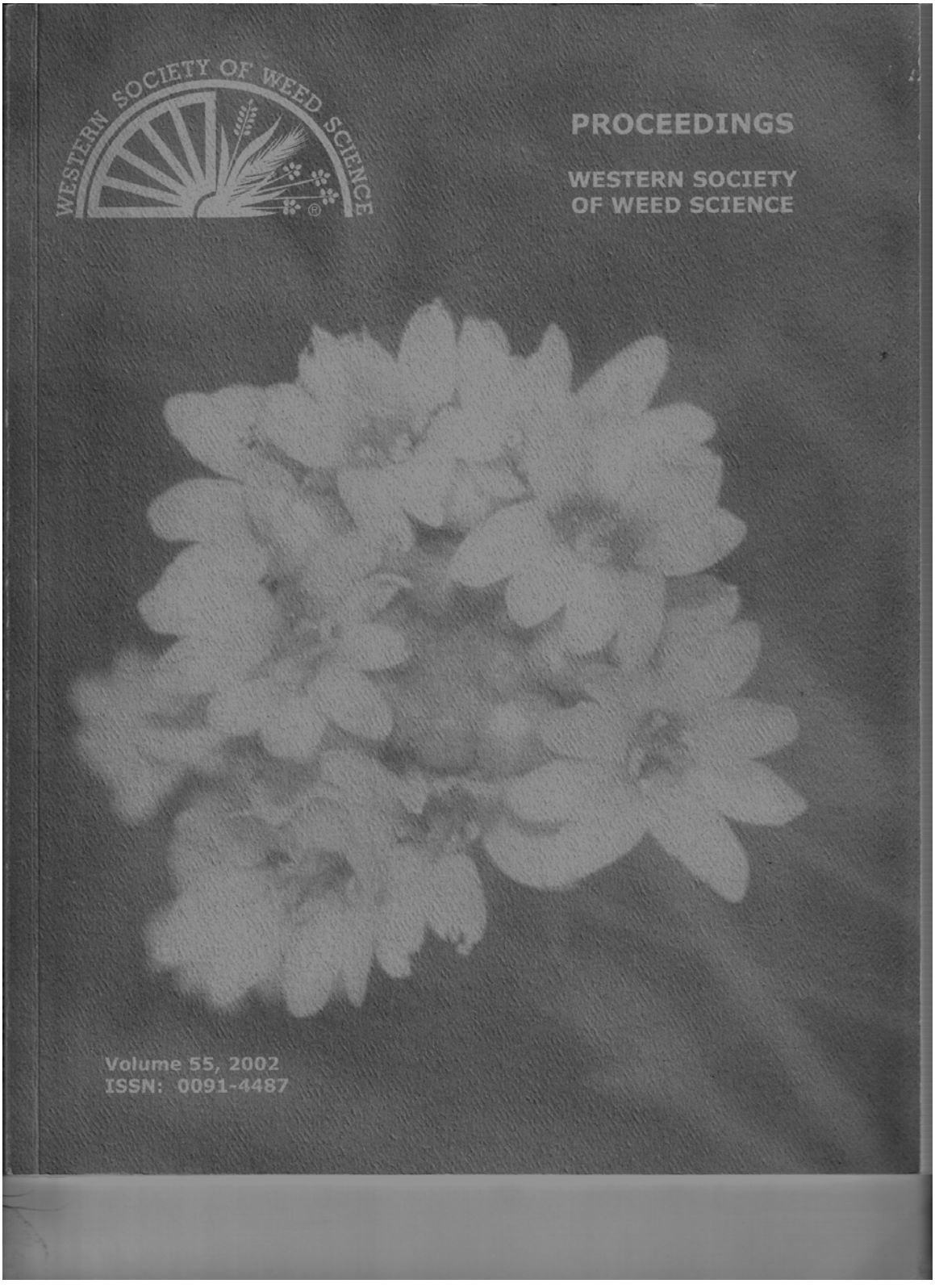
WESTERN SOCIETY OF WEED SCIENCE
PROCEEDINGS
WESTERN SOCIETY
OF WEED SCIENCE
Volume 55, 2002
ISSN: 0091-4487

Western Society of Weed Science
2002 – 2003 Officers and Executive Committee

President
Jill Schroeder
New Mexico State University
Box 30003 Dept 3BE
Las Cruces, NM 88003
Ph: 505-646-2328
Fax: 505-646-8087
jischroe@nmsu.edu

President-Elect
Gil Cook
DuPont Corporation
303 S. Barker Road
Greenacres, WA 99016
Ph: 509-922-4433
Fax: 509-922-3321
gilbert.e.cook@usa.dupont.com

Immediate Past-President
Bob Parker
Washington State University
24106 N. Bunn Road
Prosser, WA 99350
Ph: 509-786-9234
Fax: 590-786-9370
rparker@wsu.edu

Secretary
Bob Stougaard
NW Ag Research Cntr-MSU
4570 MT 35
Kalispell, MT 59901
Ph: 406-755-4303
Fax: 406-755-8951
rns@montana.edu

Chair, Research Section
K. George Beck
Colorado State University
Bioag Science & Pest Mgt.
116 Weed Research Lab
Fort Collins, CO 80523
Ph: 970-491-7568
Fax: 970-491-2462
gbeck@lamar.colostate.edu

Chair, Education and Regulatory Section
William McCloskey
University of Arizona
Dept of Plant Sciences
Forbes 303
Tucson, AZ 85721
Ph: 602-621-7613
Fax: 602-621-7186
wmcclosk@ag.arizona.edu

WSSA Representative
Steve Miller
University of Wyoming
P.O.Box 3354
Laramie, WY 82071
Ph: 307-766-3112
Fax: 307-766-5549
sdmiller@uwyo.edu

Member-at-Large
Nelroy E. Jackson
400 S Ramona Ave #212
Corona, CA 92879
Ph: 909-279-7787
Fax: 909-279-7803
nelroy.e.jackson@monsanto.com

Treasurer-Business Manager
Wanda Graves
Western Society of Weed Science
P.O. Box 963
Newark, CA 94560
Ph: 510-790-1252
Fax: 510-790-1252
Wgraves431@aol.com

Chair-elect, Research Section
Dan Ball
Oregon State University
Columbia Basin Ag.Research Center
P O Box 370
Pendleton, OR 97801
Ph: 541-278-4394
Fax: 541-278-4188
daniel.ball@orst.edu

Chair-elect, Education and Regulatory Section
Monte Anderson
Aventis
16304 South Yancey Lane
Spangle, WA 99031
Ph: 509-443-8749
Fax: 509-443-0752
monte.anderson@aventis.com

CAST Representative
Rodney G. Lym
Department of Plant Sciences
Loftsgard Hall 474B
P.O. Box 5051
North Dakota State University
Fargo, ND 58105
Ph: 701-231-8996
Fax: 701-231-8474
Rod.Lym@ndsu.nodak.edu

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2002

PROCEEDINGS

OF

THE WESTERN SOCIETY OF WEED SCIENCE

VOLUME 55

PAPERS PRESENTED AT THE ANNUAL MEETING

MARCH 12-14, 2002

LITTLE AMERICA HOTEL AND TOWERS

SALT LAKE CITY, UTAH

PREFACE

The Proceedings contain the written summary of the papers presented at the 2002 Western Society of Weed Science Annual Meeting plus summaries of the research discussion groups and of the business transacted by the Executive Board.

Author, crop, weed, and herbicide indexing is by paper number. The paper number is located in brackets at the end of the paper.

In these Proceedings, herbicide application rates are given as acid equivalent or active ingredient unless otherwise specified. Chemical names of the herbicides mentioned in the text are given in the herbicide index. Botanical names of crops and weeds are given in the appropriate index and are not repeated in the text unless their omission may cause confusion. Common and botanical names follow those adopted by the Weed Science Society of America as nearly as possible and *Hortus* third.

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Cover photograph, *Berteroa incana*, by Timothy Prather. Other photograpy by Kai Umeda and Phil Banks.

Proceedings Editor: Joan Campbell

TABLE OF CONTENTS

TUESDAY POSTER SESSION	Page number	Paper number
Weed Population Dynamics in Glyphosate Resistant Crops.	1	1
Competitive Interactions among Seedhead Insects Attacking Spotted Knapweed	1	2
Control of Volunteer-Herbicide Resistant Crops with Herbicides.	1	3
Feeding Impacts of a Leafy Spurge Biological Control Agent on a Native Plant, *Euphorbia brachycera robusta*.	2	4
The Effects of Root-knot Nematodes on the Growth and Development of Purple Nutsedge	2	5
Delineating the Distribution of Leafy Spurge (*Euphorbia esula*) and Yellow Starthistle (*Centaurea solstitialis*) in Western North America.	2	6
Spring Barley Tolerance to Fenoxaprop Influenced by Variety, Time of Herbicide Application, and Herbicide Combinations.	3	7
Instability in a Grassland Community Following Control of Yellow Starthistle with Prescribed Burning.	3	8
Annual Grass Weed Control in Stubble in the Inland Northwest: A Comparison of Glyphosate-Containing Herbicides.	3	9
Detecting Invasive Plants along the Lower Salmon River in Idaho with Probe 1 Hyperspectral Remote Sensing Technology.	4	10
Multiple Row Spacing and Variable Seeding Rate Vacuum Planter.	4	11
Integrated Pest Management Approach to Perennial Pepperweed Control on National Wildlife Refuges	5	12
Temperature Response of Picloram-Resistant Yellow Starthistle *(Centaurea solstitialis L.)*	5	13
Alternative Methods and Natural-based Products for Vegetation Control Along Roadsides in Northern California	6	14
Wild Carrot Emergence and Management in Grass Seed Production	6	15
Education and Outreach: Weed Resources for the Western United States	6	16
Investigations on the Nature and Source of the Cytoplasm in the TK-116 Accession of Jointed Goatgrass (*Aegilops cylindrica*).	7	17
Variation in Swainsonine Content among Extraction Methods and between Locoweed Genera.	7	18
Utilization of IMI-Tolerant Winter Wheat for Feral Rye Control.	7	19
Physiological and Growth Responses of 15 Range Grasses to a Sulfonylurea Herbicide: a Comparison of Rhizomatous and Caespitose Species	8	20
Population Structure and pPoidy Level in North American Spotted Knapweeds.	8	21

	Page number	Paper number
A Profile of BAS 662H in Range and Pasture	8	22
Differential Response of Jointed Goatgrass and Feral Rye to Imazamox	9	23
Effects of Herbicide Application Timing on Field Grown Tulip, Narcissus, and Bulbous Iris.	9	24
Presence and Distribution of ALS Resistant Kochia in the Bighorn Basin of Wyoming.	10	25
Alternatives to Methyl Bromide for Weed Management in Field-Grown Flower Crops	10	26
Flumioxazin As A Component Of Weed Management In Dry Beans.	10	27
Canada Thistle, Yellow Nutsedge, and Quackgrass Control in Blueberries and Raspberries.	10	28
Point Mutation Confers Sulfonylurea Resistance to One Downy Brome (*Bromus Tectorum*) Biotype But not in Another.	11	29
Broadleaf Weed Control in Onions	11	30
Halosulfuron for Purple Nutsedge Management in Chile	12	31
Broccoli Weed Control Studies in the Salinas Valley, CA	12	32
Monitoring and Assessing the Stability of Weed Population Dynamics in Crop Rotations Based on Roundup Ready Technology.	12	33
Response of Onion and Volunteer Potato to Fluroxypyr	13	34
Plant Population, Row Spacing and Herbicide Effects on Weeds in Sugarbeets.	13	35
GENERAL SESSION		
Presidential Address: Moving Forward	14	36
Capitol coalitions-influencing governmanet through strategic alliances	15	37
Invasion Biology: A New Paradigm for Weed Science?	16	38
Honorary Member Award - Western Society of Weed Scie Presentation - Senator Larry Craig, ID	20	39
ORAL STUDENT PAPER CONTEST		
Persian Darnel Impact on Crop Quality and Total Revenue	23	40
Effects of Leafy Spurge (*Euphorbia esula*) Herbicides on the Survival and Fecundity of the Western Prairie Fringed Orchid (*Platanthera praeclara*), a Threatened Species.	23	41
The Effects of Soil Moisture and Temperature on Tolerance of Spring Wheat and Barley and Control of Wild Oat with Tralkoxydim	23	42
Environmental Factors Influencing Yellow Toadflax Distribution in the Flat Tops Wilderness Area of Colorado	24	43

	Page number	Paper number
Management of Volunteer Glyphosate-Resistant Wheat in Glyphosate-Resistant Canola	24	44
Comparison of Spraying and Burch Wet-Blade Mower™ Herbicide Applications on Russian Knapweed	24	45
The Effects of Polyacrylamide (PAM) on Weed Seed and Herbicide Movement in Furrow Irrigated Dry Beans.	25	46
Influence of Diflufenzopyr Applied with Quinclorac and Dicamba for Leafy Spurge (*Euphorbia esula*) Control and Forage Production.	25	47
Evaluation of Colored Polyethylene Mulches for Weed Control in California Coastal Strawberries.	26	49
Performance of Mesotrione for Annual Weed Control in Field Corn.	26	50
Effects of Halosulfuron, Trifloxysulfuron (CGA362622) and Glyphosate on a Natural Population of Purple Nutsedge.	26	51
Spatial Pattern and Rate of Spread of Persian Darnel and Wild Oat in a Diversified Cropping System.	27	52
Glufosinate Resistant Corn Performance as Influenced by Plant Population and Row Spacing.	27	53
Production of Geo-Referenced Weed Density Maps in Irrigated Corn for Precision Weed Control.	27	54
BASIC SCIENCE PROJECT 6		
Influence of Soil Water Content on Wild Oat Seed Mortality and Seedling Emergence.	28	55
Methodology for Tracking Weed Seed Drift and Viability in Tillage Systems.	28	56
Predicting the Likelihood of Yellow Starthistle Occurrence Using a Nonlinear Regression Model.	29	57
Auxin-mediated Responses in Dicamba-resistant *Kochia scoparia*	29	58
The Use Of Biochemical Markers as Indicators of Plant Exposure to Certain Herbicides.	29	59
Integrating Chemical and Biological Control for Suppression of Volunteer Potato.	30	60
A Comparison of Drift Reduction Ability of PCC-1185 to Standard Drift Reduction Additives in Combination with Roundup UltraMax.	30	61
Cotton Injury from Staple (pyrithiobac) is Influenced by Nitrogen Availability.	31	62
TEACHING AND TECHNOLOGY: PROJECT 4		
Teaching Pesticide Application Technology	31	63
Grower Adoption of Cultural and Chemical Weed Management Practices, including GMO Crops.	31	64
The Wilke Project - A Case Study for the Value of Grower Centered Research and Extension.	32	65

WEDNESDAY POSTER SESSION

	Page number	Paper number
ALS Resistant Kochia Management in a Barley - Sugar Beet Rotation	32	66
Integrated Approach to Post-harvest and Fallow Management of Kochia.	33	67
Evaluation and Demonstration of Kochia Control in Montana Wheat Stubble with ENGAME.	33	68
Contrasting Herbicide Treatment Costs and Effectiveness in Controlling Russian Thistle and Knotweed in Winter Wheat.	33	69
Economics of Rotational Cropping Systems to Reduce Cheat (Bromus secalinus) Densities.	34	70
Italian Ryegrass Control in Winter Wheat.	34	71
Viable Jointed Goatgrass-winter Wheat Hybrids in Oklahoma Wheat Fields.	35	72
CLEARFIELD Production System - Stewardship Program for CLEARFIELD Winter Wheat.	35	73
ENGAME Herbicide, a Glyphosate Acid Formulation was Compared to ROUNDUP ULTRA and ROUNDUP ORIGINAL when Applied in Wheat Fallow Agronomic Systems.	35	74
Rotation, Seeding Rate, and Herbicide Intensity Effects on Weed Populations in Wheat, Barley, and Pea.	36	75
Green and Yellow Foxtail Control in Spring Wheat	36	76
Chemical Suppression of Kentucky Bluegrass.	37	77
Use of Visual and Sensor Based Technology to Examine Feral Rye for Differences in Tolerance to Imazamox	37	78
Integrated Management of Clover Broomrape in Red Clover Seed Production.	38	79
Agronomic and Economic Crop Responses to Weed Management Systems in Field Crops	38	80
Historical Overview of Weed Control Research at the KSU Agricultural Research Center-Hays.	39	81
Endurance and/or Direx for Vegetation Management along Irrigation Ditches in Central Arizona.	40	82
Annual Morningglory and Perennial Bindweed Control in Herbicide Tolerant Cotton	40	83
Weed Control in Cotton using a Light-Activated Hooded Sprayer	41	84
Yield Penalty Due to Delayed Weed Control in Corn and Soybean.	41	85
Evaluation of Carfentrazone Applied Alone and in Tank Mixture in Grain Sorghum.	42	86
Spray Volume Effects on Herbicide Efficacy	42	87
Common Waterhemp Resistance to Protoporphtrinogen Oxidase (PPO)-inhibiting Herbicides.	43	88
Seed Longevity of Ten Weed Species Ten Years after Burial at Two Depths in Wyoming.	44	89

	Page number	Paper number
Clipping Weeds Above the Crop Canopy Reduces Subsequent Seedling Recruitment.	44	90
Cross-commodity Research and Outreach Program (CROP)	45	91
Broadleaf Weed Control in Spring-seeded Alfalfa.	45	92
A Sustainable Approach to Nematode and Nutsedge Management in Chile using Nematode Resistant Alfalfa as a Rotation Crop.	46	93
The Affect of *Meloidogyne Incognita* on Purple Nutsedge and Yellow Nutsedge Inter- and Intraspecific Competition.	46	94
Two- and Three-Way Tank Mixtures for Preemergence Weed Control in Potatoes: Efficacy and Economics.	47	95
Late Season Hairy Nightshade Control with Potato Vine Desiccants and Effect on Weed Seed Viability	47	96
WEEDS OF HORTICULTURAL CROPS: PROJECT 2		
Weed Control and Vegetable Crop Tolerance to Halosulfuron	48	97
Rotational Crop Response Following Halosulfuron use in Melons	48	98
Effect of Stinger on Crops Grown in Rotation.	49	99
Effect of Timing, Rate, and Pesticide Use Pattern on Performance of Imazamox Herbicide in Snap Beans.	49	100
Maintenance of Corky Ringspot Disease in Crop Rotations by the Presense of Weeds.	50	101
Evaluation of Glyphosate-Tolerant Lettuce in Arizona and California: A Two-Year Summary.	50	102
Evaluation of New Herbicides for use in Strawberries.	50	103
Effectiveness of Dimethenamid-p Tank Mixtures for Preemergence Weed Control in Potatoes.	51	104
WEEDS OF RANGE AND FOREST: PROJECT 1		
Impact of Imazapic on Western Prairie Fringed Orchid, a Threatened Species, in Rangeland and Pastures	52	105
Camelthorn *Alhagi pseudalhagi* Control in North-central Arizona.	53	106
Efficacy of Spring Applied Picloram Combinations on Leafy spurge.	53	107
Herbicidal Control of Madagascar Fireweed in Pastures of Hawaii.	53	108
Combination of Prescribed Burning and Clopyralid for Control of Yellow Starthistle and Noxious Annual Grasses.	54	109
Diffuse Knapweed Movement – A Critical, Often Overlooked Component of Control.	54	110

	Page number	Paper number
The Significance and Role of Small Mammal Mounds For Noxious Weed Establishment And Spread.	54	111
Cheatgrass Invasion Alters Soil Morphology and Organic Matter Dynamics in Western Rangelands.	65	136
Succession of Mixed Grass Prairie after Biological Control of Leafy Spurge using *Aphthona* spp. Flea Beetles.	65	137
SYMPOSIUM: TECHNIQUES FOR EVALUATING AND DIAGNOSING HERBICIDE PROBLEMS		
Herbicide Diagnosis in Woody Perennial Plants	55	113
Diagnosis of Herbicide Problems in Field Crops.	55	114
The Physics of Herbicide Drift	55	115
Distinguishing Disease From Damage: A Diagnostic Challenge.	56	116
Biochemical Methods as Diagnostic Tools,	56	117
Reproducing Herbicide Field Symptoms in the Laboratory or Greenhouse	56	118
Bullet Proofing Your Diagnosis	57	119
WEEDS OF AGRONOMIC CROPS (Project 3)		
The Introduction of *Aceria malherbae*-Challenges and Successes.	57	120
Winter Annual Grass Control in Imidazolinone Resistant Winter Wheat.	58	121
Effects of Cultural Practices on Jointed Goatgrass Control in Winter Wheat Rotations.	58	122
Spikelet Structures as Mechanisms for Jointed Goatgrass (*Aegilops cylindrica*) Dormancy.	59	123
Progress Report on controlling Jointed Goatgrass in Winter Wheat in Nebraska with Rotations,Tillage, and Cultivars in 2001.	59	124
Ae F130060 - A New Selective Herbicide for Grass Control in Wheat..	60	125
The Use of AE F130060 Herbicide for Grass Control in Wheat.	60	126
Foramsulfuron (AE F130360) Herbicide Performance and Recropping Profile in Postemergent Weed Control Programs.	61	127
Differences in Efficacy Among New Herbicides for Wheat.	61	128
Imidazolinone Resistant Production System - Imazamox Herbicide for Winter Wheat	62	129
Clearfield* Production System: Winter Wheat Varieties and Crop Tolerance	62	130
Wheat seeding rate and herbicide rate effect on broadleaf weed control in spring wheat.	63	131

	Page number	Paper number
Reduced Herbicide Rates for Wild Oat Control: Influence of Tank-Mix Herbicides.	63	132
Perennial Ryegrass Response to Repeated Annual Diuron Applications.	64	133
Express Resistant Sunflower.	64	134
Postemergence Herbicide Application Considerations when Using Venturi-Style Spray Nozzles.	64	135
Weed Control with Imazamox in Seedling and Established Alfalfa.	67	140
2,4-DB Ester Alternatives for Weed Control in Alfalfa Seed Establishment	67	141
Post Harvest Weed Control in Winter Wheat Stubble with Glyphosate and Glyphosate Tankmixes	68	142
The Impact of Five Glyphosate Rates and Times of Application for Control of Volunteer Wheat on Stored Soil Moisture.	68	143
Weed Control and Crop Response with Roundup Ready Spring Wheat.	68	144
Field Studies With Glyphosate Formulations For Weed Control In Diverse Cropping Systems	69	145
Plant Desiccation and Flax Germination Following Pre-Harvest Herbicide Application	69	146
Controlling Weeds in Glyphosate-Tolerant Corn and Soybean with Glyphosate in the Central Great Plains.	69	147
Corn Response to Simulated Drift of Imazethapyr, Glyphosate, Glufosinate, and Sethoxydim.	70	148
Investigations into Glyphosate Resistant Horseweed (*Conyza canadensis*): Biological Evaluations and Control Recommendations	70	149
New Application Methods for Shark™ Herbicide to Rice in California	71	150
WEEDS OF WETLANDS AND WILDLANDS (Project 5)		
Compost and a Natural-based Product, Corn Gluten Meal, for Roadside Vegetation Control	66	138
The Effects of Mowing on the Translocation of Glyphosate within Perennial Pepperweed.	66	139
EDUCATION AND REGULATORY	72	
RESEARCH PROJECT MEETINGS		
Project 1. Weeds of Range and Forest	73	
Topic: Determining the process and criteria for designating plants as noxious		
Project 2. Weeds of Horticulture Crops	74	
Topic I: The challenge of minimum-till vegetable production		
Topic II: Use of Brassica spp. green manure crops for supplemental weed control in horticultural crops.		

Page number

Project 3. Weeds of Agronomic Crops 75
Topic 1: Use and misuse of statistical methods and procedures
Topic 2: Weed management decision support systems

Project 4. Weeds of Teaching and Technology 76
Topic: Developing distance education materials

Project 5. Weeds of Wetlands and Wildlands 78
Topic 1: New regulations for herbicide use in aquatic environments: The Talent Irrigation Case and NPDES Permit Process.
Topic 2: Pending federal legislation concerning invasive plants: HR 1462, HR 3260, S 198, and NISA reauthorization.

Project 6. Basic Sciences 78
Topic: Genomics, potential uses in industry, academic and weed science

WSWS Summer Business Meeting 79
WSWS Executive Meeting 89
WSWS Business Meeting 102
WSWS Executive Committee Closing Meeting 103
Financial Statement 106
Senator Larry Craig, 2002 Honorary Member, ... 108
WSWS 2002-2003 Officers and Executive Committee 109
Jeff Tichota, 2002 Fellow 110
Phil Westra, 2002 Fellow 111
Tom Whitson, 2002 Presidential Merit Award, ... 113
Tom Whitson, 2002 Outstanding Weed Scientist, Public Sector 113
Doug Ryerson, 2002 Outstanding Weed Scientist, Private Sector 113
Photographs, WSWS Award Winners 114
Necrology 116
Registration List 117
Author Index 133
Crop Index 136
Weed Index 138
Herbicide Index 141
Sustaining Members 145
Standing and Ad Hoc Committee Members ..... Inside Back Cover

TUESDAY POSTER SESSION

WEED POPULATION DYNAMICS IN GLYPHOSATE RESISTANT CROPS. Lisa L. Boggs and Stephen D. Miller. Graduate Student and Professor. University of Wyoming, Laramie, WY 82070.

Abstract. Weed Population Dynamics in Glyphosate Resistant Crops Lisa L. Boggs and Stephen D. Miller Glyphosate resistant crops were first introduced in 1997. Since that time, their use has expanded greatly. This increased usage of crops allowing the application of one effective herbicide puts selection pressure on weed populations in cropping systems. In turn, this may result in weed shifts in surviving populations or cause development of herbicide resistance in weeds. Rotation of herbicides may slow down or avoid development of resistance because it allows susceptible phenotypes to regenerate and dilutes the resistant phenotypes in the soil seed bank (Gressel and Segel, 1990). Crop rotation also effects weed shift patterns. Monoculture cropping systems may promote development of a particular suite of weeds over time. Crop rotation disrupts patterns of weed communities and can prevent establishment of dominant weeds through various management practices (Liebman and Dyck, 1993). This project has two objectives: 1) to investigate weed population dynamics under chisel plow tillage, with two rotation sequences and continuous glyphosate application at different rates in glyphosate-resistant corn and sugarbeets, and 2) to determine which weed management strategies avoid or delay weed shifts or development of herbicide resistance. Results of studies from 1998 through 2000 show that both common lambsquarter (*Chenopodium album*) and volunteer corn (*Zea mays*) are increasing in population. Common lambsquarters is increasing at all treatment levels. Volunteer corn is increasing in both the corn and sugar beet rotations, however, it is increasing more slowly in sugarbeets. Preliminary results from 2001 show no significant increase in common lambsquarter but an increase in volunteer corn. In 2001, ALS (acetolactase synthase) resistant kochia (*Kochia scoparia*) increased in the non-glyphosate sugarbeet treatments. [Paper Number 1]

COMPETITIVE INTERACTIONS AMONG SEEDHEAD INSECTS ATTACKING SPOTTED KNAPWEED. Lincoln Smith. Research Entomologist. USDA-ARS, Albany CA 94710.

Abstract. Field studies were conducted to determine the competitive interactions between introduced biological control agents that attack the capitula of spotted knapweed: two weevils, *Bangasternus fausti* and *Larinus minutus*, and the tephritid fly, *Urophora affinis*. The insect species were released either alone or in combinations inside screen cages placed over existing knapweed plants at several field sites. Sixteen unsexed weevils or 6 pairs of flies were released in July. Individual capitula were bagged in August, and later collected for insect emergence. *Bangasternus* reduced *Urophora* numbers by 48%, but *Urophora* did not significantly reduce *Bangasternus* numbers. *Larinus* reduced *Urophora* numbers by 50%, but *Urophora* did not significantly reduce *Larinus* numbers. The mean number of progeny produced by the insects, in cages where they were released alone, were: 13, 10, and 140 for *Bangasternus*, *Larinus*, and *Urophora*, respectively. [Paper Number 2]

CONTROL OF VOLUNTEER-HERBICIDE RESISTANT CROPS WITH HERBICIDES. Curtis R. Rainbolt[1], Donald C. Thill[1] and Frank L. Young[2]. Graduate Student, Professor and USDA-ARS Weed Scientist. [1]University of Idaho, Moscow ID 83844 and [2]Washington State University, Pullman WA 99164.

Abstract. Herbicide-resistant canola is currently available for production in the United States and herbicide-resistant wheat will be introduced during the next few years. In the Pacific Northwest (PNW) this may result in crop rotations containing mostly or all herbicide-resistant cultivars. There is little or no information on how to safely and effectively incorporate HRC into PNW direct-seed, dry land crop rotations. Currently, growers rely on glyphosate for control of volunteer crops and weeds during fallow periods. This poses a problem for control of volunteer glyphosate-resistant wheat and canola. Studies were established in spring 2000 and 2001 near Moscow, ID at the University of Idaho Parker Research Farm and near Ralston, WA at the USDA Ralston Direct Seed Project site to evaluate alternatives to traditional glyphosate treatments for control of volunteer HRC. Glyphosate-resistant spring wheat (RRW), glyphosate-resistant spring canola (RRC), imidazolinone-resistant wheat (CFW), imidazolinone-resistant spring canola (CFC), and glufosinate-resistant spring canola (LLC) were seeded into standing wheat or barley stubble with a no-till drill to simulate volunteer HRC. RRW was controlled 93% by paraquat + diuron 14 days after treatment (DAT). By 21 DAT, control ranged from 90 to 95% with paraquat + diuron and treatments containing clethodim or quizalofop. CFW was controlled 93 to 97% by quizalofop, clethodim, paraquat + diuron,

and all glyphosate treatments except glyphosate in combination with glufosinate or paraquat (66 to 79% control) 21 DAT. At 28 DAT, RRC was controlled 98% by paraquat + diuron. At 28 DAT, control of CFC and LLC ranged from 94 to 98% with paraquat + diuron, and all glyphosate treatments except glyphosate in combination with glufosinate (CFC only) or paraquat (67 to 88% control). [Paper Number 3]

FEEDING IMPACTS OF A LEAFY SPURGE BIOLOGICAL CONTROL AGENT ON A NATIVE PLANT, *EUPHORBIA BRACHYCERA ROBUSTA*. John L. Baker, Nancy A P. Webber and Kim K. Johnson. Supervisor, Research Associate and Research Associate. Fremont County Weed and Pest, Lander Wy 82520.

Abstract. The biological control agent *Aphthona nigriscutis* has been established in Fremont County, Wyoming since 1992. Near one release site a mixed stand of Leafy Spurge (*Euphorbia esula*) and a native plant (*Euphorbia brachycera* Engelm. var *robusta* (Englem.) Dorn) was discovered in 1998. During July of 1999, *A.n.* was observed feeding on both the Leafy Spurge and *E.b.r.* A total of thirty-four *E.b.r.* plants were located and staked on about 4 acres of land which had a visually estimated Leafy Spurge canope of over 40%. Eighty-eight percent of the *E.b.r.* showed feeding damage. By August of 2001, the Leafy Spurge canope had declined to less than 5% at the site and the *E.b.r.* population had increased to 450 plants. Only 26 of 450 plants, 5.7%, showed any feeding damage. For the three year period, Leafy Spurge canope was inversely correlated to *E.b.r.* density and positively correlated to *A.n.* feeding damage. [Paper Number 4]

THE EFFECTS OF ROOT-KNOT NEMATODES ON THE GROWTH AND DEVELOPMENT OF PURPLE NUTSEDGE. Ericka L. Luna, Jill Schroeder, Cheryl Fiore and Devonna Coolidge. Undergraduate Assistant, Professor, Research Assistant and Bridges Student. New Mexico State University, Las Cruces NM 88003.

Abstract. Purple nutsedge (*Cyperus rotundus*) and root-knot nematodes (*Meloidogyne incognita*) form a beneficial relationship that increases the impact these pests have in agricultural crops. Three greenhouse studies were conducted to determine the growth and development of purple nutsedge grown from tubers infected with nematodes or not infected. Tubers (0.5 to 0.7 g) were collected, germinated, and planted 2.5 cm deep in pasteurized soil (85% sand, 10% silt, 5% clay, 0.4% organic matter, pH 7.4) on June 21, September 17, and October 23. The pots were arranged in a randomized complete block design with four replications. Treatments included presence or absence of nematodes and harvest date. Two pots, one infected and one non-infected, were harvested per replication each week for five weeks after emergence. Data included leaf area, root length, and dry weight of shoots, roots, rhizomes and tubers. A significant study by harvest interaction was observed for all of the variables. For example, tuber number was 23 at harvest five in the June planting, and around four for the later plantings. While greenhouse temperatures did not differ, light quality was lower for the later experiments. A significant nematode by harvest interaction was observed for root length; however, root weight was unaffected. Roots elongated to 17 cm over the five weeks when nematodes were absent but grew to only 10 cm when nematodes were present. Nematodes typically cause a proliferation of roots, which would affect length but not weight. Root-knot nematodes did not affect the growth of any other purple nutsedge structure. [Paper Number 5]

DELINEATING THE DISTRIBUTION OF LEAFY SPURGE (*EUPHORBIA ESULA*) AND YELLOW STARTHISTLE (*CENTAUREA SOLSTITIALIS*) IN WESTERN NORTH AMERICA. Eric M. Lane[1], Bill G. Cheatum[2] and Jason W. Thoene[3]. Chairman, Colorado Weed Mapper and Technical Assistant. [1]Western Weed Coordinating Committee, Lakewood CO 80215, [2]Colorado State University, Lakewood CO 80215 and [3]U.S. Forest Service, Region 2, Lakewood CO 80215.

Abstract. Both leafy spurge and yellow starthistle infest many millions of acres across western North America and cause damage to local, state and regional economies estimated in the hundreds of millions of dollars annually. To develop an effective regional strategy to stop the continued spread of these species and provide an effective framework for coordinated management efforts across western landscapes and jurisdictions, it is useful to develop a more sophisticated understanding of the regional distribution of each noxious weed species. During January and February 2002, we surveyed counties in 18 states and 4 provinces of western North America. In an effort to standardize a regional reporting format, each county was presented with a map of its jurisdiction gridded with USGS topographic quadrangles of 1:24,000 scale. Furthermore, each quadrangle was subdivided into four equal portions called quarterquads. Each quarterquad comprises approximately 9,000 acres and is uniquely identified by a six digit

number. County respondents identified specific quarterquads infested with leafy spurge and/or yellow starthistle and provided an estimate of the number of infested acres (defined by the North American Weed Management Association) for each quarterquad. These data are summarized in graphic form in two separate maps. For counties that did not respond to this survey, state and provincial weed coordinators provided supplementary data that allow a reasonably accurate and complete description of the distribution of these species across the West. Providing an example of an effective standardized reporting format may be an important outcome of this study. [Paper Number 6]

SPRING BARLEY TOLERANCE TO FENOXAPROP INFLUENCED BY VARIETY, TIME OF HERBICIDE APPLICATION, AND HERBICIDE COMBINATIONS. Lori J. Crumley and Donn C. Thill. Graduate Research Assistant and Major Professor. University of Idaho, Moscow ID 83844.

Abstract. Fenoxaprop/mefenpyr diethyl (safener) is used to control wild oat in wheat and barley. Sometimes fenoxaprop can injure spring barley. The effect of two rates of fenoxaprop (93 and 186 g/ha) on growth and grain yield of 20 spring barley varieties was determined near Moscow, Winchester, and Nezperce, ID in 2000 and 2001. Additionally, the effect two rates of fenoxaprop, applied at six barley growth stages, on barley growth and yield was determined near Moscow, ID in 2000 and 2001. Klages, Galena, and Gallatin usually were the varieties injured most by fenoxaprop, with visible injury ranging from 9 to 22% 14 days after treatment (DAT). Barley grain yield averaged over varieties was reduced 10% by both rates of fenoxaprop in 2000, but was not affected in 2001. Based on single degree of freedom contrasts, 2-row barley varieties were injured 1 to 2% more than 6-row varieties during both years, and grain yield was reduced by 15% in 2-row compared to 6-row varieties in 2000. Injury usually was greatest when fenoxaprop was applied at the 4-5 leaf, 1st node detectable, and flag leaf growth stages of barley and averaged 26% 14 DAT. Grain yield was 6 to 7% less when fenoxaprop was applied at the flag leaf stage compared to the 1-leaf and 3-leaf stages. Planting 2-row varieties and applying fenoxaprop to barley plants with more than five leaves may increase fenoxaprop injury to spring barley. [Paper Number 7]

INSTABILITY IN A GRASSLAND COMMUNITY FOLLOWING CONTROL OF YELLOW STARTHISTLE WITH PRESCRIBED BURNING. Guy B. Kyser and Joseph M. DiTomaso. Staff Research Associate and Extension Weed Specialist. University of California, Davis CA 95616.

Abstract. An open grassland at Sugarloaf Ridge State Park, Sonoma County, California, was burned during three consecutive summers (1993 to 1995) to control yellow starthistle (*Centaurea solstitialis* L.). By 1996 yellow starthistle seedbank, seedling density and mature vegetative cover were reduced by 99%, 99%, and 91% respectively, and the plant community had greater diversity and greater species richness, particularly native forbs. Following cessation of prescribed burning after 1995, the community was monitored for four years to determine if the reduced yellow starthistle population represented a stable state or if yellow starthistle population levels would quickly recover. Yellow starthistle seedbank rose dramatically over a four-year period. Seedling counts and summer vegetative cover also rose, though less rapidly. Total forb cover, particularly native species, total plant cover, and plant diversity decreased significantly following burn cessation. Grass cover did not show any strong trends, and year-to-year variation in grass cover appeared to be more important than treatment effects. In the absence of some overall change in management, e.g., periodic prescribed burning, herbicide treatments, and/or revegetation, it may not be possible to establish and maintain a stable state with a low population of yellow starthistle in annual grasslands in California. [Paper Number 8]

ANNUAL GRASS WEED CONTROL IN STUBBLE IN THE INLAND NORTHWEST: A COMPARISON OF GLYPHOSATE-CONTAINING HERBICIDES. Thomas M. Ireland, Donn C. Thill, Joe Yenish and Dan Ball. Graduate Research assistant, Professor of Weed Science, Extension Weed Scientist and Extension Weed Scientist. [1]University of Idaho, Moscow ID 83843, [2]University of Idaho, Moscow ID 83843, [3]Washington State University, Pullman WA 99164 and [4]Oregon State University, Pendleton OR 97801.

Abstract. Weed management in direct seed cropping systems relies on burn down herbicides during the fallow period. The objective of this study was to compare annual grass weed control with four glyphosate-containing herbicide products, applied at several rates with and without ammonium sulfate (AMS). Trials were established in spring 2001 near Davenport and Ritzville, WA; Moro and Pendleton, OR; and Lewiston and Moscow, ID. The glyphosate products tested were Roundup Ultra, Roundup Original, Touchdown IQ, and Engame, each applied at

0.281, 0.375, and 0.562 lb ae/A with and without AMS. Control was evaluated 7, 14, 21 and 28 days after treatment (DAT). There were no differences among treatments at the Moro and Moscow sites. Control of weeds ranged from 83 to 86% at Moro and was 100% at Moscow. At Davenport, all rates of Engame and Roundup Ultra, and the high rate of Roundup Original and Touchdown IQ, controlled weeds 94% or more. Engame and Roundup Ultra applied with and without AMS controlled weeds 96 to 98%. Roundup Original and Touchdown IQ with AMS controlled weeds 90 to 92%, and 86% without AMS. At Pendleton, all treatments except Touchdown IQ without AMS controlled weeds 99% or more. At Ritzville, low, medium, and high herbicide rates controlled grass weeds 88, 91 and 93%, respectively. The low herbicide rate without AMS reduced biomass 94%, while other treatments reduced biomass 99% or more. At Lewiston, Engame controlled weeds 99%, while other herbicides controlled weeds 93 to 94%. All treatments with AMS controlled weeds 96%, while treatments without AMS controlled weeds 93%. [Paper Number 9]

DETECTING INVASIVE PLANTS ALONG THE LOWER SALMON RIVER IN IDAHO WITH PROBE 1 HYPERSPECTRAL REMOTE SENSING TECHNOLOGY. Lawrence W. Lass and Timothy S. Prather. Support Scientist and Assistant Professor. University of Idaho, Moscow ID 83844.

Abstract. The lower Salmon River canyons are favorite water sport and sportsman destination for many tourists visiting Northern Idaho. The spread of weeds in the annual grasslands has been rapid in these canyons. The steep canyons with few roads limits access for intensive plant surveys. Remote sensing offers an opportunity to survey invasive plants and assess their spread. The lower Salmon River was imaged at a 5 m spatial resolution with the Probe hyperspectral sensor by Earth Search Sciences Inc of Kalispell, MT, on September 12, 2000 and July 3, 2001. The sensor has 128 channels and spectral resolution between 450 to 2500 nm. The purpose of this project is to develop spectral reflectance curves for the major weeds found in the canyon and establish the accuracy of classified images. Spectral reflectance curves for yellow starthistle, spotted knapweed, Dalmatian toadflax, rush skeletonweed, Scotch thistle, poison oak, and annual brome were developed using a posteriori least squares orthogonal subspace projection algorithm from the atmospherically corrected images and preselected identifiable sites with greater than 80% weed cover. Classified images showed hyperspectral data could define the major infestations of annual grass, yellow starthistle, spotted knapweed, and poison oak. Dalmatian toadflax infestations in moist areas were detectable near the signature development site but not detectable in the dry areas at the other end of the flight line, suggesting differences in spectral signature. Images showing Dalmatian toadflax tended to over-commit in non-native perennial brome grass areas. Rush skeletonweed and Scotch thistle were detected with the hyperspectral images, but the classification over committed and produced several false infestations on the images and not on the ground. Hyperspectral technology was capable of detecting multiple invasive species in the Lower Salmon River Canyon. Weed species forming dense stands were more accurately detected by the Probe sensor. Weed species having significant mixtures with annual grasses were more difficult to detect and separate from the annual bromes and fescues. [Paper Number 10]

MULTIPLE ROW SPACING AND VARIABLE SEEDING RATE VACUUM PLANTER. Craig M. Alford and Stephen D. Miller. Graduate Research Associate and Professor. Dept. of Plant Sciences, University of Wyoming, Laramie WY 82071.

Abstract. Numerous studies have been conducted across the United States that show increased yields and other benefits from growing crops in rows narrower than 76 cm at a range of plant populations. However, few of these studies have been conducted in the High Plains. Researchers at the University of Wyoming have undertaken an initiative to investigate the effects of growing crops in row spacings of less than 76 cm. To facilitate conducting these studies a more efficient method than manually moving row units and changing planting populations needed to be developed. After reviewing a planter that was constructed by Michigan State University, a planter was built that allows crops to be planted in 38, 56, and 76 cm row with varying populations. The row units (John Deere Maxemerge II) can be moved hydraulically and planting populations can be changed, as the planter is moving with the use of a hydraulic seed drive. The use of a standard planting unit allows the planter to plant any crop that a commercial planter would be able to plant. In a series of studies conducted with corn during 2000, the planter was able to plant to stand within 3% of the desired planting population regardless of row spacing or population. Plants were evenly spaced and variability from plot to plot was low. [Paper Number 11]

INTEGRATED PEST MANAGEMENT APPROACH TO PERENNIAL PEPPERWEED CONTROL ON NATIONAL WILDLIFE REFUGES. Tom Whitson, Les Burrough and Alex Ogg. IPM Extension Weed Specialist, Temporary Research Assistant and Research Scientist. [1]University of Wyoming, Laramie WY , [2]University of Wyoming, Laramie WY and [3]University of Wyoming, Laramie WY .

Abstract. Integrated pest management systems approach to perennial pepperweed control on national wildlife refuges. Tom Whitson, Les Burrough, Mark Farrell, Scott Votaw. (Department of Plant Science, University of Wyoming, P. O. Box 3354 University Station, Laramie, WY 82071) Perennial pepperweed is one of the most rapidly expanding noxious weed species in the West. It has taken over river bottoms and riparian areas below water control projects and dams. A series of studies were established on the Seedskadee (WY) and Ouray (UT) National Wildlife Refuges in a rangeland setting to develop approaches for integrated control of perennial pepperweed. The goal is to replace the weed infested areas with species of permanent native vegetation to develop a sustainable system. The integrated program was designed to include mechanical, chemical and vegetative control systems. Mechanical and biological controls practices were evaluated. No significant difference was noted between treatments using 5 sheep and one goat in an attempted to simulate a short-term high intensity grazing system (Table 1). There was no significant difference in the reduction in perennial pepperweed stem counts after mowing, alone. Herbicides applied as a cut stem application at time of mowing showed positive control results (Burch Wetblade Mowing System). The success of the wetblade mowing system during dry conditions depends on timing, soil moisture and subsequent plant activity. It showed little advantage at full bloom until the level of imazapic was elevated to 0.125 lb ae/A on the July 5, 2000 trial (Table 2). Good to excellent control followed the use of imazapic, imazapic + 2,4-D and metsulfuron. Antagonism appeared in the pre-bloom treatments when the growth regulator 2,4-D was added with imazapic (Table 3). Imazapic showed excellent control at all rates tested at full bloom stage (Table 3). Low rates of imazapic performed as well as high rates thus offering a savings in cost of treatment. The plot size was 10 by 27 feet. Herbicide treatments were distributed on a RCBD with four replications. A CO2 pressurized backpack sprayer was calibrated to deliver 20 gpa. Grazing and mechanical mowing efficacy – high density (52 animals/A), short duration (24 hours) accumulated averages from stem counts ¼ meter quadrats. Mower efficacy Burch wetblade rotary mower - total stem count on a strip evaluation 1.5' x 162' = 243 sq.ft. (x) 179.26 = estimated stems/A. The grazed plots were in a dense stand under cottonwood trees in almost a 100% stand density in spots. The mowed plots were out in an area with 50% grass competition. The following is a list of plant species seeded to evaluate competitive effect following farming and herbicide treatments. Only a trace of Slender wheatgrass,Rosana western wheatgrass, and Critana thickspike wheatgrass have appeared during drought conditions over the past two years. The list includes, tall wheatgrass, Covar sheep fescue, Sodar streambank wheatgrass, bluebunch wheatgrass, Trailhead basin wildryegrass, Arriba western wheatgrass, Sandberg bluegrass, Bromar mountain bromegrass, native basin wildryegrass, common barley, oats, rye; American vetch, fourwing saltbush, penstemon, gardner saltbush, green rabbitbrush, and winter fat. Drought has inhibited germination. Soil crusting and deer herbivory will play a role in the future success of these trials. [Paper Number 12]

TEMPERATURE RESPONSE OF PICLORAM-RESISTANT YELLOW STARTHISTLE *(CENTAUREA SOLSTITIALIS L.).* Kevin S. Branum, Harish H. Ratnayaka, Amber D. Vallotton and Tracy M. Sterling. Student Aide, Post Doctoral Fellow, Research Assistant and Professor. New Mexico State University, Las Cruces NM 88003.

Abstract. Yellow starthistle is spreading rapidly across the western United States and taking over rangelands, decreasing native plant and animal diversity, depleting soil moisture reserves and invading recreational areas. Resistance to picloram in yellow starthistle was first observed near Dayton, WA in 1988 and confirmed in 1990. Previous research has found that both picloram-susceptible (S) and picloram-resistant (R) accessions have similar competitive ability and that a single recessive gene confers picloram-resistance in yellow starthistle. Previous observations suggested that temperature might have an effect on the level of resistance. Therefore, experiments were conducted to determine whether R and S grow differently from one another at different temperatures and if temperature alters the R:S ratios in yellow starthistle due to picloram. Seedlings were grown in pots with Metro Mix 360 for 30 days under greenhouse conditions. They were then randomly assigned to three growth chambers at 12/8, 24/20 and 32/28 C day/night temperatures each under 150 mmol m^{-2} s^{-1} PAR. After 14 days, picloram was applied with a CO_2 sprayer at four rates: 0, 0.14, 0.28, and 0.56 kg ae/ha. Photosynthesis and chlorophyll fluorescence were measured pre-treatment. Photosynthesis was greater in R versus S; however, stomatal conductance and fluorescence did not differ. Photosynthetic levels differed among temperatures with low = medium > high. Fluorescence and

epinasty were measured post-treatment. After treatment, S had lower photosynthetic efficiency, but greater epinasty when compared to R plants. Under herbicide pressure, there was no accession by temperature interaction suggesting R:S ratios are unaffected by temperatures. [Paper Number 13]

ALTERNATIVE METHODS AND NATURAL-BASED PRODUCTS FOR VEGETATION CONTROL ALONG ROADSIDES IN NORTHERN CALIFORNIA. Steve L. Young. Staff Research Associate. UC Hopland R & E Center, Hopland CA 95449.

Abstract. The California Department of Transportation (Caltrans) manages approximately 24,000 km of highway and more than 93,000 ha of right-of-way throughout the state. A major portion of their maintenance effort is associated with vegetation control. This need is driven by safety concerns, such as ensuring visibility of traffic and highway structures and minimizing fire potential by reducing vegetative biomass. Additionally, vegetation control provides benefits by reducing the presence of noxious weeds and other pests, and it is a major component of erosion control. The use of herbicides on Caltrans-managed acreage has raised concerns of environmental quality, public health and worker safety, especially in the North Coast area of California. An Environmental Impact Report (EIR) that assessed the risks of the agency's use of chemical vegetation control programs was completed in late 1992. Caltrans subsequently adopted an integrated vegetation management program and set goals for reduction of chemical use: a 50% reduction by 2000, and an 80% reduction by 2012. Currently, two counties within Caltrans' District 1 (Mendocino and Humboldt) have severely limited the use of herbicides within their borders. Alternative methods of vegetation control need to be developed and proven effective in a variety of types of plant communities and climates. A variety of studies have been initiated to determine the efficacy of vegetation control and costs associated with the use of natural-based products and alternative methods. In particular, experiments incorporating the use of corn gluten meal and compost, postemergence natural-based products and flaming have been conducted and the results summarized thus far. [Paper Number 14]

WILD CARROT EMERGENCE AND MANAGEMENT IN GRASS SEED PRODUCTION. Daniel M. Hancock, Jed Colquhoun, Bill Brewster, Charles M. Cole and Carol Mallory-Smith. Graduate Research Assistant, Assistant Professor, Senior Instructor, Faculty Research Assistant and Associate Professor. Department of Crop and Soil Science, Oregon State University, Corvallis OR 97331.

Abstract. Wild carrot reduces crop yield and quality in Western Oregon grass seed production. Studies were conducted to determine timing of wild carrot emergence relative to herbicide application and to evaluate several herbicides for wild carrot control and crop tolerance. Four sites with four replications each were established for the emergence trials. Wild carrot emergence was quantified every 20 days from October to March over the past two years. Emerged plants were counted and removed from the plot. Percent emergence for each evaluation date was determined by date counts divided by total counts from October through March. There were no significant differences in percent emergence for any date. Herbicide studies were established in perennial ryegrass and tall fescue fields. Wild carrot control was greatest where prosulfuron and tribenuron were applied, although control with tribenuron was variable. Wild carrot control was poor where quinclorac was applied. None of the treatments provided season-long control of wild carrot. Crop injury varied among herbicide treatments, and was the greatest where prosulfuron was applied on perennial ryegrass variety 'Barlennium'. [Paper Number 15]

EDUCATION AND OUTREACH: WEED RESOURCES FOR THE WESTERN UNITED STATES. Susan B. Kelly. Center for Invasive Plant Management, Bozeman MT.

Abstract. The Center for Invasive Plant Management synthesizes general information about invasive plants, scientific knowledge, and practical solutions for weed control so that it is accessible by land management personnel, education and research communities, and private landowners across the West. The Center will achieve this goal through the development of a variety of educational initiatives. Our first initiative is a web-based, weed education, distance–learning program. This is a logical way to reach a diverse, geographically divided population, and to provide scientifically based information about weed ecology and management to people working in the field. Our first course, Ecological Principles of Invasive Plant Management, will be co-taught by weed experts across the West. It will be offered to land managers through distance-learning technology, during the fall of 2002. The second initiative, the Center's website, is designed to reach a wide and varied audience. It provides a valuable regional resource for invasive plant issues, and serves as a clearinghouse for information. Hands-on weed education

is provided for the classroom and community through our third initiative, a weed resource box. The box has been developed as an educational tool for western weed managers and educators. Information about weed biology, weed management, and regional resources are included along with curricula, activity guides and educational props. [Paper Number 16]

INVESTIGATIONS ON THE NATURE AND SOURCE OF THE CYTOPLASM IN THE TK-116 ACCESSION OF JOINTED GOATGRASS (AEGILOPS CYLINDRICA). Harish T. Gandhi[1], M. Isabel Vales[1], Christy Watson[1], Robert S. Zemetra[2], Carol A. Mallory-Smith[1] and Oscar Riera-Lizarazu[1]. Graduate Research Assistant, Research Assistant Professor, Faculty Research Assistant, Professor, Professor and Assistant Professor. [1]Dept. of Crop and Soil Science, Oregon State University, Corvallis OR 97331 and [2]Plant, Soil and Entomological Sciences, University of Idaho, Moscow ID 83844.

Abstract. Jointed goatgrass *(Aegilops cylindrica)* is a major weed of winter wheat *(Triticum aestivum)* in the Midwestern and Western United States and in the some areas of Europe and Middle East. Jointed goatgrass is an allotetraploid (2n=4x=28, CCDD) that resulted from interspecific hybridization between two diploid species - *Aegilops tauschii* (2n=2x=14, DD) and *Aegilops markgrafii* (2n=2x=14, CC). *Ae. tauschii* has been shown to be the maternal parent and cytoplasmic donor during the formation of jointed goatgrass. A recent evaluation of plastome (chloroplast) diversity with 19 chloroplast microsatellite markers suggests that one accession collected in Turkey, TK-116, contained a plastome that was derived from *Ae. markgrafii*. All other jointed goatgrass accessions (8) had plastomes that were derived from *Ae. tauschii*. Since cytological, morphological, and genomic SSR marker analyses showed that TK-116 was a bona fide *Ae. cylindrica* accession, our results indicate that *Ae. markgrafii* in addition to *Ae. tauschii* has served as the maternal parent and cytoplasmic donor during the creation of jointed goatgrass. The importance of plastome variation on jointed goatgrass' weed biology remains to be explored. [Paper Number 17]

VARIATION IN SWAINSONINE CONTENT AMONG EXTRACTION METHODS AND BETWEEN LOCOWEED GENERA. Amber D. Vallotton and Tracy M. Sterling. Research Assistant and Professor. New Mexico State University, Las Cruces NM 88003-8003.

Abstract. Locoweeds are part of a plant group comprised of *Astragalus* and *Oxytropis* species that contain the alkaloid swainsonine. When ingested, swainsonine causes the accumulation of oligosaccharides, which in turn erratically alter neurological function in livestock. Economic losses due to locoweed poisoning are significant in the western United States. Great variation in swainsonine content occurs in field-grown locoweed. Thus, to eliminate environmental variability, all plants were grown in a common environment in the greenhouse. Extraction methods for quantitative analysis of swainsonine include small-scale Soxhlet distillation, which requires specialized equipment with limited sample capacity. Alternative extraction methods were compared to the Soxhlet method to determine extraction efficiency from locoweed tissue. Dried leaf samples from three locoweed species (woolly loco, Lambert crazyweed, and silky crazyweed), replicated four times, were ground and placed in methanol and then either shaken at room temperature (24 and 72 h), not shaken (24 h), heated to boiling, cooled, and not shaken (24 h), or Soxhlet distilled. Swainsonine concentrations (ng/ml) for these extracts were then determined spectrophotometrically using the alpha-mannosidase enzyme assay. Swainsonine acts as an inhibitor of alpha-mannosidase, thus the greater the swainsonine concentration in the extract, the lower the amount of substrate cleaved. There was no species by extraction method interaction. Of the five methods used, the Soxhlet and hot treatment recovered the most swainsonine compared with the other methods. The hot treatment extraction was then used to compare swainsonine levels between two locoweed genera (*Astragalus* and *Oxytropis*), and among six varieties of woolly loco (*Astragalus mollissimus*) and two species of *Oxytropis*. Swainsonine content varied within and between genera suggesting that a working knowledge of locoweed varieties could be important as a tool for locoweed management. [Paper Number 18]

UTILIZATION OF IMI-TOLERANT WINTER WHEAT FOR FERAL RYE CONTROL. John C. Frihauf and Stephen D. Miller. Graduate Student and Professor of Weed Science. University of Wyoming, Laramie WY 82071.

Abstract. Feral rye (*Secale cereale L.*) is a winter annual grass that is spreading throughout winter wheat production areas of the high plains. Farming practices such as conservation tillage, increased fertilizer application, and semi-dwarf winter wheat varieties has contributed to the rapid spread of feral rye. Surveys conducted in Colorado indicate

that feral rye causes economic losses exceeding $10 million annually. Field experiments were conducted in southeastern Wyoming from 1998 to 2001 in order to evaluate feral rye control in imi-tolerant winter wheat. Control of feral rye increased as the imazamox rate increased from 35 g/ha to 54 g/ha. Control was better in early fall treatments (2 to 4 leaf with < 2 tillers) compared to late fall treatments or early spring treatments (4 to 6 leaf with 2 to 6 tillers). Imi-winter wheat tolerance ranged from marginal to excellent. Tolerance appears to be affected by cultivar, environment, and spray additive. Plant back studies indicated corn and sunflower injury with imazamox treatments made 2 to 6 months earlier in winter wheat. However, corn and sunflower showed excellent tolerance after 13 to 18 months following treatment in winter wheat. [Paper Number 19]

PHYSIOLOGICAL AND GROWTH RESPONSES OF 15 RANGE GRASSES TO A SULFONYLUREA HERBICIDE: A COMPARISON OF RHIZOMATOUS AND CAESPITOSE SPECIES. Thomas A. Monaco and Justin R. Williams. Ecologist and Rangeland Scientist. USDA-ARS, Logan UT 84322.

Abstract. There is considerable need to control invasive grasses in pastures and rangelands without negatively impacting existing desirable perennial grasses. We conducted a greenhouse experiment to compare physiological and growth responses of 2 invasive annual grasses (*Bromus tectorum*, and *Taeniatherum caput-medusae*), 6 bunchgrasses, and 7 rhizomatous range grasses to the herbicide Outrider™. Herbicide was applied to 4 3-L pots of each species at 75 and 95 days after emergence at 2 rates (low = 52.6 and 93.3 g/ ha). In addition, 4 pots of each species did not receive the herbicide and served as a control. To assess physiological impacts, we measured photosynthesis, stomatal conductance, and transpiration 1 week following herbicide exposure. Two weeks after herbicide exposure, all plants were harvested to evaluate number of tillers/plant and obtain aboveground dry mass. In general, 6 of the 7 rhizomatous grasses showed a significant ($P < 0.05$) reduction in physiological and growth parameters compared to the control. In contrast, only 1 of the 6 bunchgrasses consistently showed a significant ($P < 0.05$) reduction in physiological and growth parameters. Of the two invasive annual grasses, only *Bromus tectorum* showed a significant ($P < 0.05$) reduction in physiological and growth parameters. These results indicate a strong association between herbicide impact, physiological performance, and subsequent reduction in growth. This suggests that Outrider™ may be an effective management tool to selectively suppress some invasive annual and rhizomatous grasses without adverse affects on desirable grass species. [Paper Number 20]

POPULATION STRUCTURE AND PLOIDY LEVEL IN NORTH AMERICAN SPOTTED KNAPWEEDS. Robin A. Marrs[1], Ruth A. Hufbauer[1], Shanna E. Carney[1] and Lincoln Smith[2]. Student, Professor, Professor and Research Entomologist. [1]Colorado State University, Fort Collins CO 80523 and [2]USDA-ARS Western Regional Research Center, Albany CA 94710.

Abstract. Knowing the genetic composition of weeds can be important to their management by both herbicides and biological controls. We are using inter-simple sequence repeats (ISSRs), a genetic fingerprinting technique, to determine the structure of western North American populations of spotted knapweed (*Centaurea maculosa* Lam., Asteraceae). Ploidy level can also affect invasiveness, and North American spotted knapweed populations may have either diploid or tetraploid morphs. Thus, we are using cytological techniques, including root squashes, to determine ploidy levels. Knowledge gained from this research will help improve long term management of this noxious weed. [Paper Number 21]

A PROFILE OF BAS 662H IN RANGE AND PASTURE. Leo D. Charvat[1] and Joe E. Zawierucha[2]. Senior Field Biologist and Biology Project Leader. [1]BASF Corporation, Lincoln NE 68523 and [2]BASF Corporation, Research Triangle Park NC 27709.

Abstract. BAS 662H is a postemergence broadleaf herbicide being evaluated by BASF Corporation for use in range and pasture. BAS 662H currently has a full EPA registration for use in field corn and non-crop areas for the control of annual and perennial broadleaf species. BAS 662H is formulated as a 70% WG, containing 50% sodium salt of dicamba (50% ae) and 21.4% sodium salt of diflufenzopyr (20% ae). The current BAS 662H label for non-crop uses include 64 broadleaf species, many of which are current problem species in range and pasture through the United States. The current list contains 45 annual species that are controlled, including some ALS and Triazine resistant biotypes, and 19 perennial broadleaf species that are partially controlled or suppressed. Major species currently listed on the non-crop label include common annual species such as buffalobur, Devil's claw, kochia, marestail, pigweed and waterhemp species, common and giant ragweed, sicklepod, annual sowthistle, sunflower and Russian

thistle and perennial species such as bindweed, dandelion, curly dock, horsenettle, spotted knapweed, perennial sowthistle and Canada thistle. Current research is being conducted to evaluate potential use patterns in range and pasture for the control of annual, perennial and some woody perennial broadleaf species. Thirty-eight randomized studies were conducted in 2001 across the United States in range, pasture and right-of-way sites, to determine the efficacy of BAS 662H on additional broadleaf species. BAS 662H was applied postemergence in spring, summer and fall timings at use rates of 0.196 kg ae/ha to 0.392 kg ae/ha. Treatments included the use of a methylated seed oil at 1.75 l/ha, with all applications made at a volume of 187 l/ha, to broadleaf species that were actively growing. BAS 662H was found to have efficacy on an additional 58 broadleaf species. Efficacy ranged from suppression to complete control, depending on the species tested. Major range and pasture species such as goldenrod, diffused knapweed, Dalmatian toadflax, buckbrush, Arkansas rose, sericea lespedeza, western ragweed, yellow starthistle, musk thistle, western yarrow and ironweed species, were found to respond at favorable control levels. Currently BAS 662H is not registered for use in range and pasture, however it is under EPA review for use in range and pasture, with registration expected in 2003. The information provided in this abstract is for informational and research purposes only, and not intended to promote use of BAS 662H in range and pasture. [Paper Number 22]

DIFFERENTIAL RESPONSE OF JOINTED GOATGRASS AND FERAL RYE TO IMAZAMOX. Reginald D. Sterling[1], Scott J. Nissen[1], Philip Westra[1], Gus Foster[2] and Paul Ogg[2]. Graduate Research Assistant, Associate Professor, Professor, Field Biologist and Tech Service. [1]Colorado State University, Fort Collins CO 80523 and [2]BASF Corporation, RTP NC 27709.

Abstract. The winter annual grass complex of bromes, jointed goatgrass, and feral rye currently represent the single greatest threat to sustainable winter wheat production on millions of acres best suited for wheat production because of erratic rainfall amounts and patterns in the Central Great Plains region. These weeds have spread uncontrolled because historically there have been no selective herbicides for their control in winter wheat. Clearfield spring and winter wheat offer producers new value-added technology for the management of these weeds. Greenhouse studies were conducted to examine differential response of jointed goatgrass (JGG) and feral rye to imazamox. JGG and feral rye were planted and thinned to 25 plants per flat. The plants were treated at three growth stages: 2-3 leaves, 1-2 tillers, and 3-4 tillers. Imazamox was applied at rates ranging from 0.0005 to 0.256 lbs a.i./A plus MSO and UAN 28% both at 1.0% v/v. Plants were evaluated 7, 14, and 28 DAT using visual evaluations and 28 DAT for plant biomass. JGG control was greater than or equal to that of feral rye with imazamox applied at 0.008, 0.016, and 0.032 lbs a.i./A over all growth stages. JGG dry weight was significantly less than that of feral rye with imazamox applied at 0.008, 0.016, and 0.032 lbs a.i./A at the 2-3-leaf growth stage. JGG dry weight was less than or equal to that of feral rye with imazamox applied at 0.008, 0.016, and 0.032 lbs a.i./A at the 1-2 tiller growth stage. [Paper Number 23]

EFFECTS OF HERBICIDE APPLICATION TIMING ON FIELD GROWN TULIP, NARCISSUS, AND BULBOUS IRIS. Timothy W. Miller and Carl R. Libbey. Extension Weed Scientist and Ag. Research Technologist. Washington State University, Mount Vernon WA 98273.

Abstract. Thiazopyr, pendimethalin, diuron, isoxaben, and oryzalin were applied in combination with glyphosate or glufosinate to ornamental bulbs. Application timing was (1) all in the fall, (2) all PRE in the spring, (3) all early POST in the spring, (4) half in the fall/half PRE in the spring, or (5) half in the fall/half POST in the spring. Weed control was generally excellent for all treatments, with only isoxaben tank mixtures not providing adequate weed control by June 15. Foliar injury to tulip and iris ranged from 16 to 58% from POST applications, while fall PRE, spring PRE, and split PRE were generally safe; only slight foliar damage was caused by POST treatments to narcissus. Flower number and height followed the same pattern as foliar injury in tulip. Iris were more sensitive to glyphosate than glufosinate POST, as based on flower data; narcissus flowers were not significantly affected by herbicide treatment. Tulips treated with diuron in the spring yielded poorer than fall treated tulips. Thiazopyr and pendimethalin reduced bulb size if applied POST with glyphosate or glufosinate, as did oryzalin + glyphosate POST. Fall thiazopyr decreased tulip bulb production compared to diuron or pendimethalin, while tulips treated with isoxaben or oryzalin also yielded less than diuron-treated tulips. Thiazopyr also reduced bulb number compared to pendimethalin-treated tulips. Diuron in spring reduced narcissus bulb size, as did isoxaben + glufosinate. Iris bulb size was reduced by all spring pendimethalin and oryzalin combinations, and by all spring diuron treatments except split with glyphosate. Isoxaben + glyphosate in spring also reduced bulb size, as did POST thiazopyr combinations. [Paper Number 24]

PRESENCE AND DISTRIBUTION OF ALS RESISTANT KOCHIA IN THE BIGHORN BASIN OF WYOMING. Bryon L. Lorenz and Stephen D. Miller. Graduate Student and Professor of Weed Science. University of Wyoming, Laramie WY 82071.

Abstract. The purpose of this research was to collect data on the presence and distribution of acetolactate synthase resistant (ALS) (*Kochia scoparia* L.) in the Big Horn Basin of Wyoming. The Big Horn Basin is contained within Bighorn, Fremont, Hot Spring, Park, and Washakie counties. Proper weed control is critical to production of food and fiber crops. The loss of the effective control of weeds due to herbicide resistance is well known. *Kochia scoparia* is a serious weed in many parts of Wyoming's crop and rangeland. With repeated application of ALS herbicides to crops, roadsides and other areas in the Big Horn Basin, there is a strong likelihood of ALS resistant kochia. Kochia samples from a number of sites in the Big Horn Basin and ALS resistance in these samples will be verified. Seeds will be germinated in a growth chamber for 10 days at 25°C using the STS soybean herbicide tolerance testing protocol. Statistical analysis of the germinating and surviving kochia specimens will allow for the calculation of herbicide tolerances. The results and data collected from this research project will be distributed to Weed Coordinators from the Bighorn basin counties and to interested parties promoting integrated control of kochia in crop and rangeland settings. [Paper Number 25]

ALTERNATIVES TO METHYL BROMIDE FOR WEED MANAGEMENT IN FIELD-GROWN FLOWER CROPS. Clyde Elmore and John Roncoroni, University of California, Davis, CA.

Abstract not submitted. [Paper Number 26]

FLUMIOXAZIN AS A COMPONENT OF WEED MANAGEMENT IN DRY BEANS. Dana F. Coggon[1], Scott J. Nissen[1], Stephen D. Miller[2] and Robert G. Wilson[3]. Graduate Student, Professor, Professor and Professor. [1]Colorado State University, Fort Collins Co 80523, [2]University of Wyoming Plant Sciences, Laramie WY 82071 and [3]University of Nebraska, Panhandle Research Station, Scottsbluff NE 69361.

Abstract. ALS resistant weeds are a problem in dry beans production. Flumioxazin is a pre-emergence herbicide currently being developed for broadleaf weed control in soybeans and peanuts, and was evaluated in this study for use in dry beans. A rate titration study was conducted at three locations: Fort Collins, CO; Scottsbluff, NE; and Torrington; WY. Plots were treated with flumioxazin rates varying from 0.034 - 0.135 kg ai/ha. Crop response, broad leaf weed control, and yield were evaluated. There was no significant crop response at the Fort Collins and Torrington locations; however, crop response at the Scottsbluff location averaged 16% for rates above 0.068 kg ai/ha. Redroot pigweed (Amaranthus retroflexus) control was greater than 90% at all rates and all locations, while lambsquarter (Chenopodium album) control was good to excellent at two of the three locations. There were no significant yield differences among treatments across all locations. The injury observed at the Scottsbluff site did not result in significant yield loss. These data suggest that flumioxazin may provide a new mode of action for broadleaf weed control in dry beans. [Paper Number 27]

CANADA THISTLE, YELLOW NUTSEDGE, AND QUACKGRASS CONTROL IN BLUEBERRIES AND RASPBERRIES. Timothy W. Miller and Brian G. Maupin. Extension Weed Scientist and Ag. Research Technologist. Washington State University, Mount Vernon WA 98273.

Abstract. Several herbicide trials have been conducted in established blueberries and raspberries at various western Washington sites since 1998. Canada thistle control was maximized using clopyralid at 0.125 and 0.25 lb/a applied late postemergence (LPOST) in raspberry (77 and 93% at 3 months after treatment), or at the same rates applied LPOST in blueberry (86 and 97% at 3 months after treatment, respectively). Raspberry foliar injury by clopyralid at 0.25 lb/a was slight and transitory, and neither raspberry nor blueberry yield was significantly affected by either rate. Diclobenil at 4 lb/a applied early postemergence (EPOST) gave 95% Canada thistle control with no visual raspberry injury. Diclobenil PRE also provided 84% yellow nutsedge control after two years at 4 lb/a in raspberry, while halosulfuron POST at 0.047 lb/a controlled 83%; neither product reduced raspberry yield or fruit size. Quackgrass control was 83 to 96% in raspberry using EPOST glyphosate or sulfosate at 1.5 lb ai/a, fluazifop 0.375 lb/a, or quizalofop at 0.88 lb/a for 2 years. Raspberry yield was significantly improved when treated with 4 lb/a diclobenil, sulfosate, glyphosate, or quizalofop than with untreated raspberries. [Paper Number 28]

POINT MUTATION CONFERS SULFONYLUREA RESISTANCE TO ONE DOWNY BROME (*BROMUS TECTORUM*) BIOTYPE BUT NOT IN ANOTHER. Kee-Woong Park[1], Carol A. Mallory-Smith[1], Daniel A. Ball[2] and George W. Mueller-Warrant[3]. Graduate Student, Associate Professor, Research Agronomist and Associate Professor. [1]Department of Crop and Soil Science, Oregon State University, Corvallis OR 97331-3002, [2]Oregon State University, Columbia Basin Agricultural Research Center, Pendleton OR 97801 and [3]USDA-ARS, National Forage Seed Production Research Center, Corvallis OR 97331-7102.

Abstract. Acetolactate synthase (ALS) inhibitors, which inhibit the first committed step of branched-chain amino acid biosynthesis, are commonly used herbicides. ALS resistant downy brome biotypes were discovered at Athena and Madras, Oregon. This study was conducted to determine the molecular basis for herbicide resistance in both resistant biotypes. Primers were designed based on homologous regions of other grass family ALS genes. Genome walker and polymerase chain reaction (PCR) were performed to clone the ALS genes from four different downy brome biotypes. Partial 1725-bp genomic DNA sequence was obtained which encoded 573 amino acid residues. There were no intron regions in ALS genes based on other plant ALS genes. DNA sequence analysis of the ALS gene demonstrated a single-point mutation from C to T at nucleotide 451 of the ALS coding sequence that changed amino acid residue Pro to Ser in the Athena resistant biotype. However, there was no mutation in the ALS gene of the Madras resistant biotype or either susceptible biotypes. Resistance in the Athena biotype appears to be due to a point mutation in the ALS gene while resistance in the Madras biotype is not. [Paper Number 29]

BROADLEAF WEED CONTROL IN ONIONS. Paul Hendrickson[1], Harlene Hatterman-Valenti[2] and Richard Greenland[3]. Research Specialist, Assistant Professor and Associate Agronomist. [1]Carrington Research/Extension Center, Carrington ND 58421, [2]North Dakota State University, Fargo ND 58105 and [3]Oakes Irrigation Research Site, Oakes ND 58474.

Abstract. Field trials were conducted at three locations in North Dakota to evaluate herbicide combinations for crop tolerance and broadleaf weed control in onion. Trials were conducted on a loam soil with 3.1% organic matter and 7.9 pH at the Carrington Research Extension Center, a clay loam soil with 3.5% organic matter and 7.5 pH at a site near Prosper, and a sandy loam soil with 2% organic matter and 7.5 pH at the Oakes Irrigation Site. Delayed PRE treatments were applied 7 to 15 days after planting. POST1 treatments were applied to flag- to 1-leaf onion at all locations. POST2, POST3, and POST4 treatments were applied to 3.5-leaf, 4.5-leaf, and 5-leaf onion at Carrington, 2-leaf, 2-leaf, and 5-leaf onion at Prosper, and 2-leaf, 3-leaf, and 4- to 5-leaf onion at Oakes, respectively. Rates for bromoxynil, pendimethalin, metolachlor, dimethenamid, and bromoxynil + oxyfluorfen, were 0.25, 0.619, 0.595, 0.469, and 0.375 + 0.15 lb ai/A. Flumioxazin was applied at 0.765 and 1.53 lb/A. Rates for ethofumesate and flufenacet + metribuzin were adjusted for soil type at each location. The 1X and 2X rate of ethofumesate was 1.5 and 3 lb/A at Carrington, 2 and 4 lb/A at Prosper, and 1 and 2 lb/A at Oakes. The 1X and 2X rate of flufenacet + metribuzin was 0.34 + 0.08 and 0.68 + 0.16 lb/A at Carrington, 0.46 + 0.12 and 0.92 + 0.24 lb/A at Prosper, and 0.23 + 0.06 and 0.46 + 0.12 lb/A at Oakes. Individual plots were harvested at Carrington. Flumioxazin applied PPI (Carrington) or PRE (Prosper and Oakes) and flufenacet + metribuzin applied PRE caused significant injury at all three sites and a reduction in the number of harvested bulbs and yield at Carrington. Injury from bromoxynil applied delayed PRE and pendimethalin applied PRE or POST1 was < 10% at all three locations. Pendimethalin, metolachlor, and dimethenamid applied POST3 did not injure the onion and provided residual late season weed control. A 1-leaf application of 28% UAN at 20 gal/A did not increase broadleaf weed control. Bromoxynil applied delayed PRE followed by pendimethalin at POST1 and POST3 and bromoxynil + oxyfluorfen at POST2 and POST4 provided season long weed control at all three locations and the highest numerical yield (794 cwt/A) at Carrington. [Paper Number 30]

HALOSULFURON FOR PURPLE NUTSEDGE MANAGEMENT IN CHILE. J.H. Norsworthy, J. Schroeder, P.A. Banks, and L.W. Murray. Graduate Assistant, New Mexico State University, Las Cruces NM 88003; Professor, New Mexico State University, Las Cruces NM 88003; President, Marathon Consulting, Las Cruces, NM 88005; and Professor, New Mexico State University, Las Cruces NM 88003

Abstract. Purple nutsedge (*Cyperus rotundus* L.) is a major weed management problem for chile pepper producers of New Mexico. Research was conducted near Rincon, New Mexico in 2001 to evaluate purple nutsedge control and chile injury after treatment with halosulfuron. Chile ('Sandia') was direct-seeded in March and thinned on June 13. Management was standard for the region and plots were cultivated as needed. Halosulfuron at 0.036 and 0.053 kg ai

ha^{-1} plus Latron AG-98 (0.125% v/v) or MSO plus CMR Embrace Plus (1.0% plus 2.5% v/v respectively) was applied as a directed treatment at two timings after thinning (14 or 29 days post thinning (PT)). Plots were rated compared to weedy and hand-weeded controls at one-week intervals throughout the growing season. Nutsedge control with halosulfuron averaged 72% over the season. This was 38% higher than hand-weeded controls, although herbicide treatments differed statistically from the hand-weeded controls on only three of five rating dates. Overall, the 14 PT treatments at the low rate caused 3.5% chile injury and the treatments at the high rate caused 7.6% chile injury. The 29 PT treatments caused 7.1% chile injury at the low rate and 6.0% injury at the high rate. Overall, chile injury was low regardless of halosulfuron rate or adjuvant, and nutsedge control was acceptable throughout the season. However, the nutsedge began to reestablish towards the end of the season. Total and marketable pod yields were not affected by treatment; however, yields in herbicide treated plots tended to be greater than non-weeded plots. [Paper Number 31]

BROCCOLI WEED CONTROL STUDIES IN THE SALINAS VALLEY, CA. Richard F. Smith. Farm Advisor. UC Cooperative Extension, Salinas CA 93901.

Abstract. The return of DCPA to the market has been a benefit to weed control in broccoli in the Salinas Valley. In particular, DCPA preemergence followed by post emergence applications of a 20% ammonium nitrate solution (AN 20) provides excellent weed control. However, key weeds such as shepherd's purse can be problematic, especially in the winter when AN 20 cannot be used due to reduced crop safety. Trials were conducted over the past three years to evaluate preemergence and post emergence materials for weed control, crop safety and yield on broccoli. Preemergence herbicides evaluated included: sulfentrazone, S-metolachlor, cycloate, trifluralin, EPTC, quinclorac, and fluroxypyr and the standards DCPA and bensulide. Post emergence herbicides evaluated included: Pyridate, ethanmetsulfuron methyl and carfentrazone with AN 20 used as the standard. Trials were conducted in numerous locations in the Salinas Valley on soil types ranging from sandy to clay loams, and at various times of the year. Preemergence. Sulfentrazone provides excellent control of key weeds in broccoli including shepherd's purse, burning nettle, redroot pigweed and common purslane. It is generally safe on broccoli at 0.112 a.i./A on light soils, and safe up to 0.15 lb a.i./A on heavier soils. S-metolachlor provides improved control of shepherd's purse compared to DCPA at 0.5 lb a.i./A. However, broccoli is sensitive to S-metolachlor at 0.5 lb a.i./A, and rates can not be further reduced to improve crop safety without reducing weed control. All other preemergence herbicides tested in these trials were weak on key weeds of broccoli. Post emergence. Carfentrazone is too phytotoxic even at the lowest rate tested, 0.008 lb a.i./A. Pyridate provides moderate weed control at 0.23 lb a.i./A, but better weed control is achieved at 0.46 lb a.i./A. However, 0.46 lb a.i./A of pyridate is too phytotoxic to broccoli for commercial acceptance. The lower rate of pyridate is most effective on small weeds (cotyledon to 1st true leaf), and its use on transplanted broccoli may be the most promising use. Ethanmetsulfuron methyl had excellent safety on broccoli, but was weak on shepherd's purse in one preliminary study. Three organically acceptable materials were evaluated on broccoli: acetic acid, DR-A-035 and hydrogen peroxide. None were safe for post transplant application on broccoli. [Paper Number 32]

MONITORING AND ASSESSING THE STABILITY OF WEED POPULATION DYNAMICS IN CROP ROTATIONS BASED ON ROUNDUP READY TECHNOLOGY. Jason N. Miller, Philip Westra and Scott Nissen. Graduate Research Assistant, Professor and Associate Professor. Colorado State University, Fort Collins CO 80523.

Abstract. In 1998, a long-term study was initiated to determine whether weed population shifts occur as the result of continuous glyphosate use. Two crop rotations and four herbicide treatments were fixed in location for the duration of the study. Glyphosate-tolerant crops evaluated were continuous corn and a corn / sugarbeet rotation. Herbicide treatments represented a high rate glyphosate, a low rate glyphosate, annually rotating the high rate glyphosate with a non-glyphosate herbicide, and strictly a non-glyphosate treatment. In the glyphosate treatments, two applications were used. Systems built on the sequential glyphosate treatments resulted in the best weed control and highest crop yields. Generally, two applications of the high glyphosate rate provided better weed control than the two applications of the low rate. The use of soil residual herbicides usually resulted in late season weed flushes. Weeds that are increasing with repeated glyphosate applications include toothed spurge, wild buckwheat, common lambsquarter, and volunteer corn. However, we are also seeing weed population increases in the conventional herbicide plots as well. Soil samples taken annually will be used to correlate seedling populations with the soil cores

from which weed seeds are extracted. The study is scheduled to continue for another two seasons. [Paper Number 33]

RESPONSE OF ONION AND VOLUNTEER POTATO TO FLUROXYPYR. Clark C. Oman[1], Mack Thompson[2], Corey Ransom[3], Martin M. Williams[4] and Scott J. Nissen[1]. Research Associate, Assistant Professor, Assistant Professor, Assistant Professor and Associate Professor. [1]Colorado State University, Fort Collins CO 80523, [2]University of Idaho-Parma Research & Extension Center, Parma ID 83660, [3]Oregon State University-Malheur Experiment Station, Ontario OR 97914 and [4]Washington State University-IAREC, Prosser WA 99350.

Abstract. Abstract Volunteer potatoes reduce onion yields and serve as hosts for several important potato pathogens. Fluroxypyr was evaluated as a potential management tool for volunteer potato control in dry bulb onions. Initial field studies evaluated potato (Norkotah) response to fluroxypyr applications of 71 to 284 g ai/ha. All rates significantly reduced top growth and daughter tuber yields. Potato variety response was evaluated by applying fluroxypyr at rates of 142, 213, and 284 g ai/ha to four potato varieties representing several market classes: chipping (Chipeta), red fresh-market (Sangre), and white fresh-market (Norkotah and Nugget). Norkotah was the most sensitive variety, while Nugget and Chipeta were intermediate. Sangre was the most tolerant variety, producing a significant number of daughter tubers at the highest fluroxypyr rate. Onion response to fluroxypyr applied alone and in sequential applications with oxyfluorfen and bromoxynil was evaluated under weed free conditions. Onion yields were similar to the untreated control for all treatments, including a 560 g ai/ha fluroxypyr application to four leaf onions. Volunteer potato biomass and daughter tuber yield were significantly reduced by the same treatments including three applications of oxyfluorfen and bromoxynil. Fluroxypyr was affective in controlling volunteer potatoes and onions appear to have acceptable tolerance. [Paper Number 34]

PLANT POPULATION, ROW SPACING AND HERBICIDE EFFECTS ON WEEDS IN SUGARBEETS. Katherine K. Nelson and Dr. Stephen D. Miller. Graduate Research Assistant and Professor, Weed Science. University of Wyoming, Laramie WY 82071.

Abstract. Today's agricultural economy dictates that producers fine-tune their farming practices to maximize yields and minimize production costs. To help identify practices that might benefit sugarbeet producers, the University of Wyoming is conducting a two year study on the role that row spacing, sugarbeet population and herbicide treatments play in weed control and beet yield. The study was conducted on a Mitchell sandy loam soil at the University of Wyoming Agricultural Experiment Station at Torrington, Wyoming with glyphosate-tolerant sugarbeet. The experiment was conducted as a split plot with three replications. Main plots were sugarbeet row spacing (15, 22 and 30 inches) and subplots a factorial arrangement of plant populations (40,80 and 120,000 seed/a) and weed management level (1 or 2 applications of glyphosate at 0.75 lb ai/a, 3 micro-rate applications of desmedipham-phenmedipham plus triflusulfuron plus clopyralid and MSO at 0.08+0.0.004+0.023 lb ai/a+1.5%v/v, a hand weeded and a weedy check plot). Data collected included sugarbeet yield, sucrose yield, sugar loss to molasses, weed biomass, weed counts and light measurements at the bottom of the sugarbeet canopy. Preliminary analysis shows plant population of 80,000 seed/a produced highest yields, lowest weed weights, highest percent sugar, least sugar loss to molasses and most sucrose. Fifteen-inch row spacing produced the best yields, least weeds, lowest sugar loss to molasses and highest sucrose, while 30-inch rows produced highest percent sugar. Hand weeded plots and those treated with two applications of glyphosate produced the best yields, the highest sucrose and the least weeds. [Paper Number 35]

GENERAL SESSION

PRESIDENTIAL ADDRESS: MOVING FORWARD. Robert Parker, Extension Weed Scientist, Washington State University, 24106 North Bunn Road, Prosser, WA 99350

I often think I would like to return to the past when things were simpler. Life seemed a lot less complicated, no EPA, FQPA, NPDES, and fewer regulations. Some government agencies seemed a lot friendlier and we were appreciated by the public. There seemed to be a lot more employment opportunities in the field of weed science. The majority of the people in the United States knew that food did not miraculously show up in the supermarket and that farmers were needed to produce this food.

Let's look closer at these good old days. Somewhere I read that there was three eras of agriculture. The first being the "The Blood, Sweat and Tears Era." Famine and fatigue was common. Most people were farmers, but they were subsistence farmers and didn't really have much in life to look forward to. If they had enough food to feed themselves and their families they were successful.

The second era was the "Mechanical Era." This era began with the invention of labor saving machines. In 1830, 4 farmers supported 5 nonfarmers; in1910, 1 farmer supported himself and 6 others; by1930, 1 farmer supported himself and 10 others, in 1965, 1 farmer supported 40 others, and in 1992, 1 farmer fed 128 others (94.3 Americans and 33.7 in other countries). Much of this increase in productivity was due to mechanization but also from improved technology.

The third era was "The Chemical Era" which really got going in the 1940's and it complemented the Mechanical Era helping the quantum leaps that the American farmer made in feeding his family and others. We as weed scientists often regard the chemical era for weed management beginning in the 1940's with the discovery of the phenoxy herbicides but it really got started earlier. Some history books say the chemical era really began about 1000 B.C. when Homer wrote of pest averting sulfur, with the first weed control about 300 B.C. by Theophrastus who found that young trees could be killed by oil (olive?) poured over their roots. Salt was reportedly used by the Romans on fields when sacking Carthage to prevent crop growth (probably a myth). However, salt was later used as a herbicide in England and Germany, and was tested on orange hawkweed in Vermont in 1896, and tested for field bindweed conteol in 1915 and used extensively for field bindweed control in Kansas from 1937 to 1950 in noncrop sites.

The first selective weed control was used when it was discovered that Bordeaux mixture (copper sulfate, lime, and water) turned charlock leaves black, leading Bonnet in France in 1896 to find it would selectively kill yellow charlock in cereals. Many other trials with copper sulfate, iron sulfate, sulfuric acid, and nitric acid were tested over the next few years in the US, Canada, France and Germany. It is interesting to note that copper sulfate is still widely used to control algae in aquatic sites

In this period of early chemical weed control in the early to mid 1900's some of the materials that were being used besides some of those already mentioned, included sodium arsenite and some petroleum derivatives. The US Army Corp of Engineers used sodium arsenite to control waterhyacinth in Louisiana in 1902 and the use continued until 1937 despite the toxicity to humans, livestock and wildlife. In California it was shown that under high humidity and dry soil that sodium arsenite would move extensively in field bindweed roots. Orchard heating oil was used to control wild garlic and onion as early as 1914 and from 1919 through the 1940's petroleum herbicides were used extensively on ditchbanks, noncrop areas and for selective weeding in carrots, parsley and dill. These latter uses of the oils were still in use in the 80's and xylene is still used in irrigation water delivery systems.

Dinitrophenol was used in France to control annual forbs in cereals and it was used extensively in the US in peas, onions, cereals, flax, and other legumes. Dinoseb would still be the herbicide of choice in some areas if it hadn't been banned in the 1980's.

Even though some of these early products are still being used or were used until recently, the discovery of the phenoxyacetic herbicides in Britain and the US during World War II marked the real beginning of the "Chemical Era of Agriculture." This discovery led to the development of many more products. About 330 herbicides have been developed since then, of these approximately 200 are currently available for use. I have a copy of the 1963 University of Wyoming Weed Control Recommendations. This set of recommendations was 19 pages long and printed on 6 by 9 inch pages. In these recommendations there were a total of three entries for corn herbicides, two for 2,4-D and one for atrazine; and three alfalfa herbicides listed. The Wyoming recommendations for 2001-2002 are 299 pages long and printed on 9 by 11 inch pages. In corn there are 43 herbicide entries listed and 22 for alfalfa. Other great strides have been made, for example the average herbicide rate applied per acre prior to 1940 was 1472 pounds and now is something like 0.34 pounds per acre.

Do we really want to go back to even the early 1960's when we had just 2,4-D and atrazine registered for corn? I think not. Rachel Carson's book, Silent Spring had just made its debut and regulations seemed to multiply after that. We may have to operate in a clime where there are many more regulations. Some of the regulations we work under today are not very scientific or based on fact, but none are as severe as a law that was on the books in Scotland from 1212 to 1249. This law decreed severe penalties to tenants or bond servants who seed (grew) weeds on the land or did not destroy certain weeds. Enforcement was so effective that the weeds were practically eliminated and the "Gool riders" could no longer find enough weeds to collect enough fines to afford dinner or drink. In fact this law was so effective that a fellow by the name of Sinclair in 1814 thought those laws should be renewed. Even with the present regulations, I believe that our profession is a lot better today than it was even 10 years ago. We will continue to make strides and we will continue to have our critics, but we can do things today that we couldn't do before and we will be able to do things tomorrow that we can only dream of today.

Some of our critics have asked are we really gaining with all of this technology. All in all has our weed population decreased? Probably not, but we have helped make farming, ranching, and our other stewardships easier and more profitable, while conserving natural and human resources. We shouldn't forget the past, as we can learn from those times, but we should look towards the future and learn live and continue to be productive in the environment we have today and will have in the future. More changes will be coming, but the future of weed science continues to remain bright. The need for weed management will still be needed and it will become more so as more folks try to go into organic production. New chemistry will still be discovered and we will continue to find new uses for some of the older products. We will lose some of the current products, but many of the new products will be used at even lower rates making make them even more environmentally friendly. [Paper Number 36]

CAPITOL COALITIONS-INFLUENCING GOVERNMANET THROUGH STRATEGIC ALLIANCES.

Robert Hedberg, Director of Science Policy, Washington DC 20002

Much of the work done in Washington by the Director of Science Policy for the National and Regional Weed Science Societies is done through coalitions. In fact the position itself is an example of a coalition that includes two national weed science societies, the Weed Science Society of America and the Aquatic Plant Management Society, and four regional societies, the Western Society of Weed Science, the North Central Weed Science Society, the Southern Weed Science Society and the North Eastern Weed Science Society. Given the importance of coalitions to these efforts it is valuable to look at the who, what, why and how of our coalition efforts.

The first question that comes to mind is, "Why form coalitions?" In Washington the first answer to that question is relatively simple, namely coalitions provide clout. There is a much truth in the concept of strength in numbers. The more people or groups support an idea or an effort, the more comfortable policy makers will be with the concept because they know that the idea has broad appeal. Washington is not a conducive environment for Lone Rangers.

Another question is, "Who are your coalition partners?" By their very nature politicians respond to the constituents whose votes can keep them in, or remove them from office. It makes good sense to seek alignment with groups that represent important constituencies, especially when these groups are large and well organized. For example, it makes good sense to work with the American Cattleman's Beef Association on weed issues because they share our concern with weeds, they are influential, and they generally have good access to western legislators.

Coalitions also have other benefits. They provide more ideas, more information, more credibility and more resources to get things done. But there are also downsides. It takes time to build trust and consensus. Agreement generally develops around the "least common denominator" or the least divisive elements of an issue. Coalition members generally pursue their primary issues independently and work through coalitions on their less important and secondary issues. There are also problems of leadership, with many bosses and few workers. There are also questions of accountability if things go wrong and of course, everyone is responsible when things go well.

National Invasive Weed Awareness Week is one example of a very effective coalition. This event, which is now entering its fourth year is organized by a loose coalition known as IWAC, or Invasive Weed Awareness Committee. Within IWAC a core of about six people work diligently to make the week happen with significant contributions from many others. The participants in the week have included The Nature Conservancy, National Cattleman's Beef Association, Ecological Society of America, North American Weed Management Association, Garden Clubs of

America, Aquatic Ecosystem Restoration Foundation, Union of Concerned Scientists, the National and Regional Weed Science Societies, private sector businesses and many Federal Agencies. Ultimately, the coalition was very effective by bringing these groups together in Washington to raise awareness and demonstrate a broad constituency.

Another effective Coalition was the Consortium of Crop Research Workers that was formed by Weed Science Society of America (WSSA), National Alliance of Independent Crop Consultants (NAICC), American Phytopathological Society (APS) and Entomological Society of America (ESA) to petition the Environmental Protection Agency for changes in the Worker Protection Standard (WPS). During the six years that it took to reach an acceptable compromise WSSA and NAICC worked closely and persistently on the issue. Although APS and ESA were early partners who added strength to the petition it was not a central issue for them and their involvement faded with time. Nevertheless their early participation helped and they gained equally with the other members.

Two other coalition efforts are working to build public support for agricultural research. One is CoFARM (Coalition on Funding Agricultural Research Missions) a group of 22 agricultural science societies representing over 130,000 members. The other is NCFAR (National Coalition for Food and Agricultural Research) with over 100 members including commodity groups, processor groups, scientific societies, conservation groups, universities and individuals. CoFARM is a member of NCFAR and our Director of Science Policy is the CoFARM representative to NCFAR and the Chair of its Research Committee. NCFAR recently obtained a Sense of the Senate resolution that recognizes the importance of agricultural research and the need for enhanced public support.

The CoFARM steering committee meets periodically with administrators and key staff of the research agencies within USDA. These meetings illustrate the access gained as a coalition that would not be as available to individual societies. In another example, two CoFARM members organized a congressional staff briefing to showcase the contributions of different scientific disciplines to national biosecurity efforts. Through their effort Dr. Steve Dewey had the opportunity to meet with these staff and talk about the importance of weeds, the elements of an effective detection and response system and the value of the Land Grant System to provide locally accessible expertise.

From these examples it is apparent that working in coalitions has been a productive approach for the weed science societies' efforts in Washington. As the societies have worked together to facilitate the successful liaison activities we should also continue to look for other ways that the six societies can work together for our mutual benefit. We should keep our eyes open for all manner of new opportunities where we can work effectively with new and non-traditional partners as well. Although we will probably not see eye to eye on all issues there is merit in building relationships and working together when we share needs and interests with a broad range of other organizations. [Paper Number 37]

INVASION BIOLOGY: A NEW PARADIGM FOR WEED SCIENCE? Jodie S. Holt, Professor, Botany and Plant Sciences Department, University of California, Riverside CA 92521

Weed science is in many ways a derivative science that has been viewed by some as ancillary to the fundamental scientific disciplines from which it draws its core principles. We now stand at the threshold of a unique opportunity to move to the forefront of a newly emerging applied science, invasion biology, to which we are eminently qualified to contribute. This new discipline is by its very nature derivative, combining both fundamental and applied sciences in the study of a unique category of organisms. Without contributions from both the fundamental and the applied ends of the scientific spectrum, this new science cannot progress. Weed science and the other pest disciplines constitute the applied end of invasion biology. If weed scientists fail to recognize their essential role in this new endeavor, others will quickly step in and fill the knowledge gap with information that lacks a foundation of decades of weed science research findings and technological accomplishments.

In keeping with the theme of this conference, "Moving Forward," there are compelling reasons for weed scientists and weed science organizations to rise to this new challenge. The rewards could be profound, for not only could we shed misconceptions about the nature and role of weed science in modern times, we could make a critical contribution to the growing global crisis of invasive species.

The Nature of Science

As scientists, we define ourselves primarily in one of three ways: by the questions we ask, the tools we use, or the organisms we study.[1] For example, a community ecologist might engage in research to answer the question of why a particular plant species grows where it does. A molecular geneticist, in contrast, might use the tools of DNA analysis to understand the nature of the plant genome. Using this premise, weed scientists are defined by our unifying focus on weeds as study organisms. This focus establishes weed science as an applied science since the presumed eventual endpoint of research is improved management of weeds.

Unlike those disciplines defined by questions or tools, one defined by the organism is by definition broad and diffuse, with little in common among scientists besides the particular type of organism that is the object of study. Modern weed science also combines both fundamental and applied sciences in the study of weeds. Thus, the molecular geneticist studying weed seed dormancy or herbicide binding sites in the laboratory is a weed scientist, as is the agroecologist studying competitive interactions between a weed and a crop in the field, as is the agronomist evaluating herbicide application technology for weed control in crops. Furthermore, in weed science the practitioners define the problems, the scientists work to understand them, and the practitioners then use this new knowledge to develop better techniques to solve the problems. This framework mirrors the traditional view of the Agricultural Experiment Station (AES), which encompasses the entire academic continuum from basic research by AES scientists to extension of knowledge by Cooperative Extension personnel. This breadth of the discipline of weed science, from fundamental research to applied research to extension of knowledge to practical application, is mirrored in the diverse membership of the Weed science Society of America (WSSA) as well as regional weed science societies such as the WSWS. Such diversity can be divisive if common ground is not identified.

An Incomplete History of Weed Science

Although weeds have been recognized since the beginning of agriculture, the discipline of weed science is relatively young (Radosevich et al. 1997). The desire to improve weed control was the impetus for the earliest research in weed science in the 1940s, which focused on newly discovered herbicides (Zimdahl 1993). During that time, botanists, ecologists, and evolutionary biologists also focused their research on weeds, which led to the relatively recent expansion of the discipline to include biological principles and ecological concepts as a foundation for weed management (Radosevich et al. 1997). Modern weed science encompasses fundamental scientific disciplines that study plants (biochemistry, chemistry, ecology, genetics, physiology), as well as soil and environmental sciences. Weed scientists specialize in weeds of agronomic, horticultural, and ornamental crops, turfgrass, and weeds growing in aquatic habitats, pastures, rangelands, forests, and rights-of-way. Very recently, weed scientists have expanded their focus to weeds of wildlands, as well. Weed technologists specialize in application methodology, herbicide formulations and adjuvants.

The unifying focus on weeds that links diverse scientists and practitioners within weed science is not science-based, particularly since weeds are almost universally defined anthropomorphically ("plants out of place") rather than biologically (Radosevich et al. 1997, Terminology Committee of the WSSA 1956). Similarly, scientific principles are not essential to kill a weed, unless one asks why a particular practice works rather than whether it works. In contrast, a discipline defined by the fundamental questions it asks about a particular organism is necessarily based on a unifying body of scientific knowledge and underlying principles that govern the behavior of the system under study. For example, plant ecologists at all levels of organization (individual to community) study the interactions of plants with their environment to address the fundamental question, 'why do plants grow where they do?' (Barbour, et al. 1999). To move beyond being defined by a focus on weeds to become a science-based discipline, weed science research and technology must have a foundation of fundamental scientific theory and principles.

Calls for principles-based research in weed science, particularly ecological research, have been made over the past decade, most notably by Radosevich and Ghersa (1992), Wyse (1992), and Zimdahl (1995). The most eloquent call was made by Zimdahl (1999), who stated:

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[1] Original idea of Dr. Norman Ellstrand, Department of Botany and Plant Sciences, University of California, Riverside.

> "The right question will not forbid asking what to do, but it demands that research begin with a *why* question rather than a *what* question. A *why* question leads toward development of a foundational theory to guide weed science. *Why* does something happen? *What* questions are fundamentally empirical and their answers reveal what to do, but not necessarily why a particular course of action is best or why it should be taken."

Commonality in scientific questions and underlying principles would diminish apparent differences among weed scientists working in different cropping or non-crop systems, because the question, not the system, would become more important. Similarly, weed technology would not seem so disconnected from basic weed ecology if it were designed with an understanding of the underlying ecological principles that cause it to work (Altieri and Liebman 1988, Holt 1997). This approach to weed science would also link the discipline more directly to the larger scientific community, making weed science more viable in the 21st century.

Principles of Weed Science

Whether or not weed science research and technology actually address basic principles, both should be designed with underlying principles in mind if the goal of the work is to advance knowledge or provide generalizations about the system under study. Some areas of research in weed science have historically been well integrated with their basic scientific underpinnings, most notably weed and herbicide physiology. As noted by Duke (1992), research on photosynthetic inhibitors using triazine resistant weeds led to the discovery of the photosystem (PS) II herbicide binding site (Steinback et al. 1981) and a subsequent Nobel prize for discovery of the molecular structure of PS II (Deisenhofer et al. 1985). Others have reviewed the role of basic science in weed management, such as application of genomics technology for discovery of new herbicide targets (Hess et al. 2001), genetic analysis of plant diversity to explain weed responses to control methods (Jasieniuk and Maxwell 2001, Nissen et al. 1995), application of the tools of physiological ecology to understand and manage weeds in crop canopies (Holt 1995), and the evolutionary basis of selection of herbicide resistance in weeds (Holt 1997).

Ecology as a foundation of weed management has been the topic of several texts over the past two decades (Aldrich 1984, Altieri and Liebman 1988, Radosevich and Holt 1984, Radosevich et al. 1997). In spite of the obvious role of ecology as a foundation for understanding the interactions of weeds and the environment, including crops, the traditional view of ecology does not encompass managed or disturbed systems, such as agroecosystems. As noted by Pickett et al. (1992), the classical ecological paradigm holds that "people and their activities are not a part of natural systems, and conservation should strive to exclude them." Only recently has this traditional view begun to shift and diminish the distance between basic theoretical ecology and applied ecology (agriculture, forestry, range management, weed science, and wildlife and fisheries ecology), perhaps in response to the recognition that few places on earth are protected from human influence. Pickett et al. (1992) describe a new paradigm in ecology, the "nonequilibrium paradigm," in which systems are viewed as open and influenced by their surroundings and humans are included as agents of flux and disturbance. Notably, the Ecological Society of America (ESA) established a standing section of Agroecology in 2000, as evidence of this shift (ESA 2002). While this new paradigm is not yet widely accepted, it has the potential to remove longstanding barriers and revitalize both basic and applied ecology. As evidence of a new integration of fundamental ecological principles with applied problems in species conservation and management, recent reviews have discussed the ecological principles that are the foundation of understanding and managing invasive species (Masters and Sheley 2001, Sakai et al. 2001).

Invasion Biology—the New Applied Ecology

Historically, the pest disciplines (entomology, pathology, weed science) arose from the agricultural sciences. Today weeds and other pests are recognized as invaders of wildlands as well as agricultural systems. Data on impacts of plant invasions mirror historical data on weed impacts in agroecosystems, although it is much more difficult to place an economic value on wildlands than croplands (Anonymous 2001). As an emergent discipline, invasion biology is in the descriptive phase with a great need for an understanding of the principles and processes regulating invasion. Nevertheless, invasive plants are generally viewed as exotic (introduced) plants that become naturalized, spread naturally away from the site of introduction, and transform the ecosystem in which they occur (Randall 1997, Richardson et al. 2000). The emergence of this ecological definition of an invader has been accompanied by the expansion of weed scientists' definition of 'weed' to include environmental weeds (wildland

weeds, natural area weeds), defined as "those species that invade native communities or ecosystems—they are undesirable from an ecological perspective but not necessarily from an economic one. Serious environmental weeds are defined as those that cause major modification to species richness, abundance or ecosystem function" (Humphries et al. 1991, Randall 1997). Thus, invasive plants might be viewed as a subset of the more all-inclusive definition of weed. Clearly, decades of advances in weed science and technology should be brought to bear on the management of invasive plants.

A New Paradigm for Weed Science

Many weed scientists and technologists, particularly in the western region of the US and in the WSWS, have focused their activities on rangeland weeds for decades, so that an expansion of terminology to include wildland weeds and invasive plants is a natural progression. However, there is a broader mandate for all weed scientists to modify our current paradigm to embrace this new definition of a weed as an unwanted plant in any habitat or ecosystem, including wildlands. This broader definition of weeds and expansion of what is encompassed by weed science would provide a natural home for other land and plant managers whose activities fall outside the traditional paradigm of weeds as pests of agricultural systems.

In order for this expanded mandate to be truly inclusive, weed scientists also must begin to define ourselves by more than just our study organism. Linkage of research and technology with the appropriate scientific discipline will be required to bridge the gap between weed science and ecology. Ecologists, the ESA, and funding agencies (e.g., the National Science Foundation, NSF) are already beginning to bridge that gap (ESA 2002, Lodge 1993, Sakai et al. 2001) as ecologists expand their focus into more applied areas of research. Unfortunately, far too often basic scientists lack an understanding of weed science research and technology that would inform their shift into more applied research. Weed scientists can ill afford to relinquish our role as experts in the management of unwanted plants. The solution to this dilemma is for weed scientists and invasion biologists from both ends of the basic research–technology continuum to expand their focus to include the entire continuum. The international crisis of invasion of exotic plants and animals, biotic homogenization, and loss of genetic diversity makes it imperative that weed scientists drop our scientific biases, move out of familiar intellectual territory, and begin to apply basic ecological principles to solve the problems of managed and disturbed systems. As weed scientists, we have both much to learn and much to contribute.

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HONORARY MEMBER AWARD - WESTERN SOCIETY OF WEED SCIENCE PRESENTATION - SENATOR LARRY CRAIG, IDAHO

Senator Craig: First and foremost, to all of you, thank you very much for this very generous recognition. Let me also thank Francoise Cleveland, who is there on my behalf today, who heads up our Pocatello office and is a regional manager in my State Staff. Well John, you've laid out pretty well my involvement in the issue of non-native or invasive weeds. I grew up with a dad who handed me a shovel very early on in life and said, "that's bad, and that's good, and this is bad, and that's good". Then we went from a shovel to a spray bottle, and of course, items like RoundUp and others that came along served us well. Of course I also, through my involvement with FFA, got involved in weed identification contests that many young men and women get involved in that really did teach me how bad a bad weed could be, and what it has done to the western landscape, especially in the last two or three decades where we have not had effective management and/or control. We have seen certain types of weeds literally control the landscape in a way that makes it impenetrable for any form of livestock, domestic or wild, and most assuredly for the human species that might wish to get out there and impact the land. In many areas in my state, as most know, and across the west, we have landscapes now that are literally controlled and dominated by these weeds. We know of the tremendous costs that the private sector puts in annually to manage them within their cultivated areas. When state and federal lands are not good neighbors and are harbingers of weeds, then that of course complicates the problems. My staff is not as attuned, in the general sense, to the weed issue as am I. I think that they were fascinated as I began to work with this issue several years ago and, John you've mentioned the legislation I have passed and the legislation that we are working on now, they were absolutely amazed at the attention that this issue got. Probably this issue alone has received more inches of ink and copy than almost any other issue I've been involved in. I think that it tells me, but I think it also told them, of the importance that many people put to this problem and frankly as hard as all of you have fought it over the years, some of our failures that are now so obvious even though we have had a lot of successes. You're right, the legislation that I have introduced as 198 really comes off from the model that the State Department of Agriculture and others have launched in Idaho, the bills that we call Weed Management Areas or Cooperative Management Areas and bills, the cooperative process that includes all of the ownership kinds of patterns. It allows the blending of the state, local money, and federal money in a

comprehensive effort through a cooperative process. Project cost sharing, all of those kinds of things that will make it work, is somewhere that we have got to go. I have been extremely pleased that, while for decades some of our environmental friends have been concerned about the use of herbicides and types of weed control, we now have the Nature Conservancy working hand-in-hand with the National Farmers and Beef Association in the support of 198. We are working to make some refinements now so that they can be full public supporters and sponsors of it. That is a partnership that really would be very, very helpful. I must say that Congressman Joel Hefley of Colorado has introduced a companion bill HR1462. The House is under different leadership and he has been a bit more successful than I in getting it marked up and getting it out, but the House hopes to finish it up on March 20. We are very hopeful that will help build for us a greater interest and impetus over here to get our work done. I hope that during the summer, probably in southeastern Idaho, to hold a hearing, the Secretary of Interior has shown very real interest in this as has the Secretary of Agriculture, to try to bring at least one of them and, certainly interest from both Interior and Agriculture, out to highlight this legislation and to bring more attention to it. Certainly all of you folks and your focus on, help and cooperation here will be greatly appreciated. We will reach out to you as this legislation is finalized to make sure that you can see it in a way that you find it compatible with all the work that is going on. It is also important and we all know it, is resource. I think that if they get the right legislation in place, that we can do just that kind of thing. I'm really looking at the idea of pioneering something that we are doing up in the Camas Prairie or Fairfield area of Idaho to create a multi county weed control center. Not unlike our fire fighting centers, but literally where counties can come together in a cooperative way, and the professional applicators can operate out of that area. I don't want to step on the toes of what counties are doing or have done, but be able to blend both public and private monies together to create that; we are looking at the possibility of doing that kind of modeling and building one of those centers. But, as I said, it would serve a region or a multi county area. Of course, as John had mentioned, we are also working the "after" in the after fire scenarios; where weeds can become increasingly dominant in the landscape simply because the other native species and beneficials can't compete or don't compete as well that we can get greater emphasis on that. We are always going to have fires and in many instances the question is how do we manage them after the fact and that we don't let the weeds become dominant in the landscape and then spread outside the fire areas. Again, to all of you, thank you very much for the recognition. I find it a great honor to be an honorable weed. I say that most sincerely, to be a member of the Western Society of Weed Science, I truly appreciate that. I appreciate the recognition, but what's most important is that all of you have been tremendously cooperative, interested, and involved in making this kind of thing happen.

Questions

Question: There are two separate bills, yours in the Senate and the representative from Colorado's in the House. Do you have an overview of how these bills could be combined to make the process more work-able:

Senator Craig: Well, they are not terribly incompatible at this moment. We are doing just that now. I've got a meeting planned with Congressman Hefley. We are good friends and have worked together on a lot of issues over the years. So I think that minor adjustments can get made to build a national bill. When we get ours passed in the Senate, and know what we've got, then we will go to the conference to work out our differences. I just don't see it as a great conflict because we have worked hand in glove together on this all the way through.

Question: Dealing with S198, we agree that it is a major step forward for funding invasive weed control, the bill does not currently affect specific support for Weed Science Research. We hopefully could make our control measures more effective. Would you be supportive of allowing local and state weed management associations, direct some of the funds they receive towards applied research that will help us to do a better job in controlling these weeds.

Senator Craig: Yes I would see no problem, but we would probably want to drop it to some degree, or to say that a certain percentage of total funds could be, but no I think that is an excellent suggestion. I would encourage that suggestion as a way of approaching this because we all know that not all of the answers are there and never will be and new products come along, new approaches, new biological approaches that work and let's take a look at that.

Question: Do you feel that either of these bills will be passed this year?

Senator Craig: Well, certainly the House bill looks like it is headed toward passage. I am going to make every effort to get ours passed this year and get them in the conference. We are looking to see if we can't make all of that

happen this year. The problem that we've got will simply be time, as is always a problem. There are no major enemies to this process or major opponents to what we are trying to do here, but it is a political year in the sense that all of the House and one-third of the Senate are running for reelection or at least their seats are up for reelection and that will shorten the process considerably. We will probably be out of here by late September or early October this year. So we are going to see what we can get done, but I am not going to guarantee that.

Question: Should the EPA do an environmental impact statement when a herbicide is removed from the market? What are your feelings about that?

Senator Craig: Well, I wish we could get them to do something like that. What we sense in many instances is the arbitrary nature of what the EPA has done as it relates to certain herbicides and pesticides and insecticides. I don't think we are going to get there because they are not going to want to go there, but I think that it is an excellent suggestion.

Question: What action items should the Western Society of Weed Science members and the western states do to help get your bill passed and funding appropriated?

Senator Craig: It would certainly help because all the bills have numbers now, to write the members of your House and the Senate and let them know of the importance of it. Engage your governors or your State Departments of Agriculture, get your State Directors and State Secretaries of Ag to call or write. Lifting the visibility of this, showing these Senators that there really is a concern and that this is an important piece of legislation can always be very helpful in the passage of language like this. But that is certainly one of the ways of doing it. If any of you are ever in Washington, take the time to set up an appointment with your Senators or their staff and let them know how important this is.

Question: There seems to be a disconnect between our awareness of invasive weeding and the general public's awareness. Yet, as an extension specialist the person who writes the question is not aware of funding to utilize the developed outreach and training for the general public. Are you or anyone else working to address this issue and again how can we be helpful in that each year.

Senator Craig: We are not addressing that specifically, but there is no question that the more funding we can get into weed management, weed control, research, and all of that, it then lifts the visibility of it. In all fairness, the reason there isn't money there today is that there is not a lot of attention to it. The average person out there, looks at something green growing on the ground or something that has a pretty flower and says "oh, isn't that nice", and instead of recognizing it for what it is or what it may have crowded out or the landscape that it may take over and control, and the value reduction that might occur, how that land was being used as a result of it. Let's face it, for about 99% of the American public, all that they know about it is that it is a green plant, well at least mostly green and that many of them have nice pretty flowers. So there is a huge educational gap. I am not so sure that we ever effectively bridged that, or the value of spending a lot of time trying to bridge it anyway. What we really did need to do is target our resources to those who can make the decisions to make these things happen, educate the few instead of the many, if you will, that can help us gain what we need and that's resources to target these weeds and get at them, and to move this legislation so that there is a comprehensive effort. Probably that is going to be more effective in the end, and then out of all of that effort I think there becomes a growing knowledge. Certainly educational programs in the schools, when we are looking at environmental programs, we ought to talk about good plants versus bad plants and what they do to the landscape and the environment. But I think that is all part of it. The dollars and cents are so limited in this area, I would much rather be using them in a directed control program that I would be in trying to spend a lot of time in an extensive educational program.

Thank you Senator, again I want to thank you for taking your time to be with us here today. Also your efforts on our behalf of Weed Science across the US, and as an honorary member you are entitled to come to this meeting any time you like. It is about the same time every year. You may want to come next year because we will be in Hawaii

STUDENT PAPER CONTEST – ORAL PRESENTATIONS

PERSIAN DARNEL IMPACT ON CROP QUALITY AND TOTAL REVENUE. Johnathon D. Holman[1], Bruce D. Maxwell[1], Alvin J. Bussan[1], Perry R. Miller[1] and James A. Mickelson[2]. Graduate Research Assistant, Associate Professor, Assistant Professor, Assistant Professor and Assistant Professor. [1]Department of Land Resources and Environmental Sciences, Montana State University, Bozeman MT 59717 and [2]Southern Agricultural Research Center, Montana State University, Huntley MT 59037.

Abstract. Research was conducted in Bozeman, MT in 2000 and 2001 to determine the effects of crop and weed density on crop quality attributes and adjusted gross return (AGR) of spring wheat, canola, and sunflower. A factorial experiment was established, with crop type as the whole plot treatment, and crop and weed density as sub-plot treatments. Crops were established at 1, 1.5, and 2x densities across a range of Persian darnel densities between 0 and 1000 seedlings m^{-2}. Spring wheat and canola were seeded the 8th and 17th of April, and sunflower was seeded the 16th and 19th of May in 2000 and 2001, respectively. Prior to seeding sunflower, glyphosate and ammonium sulfate were applied at 0.42 kg ae ha^{-1} and 1.9 kg ha^{-1}, respectively. The crop quality attributes measured included test weight, protein or oil content, and weed dockage. Crop and weed density explained little variation in seed quality, and their effects varied across years. Increasing weed density was negatively correlated with protein content of spring wheat and oil content of canola, and increased the test weight of spring wheat and canola. Greater weed density did not impact dockage in sunflower, but increased dockage in spring wheat and canola. Greater crop density reduced the dockage in spring wheat, but was negatively correlated with dockage in canola. Crop and weed density effects on crop quality and previously modeled crop yield functions were used to predict AGR. AGR gives a better estimate of the economic impact of a weed by accounting for its impact on crop yield and quality. [Paper Number 40]

EFFECTS OF LEAFY SPURGE (*EUPHORBIA ESULA*) HERBICIDES ON THE SURVIVAL AND FECUNDITY OF THE WESTERN PRAIRIE FRINGED ORCHID (*PLATANTHERA PRAECLARA*), A THREATENED SPECIES. Ann M. Erickson and Rodney G. Lym. Graduate Research Assistant and Professor. Department of Plant Sciences, North Dakota State University, Fargo ND 58105.

Abstract. Habitat invasion by leafy spurge is a threat to the survival of the western prairie fringed orchid (*Platanthera praeclara* Sheviak and Bowles). Current law prohibits the use of herbicides to control leafy spurge in areas where the orchid grows because it is a federally-listed threatened species. Leafy spurge biological control using *Aphthona* spp. flea beetles has been successful in many areas, but establishment of these beetles in the habitat of the western prairie fringed orchid has not yet been successful. Previous research has shown that orchids regrew in plots treated with imazapic and quinclorac. Therefore, research was initiated to evaluate the effect of imazapic and quinclorac on the survival and fecundity of the western prairie fringed orchid. Imazapic at 140 and 210 g ai/ha and quinclorac at 840 and 1120 g ai/ha were applied with a methylated seed oil to 1-m^2 plots each containing a single orchid in September 2000. The number of orchids that regrew in July 2001 was similar between treatments, and occasionally more than one orchid grew per plot. However, orchids treated with imazapic, especially at 210 g/ha, tended to regrow as vegetative plants or if they flowered, were shorter, had shorter racemes, and produced fewer flowers than untreated orchids. These data suggest that treating orchids with imazapic may have a negative effect on flower production. Orchids treated with quinclorac regrew similar to untreated orchids. Therefore, quinclorac may be useful to control leafy spurge in the habitat of the orchid. [Paper Number 41]

THE EFFECTS OF SOIL MOISTURE AND TEMPERATURE ON TOLERANCE OF SPRING WHEAT AND BARLEY AND CONTROL OF WILD OAT WITH TRALKOXYDIM. Branden L. Schiess and Donald C. Thill. Graduate Research Associate and Professor of Weed Science. Department of Plant, Soil and Entomological Sciences, University of Idaho, Moscow Id 83844-2339.

Abstract. Herbicides sometimes are applied when weather conditions are less than optimal in many cereal-producing areas of the Pacific Northwest. Cold, wet conditions can slow metabolic processes in plants, including herbicide metabolism. The effects of saturated and unsaturated soil on tolerance of spring wheat and spring barley to various rates of tralkoxydim were determined in field experiments in 2000 and 2001. Experiments were randomized complete block, split-split-plot designs. Tralkoxydim was applied to wheat and barley plants at the three to seven

leaf stages at 0.12, 0.24, and 0.48 lb ai/A (0.5x, 1x, and 2x the highest suggested label rate). In 2000 and 2001, one randomly selected main plot in each replication was irrigated to field capacity 12 hours after herbicide application and remained saturated until 21 days after treatment (DAT). The other main plot received no irrigation. In 2001, the irrigated main plots also were irrigated 3 d prior to herbicide application. Crop injury was evaluated visually 5, 7, 14, and 28 DAT. Biomass was determined 28 DAT. Plant height was measured at heading. Wheat and barley grain yield was determined for each plot. At 5 DAT, slight chlorosis was visible in the leaf whorl of wheat plants, but was not observed 7 DAT. No injury was observed at later evaluations. Plant biomass, plant height, and grain yield in 2000 and 2001 were not affected by herbicide rate or the interaction of herbicide rate by irrigation treatment. [Paper Number 42]

ENVIRONMENTAL FACTORS INFLUENCING YELLOW TOADFLAX DISTRIBUTION IN THE FLAT TOPS WILDERNESS AREA OF COLORADO. Jason R. Sutton and K. G. Beck. Graduate Student and Professor. Colorado State University, Ft. Collins CO 80523.

Abstract. Yellow toadflax (*Linaria vulgaris* Mill.) is a common weed that has become a serious problem in the Flat Tops Wilderness of Colorado. Using GPS technology, yellow toadflax infestations were mapped in the Ripple Creek and Marvine Creek drainages of the Flat Tops Wilderness during the summers of 1999 and 2000, respectfully. Characteristics of plots containing yellow toadflax were recorded and compared to non-infested control plots surveyed during the same season. Statistical design was a case control study in two locations. Plot characteristics were analyzed using logistic regression with forward selection. Yellow toadflax was positively correlated with parks, trailsides, and higher number of species per plot ($p<0.05$). Individual species correlations were determined by chi-square comparision of a species' presence in a plot to yellow toadflax presence. Yellow toadflax positively correlated with several species including *Achillea lanulosa*, and negatively correlated to gymnosperms ($p<0.05$). Percent bare ground and litter were analyzed using one-way analysis of variance (ANOVA). Yellow toadflax plots had a higher percentage of bare ground than non-infested plots ($p=0.0547$). Results of this study will direct future research on the ecological and environmental requirements of yellow toadflax, as well as assist in the development of inventory and monitoring protocols for yellow toadflax. [Paper Number 43]

MANAGEMENT OF VOLUNTEER GLYPHOSATE-RESISTANT WHEAT IN GLYPHOSATE-RESISTANT CANOLA. Shannon M. Oltmans and Richard K. Zollinger. Graduate Research Fellow and Associate Professor. North Dakota State University, Fargo ND 58105.

Abstract. Glyphosate-resistant wheat may be available to growers within 2 to 4 years. Additional herbicides must be applied with glyphosate to control volunteer glyphosate-resistant wheat in glyphosate-resistant crops. The objectives of this experiment were to evaluate canola injury from glyphosate tank-mixes, and control of volunteer glyphosate-resistant wheat and other weeds in glyphosate-resistant canola. The experiment was a randomized complete block design with four replicates per treatment. There were 10 treatments including an untreated at two locations, Prosper and Carrington, ND, in both 2000 and 2001. Treatments were applied to canola early-postemergence at cotyledon to 2 leaf, mid-postemergence at 3 to 4 leaf, and late-postemergence at 5 to 6 leaf stages. Weed species present were common lambsquarters, green and yellow foxtail, redroot pigweed, volunteer glyphosate-resistant wheat, wild buckwheat, and wild mustard. Data presented are weed control ratings from 28 days after treatment (DAT). Injury ratings were recorded 7 and 28 DAT. Means were separated using Fischer's Protected LSD. There was no canola injury 7 or 28 DAT when applying glyphosate with quizalofop or clethodim. All glyphosate treatments 28 DAT provided greater than 97% common lambsquarters, 95% foxtail, 98% redroot pigweed, 98% wild buckwheat, and 95% wild mustard control. All treatments had greater than 94% volunteer glyphosate-resistant wheat control, except 0.42 kg/ha glyphosate plus 0.82 kg/ha ammonium sulfate plus 0.07 kg/ha clethodim, which provided 84% control. Labeled- and reduced-rates of quizalop and clethodim applied once or in sequential applications with glyphosate were effective for volunteer glyphosate-resistant wheat control in glyphosate-resistant canola. [Paper Number 44]

COMPARISON OF SPRAYING AND BURCH WET-BLADE MOWER™ HERBICIDE APPLICATIONS ON RUSSIAN KNAPWEED. James S. Votaw, Tom D. Whitson and Ann Hild. Graduate Research Asistant, Professor and Associate Professor. University of Wyoming, Laramie WY 82071.

Abstract. Russian knapweed often occurs in wetland and other areas where minimal herbicide use and reduced spray drift potential are desired. A new method of herbicide application, the Burch Wet-Blade Mower™, may

provide suitable application techniques in these settings. To compare Russian knapweed control with the Burch Wet-Blade Mower™ to spraying and to determine most effective treatments, field trials were conducted near Rock River, WY and duplicated near Shoshoni, WY in 2000. Using a split-plot design with side-by-side comparisons of both application methods, we applied picloram, clopyralid, and clopyralid + trichlopyr treatments when Russian knapweed was in the early seed development stage. Treatment effectiveness was measured by counting all live plants in the 13.1 X 8.2 plots. One year after treatment, control was excellent at the Shoshoni location (92, 96, 97, 98%) for 0.11 + 0.32 kg ai/ha clopyralid + trichlopyr, 0.21 kg ai picloram, 0.21 kg ai/ha clopyralid, and 0.21 + 0.63 kg ai/ha clopyralid + trichlopyr spray treatments, respectively. Spraying treatments were significantly ($p = 0.0258$) more effective than the Burch Wet-Blade Mowerâ at the Shoshoni site. At the Rock River site, control was 78 and 87% for 0.21 kg ai/ha clopyralid and 0.21 kg ai/ha picloram, respectively, and application methods did not differ significantly. These results suggest that applications to Russian knapweed using the Burch Wet-Blade Mower™ and these treatments are not more effective than spraying. [Paper Number 45]

THE EFFECTS OF POLYACRYLAMIDE (PAM) ON WEED SEED AND HERBICIDE MOVEMENT IN FURROW IRRIGATED DRY BEANS. Matthew J. West[1], Don W. Morishita[1], Pamela J. S. Hutchinson[2] and Robert E. Sojka[3]. Graduate research Assistant, Associate Professor, Assistant Professor and Soil Scientist. [1]Department of Plant, Soil, and Entomological Sciences, University of Idaho, Twin Falls ID 83303, [2]Department of Plant, Soil, and Entomological Sciences, University of Idaho, Aberdeen ID 83210 and [3]USDA-ARS, Kimberly ID 83341.

Abstract. Polyacrylamide (PAM) is being adopted in surface irrigated areas as a means of reducing irrigation induced erosion by preventing shear detachment of soil and by flocculating fine clay sized particles that do detach. The influence of PAM in irrigation water on weed seed and soil-applied herbicide movement is unknown. Field studies were established in 2000 and 2001 near Kimberly, Idaho to determine the effect of PAM on 1) the transport of two herbicides; ethalfluralin and dimethenamid-p (Koc = 4,000 and 155 ml/g, respectively) in irrigation run-off and 2) weed seed migration in irrigation run-off. Water samples were taken during each irrigation and analyzed for herbicide concentration using gas chromatography and mass spectroscopy. Weed seeds were collected continuously from the irrigation run-off to determine total weed seed migration as influenced by PAM. Polyacrylamide-treated irrigation water reduced ethalfluralin concentrations in run-off water compared to run-off water without PAM. Dimethenamid-p concentration in irrigation water was not affected by the addition of PAM. Broadleaf weed seed migration in irrigation run-off was reduced 34 to 95%, 84 to 99%, and 61 to 98% in ethalfluralin, dimethenamid-p, and untreated control herbicide treatments, respectively, when PAM was added to the irrigation water compared to untreated irrigation water. Grass weed seed migration in irrigation run-off was reduced 26 to 99%, 70 to 99%, and 97 to 99% in ethalfluralin, dimethenamid-p, and untreated control herbicide treatments, respectively, when PAM was added to the irrigation water compared to untreated irrigation water. [Paper Number 46]

INFLUENCE OF DIFLUFENZOPYR APPLIED WITH QUINCLORAC AND DICAMBA FOR LEAFY SPURGE (*EUPHORBIA ESULA*) CONTROL AND FORAGE PRODUCTION. Kenneth J. Deibert and Rodney G. Lym. Graduate Research Assistant and Professor. Department of Plant Sciences, North Dakota State University, Fargo ND 58105.

Abstract. Quinclorac is an auxin herbicide registered in rice, non-cropland, and fallow for control of annual grass, broadleaf, and some perennial weeds. Research has shown that quinclorac provided effective short-term leafy spurge control. However, quinclorac is cost-prohibitive at the rates required for effective control. Preliminary research found that diflufenzopyr applied with auxin herbicides dramatically increased leafy spurge control compared to auxin herbicides alone. Diflufenzopyr is an auxin transport inhibitor that suppresses the flow of indoleacetic acid (IAA) and other synthetic auxin-like compounds within the plant. The purpose of this research was to evaluate quinclorac applied alone or with diflufenzopyr for leafy spurge control and the effect on herbage production. Currently, pure diflufenzopyr is not available to land managers; however, diflufenzopyr is included in a premix with dicamba. Quinclorac, diflufenzopyr, and dicamba plus diflufenzopyr (premix) were applied alone or together to evaluate leafy spurge control and grass production in a series of field and greenhouse experiments. Leafy spurge control with quinclorac plus diflufenzopyr averaged 80% control 3 months after treatment compared to only 65% control when quinclorac was applied alone. The effect of quinclorac applied alone or with dicamba plus diflufenzopyr at field rates on production of four warm-season and six cool-season perennial grass species was evaluated. Production of sideoats grama (*Bouteloua curtipendula*), switchgrass (*Panicum virgatum*), and smooth

brome (*Bromus inermis*), was reduced by 76, 68, and 28%, respectively. Leafy spurge control was increased when quinclorac was applied with diflufenzopyr compared to quinclorac alone without injury to most forage grasses. [Paper Number 47]

EVALUATION OF COLORED POLYETHYLENE MULCHES FOR WEED CONTROL IN CALIFORNIA COASTAL STRAWBERRIES. Mark S. Johnson and Steve A. Fennimore. Student and Extension Specialist. University of California, Davis, Davis Ca 95616-8504.

Abstract. Plastic mulches are utilized in California strawberry production for many purposes such as control of fruit maturity through modification of soil temperature, protection of fruit, and weed control. However, there are many mulch colors commercially available and little information about the effectiveness of these various mulch colors on weed control in strawberries. Three studies to evaluate the weed control efficacy of several polyethylene mulch colors were initiated in September of 2000. One of the studies at Watsonville, CA, was established in a certified organic strawberry field and all inputs were consistent with organic production practices. Two conventional strawberry trials were established, one in Oxnard and the other in Watsonville, CA, on ground that was fumigated with Chloropicrin at a rate of 187 and 180 pounds per acre, respectively. In the organically farmed trial the highest production of marketable fruit and the lowest weed biomass came from the plots covered with black, brown, green, red (on brown), white (on black) and yellow (on brown) mulches. Plant growth was enhanced by all of the mulches compared to bare ground. At the conventionally farmed Watsonville site, blue mulch had the highest weed densities and black mulch the lowest weed densities. Plant growth and yields were enhanced by the clear mulch, but were reduced by the white mulch. At the Oxnard site, weed densities were highest in the plots covered with clear mulch. More weeds were present in plots with blue and white mulch than plots with the other colored mulches. Results indicate that black, green and brown mulches provide the highest level of weed control. [Paper Number 49]

PERFORMANCE OF MESOTRIONE FOR ANNUAL WEED CONTROL IN FIELD CORN. Earl Creech and John O. Evans. Research Assistant and Professor. Utah State University, Logan UT 84322-4820.

Abstract. Mesotrione is a new natural product herbicide that is being developed for preemergence and postemergence use in corn. Studies were conducted at two locations in northern Utah in 2001 to evaluate weed and crop response to mesotrione applications. The addition of adjuvants and nitrogen solution to the mid-range postemergence dosage of 140 g ai/ha treatments increased the activity of mesotrione significantly. Redroot pigweed control with mesotrione averaged 48% without adjuvants while treatments with additives showed 85% control. Similarly, common lambsquarters control increased from 85% to 98% when adjuvants and nitrogen solution were added. Soil applied mesotrione treatments demonstrated equal toxicity towards weedy broadleaf species as foliar applications with additives. A comparison of mesotrione with other presently registered herbicides reveals that mesotrione provides similar broadleaf weed control. Corn injury was not observed with any mesotrione treatment in the presence or absence of additives. [Paper Number 50]

EFFECTS OF HALOSULFURON, TRIFLOXYSULFURON (CGA362622) AND GLYPHOSATE ON A NATURAL POPULATION OF PURPLE NUTSEDGE. Maren E. Veatch and William B. McCloskey. Graduate Research Assistant and Associate Specialist. University of Arizona, Tucson AZ 85721-0036.

Abstract. Purple nutsedge is an agronomically important, difficult to control weed. The effect of various rates and numbers of applications of halosulfuron, trifloxysulfuron (CGA362622) and glyphosate on purple nutsedge were measured by visually estimating injury (chlorosis and necrosis), following changes in leaf number of flagged large (>7 leaves) and small (<5 leaves) plants and counting regrowth within 3.5 cm of small and large plants. Greatest injury (70-95%) was obtained by making at least 2 applications of halosulfuron at 35, 53 and 70 g ai/ha or trifloxysulfuron at 15 g/ha, but initial injury from trifloxysulfuron at 5 g/ha disappeared after 3 to 4 weeks. All herbicide treatments controlled small plants (<0.5 green leaves following treatment) including the two lowest rates of trifloxysulfuron (5 and 10 g/ha). Greatest injury of large plants (<1.5 green leaves following treatment) was obtained by applying halosulfuron at 35, 53 and 70 g/ha or trifloxysulfuron at 10 and 15 g/ha. Two applications of halosulfuron at 35, 53 and 70 g/ha or trifloxysulfuron at 10 and 15 g/ha effectively limited regrowth (<1 new shoot) around small and large plants. Overall, greatest control of purple nutsedge was provided by 2 or 3 sequential applications of halosulfuron at 35, 53 and 70 g/ha or trifloxysulfuron at 10 and 15 g/ha at 4 to 6 week intervals. Two glyphosate formulations (Roundup Ultra and Touchdown) at 0.84 kg ae/ha were equivalent and provided control

comparable to halosulfuron and trifloxysulfuron if applied at least 3 to 4 times at two week intervals. [Paper Number 51]

SPATIAL PATTERN AND RATE OF SPREAD OF PERSIAN DARNEL AND WILD OAT IN A DIVERSIFIED CROPPING SYSTEM. Andrew G. Hulting, Bruce D. Maxwell and Alvin J. Bussan. Graduate Research Associate, Associate Professor and Assistant Professor. Montana State University, Bozeman MT 59715.

Abstract. Implementation of diversified crop rotations may beneficially impact weed population dynamics and reduce the need for off-farm inputs for weed management. Through a cropping systems study in central Montana, research focusing on the spatial and temporal population dynamics of Persian darnel and wild oat as influenced by herbicide input level, crop rotation, and other cultural management techniques is being conducted. Populations of Persian darnel and wild oat were established individually in 0.9 by 0.9 m permanent plots in conventional input, reduced input, and organic crop rotations in 1999. To determine the potential pattern and extent of weed spread, a census of crop and weed seedling densities on a 0.3 by 0.3 m grid system was completed in and around the weed establishment zones during 2000 and 2001. In the conventional and reduced input rotations the pattern of spread of both species currently resembles previously described advancing front patterns that are parallel to the direction of machine travel in the plots. In the organic rotation, possibly due to repeated tillage operations needed for weed management, the pattern of spread of both species more closely resembles a random diffusion process. The rate at which these populations are spreading is greatest in the organic and reduced input rotations followed by the conventional input rotation, but can be heavily influenced by phase of the crop rotation and environmental conditions. This detailed data set appears to be at the scale necessary to determine patterns of weed spread over time and space in response to varying weed management techniques in agroecosystems. [Paper Number 52]

GLUFOSINATE RESISTANT CORN PERFORMANCE AS INFLUENCED BY PLANT POPULATION AND ROW SPACING. Craig M. Alford and Stephen D. Miller. Graduate Research Associate and Professor. Department of Plant Sciences, University of Wyoming, Laramie WY 82071.

Abstract. Producers in the North Platte Valley of Wyoming and Nebraska have grown corn in 76 cm rows at populations of 69 to 79,000 plants per hectare for the past several years. An alternative to this system would be to produce corn and other crops in rows narrower than 76 cm. A number of studies conducted in other regions of the country have reported the following advantages for narrow row corn: higher yields, reduced herbicide inputs, improved weed control, decreased soil erosion, as well as more efficient use of light, water, and nutrients. A study was established at Torrington, WY. to investigate the effects of row spacing, plant population and herbicide treatment on the production of glufosinate tolerant corn. Corn was planted in 38, 56, and 76 cm rows at three populations, 39,500 79,000 and 118,500 seed per hectare. Each of these combinations was then treated with five weed management levels: a pre-emergence application of metolachlor/atrazine, a single application of glufosinate, two applications of glufosinate, a hand weeded and a weedy check. The study was setup in a split plot factorial arrangement with four replications. Row width or plant population had no significant impact on corn yields. All of the herbicide treatments yielded significantly better than the weedy check. However, weed biomass was significantly higher in the low population, wide row treatments. Herbicide treatment significantly impacted weed biomass with the weedy check, and the single application of glufosinate producing the greatest amounts of weed biomass. [Paper Number 53]

PRODUCTION OF GEO-REFERENCED WEED DENSITY MAPS IN IRRIGATED CORN FOR PRECISION WEED CONTROL. Scott A. O'Meara and Phil Westra. Graduate Student and Professor. Colorado State University, Fort Collins CO 80523.

Abstract. Chemical weed control with uniform whole-field applications is common. But weeds are not uniformly distributed in the field; they are spatially heterogeneous and aggregate in patches. Precision weed control involves application of herbicides only where weeds exist, effectively reducing the cost of application as well as environmental pressure while maintaining weed suppression. Accurate maps of weed infestations are integral to the implementation of precision weed control, but the intensive sampling necessary to create such maps is not cost effective in most cases. The purpose of this study is to investigate the correlation between management zones and weed density in order to reduce sampling costs. Three irrigated cornfields were sampled for weed density by individual species within a .1629-m^2 quatrat on a 1349-m^2 grid. Management zones were previously established

using multiple data layers, and mean weed densities within each zone were analyzed using a one-way ANOVA. No significant differences were found between the mean weed densities of the management zones. Because of the aggregated nature of weed distributions, the data from this study may be more accurately interpolated using kriging or co kriging using a separate variable, or possibly correlated with other field characteristics that are more easily measured. [Paper Number 54]

BASIC SCIENCE

INFLUENCE OF SOIL WATER CONTENT ON WILD OAT SEED MORTALITY AND SEEDLING EMERGENCE. James A. Mickelson, Mike G. Particka and Nicole D. Flowers. Assistant Professor, Research Associate and Research Associate. Montana State University, Southern Ag Research Center, Huntley MT 59037.

Abstract. Weed seed bank research is important to the development of weed management practices that consider the effects of current weed populations on future weed management and crop production. Little information is available on factors affecting weed seed mortality in the soil. Research on these factors could provide information necessary to develop biologically based weed management strategies for use in integrated weed management systems. Field experiments were conducted near Huntley, MT to determine the effects of soil water content on wild oat seed mortality and seedling emergence. Experiments were initiated in late October of 1999 and 2000 by establishing wild oat seed banks that were 61- by 61-cm in area and 15 cm deep. Each experiment consisted of four supplemental irrigation treatments (0, 2.5, 5, and 10 cm of supplemental irrigation per month) in a randomized complete block design with three replicates. The site was overseeded with spring wheat during the growing season. Seedbanks were sampled each fall and spring (beginning in the fall of the establishment year) by removing 3.8-cm dia by 15-cm deep soil cores to estimate the viable seedbank. Wild oat seedling emergence was determined during the growing season by counting and removing newly emerged seedlings at 7 to 10 day intervals. Soil water content in the top 15 cm of soil was measured twice per week using a time domain reflectometry based sensor unit. Regression analysis was used to relate mean soil water content (% volumetric basis from June through September) to mortality and emergence parameters. Mean soil water content ranged from 6 to 24% in 2000 and 8 to 22% in 2001. As mean soil water content increased, total seed bank decline over a 1 year period increased linearly ranging from 81 to 88% during the first year for seed banks established in 1999, 63 to 91% during the first year for seed banks established in 2000, and 66 to 99% during the second year for seed banks established in fall of 1999. Differences in slopes of the linear relationships occurred between years. Differences in wild oat seedling emergence pattern occurred among treatments and emergence occurring during the fall was affected by mean soil water content. However, total seedling emergence (% of the seed bank) was not related to mean soil water content. [Paper Number 55]

METHODOLOGY FOR TRACKING WEED SEED DRIFT AND VIABILITY IN TILLAGE SYSTEMS. David W. Wilson, Stephen D. Miller and QiQi Wang. Associate Lecturer, Professor and Research Aide. University of Wyoming, Laramie WY 82071.

Abstract. Previous research on weed seed viability has been based on analysis of sedentary studies. This study was designed to develop a method of studying weed seed viability under tillage conditions. An 11mm, 134.7 khz microchip was tested for depth sensitivity and readability in various soil types, durability to withstand severe mechanical tillage, and tillage drift characteristics. The glass encapsulated ferrous copper inductance core microchip is approximately the same size as a cereal grain seed. Microchip and seed packet durability tests were conducted using a tractor mounted rototiller, operating at 500 rpm in a sandy loam soil. The initial site was rototilled to a depth of 30 cm. Microchips were implanted and fifty passes were made through the test plot. Microchips and packets were recovered and examined after each pass. There was no visible or functional damage to the fiberglass mesh packets or microchips. The seed packet moved an average of 10 cm deeper vertically, and had an average horizontal movement of 21 cm from initial implant point. In all but one pass, the microchip moved deeper in the soil, moving deeper than 13 cm in 40% of the passes. The longest horizontal drift distance was 120 cm. Depth sensitivity testing was done in three soil types. A sandy loam soil with a 5% Fe content, a washed granitic mortar sand and an artifical soil (Fafard #2 Growth Mix) containing vermiculite (mica), perlite and peat moss. The variability of microchip detection was related to soil texture, soil density and the angle of recline of the microchip. Microchips on end were easier to detect than microchips laying flat. There were no real differences between detection depths in the sandy loam and artificial soil. Microchips were detected at an average depth of 23.5 cm in the sandy loam soil and 24 cm in artificial soil, with 28 and 33 cm maximum readings made in each of the soils, respectively. A minimum reading of 15 cm was

made in native soil, with an 20 cm minimum in artificial soil. The mortar sand had slightly lower readings, averaging 20 cm with the deepest measurement at 23 cm and the shallowest at 12.5 cm. Tests of individual microchip movement compared to seed packet movement were non-significant. Further testing will be conducted on two prototype superchips, a prototype deep sensing ring antenna, a soil probe type antenna and boosted transceiver power pack.. Additionally, even smaller microchips are becoming available which could emulate smaller seeds such as lambsquarter, or even pigweed. With these added developments, a metal detection unit and a 5mm accuracy GPS unit it would not only be possible to more accurately track tagged seed packets, but also individual microchips in soil. A four year wheat rotation study under five different types of tillage was initiated in September of 2001 to track the drift and viability of feral rye and wild oats using the developed microchip methodology. [Paper Number 56]

PREDICTING THE LIKELIHOOD OF YELLOW STARTHISTLE OCCURRENCE USING A NONLINEAR REGRESSION MODEL. Bahman Shafii, William J. Price, Timothy S. Prather, Lawrence W. Lass and Donn C. Thill. Statistician, Statistician, Professor, Scientist and Professor. University of Idaho, Moscow ID 83844.

Abstract. Yellow starthistle is a noxious weed common in the semiarid climate of Central Idaho and other western states. Early detection of yellow starthistle and estimating its infestation potential have important scientific and managerial implications. Weed detection and delineation are often carried out by using ground survey techniques. However, such methods can be inefficient and expensive in detecting sparse infestations. The distribution of yellow starthistle over a large region may be affected by various landscape variables such as elevation, slope and aspect. These exogenous variables may be used to develop prediction models to estimate the potential for yellow starthistle invasion into new areas. A nonlinear prediction model has been developed utilizing a polar coordinate transformation of landscape characteristics to predict the likelihood of yellow starthistle occurrence in North Central Idaho. The study region included the lower Snake River and parts of the Salmon and Clearwater basins encompassing various land use (range, pasture, and forest) categories. The model provided accurate estimates of yellow starthistle incidence within each specified land use category and performed well in subsequent statistical validations. This prediction model can assist land managers in focusing their efforts by identifying specific areas to survey. [Paper Number 57]

AUXIN-MEDIATED RESPONSES IN DICAMBA-RESISTANT *KOCHIA SCOPARIA*. William E. Dyer, Gina A. Goss and Patrick Buck. Professor, Undergraduate and Undergraduate. Montana State University, Bozeman MT 59717.

Abstract. Resistance (R) to the auxinic herbicide dicamba has been verified for kochia biotypes in several areas of the United States. Dose response studies show that the inbred R line HRd is 4- to 5-fold more tolerant to dicamba than susceptible (S) plants. Resistance is not due to altered rates of herbicide uptake, translocation, or metabolism. Growth of HRd roots is less sensitive than S roots to inhibition by dicamba, 2,4-D, and the synthetic auxin NAA. Also, gravitropic responses are significantly delayed in HRd shoots, indicating that auxin perception or signal transduction is impaired. To further characterize auxin-mediated growth responses, the induction and growth rates of callus from R and S seedling explants were compared on several concentrations of 2,4-D and NAA. On 2,4-D, callus growth from S explants was optimal at 0.1 mg L^{-1}, while R callus growth was less sensitive and rates were similar on concentrations ranging from 0.1 to 3.0 mg L^{-1}. More recently, we discovered that HRd contains two mutations in a partial cDNA encoding an auxin binding protein (ABP), and the mutations occur in conserved protein domains thought to be necessary for auxin binding. We speculate that these mutations may confer resistance to dicamba while concomitantly affecting auxin-mediated responses like shoot gravitropism and perhaps apical dominance. [Paper Number 58]

THE USE OF BIOCHEMICAL MARKERS AS INDICATORS OF PLANT EXPOSURE TO CERTAIN HERBICIDES. William T. Cobb[1], Kim A. Anderson[2] and Bobby R. Loper[2]. Owner, Director and Research Assoc. [1]Cobb Consulting Serv., Kennewick WA 99336 and [2]Oregon State Univ., Corvallis OR 97331.

Abstract. The biochemical mode of action of the herbicide glyphosate blocks aromatic amino acid synthesis in susceptible plants by inhibiting the enzyme 5-enolpyruvlyshikimate-3-phosphate synthase (Steinrucken, et al 1980). This inhibition results in the accumulation of shikimic acid in susceptible plants proportional to the rate of glyphosate applied (Anderson, et al 2001). The sulfonylurea, imidazolinone, triazopyrimidine sulfonanilides and

pyrimidyloxyl salicicylic acid herbicides act by inhibiting branched-chain amino acid biosynthesis by inhibition of acetolactate synthase [ALS](Wittenbach and Abell, 1999). This inhibition leads to both the depletion of valine, leucine and iso-leucine and the accumulation of 2-oxybutyrate and its transamination product, 2-aminobutyric acid [2-aba](Rhodes, et al 1987). Field experiments were conducted in 2000 and 2001 on white potatoes using sub-lethal rates of glyphosate, thifensulfuron-methyl + tribenuron-methyl, rimsulfuron and imazethapyr. Plant tissue samples were collected at regular intervals up to 500 hrs after application and were analyzed for the presence of shikimic acid, in the case of the glyphosate treatments and 2-aminobutyric acid in the case of ALS inhibiting herbicide treatments. The shikimic acid was analyzed for in plant tissue using a water extraction, followed by HPLC, which required no post column derivatization. For the analysis of 2-aminobutyric acid in plant tissue, a water-trichloroacetic acid extraction used followed by HPLC, again without requiring post column derivatization. As with shikimic acid accumulation in glyphosate treated plants, 2-aminobutyric acid appeared to accumulate in ALS inhibiting herbicide treated susceptible plants proportional to the herbicide rate. The use of these biochemical markers as potential diagnostic tools is discussed. [Paper Number 59]

INTEGRATING CHEMICAL AND BIOLOGICAL CONTROL FOR SUPPRESSION OF VOLUNTEER POTATO. Martin M. Williams II[1], Douglas B. Walsh[1] and Rick A. Boydston[2]. Assistant Professor, Assistant Professor and Plant Physiologist. [1]Washington State University, Prosser WA 99350 and [2]USDA-ARS, Prosser WA 99350.

Abstract. Few studies have evaluated interactions between herbicide-induced stress and arthropod herbivory on weed fitness, moreover, the significance of such interactions at an integrated pest management level is unknown. A model study system is being developed that focuses on suppression of a Solanaceous weed with an oligophagous grazer, sub-lethal herbicide doses, cultivation, and crop competition. Volunteer potato (*Solanum tuberosum* L.) is poorly controlled in several Pacific Northwest potato rotation systems, causing significant yield loss and serving as an alternate host and viral vector for serious pests of potato. Colorado potato beetle (*Leptinotarsa decemlineata* Say) is a potato pest because of its ability to defoliate the plant and reduce yield, however, the beetle grazes on many Solanaceous weeds and is currently controlled in Pacific Northwest potato production. Elsewhere, Colorado potato beetle has expressed resistance to most classes of insecticides used on the beetle and maintaining a reservoir of susceptible individuals in beetle populations is cited as important for mitigating further insecticide resistance. Literature indicates the beetle is attracted to potato stressed chemically and physically, although extent of anemotaxis to herbicide-injured plants is unknown. We are developing functional relationships between fluroxypyr dose and beetle density on weed fitness. Recognizing this research is in its infancy, early findings indicate the biologically effective herbicide dose may be reduced 50% and more when coupled with modest levels of beetle grazing in the greenhouse. The overall goal is to develop integrated pest management systems for a problematic weed that escapes conventional management tactics. [Paper Number 60]

A COMPARISON OF DRIFT REDUCTION ABILITY OF PCC-1185 TO STANDARD DRIFT REDUCTION ADDITIVES IN COMBINATION WITH ROUNDUP ULTRAMAX. Daniel L. Bergman. Director of Product Development. Loveland Industries, Greeley CO 80632.

Abstract. The size of pesticide spray drops along with their physical properties are very influential on pesticide performance. Both spray droplet production and behavior are routinely managed and manipulated with adjuvant products. The portion of the spray spectrum comprised of droplets < 150 microns are at risk for loss due to evaporation as well as drift out of the target zone. Drift reduction adjuvants composed of polyacrylamide and polymeric starch have frequently and routinely been utilized to reduce the production of those sizes of drops. Comparisons of the functionalities of the adjuvant products were made with respect to: spray drop spectrum, droplet adhesion on hard-to-wet weeds, effect of pump shear, foam production, effect on nozzle fan angle, mixing issues and interactions with Boron. In all areas of comparison, the Valid product illustrated superiority over the conventional polyacrylamide and polymeric starch based adjuvants. Valid was designed specifically to deliver Glyphosate TranSorb technology with greater efficacy; the results of these studies document that efficacy. [Paper Number 61]

COTTON INJURY FROM STAPLE (PYRITHIOBAC) IS INFLUENCED BY NITROGEN AVAILABILITY. Bill Molin. Plant Physiologist. USDA-ARS, Stoneville MS 38776.

Abstract. Staple (pyrithiobac sodium) is a postemergence herbicide used to control broadleaf weeds in cotton (*Gossypium hirsutum* L). Pyrithiobac may cause temporary chlorosis in cotton and the injury may be enhanced by diseases, insects, or unfavorable temperatures and soil moisture levels. The physiological basis for the injury is unknown. The objective of this research was to identify specific causes for pyrithiobac injury. Cotton (Delta and Pine Land 5415) was grown to the 2-leaf stage in a soil-sand mixture. Pyrithiobac was applied with a track sprayer delivering 187 L/ha at 42 and 84 g/ha. A nonionic surfactant, Induce, was added to the pyrithiobac solution at 0.25% v/v. The pots were transferred to solutions containing either potassium nitrate or potasium chloride. At 7 DAT, leaves of pyriyhiobac-treated plants in nitrate solutions developed chlorosis whereas those in nitrogen free solutions did not develop chlorosis. Pyrithiobac inhibited chlorophyll synthesis 100% and leaf expansion 25% in plants receiving nitrogen. The results suggest that pyrithiobac causes a transient interference with chlorophyll synthesis when nitrogen is available. The injury under field conditions may be most apparent in plants that are readily using soil applied nitrogen. [Paper Number 62]

TEACHING AND TECHNOLOGY

TEACHING PESTICIDE APPLICATION TECHNOLOGY. Robert N. Klein. Professor. University of Nebraska, North Platte NE 69101.

Abstract. Pesticide Application Technology was taught at a number of activities including Custom Application Training, Field Days, Corn/Soybean Expos, Crop Protection Clinics, Crop Management Summer Diagnostic Clinics, Center of Excellence Field Days, Weed Science Workshops, Weed Science Classes, and many county and area meetings. Several workshops and demonstrations were also held for advanced applicators. Most training sessions start with sprayer calibration. The method we use does not require one to remember any formulas but used relationship in what happens during a minute or other unit of time or area and how it relates to an acre. Included in this part is how nozzle tips are labeled and calibrated along with how spray solution density and pressure affects the application rate. Kits were set up and given to the participants so they can examine the various nozzles as the speaker discussed the nozzle tips and their uses. A spray table is used to demonstrate spray patterns. The nozzle kits and demonstration included standard flat spray, even flow, extended range, drift guard, twin flat, Turbo TeeJet®, Turbo Floodjet®, four air induction nozzles and 50 and 100 mesh nozzle screens. Strobe lights are used along with fans to create wind in the demo. The spray demo also included the Blended Pulse spraying technology. A sprayer with three booms was modified to show how a sprayer was set up when the sprayer was built, how most sprayers are set up today, and how our research shows a sprayer could be set up to save money, time, and improve pest control. Today's application technology used a stainless steel boom, 30-inch nozzle spacing, nozzles set up for 100% overlap and angled back to increase deposition. A quote from Dave Mortensen several years ago in his letter to the Weed Science faculty, "Finally a special thanks to Bob Klein who has contributed his expertise to the course (for 8 years running) in the form of his calibration work with the students. Bob, the students love you and your work". [Paper Number 63]

GROWER ADOPTION OF CULTURAL AND CHEMICAL WEED MANAGEMENT PRACTICES, INCLUDING GMO CROPS. Dudley T. Smith. Professor. Texas A&M University, College Station TX 77943-2474.

Abstract. Historically, weed management practices have evolved with changes in technology, particularly herbicide chemistry. However surveys show that U.S. growers still utilize several non-chemical practices, such as crop rotation, cultivation, and hand weeding(mainly hoeing), to suppress weeds, along with chemical control. Decisions on herbicide use and the selection of specific chemicals are based on several factors, with emphasis on historical problems, timing and weed species, and economics. The development of GMO crops in the U.S., especially cotton and soybeans, has resulted in unprecedented rates of change in weed management programs. For example,in cotton and soybean glyphosate was applied on 8 and 13% of the acreage in 1994 and progressively increased to 56 and 62% of the crop by 2000, respectively, while the overall percentage treated acreage was similar over the same period. However, the commercial adoption of GMO technology has been slow in some other crops due to several

factors. For example, GMO sugar beet seed has been developed but not planted due to consumer issues. In sugarcane, a vegetatively propagated crop, collection of technology use fees from reoccurring plantings from initial seed stock may limit availability. [Paper Number 64]

THE WILKE PROJECT - A CASE STUDY FOR THE VALUE OF GROWER CENTERED RESEARCH AND EXTENSION. Dennis J. Tonks[1], Darla J. Rugel[1], Diana Roberts[2], Tom Platt[1], Jonathan Newkirk[2], Aaron D. Esser[3] and Edward B. Adams[2]. Dryland Cropping Systems Specialist, Ag. Research Tech., Area Agronomist, Area Extension Agent, Extension Economist, On-Farm Testing Project Associate and Extension Ag. Project Leader. [1]Washington State University Cooperative Extension, Davenport WA 99122, [2]Washington State University Cooperative Extension, Spokane WA 99202 and [3]Washington State University Cooperative Extension, Ritzville WA 99169.

Abstract. The value of grower centered research and extension programs is increasing in importance. In some instances research projects are perceived to be ?out of touch? with the needs of growers while some basic research projects do not have an immediate application to growers. In an era of budget reductions and lack of resources for research and extension programs, grower involvement has many benefits. Strong grower support can influence university administrators and state and federal lawmakers. Adding grower components to a research project can sometimes increase chances of obtaining grant funding, access to grower associations and commodity commissions, and provide access to equipment, land, and expertise. Many times, growers are credible among their peers. The Wilke Project has formed a unique grower/university partnership to address direct seed cropping systems and weed management issues with funding and in-kind services from federal, state, and private entities. A group of growers wanting to improve their farm economics and soil conservation instigated the project with WSU Cooperative Extension. Large-scale replicated research and demonstration plots (21 total plots at 10 acres/plot) were established at the WSU Wilke Research and Extension Farm near Davenport, WA in 1998 using 3- and 4- year crop rotations. The farm is operated as a commercial operation using farm scale equipment. In addition, five cooperators in Lincoln County, WA are replicating the 3- or 4-year rotation on their own farms. Field size ranges from 25 to 100 acres for each crop depending on grower. Each grower selects crops and varieties within a crop type and is responsible for all farming operations. WSU extension personnel collect data on crop establishment and development, weeds, insects, diseases, crop yield and residue, soil quality, and economics. There is intense interest among growers to adopt direct seeding practices which is due in large part because of the Wilke Project. In 1997, eight people attended a field day at the Wilke Farm, however, in subsequent years, attendance has ranged from 85 to 120. In Lincoln county the adoption of direct seeding practices have increased from 5 to 10% of the dryland cropping acres from 1996 to 2000, respectively. The project is recognized throughout the Pacific Northwest for an innovative approach to research and extension. [Paper Number 65]

WEDNESDAY POSTER SESSION

ALS RESISTANT KOCHIA MANAGEMENT IN A BARLEY - SUGAR BEET ROTATION. Michael G. Particka, James A. Mickelson and Nicole D. Flowers. Research Associate, Assistant Professor and Research Associate. Montana State University, Southern Ag. Research Center, Huntley MT 59037.

Abstract. Kochia is a troublesome, competitive weed that infests barley and sugar beet fields in Montana. ALS inhibiting herbicides have been used extensively to control kochia in both of these crops. Triflusulfuron has been relied upon almost exclusively for kochia management in sugar beets. Tribenuron and thifensulfuron + tribenuron are commonly used in barley for kochia management. The repeated use of these herbicides has contributed to the development of kochia populations that are resistant to ALS inhibiting herbicides. As resistant populations increase and spread triflusulfuron will not provide acceptable levels of kochia control in sugar beet. Alternative options for controlling ALS resistant kochia in sugar beets are limited. Ethofumesate has activity on kochia, but is relatively expensive and soil applications do not fit well with practices used in flood irrigation systems in Montana. More alternatives exist for kochia control in barley with non-ALS inhibiting herbicides. Premixes of bromoxynil+MCPA ester and fluroxypyr+MCPA ester are two examples of non-ALS inhibiting herbicides that can be used for kochia management in barley. The use of these herbicides in rotations with triflusulfuron may provide better kochia control in fields with resistant populations and prevent the development of resistant populations. A field experiment was conducted during 2000 and 2001 to determine the effect of kochia management in barley in 2000 in kochia density and sugar beet yield in 2001. Bromoxynil+MCPA and fluroxypyr+MCPA reduced kochia densities in barley by 85

and 98%, respectively, and resulted in greater sugar beet yield the following year, compared to untreated barley. Triflusulfuron and desmedipham+phenmedipham+ethofumesate together reduced kochia densities but desmedipham+phenmedipham+ethofumesate alone did not. Sugar beet treatments that contained ethofumesate but not triflusulfuron resulted in kochia densities that were similar to or greater than treatments containing triflusulfuron. Results suggest that preventing kochia seed production in barley will improve kochia control and sugar beet yield in the following year. [Paper Number 66]

INTEGRATED APPROACH TO POST-HARVEST AND FALLOW MANAGEMENT OF KOCHIA. Edward S. Davis and Alvin J. Bussan. Research Associate and Assistant Professor. Montana State University, Bozeman MT 59717.

Abstract. Kochia management in dryland wheat producing regions of Montana has presented a major challenge due to several consecutive drought years resulting in reduced crop competitiveness and limited herbicide efficacy. Successful management of kochia must include employment of effective control measures during the fallow season as well as post-harvest to the grain crop in order to prevent or reduce kochia seed production and conserve soil moisture. The objectives of this research were to: 1) determine the optimum post-harvest timing of application for several herbicides as kochia burn-down treatments 2) measure the effect of herbicide treatment and timing of application on kochia seed production and seed viability. Field trials were conducted at three Montana locations (Fort Benton, Havre, and Huntley) under a typical dry land, wheat-fallow cropping system. Fourteen herbicide treatments were applied at three post-harvest timings, mid-August, end-August, and mid-September. Herbicides tested included: glyphosate, 2,4-D amine, sulfentrazone, paraquat, carfentrazone-ethyl, and ETK 2303. Visual assessment of kochia control was recorded every 2 weeks following application until a killing frost. Ten kochia plants were harvested from each of 4 replications of the glyphosate, 2,4-D amine, glyphosate + 2,4-D amine, and paraquat treatments as well as a weedy check. Kochia plants were processed in the lab to measure seed production and seed viability. Herbicide applications at the mid-August timing provided the highest level of kochia control and glyphosate at 0.56 lb ae/A provided 85-98% and addition of 2,4-D amine, sulfentrazone or carfentrazone to glyphosate did not improve burn down of kochia. Paraquat at 0.625 lb/A was the most effective treatment at later application timings. Kochia seed production was minimized by earlier herbicide applications and varied by herbicide treatment. [Paper Number 67]

EVALUATION AND DEMONSTRATION OF KOCHIA CONTROL IN MONTANA WHEAT STUBBLE WITH ENGAME. Jim T. Daniel[1], Rick Anderson[2], Ryan Holt[2] and Arleen Rice[2]. PDM, Sales Rep, Sales Rep and Loca Mgn. [1]United Agri Products, Greeley CO 80632 and [2]UAP Northern Plains, Fargo ND 58105.

Abstract. Demonstration trials were conducted near Billings, Great Falls, and Havre Montana to evaluate two glyphosate formulations, ENGAME and RT MASTER, for kochia control in wheat stubble. ENGAME is a 1.3 lb/gal glyphosate formulated as an acid. RT MASTER is a conventional 4 lb/gal glyphosate with 0.4 lb/gal 2,4-D premix. At each location, plots were 20 X 100 feet, and treatments were replicated twice. ENGAME and RT MASTER were applied alone at 0.51 and 0.56 lbae/A respectively. ENGAME was also applied at 0.31 lbae/A. Two tank mixes were also evaluated: ENGAME + PCC 1133 at 0.31 + 0.35 lbae/A (PCC 1133 is a 2, 4-D acid formulation), and RT MASTER + LV4 (2,4-D ester) at 0.35 + 0.35 lbae/A. Similar kochia control was observed at all locations. Averaged across all locations, ENGAME at 0.31 lbae/A gave kochia control similar to 0.56 lbae/A RT MASTER, near 85%, while ENGAME at 0.51 lbae/A gave 98.7% control of kochia. The ENGAME + PCC 1133 tank mix gave 96.7% kochia control while the RT MASTER + LV4 tank mix gave 73.2% kochia control. ENGAME and ENGAME + PCC 1133 achieved control 10 to 13 days faster than the conventional formulations. It was extremely dry at all three test sites. [Paper Number 68]

CONTRASTING HERBICIDE TREATMENT COSTS AND EFFECTIVENESS IN CONTROLLING RUSSIAN THISTLE AND KNOTWEED IN WINTER WHEAT. Mary K. Corp and Daniel A. Ball. Assistant Professor and Associate Professor. Oregon State University, Pendleton OR 97801.

Abstract. Continuing expansion of vineyards in eastern Oregon and Washington has led to suggestions that phenoxy herbicide uses be curtailed or eliminated in surrounding cereal production areas. A field study conducted in 2001 examined the effectiveness of alternative herbicide treatments for the control of Russian thistle and prostrate knotweed in wheat. Emphasis was placed on alternatives to phenoxy herbicides. The study examined the cost of

eliminating phenoxy-type herbicides to minimize concern about long-distance transport of herbicides. Twenty-four different treatments were evaluated, 6 without phenoxys and 18 mixtures with 2,4-D or dicamba. A randomized complete block design was used with three replications. The plots were located on a grower's field near Pendleton, Oregon. All treatments effectively controlled the targeted weeds although a dry season limited pressure from late germinating weeds. Control percentages on Russian thistle ranged from 94% to 100% with phenoxys and 88% to 100% without phenoxys when evaluated six weeks after application. Only 2 treatments resulted in significantly higher yields over the weedy check. Economic analysis of treatment costs shows a median cost of treatments with phenoxys of $7.00 while treatments without a phenoxy increase to a median cost of $13.00. Costs for the different treatments ranged from $4.50 to $19.25 per acre. Selecting the lowest cost treatment from each category, $4.00 with a phenoxy versus $6.75 without a phenoxy, shows a 68% increase in treatment costs without phenoxy herbicide. This represents an annual increase in herbicide cost to Oregon's cereal producers of $2.9 million. [Paper Number 69]

ECONOMICS OF ROTATIONAL CROPPING SYSTEMS TO REDUCE CHEAT (BROMUS SECALINUS) DENSITIES. Jon C. Stone, Thomas F. Peeper, Eugene G. Krenzer, Ron Scholar and Amanda E. Stone. Graduate Research Assistant, Professor, Professor, Professor and Graduate Research Assistant. Oklahoma State University, Stillwater OK 74078.

Abstract. In the Southern Great Plains, producers of winter wheat are seeking alternative methods of controlling Bromus species and improving economic returns. Experiments were conducted at three sites in North Central Oklahoma to determine the effect on Bromus densities of three crop sequences, each under no-tillage and conventional tillage, with various herbicide treatments in each sequence. The economics of each sequence were determined. The cropping sequences included wheat, double-crop soybeans, soybeans, double-crop wheat; wheat, double-crop grain sorghum, soybeans, double-crop wheat; and continuous wheat. These experiments were initiated following wheat harvest in June 1999. In the continuous wheat prior to the application of selective Bromus control herbicides in the fall of 1999, conventional tillage plots had lower cheat densities than no-tillage plots. In the following winter wheat crop seeded in the fall 2000, cheat densities in continuous wheat with no herbicide were lower in conventional tillage than in no-tillage at two sites. Spring applied selective Bromus control herbicides and simulated grazing reduced cheat densities in the subsequent wheat crop at one of three sites. The use of selective Bromus herbicides for one year in continuous wheat seldom improved net returns. Cheat densities in the subsequent wheat crop following either sorghum or soybean sequences were not affected by tillage at two of three sites. The use of crop sequences reduced cheat densities in the subsequent wheat crop compared to continuous wheat with no herbicide at two of three sites. Compared to continuous wheat with no herbicide, net returns were increased by growing double-crop grain sorghum followed by soybeans at all sites or by growing double-crop soybean followed by soybean at two of three sites. [Paper Number 70]

ITALIAN RYEGRASS CONTROL IN WINTER WHEAT. Traci A. Rauch and Donn C. Thill. Research Support Scientist and Professor. Department of Plant, Soil, and Entomological Sciences, University of Idaho, Moscow ID 83844-2339.

Abstract. Italian ryegrass, a highly competitive weed that can reduce wheat yields significantly, usually is controlled with diclofop, an aryloxyphenoxy propionate herbicide. However, diclofop-resistant Italian ryegrass has been reported in North Idaho. Several studies were conducted from 1997 to 2001 in winter wheat to determine Italian ryegrass control and winter wheat yield with different herbicides (chlorsulfuron, clodinafop, flucarbazone-sodium, flufenacet/metribuzin, imazamox, sulfosulfuron, tralkoxydim, and triasulfuron). When data were combined over experiments, Italian ryegrass control with clodinafop (92%) and flucarbazone-sodium (96%) was best at the 3 to 4 leaf stage, while control with sulfosulfuron (88%), tralkoxydim (92%), and imazamox (99%) was best at the 4 to 8 leaf stage. In several years' experiments, average control of Italian ryegrass was 77, 70, and 66% with flucarbazone-sodium, tralkoxydim, and sulfosulfuron; 83 and 84% with flufenacet/metribuzin and clodinafop; and 88, 92, and 92% with triasulfuron, chlorsulfuron, and triasulfuron plus flufenacet/metribuzin, respectively. In other studies, average control of Italian ryegrass with imazamox at 0.32, 0.40, and 0.48 lb/A was 88, 92, and 95%, respectively. In 1998, winter wheat yield in chlorsulfuron, triasulfuron, and flufenacet/metribuzin treatments was 24 to 46% greater than the untreated check. Grain yield was 30 to 64% higher with flufenacet/metribuzin applied preemergence at 0.40 lb/A than the 2 to 3 and 6 to 8 leaf timings of sulfosulfuron and flucarbazone-sodium alone. In a 2001 study, wheat yield in imazamox treatments applied at the 2 to 3 and 3 to 5 leaf growth stages was 18 and 7% greater than

treatments applied at the 5 to 6 leaf growth stage of Italian ryegrass. Wheat treated with imazamox at 0.04 and 0.048 lb/A at the 2 to 3 leaf growth stage and 0.048 lb/A at the 3 to 5 leaf growth stage yielded 19 to 32% more grain than the untreated check. In a second study in 2001, wheat grain yield was greatest with flufenacet/metribuzin + triasulfuron (79 bu/A), but did not differ from triasulfuron alone (77 bu/A) or flufenacet/metribuzin at 0.425 lb/A (75 bu/A). [Paper Number 71]

VIABLE JOINTED GOATGRASS-WINTER WHEAT HYBRIDS IN OKLAHOMA WHEAT FIELDS. Amanda E. Stone, Thomas F. Peeper and Deborah A. Solie. Graduate Research Assistant, Professor and Undergraduate. Oklahoma State University, Stillwater OK 74078.

Abstract. Jointed goatgrass-winter wheat hybrids were identified in jointed goatgrass winter wheat competition experiments at three locations. All three experiments were seeded in jointed goatgrass free fields. The wheat used to seed these three studies had been saved from similar experiments conducted the previous year. Some hybrids were found in plots seeded without jointed goatgrass, indicating that the seed that produced a hybrid plant was similar in appearance to wheat seed. The hybrids were collected in June, 2001. Collected hybrid spikelets were germinated in Oklahoma Crop Improvement Association germination chambers. Spikelets that germinated were transferred to peat pucks under growth lights before final transplantation to the field. Of the 16,659 spikelets that were placed in the germination chambers, 161 germinated. The surviving plants are in the field and will be harvested this summer. Additionally, chromosomes from the apical meristem of selected hybrids will be counted to determine the number of chromosome pairs. [Paper Number 72]

CLEARFIELD PRODUCTION SYSTEM - STEWARDSHIP PROGRAM FOR CLEARFIELD WINTER WHEAT. Chad H. Fabrizius, Gary Fellows, Mark Dahmer and Chad Shelton. Technical Specialist, Biology Project Leader, Development Manager and Market Specialist. BASF Corporation, Research Triangle Park NC 27709.

Abstract. Beyond™ herbicide (imazamox) and the CLEARFIELD Wheat Production System* provide a novel approach to controlling broadleaf and grass weeds in winter wheat. Beyond selectively controls previously uncontrolled weeds in wheat, including jointed goatgrass and feral (volunteer) rye. A comprehensive stewardship program has been developed that allows growers to reduce the development of herbicide resistance and increase the long-term utility of the CLEARFIELD Production System for wheat growers. Key elements of the stewardship program include: 1) Planting Certified CLEARFIELD wheat seed each year to ensure the seed is free of noxious weeds and "off-type" wheat; 2) Restricting continuous use of CLEARFIELD wheat without rotation, reducing selection pressure for resistant weed biotypes; 3) Rotating crops, disrupting the growth cycles of weeds by planting spring crops; 4) Rotating herbicides with different modes-of-action, reducing selection pressure and limiting ALS herbicides; and 5) Managing wheat-fallow-wheat rotations, controlling weeds in fallow before they set seed by using burndown herbicides and/or tillage. Additional stewardship practices are recommended when jointed goatgrass is present to limit development of hybrid populations. These include using labeled rates of Beyond herbicide and treating the entire field, as well as controlling jointed goatgrass in ditches, fencerows, and pastures adjacent to CLEARFIELD wheat fields. Field testing of the CLEARFIELD Stewardship Program is ongoing. Implementation of the stewardship program for CLEARFIELD winter wheat will enable wheat growers to maintain the long-term benefits of this technology by controlling problem grass and broadleaf weeds that infest wheat. [Paper Number 73]

ENGAME HERBICIDE, A GLYPHOSATE ACID FORMULATION WAS COMPARED TO ROUNDUP ULTRA AND ROUNDUP ORIGINAL WHEN APPLIED IN WHEAT FALLOW AGRONOMIC SYSTEMS. Scott K. Parrish. Product Development Manager. United Agri Products, Spokane WA 99208.

Abstract. A glyphosate acid formulation, ENGAME, has shown improved glyphosate herbicidal performance under sub optimal conditions. Due to low use rates, difficult growing conditions and 2,4-D antagonism sub optimal situations are frequently encountered with spring applications of glyphosate in wheat fallow agronomic systems. A multiple location study was conducted in the wheat fallow growing areas of the United States where ENGAME and ROUNDUP ULTRA were applied weekly at rates between 0.28 kg ae/ha to 0.42 kg ae/ha. Each application at each location was made in the same field and side by side with previous applications. Applications were made in the spring, during the time period when most growers use a glyphosate product to control volunteer wheat and weedy grasses. ENGAME and ROUNDUP ULTRA demonstrated statistical equivalence for downy brome control in 68% of applications. ENGAME demonstrated statistical better control of downy brome than ROUNDUP ULTRA in 32%

of applications. ROUNDUP ULTRA was never better that ENGAME for downy brome control. Volunteer wheat control showed a similar pattern. There was statistical equivalence with 77% of applications. ENGAME was better in 23% of applications. ROUNDUP ULTRA was never better than ENGAME for volunteer wheat control. ROUNDUP ULTRA + 2,4-D showed statiscally significant antagonism for downy brome control in 32% of applications and antagonized volunteer wheat control in 14% of applications. ENGAME + 2,4-D did not show antagonism. [Paper Number 74]

ROTATION, SEEDING RATE, AND HERBICIDE INTENSITY EFFECTS ON WEED POPULATIONS IN WHEAT, BARLEY, AND PEA. Joan M. Campbell, Michael J. Wille and Donn C. Thill. Research and Instructional Associate, Research Support Scientist and Professor. University of Idaho, Moscow ID 83843.

Abstract. A six year experiment was established at the University of Idaho Plant Science Farm east of Moscow, Idaho to compare the effectiveness of different combinations of weed management practices on weed control in a winter wheat-spring barley-spring pea production system. The experiment was designed as a two by two by two split-split plot with four replications. Minimum sub-plot size was 10 by 50 ft. Rotation was the main plot which compared a three year rotation of winter wheat, spring barley, and spring pea to a two year rotation of winter wheat and spring pea. Sub-plots were two seeding rates which compared a typical rate for the area and 130% of the typical rate. Herbicide management was the sub-sub-plot which compared a university extension recommended practice and 70% rate of the recommended herbicides. The experimental area was seeded uniformly with a mixture of broadleaf weed seeds (25 seeds/ft2) and wild oat seeds (25 seeds/ft2) prior to the experiment initiation. Weeds were counted before postemergence herbicide applications to determine the herbicide program, and weed seed was collected before harvest. Net return was calculated based on seed cost, herbicide cost, and yield only, and did not include insecticide applications on pea, tillage, or fertilizer applied for the grains which were the same across treatments. Wheat yield was 5700 and 5455 lb/a and pea yield was 1630 and 1478 lb/A for the 3 year and 2 year rotation, respectively, averaged from 1995 to 2000. Average net return for wheat was $290.06/A and $275.21/A, and average net return for pea was $64.41/A and $50.50/A for the 3 year and 2 year rotation, respectively. Average net return for barley was $150.34/A. Net return was $168.27 for the 3 year rotation and $162.85 for the 2 year rotation, averaged over the six years. [Paper Number 75]

GREEN AND YELLOW FOXTAIL CONTROL IN SPRING WHEAT. Brian M. Jenks[1], Kirk A. Howatt[2], Gregory J. Endres[3], Kent R. McKay[1], Denise M. Markle[1] and Gary P. Willoughby[1]. Weed Scientist, Assistant Professor, Extension Agronomist, Extension Agronomist, Research Specialist and Research Specialist. [1]North Dakota State University, Minot ND 58701, [2]North Dakota State University, Fargo ND 58102 and [3]North Dakota State University, Carrington ND 58421.

Abstract. Yellow and green foxtail can be a threat to spring wheat yield in North Dakota. Spring wheat will compete with late emerging foxtail, but will require weed control when yellow and green foxtail emerge early. Yellow foxtail can be more difficult to control than green foxtail. Studies using tralkoxydim, clodinafop, flucarbazone, and fenoxaprop alone, or tank mixed with broadleaf compounds have shown variable levels of yellow and green foxtail control. In trials conducted at Minot, ND in 2001, clodinafop and fenoxaprop alone provided 90 to 95% yellow foxtail control, 6 weeks after treatment (WAT). Flucarbazone applied alone provided 73% yellow foxtail control. Fenoxaprop, clodinafop, and flucarbazone tank mixed with bromoxynil&MCPA or thifensulfuron + fluroxypyr, provided 43 to 60%, 53 to 58%, and 58 to 60% yellow foxtail control, respectively. Herbicides were applied June 7 to 4- to 5-leaf wheat and 3-leaf yellow foxtail. Air temperature and relative humidity at application time were 68 F and 51%, respectively. High temperatures 3 days after treatment (DAT) ranged from 81 to 85 F. In a separate study conducted at Minot, fenoxaprop tank mixed with thifensulfuron + fluroxypyr, thifensulfuron + MCPA-e + fluroxypyr, thifensulfuron&tribenuron + fluroxypyr, thifensulfuron&tribenuron + MCPA-e + fluroxypyr provided 95 to 98% green foxtail control, but only 65 to 68% yellow foxtail control, 3 WAT. Clodinafop tank mixed with the same herbicides provided 76 to 91% green foxtail control, but only 46 to 57% yellow foxtail control, 3 WAT. Treatments were applied to separate foxtail infestations that were located in different areas of the same research field. For the yellow foxtail infestation, herbicides were applied June 7 to 4- to 5-leaf wheat and 3-leaf yellow foxtail. Air temperature and relative humidity at application time were 68 F and 51%, respectively. High temperatures 3 DAT ranged from 81 to 85 F. For the green foxtail infestation, herbicides were applied June 25 to 4- to 5-leaf wheat and 3- to 4-leaf green foxtail. Air temperature and relative humidity at application time were 82 F and 62%, respectively. High temperatures 3 DAT ranged from 73 to 83 F. At Carrington, ND in 2001, tralkoxydim,

clodinafop, or fenoxaprop tank mixed with bromoxynil&MCPA; and flucarbazone + thifensulfuron&tribenuron + 2,4-D provided 86 to 93% yellow foxtail control and 93 to 98% green foxtail control, 6 WAT. Herbicides were applied May 31 to 3.5-leaf wheat and 2- to 4-leaf yellow and green foxtail. Air temperature and relative humidity at application time were 58 F and 92%, respectively. High temperatures 3 DAT ranged from 63 to 71 F. At Fargo, ND in 2001, fenoxaprop tank mixed with bromoxynil&MCPA, thifensulfuron + fluroxypyr, thifensulfuron&tribenuron + fluroxypyr, thifensulfuron + fluroxypyr + MCPA, and thifensulfuron&tribenuron + fluroxypyr + MCPA provided 86 to 95% yellow foxtail control, 5 WAT. Clodinafop tank mixed with the same herbicides provided 76 to 90% yellow foxtail control. Herbicides were applied June 21 to 3.5-leaf wheat and 2- to 3-leaf yellow foxtail. Air temperature and relative humidity at application time were 66 F and 49%, respectively. High temperatures 3 DAT ranged from 76 to 89 F. At Minot, fenoxaprop, clodinafop, and flucarbazone were applied at 1.32, 1.0, and 0.42 oz ai/A, respectively. At Carrington, fenoxaprop, clodinafop, flucarbazone, and tralkoxydim were applied at 1.32, 0.8, 0.42, and 2.9 oz ai/A, respectively. At Fargo, fenoxaprop and clodinafop were applied at 0.8 and 1.0 oz ai/A, respectively. [Paper Number 76]

CHEMICAL SUPPRESSION OF KENTUCKY BLUEGRASS. Janice M. Reed and Donald C. Thill. Scientific Aide and Professor, Weed Science. University of Idaho, PSES Dept., Moscow ID 83844-2339.

Abstract. Sustained Kentucky bluegrass seed productivity historically has relied on open-field burning of post-harvest residues that has been associated with significant air quality issues and public health impacts. Alternative management systems must be developed that eliminate or substantially reduce the need to burn Kentucky bluegrass residues yet sustain productivity and economical seed yield. Non-thermal Kentucky bluegrass seed production systems reduce the consecutive number of bluegrass seed crops and require more frequent bluegrass establishment. Bluegrass stand suppression using herbicides may increase the number of consecutive bluegrass seed crops, thus reducing the need for frequent stand establishment. In March 2001, plots were established near Nezperce, ID to determine the optimum glyphosate application time for stand suppression and sustained seed yield of three Kentucky bluegrass varieties. Plots were 10 by 30 ft, arranged in a randomized complete block design with four replications. Glyphosate was applied to all varieties at five timings. Tiller density was determined from 4-inch sod cores taken prior to application and 5 weeks post-application. Bluegrass regrowth was visually estimated. The effect of imazapic on stand suppression of eight Kentucky bluegrass varieties was determined near Moscow, ID. Plots were 16 by 16 feet, arranged in a split plot design, with four replications. Imazapic was applied to one-half of each plot (8 by 16 ft) in April 2001. Regrowth was visually estimated in June and July, 2001. The percentage bluegrass tiller reduction 5 weeks after glyphosate treatment tended to be highest at early application times and least at later application times. Regardless of variety, percentage bluegrass ground cover during September 2001 always was greatest in plots sprayed with glyphosate early in the season, 65 to 81% at application times one and two, and least in plots sprayed last, 8 to 19% at application time five. This study will be repeated in 2002. By 3 months after imazapic treatment, recovery ranged from 12 to 54% and was greatest in Blue Chip and least in Nublue. The effect of stand suppression on subsequent bluegrass seed yield will be determined for both the glyphosate and imazapic studies in 2002. [Paper Number 77]

USE OF VISUAL AND SENSOR BASED TECHNOLOGY TO EXAMINE FERAL RYE FOR DIFFERENCES IN TOLERANCE TO IMAZAMOX. Deborah A. Solie, Thomas F. Peeper, John B. Solie and Amanda E. Stone. Undergraduate, Professor, Professor and Graduate Research Assistant. Oklahoma State University, Stillwater OK 74078.

Abstract. Previous research conducted at Oklahoma State University observed variation in morphological characteristics of feral rye. These morphological differences suggest that genetic variation exist in feral rye in Oklahoma. In field experiments, applications of imazamox to rye seldom kill every plant. This suggests that variation in herbicide tolerance may be present, as well as variation in morphological characteristics. A characteristic of rye is that it cross-pollinates up to 50% (Sprague 1938). In situations when increased tolerance to a herbicide is not controlled by a single gene, a high level of cross-pollination could lead to rapid selection for characteristics that contribute to herbicide tolerance. We hypothesized that feral rye varies in its response to imazamox. To test this hypothesis, six feral rye spikes were collected from 55 sites in northern and western Oklahoma. Each spike was measured and individually threshed. Seeds from each spike were individually planted approximately 1.3 m apart, in the fall of 2001. The rye was sprayed with imazamox at 0, 0.024, and 0.048 lb ai/ac and examined for differences in tolerance using visual and sensor technology estimates. Prior to herbicide

application, a sensor that captures incident and reflected light at 670 nm (red) and 780 nm (NIR) measured NDVI for each individual plant. NDVI was also determined nine days after treatment and weekly thereafter to monitor the effect of the herbicide on individual plants. Preliminary analysis indicates substantial variation in early response. Data collection and analysis are continuing. [Paper Number 78]

INTEGRATED MANAGEMENT OF CLOVER BROOMRAPE IN RED CLOVER SEED PRODUCTION. Jed B. Colquhoun, Richard P. Affeldt, Carol A. Mallory-Smith, Kyle C. Ross and Charles M. Cole. Assistant Professor, Faculty Research Assistant, Associate Professor, Graduate Research Assistant and Faculty Research Assistant. Oregon State University, Corvallis OR 97331.

Abstract. Clover broomrape is an obligate parasite that attaches to roots of host plant species and often reduces host crop yield. Clover broomrape is a relatively new pest in Oregon and is a federally prohibited noxious weed, yet minimal research has been conducted to evaluate management or eradication strategies in red clover. Therefore, research was conducted to evaluate practical and economic management strategies that could be rapidly adopted by growers. Strategies included control with herbicides and soil fumigation, and clover broomrape suppression with nitrogen. Low rates of glyphosate (0.11 to 0.22 kg ai ha^{-1}) prevented the emergence of additional clover broomrape plants with minimal crop injury. Clover broomrape control was greatest where imazamox was applied. Crop injury was greater where soil was fumigated with metam sodium when compared to an untreated check. Additionally, metam sodium product and application costs prohibited profitable red clover seed production. Preliminary results of greenhouse studies indicated that ammonium sulfate fertilizer (5.7 to 11.4 kg ha^{-1}) decreased clover broomrape germination and attachment to red clover. [Paper Number 79]

AGRONOMIC AND ECONOMIC CROP RESPONSES TO WEED MANAGEMENT SYSTEMS IN FIELD CROPS. Frederick A. Holm[1], Kenneth L. Sapsford[1], Gordon Thomas[2] and Robert P. Zentner[3]. Professor, Research Assistant, Research Scientist and Research Scientist. [1]Crop Development Centre, University of Saskatchewan, Saskatoon SK S7N 5A8, [2]Agriculture and Agri-Food Canada, Saskatoon SK S7N 0X2 and [3]Agriculture and Agri-Food Canada, Swift Current SK S9H 3X2.

Abstract. The effects of various crop and weed management systems on grain yield and quality and on the weed population and density over time in a four year wheat – canola – barley – pea rotation were investigated. A second objective was to measure the impact of annual fungicide applications on the yield and quality of the four crops grown in rotation. The four replicate trial was conducted from 1997 through 2000 at Saskatoon, Saskatchewan. Within each rotation there were 6 cropping systems: High Herbicide / Zero Till (HH/ZT), Medium Herbicide / Zero Till (MH/ZT), Low Herbicide / Zero Till (LH/ZT), Low Herbicide / Low Till (LH/LT), Medium Herbicide / Medium Till (MH/MT) and No Herbicide / High Till (NH/HT). Within each of these systems there were differences in seeding rate, fall weed control, pre-seeding weed control, in-crop herbicide rate and seeding date. Half of each plot was sprayed with a fungicide and the other half was left untreated. Every crop was grown each year in each of the cropping systems. In general, zero-till systems resulted in higher yields and yields declined as the intensity of tillage was increased. The HH/ZT system always resulted in the highest yield. The MH/ZT, LH/ZT and MH/MT systems always resulted in similar yields just slightly lower than the HH/ZT system. Canola yields declined the most and barley and pea yields the least when herbicide inputs were reduced. Management system had little or no effect on crop quality and weed biomass tended to be greatest when herbicides were not used. As herbicide intensity decreased, weed biomass increased and yield decreased in all crops. The fungicide effect was greatest in wetter years (1999, 2000) and generally increased seed yield of barley, wheat and field pea with the greatest increases occurring in barley. Fungicide increased seed weight of all crops except canola, tended to reduce protein concentration of cereals and field pea and increased barley kernel plumpness. However, the economic impact of fungicide application was usually not positive. The maximum breakeven price that could be paid for the fungicide was estimated at about 25% to 33% of its current market cost. Total production cost was highest for the HH/ZT system and typically lowest for NH/HT. Total costs of the medium-herbicide treatments (MH/ZT and MH/LT) were similar and ranked second highest, while total costs for the low-herbicide treatments (LH/ZT and LH/LT) ranked third highest. ZT systems resulted in lower machinery and labour costs, but higher expenditures for herbicides compared to those that included mechanical tillage. Cash outlays were highest for fertilizer and chemical inputs, and together they represented 24 to 46% of the total costs for most cropping systems. The total costs of producing individual crops within each cropping system were highest for pea, intermediate for canola and lowest for wheat and barley. Overall, the use of in-crop fungicide was not profitable with net returns averaging $30 to $70 ha-1 lower than

for the comparable no-fungicide treatments. Net returns for the no-fungicide treatments were highest and similar for the zero-till systems (HH/ZT, MH/ZT, and LH/ZT), and lowest for NH/HT. On an annual basis, net returns were highest in 1999, a year with cool and wet growing season conditions, which resulted in the highest grain yields. Under these favourable growing conditions, HH/ZT was the most profitable management method (no-fungicide treatments only). This was followed by MH/ZT which ranked second highest, and then by LH/ZT and MH/MT. In the relatively dry years of 1998 and 2000, the HH/ZT, MH/ZT and LH/ZT systems generally performed best, reflecting the improved soil moisture conservation and utilization with zero tillage management. In all years except 1997, the NH/HT system, and to a lesser extent LH/LT, provided the lowest net return, reflecting, in part, the difficulty of adequately controlling weeds when relying primarily on tillage. Changes in grain prices had a major impact on the absolute level of net returns earned, but had relatively little impact on the rankings of net returns for the various cropping systems due to negligible impacts of management system on grain yield and quality. The HH/ZT, MH/ZT, and LH/ZT management systems provided the highest net returns and NH/HT provided the lowest net return under all grain price scenarios when no fungicide was applied. When the treatments included in-crop fungicide, the most profitable systems were HH/ZT and LH/ZT when prices were high, while at low grain prices LH/ZT was typically the most profitable management system. The results of the economic analysis support the use of the LH/ZT management method at Saskatoon when using a 4-year wheat-canola-barley-pea crop rotation. This cropping system provided the highest net return and displayed the lowest income variability, despite not being the lowest cost production system. The least profitable management system was typically NH/HT, in part because of the lower grain yields resulting from increased competition with weeds. [Paper Number 80]

HISTORICAL OVERVIEW OF WEED CONTROL RESEARCH AT THE KSU AGRICULTURAL RESEARCH CENTER-HAYS. Phillip W. Stahlman. Research Weed Scientist. Kansas State University, Agricultural Research Center-Hays, Hays KS 67601.

Abstract. Some of the first experiments conducted after establishment of the Fort Hays Branch Experiment Station in 1901 (renamed Kansas State University Agricultural Research Center-Hays in 1994), were on field bindweed control. Early research involved repeated tillage and high rates (up to 20 tons per acre) of common salt. The salt eliminated the weed but affected soil productivity and physical properties for 50 years or more. Crops research scientists helped develop use of sodium chlorate, which quickly replaced sodium chloride as the herbicide of choice for treating small bindweed patches. In 1935, the U.S. Department of Agriculture (USDA) started a cooperative federal-state field bindweed control project under the direction of F. Leonard Timmons (1935-1948). This was the formal beginning of the Weed Control Investigations Project at Hays. Over the next 15 years, extensive and highly detailed cultural control experiments were conducted using intensive cultivation and competitive cropping systems. The effects of cultivation depth and frequency on bindweeds root system and root food reserves were documented and studies were initiated and continued by others that showed bindweed seeds can remain viable in the soil for more than 50 years. Starting in 1945, research expanded to include testing and development of herbicides. Timmons was one of the first civilians allowed to test 2,4-D. He conducted numerous experiments on its use for control of field bindweed and broadleaf weeds in winter wheat. William M. Phillips (1948-1976) succeeded Timmons as Project Leader in 1948. He scaled back research on field bindweed and broadened the scope of research to include control of annual weeds in winter wheat, grain sorghum, and fallow. In the 1960s, Phillips conducted pioneering research leading to the development of a reduced- or minimum-tillage system for wheat-sorghum-fallow rotations that reduced soil erosion, increased soil moisture storage, and stabilized crop production. The system continues to change with new developments, but variations of it remain the most common conservation tillage system used in wheat-sorghum (or corn)-fallow producing areas throughout the central Great Plains. In 1973, the USDA ended support of the Weed Investigations Project. The state of Kansas assumed full support of the project and Phillips left USDA to continue as project leader until 1976. Phillip W. Stahlman (1976-current) succeeded Phillips as leader of the renamed Weed Control Research Project. In the 1980s and 1990s, Stahlman expanded herbicide testing and development research to include most crops grown in western Kansas, and conducted research on crop-weed competition to determine economic control thresholds, and on biological control of winter annual grass weeds in wheat using indigenous soil bacteria. Current research focuses on integrated weed management systems, assessment of benefits and risks of herbicide resistant crops, systems-mediated weed spectrum shifts, and continuation of crop-weed interactions, development and evaluation of selective herbicides. [Paper Number 81]

ENDURANCE AND/OR DIREX FOR VEGETATION MANAGEMENT ALONG IRRIGATION DITCHES IN CENTRAL ARIZONA. John H. Brock. Professor. Arizona State University East, Mesa AZ 85212.

Abstract. Endurance herbicide alone or in combination with Direx (Karmex) was applied to unlined irrigation ditches near Scottsdale, AZ. Endurance was applied alone at 2.3 and in combination with Direx at 1.5 + 5.0 and 2.3 + 5.0 and Direx only at 5.0 in water with surfactant on March 3, 2000. All herbicide rates were lbs/ac a.i. Plots were evaluated for 6 months following treatment for plant numbers and foliage cover. Plant cover was lower on all treated plots compared to the control, with the combination of Endurance + Direx at 2.3 + 5.0 providing as much as 93 % reduction in weed numbers and 94 % reduction in weed foliage cover. Weed control results on Endurance herbicide only plots were not significantly different. Barnyard grass, lambsquarter and morning glory were easily controlled. The only plant not controlled by these treatments was nutsedge. [Paper Number 82]

ANNUAL MORNINGGLORY AND PERENNIAL BINDWEED CONTROL IN HERBICIDE TOLERANT COTTON. Ron N. Vargas[1], Steve Wright[2], Tome Martin-Duvall[1] and Lolo Banuelos[2]. Farm Advisor, Farm Advisor, Research Assistant and Research Assistant. [1]University of California Cooperative Extension, Madera CA 93637 and [2]University of California Cooperative Extension, Tulare CA 93291.

Abstract. Both annual morningglory (Ipmoea hederacea) and field bindweed (Convolvulus arvensis) are widespread, persistent and hard to control problems weeds in cotton grown in the San Joaquin Valley of California. Previous weed management and production systems have not provided satisfactory control of either weed species. Poor control has resulted in increased cultivation and hand weeding cost, and reduced harvest efficiencies and reductions in lint yield and quality Field studies were conducted in 2000 and 2001 to evaluate the control of annual morningglory and field bindweed in Roundup Ready Riata and BXN Nova cotton. Uniform fields of cotton, infested with one or the other of these species, were divided into treatments and replicated four times in a randomized complete block design. Initial herbicide applications were applied early over the top of cotyledon to 2 to 4-leaf cotton when weeds were small seedlings with followup treatments applied post directed at various stages of cotton and weed growth. Applications of non-selective herbicides were applied as later post directed treatments to minimize cotton injury. Field bindweed control. Three applications of Roundup (glyphosate) at 1 lb. ai/A, with the first application being applied over the top of one (1) true leaf cotton to field bindweed with up to 18 inch stolons, provided season long control (99 percent control at harvest). Additions of Caparol (prometryn), Prowl (pendimethalin), Dual (metolachlor), Goal (oxyfluorfen), or Shark (carfentazone) at the third application, when the cotton was 13 nodes between 22 and 26 inches tall and field bindweed 8 to 24 inch stolons, did not provide greater control than Roundup alone. Roundup applied in combination with Staple, either at two or three applications also provided no better control than Roundup alone. Treatments that included Staple (pyriothiobac), Shark and Caparol exhibited slight cotton injury, which subsequently disappeared producing no long term effect. All herbicide treatments exhibited greater statistically significant seed cotton yields than the untreated control. In a second study conducted in 2001, post directed treatments of Shark alone and in tank mix combination with either Buctril (bromoxynil), Staple or MSMA provided 70 to 86 percent burndown of field bindweed 7 days after treatment. An evaluation 7 days later at 14 DAT indicated regrowth of field bindweed, reducing burndown and control by 50 percent. Annual Morningglory. Roundup applied over the top of Roundup Ready Riata cotton in the 3 to 4-leaf stage, when annual morningglory was 1 to 4 inches tall, followed by one or two directed applications of Roundup at later stages of cotton growth provided 100 percent control of annual morningglory. There were no differences in control between two and three applications of Roundup or applications at either the 6 or 8-leaf stage of cotton at the second application. Roundup applied over the top of cotton at the 2 and 4-leaf stage followed by post direct application at the 6, 8 and 12-leaf stage exhibited no injury symptoms. Post directed applications of Shark, up to 1 oz./A, when Nova cotton was 18 - 24 inches tall, with morningglory at 12 to 18 inch shoots provided 100 percent control at 21 DAT. There was no advantage in tank mixing either Buctril, MSMA or Staple with Shark. At 7 DAT cotton injury ranged from 15 - 20 percent, but only 2 to 4 percent at 21 DAT. [Paper Number 83]

WEED CONTROL IN COTTON USING A LIGHT-ACTIVATED HOODED SPRAYER. Peter A. Dotray[1], D. Alan Peters[1], J. Wayne Keeling[2] and John Wilkerson[3]. Associate Professor, Graduate Research Assistant, Professor and Associate Professor. [1]Texas Tech University, Lubbock TX 79409, [2]Texas Agricultural Experiment Station, Lubbock TX 79403 and [3]University of Tennessee, Knoxville TN .

Abstract. A field experiment was conducted in 2001 near New Deal, TX to compare weed control in a glyphosate-tolerant cotton (*Gossypium hirsutum* L.) system using mechanical cultivation, a conventional hooded sprayer (HS), and a light-activated hooded sprayer (LAHS). Treatments included trifluralin at 0.75 lb ai/A applied preplant incorporated (PPI) followed by prometryn at 1.2 lb ai/A applied preemergence (PRE) followed by mechanical cultivation as needed; trifluralin PPI followed by a postemergence-topical (PT) broadcast application of glyphosate at 0.75 lb ae/A at the four-leaf growth stage, and glyphosate applied with a HS as needed; trifluralin PPI followed by glyphosate PT broadcast and glyphosate applied with a LAHS as needed; and trifluralin PPI followed by a PT application of glyphosate on a 14-inch band over the row at the four-leaf stage and glyphosate applied with a LAHS as needed. 'Paymaster 2326RR' cotton was planted at a seeding rate of 15 lb/A on 40-inch rows on May 10 and harvested on December 10. Experimental design was a randomized complete block with of four replications. Plots were 8 rows by 600 feet. Preplant incorporated treatments were applied on March 2 and incorporated with a springtooth harrow, and preemergence applications were made on May 10. Postemergence treatments were applied on June 9 and July 5 when weeds were 1 to 6 inches tall. Palmer amaranth (*Amaranthus palmeri* S. Wats.), common cocklebur (*Xanthium strumarium* L.), and silverleaf nightshade (*Solanum elaeagnifolium* Cav.) control was rated visually throughout the growing season. At each rating date, plots were accessed to determine if supplemental applications were needed. The amount of spray solution used by the LAHS was determined by subtracting the volume left after spraying a single plot from the initial volume in the tank. Percent herbicide reduction was calculated based on the amount of solution required to apply a broadcast treatment. Control of Palmer amaranth ranged from 64-76% for all treatments early-season. At the mid- and late-season ratings, glyphosate PT followed by a LAHS treatment provided at least 91% control. Late-season Palmer amaranth control from this treatment (94%) was similar to the HS treatment (95%) and greater than two applications using the LAHS only (80%). Common cocklebur control with the LAHS (80 to 93%) was similar to the HS treatment (95%) and greater than the PRE followed by cultivation treatment (40%) late-season. Silverleaf nightshade was controlled 60 to 68% by all treatments early-season. At the mid-season rating, the HS treatment controlled silverleaf nightshade more effectively (81%) than the LAHS followed by LAHS treatment (66%). A similar trend was observed late-season. At the June application, a 74% reduction in glyphosate solution was observed using the LAHS treatment. Glyphosate reductions of 63 and 84% were observed with the July application. Lint yields ranged from 847 to 936 lb/A in the HS and LAHS treated plots, while the PRE followed by cultivation treated plots yielded 510 lb/A. Weed maps during the July application indicated that weeds were not randomly distributed across the field, but were found in patches. Weed maps will be used to observe how weedy patches change within a growing season and over growing seasons. [Paper Number 84]

YIELD PENALTY DUE TO DELAYED WEED CONTROL IN CORN AND SOYBEAN. Stevan Z. Knezevic. Weed Scientist. Univ of Nebraska, Concord NE 68728.

Abstract. The two commonly asked questions by corn/soybean producers are: (1) how to time post emergence weed control and (2) how much is it going to cost if weed control is delayed. This is especially true for the cropping systems that utilize genetically modified crops. The first question was addressed using a concept of critical period of weed controls (CPWC) CPWC is a period in the crop growth cycle during which weeds must be controlled to prevent yield losses. Research from University of Nebraska has determined that the length of such critical period was influenced by the cropping practices (eg. nitrogen (N) fertilizer and crop row spacing). Field studies conducted in eastern Nebraska determined the effects of three nitrogen rates on the CPWC in dry land corn and of three row spacings on the critical time for weed removal in dry land soybean. When data was averaged over years and locations, the study in corn concluded that CPWC ranged from V1-V11, V3-V10, V4-V9 and V6-V9 for N-rates of 0, 55, 110 and 210 kg/ha, respectively. Study in soybean suggested that critical time for weed removal coinsided with V3, V2 and V1 for soybean row spacing of &.5", 15" and 30", respectively. In order to address the second question the yield loss data from the above studies were pooled over years-locations and related to the crop growth stage at the time of weed removal for both corn and soybean. The 5% yield loss was arbitrarily selected as a maximum acceptable loss. The two percent yield loss per every leaf stage of delay passed the critical time of weed removal was determined as the cost of delaying weed control in both corn and soybean. For example, the time (5%

yield loss) to control weeds in 7.5 inch rows soybean was the V3 stage If weed control was delayed to the V4 (fourth trifoliate) the yield loss was 7%, costing a producer about 2 percent in yield losses due to prolonged competition from weeds. The same is true if weed control is delayed past the recommended critical time in other row spacings in soybean and various nitrogen levels in corn. This recommendation is applicable up to canopy closure in corn (about 11 fully developed leaves) and the R3 stage in soybean (beginning pod). If the weed control is delayed further than these indicated stages the yield losses will be much higher than suggested. In terms of actual economic losses: (a) in corn, it will be about $4 per acre for every corn leaf stage of delay, assuming a price of $2 per bushel and a yield goal of 100 bushels per acre, and (b) in soybean, it will be about $5 per acre for every soybean leaf stage of delay, assuming a price of $5 bushel and a yield goal of 40 bushels per acre. [Paper Number 85]

EVALUATION OF CARFENTRAZONE APPLIED ALONE AND IN TANK MIXTURE IN GRAIN SORGHUM. Anthony D. White[1], Patrick W. Geier[1], Phillip W. Stahlman[1], Troy M. Price[2] and David L. Regehr[3]. Research Scientist, Assistant Scientist, Professor, Assistant Scientist and Professor. Kansas State University, Hays, Colby, and Manhattan KS .

Abstract. Carfentrazone ethyl is a protoporphyrinogen oxidase (PPO) inhibitor herbicide registered for broadleaf weed control in various crops, including grain sorghum. Carfentrazone provides a weed control alternative to atrazine at a lower cost per acre and has no rotation restrictions to subsequent field crops grown in Kansas. Studies were conducted near Colby, Hays, and Manhattan, KS (two trials at each location) to evaluate the effects of carfentrazone alone or in tank mixture with atrazine, 2,4-D (amine), fluroxypyr, prosulfuron, dicamba, metsulfuron, or halosulfuron in grain sorghum. S-metolachlor was applied to one of the trials at each location to provide grass control. Not all weeds were present at each location and are indicated accordingly. Carfentrazone by itself provided greater than 97 % control of redroot pigweed (Colby and Hays), tumble pigweed (Colby) and kochia (Colby). These species also were controlled >97% when carfentrazone was used in combination with the herbicides previously listed. Palmer amaranth (Manhattan) control was inconsistent between trials whether carfentrazone was applied alone or in combination with atrazine, 2,4-D, dicamba, halosulfuron, metsulfuron, or prosulfuron. Velvetleaf control was higher with carfentrazone tank mix treatments compared to carfentrazone alone. Substituting COC for NIS at Hays improved puncturevine control by as much as 28%, but increased crop injury by as much nine-fold. Most treatments containing carfentrazone caused significant leaf necrosis at Hays 1 DAT. However, later emerging leaves were not affected. Carfentrazone tank mixed with atrazine did not cause leaf necrosis or other crop injury at Colby. However, other tank mixtures caused up to 20% crop injury at 5 DAT. There was minimal crop response 7 DAT at Manhattan. Corn exhibited no visible injury at any location prior to harvest. Significant yield loss resulted only when COC was added to carfentrazone. [Paper Number 86]

SPRAY VOLUME EFFECTS ON HERBICIDE EFFICACY. Brad K. Ramsdale and Calvin G. Messersmith. Postdoctoral Research Fellow and Professor. North Dakota State University, Fargo ND 58105.

Abstract. Low spray volumes provide savings in time to fill sprayer tanks and for travel to and from fields without any additional chemical costs. The proper adjuvant and adjuvant amount is important for low volume applications, but results vary depending on the herbicide and adjuvant. The objective of these studies was to examine the influence of spray volume on herbicide efficacy over a range of environments. Experiments were conducted in 2001 near Fargo (east central), Carrington (central), Minot (north central), and Hettinger (southwest), North Dakota. Barley, oat, foxtail millet, and proso millet assay species were seeded side-by-side with a grain drill, and plots 12 ft wide were laid out perpendicular to the strips so that each plot contained all assay species. Treatments were applied with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. All treatments were applied at 20 psi. Spray volumes of 2.5 and 5 gal/A were applied with Turbo TeeJet 11001 nozzles, and spray volumes of 10 and 20 gal/A were applied with Turbo TeeJet 11004 nozzles, and speed was adjusted to attain the target volume. Herbicide treatments were imazamox at 0.25 oz ai/A plus methylated seed oil at 1.5 pt/A; sethoxydim at 1 oz ai/A plus methylated seed oil at 1.5 pt/A; MKH 6562 (proposed common name flucarbazone) plus basic blend adjuvant at 1% v/v; glyphosate isopropylamine salt (Roundup Ultra) at 1 oz ae/A; and glyphosate diammonium salt (Touchdown Pro) at 1 oz ae/A. Herbicides were applied at reduced rates to better detect treatment effects on herbicide efficacy. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete death of assay species. Imazamox efficacy was generally best when spray volume was 2.5 or 5 gal/A. Grass species control by sethoxydim in 2.5 or 5 gal/A spray volume was equal to or greater than when applied in 10 or 20 gal/A. MKH 6562 efficacy was

generally not influenced by changes in spray volume. Glyphosate was most effective when applied in 2.5 or 5 gal/A spray volume, regardless of formulation. Additionally, glyphosate applied in 10 gal/A spray volume was generally equally or more effective than when applied in 20 gal/A spray volume. The concentration of herbicide and adjuvant from formulated glyphosate would decrease as spray volume increased, which likely contributed to reduced glyphosate efficacy. These results suggest that herbicide efficacy at 2.5 or 5 gal/A spray volume was consistently equal to or greater than herbicide efficacy at 10 or 20 gal/A. [Paper Number 87]

COMMON WATERHEMP RESISTANCE TO PROTOPORPHTRINOGEN OXIDASE (PPO)-INHIBITING HERBICIDES. Douglas E. Shoup, Kassim Al-Khatib and Dallas E. Peterson. Graduate Research Assistant, Associate Professor and Professor. Kansas State University, Manhattan KS 66506.

Abstract. Common waterhemp (*Amaranthus rudis*) is a troublesome weed throughout the Midwestern United States. It is a dioecious plant that can produce up to 2 million seeds per plant (Battles et al., 1998). Because of its rapid growth characteristics and its ability to reach heights of 2 to 3 m (Bensch et al., 2001; Horak and Loughin, 2000), common waterhemp compete strongly with many crops. Bensch et al. (2002) investigated the competition of *Amaranthus* species with soybean and found that when common waterhemp emerged with the crop, yields were reduced up to 56%, with a population of 11 plants/m_2. Common waterhemp is second only to Palmer amaranth in relative growth rate among the *Amaranthus* species that are common in Kansas (Horak and Loughin, 2000). In the past, common waterhemp was controlled with triazine herbicides and acetolactate synthase (ALS)-inhibiting herbicides, such as sulfonylurea, imidazolinone, and triazolopyrimidine herbicides. However due to widespread use of triazine and ALS herbicides, common waterhemp resistance to these herbicides developed (Anderson et al., 1996; Horak and Peterson, 1995). Because protoporphyrinogen oxidase (PPO)-inhibiting herbicides such as acifluorfen, lactofen, and fomesafen provided excellent control of common waterhemp, many soybean producers tank mix these herbicides with ALS herbicides to control ALS and triazine resistant biotypes (Gaddert et al., 1997). In 2000 poor control of common waterhemp with acifluorfen was observed in a soybean field near Sabetha in northeast Kansas where acifluorfen had been applied the previous 4 years. The objectives of this research were (1) determine if the common waterhemp biotype from the field near Sabetha developed resistance to acifluorfen and to other PPO-inhibitors, and (2) examine possible multiple-resistance by the biotype to other herbicides. MATERIALS AND METHODS Plant Materials. Common waterhemp seeds were collected from a field near Sabetha, KS in the fall of 2000. The field was suspected to contain a population of common waterhemp resistant to PPO-inhibiting herbicides. The field was in continuous soybeans for the last 15 years and a 5 year history of herbicide use at the site was obtained from the grower and is summarized in Table 1. Susceptible common waterhemp seeds were collected from Kansas State University research farm at Ashland Bottoms south of Manhattan, KS where PPO-inhibitors have not been used in the past 10 years to control weeds. The seeds were incubated with 10% methanol for 15 min then planted in 50 x 35 x 9.5-cm flats. Common waterhemp seedlings were transplanted into 21-cm diameter containers filled with 700 g soil. The soil mix was a sand : Morrill loam (mesic Typic Argiudolls) soil, 1:1 by volume, with a pH of 7.2 and 1.4% organic matter, each container held one common waterhemp plant. Plants were grown under greenhouse conditions at 28/25 ± 2 C day/night temperatures and 16/8 h day/night periods. Herbicide Treatment. Suspected PPO inhibitor-resistant (R) and -susceptible (S) biotypes of common waterhemp were treated at 13 to 18 cm in height. Herbicides were applied at 0, 0.125, 0.25, 0.5, 1, 2, 4, and 8 times the use rate of acifluorfen, lactofen, fomesafen, sulfentrazone, imazethapyr, thifensulfuron, glyphosate, and paraquat. The use rates were 421, 219, 421, 279, 71, 4, 1122, and 701 g/ha respectively. Herbicides were applied with 0.5% (v/v) crop oil concentrate (COC). Herbicides were applied with a bench-type sprayer calibrated to deliver 187 L/ha at 138 kPa. Control treatment received water and COC at 0.5% v/v. Visible injury ratings were determined 7 and 14 days after treatment (DAT). Visible injury rating was based on 0 = no injury and 100 = mortality. Plant heights were determined 14 DAT, then plants were harvested and dried at 72 C for 72 h. Experimental Design and Data Analysis. Experiments were conducted as randomized complete blocks. Treatments were replicated eight to twelve times and the experiment was repeated twice. Data were analyzed using analysis of variance and regression analysis as appropriate means were compared using LSD at p=0.05. Nonlinear regression analysis was used to determine the herbicide rate required to cause 40% visible injury (GR_{40}) (Seefeldt et al., 1999). RESULTS AND DISCUSSION Cross Resistance. All PPO-inhibiting herbicides caused injury symptoms on S common waterhemp within 2 DAT. Symptoms increased as the rate of herbicide increased. The order of PPO herbicide injury for the S biotype was fomesafen > acifluorfen > sulfentrazone > lactofen. Symptoms were general chlorosis, necrosis, stunting, and crinkling of leaves. Injury symptoms for the R biotype were unique. R biotypes did display injury symptoms within 2 d after treatment to all PPO herbicides at all rates, although not to the severity of the S biotype. The order of PPO herbicide injury was

fomesafen > sulfentrazone > acifluorfen > lactofen. Minor chlorosis, necrosis, and minimal crinkling of the leaves were observed. New leaves emerged within two weeks after treatment appeared normal, however leaves were stunted. The herbicide rate that causes 40% injury (GR_{40}) were 106.9, 302.4, and 165.2 for the R biotype, and 1.3, 8.8, and 19.8 for the S biotype for lactofen, acifluorfen, and fomesafen, respectively. In addition, a postemergence application of sulfentrazone, a triazolinone PPO-inhibiting herbicide, caused injury to both R and S biotypes. Again the S biotype exhibited more injury than the R biotype. GR_{40} was 106.1 for the R biotype, and 26.6 for the S biotype for sulfentrazone. Multiple Resistance. R and S biotypes were treated with glyphosate and paraquat to determine multiple resistance by the R biotype. R and S biotypes had similar GR_{40}'s for glyphosate and paraquat. Given that resistant plants were killed by paraquat at low rates, the possibility that rapid breakdown of the free radicals might be eliminated as a mechanism of resistance (Hart and Di Tomaso, 1994). Resistant and susceptible plants were treated with ALS-inhibiting herbicides imazethapyr and thifensulfuron to determine multiple resistance. Results showed that both biotypes were resistant to these ALS- inhibiting herbicides. CONCLUSIONS This study showed that the biotype found near Sabetha was resistant to PPO-inhibiting herbicides. In addition, this biotype exhibited resistance to ALS-inhibitors, but not to glyphosate or paraquat. LITERATURE CITED Anderson, D., F. Roeth, and A. Martin. 1996. Occurrence and control of triazine-resistant common waterhemp (*Amaranthus rudis*) in field corn (*Zea mays*). Weed Technology. 10:570-575. Battles, B., B. Hartzler, and D. Buhler. 1998. Effect of common waterhemp emergence date in soybean on growth and competitiveness. Proc. North Central Weed Sci. Soc. 53:145-146. Bensch, C., M. Horak, and D. Peterson. 2002. Interference of redroot pigweed, palmer amaranth, and common waterhemp in soybean. Weed Sci. (submitted for publication). Gaddert, J., D. Peterson and M. Horak. 1997. Control and cross-resistance of an acetolactate synthase inhibitor-resistant Palmer amaranth (*Amaranthus palmeri*) biotype. Weed Technology. 11:132-137. Hart, J. and J. Di Tomaso. 1994. Sequestration and oxygen radical detoxification as mechanisms of paraquat resistance. Weed Science. 42:277-284. Horak, M. and D. Peterson. 1995. Biotypes of palmer amaranth (*Amaranthus palmeri*) and common waterhemp (*Amaranthus rudis*) are resistant to imazethapyr and thifensulfuron. Weed Technology. 9:192-195. Horak, M. and T. Loughin. 2000. Growth analysis of four amaranthus species. Weed Science. 48:347-355. Seefeldt, S., J. Jensen and E. Fuerst. 1995. Log-logistic analysis of herbicide dose- response relationships. Weed Technology. 9:218-227. [Paper Number 88]

SEED LONGEVITY OF TEN WEED SPECIES TEN YEARS AFTER BURIAL AT TWO DEPTHS IN WYOMING. David W. Wilson and Stephen D. Miller. Associate Lecturer and Professor. University of Wyoming, Laramie WY 82071.

Abstract. A seed burial study plot was established in the last week of October of 1990 at four different dryland locations in Wyoming. Ten weed species were buried at two depths (one and six inches) in replicates of four, at each of the sites. Packets made from 100 micron mesh screen, containing 100 seeds of each species were buried in four inch diameter holes, spaced twelve inches apart. Soil was firmly tamped after packet placement and a grass cover was allowed to develop over each study site. Holes were exhumed after one, two, four, six and ten years of burial and the packets were transported to the laboratory for comparison with stored samples using the tetrazolium chloride viability test. The average seed viability after 10 years, of stored samples, ranged from a high of 47% for spotted knapweed to a low of less than 1% for Canada thistle and downy brome. Stored viability for field bindweed was 34%, cutleaf nightshade 27%, leafy spurge 17%, jointed goatgrass 9%, green foxtail 6%, kochia 3% and wild oat 2%. Field bindweed and cutleaf nightshade retained the highest field viability of the weed species tested with viability remaining greater than 28% and 3% respectively, as an overall average of all four sites at the six inch depth. Viability of these two species dropped to 8% and 4% at the one inch depth. Of the four monocot species tested, jointed goatgrass was the only species to maintain viability in the field after ten years. Jointed goatgrass had a 2% viability at one location (Laramie) at the six inch depth. The remaining seven species, spotted knapweed, leafy spurge, Canada thistle, wild oat, green foxtail, kochia and downy brome had buried seed viabilities under one percent at both depths and all locations at the end of the ten year study. [Paper Number 89]

CLIPPING WEEDS ABOVE THE CROP CANOPY REDUCES SUBSEQUENT SEEDLING RECRUITMENT. Eric N. Johnson[1] and G. Hultgreen[2]. Weed Biologist and Agronomist. [1]Agriculture and Agri-Food Canada, Scott SK and [2]Prairie Agriculture Machinery Institute, Humboldt SK .

Abstract. Weed control is a challenge for organic growers. Organic producers rely on crop rotation, cultural practices, and mechanical weed control to control weeds. Some organic producers have experimented with clipping weeds above the canopy of short stature crops such as lentil or flax. A study was initiated in 1999 to develop or

modify equipment for weed clipping and to evaluate whether the practice improved crop yield and/or reduced weed seedling recruitment the following growing season. A field experiment evaluating clipping at various stages of weed development was conducted over three years (1999-2001) at Scott, SK. The clipping was done above a lentil crop canopy with a gas-powered hedge trimmer. The Prairie Agriculture Machinery Institute at Humboldt modified the cutting component of a self-propelled swather and carried out field trials on four farmer's fields. At Scott, weed clipping did not result in a detectable lentil yield increase in either year. Although variable, clipping generally reduced subsequent weed seedling emergence. Clipping in 1999 reduced wild oat emergence by 64% in the spring of 2000 if clipping was done after wild oat heading. There was a trend towards lower wild mustard recruitment if clipping was done at the podding stage, however the differences were not detectable. In 2000, wild oat populations were low and clipping had no detectable effect on 2001 recruitment. Clipping at any broadleaf weed stage past flowering in 2000 resulted in a 95% and 85% decline in wild mustard and common lambsquarters recruitment, respectively in the spring of 2001. The PAMI field trials resulted in an average of 80% reduction in wild oat recruitment the year following clipping. While the results are preliminary, weed clipping may have potential as an integrated weed management practice for organic producers. Further study is warranted to improve consistency of results. [Paper Number 90]

CROSS-COMMODITY RESEARCH AND OUTREACH PROGRAM (CROP). Pat A. Clay[1], Kai Umeda[1], Peter C. Ellsworth[2], Jennifer S. Jones[3] and John C. Palumbo[4]. Extension Agent, Area Extension Agent, IPM Entomologist, Program Coordinator and Research Entomologist. [1]University of Arizona Cooperative Extension, Phoenix AZ 85040, [2]University of Arizona Department of Entomology, Maricopa AZ 85239, [3]University of Arizona Maricopa Agricultural Center, Maricopa AZ 85239 and [4]University of Arizona Department of Entomology, Yuma AZ 85364.

Abstract. CROP's mission is to enhance the success of Arizona's diverse agriculture through improved cross-commodity interactions among industry stakeholders and University of Arizona research and educational programs. Arizona's agricultural systems are becoming increasingly diverse. This diversification has resulted in an increasing number of cross-commodity interactions. These interactions span a diverse group of agricultural issues including shared pests and shared pest control chemistries and technologies. One example of such interaction is the potential for off-target movement of herbicide and defoliant applications in a diverse cropping community. Cotton defoliation timing coincides with fall melon production, lettuce, cole crops, and leafy vegetable plantings and tools are being developed to aid clientele in proper identification of symptoms of different herbicide/defoliant chemistries. Additional educational outreach materials are being developed for cross-commodity crop rotational limitations for herbicides. CROP is composed of many different, integrated components. One is the formation of an advisory group that identifies and prioritizes cross-commodity issues. The formation of this group sets up a mechanism to proactively handle cross-commodity problems before they become acute. Other components of CROP are the collection, development, publication, distribution and dissemination of cross-commodity information and tools. One of the tools created by this effort is ACIS, the Arizona Crop Information Site. This web site (http://ag.arizona.edu/crops) has pulled together many of the existing University of Arizona web sites for different commodities into one, easy to use site. New information on these commodities and cross-commodity issues have been written and placed on this site, creating a rich, one-stop source for the University of Arizona's crop production and protection information. [Paper Number 91]

BROADLEAF WEED CONTROL IN SPRING-SEEDED ALFALFA. Richard N. Arnold, Michael K. O'Neill and Dan Smeal. Pest Management Specialist, Superintendent-Assistant Professor and Agricultural Specialist. New Mexico State University, Agricultural Science Center, Farmington NM 87499.

Abstract. Alfalfa is New Mexico's leading cash crop, accounting for approximately 20% of the state's crop income. Weeds compete vigorously with spring-seeded alfalfa for light, nutrients, and moisture. Some weeds, when harvested with alfalfa, may reduce quality. Hay quality, particulary protein content, is an important consideration in feed rations in some markets, such as the dairy and horse racing industries. A field experiment was conducted in 2001 at Farmington, NM to evaluate the response of alflafa (var. Legend) and annual broadleaf weeds to postemergence applications of imazamox and imazethapyr applied alone or in combination. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied on June 12 when alfalfa was in the second trifoliolate leaf stage and weeds were small. Plots were evaluated on July 12. Alfalfa was harvested on August 20, using a self-propelled Almaco plot harvester. No crop injury was observed in

any of the treatments. Bromoxynil plus clethodim applied at 0.25 plus 0.094 lb/A gave poor control of redroot and prostrate pigweed and black nightshade. Russian thistle and common lambsquarters control were good to excellent with all treatments except the check. The weedy check and bromoxynil plus clethodim applied at 0.25 plus 0.094 lb/A had significantly higher yields as compared to other treatments. This is possibly attributed to the high weed content when harvested. [Paper Number 92]

A SUSTAINABLE APPROACH TO NEMATODE AND NUTSEDGE MANAGEMENT IN CHILE USING NEMATODE RESISTANT ALFALFA AS A ROTATION CROP. Cheryl Fiore, Jill Schroeder, Stephen Thomas, Ian Ray and Leigh Mkurray. Research Assistant, Professor, Professor, Assistant Professor and Professor. New Mexico State University, Las Cruces NM 88003.

Abstract. Southern root knot nematodes (*Meloidogyne incognita* (RKN)) and the perennial weeds, yellow (*Cyperus esculentus* L. (YNS)) and purple (*Cyperus rotundus* L. (PNS)) nutsedge are among the most difficult pests to manage in chile, in part, because of a lack of effective control measures. Our research indicates that tubers of both nutsedge species and crops traditionally rotated with chile also host RKN. However, a few non-dormant cultivars of alfalfa, a very competitive crop, are RKN resistant. The objective of this four year rotational study was to determine if RKN-resistant alfalfa in rotation with chile is an effective approach to RKN and nutsedge management. The experiment was designed as a split-plot, randomized complete block with four replications and five treatments. Alfalfa cultivars Magna 8 (RKN resistant) and Dona Ana (RKN susceptible) were planted at high and low seeding rates in September 1997. Acala 1517 cotton, the least RKN susceptible row crop traditionally planted in rotation with chile, was grown as a control each season from 1998 to 2000. Alfalfa was harvested five times each growing season with no significant yield differences among cultivars or seeding rates. Seven days after each harvest, yellow and purple nutsedge shoot biomass was estimated by sampling four 0.25 m^2 quadrats in each alfalfa plot. Within the same quadrats, four 20-cm deep soil cores were obtained to estimate RKN populations. RKN remained at non-significant levels in the alfalfa plots over the three years. Nutsedge biomass and RKN populations were sampled in the cotton plots once each September. RKN recovered from the cotton plots remained at economically significant levels each year. The alfalfa was destroyed in the fall of 2000 and chile was planted twice in the spring of 2001. Both stands suffered severe losses due to environmental problems. Nutsedge shoot biomass and RKN data were collected from the field on July 3, August 3, and August 31 using methods described above. PNS and YNS dry shoot weights in 2001 were significantly higher in plots rotated from cotton, averaging over 11 g/m^2 for each species, compared to 5 g/m^2 for each species in plots rotated from alfalfa. PNS shoot weight in the plots rotated from alfalfa averaged 1.68 g/m^2 in the fall of 2000 and did not re-establish until the third harvest in 2001 when an average weight of 14.8 g/m^2 was recorded. YNS shoot weight in the plots rotated from alfalfa averaged 0.9 g/m^2 in the fall of 2000 and started to show higher densities by the second harvest when an average of 13.0 g/m^2 was recorded. Alfalfa variety did not affect the nutsedge biomass harvested in 2001. Our research shows that a three year rotation of alfalfa suppressed nutsedge populations which may provide a longer period for chile establishment. [Paper Number 93]

THE AFFECT OF *MELOIDOGYNE INCOGNITA* ON PURPLE NUTSEDGE AND YELLOW NUTSEDGE INTER- AND INTRASPECIFIC COMPETITION. Brian J. Greenfield, Jill Schroeder, Stephen H. Thomas, Leigh Murray and Jacqueline M. Fuchs. Research Assistant, Professor, Professor, Professor and Research Specialist. New Mexico State University, Las Cruces NM 88003.

Abstract. Previous studies have demonstrated a mutually beneficial relationship between purple nutsedge and *Meloidogyne incognita*, and yellow nutsedge and *M. incognita*. However, these studies were maintained with regular fertilizer applications and sometimes shoot-density control. This study was designed to explore the interactions between purple nutsedge, yellow nutsedge, and *M. incognita* over time in a minimally fertilized environment with no management of shoot density. Two pre-germinated greenhouse-stock tubers of either purple nutsedge, yellow nutsedge, or one of each were planted into 76-cm diameter fiberglass-shell microplots in the early growing season of 2000. Half of the plots were planted with tubers collected from and planted in soil free of *M. incognita*. The remaining tubers came from *M. incognita*-infested greenhouse pots. Soil cores were taken from random locations in each of the microplots at the end of the growing seasons of 2000, 2001, and the early growing season of 2001. Proc Mixed (SAS 8) analysis of tuber counts and tuber dry weights found three, three-way interactions between tuber size, *M. incognita*, season, and weed-species competition. Overall, *M. incognita* reduced tuber count and dry weight for both plant species. Yellow nutsedge did not affect purple nutsedge tuber counts or dry weights in the first two

samplings, but increased smaller purple nutsedge counts in the third sampling. Purple nutsedge reduced yellow nutsedge tuber counts over time, but not significantly when in the presence of *M. incognita*. These results demonstrate that other factors may affect the mutually beneficial relationship between each weed species and *M. incognita* that was in previous experiments. [Paper Number 94]

TWO- AND THREE-WAY TANK MIXTURES FOR PREEMERGENCE WEED CONTROL IN POTATOES: EFFICACY AND ECONOMICS. Brent R. Beutler[1], Pamela J.S. Hutchinson[1], Paul E. Patterson[2], Charlotte V. Eberlein[3] and Dennis J. Tonks[4]. Support Scientist I, Assistant Professor, Extension District Agricultural Economist, Director, District III Cooperative Extension and Dryland Cropping Systems Specialist. [1]Aberdeen Research and Extension Center, University of Idaho, Aberdeen ID 83210, [2]University of Idaho, Idaho Falls ID 83402, [3]University of Idaho, Twin Falls ID 83303 and [4]Washington State University, Davenport WA 99122.

Abstract. Potato growers throughout the Pacific Northwest rely almost completely on herbicides for weed control. The majority of these herbicides are applied preemergence in at least two-way tank mixtures. A third herbicide may be added to increase efficacy, however, this practice may not be economically favorable. Replicated field trials were conducted over a two-year period to compare two- and three-way tank mixtures of standard preemergence potato herbicides, in Aberdeen, ID. Treatments included metribuzin, rimsulfuron, pendimethalin, EPTC, ethalfluralin, and s-metolachlor in two- and three-way combinations. All treatments were applied preemergence to an area with broadleaf weed infestations of 20 to 200 plants/m^2, depending on species, and grass infestations of 1 to 10 plants/m^2 in 2000. In 2001, weed infestations consisted of 10 to 100 broadleaf plants/m^2 and 1 to 2 grass plants/m^2. In 2000, all of the three-way tank mixtures and a majority of the two-way tank mixtures provided greater than 90% control of all weed species present. In 2001, all treatments provided at least 88% control of all weeds present, except hairy nightshade. All three-way and a majority of two-way tank mixtures provided greater than 80% control of hairy nightshade. However, the pendimethalin + metribuzin, and ethalfluralin + metribuzin treatments resulted in less than 70% control of hairy nightshade. While some three-way tank mixtures provided marginally better weed control by late season, they did not result in any consistent increases in yield or quality of the potato crop. Also, addition of a third herbicide to the tank mixture increased costs 6 to 24 dollars/A. [Paper Number 95]

LATE SEASON HAIRY NIGHTSHADE CONTROL WITH POTATO VINE DESICCANTS AND EFFECT ON WEED SEED VIABILITY. Felix E. Fletcher, Brent R. Beutler and Pamela J.S. Hutchinson. Research Technician Senior, Support Scientist I and Assistant Professor. Aberdeen Research and Extension Center, University of Idaho, Aberdeen ID 83210.

Abstract. Replicated field studies were conducted in 2000 and 2001 to evaluate the efficacy of several potato desiccants for potato vine desiccation and late-season hairy nightshade control. Treatments consisted of sequential applications of carfentrazone, applied alone with methylated seed oil (MSO), or Silwet, or tank mixed with endothall or diquat and MSO, compared to single applications of endothall + MSO, glufosinate ammonium, paraquat, sulfuric acid, or diquat. In 2000 only single applications of carfentrazone were applied. In 2000, Endothall alone did not provide desiccation significantly different than the untreated control. Paraquat + NIS provided the greatest potato desiccation one week after treatment (WAT) with 94%, compared to the next highest desiccation of 73% by carfentrazone + endothall + MSO, or diquat + NIS. In 2001, sulfuric acid, diquat, or glufosinate ammonium + ammonium sulfate (AMS), ethylated seed oil, or SuperTin and AMS, resulted in greater than 90% hairy nightshade control and potato vine desiccation 1 WAT. All carfentrazone treatments were providing at least 85% control, and all other treatments except paraquat or endothall alone were providing greater than 89% hairy nightshade control by the second week after treatment. Preliminary hairy nightshade seed germination testing performed in the greenhouse after fall 2001 harvest has revealed no difference between desiccation treatments, but fewer hairy nightshade seeds were present in plots with at least 90% hairy nightshade control 1 WAT. [Paper Number 96]

WEEDS OF HORTICULTURAL CROPS

WEED CONTROL AND VEGETABLE CROP TOLERANCE TO HALOSULFURON. W. Thomas Lanini. Extension Weed Ecologist. University of California, Davis CA 95616.

Abstract. Yellow nutsedge is a perennial weed that is difficult to control with the herbicides currently available in bell peppers and cucurbit crops. Hand-weeding is generally used for yellow nutsedge control in these crops. Since yellow nutsedge is a perennial, hand weeding must be done repeatedly during the crop season, which increases production costs. Halosulfuron is reported to effectively suppress yellow nutsedge. The objective of these studies was to evaluate the effect of halosulfuron rate and application timing on yellow nutsedge control and crop tolerance. Field studies were conducted in 2001 at UC Davis. Bell peppers (var. Grande Rio 66) seedlings were transplanted on May 18, onto 76cm beds; a single row per bed, with individual plants spaced 10 to 12 inches apart. Cucumbers (var. F1 Prolific) and yellow squash (var. Monet F1) were direct seeded on June 4, 2001. Cucumbers and squash were planted as a single seed line on 1.5m beds. Halosulfuron was applied at either 0.036 or 0.053 kg/ha in each crop at each timing. Post-directed applications of halosulfuron were made on June 11 or July 9 in bell peppers. All treatments were applied as directed application, confining spray to the lower portion of the bell pepper canopy. In cucumber and squash, postplant-preemergence treatments were applied on June 5 followed by sprinkler irrigation to incorporate the herbicide and germinate the crop. A postemergence treatment was applied on July 11. Bell peppers growth was reduced 12 to 25% from Halosulfuron treatment when treated early post compared to no injury from late post applications. Bell peppers were slow to recover from halosulfuron injury, with significant injury still evident four weeks after treatment. Minimal injury was seen from postemergence applications made after layby. Yellow nutsedge control was 80% or greater with either the pre- or postemergence applications of Halosulfuron. Bell peppers were harvested as mature red fruit. There was no statistical difference among treatments in weight or number of fruit. Squash vigor was reduced in plots where halosulfuron was applied preemergence to the crop. Overall weed control was 50 to 70% on the preemergence Halosulfuron plots, while postemergence treatments did not appear to control weeds other than nutsedge. Squash yields differed among treatments on two of the 12 harvest dates. When Halosulfuron was used as a preemergence treatment, squash yield on July 16 (second harvest), was reduced about 50% by weight and 40% by number of fruit, compared to untreated plots. Additionally, there was a tendency toward yield reductions in the first through third harvest, and the last harvest as well. At the last harvest on August 20, we saw reduced yield (weight) where Halosulfuron was applied preemergence or at the high application rate of the post emergence plots, compared to untreated. Although total squash yield (lbs or number of fruit) was not statistically different among treatments, there was a tendency towards a reduction in yield on the plots which received a preemergence Halosulfuron treatment. Cucumber vigor on plots receiving a preemergence Halosulfuron application, was 8 to 15% less than other plots when measured on June 19, but plants appeared to recover as the season progressed. Weed control was similar to that observed in the squash plots. Cucumber weights did not differ among treatments at any of the harvest dates or in total weight for the season. [Paper Number 97]

ROTATIONAL CROP RESPONSE FOLLOWING HALOSULFURON USE IN MELONS. Kai Umeda. Area Extension Agent. University of Arizona Cooperative Extension, Phoenix AZ 85040.

Abstract. A field test was conducted to evaluate and determine the safety of halosulfuron on typical rotational crops such as lettuce, broccoli, spinach, onion, alfalfa, barley, field corn, and melons after an initial application on cantaloupes. Halosulfuron at 0.05 or 0.1 lb AI/A applied preemergence, postemergence, or sequentially preemergence plus postemergence on cantaloupes did not detrimentally affect crop stand establishment, height, or whole plant fresh weights when alfalfa, barley, spinach, lettuce, onion, and broccoli were planted at approximately 4 to 5 months after treatment. Cantaloupes and field corn planted at 1 year after treatment were not affected in establishing a stand and in growing during the early season as height or vine lengths were measured. At 15 to 16 months after treatment, lettuce, onion, and broccoli were not affected in establishing a stand. Watermelon planted at 1 year after treatment exhibited slight stand reduction and crop injury with halosulfuron applied preemergence. Alfalfa planted after preemergence applications indicated slightly depressed height and yield compared to postemergence treatments and the untreated check. Spinach planted where postemergence applications were made on cantaloupes tended to show a slight reduction in fresh weight at 15 to 16 months after treatment. Halosulfuron does not appear to be a deterrent to typical crop rotational schemes in the diverse desert agricultural systems. [Paper Number 98]

EFFECT OF STINGER ON CROPS GROWN IN ROTATION. Jesse M. Richardson[1], Barry R. Tickes[2], Robert F. Norris[3] and Alan E. Haack[4]. Field Scientist, Extension Agent, Professor and Field Scientist. [1]Dow AgroSciences, Hesperia CA 92345, [2]Yuma County Cooperative Extension, Yuma AZ 85364, [3]Vegetable Crops Department, University of California, Davis CA 95616 and [4]Dow AgroSciences, Roseville CA 95661.

Abstract. Field studies were established in Yuma, Arizona and Davis, California to determine safe rotational plant-back intervals for Stinger herbicide (clopyralid) in several key crops. At the Yuma site, a broccoli field was broadcast treated with Stinger at 8.0, 16.0, and 24.0 fl oz/A when the crop was at the 4-6 inch rosette and 6-10 leaf stage of growth. Later, the broccoli plants were shredded and the beds reworked with a cultivator, with minimal soil movement. Rotational crops were planted into these beds approximately 3 and 12 months after the herbicide was applied. At the Davis site, a field was prepared for sugar beet culture and was treated with Stinger at 2.0, 4.0 and 8.0 fl oz/A in a 10 inch wide band. However, no sugar beet crop was established. After application, the field was maintained as a simulated sugar beet crop, including irrigation on a typical schedule. The field was then disked and listed, with rotational crops planted approximately 4 and 12 months after herbicide application. Injury to alfalfa was substantial with all Stinger rates in the earlier plantings at both study sites. Lettuce injury was considerable at Davis, but was less severe at Yuma. Injury to tomatoes, cotton and carrots was slight to moderate at Yuma, while impact on onions, broccoli and sweet corn was negligible or undetectable. Twelve months after application, tomato and cantaloupe crops displayed no herbicide effects at Davis, while lettuce exhibited a slight trend for decreasing stand with increasing rates. At Yuma, all rotational crops grew without measurable effects from Stinger carryover one year after application. [Paper Number 99]

EFFECT OF TIMING, RATE, AND PESTICIDE USE PATTERN ON PERFORMANCE OF IMAZAMOX HERBICIDE IN SNAP BEANS. R. E. Peachey and Ray D. William. Senior Research Assistant and Professor. Oregon State University, Corvallis OR 97331.

Abstract. Experiments were conducted from 1998-2001 to determine the potential of imazamox herbicide for postemergence weed control in snap beans. Snap bean tolerance to imazamox was assessed with variables of application timing (trifoliate growth stage), imazamox rate, herbicide tankmix, surfactant, and interactions with insecticides. Imazamox injury potential also was compared to other herbicide use patterns. Both imazamox application timing and rate were important variables determining phytotoxicity. Imazamox reduced yield in several experiments when rates exceeded 0.048 lbs ai/A or when imazamox was applied after the third trifoliate growth stage. Results varied between years and sites, however. Applying imazamox with bentazon greatly reduced phytotoxicity caused by imazamox and lessened the effect of imazamox on snap bean yield, even when imazamox was applied at 0.064 lb ai/A. Bentazon reduced imazamox injury to snap beans at rates as low as 0.25 lb/A. Imazamox applied sequentially after bentazon produced moderate injury symptoms. Nonionic surfactants (NIS)in general increased imazamox injury to snap beans. The exception was the nonionic surfactant X-77 that caused less injury than other nonionic surfactants. Crop oil concentrate, methylated seed oil, and organo-silicone surfactants also increased phytotoxicity symptoms when applied with imazamox at the second trifoliate. Imazamox injury on snap beans was insignificant compared to crop injury often noted with soil-applied herbicides such as metolachlor and lactofen in cold and wet soil conditions of early spring. Imazamox injury was exacerbated when applied to beans that were planted into soil treated with ethoprop insecticide. Imazamox applied at 0.016 lb ai/A before the first trifoliate was fully expanded did not provide season long weed control. Imazamox applied alone to beans at the first trifoliate growth stage did not adequately control weeds even though weed control was good to excellent at midseason. Applying imazamox sequentially after metolachlor, EPTC or lactofen herbicides controlled nearly all weeds. Nightshade and lambsquarters were more tolerant to imazamox than pigweed at 0.016 lb/A. Bentazon tankmixed with imazamox diminished imazamox efficacy. The effect was most noticeable on barnyardgrass control. Non-ionic surfactants and crop oil concentrate generally improved lambsquarter and nightshade control, particularly at 0.016 lb/A. Purslane, smartweed, and groundsel were very tolerant to imazamox. [Paper Number 100]

MAINTENANCE OF CORKY RINGSPOT DISEASE IN CROP ROTATIONS BY THE PRESENSE OF WEEDS. Rick A. Boydston[1], Hassan Mojtahedi[2], Gerald Santo[2], James M. Croslin[2] and Peter E. Thomas[1]. Plant Physiologist, Research Associate Nematology, Professor Nematology, Research Associate Virology and Plant Pathologist. [1]USDA-ARS, Prosser WA 99350 and [2]Washington State University, Prosser WA 99350.

Abstract. Corky ringspot disease (CRS) is a serious disease in potato that is caused by tobacco rattle virus (TRV). TRV is transmitted by the stubby root nematode *(Paratrichodorus allius)* in the Pacific Northwest potato producing regions. Alfalfa has been suggested as a rotation crop to eliminate the disease from the soil. Although alfalfa is a good host of *P. allius*, the nematode vector cannot acquire the virus from alfalfa. Viruliferous *P. allius* sheds the virus with each molt, and the population is cleansed after several generations on alfalfa. We have demonstrated similar results with 770 Scotch spearmint *(Mentha cardiaca*, Baker). However, weeds present in these rotation crops may serve as hosts for TRV and perpetuate the disease. This research determined the host status of over thirty common weed species for TRV and *P. allius*. Canada thistle *(Cirsium arvense)*, black nightshade *(Solanum nigrum)*, hairy nightshade *(Solanum sarrachoides)*, downy brome *(Bromus tectorum)*, prickly lettuce *(Lactuca serriola)*, henbit *(Lamium amplexicaule)*, common chickweed *(Stellaria media)*, and kochia *(Kochia scoparia)* were found to be hosts of both TRV and *P. allius*. In greenhouse trials, prickly lettuce grown with alfalfa and green foxtail *(Setaria viridis)* grown with Scotch spearmint were infected with TRV using *P. allius* as a vector. After removing these plants, Russet Burbank potato was planted in the same soil and the residual population of *P. allius* in the pots previously harboring weeds and crop plants transmitted TRV to potato tubers and caused CRS. The nematodes present in pots previously planted to alfalfa or spearmint without weeds did not transmit TRV to cause CRS on potato. The presence of weeds that serve as hosts of both TRV and *P. allius* may nullify the positive effects of growing alfalfa and spearmint for CRS control. Targeted control efforts on these weeds may be required to successfully eliminate CRS from fields using crop rotation as a method to eliminate the disease.
boydston@pars.ars.usda.gov [Paper Number 101]

EVALUATION OF GLYPHOSATE-TOLERANT LETTUCE IN ARIZONA AND CALIFORNIA: A TWO-YEAR SUMMARY. Steven A. Fennimore[1], Kai Umeda[2], Jose A. Valdez[1] and Vint Hicks[3]. Extension Specialist, Extension Agent, Post Graduate Researcher and Technical Development Manager. [1]University of California, Davis, Salinas CA 93905, [2]University of Arizona, Phoenix AZ 85040 and [3]Monsanto Company, Fountain Hills AZ 85268.

Abstract. Studies were conducted in Arizona and California over a two-year period to determine the optimum time to apply glyphosate to glyphosate-tolerant lettuce. Four studies were conducted during 2000 and 2001 at Salinas, California and Yuma, Arizona. In all studies, single applications of glyphosate at 1.0 lb/A were made to iceberg lettuce at the 2-, 4-, 6- and 8-leaf stages. At Salinas only, sequential applications of glyphosate at 1.0 lb/A were made to lettuce at the 2-leaf stage followed by a second application 14 days later, or to lettuce at the 4-leaf stage followed by a second application 14 days later. Bensulide and pronamide were applied preemergence as commercial standards. Both studies also included hand weeded and untreated controls. None of the glyphosate treatments resulted in lettuce injury. At Salinas the 2 to 4-leaf stage was the optimum lettuce growth stage to apply a single application of glyphosate for the control of hairy nightshade, little mallow, nettleleaf goosefoot, redroot pigweed and shepherd's purse. At Yuma, a single application made to lettuce at the 2- or 4-leaf stages was optimal for the near-complete control of common purslane, nettleleaf goosefoot, little mallow, and sprangletop. In both studies, applications at the 8-leaf stage of lettuce allowed weeds, to compete with the lettuce such that yield and quality were reduced. Both sequential application timings tested at Salinas provided excellent weed control and produced the highest yields. Treatments that resulted in the lowest lettuce thinning and hand weeding times, at Salinas and Yuma were a single glyphosate application made at the 2 to 4-leaf stage. Lettuce quality was best when a single glyphosate was applied at the 4-leaf stage, or when a sequential application of glyphosate was made at the 2-leaf stage followed by a second application 14 days later. [Paper Number 102]

EVALUATION OF NEW HERBICIDES FOR USE IN STRAWBERRIES. Diane Kaufman[1], Joe DeFrancesco[2], Gina Koskela[1] and Ed Peachey[2]. District Extension Agent, Senior Research Assistant, Research Assistant and Research Assistant. [1]North Willamette Research and Extension Center, Aurora OR 97002 and [2]Oregon State University, Corvallis OR 97231.

Abstract. Two field trials were established in 2000 at the North Willamette Research and Extension Center (NWREC) in the North Willamette Valley of Oregon on a Quatama loam soil with 5% organic matter. Herbicides

were applied using a CO2 backpack sprayer equipped with a 3-nozzle boom (TeeJet 8002, flat fan) at 40 psi, at a rate of 40 gallons of water per acre. Plots in both experiments were four rows wide and 25 feet long and were arranged in a completely randomized block design. 1. Establishment Trial. 'Totem' strawberries were planted on raised beds and lightly irrigated on May 22, 2000. The following herbicides were applied on May 23, 2000 and followed immediately with approximately one inch of irrigation (herbicide rate in lb ai/A): azafenidin (0.1 and 0.2); dimethenamid (1); ethofumesate (1 and 2); fluamide + isoxaben (0.25 + 0.75); fluamide + sulfentrazone (0.25 + 0.125); flumioxizan (0.0625 and 0.0925); Isoxaben (0.75); oxyfluorfen (0.25); sulfentrazone (0.125 and 0.25); thiazopyr (0.5). Phytotoxicity was evaluated beginning two days after herbicide application, and then periodically during the growing season, with plant size measurements recorded on July 18, 2000. Weed control was evaluated approximately every 20 days through September. On September 29, 2000 a maintenance application of simazine was made to all plots. Herbicides applied at planting were applied again during winter dormancy (similar to the program developed for use of oxyfluorfen). At that time the ethofumesate (1) treatment was changed to ethofumesate (2) + flumioxazin (0.0625) to improve quality of weed control. Weed control was monitored through May, 2001. Fruit was hand harvested in June from a 5-foot length of row per plot. All herbicides provided excellent broadlef weed control through early July, with the exception of ethofumesate, which provided inadequate control of broadleaf weeds at both rates. Most herbicides, with the exception of ethofumesate and dimethenamid, continued to provide excellent broadleaf weed control through August. Isoxaben and sulfentrazone provided little control of grasses when used alone. However, in mixture with fluamide, both isoxaben and sulfentrazone performed well. There were few signs of phytotoxicity with most herbicides. Oxyfluorfen-treated plants exhibited many red spots on the first flush of leaves after treatment application and well into early June. By late June, plants treated with oxyfluorfen showed no signs of phytotoxicity. Plants treated with azafenidin and flumioxazin had a few red spots on newly emerged leaves, but subsequent growth was normal. Plants treated with the high rate of ethfumesate had some blackening of margins on newly emerged leaves until mid-June. The remaining herbicide treatments did not cause phytotoxicity. There were no differences among treatments in measurements taken on July 18, 2000 of number of leaves or runners or plant size. There were also no differences in total marketable yield or adjusted berry size. Experiment 2. Fall Timing Trial. This planting of 'Totem' strawberries was also established on raised beds at NWREC on May 22, 2000. However, it was used to evaluate herbicide treatments made in the fall, following the traditional program developed for use of simazine. Napropamide (4.0) was applied to all plots immediately after planting. The following herbicides were applied on October 4, 2000 and followed immediately with one inch of irrigation: azafenidin (0.2); dimethenamid (1.25); ethofumesate (2.0); flumioxazin (0.0625); isoxaben (1.0); sulfentrazone (0.25) and simazine (1.0). Phytotoxicity, weed control, and yield data were collected. Despite abnormally dry weather during fall through spring, weed pressure was moderate by late March. Predominant weeds were annual bluegrass, common groundsel, and pineappleweed. Azafenidin, flumioxazin, and sulfentrazone provided excellent overall weed control through May, 2001. Isoxaben provided no measurable control of annual bluegrass. Although ethofumesate provided excellent control of annual bluegrass, it provided little control of groundsel and pineappleweed. By late spring, overall weed control had deteriorated to marginal or unacceptable levels in plots treated with dimethenamid, ethofumesate, isoxaben, and simazine. As in Experiment 1, there were no differences among treatments in total marketable yield or adjusted berry size. Yield and fruit size were similar in both timing trials. [Paper Number 103]

EFFECTIVENESS OF DIMETHENAMID-P TANK MIXTURES FOR PREEMERGENCE WEED CONTROL IN POTATOES. Pamela J.S. Hutchinson[1], Rick A. Boydston[2] and Corey V. Ransom[3]. Assistant Professor, Plant Physiologist and Assistant Professor. [1]Aberdeen Research and Extension Center, University of Idaho, Aberdeen ID 83210, [2]USDA-ARS, Irrigated Agriculture Research and Extension Center, Prosser WA 99350 and [3]Malheur Experiment Station, Oregon State University, Ontario OR 97914.

Abstract. Dimethenamid-p efficacy field trials were conducted in Idaho, Oregon, and Washington in 2001. In all trials, herbicides were applied after hilling, prior to potato and weed emergence, and sprinkler incorporated immediately after application. 'Russet Burbank' potato variety was planted in all trials. Dimethenamid-p at 0.64 lb/A was applied alone or in combination with EPTC (3 lb/A), metribuzin (0.5 lb/A), pendimethalin (1 lb/A) rimsulfuron (0.023 lb /A), or pendimethalin + metribuzin. Tank mixtures of dimethenamid-p and pendimethalin or EPTC improved season-long redroot pigweed control compared to pendimethalin or EPTC applied alone. Tank mixtures of dimethenamid-p and pendimethalin, rimsulfuron, or EPTC improved common lambsquarters control compared to pendimethalin, rimsulfuron, or EPTC applied alone. Hairy nightshade control was improved when dimethenamid-p was tank-mixed with pendimethalin, metribuzin, rimsulfuron, or EPTC compared to control provided by those

herbicides applied alone without dimethenamid-p. The two- and three-way tank mixtures resulted in greater than or equal to 90% control of all weeds present at all locations. All treatments resulted in greater total tuber yields compared to the weedy check with the exception of rimsulfuron alone. [Paper Number 104]

WEEDS OF RANGE AND FOREST

IMPACT OF IMAZAPIC ON WESTERN PRAIRIE FRINGED ORCHID, A THREATENED SPECIES, IN RANGELAND AND PASTURES. Kenneth L. Carlson[1], Scott Wessel[2], Gerry Steinauer[3] and Jeremy Lubke[4]. Field Biologist, Wildlife Biologist II, Botanist and Student. [1]BASF Corporation, Lincoln NE 68506, [2]Nebraska Game & Parks Commission, Norfolk NE 68701, [3]Nebraska Game & Parks Commission, Aurora NE 68818 and [4]Wayne State College, Wayne NE 68787.

Abstract. Western prairie fringed orchid *(Platanthera praeclara)* is a native plant of the American tallgrass prairie and is a threatened plant species under the Endangered Species Act. It has been found west of the Mississippi River to the Sandhills of Nebraska, North to Manitoba, Canada and as far south as northeastern Oklahoma. Habitat sites for the western prairie fringed orchid is typified by areas of a high soil moisture profile in a tall grass prairie. Prior to pioneer settlement it was commonly found throughout this area. It is estimated that population location numbers have declined by more than 60%, and plant numbers to an even greater extent. Several factors account for the decline in population of the western prairie fringed orchid. Early habitat losses due to plowing of the prairie by settlers, followed by mechanized agriculture when tractors replaced draft animals resulted in decreased populations. More recent threats to the orchid population include haying of areas instead of grazing, reduced pollination due to reduced hawkmoth numbers, and effects from noxious weeds. The effects from noxious weeds such as leafy spurge include aggressive direct competition, as well as injury from herbicide applications designed to control the leafy spurge. Populations of leafy spurge are commonly found in the same habitat as the western prairie fringed orchid in northern Nebraska. Imazapic, a member of the imidazolinone herbicide family, is a broad spectrum herbicide that provides contact, translocation, and residual activity on leafy spurge. Imazapic (is currently sold under the tradename Plateau^{R} herbicide), and is registered for the control of over 90 grass and broadleaf weed species, including key perennial weeds. The objective of this study was to evaluate the impact of fall applications of imazapic, at rates used for the control of leafy spurge, on the population of western prairie fringed orchids. Approval for this research was granted by EPA through Nebraska Game and Parks Commission. Two sites containing western prairie fringed orchid populations were located in Pierce County Nebraska. Plants were located, mapped, flagged, and tagged in June of 2000. Imazapic was applied to 44 areas containing a western prairie fringed orchid using a CO2 backpack sprayer at 0.188 lb ai/A, the maximum leafy spurge use rate, in combination with a methylated seed oil and liquid nitrogen as spray adjuvants on September 20, 2000. An additional 44 plants were left untreated for comparison. All plant areas were re-located on June 28, 2001 and the presence or absence of the western prairie fringed orchid was recorded. Based on counts from both sites, the number of plants present in the imazapic treated plots was greater than or equal to the number present in the untreated plots. Imazapic effectively controls leafy spurge. Dry weather in 2000 and anthracnose leaf blight greatly affected orchid reemergence, growth, and flowering. These factors greatly influenced our ability to record observations in this first year. The fact that nearly equal numbers of orchids reemerged in both the imazapic treated and untreated plots suggests that imazapic does not impact western prairie fringed orchid populations. Imazapic was currently registered under Section 18 emergency use labeling for the control of leafy spurge in rangeland and pastures in Nebraska, Colorado, Idaho, Montana, North and South Dakota, and Wyoming during the 2001use season. Section 3 registration of imazapic for use in rangeland and pastures was received from the EPA in December of 2001. Plans are to continue this research by looking at the impact that consecutive year applications of imazapic have on western prairie fringed orchid populations. In most heavy populations of leafy spurge consecutive year applications will be required to retain effective control. Thanks to Nebraska Game and Parks Commission, especially Scott Wessel and Gerry Steinauer, and to Jeremy Lubke a Wayne State College student for their assistance in conducting this research. Thanks also to the Venteicher and Zimmerman families for allowing this research to be conducted on their land. [Paper Number 105]

CAMELTHORN *ALHAGI PSEUDALHAGI* CONTROL IN NORTH-CENTRAL ARIZONA. John H. Brock. Professor. Arizona State University East, Mesa AZ 85212.

Abstract. Camelthorn (Alhagi pseudalhagi) invaded roadsides in a residential subdivision in a pine-oak forest in north-central Arizona. An average plant density of 1.7 and a range of 0.4 to 3.7 plants/m2 existed on the infested

sites. The seeds of camelthorn were most likely introduced to the forest in roadbed aggregate, and had began to penetrate the asphalt roads. The roads were first constructed approximately 15 years ago. Herbicides were applied on July 8, 2000 when the camelthorn were in flower. Metsulfuron was applied at a rate of 0.225 oz/ac a.i. in 100 gal of water with 8 oz of silicone surfactant. A combination of herbicides, dicamba + triclopyr + 2,4-D amine were applied at 1 + 1 + 0.5% in water with 1 % v/v nonionic surfactant. Herbicides were applied with knapsack sprayer and a cone spray nozzle to individual crowns of the plant until the foliage was saturated with spray solution. Twelve months after treatment, metsulfuron plots showed over 99 % control of camelthorn. The dicamba + triclopyr + 2,4-D treatment controlled 68% of the original population. [Paper Number 106]

EFFICACY OF SPRING APPLIED PICLORAM COMBINATIONS ON LEAFY SPURGE. Todd C. Geselius. Development Biologist. Dow AgroSciences, Fargo ND 58104.

Abstract. Leafy spurge is a long-lived, deep-rooted perennial weed that has proven to be difficult to control. Of the control measures attempted herbicides have proven to be one of the most effective in controlling this troublesome weed. Spring applied Picloram has proven to an effective treatment for the control of leafy spurge. Dow AgroSciences has conducted numerous field experiments over the last 10 years investigating whether the addition of other active ingredients to picloram can improve the control of leafy spurge over that of picloram alone. Picloram applied alone in the spring at 0.25, 0.5 and 1.0 lbs/A provided 31, 55 and 71% control respectively 12 months after application in experiments over this 10 year period. Picloram at 0.25 lbs/A in combination with 2,4-D amine at 1.0lbs/A provided 41% control over this same period while 2,4-D amine alone at 1.0lbs/A provided only 12% control. Picloram at 0.25 lbs/A in combination with fluroxypyr at 0.25 lbs/A provided 38% control 12 months after application while fluroxypyr alone at 0.25 lbs/A provided only 28% control. [Paper Number 107]

HERBICIDAL CONTROL OF MMDAGASCAR FIREWEED IN PASTURES OF HAWAII. Philip S. Motooka[1], John Powley[1], Michael duPonte[1], Glen Fukumoto[1], Andrew Kawabata[1] and Kyle Onuma[2]. Extension Specialist in Weed Science, Extension Agent, Extension Agent, Extension Agent, Extension Agent and Noxious Weed Specialist. [1]University of Hawaii Cooperative Extension Service, Kealakekua HI 96750 and [2]Hawaii Department of Agriculture, Hilo HI 96720.

Abstract. Madagascar fireweed (Senecio madagascariensis Poiret), a recent introduction to Hawaii, is a poisonous herb that infests roadsides and pastures on the islands of Hawaii and Maui. Native to Madagascar and East Africa, fireweed is a serious pest in parts of Australia, Argentina and Kenya. It was first observed in Kohala, Hawaii in the mid-1980's, and has spread throughout the northern end of the island and has jumped to the southern end through livestock shipments. Maui is also infested perhaps through livestock shipments from Hawaii or by contaminated grass seed from Australia. A small infestation on Kauai has apparently been eradicated after a decade of monitoring and control by the Hawaii Department of Agriculture. Trials were conducted in pastures on Maui and Hawaii to define the susceptibility of fireweed to herbicides. MCPA at 2 kg a.i./ha was effective under conditions favorable for plant growth and, at $27/ha, the least costly of the herbicides studied. Clopyralid at 0.25 and 0.5 kg a.e./ha was effective but expensive, $90 and $180/ha for the respective rates. Metsulfuron was effective at 0.03 kg a.i./ha but expensive at $62/ha. Dicamba was erratic, effective in one trial, ineffective in another. Trilcopyr at up to 1 kg a.e./ha was generally ineffective. Trials at two sites that experienced drought produced poor response by fireweed to herbicides. [Paper Number 108]

COMBINATION OF PRESCRIBED BURNING AND CLOPYRALID FOR CONTROL OF YELLOW STARTHISTLE AND NOXIOUS ANNUAL GRASSES. Joseph M. DiTomaso, Guy B. Kyser, Steve Orloff, Sergio Garcia, Glenn Nader and Richard Smith. Ext. Specialist, Staff Research Associate, Farm Advisor, Farm Advisor, Farm Advisor and Farm Advisor. University of California, Davis CA 95616.

Abstract. Prescribed burning and the herbicide clopyralid have been shown to be very effective tools for the management of yellow starthistle (*Centaurea solstitialis*) in large areas. However, repeated use of burning can be impractical and continuous clopyralid treatments can suppress desirable legume species or select for undesirable exotic annual grasses. We tested an integrated management strategy using 0.25 to 0.5 acre plots with one of five possible treatments; 1) untreated control, 2) two consecutive years of clopyralid (1.5 oz ae/A), 3) two consecutive years of prescribed summer burning, 4) first year clopyralid followed by second year prescribed burning, and 5) first year prescribed burning followed by second year clopyralid. Treatments were made in 1999 and 2000 at two study

sites in California (San Benito and Yuba counties). In 2001, vegetative cover was evaluated in all treated plots. In both sites two consecutive years of clopyralid or first year burning followed by second year clopyralid reduced yellow starthistle cover in the following year by more than 95%. However, in Yuba County, this treatment increased medusahead (*Taeniatherum caput-medusae*) and ripgut brome (*Bromus diandrus*) cover. Two consecutive years of prescribed burning reduced both medusahead and yellow starthistle in Yuba County, but did not reduce yellow starthistle in San Benito County because of the incompleteness of the second year burn. Clopyralid treatment the first year followed by prescribed burning in the second year did not reduce starthistle in either site. The most consistent and best combination for yellow starthistle and noxious annual grass control was a first year prescribed burn followed by a second year clopyralid treatment. [Paper Number 109]

DIFFUSE KNAPWEED MOVEMENT – A CRITICAL, OFTEN OVERLOOKED COMPONENT OF CONTROL. Jody K. Nelson. Botanist/Plant Ecologist. Exponent, Boulder CO 80301.

Abstract. Diffuse knapweed is an aggressive noxious weed that disperses widely by tumbling. Herbicides provide effective temporary control of infestations by keeping the number of adult plants and seed production to a minimum in treated areas. However, immigration of plants into treated areas by wind often remains a problem for resource managers. At the Rocky Flats Environmental Technology Site (the Site), a study was conducted during the winter of 2000/2001 to investigate the significance of diffuse knapweed movement. Three separate infestations at the Site were tagged using different colored paint and flagging in October 2000. Throughout the winter, counts were made of the number of individuals remaining in the original marked populations and searches were conducted to locate missing individuals. Fifty-six percent of the tagged plants emigrated from their original locations during the study (October to April). The maximum distance an individual plant moved was approximately 1,480 meters (4,857 feet) while the average distance was approximately 399 meters (1,310 feet). The greatest period of movement occurred between November and January when 34% of the tagged plants blew away. Most plants traveled directly downwind and stopped when they became trapped by embankments, ravines, shrubs, or other topographic features that provided reduced wind velocities. Counts of diffuse knapweed plants in four-strand barbed wire fences found an average of 119.73 plants/meter or an average of 119,733 plants per linear kilometer (192,651 plants per linear mile) of fence. Fencing is an often overlooked method of control that can significantly reduce diffuse knapweed movement and establishment. [Paper Number 110]

THE SIGNIFICANCE AND ROLE OF SMALL MAMMAL MOUNDS FOR NOXIOUS WEED ESTABLISHMENT AND SPREAD. Jody K. Nelson. Botanist/Plant Ecologist. Exponent, Boulder CO 80301.

Abstract. During 2001, a study was conducted at the Rocky Flats Environmental Technology Site (the Site), a U.S. Department of Energy facility in Colorado, to characterize the vegetation on small mammal mounds commonly found on the xeric tallgrass prairie. The objective was to evaluate the significance and role these mounds have with respect to plant community composition and noxious weed infestations. Mounds were classified as active or inactive and compared to intermound areas. Results indicate that the species composition on the small mammal mounds differs from the intermound areas in that they lack warm-season, native, perennial graminoid cover and have a high abundance of cool-season, non-native forbs and graminoids. Non-native forb cover is six to eight times higher on the mounds compared to the intermound areas. Detrended correspondence analysis showed the inactive mounds were more similar in composition to the intermound areas than the active mounds. The mounds are in effect "weed islands" on the prairie where noxious weeds such as diffuse knapweed, dalmatian toadflax, and downy brome establish and occur with much higher frequency than in the intermound areas. Thirteen Colorado State-listed noxious weeds were found on the mounds in 2001, compared to one in a similar study conducted nearby 40 years ago. While historically the mounds generally provided habitat for native pioneer species, today, given the higher number and abundance of non-native species available for invasion into disturbed habitats, the mounds act as a significant pathway for noxious weed establishment on the xeric tallgrass prairie. [Paper Number 111]

SYMPOSIUM: TECHNIQUES FOR EVALUATING AND DIAGNOSING HERBICIDE PROBLEMS

HERBICIDE DIAGNOSIS IN WOODY PERENNIAL PLANTS. Clyde L. Elmore. Extension Weed Specialist. University of California, Davis CA.

Abstract not submitted. [Paper Number 113]

DIAGNOSIS OF HERBICIDE PROBLEMS IN FIELD CROPS. Philip A. Banks and Edward L. Morris. President and Research Associate. MARATHON-Agric. & Environ. Consulting, Inc., Las Cruces NM 88005.

Abstract. Diagnosing herbicide problems in field crops usually involves complaints of poor weed control or crop injury. While it is not difficult to list reasons for either problem, the actual investigation of the complaint can be as complicated, intriguing, surprising, and sometimes as terrifying as a Stephen King novel. The investigator must be prepared, not only through training and experience, but also with a logical procedure that will make success more probable. Field crops by nature, can encompass large acreages and may involve several fields. The following steps can be helpful when conducting the investigation. 1. Get as much information as possible at the first contact. Be sure there is no conflict of interest. Schedule the field visit as soon as possible. 2. Do your homework before the visit. Look up labels and review product activity. Make sure all equipment (cameras, sampling equipment, GPS, etc.) is working and ready. 3. When meeting with the client, be as objective as possible. 4. Ask lots of questions and do not assume anything. 5. Visually inspect the field and surrounding vegetation for patterns of injury or lack of weed control, symptoms, etc. Make a map of the field and/or use GPS to mark the location. Inspect the appropriate equipment and chemical storage area. 6. Take photographs and samples as needed. 7. Give the client a preliminary review of the inspection explaining what was observed and ask follow-up questions. Do not make the final judgement on site, since more information or results of tests may be needed. Give the client a date when you will have a final report (written or oral) available. 8. After the site visit, gather additional information as needed, label photos, and send samples for analysis. 9. Follow-up with the client and an additional visit may be necessary. 10. Give the results of the investigation to the client. Be honest, and do not stretch facts to come to a conclusion. It is possible that not all facts were available for a final conclusion. [Paper Number 114]

THE PHYSICS OF HERBICIDE DRIFT. Richard H. Wilson. DR. Private Consultant, Tucson AZ 85737.

Abstract. The Physics of Herbicide Drift Richard H. Wilson, Agricultural Consultant, 1940 E. Andromeda Pl. Tucson AZ 85737. Spray droplet size is an overriding factor impacting pesticide drift from all application systems. Spray equipment factors that control droplet size include nozzle type, spray pressure and spray volume. In an effort to obtain good spray coverage of target pests, applicators often deliver spray droplets that include high levels of small droplets. Droplets 150 microns or less evaporate within a few feet of the nozzle, leaving the pesticide suspended in air and susceptable to floating off target. Wind speed is clearly a key weather parameter impacting drift. Some pesticide labels limit applications when wind speeds are high, above 10-12 mph. Data show that increased wind speeds in this range and above actually result in decreasing incremental levels of downwind drift deposition. Moreover, lower wind speeds, less than 5 mph such as can occur in early morning hr, can be associated with low levels atmospheric inversions leading to drift significant distances downwind. If droplet sizes are kept large, the drift impact of wind can be significantly reduced. Today most nozzle manufactures provide data on droplet size distribution for nozzles under a range of different spray pressures and application volumes. [Paper Number 115]

DISTINGUISHING DISEASE FROM DAMAGE: A DIAGNOSTIC CHALLENGE. Steven T. Koike. Plant Pathology Farm Advisor. University of California Cooperative Extension, Salinas CA 93901.

Abstract. The ability to distinguish between diseases and damage on plants is a critical skill required of virtually all industry and extension professionals involved with agriculture and horticulture. However, the diagnostic task can be quite challenging when symptoms caused by plant pathogens resemble damage from herbicides and other chemicals. Incomplete information about the situation can further blur the distinctions between disease and damage. An effective diagnostic strategy is systematic in its approach, seeks answers to appropriate questions about the case, and

thoroughly investigates four major aspects of the problem. Professionals must analyze plant samples completely and note symptom distribution and signs of microorganisms. Because each crop site provides much useful information, investigators must examine it for symptom patterns and distributions, the identities of plant species affected, associations with the site's physical features, and off-site occurrences of symptoms. In addition, investigators must recover the comprehensive history of the grower's production practices, the weather conditions, and the previous crops grown at the site. Finally, diagnosticians must use appropriate laboratory tests for plant pathogens and in some circumstances, chemical residues. After compiling all notes, observations, maps, lab results, and other information, professionals will be able to render an informed diagnosis. [Paper Number 116]

BIOCHEMICAL METHODS AS DIAGNOSTIC TOOLS,. Dale L. Shaner. Plant Physiologist. USDA-ARS WMU, Ft. Collins CO 80523.

Abstract. Diagnosing what may have injured a plant can be difficult because many herbicides and/or environmental factors result in similar symptoms. It would be helpful if there were methods to clearly determine what causes plant injury. One can look for residues of herbicides in plants, but the presence or absence of such residues does not necessarily mean the injury was caused by the herbicide. Herbicides kill plants by interfering with specific metabolic pathways which often results in the accumulation of metabolites that are normally in low abundance. One can take advantage of this phenomenon by screening plants for the presence of these unusual levels of metabolites. This, in turn, can be used for diagnostic purposes. In some cases, the presence of certain metabolites, such as shikimate, has been successfully used to determine if glyphosate or some other herbicide killed a plant.. Similarly, extremely high ammonia levels are present in plants treated with a glutamine synthetase inhibitor and aminobutyrate levels increase in plants treated with ALS inhibitors. However, the build up of these metabolites is often transitory, if the plant recovers from herbicide injury, and they may or may not be present if analysis in not done soon after treatment. A more definitive method might be possible in the future by utilizing the new techniques of molecular biology. If specific proteins are produced or unusual genes are activated after herbicide injury and the presence or absence of these pathways can be detected, then one may be able to detect these changes utilizing simple "dipstick" assays or PCR based assays. The more we know about how herbicides kill plants, the more tools that will become available for diagnosis. [Paper Number 117]

REPRODUCING HERBICIDE FIELD SYMPTOMS IN THE LABORATORY OR GREENHOUSE. Kassim M. Al-Khatib. Associate professor. Kansas State University, Manhattan KS 66506.

Abstract. Abstract. The most common and successful way to reproduce herbicide field symptoms in the laboratory or greenhouse is to use a design with a constant dilution factor so that we get equidistance doses on a logarithmic scale. This herbicide dose response study will generate herbicide symptoms that simulate symptoms produced by herbicide drift, carryover, or tank contamination. In most cases, off-target herbicide movement, carry over, or tank contamination rates may range between 1/100 and 1/3 of the use rate. Therefore, the dose response study usually included soil concentrations of the test substance prior to germination or foliar application to actively growing seedlings at rates between 1/100 and 1/3 of the use rate. The dose response study needs to be reliable, well planned, carefully conducted and analyzed, and results are reproducible to permit accurate extrapolation from data generated under controlled conditions to a broad spectrum of different environmental and soil conditions in the field. In addition, herbicide symptoms developed by one species in the dose response study cannot be extrapolated to other species since these symptoms may be species specific. Greenhouse methods are very conservative in approach, and it is believed that when one considers the various differences between potential exposure experienced in the field to those simulated in the laboratory, an over estimate between three and 30 folds of effects may occur. The tests under controlled conditions may utilize plants that are more susceptible to herbicides compared to field conditions. Plants grown under controlled conditions developed a thinner cuticle that allows higher herbicide absorption. In addition, dissipation of the chemical in the environment and herbicide exposure techniques such as drench exposure in the test versus drift exposure in the field also may accentuate herbicide injury under controlled conditions. Additionally, the greenhouse assessment is based on an effect level, not lethality or yield lost. So, while a 25% effect is measured, this does not mean that the plant's ability to survive, grow and replicate is permanently impaired. Research indicated that shoot dry weight was generally the most sensitive endpoint to assess herbicide injury on plants, followed by visual response rating. The levels of response for these parameters were very similar in many instances. Shoot height was seldom the most sensitive in studies where all three of the parameters were measured. Studies that were conducted under controlled environments (growth chamber and greenhouse) frequently reduce herbicide dose that cause a plant

response compared to field conditions. This occurs because assessments for reproductive effects in controlled environment are hindered by the gross development, physiological, morphological differences between plants in field and those produced under controlled conditions. Controlled environments can only approximately mimic field conditions, and generally will not replicate conditions such as rainfall pattern, wind, soil type and structure, moisture and micro climatological conditions. Research has shown that under controlled conditions, plant response to herbicides as indicated by visual injury and biomass are much more sensitive to herbicides than reproductive measures. [Paper Number 118]

BULLET PROOFING YOUR DIAGNOSIS. William T. Cobb. Owner. Cobb Consulting Serv., Kennewick WA 99336.

Abstract. The diagnosis of suspected herbicide problems usually will involve more than just the discipline of weed science and more than just recognizing that a particular conspicuous plant symptom may have been caused by exposure to an herbicide. Specific plant symptoms may have varied causes. Factors such as environmental conditions, disease or insects, may intensify, mimic or mask any particular visual symptom. The degree of symptom expression may not necessarily equate to plant damage, nor a loss in crop yield or quality. This presentation discusses a number of investigative techniques, direct and indirect, that can be used to not only diagnose the cause of a suspected problem, but also quantify its impacxt on the crop as well. Diagnostic protocols are suggested which can help "bullet proof" a diagnosis. [Paper Number 119]

WEEDS OF AGRONOMIC CROPS

THE INTRODUCTION OF *ACERIA MALHERBAE*-CHALLENGES AND SUCCESSES. Emalee J. Friend and Thomas F. Peeper. Undergraduate Research Assistant and Professor. Oklahoma State University, Stillwater OK 74078.

Abstract. For the past two years Oklahoma State University has been working on establishing *Aceria malherbae*, a mite that feeds on field bindweed leaves, petioles,stems and roots, forming galls. The shoots of infested plants exhibit stunted growth and flowers are not produced on heavily damaged plants. Distribution originally focused on the north central part of Oklahoma. Of the 115 initial release sites, follow-up surveys indicated that only two sites had noticeable damage caused by *A. malherbae*. In May 2001, *A. malherbae* was again distributed to interested farmers. Procedures were changed and the distribution point changed from north central Oklahoma to the panhandle of Oklahoma. The field bindweed was collected the night before by placing 10 to 15 infested field bindweed stems with five to seven centimeters of attached root in polyethylene bags. The bags were left open for ventilation and to avoid condensation and placed in a 18-21 C room. The recipients were instructed to dig a small hole next to their healthy field bindweed, place some of the infested field bindweed in it, and replace the soil. The purpose was to initially place some mites in a shady, cooler environment, free from direct sunlight. The recipients were instructed to place the remaining infested field bindweed foliage and roots next to their healthy field bindweed, making the galls touch the healthy foliage. They were asked to place a flag at that site. The sites were visited in August 2001. Nine of the ten sites visited were found to have *A. malherbae* feeding on the field bindweed. All of these sites were located in the High Plains. During July 2001, soil cores (6.0 x 13.0 cm) containing field bindweed infested with *A. malherbae* were collected, placed in pots and planted at two locations in northwestern Oklahoma (Blaine and Woods counties) and two locations in north central Oklahoma (Payne and Garfield counties). The soil core method was used to get more roots, so that the infested field bindweed foliage would live longer. Placement of the infested field bindweed involved transplanting the cores into the ground, and with plastic coated wire ties, tying the infested field bindweed to the healthy field bindweed. This was done to keep the infested field bindweed from blowing away from the healthy field bindweed. Within one week, the field bindweed had *A. malherbae* feeding on it at one of the sites in northwestern Oklahoma, and the north central Oklahoma sites were again unsuccessful. In July, infested field bindweed roots and foliage were collected and plastic coated wire ties were again used to tie the field bindweed together, but this time placed at three locations in northwestern Oklahoma (Blaine and Harper counties) two locations in north central Oklahoma (Payne and Garfield counties) and five locations in southwestern Oklahoma (Greer county). Approximately one week later *A. malherbae* was found feeding on field bindweed at one location in northwestern Oklahoma and three locations in southwestern Oklahoma. The other two locations in southwestern Oklahoma had been heavily disturbed. To determine whether field bindweed biotype affected establishment of the mite, field bindweed from Goodwell (Oklahoma panhandle), Freedom, Canton, (Northwestern Oklahoma) Lahoma,

and Stillwater (North Central Oklahoma) were transplanted into pots (19.0 x 21.5 cm) and placed under lights in a laboratory at Stillwater. Infested field bindweed foliage was wrapped around the field bindweed and tied with plastic coated wire ties. All transplants were soon found to have *A. malherbae* feeding on their leaves, suggesting that biotype was not affecting the success of introduction attempts. In the summer of 2002, we plan to distribute *A. malherbae* to more sites in the successful areas and we will continue trying to identify factors that influence the success of mite introductions. [Paper Number 120]

WINTER ANNUAL GRASS CONTROL IN IMIDAZOLINONE RESISTANT WINTER WHEAT. Phillip W. Stahlman[1], Patrick W. Geier[1] and Troy M. Price[2]. Research Weed Scientist, Assistant Scientist and Assistant Scientist. [1]Kansas State University, Agricultural Research Center-Hays, Hays KS 67601 and [2]Kansas State University, Northwest Research-Extension Center, Colby KS 67701.

Abstract. Field studies were conducted near Hays (2 experiments) and Colby, Kansas in 2000-2001 to evaluate effects of imazamox rate and time of application on crop response and winter annual grass control in winter wheat. Another study at Hays compared the effects of different concentrations of liquid nitrogen in the spray solution along with imazamox on weed control and crop response. Jointed goatgrass was present in all experiments and downy brome also was present in experiments at Hays. In the first study, imazamox at rates of 0.032, 0.040, or 0.048 lb ai/A plus 2% urea-ammonium nitrate (UAN) and 1% methylated seed oil (MSO) was applied in water at each of four times: early fall POST (EFP), late fall POST (LFP), early spring POST (ESP) or late spring POST (LSP). Regardless of rate, imazamox controlled jointed goatgrass and downy brome by 98% or more when applied at either time in the fall. When applied in spring, jointed goatgrass and downy brome were controlled at least 96% in the Hays experiments, but jointed goatgrass control at Colby ranged from 90 to 95% for ESP treatments and 72 to 80% for LSP treatments. Spring-applied imazamox reduced the growth of wheat by up to 33% at Hays, but no treatment visibly reduced wheat growth at Colby. Wheat growth reduction at Hays increased with increasing imazamox rate and later application. However, there was no rate by timing interaction for wheat yield in any of the three experiments. Averaged over time of application, wheat treated with imazamox at 0.032 or 0.040 lb/A produced similar or higher yields than wheat treated with the 0.048 lb/A rate. Averaged over imazamox rate, fall-treated wheat yielded similarly or more than wheat treated ESP, which in turn yielded considerably more than wheat treated LSP. In the second study, imazamox plus 2% UAN and 1% MSO controlled jointed goatgrass, downy brome, and feral rye by 97% or more, regardless of imazamox rate or time of application. Higher concentrations of nitrogen in the spray solution containing imazamox did not affect weed control but increased foliar burn on wheat by 10 to 15% more than nitrogen-containing spray solutions without imazamox. Fall-applied UAN (30 lb N/A) without imazamox or adjuvant caused 22% foliar burn at 13 DAT compared to 7% foliar burn when diluted 50% with water. Despite moderate to severe foliar burn and regardless of imazamox in the spray solution, wheat recovered fully in about 3 weeks and yields were not affected. [Paper Number 121]

EFFECTS OF CULTURAL PRACTICES ON JOINTED GOATGRASS CONTROL IN WINTER WHEAT ROTATIONS. Anthony D. White and Phillip W. Stahlman. Research Scientist and Professor. Kansas State University, Hays KS 67601.

Abstract. Jointed goatgrass is a increasing problem in winter wheat producing regions of the Great Plains and Western United States. Research has suggested that interrupting the life cycle of jointed goatgrass with spring seeded crop rotations or other cultural practices may provide effective control. The objective of this research was to determine the best management practices for controlling jointed goatgrass in winter wheat rotations. Field experiments were conducted at the KSU Agricultural Research Center near Hays, KS between 1996 and 2001 to evaluate the effects of multi-year crop rotations, fallow weed management, and wheat cultivar on jointed goatgrass control. Crop rotation factors included combinations of wheat (W), fallow (F), grain sorghum (GS), or sunflower (SF). Tillage or herbicide treatments were used for fallow weed control. Two winter wheat cultivars of differing stature and competitiveness were evaluated. A rapid decline in jointed goatgrass density occurred between 1997 and 1998, regardless of crop rotation, method of fallow weed management, or winter wheat cultivar. Spring 1997 jointed goatgrass population densities in wheat plots decreased from 17.5 plants/m^2 to <0.1 plants/m^2 in 1998 and 1999. In the fall of 1999, the experimental area was reinfested with jointed goatgrass by overseeding to restore the population to initial levels. Between 1997 and 1999, crop rotation had minimal effect on jointed goatgrass densities because of the large decline in population during the initial year of the study. However, in 2000 and 2001 jointed goatgrass densities in the W-GS-SF-G and W-GS-F rotations were 10 to 30% lower compared to the W-F rotation. Fallow

weed management effects were inconsistent between years. However, in some years total jointed goatgrass emergence was lower in tillage treatments compared to herbicide treatments. Although tillage promoted seed-soil contact, tillage also reduced surface soil moisture content and fewer jointed goatgrass spikelets germinated. In contrast, conditions on the soil surface protected by undisturbed wheat stubble often remained moist long enough to stimulate germination of jointed goatgrass spikelets on the soil surface. Wheat varieties have had little affect on jointed goatgrass populations but wheat yields often differed between varieties. In 2001, there was an inverse curvilinear relationship between wheat yield and percentage of jointed goatgrass spikelets (dockage) in harvested grain. Despite similar jointed goatgrass populations, grain of the taller of two varieties contained more jointed goatgrass dockage than the shorter variety. Grain sorghum yield has been higher in 4 of 5 years when grown in the GS-F-W compared to the GS-SF-F-W rotation. Inadequate soil moisture or depleted soil minerals may be the result of adding sunflower into the rotation. Further testing is planned to confirm this hypothesis. [Paper Number 122]

SPIKELET STRUCTURES AS MECHANISMS FOR JOINTED GOATGRASS (*AEGILOPS CYLINDRICA*) DORMANCY. Lynn M. Fandrich and Carol Mallory-Smith. Graduate Research Assistant and Associate Professor. Department of Crop and Soil Science, Corvallis OR 97331.

Abstract. The persistence of jointed goatgrass (*Aegilops cylindrica*) seed in soil and its potential dormancy poses problems for the development of effective weed management strategies. This study evaluated seed germination characteristics of jointed goatgrass collected from winter wheat fields in northeastern Oregon. After-ripened (AR) spikelets were physically modified to test the hypothesis that spikelet structures were mechanisms for dormancy. Altered spikelets and controls were placed in moistened germination boxes and maintained in growth chambers under optimum conditions. Germination was visually measured every 2 d through 18 and 21 days after imbibition. After-ripening increased the onset of spikelet germination, germination rate, and germination of secondary caryopses compared to the control. Removal of the rachis segment did not affect onset or total spikelet germination, but germination rate was improved. Removal of the glumes improved all germination parameters compared to the control and "no rachis" treatment. Naked primary caryposes of AR spikelets germinated within 4 hours after removal from glumes, lemma and palea. Germination of naked secondary caryopses was slower than primary caryopses, but improved compared to unmodified spikelets. Naked caryopses showed greater increases in germination onset, rate and total germination than any other physical modification. Improved germination through manipulation of spikelet structures may support evidence for physical dormancy in jointed goatgrass. Additional experiments are needed to evaluate chemical and physiological effects on jointed goatgrass dormancy. [Paper Number 123]

PROGRESS REPORT ON CONTROLLING JOINTED GOATGRASS IN WINTER WHEAT IN NEBRASKA WITH ROTATIONS,TILLAGE, AND CULTIVARS IN 2001. Gail A. Wicks[1], Gordon E. Hanson[2] and Gary W. Mahnken[3]. Professor, Technician and Technician. [1]University of Nebraska, North Platte NE 69101, [2]University of Nebraska, North Platte NE 69101 and [3]University of Nebraska, North Platte NE 69101.

Abstract. Four replications of three rotations involving winter wheat-fallow, winter wheat-ecofallow corn-fallow, and winter wheat-ecofallow corn-corn-fallow were established in a jointed goatgrass infested field in 1996. 'Pronghorn', 'Alliance', and 'Vista' winter wheat cultivars representing a medium-tall, medium, and short winter wheat cultivar adapted to western Nebraska were planted each year in the fallow plots. Two tillage treatments were imposed on each wheat treatment. One to plant the jointed goatgrass in the spring and the second remained no-till until it was necessary to prepare a seedbed for winter wheat. Following wheat harvest all plots were sprayed with glyphosate + atrazine and glyphosate was used as needed to keep the plots weed free during the fallow period. Half of the corn plots were tilled before planting corn to prepare a seedbed. In the other half the corn was planted no-till. Preemergence herbicides were used and the corn planted into the tilled plots was cultivated once. Hail on May 31, 2001 destroyed the winter wheat and the corn seedling growth above the ground. The wheat was not harvested and the corn recovered. There were no differences in jointed goatgrass densities among wheat cultivars. Tillage in early May before wheat seeding decreased jointed goatgrass emergence in the winter wheat. Jointed goatgrass density (plants/m2) in the newly sown wheat in 2001 for the tillage and no-till treatments were 3.5 vs. 5 in the winter wheat-fallow, 0.02 vs. 9 in the winter wheat-ecofallow corn-corn-fallow, and 0.04 vs. 3 in the winter wheat-ecofallow corn-fallow rotation. This year it was necessary to have a 4-year rotation to control jointed goatgrass adequately in the no-till. The corn in the 3-yr rotation showed drought stress sooner than first year corn in the 4-year rotation. The early stress was contributed to poor control of wild buckwheat with glyphosate in the wheat stubble following

harvest. Wild buckwheat density in the wheat in the 3-yr rotation was 4 plants/m2 compared to 0.5 plants/m2 in the 4-yr rotation. Tillage before corn planting reduced corn yields by 14% because the tilled soil did not store and maintain as much soil water. Also, the corn may have used the soil water quicker than the no-till corn because soil temperatures were warmer and the corn grew faster in the early summer. Corn yields were not different among corn planted into the three wheat cultivars stubble. However, in the second crop of corn in the 4-yr rotation corn yield was greater when corn was planted into Pronghorn wheat stubble than Vista stubble. [Paper Number 124]

AE F130060 - A NEW SELECTIVE HERBICIDE FOR GRASS CONTROL IN WHEAT. C.HICKS, D. MARUSKA, M. ANDERSON, M. PAULSGROVE, W. BERTGES, K. THORSNESS, K. LUFF, M. HOOBLER; AVENTIS CROPSCIENCE RTP, NC 27709. Charles P. Hicks, Dean R. Maruska, Monte D. Anderson, Matt Elhardt, Kelvan R. Luff, Marc A. Hoobler, Kevin T. Thorsness, Mary P. Paulsgrove and William R. Bertges. Technical Development, Technical Development, Technical Development, Technical Development, Technical Development, Technical Development, Technical Development, Product Development Manager and Technical Development Manager. Aventis CropScience, RTP NC 27709.

Abstract. AEF130060, mesosulfuron-methyl, is a new postemergence herbicide being developed by Aventis CropScience for weed control in wheat. This herbicide acts as an inhibitor of acetolactate synthase (ALS) and is being developed for use in both spring and winter wheat. Mesosulfuron-methyl formulated with the post-emergence safener, mefenpyr-diethyl, at a 1:2 ratio demonstrates excellent crop tolerance on winter wheat. In trials conducted in North America on winter wheat, mesosulfuron-methyl applied at 10-15 gai/ha controls many problem grass weeds, including annual ryegrass, annual bluegrass, windgrass, wild oat, canarygrass and bromus species. The addition of an external adjuvant such as NIS or MSO resulted in optimum performance. Mesosulfuron-methyl will be formulated with a higher, 1:6 ratio of safener and used at 2.5-5 gai/ha for control of wild oat in spring wheat. AEF130060 has a very favorable ecological, ecotoxicological and environmental profile with low acute mammalian toxicity and no genotoxic, mutagenic or oncogenic properties noted. Microbial degradation is the primary degradation pathway of mesosulfuron-methyl in the environment. Mesosulfuron-methly is rapidly degraded and unlikely to pose any risk to succeeding crops. Excellent control of ACC-ase resistant wild oat (Avena fatua L.) biotypes have been attained with AEF130060 in field trials. AEF130060 also controls diclofop resistant annual ryegrass (Lolium multiflorum L.). The low use rate, excellent weed control and crop safety combined with very favorable toxicological, ecotoxicological and environmental properties will make this product a valuable tool for wheat farmers. [Paper Number 125]

THE USE OF AE F130060 HERBICIDE FOR GRASS CONTROL IN WHEAT. Monte Anderson, William Bertges, Matt Elhardt, Charlie Hicks, Kelly Luff, Marc Hoobler, Dean Maruska, Mary Paulsgrove and Kevin Thorsness. Technical Development, Technical Development, Technical Development, Technical Development, Technical Development, Technical Development, Technical Development, Technical Development and Technical Development. Aventis CropScience, RTP NC 27709.

Abstract. AEF130060, mesosulfuron-methyl combined with a safener, mefenpyr-diethyl, is a new postemergence herbicide being developed by Aventis CropScience for weed control in wheat. This herbicide acts as an inhibitor of acetolactate synthase (ALS). Mesosulfuron-methyl will control many important grass weeds and certain broadleaf weeds in winter wheat grown in western states. Mefenpyr-diethyl is a postemergent safener used with mesosulfuron to provide crop tolerance in a 1:2 ratio of herbicide:safener. Field experiments have been conducted evaluating herbicide rate, safener ratios, and adjuvants since 1996. In winter wheat, mesosulfuron-methyl will be recommended at a rate of 10-15 g ai/ha with external adjuvant such as MSO or NIS. In the Pacific Northwest, excellent wild oat and interrupted windgrass control has been observed from the 10 g ai/ha rate of mesosulfuron-methyl in winter wheat. Italian ryegrass has shown excellent results with rates between 12.5 and 15 g ai/ha. Control of downy brome requires 15 g ai/ha of AE F130060. In California and Arizona, littleseed and hood canarygrass were controlled with 10 g ai/ha rates. Mesosulfuron-methyl performed best on grassy weeds up to 2 tiller, with good activity up to 4 tillers on Italian ryegrass. AE F130060 controls both susceptible and ACC-ase resistant biotypes of wild oat and Italian ryegrass. [Paper Number 126]

FORAMSULFURON (AE F130360) HERBICIDE PERFORMANCE AND RECROPPING PROFILE IN POSTEMERGENT WEED CONTROL PROGRAMS. Marc A. Hoobler and Chad J. Effertz. Technical Development Representative and Product Development Manager. Aventis CropScience, Research Triangle Park NC 20779.

Abstract. Foramsulfuron (AE F130360; 1-(4,6-dimethoxypyrimidin-2-yl)-3-(2-dimethylcarbamoyl-5-formamidophenylsulfonyl)urea) is a novel sulfonylurea herbicide for post-emergence use in corn. Foramsulfuron is effective against major grass weed species, as well as some broad-leaved weeds. It is applied with the safener, isoxadifen-ethyl (AE F122006; ethyl 5,5-diphenyl-2-isoxazoline-3-carboxylate). Foramsulfuron and isoxadifen-ethyl are always applied at a 1:1 ratio. Research trials were conducted at universities and by Aventis CropScience across the United States in 2000 and 2001 to evaluate the performance of foramsulfuron on grass and broadleaf weeds. Research trials were also conducted to determine the recropping profile of foramsulfuron. In university trials, foramsulfuron provided superior broadleaf weed control and equalivalent grass control when compared to nicosulfuron. Control in eigthy-six paired broadleaf comparisons was 80.2 and 65.3 percent respectively, while control in forty-one paired grass comparisons was 89.3 and 89.2 percent respectively. Foramsulfuron provided similar grass control and inferior broadleaf control when compared to nicosulfuron+rimsulfuron+atrazine. Control in seventy-eight paired broadleaf comparisons was 79.2 and 89.5 percent respectively, while control in 38 paired grass comparisons was 85.3 and 89.4 percent respectively. In university trials, maximum corn injury occurred within seven days after treatment and was highest with nicosulfuron+rimsulfuron+atrazine with an average of 4.8 percent injury in thirty trials. Foramsulfuron injury averaged 3.2 percent in sixty-three trials and nicosulfuron injury averaged 1.2 percent in 31 trials. The recropping profile of foramsulfuron is very positive and is superior to other sulfonylurea's presently available. Foramsulfuron injury across the five most sensitive crops was 26 percent when crops were planted seven days after application and only 7 percent when crops were planted thirty days after application. Nicosulfuron injury was 56 percent and 33 percent respectively at seven and thirty days after application. Primisulfuron/prosulfuron injury was the greatest with 87 percent injury and 66 percent injury at seven and thirty days after application. Results indicate the behaviour of foramsulfuron in soil poses no practical recropping restrictions. These studies indicate field, pop, seed, and sweet corn can be planted 7 days after application. Rotation restrictions for all other crops will fit normal cropping sequences. [Paper Number 127]

DIFFERENCES IN EFFICACY AMONG NEW HERBICIDES FOR WHEAT. Jason P. Kelley and Thomas F. Peeper. Senior Agriculturist and Professor. Department of Plant and Soil Sciences, Oklahoma State Univeristy, Stillwater OK 74078.

Abstract. Field experiments were conducted at two sites in north central Oklahoma during the 2000-2001 growing season to compare Italian ryegrass and cheat control with Maverick (sulfosulfuron), Olympus (MKH 6561), and AE F130060 + AE F107892 in winter wheat. Treatments included Maverick at 0.031, Olympus at 0.04, and AE F130060 + AE F107892 at 0.0134 + 0.026 and 0.016 + 0.032 lb ai/acre, all applied with 0.25% or 0.5% v/v NIS. All treatments were applied in 20 GPA of water carrier using a CO2 backpack sprayer on December 5, 2000. Maverick controlled Italian ryegrass 48 to 59%, Olympus 30 to 54%, and AE F130060 + AE F107892 controlled it 95 to 99%. Cheat control with Maverick and Olympus was 98 to 99% versus 35 to 61% with AE F130060 + AE F107892. Henbit was controlled 100% by AE F130060 + AE F107892 at either rate at both sites, while Maverick and Olympus controlled henbit 40 to 77%. No wheat injury was seen from any treatment. All treatments increased wheat yield compared to the untreated check. However, yield increases were greater with AE F130060 + AE F107892 than with Maverick or Olympus. A field experiment was conducted in central Oklahoma to evaluate the effect of application timing and carrier on cheat control in winter wheat. Treatments were applied in December, February, and March with water carrier or a 50/50 mix of water and 28-0-0 liquid fertilizer, both at 20 GPA. Nonionic surfactant was added at 0.5% v/v to water carrier treatments and at 0.25% v/v to water/28-0-0 mixes. Herbicide rates evaluated included Maverick at 0.031, Everest at 0.027, Olympus at 0.04, and AE F130060 + AE F107892 at 0.016 + 0.032 lb ai/acre. Cheat control ranged from 85 to 99% with Maverick, 97 to 99% with Everest, 94 to 99% with Olympus, and 75 to 97% with AE F130060 + AE F107892. Neither application timing nor carriers affected cheat control. Wheat yields tended to be higher when herbicides were applied in December. A field experiment was conducted in the 2000-2001 wheat growing season near Perkins, Oklahoma to evaluate performance of herbicides applied after cattle had grazed cheat infested wheat from late November to early March. Treatments evaluated included Maverick at 0.031, Everest at 0.027, Olympus at 0.04, and AE F130060 + AE F107892 at 0.016 + 0.032 lb ai/acre. Treatments were applied with a CO2 backpack sprayer in 20 GPA of water or 28-0-0 fertilizer carrier with

0.5% v/v NIS. Cattle were removed and treatments were applied three days later. All treatments controlled cheat 90 to 98%. Little wheat injury was seen when herbicides were applied with water carrier. Using 28-0-0 as a carrier increased wheat foliar burn. Visual foliar burn 10 DAT was 14, 18, 18, and 43% for Maverick, Olympus, Everest, and AE F130060 + AE F107892, respectively. All treatments increased wheat yield compared to the untreated check. Wheat yields were similar among herbicides. [Paper Number 128]

IMIDAZOLINONE RESISTANT PRODUCTION SYSTEM - IMAZAMOX HERBICIDE FOR WINTER WHEAT. Gary M. Fellows, Ted Alby, Mark C. Boyles, Gaylan F. Goddard, Paul J. Ogg, Steve M. Van Vleet, Mark L. Dahmer and Phil M. Munger. Biology Project Leader, Field Biologist, Field Biologist, Field Biologist, Field Biologist, Field Biologist, Biology Project Leader and Biology Manger. BASF, Research Triangle Park NC 27709.

Abstract. Field trials demonstrate that imazamox herbicide provides a novel approach to controlling broadleaf and grass weeds in imadazolinone resistant winter wheat. These weeds include jointed goatgrass and feral (volunteer) rye, weeds not previously controlled with existing herbicide programs. Other grasses controlled include wild oats, cheat, Japanese brome, downy brome, Italian ryegrass, Persian darnel, and volunteer spring and winter cereals. Additionally, imazamox controls many winter and summer annual broadleaves. Imazamox with a variable application rate of 0.032 to 0.048 lbai/A, was applied in field trials in fall or spring to imadazolinone resistant winter wheat from the 3-leaf to prejoint stage. The variable rate allows for precision application based on weed targets and application sizes. Imidazolinone resistant wheat tolerance at 2x rates of imazamox application was excellent. Field trials demonstrate that economic benefits include reduced weed competition, higher yields, and less weed seed contamination of the crop. Ease of tankmixing with imazamox has also been demonstrated in field trials, allowing resistance management options and management of more difficult to control weeds. Imazamox offers a wide range of followcrop flexibility for crop rotation in all geographic areas of the United States. Efficacy data from over seven years of field research trials, both at universities and with BASF researchers have demonstrated that imadazolinone resistant winter wheat and imazamox herbicide comprise an excellent weed control system. Registration for Imazamox herbicide (Beyond) on imidazolinone resistant (Clearfield) winter wheat within the United States was granted in the fourth quarter of 2001. [Paper Number 129]

CLEARFIELD* PRODUCTION SYSTEM: WINTER WHEAT VARIETIES AND CROP TOLERANCE. Mark Dahmer, Ted Alby, Scott Asher, Mark Boyles, Ken Carlson, Gaylan Goddard, Paul Ogg, Steve Van Vleet, Gary Fellows and Phil Munger. Development Manager, Field Research Biologist, Tech Service Representative, Field Research Biologist, Field Research Biologist, Field Research Biologist, Field Research Biologist, Field Research Biologist, Biology Manager and Field Biology Manager. BASF Corporation, Research Triangle Park NC 27709.

Abstract. BASF will introduce BEYOND herbicide (imazamox) for use with CLEARFIELD wheat varieties in fall of 2002. BEYOND provides effective, season-long control of jointed goatgrass, cheatgrass, downy brome, volunteer cereals, and other grass and broadleaf weeds when used in the CLEARFIELD Production System. Labeled use rates for wheat in the 3-lf to pre-jointing stages range from 0.035 to 0.054 kgai ha-1 of imazamox. The variable rate range allows producers to optimize the application based on weed target and size. AgriPro Wheat and the Colorado Wheat Research Foundation recently announced release of two new hard red varieties of CLEARFIELD winter wheat developed using the FS4 imidazolinone tolerance trait. These will be commercially available in fall of 2002. Wheat varieties possessing the FS4 trait provide acceptable crop tolerance to 0.070-0.108 kgai ha-1 of imazamox (>2x commercial rates). Transient crop response in the form of plant height reduction and/or chlorosis may occur after imazamox applications in excess of 0.108 kgai ha-1. In general, spring applications resulted in lower crop response than fall applications. Recovery was delayed when applications were made prior to the 3-leaf stage, but response was minimal when applications were made after wheat reached the 1-tiller stage. Non-ionic surfactants provided a wider margin of crop safety than methylated seed oils at all application timings. Differences in crop response due to herbicide rate, adjuvant choice (non-ionic surfactant vs. methylated seed oils), application timing, and genetic background will be presented. [Paper Number 130]

WHEAT SEEDING RATE AND HERBICIDE RATE EFFECT ON BROADLEAF WEED CONTROL IN SPRING WHEAT. Don W. Morishita, Michael J. Wille and Matthew J. West. Associate Professor of Weed Science, Support Scientist II and Graduate Research Assistant. University of Idaho, Twin Falls ID 83303.

Abstract. A study was initiated to determine the effect of irrigated spring wheat plant population and herbicide rate on the control of broadleaf weeds. Spring wheat was seeded at 30, 60, 90, and 120 lb/A in a split plot randomized complete block design. Wheat seeding rate was the main plot and herbicide rate was the sub-plot. Herbicide treatments were fluroxpyr + tribenuron applied at 0x, 0.25x, 0.50x, 0.75x, and 1x, where 1x = fluroxypyr + tribenuron at 0.125 + 0.008 lb ai/A, respectively. Spring wheat plant populations in the 30, 60, 90, and 120 lb/A seeding rates had plant populations averaging 13, 19, 26, and 38 plants/ft2, respectively. Kochia plant populations were not different among the different wheat populations and averaged 66 plants/ft2 across all wheat seeding rates. Common lambsquarters populations averaged 40 plants/ft2, with the 60 lb/A seeding rate having the highest population at 59 plants/ft2. All other seeding rates had similar common lambsquarters populations. Kochia control and common lambsquarters control generally increased with increasing wheat populations and herbicide rates. At the 0.25x herbicide rate, kochia control ranged from 43 to 74% and generally increased with higher wheat populations. Common lambsquarters control responded similarly at the 0.25x herbicide rate and ranged from 46 to 84% control. At the 0.5x herbicide rate and higher, kochia and common lambsquarters control ranged from 78 to 97% control. Grain yield was not different between the 60 to 120 lb/A seeding rates. Grain yields between the 0.5x and 1x rate did not differ. These data indicate that wheat plant populations greater than 19 plants/ft2 achieved maximum competitiveness when treated with at least the 0.5x rate of fluroxypyr + tribenuron. [Paper Number 131]

REDUCED HERBICIDE RATES FOR WILD OAT CONTROL: INFLUENCE OF TANK-MIX HERBICIDES. Brad K. Ramsdale and Calvin G. Messersmith. Postdoctoral Research Fellow and Professor. North Dakota State University, Fargo ND 58105.

Abstract. Previous research has found that wild oat herbicide rates could be greatly reduced if applied as split treatments. However, the potential antagonism from a broadleaf herbicide tank-mix partner has not been examined for low-rate split-applied treatments of wild oat herbicides. Therefore, our objective was to determine whether a broadleaf herbicide tank-mix partner would reduce wild oat control if applied with the first or second split treatment of wild oat herbicide. Experiments were conducted over natural wild oat infestations seeded with hard red spring wheat. Treatments were a single 1X rate of wild oat herbicide applied at standard timing or two split-applications each at a 0.25X rate. Split treatments were applied two weeks apart. The 1X rates of herbicides were CGA 184927 (proposed common name clodinafop) at 0.8 oz ai/A, fenoxaprop-P at 1.24 oz ai/A plus safener, imazamethabenz at 5 oz ai/A, MKH 6562 (proposed common name flucarbazone) at 0.42 oz ai/A, and ICIA 0604 (proposed common name tralkoxydim) at 2.9 oz ai/A. Wild oat herbicides were applied alone and with either bromoxynil plus MCPA at 4 plus 4 oz ai/A or thifensulfuron plus fluroxypyr at 0.3 plus 1 oz ai/A. Broadleaf herbicides were applied once with either the first or second split treatment. Adjuvants were included which maximized wild oat herbicide efficacy in previous studies. Separate experiments were conducted for each wild oat herbicide at two locations in eastern North Dakota. Experimental design was a randomized complete block with four replicates, and plot size was 10 by 30 ft. All treatments were applied at 8.5 gal/A with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Weed control and wheat injury were evaluated visually where 0 equaled no visible injury and 100 equaled complete plant death. Bromoxynil plus MCPA or thifensulfuron plus fluroxypyr did not antagonize reduced-rate split-treatments of fenoxaprop-P, MKH 6562, ICIA 0604, and CGA 184927. However, imazamethabenz applied once at 5 oz/A provided greater wild oat control than imazamethabenz at 5 oz/A with bromoxynil plus MCPA or thifensulfuron plus fluroxypyr. Imazamethabenz as reduced-rate split-treatments generally was not antagonized by broadleaf herbicides, except with bromoxynil plus MCPA in the first split-treatment of imazamethabenz. ICIA 0604 at the full-labeled rate applied alone or plus bromoxynil plus MCPA significantly injured wheat. However, ICIA 0604 at the full-labeled rate plus thifensulfuron plus fluroxypyr did not injure wheat. The thifensulfuron and/or fluroxypyr likely antagonized ICIA 0604 such that no wheat injury occurred, but excellent wild oat control was maintained. Wheat yield was generally similar among all treatments of each herbicide. Thus, these wild oat herbicides can be applied as half-rate split-applied treatments plus a broadleaf herbicide and maintain effective weed control without loss of wheat yield. [Paper Number 132]

PERENNIAL RYEGRASS RESPONSE TO REPEATED ANNUAL DIURON APPLICATIONS. Charles M. Cole[1], Carol Mallory-Smith[1], Brewster D. Bill[1] and Hendrickson E. Paul[2]. Faculty Research Assistant, Associate Professor, Senior Instructor and Faculty Research Assistant. [1]Oregon State University, Corvallis OR 97321 and [2]North Dakota State University, Fargo ND 58105.

Abstract. Perennial ryegrass stand decline, or dieback, is a problem that western Oregon seed growers have been dealing with for years. Research has found no relationship between stand decline and disease, insect pests, or nematodes. Herbicide usage may contribute to stand decline because several herbicides are commonly applied each year to maintain crop seed purity. Research was conducted to study the impact of diuron in perennial ryegrass seed production because it is used almost universally among western Oregon seed growers and is fairly persistent in the soil. There are numerous ryegrass cultivars that are produced in Oregon, and the possibility exists for differences in decline among cultivars. A multiple-year study was initiated in 1997 to evaluate the effects of repeated diuron applications on perennial ryegrass growth and to measure the soil accumulation of residual diuron and the herbicidal metabolite DCPMU. "Linn" and "Affinity" perennial ryegrass cultivars were carbon-seeded, a technique that allows a pre-emergence broadcast application of diuron. Treatments were: 1) diuron applied at 2.4 lb/A in 1997 with no subsequent treatments; and, 2) diuron applied at 2.4 lb/A in 1997 followed by annual applications of diuron at 1.2 lb/A in 1998, 1999, and 2000. Soil samples were collected each year prior to the diuron application in the fall. Perennial ryegrass seed yield was measured each year. The repeated annual diuron treatments caused considerable injury to the ryegrass and a reduction in seed yield was observed in both cultivars in 2001. Soil analysis performed in 2001 recovered 13% of the initial single 2.4 lb/A diuron application from 1997 and 22% of the 6 lb/A from the repeated annual diuron applications. [Paper Number 133]

EXPRESS RESISTANT SUNFLOWER. Richard K. Zollinger and Jerry L. Ries. Extension Weed Specialist and Research Specialist. North Dakota State University, Fargo ND 58105.

Abstract. Field research was conducted at four locations in 2001 to determine tribenuron resistant sunflower response to tribenuron at various rates, application timings, and adjuvants, and to other ALS inhibiting herbicides. Tribenuron at 0.125, 0.188, 0.25, and 0.5 oz ai/A with nonionic surfactant, petroleum oil, or methylated seed oil (MSO) adjuvants controlled common lambsquarters, redroot pigweed, wild mustard, marshelder, and between 40% to 80% eastern black nightshade control. Tribenuron treatments at all rates and adjuvants used gave 0% to 17% sunflower stunting and slight yellowing. Greater injury was observed from applications made V4 to V6 sunflower (10% to 17%) than applications made at V8 to V14 sunflower (0% to 6%). No reduction in foxtail control occurred when tribenuron was applied with clethodim but antagonism and reduced foxtail control occurred when tribenuron was applied with quizalofop. Other ALS inhibiting herbicides of imazamox, cloransulam, nicosulfuron, and metsulfuron seriously injured or killed tribenuron resistant sunflower and the sunflower plants that survived did not recover during the growing season. Tribenuron resistant sunflower was developed independently by DuPont and by scientists at USDA in Fargo, ND and germ plasm has been released to most sunflower breeding companies. DuPont, Pioneer, and the National Sunflower Association support development of tribenuron resistant sunflower and registration is in progress. In 2001, tribenuron magnitude of the residue trials were conducted as directed by the IR-4 Project. Registration of tribenuron resistant sunflower will greatly improve postemergence weed control in sunflower and facilitate expansion of reduced-till sunflower in the U.S. [Paper Number 134]

POSTEMERGENCE HERBICIDE APPLICATION CONSIDERATIONS WHEN USING VENTURI-STYLE SPRAY NOZZLES. Robert E. Wolf, Dallas E. Peterson and Cathy L. Minihan. Assistant Professor, Professor and Graduate Research Assistant. Kansas State University, Manhattan KS 66506.

Abstract. The introduction of several new postemergence herbicides and the presence of Roundup Ready crops have placed a renewed interest in the need to determine the operating parameters that optimize the spray deposition on the target weeds while minimizing drift. Techniques for foliar spraying are considerably different than those traditionally used for soil-applied products. The herbicides are not always distributed uniformly, do not completely penetrate into the lower parts of the plant canopy, may not provide adequate coverage on the target, and a portion may drift from the target field into sensitive areas. Recent nozzle technology is placing an increased emphasis on achieving optimum efficacy while keeping the drift potential at a minimum. The most recent development is the venturi nozzle. Venturi nozzles can produce very coarse sprays that could result in reduced target coverage under some conditions. The adoption of this nozzle type is widespread and without adequate knowledge of performance or

good operating parameters. Our venturi nozzle studies are utilizing a scanner and software system to evaluate nozzle spray quality in field-based applications. Several nozzle treatments of Gramoxone and Glyphosate at 47, 94, and 187 L/ha on early and late stage oats (aventa sativa L.)have been used to evaluate efficacy. Water-sensitive cards placed in the treatment area have been used to collect the spray droplet information. A flatbed scanner and computer-based software program measured the droplet characteristics providing critical droplet statistics comparing the different nozzle treatments. Results show that herbicide efficacy at low volumes with venturi nozzles is not sacrificed compared to conventional sprays despite much larger droplet sizes and potentially reduced coverage. Results also show that spray drift potential is significantly reduced with venturi nozzles when compared to conventional spray tips. It is hopeful that this information will be useful in helping the industry sort out some very important questions regarding use parameters for the venturi style nozzles. [Paper Number 135]

WEEDS OF RANGE AND FOREST (Continued from page 54)

CHEATGRASS INVASION ALTERS SOIL MORPHOLOGY AND ORGANIC MATTER DYNAMICS IN WESTERN RANGELANDS. Jay B. Norton[1], Thomas A. Monaco[2], Jeanette M. Norton[1], Douglas A. Johnson[2] and Thomas A. Jones[2]. Research Associate, Scientist, Associate Professor, Scientist and Scientist. [1]Utah State University Department of Plants, Soils, and Biometeorology, Logan UT 84322-4820 and [2]USDA-ARS Forage and Range Research Laboratory, Logan UT 84322-6300.

Abstract. Cheatgrass (Bromus tectorum) is an invasive annual grass that increases wildfire frequency, degrades native ecosystems, and threatens agriculture across vast areas of the western U.S. Over time, cheatgrass dominance may alter physical and biological properties of native shrub-steppe soils in ways that are analogous to the effects of cultivation. For example, proliferation of very fine roots and high production of low quality litter by cheatgrass may increase porosity and near-surface microbial activity, enhancing decomposition of soil organic matter (SOM). This may enlarge active SOM pools (mineral and microbial biomass C and N) at the expense of slow pools and humus. To test this hypothesis we compared soil physical, chemical, and biological properties beneath long-term cheatgrass-invaded areas with carefully matched soils under undisturbed Wyoming big sagebrush (Artemesia tridentata ssp. wyomingensis) plant communities at seven sites in northern Utah and southeastern Idaho. Our results suggest that soils under cheatgrass have: 1) higher porosity in surface horizons, 2) higher concentrations of mineral N throughout the soil profiles at the time of sampling, and 3) a larger proportion of mineralizable C and N in total SOM of surface horizons compared to native shrub-steppe soils. These results support our hypothesis and suggest that long-term cheatgrass invasion may alter ecological stability and resilience by depleting slow and passive SOM pools (e.g., humus). This research will contribute to an improved understanding of fundamental ecosystem processes that may facilitate successful ecological restoration. [Paper Number 136]

SUCCESSION OF MIXED GRASS PRAIRIE AFTER BIOLOGICAL CONTROL OF LEAFY SPURGE USING *APHTHONA* SPP. FLEA BEETLES. John A. Kava, Don R. Kirby and Rodney Lym. Student, Professor and Professor. North Dakota State University, Fargo ND 58105.

Abstract. Succession of Mixed Grass Prairie after Biological Control of Leafy Spurge using *Aphthona* spp. Flea Beetles. John A. Kava, Don R. Kirby, Graduate Research Assistant, and Professor, Animal and Range Sciences Department, North Dakota State University, Fargo, ND 58105, and Rodney G. Lym, Professor, Plant Sciences Department, North Dakota State University, Fargo, ND 58105. Leafy spurge infested over 450,000 hectares of North Dakota rangeland in 2000. Leafy spurge causes large economic losses to ranchers due to its competitiveness and avoidance by grazing cattle. To date, biological control using *Aphthona* spp. flea beetles in southwestern North Dakota has indicated that good leafy spurge control is possible. Long-term success should be measured by evaluating the ecological succession of leafy spurge in controlled sites. Therefore, research was initiated to evaluate density, distribution and yield of native and introduced grasses, forbs, shrubs and leafy spurge where *Aphthona* spp. had reduced the weed. Separate range sites, silty and overflow, with equal amounts of north and south facing aspects were selected for study. Each site was randomly sampled for basal cover using a 10 pin point frame and there were 20 replicates. Foliar cover and density of leafy spurge was estimated using 0.1 m2 Daubenmire frames placed randomly within each site. Yields were evaluated by clipping, separating, drying, and weighing all forage within randomly placed 0.25 m2 quadrats. Leafy spurge percentage of foliar and basal cover and yield decreased on both silty and overflow range sites following *Aphthona* spp. release. Basal cover of native grass and grass-like species showed no consistent trends in reestablishment of leafy spurge controlled sites. Grass yield tended to increase

following leafy spurge control on overflow sites. These data suggest that *Aphthona* spp. are controlling cover and yield of leafy spurge; however, revegetation of sites by native, perennial plant species typical of the mixed grass prairie is occurring slowly and may need stimulation. [Paper Number 137]

WEEDS OF WETLANDS AND WILDLANDS

COMPOST AND A NATURAL-BASED PRODUCT, CORN GLUTEN MEAL, FOR ROADSIDE VEGETATION CONTROL. Steve L. Young. Staff Research Associate. UC Hopland R&E Center, Hopland CA 95449.

Abstract. Compost consists of organic matter, such as leaves, landscape trimmings, food scraps, or woody debris, that has undergone varying degrees of decomposition. Applications are made to roadsides on a limited basis for vegetation control. Corn gluten meal (CGM), a byproduct of corn wet-milling, is a natural-based product shown to be an effective preemergence weed control treatment in turf grass. Dipeptides that have been isolated from CGM inhibit root formation of germinating weed seedlings. Young plants die quickly when their root development is stopped, water is lacking and other established vegetation is present. Field sites have been installed at the Hopland Research and Extension Center (HREC) and Jackson Demonstration State Forest (JDSF) to determine whether the combination of these products can effectively control vegetation along roadsides by combining the shade effects from compost and the biological activity from GCM at a cost comparable to currently registered herbicides. Vegetation at HREC is dominated by annual grasses with a few broadleaf species, while a mix of annual forbs and grasses, jubatagrass (*Cortaderia jubata* Lemoine) and French broom (*Cytisus monspessulanus* L.) are most common at JDSF. In year one following the removal of existing vegetation, CGM was applied at 12206, 24412, and 48824 kg/ha with and without compost at both HREC and JDSF. Compost alone and a standard synthetic preemergence herbicide treatment of isoxaben and oryzalin at 1.1 kg ai /ha and 4.5 kg ai /ha, respectively, was also applied. In year two, repeat applications of CGM at 12206 and 24412 kg/ha with and without compost were applied in addition to compost alone and isoxaben and oryzalin at the same rates as year one. After the first year, the highest rate of CGM (48824 kg/ha) without compost was the most effective treatment for controlling vegetation. Except at HREC, the addition of compost failed to consistently control weeds. (Data from year two is being analyzed.) Currently, the cost of a roadside application of CGM at $11,230/ha (48824 kg/ha) for weed control is not comparable to the cost of synthetic preemergence herbicides, isoxaben and oryzalin at $303/ha and $159/ha, respectively, even in urban interchanges. Weed control with repeat applications of both CGM at 12206 and 24412 kg/ha and synthetic herbicides in year two should be comparable to the single application of CGM in year one. However, a large difference in the cost to use CGM versus standard synthetic treatments for preemergence weed control is expected. [Paper Number 138]

THE EFFECTS OF MOWING ON THE TRANSLOCATION OF GLYPHOSATE WITHIN PERENNIAL PEPPERWEED. Mark J. Renz[1], Joseph M. DiTomaso[1] and Lars W. Anderson[2]. Graduate Student, Extension Specialist and Lead Scientist. [1]University of California, Davis, Davis CA 95616 and [2]USDA-ARS Exotic & Invasive Weed Research Unit, Davis CA 95616.

Abstract. Early season mowing has been shown to enhance the control of perennial pepperweed with glyphosate. Several mechanisms are likely involved, the objective of this experiment was to quantify the amount of glyphosate that translocated into belowground tissues to and if mowing altered this pattern. Treatments included plants at the flowerbud stage, fruiting stage, and plants mowed at the flowerbud stage and allowed to resprout. Treatments to plants in the flowerbud and fruiting stages consisted of applications of 8.3 kBq of 14C glyphosate to the sixth and seventh leaf subtending a sprouting axillary bud. Plants that were mowed were allowed to resprout for 1 month before 8.3 kBq of 14C glyphosate was applied to each of the 2 largest expanded leaves of the rosettes. Treated leaves were washed 48 hours after treatments with 10 mL of H2O and all plant organs were lyophilized, autoradiographed, oxidized and 14C was counted. About a third of the 14C glyphosate was recovered in the leaf wash in plants at the flowerbud and fruiting stages (36 and 34 % respectively), while 20% was recovered from mowed plants. Autoradiograms indicate that the majority of glyphosate translocated to nearby sinks in shoots (flowerbuds/flowers/fruits) when applied to plants in the flowerbud and fruiting stages. Little glyphosate was observed in the below ground tissues. However, autoradiograms of mowed plants showed glyphosate to be distributed within above and below ground tissues. The accumulation of glyphosate in below ground tissues in mowed plants is likely the cause for enhanced control. Alteration of shoot morphology and reduction of above

ground sinks in mowed plants may be responsible for the increased accumulation in below ground tissues. [Paper Number 139]

WEEDS OF AGRONOMIC CROPS (Continued from page 64)

WEED CONTROL WITH IMAZAMOX IN SEEDLING AND ESTABLISHED ALFALFA. Stephen D. Miller and Craig M. Alford. Professor and Research Scientist. Department of Plant Sciences, University of Wyoming, Laramie WY 82071.

Abstract. Alfalfa is the major leguminous forage crop grown in Wyoming. Weeds are a serious problem in both seedling and established stands. Weeds compete with alfalfa for water, nutrients and sunlight reducing crop yields, shortening stand life and lowering forage quality. Controlling weeds in alfalfa often reduces the total dry matter production from the field because weeds are eliminated from the harvest. However, weed free alfalfa is usually higher in protein and digestibility, thereby increasing the feed value of the harvested forage. Field experiments have been conducted at over 20 locations in Wyoming since 1996 to evaluate factors influencing weed control and crop tolerance with imazamox in both seedling and established alfalfa. Imazamox applied at 0.032 lb/A has provided more consistent and better control of common lambsquarters, downy brome, long spine sandbur, foxtail (green and yellow), tame oat (nurse crop) and wild oat than imazethapyr at 0.047 lb/A. Control of redroot pigweed, kochia, hairy nightshade, wild buckwheat, and mustard spp. has been similar. Additives as well as combination treatments with 2,4-DB or bromoxynil have influenced both alfalfa tolerance and weed control with imaxamoz. [Paper Number 140]

2,4-DB ESTER ALTERNATIVES FOR WEED CONTROL IN ALFALFA SEED ESTABLISHMENT. Charles A. Rice, Corey V. Ransom and Joey K. Ishida. Faculty Research Assistant, Assistant Professor and Research Technician. Oregon State University, Malheur Experiment Station, Ontario OR 97914.

Abstract. The loss of 2,4-DB ester has limited the herbicide options available for establishment of alfalfa grown for seed. Trials were conducted in 1998 and 1999 to evaluate weed control and crop tolerance with postemergence applications of imazamox. Data were analyzed separately by year due to a significant (P=0.05) treatment by year interaction associated with alfalfa seed yield. Imazamox rates evaluated in 1998 were 27, 36, 45, 54, and 71 g ai/ha applied alone or in combination with 2,4-DB amine (560 g/ha) or bromoxynil (280 g/ha). All imazamox treatments were applied with a non-ionic surfactant (0.25% v/v) plus 32% N (1% v/v). Additionally, a treatment consisting of imazamox (45 g/ha) plus methylated seed oil (MSO) (1% v/v) was included in the trial in 1999. In 1998 temperatures were greater than 27 C for several days following postemergence applications, resulting in severe alfalfa injury with some treatments. Imazamox combinations with bromoxynil or 2,4-DB amine generally increased alfalfa injury compared to imazamox applied alone in 1998. Plots receiving imazamox applied at 71 g/ha displayed greater visual injury 21, 41, and 55 days after treatment (DAT) compared to all other treatments of imazamox applied alone. Alfalfa injury was greatest in plots treated with imazamox (45 g/ha) plus MSO at 7, 14, and 32 DAT in 1999. In general, percent weed control and alfalfa seed yields were lower in 1999 compared to 1998. In both years, imazamox treatments, regardless of rate, provided greater hairy nightshade control than either 2,4-DB amine or bromoxynil applied alone. Common lambsquarters control was significantly increased when 2,4-DB amine or bromoxynil were tank-mixed with imazamox at 27 g/ha, compared to the same rate of imazamox applied alone. In 1998, kochia control was greatest when imazamox was applied in a tank-mix with either 2,4-DB amine or bromoxynil, and when applied alone at rates above 27 g/ha. The tank-mix combination of imazamox (45 g/ha) plus 2,4-DB amine increased kochia control over imazamox (45 g/ha) applied alone in 1999. In general, Russian thistle control was less with imazamox applied alone compared to tank-mix combinations of imazamox plus 2,4-DB amine or bromoxynil in 1999. Alfalfa seed yields were variable in both 1998 and 1999. All treatments in 1998 increased yields compared to the untreated check. In 1999, all treatments except imazamox (27 g/ha) applied with and without bromoxynil, and bromoxynil alone provided greater yields compared to the untreated check. [Paper Number 141]

POST HARVEST WEED CONTROL IN WINTER WHEAT STUBBLE WITH GLYPHOSATE AND GLYPHOSATE TANKMIXES. Robert N. Klein[1], Jeffrey A. Golus[1], Dennis E. Stamm[2] and Brett R. Miller[3]. Professor, Research Technologist, R&D Scientist and R&D Scientist. [1]University of Nebraska, North Platte NE 69101, [2]Syngenta, York NE 68467 and [3]Syngenta, Hector MN 55342.

Abstract. A study was conducted to evaluate glyphosate and glyphosate tankmixes for weed control in post harvest wheat stubble. Treatments included various combinations of glyphosate (diammonium and isopropylamine salts), dicamba, 2,4-D amine and ammonium sulfate. Treatments were applied with a fifteen foot shielded boom sprayer (six 11003XR nozzles on 30 inch spacing). Nozzle pressure was 20 psi and carrier volume 10 gpa. Treatments were applied on July 25, 2001 with kochia and Russian thistle present and eight to ten inches tall. Visual percent control ratings of kochia and Russian thistle were taken on August 10 and August 18. The low rate (0.375 lb ae/a) of the glyphosate formulations alone gave 87 to 98 percent control of both weeds on August 18. Adding ammonium sulfate to the low rate of glyphosate resulted in 88 to 98 percent control. The addition of dicamba or 2,4-D amine to the low rate of glyphosate gave 67 to 98 percent control of both weeds on the same date. The high rate (0.75) of the glyphosates (with and without dicamba or 2,4-D amine and/or ammonium sulfate) gave 94 to 100 percent control of both weeds on August 18. [Paper Number 142]

THE IMPACT OF FIVE GLYPHOSATE RATES AND TIMES OF APPLICATION FOR CONTROL OF VOLUNTEER WHEAT ON STORED SOIL MOISTURE. Randall S. Currie and Curtis R. Thompson. Assoc. Prof. and Assoc. Prof. Kansas State University, Garden City KS 67846.

Abstract. Wheat is a major weed in wheat-fallow-wheat rotations in Kansas. Although the approximate rates and timings to kill wheat with glyphosate are known, the effects of these treatments on soil water storage during the fallow period is understood poorly. This is important since water storage is the main objective of a fallow period. Five glyphosate rates, 0 (untreated control), 0.21, 0.41, 0.62, and 0.83 kg/ha were applied on uniform wheat stands during November, March, April, or May to produce 20 rate-timing combinations. A bare-ground control was also included by applying glyphosate as needed. Soil moisture was measured monthly for a year with measurements taken at 30-cm increments to a depth of 244 cm. After wheat senescence, the entire study area was maintained weed free with 1.1 kg/ha glyphosate as necessary. Overall, effects on soil water from rate and timing of glyphosate were similar in the August, September, and October readings. March and April applied glyphosate elevated soil water above the untreated control in the top 60 cm of soil in October. The 0.83 kg/ha April applied glyphosate elevated soil moisture in the top 60 cm relative to the bare-ground control. Total soil moisture in the top 152 cm of soil was highest with March and April applications compared to the untreated control. As with surface moisture, more total soil water was in the top 152 cm in plots receiving the 0.83 kg/ha March application compared to the bare ground control. These results show that residue grown from October to March conserves more water than the wheat plant consumes. [Paper Number 143]

WEED CONTROL AND CROP RESPONSE WITH ROUNDUP READY SPRING WHEAT. Gregory J. Endres[1], Paul E. Hendrickson[1], Blaine G. Schatz[1] and Stephen A. Valenti[2]. Extension Area Agronomist, Research Specialist, Research Agronomist and Agronomic Research Manager. [1]NDSU Carrington Research Extension Center, Carrington ND 58421 and [2]Monsanto, Fargo ND 58104.

Abstract. Two field trials were conducted in 2001 at the NDSU Carrington Research Extension Center to evaluate weed control and crop response with glyphosate-resistant (Roundup Ready) spring wheat. Glyphosate was applied at 0.38, 0.56, and 0.75 lb ae/A alone or in tank mixtures with broadleaf herbicides and compared to conventional grass and broadleaf herbicide tank mixtures. In trial 1, early-POST treatments were applied on May 30 with 62 F, 76 % RH, 10% clear sky, and 4 mph wind to 3-leaf wheat, 1- to 4-leaf yellow and green foxtail, 0.5- to 3-inch tall volunteer flax, 0.5- to 1-inch tall redroot and prostrate pigweed, and 0.5- to 2-inch tall wild buckwheat. POST treatments were applied on June 7 with 61 F, 87 % RH, clear sky, and 7 mph wind to 4.5-leaf wheat, 1- to 5-leaf yellow and green foxtail, 0.5- to 3-inch tall volunteer flax, 0.5- to 1-inch tall redroot and prostrate pigweed, and 1- to 3-inch tall wild buckwheat. In trial 2, treatments were applied on June 7 with 50 F, 100% RH, light fog, and 5 mph wind to 4.5-leaf wheat. In trial 1, glyphosate treatments including tank mixtures provided excellent foxtail control (90 to 97%) 14 and 21 d after treatment. Glyphosate at 0.38 lb/A generally provided similar control of all weeds compared to higher rates or sequential application. An exception was glyphosate at 0.75 lb/A or a sequential application was required to provide excellent wild buckwheat control (93 to 99%) compared to lower glyphosate

rates when applied at the later wheat growth stage. Tank mixtures with glyphosate improved wild buckwheat control compared to glyphosate alone at 0.38 lb/A while control of other weed species was similar. Glyphosate generally provided greater weed control, except with wild buckwheat, than conventional herbicide tank mixtures. In both trials, glyphosate did not injure wheat when visually evaluated for chlorosis, necrosis, or growth reduction. [Paper Number 144]

FIELD STUDIES WITH GLYPHOSATE FORMULATIONS FOR WEED CONTROL IN DIVERSE CROPPING SYSTEMS. Philip Westra[1], Jim Daniel[2] and Parrish Scott[2]. Professor, Field Biologist and Field Biologist. [1]Colorado State University, Ft. Collins CO 80523 and [2]UAP, Greeley CO .

Abstract. Several field studies were conducted during the summer of 2001 to evaluate the weed control efficacy of Engame compared to Roundup Ultra, and in some instances, compared to Touchdown. The studies compared the performance of these glyphosate formulations on a range of broadleaf and grass weeds including foxtail, barnyard grass, wild oats, kochia, pigweed, and wild sunflower. The studies were conducted under irrigated field conditions and under dryland conditions. In most instances, Engame provided more rapid weed death and better overall weed control, especially on broadleaf weeds. It also appeared that the Engame formulation caused a more rapid breakdown and decomposition of dead weed material. [Paper Number 145]

PLANT DESICCATION AND FLAX GERMINATION FOLLOWING PRE-HARVEST HERBICIDE APPLICATION. Kirk A. Howatt and Ronald F. Roach. Assistant Professor and Reearch Specialist. North Dakota State University, Fargo ND 58105-5051.

Abstract. In North Dakota, a section 24c label allows for pre-harvest glyphosate application in flax. Previous research in other crops has shown that pre-harvest glyphosate application may reduce germination of harvested crop seed or increase the occurrence of abnormal root and shoot development. An experiment was established near Fargo, ND, to evaluate vegetation desiccation and subsequent flaxseed germination following treatments including glyphosate products. Treatments were applied pre-harvest with an ATV sprayer when bolls were turning from tan to brown and late flush flowers were blooming. The experiment was a randomized complete block design with four replicates. Carfentrazone alone did not control vegetation, but the addition of carfentrazone to glyphosate or glyphosate & aminomethanamide dihydrogen tetraoxosulfate tended to improve redroot pigweed control 10 days after treatment. All treatments containing glyphosate were effective at killing the late flush of flowers and speeding flax desiccation. Even though all flax was allowed to mature and dry before harvest, glyphosate treated flax shattered easier in the combine and provided cleaner flaxseed samples. Flaxseed germination was conducted following common protocol of the North Dakota State Seed Laboratory. There was no difference in germination of flaxseed or expression of abnormal seedling growth. It is important to remember that treatments in this study were applied to mature bolls and new flowers. The effect of herbicide treatment to immature bolls is not known. [Paper Number 146]

CONTROLLING WEEDS IN GLYPHOSATE-TOLERANT CORN AND SOYBEAN WITH GLYPHOSATE IN THE CENTRAL GREAT PLAINS. Gail A. Wicks[1], Philip W. Stahlman[2], Troy M. Price[3] and Jeffrey M. Tichota[4]. Professor, Professor, Assistant Scientist and Monsanto Agronomic Research Manager. [1]University of Nebraska, North Platte NE 69101, [2]Kansas State University, Hays KS 67601-9228, [3]Kansas State University, Colby KS 67701 and [4]Monsanto, Littleton CO 80122.

Abstract. Studies were conducted at Hays, KS and North Platte, NE to determine weed shifts after 4 years of glyphosate applications in a continuous corn and corn-soybean rotation using glyphosate-tolerant crops. Each phase of the rotation occurred each year. Four treatments were compared. Glyphosate was applied to kill all weeds before no-till planting corn or soybean. Glyphosate at 0.38 or 0.75 lb ae/A were applied twice POST to separate plots in each cropping sequence. The check was a standard herbicide treatment for corn and soybean. An additional treatment used the high rate of glyphosate one year and the standard herbicide treatment the next year. At North Platte, NE, 43 species have been identified in 2000 and 2001. At harvest time, 24 species were present in 1998, 20 in 1999, 29 were present in 2000, and 31 in 2001. Kochia was the dominant weed with 100% occurrence in1998. In 2001, the four weed species with the highest frequency of occurrence at harvest time in plots treated with glyphosate were tumble pigweed 67%, common purslane 61%, longspine sandbur 26%, and kochia 14%. Tumble pigweed had the most biomass in the glyphosate-treated plots while longspine sandbur biomass was greatest in the non-

glyphosate treated plots. At Colby, KS, 35 species were present in September 2001. Puncturevine, was the most frequent weed species. In the pigweed family, occurrences were in the following order redroot >Palmer > tumble > waterhemp > prostrate. In the grass species, prairie cupgrass frequency was highest followed by green foxtail > longspine sandbur > barnyardgrass > windmillgrass and low densities of large crabgrass, stinkgrass, and witchgrass. At both sites, weed control was better with glyphosate at 0.75 lb ae/A than 0.38 lb/A, each applied twice. Two applications of glyphosate after crop emergence were not enough to prevent seed production of late germinating weeds. In semiarid areas of the central Great Plains, crop canopies often are insufficient to prevent late emerging weeds from producing seeds. These seeds replenish the soil seedbank and may present future weed problems. Regardless of rate, glyphosate treatments usually were more effective than conventional herbicide treatments, especially in soybean. [Paper Number 147]

CORN RESPONSE TO SIMULATED DRIFT OF IMAZETHAPYR, GLYPHOSATE, GLUFOSINATE, AND SETHOXYDIM. Randall S. Currie, Kassim Al-Khatib, Troy M. Price and Curtis R. Thompson. Assoc. Prof., Professor, Research Assoc. and Assoc. Prof.. Kansas State University, Manhattan KS 66506.

Abstract. With the advent of introduced genetic resistance to imazethapyr, glyphosate, glufosinate, and sethoxydim into corn, these products are now widely used in corn or soybeans. However, corn that is not resistant to these products is planted widely. Drift of these products from adjacent resistant corn fields or soy bean fields is common. Therefore, the objectives of this study were to determine injury and yield reduction in nonresistant corn caused by imazethapyr, sethoxydim, glyphosate, and glufosinate applied at simulated drift rates and to determine if early symptoms of herbicide drift injury are predictive of corn yield reduction. With the use rate of imazethapyr, sethoxydim, glufosinate, and glyphosate, defined as 71, 168, 404, and 1100 g/ha, 1%, 3%, 10%, and 33% of the use rate of each product was applied to 30 cm corn in the V-5 stage. The experimental design was a split plot with herbicide as the main plot and rate as the subplot with 4 to 5 blocks. Visual injury was scored 2, 4 and 8 WAT. Grain was harvested and adjusted to 15.5% moisture. Only glyphosate at 33% of use rate injured corn and reduced grain yield at all three locations. At two of the three locations, 10% of the use rate of glyphosate reduced yield to 63 and 4% compared to the untreated control. Greater than 36% injury from glyphosate was needed 2 WAT to consistently reduce yield at all locations. Greater than 10% injury from glufosinate 2 WAT was needed to produce yield loss. At 2 WAT, 87% injury from 33% of the use rate of glufosinate was observed, but by 8 WAT only 2% injury was observed. This level of injury translated into a 40% yield loss. Imazethapyr at 33% of the use rate caused 78% injury and reduced corn yield 70% at one location. Sethoxydim at 33% of the use rate caused 23% injury and reduced corn yield 19% at one location. Low levels of injury did not translate readily into yield loss. [Paper Number 148]

INVESTIGATIONS INTO GLYPHOSATE RESISTANT HORSEWEED (*CONYZA CANADENSIS*): BIOLOGICAL EVALUATIONS AND CONTROL RECOMMENDATIONS. David C. Heering, Robert F. Montgomery, T. E. Dutt, D. J. Mayonado and P. G. Ratliff. Roundup Technical Lead, Agronomic Research Manager, Agronomic Research Manager, Agronomic Systems Manager and Research Biologist. [1]Monsanto Co., St. Louis MO 63167, [2]Monsanto Co., Fogelsville PA 18051, [3]Monsanto Co., Union City TN 38261 and [4]Monsanto Co., Salisbury MD 21801.

Abstract. Horseweed has a long history of being difficult to control with glyphosate. In 1999, isolated incidences of poor control in Delaware were assumed to be weather related due to hot dry growing conditions early. In the summer of 2000, there was an increase in the number of glyphosate performance inquiries with horseweed in full-season no-till soybean fields in Delaware under near ideal growing conditions. Greenhouse and laboratory research has been initiated to determine if this biotype is resistant and to understand the mechanism of resistance. In spring 2001, growers in west Tennessee experienced difficulty controlling horseweed. Studies have been initiated to determine if poor performance in west Tennessee was due to extreme environmental conditions or resistance. Greenhouse results show that higher than labeled glyphosate rates are needed to control horseweed collected from suspect fields in Delaware. In field trials evaluating burndown treatments, excellent control of horseweed was obtained with a tank mixture of glyphosate at 0.84 kg ae ha-1 and cloransulam-methyl at 0.018 kg ai ha-1 when applied to horseweed 15 cm tall or less. In soybeans, treatments of glyphosate at 0.84 kg ha-1 and cloransulam-methyl at 0.018 kg ha-1 applied at the 30 cm stage of growth provided commercially acceptable control. In cotton, horseweed control with MSMA plus diuron or glyphosate plus prometryn was greater than 90 percent. Field results

demonstrate that this biotype can effectively be managed with either burndown or in-crop applications. [Paper Number 149]

NEW APPLICATION METHODS FOR SHARK™ HERBICIDE TO RICE IN CALIFORNIA. Knabke, J.J. and Sladen, N.A., Research Biologist, FMC Corporation, Clovis CA 93611, and Technical Service, Pleasant Hill CA 94523.

Abstract: In California the majority of rice is grown in the Sacramento Valley which has a diversity of tree, row and field crops which are often grown contiguous to rice paddies. Given the diversity of the cropping practices, it is not surprising that the widespread use of herbicides on rice has been associated with problems on the neighboring crops due to drift. Compounding the problem is that aerial application to rice is the preferred delivery method to cover large acreages within a short application window. The drift-influencing factors of droplet size and release height are increased with air applications versus ground applications particularly under inversion conditions. Shark™ Herbicide, carfentrazone-ethyl, was granted a Section 18 emergence exemption for use on California rice in 1998 and continued in 1999. However, in 1999 several instances of drift occurred. Shark™ Herbicide was registered in 2001 for weed control on rice in California by ground application only, with a half-mile buffer to sensitive crops, utilizing two use patterns: The first application timing is at early post-seeding to the flooded paddies which requires the active material to move through the water to contact the submerged weeds. The second application timing is 20 to 45 days post-seeding when the paddy water is drawn down to expose the weeds to direct foliar sprays. The early post-seeding timing utilizing the water as the dispersion medium was recognized as a potential means to deliver the Shark™ Herbicide to the weeds without using a typical wet spray. Direct Dry Application (DDA) is a method whereby the dry formulation of the herbicide is directly applied to the flooded rice paddy utilizing the floodwater as the dispersion medium. There is a precedent for DDA in California: Londax® 60 DF is currently registered for this use with a specialized applicator. Direct Stream Application (DSA) is a method whereby a concentrated solution of herbicide is applied to the paddy water utilizing very large orifices under low pressure. DSA has been utilized in Australia aerially via helicopter with 4 to 6 nozzles rigged on tubes that extended about eight feet from the boom to achieve a release height of less than one foot from the water surface or by ground with tubes slightly above or below the water surface; but, DSA is not currently registered for use in California. DDA and DSA were determined to be the most likely options for safely applying Shark™ at the early post-seeding application timing to rice grown in close proximity to sensitive crops. These application techniques do not fit the second foliar application timing when wet sprays are required for adequate foliar contact to achieve weed control. Shark™ Herbicide is marketed as a 40DF and is potentially utilizable in both DDA and DSA applications. No suitable equipment was available for DDA applications of Shark™ since the Londax® spreader was limited in delivery capacity. However, working with local applicators, a mini-spreader was developed that would accurately apply Shark™ DDA. For DSA, applicators fabricated equipment for use by helicopter or by ground following the Australian technology. Utilizing these equipment designs, eight aerial DDA applications and eight DSA aerial or ground applications of Shark™ were made from 1999 to 2001 to rice fields of typical commercial size. The results with DDA applications were generally excellent with all broadleaf weeds and sedges controlled by Shark™ at 0.20 lb active per acre. There was no evidence of streaking in weed control or crop response. As with all herbicide applications, timing to weed size was important to maximize control. Water depth management was noted to be critical to achieve adequate product dispersion throughout the paddy. DSA likewise gave excellent weed control, again weed size and water depth were critical factors. We did note with ground applications that ruts formed could interfere with water movement and dispersion of Shark™ particularly if the water level was too low. We also evaluated the risk of off-target movement of Shark™ with DDA or DSA applications under commercial conditions utilizing sensitive indicator plants. With aerial DDA applications, indicator plants were placed directly under the flight path and downwind. Plants directly over-flown showed very limited symptomatology while downwind plants indicated no off-target movement beyond 25 feet. With DSA there was no indication of downwind movement beyond 50 feet. The results indicate that aerial DDA and aerial or ground DSA applications of Shark™ at the early post-seeding timing can provide excellent weed control of broadleaf and sedge weeds in rice while minimizing off-target risk under the diverse cropping practices that occur in rice-growing areas of California. [Paper Number 150]

EDUCATION AND REGULATORY

Chairperson: Philip A. Banks

Topic 1: FQPA's Impact on Herbicides and WSWS Response
Moderated by Sandra McDonald, Colorado State University
Panelists: Allen Jennings, Director, Office of Pest Management Policy, USDA
Neil Anderson, Biological and Economic Analysis Division, USEPA
Rick Melnicoe, Director, Western Reg. Pest Mgt. Center, USDA

Topic 2: Triazine Special Review: Process, Progress and Impacts
Moderated by Philip A. Banks, MARATHON-Agric. & Environ. Consulting
Panelists: Jack Housenger, Assoc. Dir., Spec. Rev. and Reregist. Div. USEPA
Jere White, Exec. Dir., Kansas Corn and Grain Sorghum Associations
Janis McFarland, Head, Regulatory Affairs, Syngenta Crop Protection

Topic 1

Allen Jennings reviewed the history of the Food Quality Protection Act (FQPA). The act became law August 3, 1996 and set deadlines for setting new tolerances for existing pesticides. Two thirds of all pesticides must have new tolerances set by August 3, 2002 with the remaining completed by August 3, 2006. The new standards set an additional 10X safety factor, require that the aggregate risk of all exposures be considered, and that cumulative risk from all closely related chemistry be considered. The law requires that pesticides have "A reasonable certainty of no harm." The USDA Office of Pest Management Policy was created to serve as a central point for information needed by EPA. The office provides food consumption, pesticide residue, agricultural use, and agricultural practice data. He stated that FQPA is a technology forcing tool with no economic considerations that creates new toxicology end-points. The current focus is on older chemistry, such as the triazines.

Neil Anderson stated that all pesticides must be evaluated on the time table noted by Jennings. Both dietary and residential exposures are to be considered and that the benefits of pesticide use are not considered. He described the process used by EPA in determining the priority for evaluation. The evaluation process is multi-staged, looking at risk assessment needs and benefits assessment needs. He stated that more sophisticated tools are needed: temporal and spatial use characteristics, worker activities, comparative product performance, common marketing issues, and labor availability. He stressed that WSWS members can assist greatly in the process by being proactive and providing data on crop profiles, pest management strategic plans and provide comparative product performance data. He urged everyone to be responsive when requests for information are made.

Rick Melicoe said that weed scientists are important in the FQPA process since they are best qualified to provide performance data and expert opinions pertaining to herbicides. He stated that there are 29 candidate herbicides that will go through the review process soon. The key herbicides are atrazine, bensulide, molinate, and oxyfluorfen. He stressed the need to develop pest management strategic plans to assist in working out a timeline and strategy for the transition from risky to less risky practices and products. He indicated the need to create a list of priorities and repeated the need for WSWS members to participate when asked.

Many questions were asked of the panel. In summary, there was concern about the lack of funding for efficacy data to provide the information needed on comparative products. Also, for some crops, alfalfa and spinach for example, practically all herbicides are in danger because of FQPA. The members of the panel indicated that the process does not use data from the local level, only the state.

Topic 2

Jack Housenger indicated that the Triazine Special Review started in 1994 due to concerns about possible human carcinogenicity due to exposure in food, water or occupational activities. While atrazine is the most widely used triazines, others such as propazine and cyanazine were also included and cumulative risk was also a factor in initiating the special review. Many comments were received by the EPA, most from grower groups, registrants, water associations, and environmental groups. In June of 2000 the science advisor panel (SAP) determined that the Sprague-Dawley rat used for the carcinogenicity studies was not representative of how humans would respond, thus the basis of the special review was gone. Atrazine is still under reregistration and open for new comments until

April 16, 2002. Other risks being considered are subchronic, residential, occupational, and ecological. The interim reregistration eligibility decision is scheduled to be completed by August 2, 2002.

Jere White represents the Triazine Network, grower groups and individual growers that produce 30 different commodities. The goals of the group were to see that science based decisions were made and serve as a liaison between growers, the EPA and the registrants. Part of this was to serve as a check on those in EPA that wanted to remove the triazines and to work with the registrant to be more open with the growers. He stated that the triazines provide an estimated 6 to 12 bushel per acre yield increase representing a 1.66 billion dollar increase in net farm income in the United States. He also pointed out that the triazines allow for more successful use of conservation tillage which in turn improves water quality.

Janis McFarland indicated that the triazine special review had improved the state of the art for risk/benefit analysis. Over 200 new studies have been conducted. Currently, over 65 % of the corn and grain sorghum acres in the United States are treated with atrazine, with 81.5 % of the no-till corn acres being treated. The new studies included work on toxicology, carcinogenicity, runoff and leaching, best management practices, effect of application timing on residue levels, processing studies, and studies to lower the non-detect level in foods so that tolerances could also be lowered. She indicated that ecotox studies have been conducted on reptiles and amphibians and to evaluate atrazine as an endocrine disruptor. She said that the work conducted by Syngenta in defense of the triazines had cost up to 25 million dollars. Jack Housenger indicated that the EPA had spent up to two million dollars.

WSWS members asked numerous questions about the future of the triazines and the special review process. Panel members indicated that the special review process will be a thing of the past due to the experience with the triazines and with the new regulations of FQPA and the reregistration process. Many members were interested in whether minor uses of the triazines would be reinstated. The panel did not know if this would occur.

PROJECT 1: WEEDS OF RANGE AND FOREST

Chair: George Beck

There were 52 participants in the Project 1 session. A mailing list is available.

Topic 1: Determining the process and criteria for designating plants as noxious

The group discussed the importance of developing a noxious weed list based on specific objectives such as justification for the expenditure of public funds; protection of sensitive and natural resource areas; and determination of the types of areas to be protected. Some states have specific criteria that they look at, while others have a less scientific [more political] approach. Some states have a list that is tied closely to the agricultural community and need a method to add non-ag weeds to the list. It was noted that the term "noxious weed" is a term unique to the West.

There is an issue of sensitivity that horticultural plants not be added to state lists without a defendable process and indications of potential damage to target lands. There are both rights and responsibilities when bringing new varieties of plants into the United States. It would be useful to be clear on APHIS regulations for importing new plants. Possibly the horticultural industry could work on the development of alternative plants for invasive ornamentals and develop growing zones for plants.

The issue of listing native plants was also discussed. Many states do not add natives, but determine the native range of a proposed weed. It may be from North America, but not the specific region.

It is critical that there is not a lag phase for new invaders where the weeds are not managed until added to the state list, allowing them to become serious problems. The national rapid response plan can be used to help deal with new invaders into western states. If some questions in the review process can't be answered, the plant may still need to be listed, with research needs identified in the review process. Correct identification of new invaders is a critical issue.

There are cost issues to develop and implement a review process. It's also important to develop a management program while determining the potential for a plant to be added to the list.

Recommendations:
1) WSWS help provide a middle ground between the horticultural industry, the ag industry, natural resource industry, and environmental groups.
2) Identify research needs; possibly develop check-off funding from the seed and nursery industry.
3) Encourage communication between the horticultural industry and weeds personnel to develop alternative plantings. Consistency is important.
4) Suggest that NAWMA look at the burden of proof issue to decide if a plant has weedy characteristics, including identifying plants that are still in the trade that can be agreed that they are invasive in many areas; possibly developing a list of banned ornamentals; and developing a voluntary "code of conduct" to not spread invasive plants.
5) Develop a plan to enforce the section of the Executive Order that requires that no federal monies be spent to spread invasives.
6) Identify a "Watch List" that includes all plants in *Weeds of the West* and anything non-native found in herbaria in the West.
7) Continue to raise awareness of the issue. Several conferences will be held to look at aspects of invasiveness: "Weeds Across the Borders," May, 2002; Chicago Botanic Garden, October, 2002; Ecological Society of America, Tucson; discussion on invasives in November, 2002 by WSSA and ESA; CIPM conference on restoration in December, 2002; international conference on invasive plants in summer of 2003 in Florida.

Topic 2: Testing the successional weed management theory: Designing mulit-state research projects and data acquisition ~ Cancelled due to lack of a discussion leader.

2003 Chairperson: Barbra Mullin, Montana Department of Agriculture — Chair-elect: Tim Prather, University of Idaho

PROJECT 2: WEEDS OF HORTICULTURAL CROPS
Chairperson: Steve Fennimore

Topic I: The challenge of minimum-till vegetable production.

Ed Peachy, Oregon State University. Experience with minimum-till vegetable production in Oregon.

Potential for adoption of minimum-till vegetable production in western Oregon is limited by cold soils and insect pests such as symphylans. Soil compaction in wet soils is also another limitation. Symphylans cause serious damage in minimum-till sweet corn. Short-season crops such as snap beans have potential for use with minimum-tillage systems. Winter squash works very well with no-till systems since symphylans are not pests in this crop.

Jeff Mitchell, University of California-Davis. Minimum tillage vegetable production in California.

Advantages associated with minimum tillage vegetable production:
1. Is cheaper than conventional tillage due to reduced tillage trips. Labor and fuel savings are realized
2. Reduced tillage means less dust is produced
3. Field preparation time is reduced
4. Less soil compaction
5. Reduced soil erosion
6. Increased earthworm populations in the soil
7. Reduced packing from rainfall

Disadvantages associated with minimum tillage vegetable production:
1. Difficult or impossible to use with small-seeded vegetables such as carrots or lettuce. Transplants overcome this problem in crops such as tomato
2. Herbicides available for most vegetable crops are not sufficient to manage weeds without tillage
3. Difficult to manage insect and disease pests without tillage

Topic II. Use of Brassica spp. green manure crops for supplemental weed control in horticultural crops. Rick Boydston, USDA-ARS, Prosser, WA. Experience with *Brassica* spp. green manure crops in eastern Washington.

In 2001 there were 9260 acres of *Brassica* green manure crops in eastern Washington. About half of the acreage is *Brassica hirta* and the other half is *Brassica juncea*. Experience has shown that the major benefits are nematode control, with some weed suppression. Small seeded weeds are the most susceptible. Generally weed suppression is short-lived.

Extension publications developed by Andy McGuire for the use of *Brassica* spp. cover crops can be found online at http://grant-adams.wsu.edu.

Research questions posed by Rick Boydston were:

1. What is the role of shoots vs. roots in weed suppression?
2. The relationship between biomass and glucosinolate production needs to be better defined.
3. What are the effects of irrigation, fertilizer and time of incorporation on glucosinolate production?
4. What are the most effective *Brassica* spp. cover crop varieties?
5. What can be done to make the weed control effect of *Brassica* cover crops last longer?
6. Are there crops besides *Brassica* spp. that could be used to produce biofumigants?

Pam Hutchinson, University of Idaho, Aberdeen, ID. Experience with *Brassica* spp. green manure crops in Idaho.

In Idaho a fall *Brassica* cover crop program is being promoted. *Brassica* spp. cover crops need to be planted by August 15 so that sufficient biomass can be produced before winter. These cover crops perform best when fertilized and provided sufficient irrigation. *Brassica* cover crops are heavy water users. They have seen stunting in potato when planted within 8 days of cover crop incorporation. More work is needed to determine the optimal plant back period.

2003 Chairperson:
Tom Lanini
Weed Science Program
Dept. of Vegetable Crops
One Shields Avenue
University of California
Davis, CA 99616
Voice: 530-752-4476
Fax: 530-752-4604
wtlanini@ucdavis.edu

Chairperson elect:
Tim Miller
Washington State University
16650 State Rte. 536
Mt. Vernon, WA 98273
Voice: (360) 848-6138
Fax: (360) 848-6159
twmiller@wsu.edu

PROJECT 3: WEEDS OF AGRONOMIC CROPS

Chairperson: Brian Jenks

Topic 1. Approximately 85 people participated in the statistics topic. This discussion, led by Bill Price from the University of Idaho Applied Statistics Program, focused on the use and misuse of statistical methods and procedures. He commented that the number one problem is the attitude towards statistics and statisticians when designing a implementing an experiment. Statistics should be used as a tool and considered an integral part of any research project. One of the main problems he encounters is a lack of clear research objectives, which leads to problems analyzing data. Clear research objectives lead to developing better experimental designs, data collection, and data analysis. He discussed some specific areas of experimental designs and answered questions related to experimental design.

Treatments. People get confused between experimental design and treatment design. Treatment design can include factorial arrangement of treatments. Too many treatments in an experiment can degrade the ability to detect differences or the truth.

Replications. Bill believes that more is better. Adding an additional replication can reduce LSDs by 10 to 20%.

Blocking. Need to think about how to use blocks in an experimental design. Many people ignore blocking when conducting growth chamber or greenhouse experiments. One must keep in mind that the whole idea for blocking is to reduce variance in an experiment.

Homogeneity of variance. ANOVA assumes a normal distribution of every treatment. This doesn't always happen. Transformations, such as arc sin square root transformations, can help achieve HV. In weed control research, where we use a lot of percent control data, we often encounter non-homogeneity of variances and ANOVA is sensitive to skewed data. It is important to look at the distribution of percent control data before analyzing.

Nonlinear regression analysis. This works very well with many dose response data. However, it can be difficult to use because it is an iterative process. It must be kept in mind that it is an estimation approximation. One should always plot the data before beginning regression analysis to get an idea of the best type of regressions to use. And after doing regression analysis, it is important to plot the model against the data.

Multi-year data. Bill does not feel it is absolutely necessary to combine all of the data into one data set. It depends on the type of study. In a cropping systems study, it makes more sense to compare over years. In studies that are repeated, it may not be absolutely necessary to try combining years, especially if one is trying to adjust a treatment(s) from one year to the next.

Significant data. What is significance? It depends on the data's practical value. It is important to keep in mind that statistics are a tool. In research, a 95% probability is considered the lower bounds of acceptable data. In production agriculture, a grower is likely willing to accept a 75% probability level.

Topic 2. Approximately 35 people attended the discussion on weed management decision support systems. Alex Martin, University of Nebraska weed scientist, led this discussion. He presented the WeedSoft program that has been developed for use in the North Central states and demonstrated various aspects of this program.

Several attributes of this program, such as ADVISOR, EnviroFX, Map View, Weed View, etc. were presented and discussed. Alex presented many examples of how each of these attributes contributed to the utility of this program. He also explained how data and other information were obtained for use in the program. WeedSoft was developed to be more than just an electronic weed control guide. A detailed description of the program if available at the University of Nebraska web site: http://www.ianr.unl.edu/weedsoft/index.htm

One of the points he made very clear was that this program is only a tool for assisting crop advisors in making decisions for weed management in crops grown in the north central area. He also pointed out that additional data was continuing to be collected to add to the program.

2003 Chairperson:
Don Morishita
University of Idaho
Twin Falls R&E Center
P.O. Box 1827
Twin Falls, ID 83303
Phone: 208-736-3616
Fax: 208-736-0843
e-mail: don@uidaho.edu

Chair-Elect:
Jeff Herrmann
Monsanto
3478 North 2983 East
Twin Falls, ID 83301
Ph: 208-736-7294
Fax: 208-736-7295
Email: jeffrey.e.herrmann@monsanto

PROJECT 4: TEACHING AND TECHNOLOGY TRANSFER

Chairperson: Rick Boydston

Paper session.

Three papers were presented in the Project 4 session. Attendance ranged from 22 to 37.

Discussion session.

The topic of developing distance education materials was discussed. Discussions were lead by Scott Nissen, Colorado State University; Tracy Sterling, New Mexico State University; Deana Namuth, University of Nebraska; and Bill Dyer, Montana State University.

The need for distance education materials is increasing as the make-up of the learners and students are changing. Many learners are career individuals that are continuing their education by accessing distance-learning materials as time permits. Distance learning allows access for a whole new set of clientele to the University. These individuals require maximum flexibility in course schedules and time they can commit to furthering their education. Although many students participating in distance learning courses are often located away from campus, there are many students participating that are in close proximity to campus, but prefer the flexibility in time. Most distance learning students are mature, highly motivated, very demanding, and early adapters. Allowing these students adequate communication and time with instructors is important.

Deana Namuth described the Crop Technology website developed at Nebraska. A USDA grant and an American Distance Education Consortium (ADEC) grant were obtained to develop genetics lesions initially. Students may take web-based genetics lessons for college credit or noncredit. On-line exams are offered. Students may retake exams as needed to pass.

Several weed physiology, herbicide mode of action, and weed management lessons for the web are being developed by Deana, Scott, and Tracy for both academic and extension applications. Materials are being developed as modules so that use can be extended to a number of different applications and to different levels of students. The investment in these modules is an efficient use of resources and University faculty, as they will support current teaching and extension programs. An education journal will be reviewing the modules developed so faculty can obtain professional credit for their efforts.

Animations, using Flash software, are being developed for many of the modules. Several animations were demonstrated, such as, electron transport through photosystem I and II and herbicide uptake through plant cells by Scott Nissen and Tracy Sterling. Animations cost about $1000 to $1500 to develop. Animations convey one essential topic and are easily adapted to other topics. They can be downloaded and used in presentations. People working in extension thought these animations were excellent ways to deliver concepts that are often difficult to grasp and good reinforcement of lessons. Usefulness of lessons in pesticide applicator training and on-line exams for applicator training credit may also be possible.

WSWS has contributed $5,000 to host the site for herbicide mode of action and other weed-related modules being developed. A portion of the funding will be used to pay for increased bandwidth that will be required and for maintenance. The funding should be adequate for several years. The target date for the modules to be available on the WSWS website is late 2002. Those modules already completed can be obtained now from University of Nebraska. Several extension people in the audience indicated that these modules could be useful tools that could complement their current extension programs.

A distance Masters in Agronomy program is being developed at Kansas State. At Montana State, the Center for Invasion Plant Management is developing curriculum for a 10-week on-line course for land managers and advanced noxious weed short course with ecological principles. They have also taken a modular approach in developing course materials.

Bill Dyer shared his experiences and advice on teaching distance courses. He indicated that one should allow twice the normal time to gear up when developing distance-learning courses. If it is a new course versus an existing course even more time will be required. One must consider what software, platform, and organization scheme they will use. Various people that have developed distance-learning courses using Web CT and Blackboard. The course should be technologically transparent to the student.

Enrollment should be limited as most distance-learning students require a lot of one-on-one contact and frequent feedback from the instructor. How the students will interact with the instructor and other students also needs to be considered. Some have used email only and others internet-based. Student discussion groups are beneficial and

should be available. Bill requires his students to log in to discussion groups at least weekly. Discussion groups should be monitored as they can often become heated. Course materials such as textbooks can be sent by mail.

Exams can be set up with students using secure passwords. Tests can be time-limited if desired. Some concern was expressed on how to verify that students taking on-line exams were actually the registered student.

Independent companies are available to evaluate courses based on student input.
Several participants indicated the cost of distance learning courses is generally greater than traditional courses.
Experienced students of distance learning courses indicated that it had served them well and there was no prejudice by employers.

Attendance during discussion averaged about 20.

2003 Officers of Project 4:

Chairperson:	Mack Thompson University of Idaho 29603 U of I Lane Parma, ID 83660 208-722-6701 208-722-6708 thompson@uidaho.edu	Chairperson Elect:	Jed Colquhoun Oregon State University Department of Crop and Soil Sciences Crop Science Building 337 Corvalis, OR 97331 541-737-8868 541-737-1589 Jed.Colquhoun@orst.edu

PROJECT 5: WETLANDS AND WILDLANDS
Chairperson: Eric Lane

Topic 1: New regulations for herbicide use in aquatic environments: The Talent Irrigation Case and NPDES Permit Process.

Topic 2: Pending federal legislation concerning invasive plants: HR 1462, HR 3260, S 198, and NISA reauthorization.

Report for Project 5 not submitted.

PROJECT 6: BASIC SCIENCES
Chairperson: Paul Isakson

Topic: Genomics, potential uses in industry, academic and weed science

There were approximately 30 people attending this discussion session. Dr. David Fishhoff, President of Cereon Genomics, Dr. Michael Foley of USDA-ARS, and Dr. Bill Dyer of Montana State University initiated discussion with short presentations.

Dr. Fishhoff discussed the application of genomics in agricultural research and development. The presentation covered the concept of genomics, technology involved in genomics, and specific examples of the benefits of genomic research in agriculture. Examples include improved and new technologies, such as metabolic and protein profiles and transgenic expressions. In addition, the benefits of using genomics to understand gene function may provide opportunities to identify genes that control certain plant characteristics. There was general agreement that researchers in weed science may utilize markers and other advancement in genomics from other disciplines because weed scientists will not have the time and resources to develop many of these technologies. The discussion also focused on how genomics can be utilize to identify new herbicide target sites. The Ergosterol biosynthesis, a new target for fungicides was used as an example when fungicides developed to target the site without knowing the mode of action. In addition, there was interests in using genomics for advancement in the area of allelopathy. Several researchers are using genomics to develop rice and wheat with allelopathic properties.

Dr. Michael Foley discussed opportunities for utilizing genomics research in weed science. The opportunities in weeds or herbicides for genomics research is wide open. However, genomics research is very expensive so weed scientist's ability to utilize genomics may be limited by resources . Dr. Foley's research is focused on function genomics to investigate the dormancy in seeds and buds. Scientist have documented for many years that weed seeds and vegetative buds can be dormant and various treatments may be used to overcome the dormancy. However, the mechanisms, signal transduction and biochemical pathways, that directly regulate the dormancy and the transition from a dormant to a non-dormant state are not well understood. Development of fundamental knowledge on biology of weeds is important and will be key to improving existing and discovering new weed control strategies. Dr. Foley presented some of his research on wild oat where they constructed a preliminary linkage map of hexaploid wild oat using some recombinant inbred lines and AFLP techniques. The map cover about 814 cM and consists of 31 linkage groups. Dr. Foley also utilized Arabidopsis genomics research to understand seed dormancy of leafy spurge. He is currently examining the use of Arabidopsis cDNA microarray chips to investigate the dormancy in leafy spurge roots buds. The expressed genes from nondormant buds were labeled with green fluorescent dye and expressed genes from dormant buds with red fluorescent dye. The fractions were mixed in equal parts and applied to the microarray chip that contained Arabidopsis cDNA. The expressed genes bind to the DNA spots on the chip in amounts proportional to their expression. Red spots represent a gene that is disproportionately expressed in dormant buds and green spots genes that are highly expressed in nondormant buds. Yellow spots are genes that are equally expressed in both dormant and nondormant buds. This approach was used to pick up different patterns of gene expression in tissues. Research at Dr. Foley's lab showed that about 60% of the leafy spurge genes hybridized with Arabidopsis DNA.

Dr. Foley strongly promotes the use of crop or model system resources whenever possible because funding for weed genomics is very limited. Having an EST data base and DNA microarrays for spurge family would be a great advantage for leafy spurge genomics research. Therefore, research project was initiated at USDA-ARS to work on cassava, one of the few major crops in the spurge family. Cassava would be the focus and leafy spurge would be a component. The other example of crop resources that might be used to investigate some important questions on weeds such as jointed goatgrass is wheat, since they share a common ancestor. Depending on the research objectives, microarray approach may or may not be used. In any weed genomics research, the scientist must prioritize the research objectives, determine the best approach to address the objectives knowing the available resources for the species, and determine if you can utilize resources from other genome projects.

Dr. Bill Dyer discussed the implication of genomics research and graduate student training in the academic side. Areas of genomics research that fit the mission of the academic side are seed dormancy, root and bud sprouting, biological control agents, herbicide resistance, and genetic control and environmental effects on plasticity. Collaboration with scientists in other disciplines is very important to cut cost. Dr. Dyer also discussed graduate students training in genomics. The focus of graduate student training should be on functional genomics and provide a balance between different aspects of genomics.

2003 Officers of Project 6:

Chairperson:	Kassim Al-Khatib Agronomy Department 2004A Throckmorton Hall Kansas State University Manhattan, KS 66506	Chairperson-elect:	Kirk Howatt Department of plant sciences Loftsgard Hall 470F North Dakota State University Fargo, ND 58105

WSWS SUMMER BUSINESS MEETING
August 13, 2001
Little America Hotel and Towers, Salt Lake City, Utah

7:30 a.m. Continental breakfast
8:00 a.m. Call to Order - Jill Schroeder
Approval of Agenda
Minutes of 2001 WSWS Executive Board Meeting, March 15, 2001
Financial Report - Wanda Graves
Immediate Past President's Report - Don Morishita

Member-At-Large Report - Rick Boydston
Program Committee - Jill Schroeder
Research Section Report - Scott Nissen
Education and Regulatory Report - Phil Banks
Local Arrangements - Steve Dewey
WSSA Representative - Steve Miller
CAST Representative - Rod Lym (written report)

Committee Reports: (Board Contact)
- Awards - Phil Westra (Bob Parker)
- Nominations - Roland Schirman (Bob Parker)
- Site Selection - Corey Ransom (Don Morishita will present)
- Fellows and Honorary Members - John Orr (Don Morishita)
- Sustaining Membership - Traci Rauch (Don Morishita)
- Finance - Drew Lyon (Rich Zollinger)
- Necrology - Dennis Tonks (Rich Zollinger) (Nothing to report)
- Herbicide Resistant Plants - Dan Ball, Phil Banks (Rick Boydston)
- Resolutions - Jeff Herrmann (Rick Boydston) Nothing to report unless Jeff is at meeting
- Student Education Enhancement - Kirk Howatt (Rick Boydston)
- Legislative - Celestine Duncan (Steve Miller)
- Publications - Curt Thompson (Steve Miller)
- Placement - Mick Mickelson (Scott Nissen)
- Editorial - Joan Campbell, Don Morishita, Barbara Mullin, Donn Thill (Scott Nissen)
- Poster - Marvin Butler (Jill Schroeder)
- Student Paper Judging - Peter Dotray (Jill Schroeder)
- Public Relations - Kai Umeda (Phil Banks)
- Education - Scott Nissen, Celestine Duncan (Phil Banks)

Old Business:
- Knapweed Symposium Report
- Expanding WSWS Awards
- Using tradenames and product rates instead of common names and active ingredient

New Business:
- Increasing charge cost for the Proceedings and Research Progress Report
- Selecting an Editorial Committee Chair
- Number of Committee Members on each committee
- Official Policy for reimbursing outside speakers for symposia
  - Yes or No or Set Amount Per Individual Symposia?
- Change deadline for nominations for Fellow and Honorary Member Awards
- Electronic presentations in meetings

MINUTES OF THE 54th ANNUAL SUMMER BUSINESS MEETING
WESTERN SOCIETY OF WEED SCIENCE
LITTLE AMERICA HOTEL AND TOWERS, SALT LAKE CITY, UTAH
AUGUST 13, 2001

Call to Order - by Jill Schroeder
- Bob Parker was absent due to an operation. A get-well card was signed by all present.
- Approval of Agenda

Minutes - Jill Schroeder
Minutes of the WSWS Executive Board Meeting, March 15, 2001 was approved by motion and seconded by Steve Miller.

Financial Report - Wanda Graves
WSWS financial statement - April 1, 2001 through July 31, 2001.

Capital =		$343,995.57
Revolving Accounts =		
Weeds/West -	$126,232.19	
Noxious Short Course -	$14,859.11	
Bio Weed Cntrl Hndbk -	$52,351.44	$343,995.57
Knapweed Symposium	$4,880.44	
		$198,323.60
Total	$198,323.60	$145,671.97

All WSWS finances are in order. Finances for the boat cruise and the spouses breakfast at the last conference is in order. No surprise charges for the 2001 meetings. No payment has been received from Dow chemical company ($4,500) for the WSWS Breakfast Meeting. WSWS Awards luncheon cost $8,345. WSWS bought Wanda a new copy machine. Wanda resigned from providing accounting and financial services for two other societies. All revolving accounts are lumped together into one account which makes tracking interest for each account difficult. Clarification needed on contractual agreement with Montana Department of Agriculture for printing Biological Weed Control Handbook. Steve Miller moved to accept the submitted report. Seconded by Rick Boydston. Motion passed.

Immediate Past President's Report - Don Morishita
Recommendation was made to select an appropriate room for the "Member Welcome Reception" to accommodate the type of program. Motion to approve made by Rick Boydston. Seconded by Scott Nissen. Motion passed.

Member-At-Large Report - Rick Boydston
Reference was made for new awards to be discussed under "Old Business."

Program Committee - Jill Schroeder
Tentative 2002 General Session:

9:30	Welcome
9:40	Presidential Address - Bob Parker
10:00	Washington Liaison Report - Rob Hedberg
10:30	"Invasion Biology: A New Paradigm for Weed Science?" - Jodie Holt
11:15	Honorary Member Awards - John Orr, Presenting
11:30	Acceptance and Comments by Honorary Members followed by a brief question and answer period via video conference.

Topic introduced by Jodie Holt ("Invasion Biology: A New Paradigm for Weed Science?" was made to tie various groups together. Discussion about possibility of proposed Honorary Member recipient, Senator Larry Craig (ID) attending the general session. He may not be able to leave Washington on a Tuesday because the Senate would be in session. Discussion of action item to set up an interactive video conference for question and answer with Honorary Members. Possible solution to have an aid attend to represent the senator. It was recommended to determine capability of the hotel when hotel staff give a tour of the hotel after lunch.
Two Symposia proposed for 2002 meeting:
1. Herbicide Diagnostics by Bill Cobb -
WSWS should develop program by bringing in non-WSWS speakers.
2. FQPA's impact on herbicides and WSWS response - Sandra McDonald. Suggestion to have Sandra work with Steve Fennimore, Chair of the Horticulture Committee to further develop. Do not schedule in competition Graduate Student papers and/or the Agronomy Section.

Steve Miller made a motion to place the FQPA symposia topic as a component of the Education and Regulatory Session for a total of no more than one-half day time slot and to coordinate with Phil Banks, Chair of the Education and Regulatory Section to develop the complete program. Motion seconded by Don Morishita. Motion passed.

Don Morishita made a motion to accept the Herbicide Diagnostics symposium as proposed and that the society provide complimentary registrations for each of two total outside speakers. Steve Miller seconded the motion. Motion passed.

Gus Foster agreed to solicit sponsors for coffee breaks and meals as in past. Vince Ulstad agreed to coordinate and moderate the "What's New in Industry" session.

Research Section Report - Scott Nissen
Question as to who the chairs are for the Range and Agronomy Crops sections. Recommend that instructions to authors be revised for clarification on use of trade names. Electronic submission for research reports not possible until 2003 via web site. Proposed that WSWS Research Progress Reports be available on CD-ROM format which would reduce publication costs. Steve Miller made a motion that the Research Project Chair and the Editor study the feasability of converting to this format with the objective to standardize for electronic submissions of research reports and for CD-ROM format for research progress reports. Don Morishita seconded the motion. Motion passed.

The tendency for limited discussion at discussion sessions was discussed. It was recommended that all chairs of discussion sessions attend a meeting to explain responsibilities as written in the Manual of Operating Procedure. Motion to accept by Phil Banks. Seconded by Steve Miller. Motion passed.

Education and Regulatory Report - Phil Banks
Topic: Triazine Special Review: History, Process, progress, Findings, Future.
Discussion Leaders: Janis McFarland, Sungenta, Lois Rossi or Neal Anderson, U.S. EPA, Jere White, Kansas Corn Commission.
The board recommended that topics of FQPA and triazine regulations be combined into same session. Total time for discussion session no longer than three to fours hours. Bob Parker and Jill Schroeder both wanted clarification on minutes stating maximum dollars for speakers for the general session and Education and Regulatory Section. Steve Miller made a motion that WSWS would provide a maximum of $500 plus a complimentary registration. If chairs require more funding for speakers then they must submit a proposal to the board for their approval.

Local Arrangements - Steve Dewey
All arrangements for the meeting at Salt Lake City are in order. A tour of the hotel is scheduled by hotel staff at 12:30 p.m. A audio/visual technical person will be there to explain interactive capability. There has been a large turnover of contact people from the hotel. There is some concern with arrangements due to the Olympics and the Special Olympics held at the same time. The WSWS President will receive a complimentary room. A 10% discount will given to the block for graduate student rooms. Information on graduate student discounts and shuttle service provided by hotel will be disseminated in the WSWS newsletter. Most AV equipment, projectors, and cords could be provided by members of the society to save on meeting expenses. Screens would need to be provided by the hotel. Barb Mullin will be asked if there is a uniform set of signs for sessions.

WSSA Representative - Steve Miller
Member registration increase by $50 for 2002. Program to include two workshops, three symposia, 2002 meeting will include Sunday to Wednesday schedule but change to Monday through Thursday schedule. Mike Foley will replace Anne Legre as Director of Publications. Weed Science and Weed Technology will have mission statements developed. Herbicide Handbook available in early winter ($65.00/book). Site Selection: 2003 - Jacksonville, 2004 - Kansas City, 2005 - Hawaii, 2006 - New York 50th Anniversary Meeting. Director Education: WSSA co-sponsor symposia with ESA 2003 and WSSA web site top priority. WSSA has lost over 1,600 members last few year. LCD projectors will be used exclusively by WSSA starting in 2002 at Reno, NV. All paper submissions will done via web.

CAST Representative - Rod Lym (written report)
1. Dr. Teresa Gruber has now replaced Dr. Richard Stuckey as Executive Directory of CAST. Also, CAST will now have two offices. The main staff office will remain at Ames, IA but Dr. Gruber will be based in Washington, DC. She can be reached at: 505 Capitol Court, NE; Suite 200, Washington, DC 20002, Phone 202-675-8333, FAX 202-675-8334.

The program committee may want to consider inviting her to speak at our annual meeting. She has a reputation of being an outstanding speaker. Adding her to our program would help her to learn about WSWS and give our members an insight into where CAST is headed.
2. The Spring Board Meeting was held Washington DC during the WSWS annual meeting. I had been told this would not happen again. However, the 2001 board meeting in Washington DC is again being held the same week as WSWS. I have discussed this situation with Steve Miller, the former CAST rep. and he told me he never had this problem.
Action item. I am requesting a letter from President Parker to Teresa Gruber registering concern that CAST has begun scheduling its meetings over WSWS annual meetings. This situation requires either I get to the CAST meeting late or not at all, or miss the last day of the WSWS meeting which precludes me presenting the CAST report to our membership.
3 . As of June, the CAST financials resulted in an operating balance of ($18,648.58) for the month, bringing the year to date balance to ($182,386.90) based on the accrual accounting system. While CAST has experienced negative operating balances in previous years at this point in the year, CAST is at a deeper deficit now than in previous years. This is due in part to expenses relative to the executive vice president transition, higher than normal board meeting expenses for the spring meeting, computer/network upgrade expenses, and two additional executive committee meetings that were not budgeted.
4. The CAST Fall Board of Directors meeting will be September 20-22, 2001 at the Raleigh Marriott Crabtree Valley, Raleigh, North Carolina. I plan to be in attendance and represent WSWS.
5. Recent publications of special interest to WSWS include:
Vertical Coordination of Agriculture in Farming-Dependent Areas (Task Force Report No. 137, 40 pp. published in March 2001)
The Professional Portfolio: Beyond the Curriculum Vitae (Issue Paper No. 18 published in May 2001)
Reports in Progress:
Agriculture's Response to the Climate Change Challenge (Task Force Report)
Ethics in Agriculture (Issue Paper)
Evaluation of the U.S. Regulatory Process for Crops Developed through Biotechnology [former working title: Testing and Regulation of Crops Developed through Biotechnology for the U.S. Market] (Issue Paper)
Integrated Pest Management (Task Force Report)
Invasive Pest Species: Impacts on Agricultural Production, Natural Resources, and the Environment [former working title: Non-native Pests] (Issue Paper)
Natural Products Called Nutriceuticals (Issue Paper)
Urban Agriculture (Task Force Report)

Awards - Phil Westra (Bob Parker)
No written report was submitted.

Nominations - Roland Schirman (Bob Parker)
Nomination committee submitted the following for replacement on the ballot for the 2002 year: Pres. Elect - Gil Cook/Neal Hageman, Secretary - Tom Lanini/Bob Stougaard, Res. Section Chair-Elect: Dan Ball/Joe Di'Tomaso, Ed. & Reg. Chair-Elect - Monte Anderson/Todd Mayhew. Motion to accept report was made by Phil Banks. Seconded by Don Morishita. Motion passed. Steve Miller reported the difficulty in getting industry to serve in board positions.

Site Selection - Corey Ransom (Don Morishita)
Helms-Briscoe has suggested to WSWS to select meeting sites four years in advance to get lower room rates. Many hotels do not return bids because proposed rooms rates are too low. The board approved Colorado Spring, CO for 2004 and a motion was made by Steve Miller to investigate the following sites in the listed order:
1. British Columbia or Alberta (Calgary), Canada
2. Sacramento, CA
3. Nevada
Motion was seconded by Scott Nissen. Motion Passed. Interest in Canada was due in part by the value of the U.S. dollar in Canada. It was noted the efforts of Keith Duncan is appreciated but the Selection Committee will work primarily with Helms Briscoe in site selection and negotiating with particular hotels.

Fellows and Honorary Members - John Orr (Don Morishita)
The committee recommended that Dr. Phil Westra and Mr. Jeff Tichota be recipients of WSWS Fellows and Senator Larry Craig, U.S. Senator, ID as WSWS Honorary Member. Motion to accept written report and recommendations was made by Don Morishita. Seconded by Rick Boydston. Motion passed.

Sustaining Membership - Traci Rauch (Don Morishita)
Nineteen sustaining members contributed $6,200 for 2001. Idaho State Dept of Ag is a non-profit organization. The sustaining members list has been updated on the website. Action item of establishing a dues level for non-profit organizations and recommendation to establish dues levels of non-profit organizations = $100, organizations of less than $1 M = $200, and organizations of more than $1 M = $400 was discussed. Motion to accept action item as described in written report was made by Don Morishita. Seconded by Steve Miller. Motion passed.

Booth and table size should be standardized and that information should be contained in a letter to sustaining members. Those with questions or requests should contact the chair of the local arrangements.

Finance - Drew Lyon (Rich Zollinger)
The Finance Committee met via telephone in April and July to review quarterly investment reports and WSWS financial statements. It is our opinion that both the Treasurer and Investment Adviser are operating according to the WSWS Investment Policy Guidelines and Objectives.
Pursuant to the decision of the Board at the March Board meeting, $50,371 from the money market funds were used to purchase an investment grade DaimlerChrysler Corporate bond yielding 7.02% ($25,371) and a pool of investment grade Preferred securities yielding 7.32% ($25,000). The Merrill Lynch Mutual Funds Account had a March 31, 2001 balance of $186,778 and a June 30, 2001 balance of $201,543. As of June 30, 2001, the money market funds were valued at $27,986 and the checking account at $2,659. The committee recommended that the board consider increasing fees for the Proceedings and Research Progress Report to prevent WSWS loss in postage and shipping charges. The recommendation will be discussed under new business.

Necrology - Dennis Tonks (Rich Zollinger)
Nothing to report.
Herbicide Resistant Plants - Dan Ball, Phil Banks (Rick Boydston)
A discussion meeting may be planned in 2002 for those interested. Under new business, the number of committee members allowed was questioned.

Resolutions - Jeff Herrmann (Rick Boydston)
Nothing to report.

Student Education Enhancement - Kirk Howatt (Rick Boydston)
Graduate students from NDSU, KSU, and NMSU will participate with representatives from Dow, BASF, and Monsanto. It was recommended that the committee expand opportunities for students by contacting and allowing students to participate with national agencies like National Parks. All board members agreed but no motion was made.

Legislative - Roy Reichenbach (Steve Miller)
No report was submitted.

Publications - Curt Thompson (Steve Miller)
Update on the Weeds of the West: Sales have continued to average about 1000 copies per month. Currently we are sold out of the last printing. WSWS has been paid for all copies to the current date. There have been 110,000 copies sold for a profit of $180,000. Currently, 10,000 copies are being bound and should be available for sale sometime during August. All that WSWS owes currently is cost of this new printing. Special thanks to Tom Whitson for providing this information.
Barbra Mullin, project coordinator and member of the publications committee, recently requested that the Montana Department of Agriculture (MDA) review the current status of the WSWS publication *Biological Control of Weeds in the West* and consider that the terms of the contract [MDA 95-98] are met, which would currently close the contract. The director of the MDA has agreed to this request. The 1996 printing of 3000 copies is currently sold out.

The MDA requests that WSWS continue the revolving account for the book as long as there is a need. Barbra Mullin will continue as project coordinator. WSWS will continue to work closely with Janet Clark, with the Center for Invasive Plant Management, and Eric Coombs, with the Oregon Department of Agriculture, on an updated reference book and field guide for biological controls.
Janet Clark and MSU staff are working on finalizing a CD of the current publication. Additional update information is being developed on a web site by the Oregon Department of Agriculture. All individuals who have registered their copy of the book will be notified of this updated information.
Steve Miller made a motion that WSWS continue to act as a repository for Montana Department of Ag dollars and that Wanda Graves be compensated for accounting services. Seconded by Phil Banks. Motion passed.

Placement - Mick Mickelson (Scott Nissen)
Positions Available and Positions Desired binders were received from past chairman Doug West and will be updated throughout the upcoming year and will be made available at the 2002 WSWS annual meeting. An announcement will be included in the November and January WSWS newsletters that the Position Available and Position Desired sheets are available on the WSWS website or from myself. Steve Fennimore, WSSA Placement committee chair, will be contacted to attain the Position Available/Desired forms from the 2002 WSSA meeting and include them in the binders for the 2002 WSWS meeting.

Editorial - Joan Campbell, Don Morishita, Barbara Mullin, Donn Thill (Scott Nissen)
Newsletters - Previous issues have been published. Committee chairs were contacted for information to include in newsletters.
Proceedings -
1. The 2001 Proceedings had 162 pages. The cost per book was $8.50 with 398 books printed. The total cost of printing and shipping to Wanda was $3898.04. To break even, 260 books would need to be sold at $15.00. If it costs $2.00 postage for each book, about 300 books need to be sold to break even.
2. The minutes from the March 2001 board meeting and the March 2001 Business meeting were printed. The summer Board meeting 2001 should also be printed in the 2002 Proceedings as there is no other permanent record.
3.Of the 128 volunteered papers, four full-length papers and two abstracts with tables were submitted for printing in the 2001 Proceedings. No tables, figures, or full papers will printed in the 2002 Proceedings from volunteered papers. This will allow 100% online submission of volunteered papers. We will print full papers from the General Session.
4. The Call for Papers is being worked out with the Program Chairman and the Web Designer to include the information in paragraph 3 above. Also, the Call for Papers will require the submission of title and title summary by December 1, 2001 and the submission of abstracts by February 1, 2002. Abstracts must be submitted ready for printing. Revisions are no longer an option.
Action Items:
1. Board should discuss if the cost of the Proceedings is exceeding income? Cost should decrease a bit with fewer pages, but it won't be significant. Do we need to increase the charge? Perhaps we could keep it at $15.00 for the book, but add a $2.00 postage fee. I will try to negotiate a lower printing price next year.
2. Is there a need to have a permanent record of the board meeting that takes place immediately after the annual meeting? Should these minutes be printed along with minutes of the other three meetings?
Recommendation by committee: Print all minutes.
Steve Miller made a motion to increase charge to $5.00 a piece for each publication to account for increased postage charges. Seconded by Scott Nissen. Motion passed.
The board agreed that all minutes should be published in the Proceedings as a permanent record.

Web Site Report:
1. The on line paper submission program was rewritten for the 2001 meeting. The program is being rewritten again to accomodate changes in abstract submission for the 2002 meeting. This is mainly because the due date for the title and title summary are different from the due date for the abstract submission. The rewrite will take from 10 to 20 hours billed at $25.00 per hour.
2. There is interest in having a web-based course hosted on the WSWS site. Depending on the bandwidth requirements of the course, there may be an increase in fee for hosting the WSWS site. This would not take effect until after the March meeting at the earliest.

3. The new format for posting jobs has resulted in an increase in job posting activity. Society members should be encouraged to use the events posting page also.
Recommendation: Approve budget for rewrite of on line submission form.
Phil Banks made a motion to allocate $500 to revise the title submission form at web site. Seconded by Scott Nissen. Motion passed. Discussion for developing a web based course. A formal proposal would need to be submitted to the board.

Poster - Marvin Butler (Jill Schroeder)
Jay Gehrett reported at the business meeting in March that 50 posters were submitted for display at the Coeur d' Alene Resort in Coeur d' Alene, ID. Of those submitted, 14 were student posters.
Poster Committee members are Jay Gehrett (2002), Brenda Waters (2004) and Marvin Butler (2003), chairman for the 2002 meeting in Salt Lake, UT.
Poster easels and foamcore boards are currently being stored by Don Morishita at Twin Falls, ID and will be delivered for the 2002 meeting in Salt Lake, UT. Thanks go to Don for his willingness to perform this service for the committee.
Participation in the poster sessions has been maintained at 50 or above over the last 4 years:
1998 – 56, 1999 – 51, 2000 – 54, 2001 – 50. Selection of a room for the 2002 meeting site should reflect this level of participation.
It is recommended that the WSWS board consider having sustaining membership displays and coffee breaks in the same room to increase visibility and traffic.
Poster committee members will have the easels and foamboards ready for presenters prior to 4:30 p.m. on Monday.
Poster set-up will be available to presenters on Monday prior to the beginning of the conference from 4:30 to 9:00 p.m.. Exhibitors are responsible for posting materials (pins, velcro, etc). Authors must be present for the poster session Tuesday from 7:45 to 9:20 a.m.
Posters must be removed by 4:30 p.m. on Wednesday to facilitate packing easels and foamboards for shipment and storage for the 2003 site.

Student Paper Judging - Peter Dotray (Jill Schroeder)
The Student Paper Judging Committee has no additional news to report since the March meeting, but would like to restate results from the 2001 contest and restate two recommendations made at the March Board of Directors meeting.
Fourteen students participated in the poster contest and 16 students participated in the paper contest. The winners recognized at the business meeting were as follows:
Poster Section Group 1
First Place: David Belles, Colorado State university
Second Place: Lynn Fandrich, Colorado State University
Poster Section Group 2
First place: Todd Wehking, North Dakota State University
Second Place: Federico Trucco, Colorado State University
Paper Section Group 1
First Place: Oleg Daugovish, University of Idaho
Second Place: Nicole Wagner, Montana State University
Paper Section Group 2
First Place: Lee Van Wychen, Montana State University
Second Place: Johnathon Holman, Montana State University
Third Place: Branden Schiess, University of Idaho.
The poster and paper contest were both divided into two sections even though the WSWS 2000 Guidelines state that poster contests should only be split if the number of contestants exceeds 14. The committee felt it is nearly impossible to fairly judge every contestant in less than seven minutes on average; therefore, the poster section was split in half. The posters seemed to fit into applied ecology and resistance studies and university affiliations divided well between these two groups so that competition occurred between universities rather than within universities.
The committee recommends that the Paper Judging Chair have some discretion when organizing the poster section.
The committee also requests that student paper abstracts be sent to the Student Judging Chair for distribution to the judges before the meeting. Joan Campbell agreed to meet this request.

Public Relations - Kai Umeda (Phil Banks)
1) Continuing education hours were granted by states and sign-in/sign-out sheets were submitted to individual state regulatory agencies and Certified Crop Advisors (CCA). Colorado, Montana, Utah, Washington, and Wyoming were provided general sign-in/sign-out sheets signed by licensed attendees. Arizona, California, Idaho, New Mexico, and Oregon had unique individual requirements for sign-in/sign-out by licensed attendees. Representatives from Nevada provided a contact for future WSWS meetings to be accredited for CEU's by any licensed attendees from Nevada.
2) Jack Schlesselman was official photographer for the 2001 meeting and he provided photographs on a CD for inclusion on the WSWS web site. Pictures included Fellows and Honorary Member, Outstanding Weed Scientists and Presidential Award, WSWS officers and executive committee, student poster winners, and student paper winners.
3) Press release will be issued following September newsletter to announce the 2002 meeting in Salt Lake City. Inputs are requested for expansion of the distribution list for the press release.

Education - Scott Nissen, Celestine Duncan (Phil Banks)
Funding request to WSWS Board of Directors was proposed to support web hosting and maintenance of educational modules being developed as part of a grant proposal entitled Weed Science Electronic Modules 1. Herbicides Mode of Action and 2. Herbicide Resistance Weed Management. The modules will introduce learners to herbicide mode of action and resistence management. Lessons will be developed at several levels, suitable for producers, crop consultants as well as college students. Modules will include animations and text that could be downloaded and used in classroom or extension presentations.
Project PI's are Drs. Namuth and Fritz. BASF has granted non-exclusive rights to components from a training CD-ROM to enhance on-line lessons.
Other individuals collaborating on this project are: Scott Nissen, CSU, Anita Dille, KSU, Tracy Sterling, NMSU, Carol Malory-Smith, OSU, Alex Martin, Drew Lyon, Steve Knezavic, Brady Kappler, Deanna Namuth, Susan Fritz, Ron Roeber, Ashu Guru, and Todd Jensen, U of N, American Society of Agronomy, Mexican Association of Weed Science, Western Society of Weed Science, and several organizations within Mexico.
Scott Nissen proposed that these modules developed by specialists at University of Nebraska be moved to and permanently housed at WSWS web site.
1. Band width at WSWS site will need to be increased to show graphics. U. of NE specialists currently charge $20/month but will increase to $60/month to increase band width.
Scott Nissen has secured $50,000 funding from other sources. Scott requested a one time request of $5,000 composed of a $1,000 transfer fee and $4,000 for three to four years of monthly fees, increasing band width, program modification and maintenance.
Benefits to WSWS:
1. Will get exposure by being houses only at one exclusive web site.
2. Benefit to members - some board members questioned this.
3. Fulfil WSWS education directive of Service.
This will not be a source of money for WSWS as Weeds of the West.
Can publicize the modules in the newsletter and browsers.
Availability for CCA credits is under discussion.
Don Morishita proposed a motion to accept the proposal at a one-time funding of $5,000 to have the modules available through the WSWS web site and that WSWS will have sole access to the modules. Seconded by Steve Miller. Motion passed. Modules in development can be accessed at http://croptechnology.unl.edu/.

Noxious Weed Short Course - Steve Miller
The Noxious Weed Short Course sponsored by the WSWS was held in Bozeman, MT during April 2001. Both sessions were filled (35 each) with employees of USFS, BLM, Fish and Wildlife Service, and County Weed District superintendents. Instructors included: Dr. Rod Lym, Dr. Steve Dewey, Dr. Joe DiTomaso, Dr. Kurt Getsinger, Warren Ririe (USFS), Peter Rice, Barbra Mullin, Dr. Roger Sheley, Dr. Jim Jacobs, Rita Beard, Celestine Duncan, and Melissa Brown representing the Western Society of Weed Science. The committee greatly appreciates the support and assistance from all instructors. Comments regarding the course were very favorable, and there is a high level of interest in continuing the training in the present format. Participant evaluations ranked the course as excellent to good in terms of content and delivery. There continues to be a lot of interest in the course from federal

and state agencies. The April 2002 course will tentatively be held in Colorado. The current budget is $14859.11. There is a need for an advanced course. Alternating locations was discussed.

Old Business:

Knapweed Symposium Report
The 1st International Knapweed Symposium was held in March, 2000 at the 2000 WSWS Annual Meeting in Coeur d' Alene, Idaho. The planning committee included Linda Wilson, Lincoln Smith, Celestine Duncan, Jim Story, Barbara Mullin, Vanelle Carrithers, and Cindy Roche. Three hundred and fifty people from eleven western states, two Canadian provinces and four other countries attended. Sixty-seven presentations were made.
Action item: What is to be done with the $4,880.44 (as of 8/15/01) left over? The symposium organizers want WSWS to manage the funds. They may not hold another symposium in conjunction with WSWS for five years. Steve Miller made a motion that the funds left over from the Knapweed Symposium not be separated into a separate account but be combined with the money composed of the multiple revolving accounts, that WSWS will retain ownership of any interest accrued from the principle, and that the principle be made available to organizers of the next Knapweed Symposium upon request.

It was recommended that Wanda Graves be compensated for managing the various revolving accounts. Don Morishita will prepare a formal proposal to compensate Wanda Graves for managing revolving accounts.

The Operating Handbook needs to be updated with new policy changes found in past business meeting minutes. Don Morishita and Rick Boydston will review previous minutes and make the changes.

Expanding WSWS Awards - Richard Zollinger
Excluding Fellow Awards, it was proposed to institute WSWS awards available to WSWS members in both public and private sectors in the following areas:

Research	Extension
Teaching	Young Weed Scientist
Professional Staff	Weed Managers

Awards need not be given in every area each year. Bob Parker wanted more time to discuss before action was taken. The board directed a committee to have awards and requirements for each award ready for discussion and action at the next business meeting in Salt Lake City prior to the annual meeting. The committee is comprised of Richard Zollinger, Steve Miller, Jeff Tichota, Rick Boydston, and Brenda Water (Don Morishita will contact).

Using trade names and product rates instead of common names and active ingredient:
Discussed use of names in research progress reports. It is mandatory to put trade names as footnotes at bottom of tables and to use abbreviations to shorten length of trade names and names of premixes. Don Morishita made a motion for use of common names and active ingredient as currently directed and reports are to be rejected if not footnoted. Seconded by Steve Miller. After discussion the motion was amended by Phil Banks that when common names are used then trade names must be footnoted. Summary of vote: in favor = 1, against = 2, abstain = 3.
Scott Nissen will further clarify this topic and have a proposal ready at the next business meeting in March, 2002.

New Business:
Increasing charge cost for the Proceedings and Research Progress Report
See Editorial Section.

Selecting an Editorial Committee Chair
Guidelines for Editorial Committee: Combine editors into one committee. Don Morishita volunteered to oversee this action.

Discussion in combining the Resolution Committee with the Necrology Committee. Don Morishita made a motion to dissolve the Resolutions Committee and all future business be handled by the immediate past president. Seconded by Scott Nissen. Motion passed. This action needs member vote.

Number of Committee Members on each committee
Recommendation was made to make all committee chairs aware that the WSWS President will appoint all committee members.

The current copy of the Operating Guide needs to be posted on the web and updated often.

Official Policy for reimbursing outside speakers for symposia
Steve Miller made a motion for symposium organizers to propose symposium topics with budget to program chairs who then will forward to board for approval. Seconded by Scott Nissen. Motion failed. Phil Banks made a motion that for each approved symposium a maximum of $750 be available to support travel expenses for non-WSWS persons. Seconded by Don Morishita. Motion passed. This includes the symposium organized by Bill Cobb.

Change deadline for nominations for Fellow and Honorary Member Awards
The summer board meeting is being held later in summer rather than June. Don Morishita made a motion to change the deadline for nominating Fellow and Honorary Member to September 1. This will require an email vote by board. Information for nomination to go out in spring newsletter. Seconded by Phil Banks. Motion passed.

Electronic presentations in meetings
Steve Miller made a motion that WSWS not live in the dark ages and that WSWS follow the same change as other societies by using electronic presentation format beginning at the 2002 meeting. Seconded by Scott Nissen. Motion passed. Jill Schroeder and Don Morishita will develop instructions to authors. General recommendations: requires coordination of all section and project chairs, format be limited to CD-ROM or Zip disk, and Microsoft's PowerPoint will be the only format allowed. Scott Nissen is appointed as the point person for chairs in case of difficulty. Other guidelines for hardware and software specification need to be developed.

The next board meeting will be the Monday prior to annual WSWS conference in March, 2002, at the Little America Hotel and Towers, Salt Lake City, UT.
Meeting was adjourned at 4:30 p.m.

Respectively submitted,
Richard Zollinger

WESTERN SOCIETY OF WEED SCIENCE
EXECUTIVE COMMITTEE MEETING
LITTLE AMERICA HOTEL AND TOWERS, SALT LAKE CITY, UT

MONDAY, MARCH 11, 2002

Attendees: Bob Parker, Jill Schroeder, Richard Zollinger, Don Morishita, Wanda Graves, Phil Banks, Scott Nissen, Rick Boydston, Peter Dotray, Steve Miller, Corey Ransom, Linda Wilson, Rod Lym, Rob Hedberg, Barb Mullin, Joan Campbell

Call to Order: President Bob Parker called the meeting to order at 8:00 am.

Minutes: Richard Zollinger
The minutes of August 13, 2001 business meeting as mailed was approved by motion.

Financial Report: Wanda Graves
The WSWS is in good financial standing with a current balance of $352,924.92. Revolving account balances are $178,579.91 of the total capital. Revolving accounts hold funds to support Weed of the West ($83,432.19), Noxious Weed Short Course ($37,915.42), Biological Weed Control Handbook ($52,351.86), and Knapweed Symposium ($4,880.44). Capital is distributed as follows: Merrill Lynch Funds ($260,365.99), Money Market Savings ($60,195.23), and Checking Account ($32,363.70).

Immediate Past President's Report: Don Morishita
The Member Welcome and Retiree's reception is again sponsored by Monsanto Company. Five individuals have been identified as retirees. They are: Carl Buchholz, Dave Cudney, Clyde Elmore, Robert Norris, Claude Ross, and Tom Whitson. Rod Lym will be contacted to have more golf balls made with the WSWS insignia to give to retirees in the future.

Member-at-Large: Rick Boydston
Nothing to report.

Program Committee: Jill Schroeder
The program for the Salt Lake City meeting was completed January 18, printed and shipped to Wanda on January 28. I received all of the program information from the program committee, Joan Campbell, Gus Foster, and Steve Dewey in a timely manner. The cost of printing 800 copies was $531.88. We had a total of 150 submissions including 80 oral and 66 poster presentations representing all six projects plus 4 General Session presentations. A few changes to the program were made after it was printed so I prepared a handout detailing the program changes plus an updated list of sustaining members; copies will be available at the registration desk (attached, cost $51.00). Final numbers for the student competition are 17 participants in the poster competitions and 15 participants in the oral competitions. I worked with Pete Dotray, chair of the student competition committee, to organize the competition papers to allow for efficient judging and comparable judging conditions for all of the student participants. The competition will be completed on Tuesday.

The poster session will be split into two sessions on Tuesday and Wednesday because of the large number of submissions and the size of the room. The student competition posters will be presented on Tuesday and the noncompetition posters will be split between the Tuesday and Wednesday session. The student oral competition will be held in one session on Tuesday afternoon. Oral papers were submitted in three project areas but we combined them into a single session for the competition.

The biggest change for the 2002 meeting is that all oral presentations will be made using LCD projection equipment for the first time. We distributed instructions for authors via the call for papers, the January newsletter, and an email to corresponding authors in late February. Steve Dewey has worked hard to make sure that the facilities are in place to accommodate this change in projection style for the meeting. Oral presentations will be loaded onto a common computer each evening for presentation the following day.

The General Session will feature remarks by Bob Parker, Rob Hedberg, and Jodie Holt, plus the presentation of the 2002 Honorary Member Award by John Orr to Senator Larry Craig of Idaho. Senator Craig will address the session by teleconference followed by a short question and answer session if time permits. John Orr did all the work to coordinate this presentation with Senator Craig's staff. We had originally planned to set up a video-conference with the Senator; however, the cost to the society would have been prohibitive. John also worked with the Senator's staff to have the Senator prepare a videotape of his comments; however, they decided that he preferred to make his remarks via teleconference.

The program will also include a symposium on Wednesday p.m. "Techniques for Evaluating and Diagnosing Herbicide Problems". Bill Cobb proposed and organized this symposium. Vince Ulstad organized and will moderate the "What's New in Industry Session" on Wednesday afternoon. Scheduling for all of the sessions was a little tight since we had to schedule two separate poster sessions.

Acknowledgments
A lot of people worked to put together an excellent program for the 2002 WSWS meeting. The program committee included Phil Banks and Scott Nissen with the help of Sandra McDonald and the project section chairs. Bill Cobb organized the symposium; John Orr coordinated the presentation of the honorary member award, Peter Dotray took time to organizing the student competition, and Vince Ulstad organized the Industry Update. Gus Foster, as always, spent a great deal of time and effort to coordinate the sponsored breaks and meals. Steve Dewey has handled the hotel arrangements and obtained projection equipment and volunteers to help with set up and coordination of the sessions. Joan Campbell worked hard to make sure that abstract submission went smoothly and answered innumerable questions from authors and me. Steve Dewey, Don Morishita, Sandra McDonald, and Scott Nissen

helped draft the instructions for oral presentations. The publicity committee handled the accreditation process and Wanda Graves and Bob Parker provided the institutional memory and answered a lot of questions.
Recommendations
1. I recommend an addition to the operating guide for the President-elect to work with the Student Paper Judging Committee when organizing the program to ensure that the competition will run smoothly
2. The site selection committee should be aware of the fact that the poster session is growing. Hotels need to have a room large enough to accommodate the poster session.
3. I recommend that the refreshments for breaks continue to be set up near the sustaining member displays to encourage traffic by that area. However, we should try to avoid putting the refreshments by the posters to reduce general discussion during the poster session.

Research Section: Scott Nissen
1. Directions for editing and indexing research reports were provided to Project Chairs and Chair elects in mid-November by email. Additional emails were sent to remind people of their obligations to develop discussion topics and contact potential participants. Project chair and Chair-elects received instructions and suggestion designed to keep the quality of the discussion section as high as possible.

2. Project chairs did minor editing of research reports and submitted them to me in a timely manner. Reports were compiled, indexed, and forward to Research Report editor Barbra Mullin in early January. Approximately 99 Research Progress Reports were submitted for 2002 publication. Several Project Chairs had suggestions regarding directions to contributors and minimal requirements for statistical analysis. Statistics in research reports will be mandatory to be accepted for publication in the WSWS Research Progress Report. Methods to denote products and premixes by used of tradenames or active ingredients in text were discussed. The board designated a committee composed of Barbra Mullin, Scott Nissen, Steve Miller, Brian Jenks, George Beck, Dan Ball, and Joan Campbell to discuss options of designating products and premixes and provide a recommendation to the board for approval. The motion to change the format of the research progress report to CD-ROM passed. The committee listed above will also evaluate and make a recommendation to the board for posting research reports on the WSWS web site.

3. Discussion topics and Project Chairs are listed in the program.

Education and Regulatory: Phil Banks
At the summer Board of Director's meeting, a proposal was presented to have the section discuss the current status of the triazine special review that has been in progress at the EPA for the past several years. The topic was approved by the Board and a proposal by Sandra McDonald for a special symposium on the effect of the Food Quality Protection Act on herbicides was chosen to be included in the section. As Section Chair, I coordinated the selection of panelists for the two topics. Sandra contacted Allen Jennings, Director of the Office of Pest Management Policy at USDA, Neil Anderson, Office of Pesticide Programs at USEPA, and Rick Melnicoe, Director of the Western Region Pest Management Center and all agreed to participate in the FQPA portion of the program. Janis McFarland of Syngenta Crop Protection Company, Jere White, Executive Director of the Kansas Corn and Grain Sorghum Associations, and Lois Rossi, Director of Special Review and Reregistration Division at USEPA all agreed to participate in the session on the Triazine Special Review. Due to a conflict, Lois Rossi was unable to attend the meeting and Jack Housenger of the same office will participate instead. All speakers were contacted several times to inform them when our section was scheduled and to update them on the format of the presentations.
At the general session and during the Education & Regulatory Section, members will be asked for suggestions on topics for next year's meeting in Hawaii.

It would be extremely helpful in the future, if the society would allow for a set budget to fund travel for invited speakers in the section. While a small amount of money was approved for speaker travel at the summer board meeting, it would allow the section chair more flexibility in planning the session if a set budget existed. Final expenditures for speaker travel at the 2002 meeting will be minimal. I suggest adding wording to the manual of operation procedures for expenditures of up to $ 1000 to cover expenses for conducting the section. The motion was made and passed that WSWS will pay up to $1,000 for each of the General and Education and Regulatory Sessions for non-WSWS speakers to attend and present.

Local Arrangements: Steve Dewey

Committee members: Steve Dewey (chair), Melanie Ballard, Steve Burningham, Gil Cook, Earl Creech, Jack Evans, Bill Kral, Bill Mace, Phil Matooka, Scott Nissen, Travis Osmond, John Orr, and Tyler Watt. Others who will be assisting during the meetings include Susan Kelly, Alicia Murphy, Wade Bitner, Tom Lanini, Joe DiTomaso, Peter Dotray, Mark Renz. Gus Foster has been extremely helpful in coordinating sponsorship of meals and breaks associated with the meetings.

The 55th annual WSWS meeting is being held at the Little America Hotel in Salt Lake City, Utah, on March 11-14, 2002. The original contract agreement with the hotel was signed by John Orr on September 13, 1999. At that time the hotel reserved a block of 670 sleeping room nights for WSWS members from March 9 to 15. As of February 21, 2002, a total of 636 rooms had been filled (qualifying WSWS for at least 12 complimentary room nights), and it was anticipated that WSWS would easily fill the remainder of its room commitment.

The meeting rooms appear to be adequate in size, and are located near to one another in a convenient arrangement. However, due to a significant and unanticipated increase in the number of posters submitted this year (66), the intended display room was not large enough. No other single room was available that could accommodate all of the posters at once, so for the first time in WSWS history the poster presentations had to be divided into two sessions (Tuesday and Wednesday mornings). This will require a little more attention to timely set-up and take-down of posters, but is expected to be successful.

Coffee/juice breaks on Tuesday and Wednesday mornings will be set up in the Wyoming room where the commercial displays are located, rather than in the poster room. This is intended to minimize unnecessary noise and congestion during the poster sessions, and to help encourage more people to visit the display area.

This is the first year that WSWS has required all presenters to use computer-generated "Power Point" presentations, rather than 35-mm slides or overheads. To minimize any problems in using this technology, speakers are expected to download their presentations onto the hard drive of designated computers (and a backup computer) during the evening before their scheduled session. Our committee members attending the 2002 WSSA meetings in Reno observed their procedures for downloading and projecting Power Point presentations and have suggested some changes expected to further reduce potential problems. Unlike the WSSA system, we will be using 50-ft VGA cables between each laptop and its projector so that the computer will be at the podium with the speaker. This is expected to eliminate the too-frequent problems associated with the use of remote control units. We also will have a computer operations assistant seated at a table next to podium help the speaker with any problems that may develop. A modified room configuration and the use of lapel microphones is expected to improve the uninterrupted delivery of presentations, and to place the session moderator in better view of the speaker.

Our Local Arrangements committee is providing all of the laptop computers and projectors for each meeting room, and they are the ones who will be working in the "presentations loading room" every evening getting each speaker's Power Point file loaded. At the WSSA meetings, loading presentation files was the responsibility of each session chair. Our method takes considerable pressure off of the session chairs, and allows them to concentrate more on the speaker and keeping the sessions on schedule, rather than worrying about the computer. Although our method is more work for the Local Arrangements committee, I think it will result in fewer overall problems.

In spite of the decision for "all Power Point" decision, several presenters still have requested or almost insisted that they be allowed to use 35-mm slides and/or overheads. It is my opinion that having to provide each meeting room with up to 3 kinds of projectors puts an excessive burden on the Local Arrangements committee. In the future, if speakers insist on using 35-mm slides, I suggest that they get approval from their session chair, and that they be required to bring their own projector.

The hotel's Convention Services personnel have been unusually busy with the recent Winter Olympics, and now with the current Winter Paralympics. During the past year there has been considerable turnover in the hotel personnel assigned to oversee arrangements for the WSWS meeting. However, they have been very helpful and pleasant to work with; and it appears at this time that all arrangements have been completed, and that the hotel will provide the expected level of services and support for all functions. The only negative development to this point

seems to be that prices for hotel-catered meals and breaks are somewhat higher than has been experienced by WSWS in the past.
It was decided that there would be no special pre-conference tours or spouse's programs offered this year. There is generally very little agricultural activity in northern Utah during early March, and the majority of weeds are still snow-covered. However, there are numerous other sites of interest in Salt Lake City and surrounding areas that can be reached easily, including many of the Winter Olympic venues. It is recommended that individuals wishing to see any local attractions should contact the hotel front desk for ideas and assistance.

The committee looks forward to an excellent annual meeting at the Little America hotel in Salt Lake, and we appreciate all those who have helped or will help in making this experience a success.

WSSA Representative: Steve Miller
The 2002 meeting made money for the first time in three years due to increase in registration fees by $50, higher attendance, and inclusion of the invasive species workshop. WSWS will be well represented on the board for the coming year: C. Eberlein - Past President, D. Thill - 2nd VP, and C. Mallory-Smith - Treasurer. 2003 meeting will be in Jacksonville, FL and meeting structure will change by beginning on Monday evening with the Presidential Address and announcements of the Award winners followed by a reception and the meeting will conclude on Thursday. Most committee meetings will be held Monday PM or from 7:00 to 9:00 am on Tuesday and Wednesday before poster sessions. Future meeting sites: 2004 at Kansas City, 2005 at Hawaii, 2006 in the Northeast U.S. - possibly New York. The Strategic Plan is almost complete and will be voted on at the summer board meeting. Mission statements have been developed for Weed Science and Weed Technology. John Wilcott has replaced Larry Foy as editor of Weed Technology. Bob Zimdahl is serving his last year as editor of Weed Science. Mike Foley, the Director of Publications, is currently recruiting a replacement for Bob. Both Weed Science and Weed Technology are available on line. Members can access both through WSSA with membership number or Bioshere if your library is a subscriber. Allen press is developing a bid to remain as our headquarters office and management firm and will be voted on at the summer board meeting. Director of Science position (Rob Hedberg) is doing an excellent job. WSWS contributions will remain the same for several years. Funding the Director of Education position will be discussed at the summer board meeting. More emphasis will given to education both conventionally and electronically. WSWS will be asked to contribute. Direction from the board is solicited. WSWS is the only weed science society to maintain or increase membership. WSSA has gone from 3000 to 1900 members, NEWSS has lost 40%, SWSS 50%, and the NCWSS 30% of membership in last 5 years. This is a growing concern as industry mergers continue.

CAST Representative: Rod Lym
1. The reputation of CAST continues to grow in Washington DC. CAST has much more presence now that the Executive Director, Teresa Gruber, is based in DC. CAST members are called on nearly monthly to report at various congressional hearings on all type of topics concerning agriculture. With this recognition also comes some issues. Several times CAST has been requested to be an advocate for increased funding for Ag research. In a recent conference call of the National Concerns Committee it again came up in the discussion of a new issue paper which concerns the benefits of Ag research. CAST was founded as an advocate for Ag research but operating from a position of fairness in consideration of all sides of issues in making reports. Thus, it was agreed that the title of the new report(s) generated would be "Benefits From Agricultural Research" and CAST would not use the publication to lobby for new Ag funding.

2. CAST ended December with an operating balance of $126,138.44, bringing a year end balance of ($66,899.29) based on the accrual accounting system. Two of the major revenue sources that contributed to the high revenues in December were (1) the demutualization of the CAST insurer, which resulted in earnings $79,248 worth of stock, and (2) "earning" funds that were donated by CAST members, the Farm Foundation, and others for the biotechnology program. WSWS contributed $400 to the biotechnology program.

3. Last summer I reported that the Agricultural Research Institute (ARI) was exploring merging with CAST. An ad hoc Committee determined there was little interest from former ARI members in continuing the ARI name under the umbrella of CAST. All ARI Board member terms were allowed to expire and ARI will be dissolved with remaining assets transferred to CAST. Two ARI projects may be continued under CAST. These are: 1) the EPA contract with ARI to develop training programs for the worker protection standard and applicator training; and 2) the educational

fund for government personnel from EPA which was administered by ARI. Legal steps to dissolve ARI must be finished before CAST can continue these two projects.

4. The Spring Board Meeting is being held this week in Washington DC. Due to a mix-up in scheduling, CAST did not realize they had scheduled over the top of WSWS. We were not represented at the Spring 2001 meeting for the same reason, so I have elected to leave the WSWS meeting early this year. President Parker wrote a letter to Teresa Gruber last summer expressing our concern that for the last two years CAST has scheduled the spring meeting over the WSWS meeting. I am told it won't happen again.

5. CAST participated in the National Invasive Weeds Awareness Week held February 25 to March 1, 2002 in Washington, D.C. It was organized to focus national attention on the problems created by invasive weeds. Activities included a policy breakfast on key national invasive weed issues, meetings with Federal agencies, a poster session for federal policy makers showcasing invasive weed problems and innovative management strategies, a congressional reception, and a congressional briefing. Additional information is available at: www.nawma.org/niwaw.htm. CAST published an issue paper, "Invasive Plant Species", on the topic in 2000.

6. In May CAST will participate in an urban Ag symposium. "Urban Agriculture Symposium: Emerging Opportunities in Science, Education, and Policy" will define and describe the components and issues of urban agriculture and examine the common ground and opportunities that exist between urban and rural communities. The symposium will be May 20-22, 2002 in Dallas, Texas. More details are available at urbanag.tamu.edu. CAST will release a report on urban agriculture in conjunction with the symposium.

7. Forthcoming publications of special interest to WSWS include:

On March 7-8, 2002, CAST released "Invasive Species: Impacts on Agricultural Production, Natural Resources, and the Environment." (Issue Paper)
Agriculture's Response to the Climate Change Challenge (Report)
Comparisons of Environmental Benefits and Risks of Traditional and Biotechnology-derived Crops (Report)
Ethics in Agriculture (Issue Paper)
Management of Pest Resistance: Crop Management Strategies (Symposium)
Urban Agriculture (Report)

8. To be discussed, whether WSWS should participate in the "Membership Partners Program". This will be discussed during the "New Business" section of the meeting.

The most significant news is that Richard Stuckey is resigning as Executive Director of CAST. Candidates are being interviewed and an announcement is anticipated at the March 15 board meeting. Kay Niyo retired as scientific editor and was replaced by Linda Chimentia in January. The CAST spring, board meeting was held at the same time as the 2001WSWS meeting. Thus, WSWS was not represented. Rod spoke to Dr. Harold Coble, current CAST president, and was assured it wouldn't happen again. However, the 2002 CAST meeting is scheduled for March 14-16. CAST has over 2000 individual members and 38 society members. CAST has operated in the black for the past four years. CAST's reputation as a leading source for reliable information concerning the Agricultural Sciences continues to grow. Representatives of CAST are often called to testify at agricultural hearings in Washington D.C. and reports written and edited by CAST are often sought out as sources of up-to-date, unbiased data.

Committee Reports:

Awards: Phil Westra
No report was submitted.

Nominations: Roland Schirman
The 2001-02 Nominations committee consisting of Steve Miller, Don Morishita, Robert Wilson, and myself met during the Coeur d Alene meeting and developed a prioritized list of 4 member for each of the elective positions. I as chair contacted these persons in the order of priority until 2 candidates for each position were confirmed. The

proposed slate was submitted to the summer executive meeting and the ballot with biographical sketch was included with the membership the meeting notice mailing. The membership returned 121 ballots. Those who received the majority of the votes cast were: Gil Cook - President Elect, Bob Stougaard - Secretary, Dan Ball - Research Section Chair, Monte Anderson - Education & Regulatory Section Chair. One question that was raised during the election was if there could be electronic balloting. The person asking was wanting to e-mail their vote to the chair. Personally I could also see an electronic ballot offered on the Society web page. If this would increase the number of responses I feel it is a workable alternative. Steve Miller indicated he would accept email ballot for the next election.

Site Selection: Corey Ransom
The site election committee evaluated more than six potential sites for the 2004 annual meeting of the WSWS including Albuquerque NM, Anaheim CA, San Antonio TX, San Diego CA, Seattle WA, and Colorado Springs, CO. The site selection committee recommended the Doubletree Hotel, Colorado Springs, World Arena for the site of the 2004 meeting. The Doubletree quoted the lowest rates of any of the hotels contacted and since we held our meeting there previously it was clear that the hotel facilities were sufficient for our society. At the summer meeting the executive board agreed that the 2004 meeting should be held in Colorado Springs CO. The contract with the hotel was completed in September. Also at the summer meeting the site selection committee recommended that the Society consider selecting sites four years in advance instead of three. The reason for this recommendation was that some locations are already booked when we approach them and by selecting our sites one year earlier more options may be available. The board agreed and the site selection committee began looking at locations for the 2005 annual meeting. Three sites were considered included Portland Oregon, Seattle WA, and Vancouver BC. The site selection committee recommends to the board that the 2005 annual meeting be held in Vancouver BC. Two hotels in Vancouver BC have the capacity to hold our annual meeting and have quoted room rates within the societies range. Vancouver is a beautiful city with lots of recreational opportunities nearby. The disadvantages of having the annual meeting in Canada are that there will be some additional expense for air travel and items shipped into Canada must go through customs. Some members of the society have voiced concerns that BC is not a member of the Western society of Weed Science.

An additional item is that concerns have been voiced by members of the site selection committee as to whether or not using Helms-Briscoe to identify potential meeting locations results in increased room charges for the members of the society. While it is often possible to get rooms outside of our room block at a lower rate than specified in our contract, it is important to remember that all of the conference meeting rooms are provided free of charge as long as we meet the room block specified in the contract. Also prices may be slightly inflated at the time of our annual meeting because contracts are signed three or more years prior to our actual meeting dates. Kathy Tatom from Helms-Briscoe was in attendance to answer questions about how her company operates and how they are compensated for their services. She suggested that in many cases room rates may be reduced by using their services because they often have knowledge of what is happening in the industry and with specific hotels. The issue of how the committee interacts with Helms-Briscoe and other issues regarding what things should be included in hotel contracts need to be clarified in the operating guide.

Fellows and Honorary Members: John Orr
The committee received two new nominations for the 2002 Fellow Award for the public sector. In addition, a carry-over nomination was updated and was again placed in consideration for a total of three nominees. One new nomination was received for the private sector and one carry-over nomination was considered. The committee presented the following nominees to the board at the summer meeting and they were approved as Fellows of the Western Society of Weed Science:
Dr. Phil Westra, Professor of Weed Science, Colorado State University
Mr. Jeff Tichota, Agronomic Research Manager, Monsanto Company
Both individuals have contributed significantly to the WSWS and have positively influenced weed science and agriculture on a regional and national scale. They represent the highest standards set by the society in leadership and contribution. One nomination was received for Honorary Member and the board approved: Senator Larry Craig, United States Senator, Idaho. Senator Craig authored, introduced and helped pass the Plant Protection Act in 1999. He has been an effective and tireless voice for national action on the onslaught of invasive species. He has currently introduced the Harmful Weed Control Act of 2000 and is working on its passage. He has been a champion

of the federal government to be a "good neighbor" in effectively dealing with noxious weed infestations on federal lands and will continue this fight.

The committee has two very strong carry-over nominations for the Fellow award and no up-to-date Fellow nominations from the private sector. We will continue to encourage nominations for these prestigious awards by the normal channels of the newsletter and personal contacts. There are many deserving individuals that have yet to be nominated.

Sustaining Membership: Tracy Rauch
Seventeen sustaining members as of March 2, 2002 contributed $5,400 in member dues for the year 2002, as follows: AGSCO, Inc., Agriliance, LLC, Arvesta Corporation, (formally Tomen Agro, Inc.), Aventis CropSciences, BASF Corporation, Bayer, Corporation, Bellspray, Inc. dba R&D Sprayers, Dow AgroSciences, LLC, DuPont Crop Protection, Electronic Data Solutions, Helena Chemical Company, Marathon Agricultural and Environmental Consulting, Inc., Monsanto Company, PBI/Gordon Corporation, Syngenta Crop Protection, United Agri Products, Wilbur Ellis Company
The WSWS had a loss of 4 sustaining members from 2001: Idaho State Dept of Agriculture, Valent USA Corporation, Wendy Lopez & Associates Consulting, Rohm & Haas Company (acquisition by Dow AgroSciences, LLC), Letters were sent out to 2001 sustaining members and 59 prospective members. Two organizations responded to become sustaining members who were not so in 2001: Arvesta Corporation and Wilbur Ellis Company. A new dues level structure was passed at the summer meeting: a) Non-profit (public and private) organizations = $100, and b) Organizations with annual net revenues under $1 million - $200. Organizations with annual net revenues over $1 million - $400. A change will be made in the letters to all current and prospective members in 2002 to include the December 1st deadline for inclusion in the Annual Meeting Program.

Finance: Roger Gast
1. The Finance Committee met via telephone in April, July and November 2001 to review quarterly investment reports and WSWS financial statements. It plans to meet during the March 2002 WSWS annual meeting to audit finances and review fourth quarter 2001 statements. It is our opinion that both the Treasurer and Investment Adviser are operating according to the WSWS Investment Policy Guidelines and Objectives.
2. As previously reported, pursuant to the decision of the Board at the March, 2001 Board meeting, $50,371 from the money market funds were used to purchase an investment grade Daimler-Chrysler Corporate bond yielding 7.02% and a pool of investment grade preferred securities yielding 7.32% in 3/01. This Merrill Lynch account, including bond and money market funds, had total balance of $56,605 on December 31, 2001. The Merrill Lynch Mutual Funds Account had a December 31, 2001 balance of $192,264. Year-end combined value of these two accounts was $248,870.
3. The annual (12/31/00 – 12/31/01) rate of return for the combined accounts at Merrill Lynch was –8.40%. Although a net loss of value was incurred, this was a reasonable rate of return given the market conditions of 2001. At this time the value of equities is at approximately 75% of total investments, exceeding a 65% threshold stipulated by Investment Policy Guidelines.
4. As of January 31, 2002, the money market saving account was valued at $52,380 and the checking account at $26,950.
Recommendations:
1. Reallocate investments to bring equity investments in line with Investment Policy Guidelines. Merrill Lynch representative has recommended "Bank of America Preferred W Investment Grade, Current Yield: 6.9%, callable 12-15-06.
2.Use future income and gains to fund appropriate society projects and initiatives.

The motion passed for WSWS to use money from the Weeds of the West account to pay $40 per night hotel costs for up to three nights for only students giving papers or posters at the next WSWS meeting in Hawaii in 2003 .

The committee was asked to clarify the recommendation regarding reallocation of investments for action at the Thursday noon executive committee meeting. The board spent considerable time discussing how much time Wanda spends working with the revolving accounts. The board asked the committee to make a recommendation for increasing Wanda's compensation to be acted on at the Thursday executive committee meeting.

Necrology: Dennis Tonks
The committee received notification of one death this past year. Our thoughts and prayers are extended to the family of Sud Morishita. Sud Morishita died February 6, 2002, of complications following surgery. He was born September 18, 1920, at Shelley, Idaho and lived and worked in the Idaho Falls area all his life. Sud farmed for 34 years and worked 15 years as the Bonneville County Weed Control Superintendent. During his time as a weed control superintendent, Sud, along with several other weed superintendents, became a member of the Western Society of Weed Science. He thoroughly enjoyed learning more about weed control at each of the meetings he attended, as well as making friends with many WSWS members. In addition to the WSWS, Sud was an active member and past president of the Idaho Weed Control Association and a recipient of the Weed Worker Award from that organization. He also received the Doyle L. Scott Conservation Award from the Idaho Agricultural Soil Conservation Districts in 1988 and was named to the Eastern Idaho Agricultural Hall of Fame in 1994. Both awards were in part due to his involvement in weed management. Sud also served on the Idaho Soil Conservation Commission from 1988 to 1995. He is survived by his wife Ruth, four sons, four daughters-in-law, seven grandchildren, and three great-grandchildren.

Herbicide Resistant Plants: Dan Ball
There was no committee activity in 2001.

Resolutions: Jeff Herrmann
There were no resolutions submitted during 2001-2002.

Student Educational Enhancement: Linda Wilson
Announcements were placed on the WSWS website and advertised in the newsletter. Letters of requests for application were sent to 83 university research and extension faculty. Letters of request for application and application forms were sent to 25 university departments for circulation amongst their weed science graduate students.
Five students applied to the SEE Program in 2002: 2 students from the University of Idaho, 2 students from Kansas State University, and 1 from the Montana State University. The following arrangement for student and sponsor have been made.
Johnathon Holman from MSU to Marathon Ag & Environmental Consulting, Las Cruses, NM, , Tom Ireland from UI to Dow Agro-Sciences, Tampa, FL, Brad Hanson from UI to BASF, Longmont, CO, Katherin Schirmacher from KSU to Sygenta, Yakima, WA, Doug Shoup from KSU to BASF, Potlatch, ID.

Legislative: Roy Reichenbach
After some comfusion about the Chairmanship of the committee, I finally got some correspondence from Rob Hedberg toward the end of 2001.

Rob Hedberg reviewed and drafted comments on the preliminary risk assessment of atrazine and the hypothesized cascading impacts on the ecological communities. Some excellent testimony was provided on this issue. He is also looking at organophosphate issues and the mitigation of some of the impacts of this class of pesticides.

The WPS issue accomplishing were highly publicized to the members.

Rob has been working with CARAT and other EPA issues over the years to become familiar with the complex regulatory process. He also continues to work with FQPA, and CoFARM and CFAR on the broad issues of agricultural research funding. He chairs the NCFAR committee for research and is working toward increasing research funding dollars.

Rob continued to work with IWAC on the national Invasive Weed Awareness Week in Washington, DC, coordinated member applications to the ISC, and continues to work with FICMNEW on invasive weed issues.

An "All Weed Confernece" is being planned between the WSSA and the Ecological Society of America for November 2002. Nelroy Jackson is working with Rob on this conference. He is also working to get a Federal Weed Scientist Position into the federal system.

Legislation:
The Craig Bill S.198 is in the energy committee and may be ready to go after the energy bill is complete. It provides funding through USDI for weed management areas to the states. It is suggested that $100 million be provided for funding. John Randall with TNC testified that the western states could use $300 million annually to combat weeds.

The Hefley Bill H.R. 1462 is being marked up and heading out of committee and toward the house floor at any time. It is believed that Senator Craig will substitute this bill for his bill. It provides funding through USDI for weed management areas to the states.

Congressman Moran from Kansas has a bill H.R. 3260 that provide $25 million to USDA for noxious weeds for the states.

Congressman Rayhall has a bill H.R. 3558 called SPACE, Species Protection and Conservation and Environment. It is designed to manage invasive species and restore landscapes to eliminate invasive species.

There is also a BioTerrorism bill sponsored by Congressman Bob Ethridge of NC. If weeds could be added to the definition, then there would be funding for early detection and rapid response activities for invasive weeds.

The Presidents budget for 2003 contains a new section with $100 million funding for the Cooperative Conservation Initiative grant program. 50% goes to states and 50% goes to USDI agencies to protect species and invasive weeds may be a part of this initiative.

I did attend the WSSA Washington, D.C. Liaison Committee meeting, but not the Legislative Committee meeting.

Special Report: Operating Guidelines
1. A conference call was scheduled for March 7, 2002, but most of the committee members and past members had other obligations appear at the time the call was scheduled. The time frame was too short to get another conference call put together that worked for everyone after the first call was missed.
2. Some proposed changes were developed by those on the call to be sent to the other committee members and past committee members for consideration.
3. A number of questions were raised and need to be answered before a recommendation to the Executive Board could be finalized.
   A. Should we stay with 2 year terms or go with 3 year terms?
   B. Should the Chairman serve a 1 year term or a two year term?
   C. Should the past chairman serve a 1 year term?
   D. Are the current members satisfied with the current expiration date of their terms? Cel (2002), Roy (2003), Jeffrey (2004) - It appears that members are now being appointed for 3 year terms even though the operating guide says 2 years.
   E. Does Jeff want to be the Chair for 2002? So that Roy only serves 1 term? Or should we stay with 2 years for the chairman?
   F. Does the terms expire at the end of the March meeting in the year indicated for each person?
   G. What does the consultant statement mean?
   H. What is the last part of #2 in the Operation Guide? Is it meant to say "and inform the Society membership on legislative issues?"

The board asked the Legislative Committee to clarify the duties and terms of the committee.

Publications: Curtis Thompson and Barb Mullin
Update on Weeds of the West:
Sales of Weeds of the West have continued to average about 1000 copies per month. A printing was completed fall of 2001. The current inventory is 9,100 books for a value of $118,000. As of February 26, 2002, The Weeds of the West account balance was $83,432.19. Total profit for WSWS to date is $201,732.19. Special thanks to Tom Whitson for providing this information.

Barbra Mullin requested that the Montana Department of Agriculture (MDA) review the current status of the WSWS publication *Biological Control of Weeds in the West* and consider the terms of the contract [MDA 95-98] are met, which would currently close the contract. The director of the MDA has agreed to this request. The 1996

printing of 3,000 copies is currently sold out. The MDA requests that WSWS continue managing the revolving account for the book as long as there is a need. Barabra Mullin will continue as project coordinator. WSWS will continue to work closely with Janet Clark, with the Center for Invasive Plant Managment, and Eric Coombs, with the Oregon Department of Agriculture, on an updated reference book and field guide for biological controls. Janet Clark and MSU staff are working on finalizing a CD of the current publication. Additional update information is being developed on a web site by the Oregon Dept of Ag. All individuals who have registered their copy of the book will be notified of this updated information.

The following as an update on the book project, "Biological Control of Invasive Plants in the United States," for the WSWS Publications Committee: We have received updates for almost all chapters in the previous publication ("Biological Control of Weeds in the West"), new information about aquatic weeds and eastern invasives, and manuscripts for the theory and how-to chapters that we are adding up front (see attached Tentative Outline). First-draft manuscripts for new chapters are due March 15. The book will cover about 40 weeds and more than 100 biological control agents. There are 26 contributing authors from all over the country. A concept paper for the publication has been sent to Oregon State University Press, who is having the concept reviewed by two scientists before committing to publishing. The first review was very favorable; the second will be completed in a couple weeks. It seems likely that OSU Press will offer to publish the book. If so, and if they make a deal like the last book I did with them, they appreciate some guaranteed sales up front and a contribution to the publishing costs to the make the book affordable. This is something we negotiate, but for the last book ("Biology and Mgmt of Noxious Rangeland Weeds") we paid $10,000. In this case, the book will be bigger and have many more photos (therefore expense), so we might be requested to pay more -- that's just a guess. If this could come from the WSWS revolving fund, that would be great. And it might leave enough to publish a field guide. Other publication issues: OSU Press will hold the print and perhaps electronic copyrights to the book. However, they pay royalties (at a negotiated rate) and I would request that the royalties go to WSWS. OSU Press will do layout and design (with our input), manufacturing and publishing, marketing and advertising, sales and distribution. The book will be advertised on their web site and in catalogs. OSU Press has reciprocal agreements with many university presses. If OSU Press agrees to publish the book, we would expect to have it in
time for the 2003 field season. If OSU Press decides against publishing, we feel confident that other publishers would jump at the chance to be involved with this project.

Placement: Mick Michelson
Placement service forms ("Positions Available" and "Position Desired") were slightly revised. The forms were mailed out with the November, 2001 WSWS Newsletter and were made available on the WSWS web site. The placement books will be made available in the placement room at the 2002 WSWS annual meeting.

Editorial: Joan Campbell
NEWSLETTER REPORT - The WSWS newsletter was published four times last year; January, May, September, and November. I have attempted to include a 'Calendar of Events and 'News From Around the West' section in each issue. To obtain news from around the west, I have tried establishing a contact person from each state. This has worked with limited success. I would encourage any feedback on ideas to increase information for this part of the newsletter. Don Morishita will continue as the editor.

RESEARCH PROGRESS REPORT - We printed 350 copies of the Research Progress Report. Project 1 - 25 reports, Project 2 - 14 reports, Project 3 - 56 reports, Project 4 - 0, Project 5 - 4 reports, Project 6 - 0. Standard statistical analysis appropriate for data is required. We are planning to have the Research Progress Report on CD next year. Barbra Mullin will continue as the editor.

PROCEEDINGS REPORT - The on line submission of abstracts was close to 100% . Several authors were contacted after the February 1 deadline to submit an abstract; three authors (2%) did not submit an abstract at all. Omni Press has submitted a bid that is less than last year, so we are looking at about $2270 to print 300 copies. Donn Thill is resigning as co-editor and Joan Campbell will continue as editor.

WSWS WEB SITE REPORT - The on line paper submission program was rewritten for the 2002 meeting. The program worked well with a minor bug to fix after it was live. The request for presenting author will be added in again for next year. Cost of the rewrite was $500 (20 hours @$25.00 per hour). A separate majordomo mailing list was set up to contact all corresponding authors. This will continue in future years. The sustaining membership list

will have a link to each of their individual websites. Our hosting and support company has a new name, Tavistar Limited. The fee for hosting and web support has been split into two parts. Hosting will be $180 per year and support will $500 per year. The Weed Science Society of America would like to have a calendar page with a seamless link to the regional weed science societies. This would mean some standardization among the five societies. Activity on the Website averaged about 4000 hits per month and bandwidth averaged 81 Mbytes. The activity was highest in January at 4762 hits and 132 Mbytes. It is recommended that all committees and officers are requested to make a change to the operating guide to send pertinent information electronically to the web editor according to the time schedule for posting on the web (refer to Time Schedule for Web Editor Duties). It is recommended that WSWS sign a contract with Tavistar Limited (formerly Affirmative Technologies) for another year. The motion passed for WSWS to sign a contract with Tavistar Limited (formerly Affirmative Technologies) for another year.

Poster: Marvin Butler

Sixty-six posters will be presented in two sessions at the Ballroom Reception Foyer ABC. There will be 36 posters on Tuesday and 31 on Wednesday, for a total of 66. This compares to 50 in 2001, 54 in 2000, 51 in 1999 and 56 in 1998. "Guidelines for Preparation of Posters" was provided in the January edition of the WSWS Newsletter, and was also on the WSWS website. Set up for the Tuesday morning Poster Session (7:45 a.m. to 5:00 p.m.) will be from 4:00 p.m. to 11:00 p.m. Monday evening. Take down for Session A will be from 5:00 to 6:00 p.m. Tuesday evening, followed by set up for Session B from 6:00 to 11:00 p.m. Session B will be held Wednesday from 7:45 to 9:20 a.m., with poster removal from 6:00 to 7:00 p.m. Wednesday evening. Barbra Mullin is transporting the easels and foamboards to the meeting. Unless there are other arrangements, Marvin Butler will transport the poster equipment and store it at the Central Oregon Agricultural Research Center. A decision needs to be made concerning poster equipment for the Hawaii meeting; whether the society equipment will be transported to Hawaii or other arrangements will be made. If not used in Hawaii, the equipment will be used next at the Colorado Springs meeting in 2004. Brenda Waters will assume the chair of the poster committee for the 2003 meeting in Hawaii. Jed Colquhoun has accepted membership on the Poster Committee for the coming year to replace Jay Gehrett. The committee wishes to thank Jay for his service over the last 3 years.

Student Paper Judging: Peter Dotray

Poster Contest: There are 17 posters entered in the poster contest. This contest was divided into two sections (Poster Contest Group One is a mix of agronomy (5), horticulture (1), range and forestry (2), and basic sciences (1), and Poster Contest Group Two is all agronomic (8)). University affiliations were also considered in these groupings. Therefore, there are nine posters in Group One and eight posters in Group Two. All of these posters will be presented during Poster Session A. The student posters will alternate between non-student posters to ensure judges are not crowded and to allow judges space to tally their results. According to the WSWS 2001 Operating Guide, there will be three awards ($100, $75, $50) given in Poster Contest Group One and two awards ($100, $75) given in Poster Contest Group Two.

Paper Contest: The Student Paper Judging Committee appreciated the opportunity to provide input to the Program Committee. Jill Schroeder put a lot of time and care in the paper (and poster) contest and did an excellent job of communicating with our committee. The big change this year was putting all of the student paper contestants into one section. This section will eliminate differences in the room environment (equipment, stage lighting, microphones, pointers, etc.) and eliminate spreading contest sections over days. We believe this will highlight our student contest oral presentations and that this will be a premiere section at the WSWS annual meeting. We also look forward to comments (positive and negative) from the membership after the meeting. There are 14 papers entered in the paper contest. The paper contest was divided into two sections (Paper Contest Group One is all agronomic papers (8) and Paper Contest Group Two is a mixture of range and forestry (4) and horticulture (2)). There are eight papers in Group One and six papers in Group Two. Group One and Two papers will alternate during this section to ensure judges have time to tally their results. According to the WSWS Guidelines, there will be two awards ($100, $75) per paper contest section.

Judging: Sixteen judges and two alternates have committed to judge this year. Ten judges are affiliated with a university system, five from industry, and one from USDA-ARS. Committee: The Student Paper Judging Committee appreciated the work by Joan Campbell for her timeliness in getting the student abstracts to the Students Judging Chair two weeks before the meeting. These abstracts were distributed to the judges, along with instructions, before the meeting. No board action is requested this year.

Public Relations: Kia Umeda
A press release dated February 4, 2002 announced the 55th Annual Meeting of the WSWS and was distributed to WSSA Newsletter, American Society of Horticultural Science, Farm Press, Meister Publishing, Yuma, Daily Sun, Columbia Publishing/Carrot County, and Potato Country/Onion World. Continuing education hours requests for various state licensing requirements for attendees were submitted to: AR, CA, CO, ID, MT, NE, NV, NM, OR, UT, WA, and WY. Certified Crop Advisor (CCA) certification was not applied for. Requested from local arrangements chairs that CEU sign-in area be located near the registration desk with two 6 or 8 ft tables. Phil Banks and Kai Umeda will photograph traditional officer and award recipients following awards luncheon.

Education: Scott Nissen, Carol Malory-Smith, Celestine Duncan
Several members of the WSWS (Scott Nissen and Tracy Sterling) in conjugation with Dr. Deana Namuth, Distance Education Specialist, Department of Agronomy and Horticultural, University of Nebraska, Lincoln were funded through a competitive grant program in distance education (ADEC). The objective of this grant was to develop distance learning modules devoted to understanding herbicide mode of action. Lessons are being developed at introductory and advanced levels suitable for producers as well as college students. When completed each lesson will be a stand alone module providing high quality animations and up to date information on how herbicide work and how this information can be used to manage herbicide resistant weeds. Several lessons have been translated into Spanish. Nissen, Sterling and Namuth are actively involved in lesson development and are presenting an overview of the project in the Teaching and Technology Transfer Discussion Section at the 2002 meeting. Funding permitting, modules devoted to weed biology, ecology and resistance management will be developed. WSWS has committed $5,000 for transfer, maintenance, and web hosting of the completed modules. It is anticipated that transfer of this material to the WSWS website will take place in November or December of 2002. These materials will be available to download for classroom teaching and outreach education. The completed modules should increase the number of visitors to the WSWS website and increase the societies visibility. Those of us working to develop these modules would like express our appreciation to BASF for allowing us to use pictures, animations and illustrations from one of their computer based training modules.

The 2001 Noxious Weed Short Course sponsored by the WSWS was held in Bozeman, MT the last two weeks in April. Both sessions were filled (70 total) with employees of USFS, BLM, Fish and Wildlife Service, Dept. of Transportation, and County Weed District superintendents. Instructors included: Dr. Rod Lym, Dr. Steve Dewey, Barbra Mullin, Dr. Roger Sheley, Dr. Jim Jacobs, Dr. Joe DiTimaso, and Celestine Duncan representing the WSWS. Peter Rice, Dr. Kurt Getsinger, Melissa Brown, and Warren Ririe also taught portions of the workshop. The committee greatly appreciates the support and assistance from all instructors. Participant evaluations ranked the course as excellent to, good in terms of content and delivery. Comments regarding the course were very favorable, and there is a high level of interest in continuing the training in the present format. The course is designed to compliment the web-based weed science course being developed by CIPM. Two sessions of the course will be held in Loveland, CO from April 23 through 26, and April 28 through May 1. Both sessions have been filled since early December. There continues to be strong interest in the short course from federal and state agencies throughout Western states. The current budget is $37,115.42.

Old Business:
Future of Resolutions Committee: To drop the committee would require a change in the WSWS constitution. The proposed action would require WSWS member vote at the business meeting on Thursday morning; allow resolutions to handled by the past- president; and the WSWS constitution would be changed to the number of standing committees from 18 to 17.

Operating Guide: Responsibilities of Editorial Committee - The issue was tabled with the task given to Don Morishita to address this issue and provide recommendations back to the board.

Intermountain Agricultural Foundation: Roy Reichenbach
1) The Intermountain Agriculture Foundation (IAF) would like to thank the WSWS for their superior support of this project both logistically and financially. It has helped the IAF tremendously with getting the activity packets for the various regions organized, developed, and printed. The IAF is currently very close to having the west coast regions 1 and 1a completed.

As I reported at your board meeting on Monday, the IAF is going to a web based program for the activities for the third grade to reduce expenses. But we do need further support from the WSWS to complete the activity packets for Region 1 and 1a and develop the activities for Region 3.
I would like to suggest a $1000 contribution from the WSWS, but we would appreciate any funding you can provide. Thank you for your past and continued support for this project.

2) The Intermountain Agriculture Foundation (IAF) would like to thanks the WSWS for its superior support of this project both logistically and financially and hope that we continue to receive your support in the future. You have helped IAF tremendously with getting the activity packets for the various regions organized, developed, and printed and provided some leads for activity packet distribution.
Previous accomplishments: Video completed and widely distribution, Region 2 activities have been completed and distributed, Region 6 have been completed, Region 1 activities are nearly competed. 2001 accomplishments: Region 6 activities have been distributed to four state contacts, a five-year strategic plan developed by board of directors, Search for funds for the project. 2002 work: Locate contacts for Region 6, Develop relationship with the Center for Invasive Plant Management (CIPM) to place Regions 2 and 6 on their web-site at http://www.weedcenter.org, Complete Region 1 activities based on funds availability, Search for funds for the project, Place Region 1 activities on the CIPM web-site when complete, Develop a system to publicize the availability of the activities on the web-site. , Future work: **Complete Regions 3, 4, and 5 based on** availability of funds, Place Regions 3, 4, and 5 on the CIPM web-site when completed

Expansion of Awards: Rich Zollinger
A motion was passed to accept new WSWS awards available to both public and private members. Specific criteria outlined under each award was discussed and some changes were recommended. The board asked that the changes be made and a new version of the draft be discussed at the business meeting on Thursday, March 14. The board mandated that the draft copy be given to the Awards Committee for the finalization of evaluation criteria. The following gives an overview of awards available:
I. OUTSTANDING WEED SCIENTIST
II. OUTSTANDING WEED SCIENTIST - EARLY CAREER
III. WEED MANAGER
IV. PROFESSIONAL STAFF

New Business:
CAST's Membership Partners Program: A motion passed to accept the program in that one half of the membership fee of new members ($50) who join CAST will be given to WSWS. Fee membership forms contact Rod Lym.

Operating Guide: Clarification of Legislative Committee terms. Will be discussed and action taken later after committee deliberations.
The meeting was adjourned at 4:45 pm.

Respectively submitted,
Richard Zollinger
WSWS Secretary 2001-2002

WESTERN SOCIETY OF WEED SCIENCE
55TH ANNUAL BUSINESS MEETING
LITTLE AMERICA HOTEL AND TOWERS, SALT LAKE CITY, UT

THURSDAY, MARCH 14, 2002

Call to Order: President Bob Parker called the meeting to order at 8:00 am.

Minutes: Richard Zollinger
The minutes of March 15, 2001 business meeting as published in the proceedings was approved by motion.

All committees reported items discussed at the Monday, Executive Committee Meeting.

See Minutes of the Executive Committee Meeting held Monday, March 11, 2002 for minutes of each committee. New information was reported from the Student Paper **Judging Committee and action was taken regarding the Resolutions Committee.**

Student Paper Judging: Peter Dotray
There were 17 posters entered in the student poster contest and 14 papers entered in the student paper contest. Winners from the 2002 WSWS student poster/paper contest were:

Poster Section #1:	1st - Robin A. Marrs, Colorado State University,
	2nd - Kee-Woong Park, Oregon State University
	3rd - Jason N. Miller, Colorado State University
Poster Section #2:	1st - Harish T. Gandhi, Oregon State University
	2nd - Reginald D. Sterling, Colorado State University
Paper Section #1:	1st - Shannon M. Oltmans, North Dakota State University
	2nd - Matthew J. West, University of Idaho
	2nd - Craig M. Alford, University of Wyoming
Paper Section #2:	1st - Kenneth J. Deibert, North Dakota State University
	2nd - Maren E. Veatch, University of Arizona

New Business:
Future of Resolutions Committee: Bob Parker
The motion was made to discontinue the Resolutions committee as a standing committee; for future resolutions to be handled by the past president; and the WSWS constitution to be changed to the number of standing committees from 18 to 17. Motion passed.

Respectively submitted,
Richard Zollinger
WSWS Secretary 2001-2002

MARCH 14, 2002
EXECUTIVE COMMITTEE MEETING – CLOSING SESSION

The purpose of the meeting was to discuss the positive and negative aspects of the recently adjourned 2002 WSWS meeting in Salt Lake City and to discuss logistical issues pertaining to the 2003 meeting to be held in Hawaii.

Graduate Students

Paper Session
Since the student paper session always conflicts with a project discussion session, it was suggested that there be a rotation among the various projects. In this manner, no single project discussion session would continually be in conflict with the student paper session.

Poster Session:
Two poster sessions were held this year. The decision to have more than one poster session is typically a function of the number of posters submitted as well as the amount of available space. However, there was a discussion as to whether or not there should continually be two poster sessions, one specifically for the graduate students. Although the separate room assigned to sustaining members helps reduce the amount of socializing, several committee members felt that it was still excessive. A separate session would hopefully reduce the amount of socializing and place the student posters in a more prominent position. Other suggestions included having a moderator oversee the student session and having the President make a comment during the general session, reminding the rank and file to respect those presenting posters.

Other:
It was suggested that the President or all officers of the executive committee attend the student breakfast.

Steve Dewey provided a proposal (attached) whereby students would participate in sponsored activities during Tuesday and Wednesday evenings. On Tuesday evening private or public sector weed scientists would volunteer to take 3 or 4 graduate students out to dinner. Major professors would not be invited. It would be just an informal

evening of conversation and getting acquainted with people and programs. On Wednesday evening it was suggested that the Board host a reception exclusively for students and Board members, allowing students to inform Board members of current student issues, needs, and concerns.

It was suggested that the graduated students be contacted to seek their input on what was desired. Furthermore, it was suggested that an Ad Hoc committee be formed based on Steve Dewey's proposal.

Undergraduates:
It was suggested that undergraduates be actively recruited to attend the annual meeting and that a separate undergraduate contest be held.

Oral Papers

The switch to LCD projectors was judged a huge success. The use of a computer operator on stage as well as the moderator resulted in a smooth transition between speakers. However, there needs to be a mechanism that enables more than one computer operator to rotate in and out of the sessions.

It was determined that we do not want to use a remote mouse and that cables may need to be purchased. Laser pointers had a tendency to walk off and may need to be tethered to the podiums. Steve Dewey noted that the time set aside for authors to load presentations was excessive and should be shortened. It was also suggested that CD's could be mailed ahead of time in order to be loaded. Also, authors could leave their CD along with instructions (name, title, time) at a designated drop-off point during the meeting.

Awards

On Monday, the board accepted the proposal to add several new awards. The criteria for these awards needed to go through the Awards Committee and Rich Zollinger was going to work with Paul Ogg on this. Once the motion is in final form, the proposal can be voted on during the summer Board meeting. The criteria for the new awards will be published in the newsletter. Since additional awards will be presented, the awards committee may need additional members: This issue should be raised with the committee chair.

Finance

Nelroy Jackson submitted several recommendations from the Finance Committee for the Board's approval.

It was moved (Jackson) and seconded (Stougaard) to re-balance the investment portfolio to the target of 65% in stock mutual accounts and 35% in fixed income accounts. Motion passed unanimously.

It was moved (Jackson) and seconded (Miller) to increase the annual salary of the Treasurer/Business Manager from $8,400.00 to $12,000.00 per year, effective March 1, 2002. Motion passed unanimously.

It was moved (Jackson) and seconded (Morishita) to purchase a new desktop computer plus needed software for the Treasure/Business Manager position. Motion passed unanimously.

It was recommended that a subsidy of $240 for each student be provided for the annual meeting in Hawaii provided he/she presents a poster or oral paper. This item was tabled pending recommendations from the graduate student Ad Hoc committee.

It was recommended that an overhead charge be placed on revolving accounts. A discussion ensued regarding the definition of revolving accounts. It was decided to seek additional input from the finance committee before a decision would be made.

The finance committee also recommended that the WSWS consider options for increasing our contribution to the Director of Science Policy which is occupied by Rob Hedberg. Formula funding may change in the near future.

Future Meetings

Hawaii
Easels were shipped to and from Hawaii during the last visit and Phil Motooka was able to provide used poster boards on site. It was suggested that we again ship the easels to Hawaii.

British Columbia
British Columbia is not currently part of the WSWS which may preclude the society from holding its meeting there. It was suggested that someone from British Columbia write the WSWS to formally request membership. Once their request has been approved, the local arrangements committee can initiate efforts to determine the most appropriate meeting site.

Summer Board Meeting
The summer board meeting will be held on August 16th in Phoenix AZ.

Respectively submitted,

Bob Stougaard
Secretary

WESTERN SOCIETY OF WEED SCIENCE
FINANCIAL STATEMENT
APRIL 1, 2001 THROUGH MARCH 31, 2002

	2001	2002
INCOME		
Registration & Membership Dues	1583.00	24,824.00
Proceedings	912.47	3,938.50
Research Progress Report	563.80	3,045.50
Weeds of the West Book	122,234.90	
Bio Handbook	325.00	
Noxious Weed Short Course	38,124.00	
Promotional Hats	168.00	
Bank Interest	664.54	
Contributions to General Fund		5,000.00
Sustaining Membership Dues		5,400.00
Business Breakfast – 2001 conference contribution	5,000.00	
	$211,783.71	
EXPENSES		
Office Supplies & Equipment	$1,567.29	
Telephone	1,274.52	
Postage & Shipping	2,358.93	
Storage	478.00	
Web Site	570.00	
Tax Accountant	220.00	
Franchise Tax Board	10.00	
WSSA Washington Liaison Rep	7,683.17	
CAST	946.00	
Bio Handbook	41.21	
Knapweed Symposium	12,759.81	
Noxious Weed Short Course	29,530.54	
Weeds of the West Book	109,213.00	
Printing		
Newsletters	475.47	1,234.52
Proceedings	3,889.71	
Research Progress Reports		3,563.08
Envelopes, Forms, etc.	363.72	
Programs		582.94
Student Awards & Room Subsidy	268.14	1,000.00
Business Manager Salary	8,700.00	
Executive Board & Committee Meetings	1,308.86	1,293.99
Awards Luncheon & Plaques		7,418.73
Audio Visual Rental		3,097.67
Proceedings & RPR Editor's Travel		180.74
Registration Refunds	105.00	225.00
		$200,360.04

WESTERN SOCIETY OF WEED SCIENCE

FINANCIAL STATEMENT

APRIL 1, 2001 THROUGH MARCH 31, 2002

CAPITAL

2000-01 Balance Forward	$323,191.98
Current Income	11,423.67
	$334,615.65

DISTRIBUTION OF CAPITAL

Merrill Lynch Funds	260,365.99
Money Market Savings	64,244.28
Checking Account	10,005.38
	$334,615.65

Revolving Account Balances Included in Total Capital

Weeds of the West	$83,219.19
Noxious Weed Short Course	32,212.70
Bio Handbook	52,351.86
Knapweed Symposium	4,880.44
Total Revolving Accounts	***$173,090.19***

U.S HONORARY MEMBER WSWS
SENATOR LARRY CRAIG-IDAHO

It is my pleasure to present the Honorary Member Award of the Western Society of Weed Science to U.S. Senator Larry Craig of Idaho. A third generation Westerner and former rancher, Senator Larry Craig was born and raised on the family ranch homesteaded by his grandfather in 1899 near Midvale, Idaho. Early in life he became involved in agriculture issues by becoming active in the Future Farmers of America (FFA) at Midvale High. He was elected Idaho State President and National Vice President of FFA.

After graduating from the University of Idaho where he was elected Student Body President, he pursued graduate studies before returning to the family ranching business in 1971. In 1974, he began his political career by being elected to the Idaho State Senate, where he served three terms. In 1980 he was elected to the U.S. Congress from Idaho's First Congressional District. He was elected to Congress four times, and then was elected to the U.S. Senate in 1990 and again in 1996.

U.S Senator Larry Craig has been an effective and tireless voice for greater national action to deal with the onslaught of invasive weeds across the lands of Idaho, the West and the United States. He is a great believer in the power of local initiative and action, and has worked to build local capacity through obtaining greater federal funding in support of local weed management areas. This "grass-roots" action approach is reflected in the language of Senate bill 198 "The Harmful Nonnative Weed Control Act of 2000" which he drafted and introduced in the 107th Congress and is working to pass.

Senator Craig also authored, introduced and passed the Plant Protection Act in 1999, which streamlined and modernized U.S. Department of Agriculture plant inspection and quarantine authorities. To obtain local input for this legislation, he sponsored a number of hearings across the West giving citizens an opportunity to testify and offer suggestions for improving the bill.

He has also spoken forcefully about the need for the federal government to be a "good neighbor" to more effectively and aggressively deal with weed infestations on the extensive federal lands of the West. He, along with other legislators, signed a number of letters to the President and Executive Branch urging greater federal action and funding to deal with destructive invasive species.

He has orchestrated the allocation of federal funding to assist in the implementation of Idaho's ***Strategic Plan for Managing Noxious Weeds,*** obtaining $1.5 million for cooperative weed work in Idaho for federal fiscal years 2000 and 2001. Senator Craig and his staff were also instrumental in amending language in the federal fire plan funding process to provide for critical noxious weed control work on state and private lands adjacent to the national forest lands that were burned in the 2000 wildfires.

Senator Craig has personally taken the time to visit with local weed fighters to view weed impacts up-close and to see the importance of local leadership and action. These visits have helped him to fashion common-sense language in the legislation he has introduced and to inspire local weed management leaders.

For his tireless efforts and forceful leadership, U.S Senator Larry Craig is eminently deserving of the Western Society of Weed Science's Honorary Member Award for 2002.

Jodie Holt, General Session Keynote Address

2002-2003 Officers and Executive Committee

JEFF TICHOTA
FELLOW WSWS

It is with great pleasure that Jeff Tichota is recognized as Fellow of the Western Society of Weed Science. Jeff received his BS in Plant Science and MS in Weed Science from South Dakota State University. He began his professional career with Uniroyal Chemical in 1976. In 1977, he went to work for Velsicol Chemical as a field rep and became a Field Manager in1979. He continued in that position through the merger with Sandoz until 1997 at which time he went to work for Monsanto. He has held several management positions with Monsanto since that time and currently is the Agronomic Research Manager for Colorado, SE Wyoming, and Western Nebraska. He has been a member of WSWS since 1981. Jeff has actively served western agriculture as well as the WSWS and has been recognized by industry for his contributions. He has served the Society on the Nomination and Finance committees and moderated "What's New From Industry" sessions before becoming the Program Chair and President. He was selected for the WSWS Outstanding Weed Science Award in 1997. He has actively supported the Student Educational Enhancement Program and encouraged other field representatives to be more active in this endeavor. He received the Monsanto Award for Technical Excellence in 1999.

Jeff has authored or co-authored four papers in the WSWS. Additionally, he has published papers in the NCWSS and the WSSA. His research efforts with dicamba, glyphosate and Frontier herbicides have been instrumental in obtaining and fine-tuning the labels and use patterns of these products.

Some of the quotes from his nomination letters indicate the high values that Jeff has placed on his relationships with cooperators and peers in weed science and are as follows:

"Jeff demonstrates a high level of dedication and enthusiasm for weed science in the western United States that serves as a model for many professionals in our discipline. Jeff's long and distinguished career in the weed science private sector, coupled with his enthusiastic support of university research programs makes him an excellent candidate for this award".

"He is a very dedicated and committed individual who has made numerous contributions to his profession as a weed scientist. Jeff is very knowledgeable, honest, ethical, and just a great individual to be around. He always projects a positive attitude and optimistic viewpoint".

"Jeff strives to be the best and represents the agricultural crop protection industry in a positive manner. A key quality of Jeff is that he will always ask, 'how can I help?"

It is with great pleasure to recognize Jeff Tichota, WSWS Fellow 2002.

DR. PHILIP WESTRA
FELLOW WSWS

It is with great pleasure that Dr. Philip Westra is recognized as Fellow of the Western Society of Weed Science. Phil received his B.A. degree in Philosophy from the University of Wisconsin, another B.A. degree in Secondary Education from Calvin College and his Ph.D. in Agronomy/Plant Genetics from the University of Minnesota. From 1980-1985, he was a Missionary Agronomist in Ecuador. He then joined Colorado State University, where he currently resides as Professor in the Department of Bioagriculture and Pest Management. Phil has been a member of the WSWS for over 16 years. He has served the Society as member-at-large, and on the resolutions, placement, student paper judging and herbicide resistant weeds committees. He was named the WSWS Outstanding Weed Scientist-Public Sector in 1999. He has also been active in the North Central Weed Science Society where he has served on the board. Phil has been active in both the national and international weed science arenas. He is currently a member of the WSSA where he has been involved in the photo contest, liaison committee, international affairs committee, publications board, awards committee, herbicide resistant weeds committee and the sustainable ag committee. He was named the WSSA Outstanding Extension Weed Science Worker of the Year in 1998.

Dr. Westra is dedicated to graduate student education. Four M.S. students and 11 Ph.D. students completed their degree programs under his direction and counsel since 1985. Additionally, 5 M.S. and 5 Ph.D. students are currently in his program. Phil has amassed outstanding research productivity with 28 refereed journal manuscripts in the past six years. Additionally, he and his students have given over 60 papers at the WSWS and WSSA meetings. At least one of Phil's students has placed in the WSWS Graduate Student Paper Competition each year since 1995, again a testimonial to Phil's dedication to his students.

In addition to the above awards, Phil has received many other honors and awards during his career. He was recipient of the Outstanding Graduate Student Award from the WSSA in 1979. In 1980, he received the Outstanding Graduate Student of the Year Award from the North Central Weed Control Conference and in 1981 was the co-author of the Outstanding Publication of the Year in Weed Science. Phil's reputation as an excellent educator was recognized in 1996 when the Rocky Mountain Plant Food Association awarded him the Outstanding Weed Scientist of the Year because of his dedication to weed science research and education.

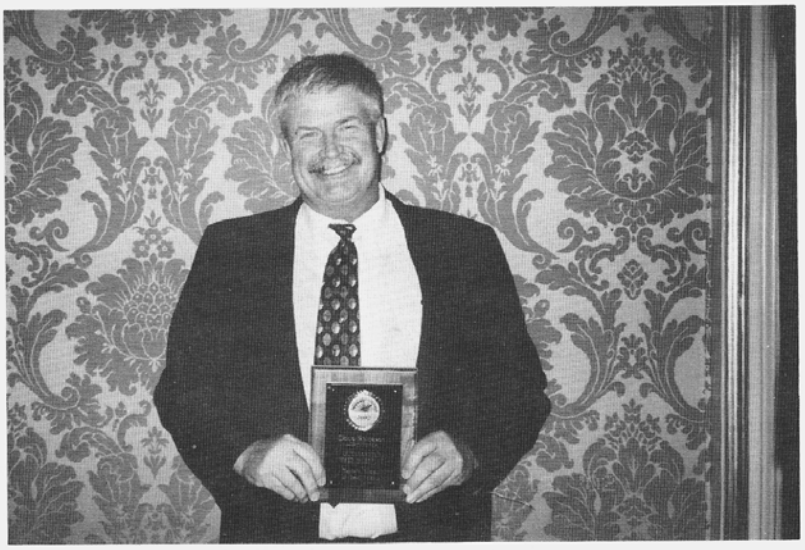
A quote from one of Dr. Westra's support letters probably sums it up best. "Dr. Westra is dedicated to the advancement of weed science. His outstanding publication record, commitment to his students and extension clientele, and service to our professional weed science societies have earned him an extraordinary reputation among our weed science colleagues."

It is with great pleasure that we recognize Dr. Phil Westra, WSWS Fellow, 2002.

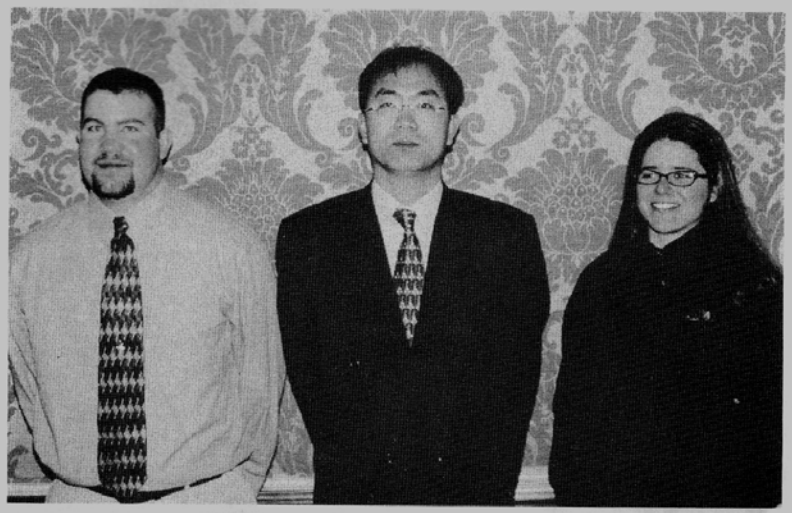
Jeff Tichota, 2002 Fellow WSWS

Dr. Philip Westra, 2002 Fellow WSWS

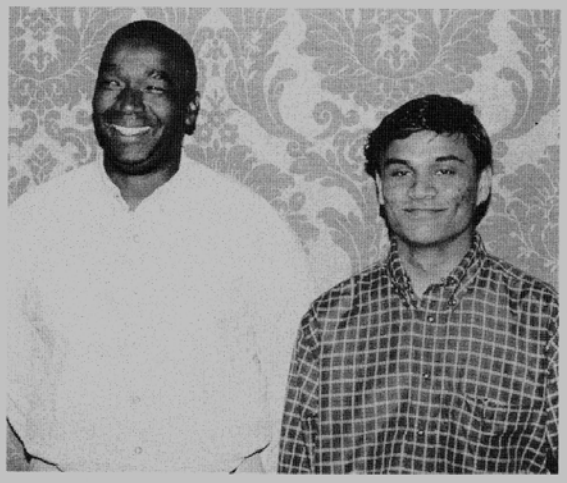
Tom Whitson, Presidential Award of Merit and Outstanding Weed Scientist, Public Sector



Doug Ryerson, 2002 WSWS Outstanding Weed Scientist, Private Sector



Student poster contest section 1: Robin Marrs, Colorado State univerity, 1st place (R), Kee-Woong Park, Oregon State Universtiy , 2nd place; Jason Miller colorado State University, 3rd place (L)



Student poster contest section 2:
Harish Gandhi, Oregon State University, 1st place (R) and Reginald Sterling, Colorado State University, 2nd place

Student oral paper contest section 1: Shannon Oltmans, North Dakota State University, 1st place; Mathew West, University of Idaho, 2nd place (L), Craig Alford, Universtiy of Wyoming, 3rd place (R)

Student oral paper contest section 2: 1st place winners
Maren Veatch, University of Arizona and Ken Deibert (R), North Dakota State University

NECROLOGY REPORT

Our thoughts and prayers are extended to the family of Sud Morishita. Sud Morishita died February 6, 2002, of complications following surgery. He was born September 18, 1920, at Shelley, Idaho and lived and worked in the Idaho Falls area all his life. Sud farmed for 34 years and worked 15 years as the Bonneville County Weed Control Superintendent. During his time as a weed control superintendent, Sud, along with several other weed superintendents, became a member of the Western Society of Weed Science. He thoroughly enjoyed learning more about weed control at each of the meetings he attended, as well as making friends with many WSWS members. In addition to the WSWS, Sud was an active member and past president of the Idaho Weed Control Association and a recipient of the Weed Worker Award from that organization. He also received the Doyle L. Scott Conservation Award from the Idaho Agricultural Soil Conservation Districts in 1988 and was named to the Eastern Idaho Agricultural Hall of Fame in 1994. Both awards were in part due to his involvement in weed management. Sud also served on the Idaho Soil Conservation Commission from 1988 to 1995. He is survived by his wife Ruth, four sons, four daughters-in-law, seven grandchildren, and three great-grandchildren.

Rich Affeldt
Dept of Crop & Soil Science
Oregon State University
Corvallis OR 97331
541-737-9108
rich.affeldt@orst.edu

Kassim Al-Khatib
Agronomy Dept
Kansas State University
Manhatten KS 66506
785-532-5155
khatib@ksu.edu

Craig Alford
University of Wyoming
P O Box 3354
Laramie WY 82071
307-766-3949
cmalford@uwyo.edu

Kim Anderson
Utah State University
4820 Old Main Hill
Logan UT 84322
435-797-2256

Jim Anderson
Bayer
2223 27th Ave Ct
Greeley CO 80634
970-339-5148

Monte Anderson
Aventis CropScience
16304 So Yancey Lane
Spangle WA 99031
509-443-8749
monte.anderson@aventis.com

Neil Anderson
US EPA Headquarters
1200 Pennsylvania Ave NW
Washington DC 20480
703-308-8187

Randy Anderson
USDA-ARS
2923 Medary Ave
Brookings SD 57006
605-693-5239

Ted Angle
BLM
P O Box 12000
Reno NV 89520
775-861-6401
tangle@nv.blm.gov

Rick Arnold
NMSU
P O Box 1018
Farmington NM 87499
505-327-7757
riarnold@nmsu.edu

John Baker
Fremont Co Weed & Pest
450 N 2nd Street Room 315
Lander WY 82520
307-332-1052
larbaker@wyoming.com

Dan Ball
OSU Columbia Basin Ag Res
P O Box 370
Pendleton OR 97801
541-278-4394
daniel-ball@orst.edu

Melanie Ballard
Utah State University
4820 Old Main Hill
Logan UT 84322
435-797-2256

Phil Banks
Marathon-Agri & Env Cons
2649 Navajo Road
Las Cruces NM 88005
505-527-8853
Marathonag@zianet.com

James Barnhill
Utah State University
1181 N Fairgrounds Dr
Ogden UT 84404
801-399-8208
jamesb@ext.usu.edu

Rita Beard
U S Forest Service
2150 Centre Ave
Ft Collins CO 80525
970-295-5745
rbeard@fs.fed.us

George Beck
Colorado State University
116 Weed Research Lab
Ft Collins CO 80523
970-491-7568
gbeck@lamar.colostate.edu

Tom Beckett
Syngenta
498 N Mariposa
Visalia CA 93277
559-735-2204
tom.beckett@syngenta.com

Carl Bell
UCCE
5555 overland Ave
San Diego CA 92116
858-694-3386
cebell@ucdavis.edu

Bill Bellah
Greystone
260 S Cummings Ave
Buffalo WY 82834
307-684-5891
bbellah@greystone-cons.com

David Belles
BSPM Department
Colorado State University
Ft Collins CO 80523
970-491-5667
dbelles@lamar.colostate.edu

Warren Bendixen
UC Cooperative Extension
515 E Evergreen Avenue
Santa Maria CA 93454
805-934-6240

Larry Bennett
OSU Pendleton
707 SW 29th Street
Pendleton OR 97801
541-276-1904
larryhbennett@bigfoot.com

Dan Beran
BASF Corporation
1422 57th Place
Des Moines IA 50311
515-279-0895
berand@basf.com

Dan Bergman
Loveland Industries
P O Box 1289
Greeley CO 80632
970-356-8920
dan.bergman@loveland.uap

Brent Beutler
University of Idaho
P O Box 870
Aberdeen ID 83210
208-397-4181
brentb@uidaho.edu

Laylah Bewick
Washington State University
2505 Johnson Road
Pullman WA 99163
509-334-3382
bewick2@hotmail.com

Brett Bingham
University of Idaho
518 Taylor Avenue #2
Moscow ID 83843
208-885-1963
bing6630@uidaho.edu

Jeff Birk
BASF Corporation
26 Davis Drive
Res Triangle Park NC 27709
919-547-2622
birkj@basf.com

Sheldon Blank
Monsanto
3805 S Dennis
Kennewick WA 99337
509-586-9060
sheldon.e.blank@monsanto

Lisa Boggs
SW Okla State University
Rt 2 Box 58
Weatherford OK 73096
580-774-3090
boggssl@swdsu.edu

Rick Boydston
USDA-ARS
24106 N Bunn Road
Prosser WA 99350
509-786-9267
boydston@pars.ars.usda.gov

Mark Boyles
BASF Corporation
11414 E 68th Street
Ripley OK 74062
918-372-4688
boylesm@basf.com

Luke Bozeman
Monsanto
800 N Lindbergh Blvd C35F
St Louis MO 63167
314-694-7539
Luke.l.bozeman@monsanto

Kevin Branum
NMSU/EPPWS
MSC 3BE Skeen Hall N141
Las Cruces NM 88003
505-646-1014
kbranum@nmsu.edu

Ron Brenchley
Bayer Inc.
3841 East 1400 North
Ashton ID 83420
208-652-3911

Bill Brewster
Dept Crop & Soil Science
Oregon State University
Corvallis OR 97331
541-735-5884
bill.d.brewster@orst.edu

Bart Brinkman
BASF Corporation
5730 2nd Avenue SE
Salem OR 97306
503-363-1934
brinkma@basf-corp.com

John Brock
Arizona State Dept of Ag
7001 E Williams Field Road
Mesa AZ 85212
480-727-1240
john.brock@asu.edu

Cynthia Brown
Colorado State Univ
2660 Fawn Lake Dr NE
Bethel MN 55005
763-413-6875
brown293@tc.umn.edu

Melissa Brown
P O Box 236
Clancy MT 59634
406-431-7962
mel@mt.net

Juliana Buckelew
Oregon State University
8809 SE 43rd Avenue
Milwaukie OR 97222
503-513-0153
jkbuckelew@msn.com

Lamar Buckelew
Bayer
8809 SE 43rd Ave
Milwaukie OR 97222
503-513-0153
lamar.buckelew.b@bayer

Stephen Burningham
Utah Dept of Ag & Food
350 N Redwood Rd
Salt Lake City UT 84114
801-538-7183
sburningham.agmain@state

Les Burrough
University of Wyoming
P O Box 363
Pinedale WY 82941
307-367-2192
lbburrough@wyoming.com

Marvin Butler
Oregon State University
34 SE D Street
Madras OR 97741
541-475-3808
marvin.butler@orst.edu

Joan Campbell
University of Idaho
P O Box 442339
Moscow ID 83844
208-885-7730
jcampbel@uidaho.edu

Mick Canevari
UC Cooperative Extension
420 S Wilson Way
Stockton CA 95215
209-468-9493
wmcanevari@ucdavis.edu

Ken Carlson
BASF Corporation
8040 Cooper Avenue
Lincoln NE 68506
402-489-9131
carlsok@basf.com

Michael Carpinelli
USDA-ARS
67826-A Hwy 205
Burns OR 97720
541-573-2064
michael.carpinelli@orst.edu

Vanelle Carrithers
Dow AgroSciences
28884 South Marshall
Mulino OR 97042
503-829-4933
vfcarrithers@dow.com

Jack Cecil
University of Wyoming
P O Box 374
Torrington WY 82240
307-532-7126
jtcecil@uwyo.edu

Leo Charvat
BASF Corporation
6211 Saddlecreek Trail
Lincoln NE 68523
402-421-8619
Charval@basf.com

Bernardo Chavez
BLM
2522 Camino Espuela
Santa Fe NM 87505
505-438-7668
bchavez@nm.blm.gov

Bill Cheatum
USFS- Colo Dept of Ag
P O Box 25127
Lakewood CO 80225
303-275-5063
wgcheatum@fs.fed.us

Ron Christensen
Monsanto
2604 W 37th
Sioux Falls ID 57105
605-332-9464
rchriste@dekalb.com

Dean Christie
Bayer Corp
4402 So Glendora Lane
Spokane WA 99223
509-443-7196

Janet Clark
MSU Dept LRES
P O Box 173120
Bozeman MT 59717
406-994-6832
cipm@montana.edu

Pat Clay
Univ of Arizona Coop Ext
4341 East Broadway
Phoenix AZ 85040
602-470-8086
pclay@ag.arizona.edu

Dean Cline
North Dakota Dept of Ag
600 E Boulevard Ave #602
Bismarck ND 58505
701-328-2983
dcline@state.nd.us

Bill Cobb
Cobb Consulting Services
815 South Kellogg
Kennewick WA 99336
509-783-3429
wtcobb42@aol.com

Dana Coggon
Colorado State University
213 West Street
Ft Collins CO 80521
970-581-0737
coggon@holly.colo.state.edu

Don Colbert
BASF Corporation
2133 Jackson Street
Lodi CA 95242
209-369-1102
colberd@basf-corp.com

Chuck Cole
Oregon State University
107 Crop Science
Corvallis OR 97331
541-737-9109
chuck.cole@orst.edu

Gil Cook
Dupont
303 S Barker Road
Greenacres WA 99016
509-922-4433
gilbert.e.cook@usa.dupont

Mary Corp
Oregon State University
721 SE 3rd Street Suite 3
Pendleton OR 97801
541-278-5403
mary.corp@orst.edu

Earl Creech
Utah State University
11675 N 4800 West
Trenton UT 84338
435-563-1294
SLZ1N@cc.usu.edu

Ron Crockett
Monsanto
17004 NE 37th Circle
Vancouver WA 98682
360-392-9884
ron.p.crockett@monsanto

Lori Crumley
University of Idaho
806 S Jefferson #4
Moscow ID 83843
208-885-6236
bour9481@uidaho.edu

Dave Cudney
University of California
Batchelor Hall Extension
Riverside CA 92521
909-228-8256
dcudney@citrus.ucr.edu

Randall Currie
KSU SW Research
4500 E Mary Street
Garden City KS 67846
620-276-8286
rcurrie@oznet.ksu.edu

Gregory Dahl
Agriliance LLC
P O Box 64089
St Paul MN 55164
651-451-4942
gkdahl@agriliance.com

Mark Dahmer
BASF Corporation
20232 East Lake Ave
Centennial CO 80016
303-617-8214
dahmerm@basf.com

Jim Daniel
United Agri Products
P O Box 1190
Johnstown CO 80534
970-396-9063
jim.daniel@uap.com

Ed Davis
Montana State University
Leon Johnson Hall
Bozeman MT 59717
406-994-7987
edavis@montana.edu

Ken Keibert
North Dakota State Univ
1125 19th Street N #16
Fargo ND 58102
701-280-9277
kenneth.deibert@ndsu.nodak

Steve Dewey
Utah State University
4820 Old Main Hill
Logan UT 84322
435-797-2256
steved@ext.usu.edu

Joe DiTomaso
Weed Science Program
University of California
Davis CA 95616
530-754-8715
ditomaso@vegmail.ucdavis

Peter Dotray
Texas Tech University
Dept Plant & Soil Science
Lubbock TX 79409
806-742-1634
p-dotray@tamu.edu

Celestine Duncan
Weed Management
P O Box 1385
Helena MT 59624
406-443-1469

Keith Duncan
NMSU
67 East Four Dinkus Rd
Artesia NM 88210
505-748-1228
erbc@nmsu.edu

Bill Dyer
Dept of Plant Sciences
Montana State University
Bozeman MT 59715
406-994-5063
usswd@montana.edu

Charlotte Eberlein
University of Idaho
Box 1827
Twin Falls ID 83303
208-736-3600
ceberl@uidaho.edu

Mike Edwards
Dupont
390 Union Blvd Ste 500
Lakewood CO 80228
303-716-3906
michael.t.edwards@usa.dupont

Matt Ehlhardt
Aventis
363 Picholine Way
Chico CA 95928
530-891-0651

Hanan Eizenberg
Oregon State University
Crop Science Bldg 331B
Corvallis OR 97331
541-732-7542
hanan.eizenberg@orst.edu

Clyde Elmore
Weed Science Program
University of California
Davis CA 95616
530-752-9978
clelmore@ucdavis.edu

Gregory Endres
NDSU
Box 219
Carrington ND 58421
701-652-2951
gendres@ndsuext.nodak.edu

Stephen Enloe
Dept of Vegetable Crops
University of California
Davis CA 95616
530-752-8284
sfenloe@ucdavis.edu

Mike Ensminger
Syngenta
498 N Mariposa Ave
Visalia CA 93292
559-735-2212
mike.ensminger@syngenta

Eric Eriksmoen
North Dakota State Univ
Box 1377
Hettinger ND 58639
701-567-4325
eeriksmo@ndsuext.nodak

Ann Erickson
Dept of Plant Sciences
North Dakota State Univ
Fargo ND 58105
701-231-8167
ann.erickson.l@nodak.edu

Steve Eskelsen
Monsanto
700 Chesterfield Pkwy N
St Louis MO 63198
636-737-5060
steven.r.eskelsen@monsanto

John Evans
Utah State University
4820 Old Main Hill
Logan UT 84322
435-797-2242
jevans@mendel.usu.edu

Chad Fabrizius
BASF Corporation
26 Davis Drive
Res Triangle Park NC 27709
919-547-2662
cfabrizc@basf.com

Lynn Fandrich
Oregon State University
107 Crop Science Bldg
Corvallis OR 97331
541-737-7542
lynn.fandrich@orst.edu

Gary Fellows
BASF Corporation
26 Davis Drive
Res Triangle Park NC 27709
919-547-2656
fellowg@basf.com

John Fenderson
Monsanto
902 Hardtner Street
Kiowa KS 67070
620-825-4315
john.m.fenderson@monsanto

Steve Fennimore
UC Cooperative Extension
1636 East Alisal Street
Salinas CA 93905
831-755-2896
safennimore@ucdavis.edu

Mark Ferrell
University of Wyoming
P O Box 3354
Laramie WY 82071
307-766-5381
ferrell@uwyo.edu

Shari File
Monsanto
210 West 22
Hays KS 67601
785-628-1362
shari.l.file@monsanto

Cheryl Fiore
NMSU
MS 3BE
Las Cruces NM 88003
505-646-1627
cfiore@nmsu.edu

David Fischhoff
Cereen Genomics
45 Sidney Street
Cambridge MA 02139
617-551-8254
david.a.fischhoff@cereon

Scott fitterer
Pioneer Hi-Bred
4050 30th Avenue South
Moorhead MN 56560
218-299-8610
scott.fitterer@pioneer.com

April Fletcher
US Fish & Wildlife Service
P O Box 1306
Albuquerque NM 87103
505-248-6632
fletcher@slocp.com

Felix Fletcher
University of Idaho
1649 S 2700 West
Aberdeen ID 83210
208-397-4181

Nicole Flowers
Montana State University
748 Railroad Hwy
Huntley MT 59037
406-348-3400
nflowers@montana.edu

Mike Foley
USDA-ARS
Biosciences Research Lab
Fargo ND 58105
701-239-1251
foleym@fargo.ars.usda.gov

Peter Forster
Syngenta
35492 WCR 43
Eaton CO 80615
970-454-5478
pete.forster@syngenta.com

Gus Foster
BASF Corporation
812 East Elizabeth
Ft Collins CO 80524
970-484-8925
fosterj1@basf.com

Lise Foy
University of Wyoming
1501 Decker Road
Sheridan WY 82801
406-757-2411
1foy@uwces.wyoming.com

James Freeman
521 1st Avenue NW
Great Falls MT 59404
406-454-6920
weedandmosquito@mcn.net

Jeremy Frie
BASF Corporation
252 Chestnut Drive
Horace ND 58047
701-281-3959
friej@basf.com

Emalee Friend
Oklahoma State University
508 South Old Hwy 51
Stillwater OK 74075
405-624-0085
Friendlyacre@hotmail.com

John Frihauf
University of Wyoming
457 Soule Apt 407
Laramie WY 82072
307-766-6077
frihaufj@juno.com

Dean Gamble
BIA-Western Navajo Agency
P O Box 127
Tuba City AZ 86045
928-283-2252

Harish Gandhi
Oregon State University
445 Crop Science Bldg
Corvallis OR 97331
541-737-5839
harish.gandhi@orst.edu

Roger Gast
Dow AgroSciences
9330 Zionsville Rd
Indianapolis IN 46268
317-337-3004
regast@dow.com

Jay Gehrett
Spray Tech
877 Whitney Road
Walla Walla WA 99362
509-525-0146
Gehretja@wwies.com

Todd Geselius
Dow AgroSciences
3240 36th Avenue SW
Fargo ND 58104
701-271-8479
tcgeselius@dow.com

Brett Glover
US Forest Service
2035 Last Chance Road
Elko NV 89801
775-738-5171
bglover@fs.fed.us

Gaylan Goddard
BASF Corporation
2958 West 14th Street
Yuma AZ 85364
928-373-9596
goddarg@basf.com

Charles Grasham
Agriliance
3781 Sutters Way
Coeur d'Alene ID 83815
208-666-0693
cdgrasham@agriliance.com

Wanda Graves
WSWS
P O Box 963
Newark CA 94560
510-790-1252
WGraves431@aol.com

Brian Greenfield
New Mexico State Univ
P O Box 328
Mesilla Park NM 88047
505-646-1627
brianjames@zianet.com

Bob Gunnell
Agraserv Inc
866 North 3200 West
Dayton ID 83232
208-747-3717
bob@agraserv.com

Alan Haack
Dow AgroSciences
103 Moorland Ct
Roseville CA 95661
916-797-7495
aehaack@dow.com

Josette Hackett
Hackett Ag Consulting
3031 Home Acres Road
Stevensville MT 59870
406-777-5584
josette@hackett-ag.com

Neil Hackett
BASF Corporation
2000 Sassacus Lane
Apex NC 27502
919-547-2890
hacketn@basf.com

Lloyd Haderlie
AgraServ Inc
3243 JoAnna Ct
American Falls ID 83211
208-226-2607
lloyd@agraserv.com

Neal Hageman
Monsanto
17754 Westhampton Woods
Wildwood MO 63005
314-694-2465
neal.r.hageman@monsanto

Patrick Haikal
Arvesta Corp
100 First Street Suite 1700
San Francisco CA 94105
415-778-4837
phaikal@arvesta.com

Darrell Hanavan
Colorado Wheat
7700 E Arapohoe Rd #220
Englewood CO 80112
303-721-3300
dhanavan@gwest.net

Daniel Hancock
Oregon State University
107 Crop Science
Corvallis OR 97331
541-737-7542
daniel.hancock@orst.edu

Jeremiah Hansen
The Weed Works
P O Box 99
Paso Robles CA 93446
805-467-1909

Brad Hanson
PSES Dept
University of Idaho
Moscow ID 83844
208-885-6236
hans5194@uidaho.edu

Liz Hanson
NMSU
67 E Four Dinkus Rd
Artesia NM 88210
505-748-1228
ehanson@nmsu.edu

Charles Hart
Texas A&M
P O Box 1298
Ft Stockton TX 79735
915-336-8585
cr-hart@tamu.edu

Greg Haubrich
Wash State Dept of Ag
21 North 1st Ave #103
Yakima WA 98902
509-225-2604
ghaubrich@agr.wa.gov

Rod Hedberg
WSSA Dir of Science Policy
900 Second Street NE
Washington DC 20002
202-498-5388
robhedberg@erol.com

Paul Hendrickson
North Dakota State Univ
P O Box 219
Carrington ND 58421
701-652-2951
phendric@ndsuext.nodak.edu

Jeff Herrmann
Monsanto
3478 North 2983 East
Twin Falls ID 83301
208-736-7294
jeffrey.e.herrmann@monsanto

Charlie Hicks
Aventis Crop Science
105 Mt Moriah
Livermore CO 80536
970-490-2993
charlie.hicks@aventis.com

Vint Hicks
Monsanto Company
15323 East Quick Draw
Fountain Hills AZ 85268
480-836-9092
t.vint.hicks@monsanto.com

Rick Holm
Univ of Saskatchewan
51 Campus Drive
Saskaton SK Canada
306-966-8195
holm@usask.ca

John Holman
Montana State University
720 Leon Johnson Hall
Bozeman MT 59717
406-994-1871
holman@montana.edu

Jodie Holt
Botany & Plant Sciences
University of CA
Riverside CA 92521
909-787-3801
jodie.holt@ucr.edu

Tom Holt
BASF Corporation
26 Davis Drive
Res Triangle Park NC 27709
919-547-2178
holtt@basf.com

Marc Hoobler
Aventis Crop Science
1305 W 6th Street
Loveland CO 80537
970-461-3660
marc.hoobler@aventis.s.com

Carla Hoopes
MSU LRES
P O Box 173120
Bozeman MT 59717
406-994-5683
choopes@montana.edu

Farrel Hoopes
Lincoln Co Weed & Pest
P O Box 1117
Afton WY 83110
307-886-3394
farrelh@lcwp.com

Heidi Hoven
SWCA
230 South 500 East #380
Salt Lake City UT 84102
801-322-4307
hhoven@swca.com

Kirk Howatt
North Dakota State Univ
470-F Loftsgard Hall
Fargo ND 58105
701-231-7209
khowatt@ndsuext.nodak.edu

Mike Hubbard
Kootenai Valley Research
HCR 61 Box 129AA
Bonners Ferry ID 83805
208-267-0903
mkhubbard@sisna.com

Ruth Hufbauer
Bioag Science
Colorado State University
Ft Collins CO 80523
970-491-6945
hufbauer@lamar.colostate

Andrew Hulting
Montana State University
334 Leon Johnson Hall
Bozeman MT 59717
406-994-1871
ahulting@montana.edu

Pamela Hutchinson
University of Idaho
P O Box 870
Aberdeen ID 83210
208-397-4181
phutch@uidaho.edu

Thomas Ireland
PSES Dept
University of Idaho
Moscow ID 83844
208-885-6236
ire1022@uidaho.edu

Joey Ishida
OSU Malheur Expt Station
595 Onion Avenue
Ontario OR 97914
541-889-2174

Nelroy Jackson
400 S Ramona Ave #212
Corona CA 92879
909-279-7787
nelroy.e.jackson@monsanto

Larry Jeffery
BYU
Dept of Agronomy & Hort
Provo UT 84602
801-378-2369

Brian Jenks
North Dakota State Univ
5400 Hwy 83 South
Minot ND 58701
701-857-7677
bjenks@ndsuext.nodak.edu

Allen Jennings
USDA-ARS
1400 Independence Ave SW
Washington DC 20250
202-720-5575

Corby Jensen
Monsanto
170 Hillcrest Drive
North Platte NE 69101
308-534-9177
corby.jensen@monsanto.com

Curt Johnson
Forest Service
324 25th Street
Ogden UT 84401
801-625-5600
cjohnson07@fs.fed.us

Eric Johnson
AAFC
Box 10
Scott SK Canada SOK4A0
306-247-2011

Mark Johnson
University of California
8347 Bailey Road
Yuba City CA 95993
530-671-5380
masjohnson@ucdavis.edu

Len Juras
Dow AgroSciences
101-421 Downey Rd
Saskatoon SK Canada
306-657-3358
ltjuras@dow.com

Larry Justesen
Carbon County
P O Box 1126
Rawlins WY 82301
307-324-6584
larrykj@trib.com

Diane Kaufman
OSU North Willamette Res
15210 NE Miley Road
Aurora OR 97002
503-678-1264
diane.kaufman@orst.edu

John Kava
NDSU Animal & Range Sci
125 6th Street SW #205
Barnesville MN 56514
218-354-7553
jakava@mac.com

Jason Kelley
Oklahoma State University
2425 W Lakeview #28
Stillwater OK 74075
405-624-7063
jkelley@mail.com

Susan Kelly
MSU Dept LRES
P O Box 173120
Bozeman MT 59717
406-994-2943
susank@monsanto.edu

Don Kirby
Animal & Range Sciences
North Dakota State Univ
Fargo ND 58105
701-231-8386
dkirby@ndsuext.nodak.edu

Bob Klein
University of Nebraska
461 W University Drive
North Platte NE 69101
308-532-3611
rklein1@unl.edu

James Knabke
FMC Corporation
6250 N Dockery
Clovis CA 93611
519-299-3254
james-knabke@fmc.com

Kitty Knaphus
Cascade County Weed Dist
521 1st Avenue NW
Great Falls MT 59404
406-454-6920

Stevan Knezevic
University of Nebraska
57905 866 Road
Concord NE 68728
402-584-2808
skezevic2@unl.edu

Steven Koike
UC Cooperative Extension
1432 Abbott Street
Salinas CA 93901
831-759-7350
sikoike@ucdavis.edu

Jeff Koscelny
Monsanto
645 Castlebrook Drive
St Peters MO 63376
314-694-6716
jeffrey.koscelny@monsanto

Bill Kral
Dupont
1739 Julie Lane
Twin Falls ID 83301
208-734-9726

Barbara Kutzner
Monsanto
1284 S Riverview
Reedley CA 93654
559-638-4012
barbara.u.kutzner@monsanto

Chris Kuykendall
Nez Perce Tribe
P O Box 365
Lapwai ID 83540
208-843-7392
chrisk@nezperce.org

Guy Kyser
University of CA
1 Shield Avenue
Davis CA 95616
530-752-8284
gbkyser@ucdavis.edu

Eric Lane
Colorado Dept of Ag
700 Kipling Street, #4000
Lakewood CO 80215
303-239-4182
eric.lane@ag.state.co.us

Tom Lanini
University of California
124 Robbins Hall
Davis CA 95616
530-752-4476
lanini@vegmail.ucdavis.edu

Larry Lass
PSES Department
University of Idaho
Moscow ID 83844
208-885-7802
llass@uidaho.edu

Robert Leavitt
CDFA
1220 N Street
Sacramento Ca 95814
916-654-0768
leavitt@cdfa.ca.gov

Nancy Lewis
University of Nebraska
316 RLH
Lincoln NE 68583
402-472-4633
nlewis2@unl.edu

Carl Libbey
WSU-Mt Vernon
16650 SR 536
Mt Vernon WA 98273
360-848-6139

Frank Lichtner
Dupont
20 East Periwinkle Lane
Newark CA 19711
302-992-6322
frank.t.lichtner@usa.dupont

Bryon Lorenz
University of Wyoming
P O Box 1121
Laramie WY 82073
307-745-9379
weeds@uwyo.edu

Kelly Luff
Aventis CropScience
3554 East 4000 North
Kimberly ID 83341
208-423-6371
k.luff@aventis.com

Ericka Luna
New Mexico State Univ
2225 Rosedale
Las Cruces NM 88005
505-620-8035
erickal_2000@yahoo.com

Cody Luthi
Silver Star Communications
P O Box 226
Freedom WY 83120
307-883-2411

Rod Lym
Plant Science Department
North Dakota State Univ
Fargo ND 58105
701-231-8996
rod.lym@ndsu.nodak.edu

Bill McCloskey
Dept of Plant Sciences
University of Arizona
Tucson AZ 85721
520-621-7613
wmccloslc@ag.arizona.edu

Tom McClure
USFS
740 Simms
Golden CO 80401
303-275-5100
tmcclure@fs.fed.us

Sandra McDonald
BSPM
Colorado State University
Ft Collins CO 80523
970-491-6027
sandra.mcdonal@colostate

Janis McFarland
Syngental Crop Protection
P O Box 18300
Greensboro NC 27419
336-632-2354

Kent McKay
North Dakota State Univ
5400 Hwy 83S
Minot ND 58701
701-857-7682
kmckay@ndsuext.nodak.edu

Patrick McMullan
Agrobiology Research
7777 Walnut Grove Rd
Memphis TN 38120
901-757-2730
agrobio@earthlink.net

Mace William
Utah State University
140 N 100 East
Hyde Park UT 84310
435-563-6757
bmace@mendel.usu.edu

Carol Mallory-Smith
Dept of Crop & Soil Science
Oregon State University
Corvallis OR 97331
541-737-5883
carol.mallory-smith@orst

Brent Marek
Aventis
17712 Fortuneta
Farmington MN 55029
952-431-1451
brent.marek@aventis.com

Robin Marrs
Bioagricultural & Pest Mgmt
Colorado State University
Ft Collins CO 80526
970-491-5984
rmarrs@lamar.colostate.edu

Alex Martin
University of Nebraska
362 Plant Sciences Bldg
Lincoln NE 68583
402-472-1527
amartin2@unl.edu

Todd Mayhew
Valent
459 N Gilbert
Phoenix AZ 85233
480-503-2918
tmayh@valent.com

Chris Mayo
Dupont
4022 Manchester Road
Grand Island NE 68803
308-389-3277

Brian Meese
Monsanto
1203-A Airport road
Ames IA 50010
515-956-3084
brian.g.meese@monsanto

Gary Melchior
Gowan Company
625 Abbott Road
Walla Walla WA 99362
509-520-4779
gmelchior@gowanco.com

Rick Melnicoe
Environmental Toxicology
University of CA
Davis CA 95616
530-754-8378
rsmelnicoe@ucdavis.edu

Abdel Mesbah
University of Wyoming
747 Road 9
Powell WY 82435
307-754-2223
sabah@uwyo.edu

Mick Mickelson
MSU Southern Ag Research
748 Railroad Hwy
Huntley MT 59037
406-348-3400
jmickelson@monsanto.edu

Jason Miller
Colorado State University
609 ½ Smith Street
Ft Collins CO 80524
970-491-5667
jnmiller@lamar.colostate.edu

Steve Miller
University of Wyoming
P O Box 3354
Laramie WY 82071
307-766-3112
sdmiller@uwyo.edu

Tim Miller
WSU-Mt Vernon
16650 State Route 536
Mt Vernon WA 98273
360-848-6138
twmiller@wsu.edu

Jeff Mitchell
UC Cooperative Extension
9240 S Riverbend Ave
Parlier CA 93648
559-646-6565
mitchell@uckac.edu

Shoumo Mitra
Cal Poly-Pomona
4371 Saint Andrews Dr
Chino Hills CA 91709
909-606-4699
smitra@csupomona.edu

Terry Mize
FMC Corporation
7602 Dreyfuss Drive
Amarillo TX 79121
806-352-8195
terry-mize@fmc.com

William Molin
USDA-ARS
141 Experiment Station Rd
Stoneville MS 38776
662-686-5245
wmolin@ars.usda.gov

Tom Monaco
USDA-ARS
Utah State University
Logan UT 84322
435-797-7231
tmonaco@cc.usu.edu

Don Morishita
University of Idaho
P O Box 1827
Twin Falls ID 83303
208-736-3616
don@uidaho.edu

Edward Morris
Marathon Consulting
2649 Navajo Road
Las Cruces NM 88005
505-527-8853
acthol@zianet.com

Adrian Moses
Syngenta
M-41 lake Shore Drive
Lake Lotawana MO 64086
816-578-5375
adrian.moses@syngental.com

Phil Motooka
University of Hawaii
79-7381 Mamalahoa Hwy
Kealakekua HI 96750
808-322-4896
pmotooka@hawaii.edu

Barbra Mullin
Montana Dept of Ag
P O Box 200201
Helena MT 59670
406-444-3140
bmullin@state.mt.us

Phil Munger
BASF Corporation
800 N Lovers Lane
Visalia CA 93292
559-732-1785

Alicia Murphy
MSU Dept LRES
P O Box 173120
Bozeman MT 59717
406-994-7551
amurphy@montana.edu

Martina Murray
New Mexico State University
P O Box 625
Artesia NM 88211
505-748-1228
marmurra@nmsu.edu

Jerry Nachtman
University of Wyoming
Rt 1 Box 374
Torrington WY 82240
307-532-7126
nachtman@uwyo.edu

Deana Namuth
Dept of Agronomy & Hort
University of Nebraska
Lincoln NE 68583
402-472-1549
denamuth@unl.edu

Jody Nelson
Exponent
175 Marble St #207
Broomfield CO 80020
303-966-2231
nelsonj@exponent.com

Katherine Nelson
University of Wyoming
521 E 2050 North
Ogden UT 84414
801-786-6412
knelson@uwyo.edu

Scott Nield
Lincoln County Weed & Pest
P O Box 1117
Afton WY 83110
307-886-3394
scottn@lcwp.com

Scott Nissen
Colorado State University
115 Weed Research Lab
Ft Collins CO 80523
970-491-3489
snissen@lamar.colostate.edu

Justin Norsworthy
NMSU
1525 Foster Road #12
Las Cruces NM 88001
915-475-4758

Jay Norton
USU-PSB
6300 Old Main Hill
Logan UT 84322
435-797-3354
jnorton@cc.usu.edu

Alex Ogg
WSU
P O Box 53
Ten Sleep WY 82442
307-366-2444
ogga@tctwest.net

Paul Ogg
BASF Corporation
3619 Mountain View Ave
Longmont CO 80503
303-772-0843
oggp@basf.com

Jim Olivarez
USDA Forest Service
3691 Brandon Way
Missoula MT 59803
406-251-3157
joliv1@aol.com

Shannon Oltmans
North Dakota State Univ
166 Loftsgard Hall
Fargo ND 58105
701-231-8167

Clark Oman
Colorado State University
4431 Warbler Drive
Ft Collins CO 80526
970-491-1910
coman@lamar.colostate.edu

Scott O'Meara
Colorado State University
1333 West 135th Place
Westminister CO 80234
303-255-7943
scottom@holly.colostate.edu

Steve Orloff
UC Cooperative Extension
1655 S Main Street
Yreka CA 96097
530-84202711
sborloff@ucdavis.edu

John Orr
Syngenta Crop Protection
251 N Longhorn Ave
Eagle ID 83616
208-286-9300
john.orr@syngenta.com

Travis Osmond
Utah State University
4820 Old Main Hill
Logan UT 84322
435-797-2256

Kee-Woomg Park
Oregon State University
101 NE Conifer Blvd #K
Corvallis OR 97330
541-754-5964
kee-woomg.park@orst.edu

Bob Parker
Washington State University
24106 N Bunn Road
Prosser WA 99350
509-786-9234
rparker@wsu.edu

Jim Parochetti
CSREES-USDA
#2220, 14th & Independence
Washington DC 20250
202-401-4354
jparochetti@reeusda.gov

Scott Parrish
Platte County
16417 North Napa
Spokane WA 99205
509-467-2167
scott.parrish@uap.com

Michael Particka
MSU Southern Ag Research
748 Railroad Highway
Huntley MT 59037
406-348-3400
particka@montana.edu

Gary Pastushok
Syngenta Crop Protection
1823 Charleswood Estate Dr
West Fargo ND 58078
701-277-0377
gary.pastushok@syngenta

Deb Paulson
University of Wyoming
4209 Navajo Drive
Laramie WY 82072
307-766-2628
debp@uwyo.edu

Ed Peachey
Dept of Hort ALS 4017
Oregon State University
Corvallis OR 97331
541-737-3152
peacheye@bcc.orst.edu

Tom Peeper
Plant & Soil Science
Oklahoma State University
Stillwater OK 74078
405-744-9589
tfp@mail.pss.okstate.edu

Adrianne Peterson
Sublette Co Weed & Pest
P O Box 729
Pinedale WY 82941
307-367-4728
subcowp@wyoming.com

Dallas Peterson
Kansas State University
2014 Throckmorton Hall
Manhattan KS 66506
785-532-5776
dpeterso@oznet.ksu.edu

Ron Pidskalny
BASF Canada
11312 – 57th Avenue
Edmonton AB Canada
780-434-2030
pidskar@basf.com

Tim Playford
Dow AgroSciences
10521 Balroyal Court
Fishers IN 46038
317-596-8930
tjplayford@dowagro.com

Alan Pomeroy
Big Horn Co Weed & Pest
355 East 5th Street
Lovell WY 82431
307-548-7261
bhcwp@tctwest.net

Tim Prather
PSES Department
University of Idaho
Moscow ID 83844
208-885-9246
tprather@uidaho.edu

Troy Price
Kansas State University
105 Experiment Farm Road
Colby KS 67701
785-462-6281
tprice@oznet.ksu.edu

Bill Price
University of Idaho
P O Box 442337
Moscow ID 83844
208-885-5930
bprice@uidaho.edu

Dawn Rafferty
Nevada Dept of Agric
350 Capitol Hill Avenue
Reno NV 89502
775-688-1180
rafferty@govmail.state.nv.us

Curtis Rainbolt
PSES Department
University of Idaho
Moscow ID 83844
208-885-6236
rain5358@uidaho.edu

Michael Ralphs
USDA-ARS
1150 East 1400 North
Logan UT 84341
435-752-2941
mralphs@cc.usu.edu

Brad Ramsdale
Dept of Plant Sciences
North Dakota State Univ
Fargo ND 58105
701-231-8732
brad.ramsdale@ndsu.nodak

Corey Ransom
OSU Malheur Expt Station
595 Onion Avenue
Ontario OR 97914
541-889-2174
corey.ransom@orst.edu

Traci Rauch
University of Idaho
P O Box 442339
Moscow ID 83844
208-885-9709
trauch@uidaho.edu

Marge Rayda
University of Wyoming
820 Ivinson Ave
Laramie WY 82070
307-766-5278
caps@uwyo.edu

Janice Reed
University of Idaho
P O Box 442339
Moscow ID 83844
208-885-9709
jreed@uidaho.edu

Roy Reichenbach
Wyoming Department of Ag
2219 Carey Avenue
Cheyenne WY 82002
307-777-6585
rreich@state.wy.us

Mark Renz
University of California
2326 Rose Street
Berkeley CA 94708
530-752-8284
mjrenz@ucdavis.edu

Chuck Rice
OSU-Malheur Expt Station
595 Onion Avenue
Ontario OR 97914
541-889-2174
chuck.rice@oregonstate.edu

Wendell Rich
Agra Serv Inc
P O Box 561
Ashton ID 83420
208-652-7860
wendell@fremontnet.com

Doug Richardson
Aventis CropScience
#204, 1144 29th Avenue NE
Calgary AB Canada
403-250-7294
doug.richardson@aventis.

Jesse Richardson
Dow AgroSciences
9330 10th Avenue
Hesperia CA 92345
760-949-2565
jmrichardson@dow.com

Jerry Reis
NDSU
470-B Loftsgard Hall
Fargo ND 58105
701-231-6220
jerry.ries@ndsu.nodak.edu

Joel Roehl
BASF Corporation
531 23rd Avenue South
Fargo ND 58103
701-297-7564
roehlj@basf.com

Ernie Roncoroni
United Agri Products
3 Rice Court
Woodland CA 95695
530-668-1524
ernie.roncoroni@uap.com

Lois Rossi
US EPA
1200 Pennsylvania NW
Washington DC 20460
703-308-8162

Doug Ryerson
Monsanto
408 Deer Drive
Great Falls MT 59404
406-771-1920
douglas.r.ryerson@monsanto

Craig Rystedt
Monsanto
308 1st Avenue West
Powers Lake ND 58773
701-464-5133
craig.m.rystedt@monsanto

Fred Salzman
IR-4 Project
681 US Hwy 1 South
North Brunswick NJ 08902
732-932-9575
salzman@aesop.rutgers.edu

Craig Sandoski
Syngenta
2261 Laya Ridge Ct
Roseville CA 95660
916-783-1834
craig.sandoski@syngenta

Ken Sapsford
University of Saskatchewan
51 Campus Drive
Saskatoon SK Canada
306-966-4999
sapsford@usask.ca

Gus Sbatella
University of Wyoming
119 Crane Hall
Laramie WY 82070
307-766-7033
gustavo@uwyo.edu

Ed Scheenstra
Washington State University
P O Box 646420
Pullman WA 99164
509-335-3481
escheenstra@wsu.edu

Branden Schiess
University of Idaho
231 Lander
Moscow ID 83843
208-882-8820
schi2649@uidaho.edu

Roland Schirman
Washington State University
202 South Second St
Dayton WA 99328
509-382-4741
ce610@coop.ext.wsu.edu

Doug Schmale
NJGGSC
3664 Road 139
Lodgepole NE 69149
308-483-5505
ustoll@cudoramail.com

Jill Schroeder
New Mexico State University
P O Box 30003 MSC 3BE
Las Cruces NM 88003
505-646-2328
jischroe@nmsu.edu

Joe Schuh
BASF Corp
9879 Citrine Court
Parker CO 80134
720-851-8639
schuhj@basf.com

Dale Shaner
USDA-ARS
Water Management Research
Ft Collins CO 80523
970-491-8263
shaner@wmu.colostate.edu

Dave Shields
BASF Corporation
10181 Avenue 416
Dinuba CA 95618
559-591-2548
shieldd@basf.com

Josh Shorb
Park County Weed & Pest
P O Bx 626
Powell WY 82435
307-754-8884
pcwpz@wir.net

Norman Sladen
FMC Corp
144 Saint Germain Lane
Pleasant Hill CA 94523
925-685-5603
norman_sladen@fmc.com

Dallen Smith
Utah State University
56 North 400 East
Richmond UT 84334
435-258-5186

Dudley Smith
Texas A&M University
Dept of Soil & Crop Science
College Station TX 77843
979-845-4702
dt.smith@tamu.edu

John Smith
BASF Corporation
2869 Bridgeport Avenue SE
Salem OR 97306
503-391-5644
smithjh@basf.com

Lincoln Smith
USDA-ARS
800 Buchanan Street
Albany CA 94710
510-559-6185
lsmith@pw.usda.gov

Richard Smith
UC Cooperative Extension
1432 Abbott
Salinas CA 93901
831-759-7350
rifsmith@ucdavis.edu

Deborah Solie
Oklahoma State University
2812 Fox Ledge Drive
Stillwater OK 74074
405-624-9962
solied@okstate.edu

Phil Stahlman
Kansas State University
1232 240th Avenue
Hays KS 67601
785-625-3425
stahlman@ksu.edu

Reginald Sterling
Colorado State University
1213 W Swallow Road #212
Ft Collins CO 80526
970-282-9380
sterli@lamar.colo.state.edu

Tracy Sterling
New Mexico State University
MSC 3BE
Las Cruces NM 88003
505-646-6177
tsterlin@nmsu.edu

Amanda Stone
Oklahoma State University
120 Brumley #2
Stillwater OK 74074
405-744-9626
solie@okstate.edu

Bob Stougaard
Montana State University
4570 MT 35
Kalispell MT 59901
406-755-4303
rns@montana.edu

Shay Sunderland
Monsanto
P O Box 6544
Englewood CO 80155
303-768-7326
shay.l.sunderland@monsanto

Jason Sutton
Colorado State University
1600 W Plum Street
Ft Collins CO 80521
970-495-5840
jasonsut@lamar.colostate.edu

Orval Swenson
Agsco Inc
P O Box 13458
Grand Forks ND 58201
701-775-5325
orvals@agscoinc.com

Donn Thill
University of Idaho
P O Box 442339
Moscow ID 83844
228-885-6214
dthill@uidaho.edu

Curtis Thompson
Kansas State University
4500 East Mary
Garden City KS 67846
620-275-9164
cthompso@oznet.ksu.edu

Tom Threewitt
Syngenta
RR3 Box 123
Larned KS 67550
620-285-6606
tom.threewitt@syngenta.com

Jeff Tichota
Monsanto
3018 East Nichols Circle
Littleton CO 80122
303-221-4795
jeffrey.m.tichota@monsanto

John Toker
Washington State University
P O Box 646420
Pullman WA 99164
509-335-3481
jtoker@wsu.edu

Dennis Tonks
WSU Coop Extension
P O Box 399
Davenport WA 99122
509-725-8311
dtonks@wsu.edu

Tim Tripp
Syngenta
1527 Rio Grande
Davis CA 94516
530-753-5078
tim.tripp@syngenta.com

Stuart A Turner
Turner & Company
500 Meadows Drive S
Richland WA 99352
509-627-6428
agforensic@aol.com

Terry Turner
Hill County Weed District
1405 West 2nd Street
Havre MT 59501
406-265-5481
hiweed@hotmail.com

Vince Ulstad
BASF Corporation
4120 – 15th Street South
Fargo ND 58104
701-588-4542
ulstadv@basf.com

Kai Umeda
University of Arizona
4341 East Broadway
Phoenix AZ 85040
602-470-8086
kumeda@ag.arizona.edu

Steve Valenti
Monsanto
5132 Rose Creek Pkwy
Fargo ND 58104
701-297-0834
stvvalenti@net

Janet Valle
USDA Forest Service
324 25th Street
Ogden UT 84402
801-625-5258
jvalle@fs.fed.us

Amber Vallotton
New Mexico State University
MSC 3BE, Skeen Hall, N141
Las Cruces NM 88003
505-646-1044
avallott@nmsu.edu

Jim Vandecoevering
BASF Corporation
2642 W Bridgestone Ct
Meridian ID 83642
208-888-7846
vandecj@basf.com

Stephen Van Vleet
BASF Corporation
P O Box 57
Potlatch ID 83855
208-875-8756
vanvles@basf.com

Ron Vargas
UC Cooperative Extension
328 Madera Avenue
Madera CA 93637
559-675-7879
rnvargas@uidaho.edu

Maren Veatch
Dept of Plant Sciences
University of Arizona
Tucson AZ 85721
520-621-1817
mev@ag.arizona.edu

Kurt Volker
Syngenta
7610 Scenic Drive
Yakima WA 98908
509-966-1081
kurt.volker@syngenta.com

Jennifer Vollmer
BASF Corporation
2166 North 15th Street
Laramie WY 82072
307-755-5218
vollmej@basf.com

Joe Vollmer
BASF Corporation
2166 N 15th
Laramie WY 82072
307-760-5275
vollmejg@basf.com

Scott Votaw
BASF Corporation
2044 Sheridan
Laramie WY 82070
307-721-7011
votawj@basf.com

L. D. Walker
BLM
345 East Riverside Dr
St George UT 84790
435-688-3242
ld.walker@blm.gov

Ted Warfield
Warfield & Associates
2707 West 44th Street
Kearney NE 68845
308-234-5195
trwarf@citilink.net

Brenda Waters
Idaho State Dept of Ag
P O Box 7249
Boise ID 83707
208-332-8540
bwaters@agri.state.id.us

Steven Watkins
Syngenta
P O Box 4817
Yuma AZ 85366
928-726-1509
steve.watkins@syngenta

Tyler Watt
Utah State University
4820 Old Main Hill
Logan UT 84322
435-797-2256

Dan Watts
BASF Corporation
3935 Graf Street
Bozeman MT 59715
406-522-7797
wattsdr@basf.com

Nancy Webber
Fremont Co Weed & Pest
450 N 2nd Street
Lander WY 82520
307-332-1052
fcwp@wyoming.com

Doug West
El Dorado Ag Consulting
4000 Meder Road
Shingle Springs CA 95682
530-677-6886
eldoradoag@directcon.net

Matt West
University of Idaho
342 Taylor Avenue #3
Moscow ID 83843
208-885-5729
west6280@uidaho.edu

Dan Westberg
BASF Corporation
26 Davis Drive
Res Triangle Park NC 27709
9190547-2552
westbed@basf.com

Phil Westra
Colorado State University
112 Weed Lab
Ft Collins CO 80523
303-491-5219
pwestra@lamar.colostate.edu

Jere White
KS Corn & Grain Assns
P O Box 448
Garnett KS 66032
785-448-6922

Tony White
Kansas State University
1232 240th Street
Hays KS 67601
785-625-3425
twhite@oz.net.ksu.edu

Tom Whitson
University of Wyoming
1560 Lane 14
Powell WY 822435
307-754-3392

Gail Wicks
University of Nebraska
Rt 4 Box 46A
North Platte NE 69101

Michael Wille
University of Idaho
P O Box 1827
Twins Falls ID 83303
208-736-3614
mwille@uidaho.edu

Justin Williams
USU-USDA-ARS
696 North 1100 East
Logan UT 84322
435-797-3066
jrw@cc.usu.edu

Marvin Williams
Washington State Univ
24106 N Bunn Road
Prosser WA 99350
509-786-9390
miwilliams@wsu.edu

Jerome Willie
BIA-Natural Resources
P O Box 1102
Window Rock AZ 86515
928-871-5763

Gary Willoughby
NDSU
5400 Hwy 83 South
Minot ND 58701
701-857-7677
gwillough@ndsu.ext.nodak

Dave Wilson
University of Wyoming
P O Box 3354
Laramie WY 82071
307-766-3329
dwwilson@uwyo.edu

Linda Wilson
PSES Department
University of Idaho
Moscow ID 83844
208-885-9489
lwilson@uidaho.edu

Barry Wingfield
UAP Pueblo
240 22nd Street
Greeley CO 80631
970-352-4750
cbarrywing@aol.com

Sandra Wingfield
Agrisan Inc.
14192 WCR 80
Eaton CO 80615
970-834-2607
agrisan@aol.com

John Withrow
Colorado State University
2050 International Blvd
Ft Collins CO 80524
970-472-9616
johnw@lamar.colostate.edu

Randall Wittie
Genesis Ag Research
938 Corral Place
Galt CA 95632
209-745-6839
rwittie@aol.com

Robert Wolf
Kansas State University
237 Seaton Hall
Manhattan KS 66506
785-532-2935
rewolf@ksu.edu

Mark Wood
Monsanto Company
2533 S Hertzler Rd
Halstead KS 67056
316-835-2716
mark.l.wood@monsanto.com

Steve Wright
UC Cooperative Extension
4437 S Laspina Street #B
Tulare CA 93274
559-685-3309
sdwright@ucdavis.edu

Joe Yenish
Washington State University
P O Box 646420
Pullman WA 99164
509-335-2961
yenish@wsu.edu

Art Yochim
Monsanto
5116 Holash Way
Regina SK Canada
306-543-4519
arthur.d.yochim@monsanto

Frank Young
WSU-USDA-ARS
161 Johnson Hall
Pulman WA 99164
509-335-4196
youngfl@wsu.edu

Steve Young
UC Cooperative Extension
4070 University Road
Hopland CA 95449
707-744-1424
slyoung@ucdavis.edu

Barry Younkin
BASF Corporation
10181 Avenue 416
Dinuba CA 93618
559-591-2548

Joe Zawierucha
BASF Corporation
26 Davis Drive
Res Triangle Park NC 27702
919-547-2095
zawierj@basf.com

Richard Zollinger
NDSU
470H Loftsgard Hall
Fargo ND 58105
701-231-8157
rzolling@ndsuext.nodak.edu

AUTHOR INDEX

Name	Paper number
Adams, E.B.	65
Affeldt, R.P.	79
Alby, T.	129,130
Alford, C.M.	11,53,140
Al-Khatib, K.	88,118,148
Anderson, K.A.	59
Anderson, L.W.	139
Anderson, M.D.	125,126
Anderson, R.	68
Arnold, R.N.	92
Asher, S.	130
Aspinall, R.	112
Baker, J.L.	4
Ball, D.A.	9,29,69
Banks, P.A.	31,114
Banuelos, L.	83
Beck, K.G.	43
Belles, D.S.	48
Bergman, D.L.	61
Bertges, W.R.	125,126
Beutler, B.R.	95,96
Boggs, L.L.	1
Boydston, R.A.	60,101,104
Boyles, M.C.	129, 130
Branum, K.S.	13
Brewster, B.	15, 133
Brock, J.H.	82, 106
Buck, P.	58
Burrough, L.	12
Bussan, A.J.	40, 52, 67
Campbell, J.M.	75
Carlson, K.L.	105, 130
Carney, S.E.	21
Charvat, L.D.	22
Cheatum, B.G.	6
Clay, P.A.	91
Cobb, W.T.	59,119
Coggon, D.F.	27
Cole, C.M.	15,79,133
Colquhoun, J.B.	15,79
Coolidge, D.	5
Corp, M.K.	69
Craig, L.	39
Creech, E.	50
Croslin, J.M.	101
Crumley, L.J.	7
Currie, R.S.	143,148
Dahmer, M.	73,129,130
Daniel, J.T.	68,145
Davis, E.S.	67
DeFrancesco, J.	103
Deibert, K.J.	47
DiTomaso, J.M.	8,109,139
Dotray, P.A.	84
duPonte, M.	108
Dutt, T.E.	149
Dyer, W.E.	58
Eberlein, C.V.	95
Effertz, C.J.	127
Elmore, C.L.	26,113
Elsworth, P.C.	91
Endres, G.J.	76,144
Erickson, A.M.	41
Esser, A.D.	65
Evans, J.O.	50
Fabrizius, C.H.	73
Fandrich, L.M.	123
Fellows, G.M.	73,129,130
Fennimore, S.A.	49,102
Fiore, C.	5,93
Fletcher, F.E.	96
Flowers, N.D.	55,66
Foster, G.	23
Friend, E.J.	120
Frihauf, J.C.	19
Fuchs, J.	94
Fukumoto, G.	108
Gandhi, H.T.	17
Garcia, S.	109
Geier, P.W.	86,121
Geselius, T.C.	107
Goddard, G.F.	129,130
Golus, J.A.	142
Goss, G.A.	58
Greenfield, B.J.	94
Greenland, R.	30
Haack, A.E.	99
Hancock, D.M.	15
Hanson, G.E.	124
Hatterman-Valenti, H.	30
Heering, D.C.	149
Hedberg, R.	37
Hendrickson, P.	30,133,144
Hicks, C.	125,126
Hicks, V.	102
Hild, A.	45
Holm, F.A.	80
Holman, J.D.	40
Holt, J.	38
Holt, R.	68
Hoobler, M.A.	125,126,127
Howatt, K.A.	76,146
Hufbauer, R.A.	21
Hultgreen, G.	90

Name	Paper number
Hulting, A.G.	52
Hutchinson, P.J.S.	46,95,96, 104
Ireland, T.M.	9
Ishida, J.K.	141
Jenks, B.M.	76
Johnson, D.A.	136
Johnson, E.N.	90
Johnson, K.K.	4
Johnson, M.S.	49
Jones, J.S.	91
Jones, T.A.	136
Kaufman, D.	103
Kava, J.A.	137
Kawabata, A.	108
Keeling, J.W.	84
Kelley, J.P.	128
Kelly, S.B.	16
Kirby, D.R.	137
Klein, R.N.	63,142
Knezevic, S.Z.	85
Koike, S.T.	116
Koskela, G.	103
Krenzer, E.G.	70
Kyser, G.B.	8,109
Lane, E.M.	6
Lanini, W.T.	97
Lass, L.W.	10,57
Libbey, C.R.	24
Loper, B.R.	59
Lorenz, B.L.	25
Lubke, J.	105
Luff, K.R.	125,126
Luna, E.L.	5
Lym, R.G.	41,47,137
Mahnken, G.W.	124
Mallory-Smith, C.	15,17,29,79,123,133
Markle, D.M.	76
Marrs, R.A.	21
Martin-Duvall, T.	83
Maruska, D.	125,126
Maupin, B.G.	28
Maxwell, B.D.	40,52,112
Mayonado, D.J.	149
McClosky, W.B.	51
McKay, K.R.	76
Messersmith, C.G.	87,132
Mickelson, J.A.	40,55,66
Miller, B.R.	142
Miller, J.N.	33
Miller, P.R.	40
Miller, S.D.	1,11,19,2527,35,53,56,89,140
Miller, T.W.	24,28
Minihan, C.L.	135
Mojtahedi, H.	101

Name	Paper number
Molin, B.	62
Monaco, T.A.	20,136
Montgomery, R.F.	149
Morishita, D.W.	46,131
Morris, E.	114
Motooka, P.S.	108
Mueller-Warrant, G.	29
Munger, P.M.	129,130
Murray, L.W.	31,93,94
Nader, G.	109
Nelson, J.K.	110,111
Nelson, K.K.	35
Newkirk, J.	65
Nissen, S.J.	23,27,33,34,48
Norris, R.F.	99
Norsworthy, J.H.	31
Norton, J.B.	136
Norton, J.M.	136
Ogg, A.	12
Ogg, P.	23,129,130
Oltmans, S.M.	44
Oman, C.C.	34
O'Meara, S.A.	54
O'Neill, M.K.	92
Onuma, K.	108
Orloff, S.	109
Palumbo, J.C.	91
Park, K-W.	29
Parker, B.	36
Parrish, S.K.	74,145
Particka, M.G.	55,66
Patterson, P.E.	95
Paulsgrove, M.P.	125,126
Peachey, R.E.	100,103
Peeper, T.F.	70,72,78,120,128
Peters, D.A.	84
Peterson, D.E.	88,135
Platt, T.	65
Powley, J.	108
Prather, T.S.	10, 57
Price, T.M.	86,121,147,148
Price, W.J.	57
Rainbolt, C.R.	3
Ramsdale, B.K.	87, 132
Ransom, C.	34,104,141
Ratliff, P.G.	149
Ratnayaka, H.	13
Rauch, T.A.	71
Ray, I.	93
Reed, J.M.	77
Regehr, D.L.	86
Renz, M.J.	139
Rew, L.J.	112
Rice, A.	68
Rice, C.A.	141

Name	Paper number
Richardson, J.M.	99
Riera-Lizarazu, O.	17
Ries, J.L.	134
Roach, R.F.	146
Roberts, D.	65
Roncoroni, J.	26
Ross, K.C.	79
Rugel, D.J.	65
Santo, G.	101
Sapsford, K.L.	80
Schatz, B.G.	144
Schiess, B.L.	42
Scholar, R.	70
Schroeder, J.	5,31,93,94
Shaffii, B.	57
Shaner, D.L.	117
Shelton, C.	73
Shoup, D.E.	88
Smeal, D.	92
Smith, D.T.	64
Smith, L.	2,21
Smith, R.	109
Smith, R.F.	32
Sojka, R.E.	46
Solie, D.A.	72,78
Solie, J.B.	78
Stahlman, P.W.	81,86,121,122, 147
Stamm, D.E.	142
Steinauer, G.	105
Sterling, R.D.	23
Sterling, T.M.	13,18
Stone, A.E.	70,72,78
Stone, J.C.	70
Sutton, J.R.	43
Thill, D.C.	3,7,9,42,57,71,75,77
Thoene, J.W.	6
Thomas, G.	80
Thomas, P.E.	101
Thomas, S.	93,94
Thompson, C.R.	143,148
Thompson, M.	34
Thorsness, K.T.	125,126
Tichota, J.M.	147
Tickes, B.R.	99
Tonks, D.J.	65,95
Umeda, K.	91,98,102
Valdez, J.A.	102
Valenti, S.A.	144
Vales, M.I.	17
Vallotton, A.D.	13,18
Van Vleet, S.M.	129,130
Vargas, R.N.	83
Veatch, M.E.	51
Votaw, J.S.	45

Name	Paper number
Walsh, D.B.	60
Wang, Q.	56
Watson, C.	17
Webber, N.A.P.	4
Wessel, S.	105
West, M.J.	46,131
Westra, P.	23,33,54,145
White, A.D.	86,122
Whitson, T.	12,45
Wicks, G.A.	124,147
Wilkerson, J.	84
Wille, M.J.	75,131
William, R.D.	100
Williams, J.R.	20
Williams, M.M.	34,60
Willoughby, G.P.	76
Wilson, D.W.	56,89
Wilson, R.G.	27
Wilson, R.H.	115
Wolf, R.E.	135
Wright, S.	83
Yenish, J.	9
Young, F.L.	3
Young, S.L.	14,138
Zawierucha, J.E.	22
Zemetra, R.S.	17
Zentner, R.P.	80

CROP INDEX

Crop	Paper number
Alfalfa (*Medicago sativa* L)	92,99,127,140,141
Barley (*Hordeum vulgare* L.)	7,42,52,66,75,87,98
Bean, dry (*Phaseolus vulgaris* L.)	127
Bean, snap (*Phaseolus vulgaris* L.)	100
Blueberry (*Vaccinium* L.).	28
Bluegrass, Kentucky (*Poa pratensis* L.)	77
Broccoli (*Brassica oleracea* L. var. *botrytis* L.)	32,99
Canola [*Brassica napus* (L.) Koch]	3,40,44
Cantaloupe (*Cucumis melo* L.)	98
Carrot [*Daucus carota* L. ssp. *sativus* (Hoffm.) Arcang]	99
Cherry (*Prunus* sp.)	118
Clover	79,127
Ccole crops	91
Ccorn (*Zea mays* L.)	1,50,54,85,98,124,127,147,148
Ccotton (*Gossypium hirsutum* L.).	62,83,91,99,149
Ccucumber [*Cucumis sativus* L.]	97
Fallow	52, 68,74,81,142
Flax (*Linum usitatissimun* L.)	146
Forest	10
Grape (*Vitis* sp.)	118
Grassland	8
Green manure	52
Iris (*Iris* spp.)	24
Lentil (*Lens culinaris* Medik.)	90
Lettuce (*Lactuca* spp.)	98,102
Melons (*Cucumis* L.)	91
Millet, foxtail [*Setaria italica* (L.) P. Beauv]	87
Millet, proso (*Panicum miliaceum* L.)	87
Narcissus (*Narcissus* sp.)	24
Noncrop	8
Oat (*Avena sativa* L.)	87
Onion (*Allium sp.*)	30,34,98
Orchid, western prairie fringed (*Platanthera praeclara* Sheviak & Bowles)	105
Ornamental bulbs	24
Pasture	10,108
Pea (*Pisum sativum* L.)	52,75,80,118,127
Pepper, bell (*Capsicum annuum* L.)	97
Pepper, chile (*Capsicum annuum* L.)	31, 93
Potato (*Solanum tuberosum* L.)	59,95,96,101,104
Prairie, tallgrass	105
Rangeland	8,12,22,105,109,136

Crop	Paper number
Raspberry (*Rubus* sp.)	28
Ryegrass, perennial (*Lolium perenne* L.)	15,133
Sorghum [*Sorghum bicolor* (L.) Moench]	81,86,118,122
Soybean [*Glycine max* (L.) Merr.]	70,85,88,118,147,149
Spearmint (*Mentha spicata* L.)	101
Spinach (*Spinacia oleracea* L.)	98
Squash (*Cucurbita sp.*)	97
Strawberry (*Fragaria Ananassa* Duchesne)	49,103
Sugarbeet (*Beta vulgaris* L.)	1,66,33,35,127
Sugarcane (*Saccharum officinarum* L.)	64
Sunflower (*Helianthus annuus* L.)	40,122
Tomato (*Solanum lycopersicum* L.)	99
Tulip (*Tulipa* spp. 'Apeldoorn')	24
Watermelon [*Citrullus lanatus* (Thunb.) Matsumura & Nakai]	98
Wheat (*Triticum aestivum* L.)	3,19,44,52,56,68,69,71,72, 73,74,75,121,122,124,125,129,130,131,132,142,143

WEED INDEX

Common and Botanical Name	Paper number
Amaranth, Palmer (*Amaranthus palmeri* S. Wats.)	84,86,147
Amaranth, Powell (*Amaranthus powellii* S. Wats.)	100
Barley, foxtail (*Hordeum jubatum* L.)	14
Barley, volunteer (*Hordeum vulgare* L.)	9
Barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.]	35,46,82,100,103,147
Bindweed, field (*Convolvulus arvensis* L.)	81,89,120
Blackberry, Himalaya (*Rubus discolor* Weihe & Nees)	14
Bluegrass, annual (*Poa annua* L.)	49,103,125
Brome, downy (*Bromus tectorum* L.)	20,74,121,125,126,129,136,140
Brome, Japanese (*Bromus japonicus* Thunb. ex Murr.)	129
Brome, ripgut (*Bromus diandrus* Roth)	109
Broom, French (*Cytisus monspessulanus* L.)	138
Broomrape, clover	79
Buckbrush (*Symphoricarpos orbiculatus* Moench)	22
Buckwheat, wild (*Polygonum convolvulus* L.)	35,44,140,144
Burclover, California (*Medicago polymorpha* L.)	40
Camelthorn [*Alhagi pseudalhagi* (Bieb.) Desv]	106
Canarygrass, littleseed [*Phalaris* minor (Retz)]	126
Canarygrass, hood (*Phalaris paradoxa*)	126
Carrot, wild (*Daucus carota* L.)	15
Catsear, common (*Hypochoeris radicata* L.)	14
Cheat (*Bromus secalinus* L.)	129
Chickweed, common (*Stellaria media*)	49,101,103
Cocklebur, common (*Xanthium strumarium* L.)	84
Crabgrass (*Digitaria* spp.)	103
Crabgrass [*Digitaria sanguinalis* (L.) Scop.]	147
Crazyweed, Lambert (*Oxytropis lambertii* Pursh)	18
Crazyweed, Silky (*Oxytropis sericea* Nutt. Ex T. &G.)	18
Cupgrass, prarie (*Eriochloa contracta* Hitchc.)	147
Darnel, Persian (*Lolium persicum* Boiss. & Hohen. ex Boiss.)	40,52,129
Filaree, redstem [*Erodium cicutarium* (L.) L'Her. ex Ait.]	49
Fireweed (*Epilobium angustifoilium* L.)	108
Flax, volunteer (*Linum usitatissimun* L.)	144
Foxtail, giant (*Setaria faberi* Herrm.)	127
Foxtail, green [*Setaria viridis* (L.) P. Beauv.]	35,44,46,53,76,89,95,127,140,144
Foxtail, yellow [*Setaria glauca* (L.) Beauv.]	44,76,140,144
Goatgrass, jointed(*Aegilops cylindrica* Host)	17,23,72,73,89,121,122,124,129
Goldenrod	22
Goosefoot, nettleleaf (*Chenopodium murale* L.)	102
Gorse (*Ulex europaeus* L.)	14
Groundsel, common (*Senecio vulgaris* L.)	100,103
Henbit (*Lamium amplexicaule* L.)	101,103
Horseweed [*Conyza canadensis* (L.) Cronq.]	149
Ironweed (*Veronia* sp.)	22

Common and Botanical Name	Paper number
Johnsongrass [*Sorghum halepense* (L.)Pers.]	127
Jubatagrass	138
Knapweed, diffuse (*Centaurea diffusa* Lam.)	22,110,111
Knapweed, spotted (*Centaurea maculosa*)	2,10,21,89
Knapweed, Russian (*Acroptilon repens* L.)	45
Knotweed, prostrate (*Polygonum aviculare* L.)	49,69
Kochia [*Kochia scoparia* (L.) Schrad.]	1,25,35,46,53,58,66,86,89,95,101,131,140,147
Lambsquarters, common (*Chenopodium album* L.)	1,27,30,35,44,50, 53,82,80,92,95,100,104,134,140
Lettuce, prickly (*Lactuca serriola* L.)	101,103
Lespedeza, sericea [Lespedeza cuneata (Dumont) G. Don]	22
Loco, woolly (*Astragalus mollissimus* Torr.)	18
Mallow, common (*Malva neglecta* Wallr.)	35,46
Mallow, little (*Malva parviflora* L.)	102
Marshelder (*Iva xanthifolia* Nutt.)	134
Medusahead [*Taeniatherum caput-medusae* (L.) Nevski]	20,134
Millet, wild-proso (*Panicum miliaceum* L.)	46
Morningglory, annual (*Ipomoea*	*83*
Morningglory, pitted (*Ipomoea lacunosa* L.)	82
Mustard, wild (*Brassica* spp.)	30,44,90,134
Nettle, stinging (*Urtica dioica* L.)	32
Nightshade, black (*Solanum nigrum* L.)	81
Nightshade, cutleaf (*Solanum triflorum* Nutt.)	89
Nightshade, Eastern black (*Solanum ptycanthum* Dun.)	134
Nightshade, hairy (*Solanum sarrachoides* Sendtner)	33,46,53,100,102,140
Nightshade, silverleaf (*Solanum elaeagnifolium* Cav.)	84
Nutsedge, purple (*Cyperus rotundus* L.)	51
Nutsedge, yellow (*Cyperus esculentus* L.)	28,82,93,94
Oat (*Avena sativa* L.)	135
Oat, slender (*Avena barbata* J.F.Pott ex Link)	14
Oat, wild (*Avena fatua* L.)	7,52,55,56,89,125,129,132
Panicum, fall (*Panicum dichotomiflorum* Michx.)	127
Pepperweed, perennial (*Lepidium latifolium* L.)	147
Phalaris sp.	25
Pigweed, prostrate (*Amaranthus blitoides* S. Wats.)	92,144
Pigweed, redroot (*Amaranthus retroflexus* L.)	30,32,35,44,46,50,85,86,92,95,103,104,134,140,144,146
Pigweed, tumble (*Amaranthus albus* L.)	86,147
Pineappleweed (*Matricaria matricarioides*)	103
Poison-oak [*Toxicondendron toxicarium* (Salisb.) Gillis]	10
Potato, volunteer (*Solanum tuberosum* L.)	34,60
Puncturevine (*Tribulus terrestris*)	35,86
Purslane, common (*Portulaca oleracea* L.)	32,35,100,102,147
Quackgrass (*Elytrigia repens* L.)	28
Ragweed, common (*Ambrosia artemisiifolia* L.)	35
Ragweed, giant (*Ambrosia trifida* L.)	127
Ragweed, western (*Ambrosia psilostachya* DC.)	22
Rose, Arkansas	125

Common and Botanical Name	Paper number
Rye, feral (*Secale cereale* L.)	23,56,73,78,121,129
Ryegrass, Italian (*Lolium multiflorum* Lam.)	71,125,126,129
Sandbur, longspine [*Cenchrus longispinus* (Hack.) Fern.]	140,147
Shepherdspurse [*Capsella bursa-pastoris* (L.) Medik]	102,103
Skeletonweed, rush (*Chondrilla juncea* L.)	10
Smartweed, Pennsylvania (*Polygonum pensylvanicum* L.)	100
Sowthistle, annual (*Sonchus oleraceus* L.)	103
Sprangletop, Mexican [*Leptochloa uninervia* (Presl) Hitchc. & Chase]	82,102
Speedwell, Persion (*Veronica persica* Poir.)	49
Speedwell, purselane (*Veronica peregrina L.*)	103
Spurge, leafy (*Euphorbia esula* L.)	41,47,89,105
Spurge, toothed (*Euphorbia dentata* Michx.)	33
Spurry, corn (*Spergula arvensis* L.)	49
Starthistle, yellow (*Centaurea solstitialis* L.)	57
Stinkgrass [*Eragrostis cilianensis* (All.) E. Mosher]	2,10,21,89
Sunflower, common (*Helianthus annuus* L.)	35
Thistle, Canada [*Cirsium arvense* (L.) Scop.]	28,89,101
Thistle, musk (*Carduus nutans* L.)	111
Thistle, Russian (*Salsola kali* L. var. *tenuifolia* Tausch)	33,35,67,69,92,142
Thistle, Scotch (*Onopordumacnthium* L.)	10
Toadflax, Dalmation [*Linaria genistifolia* ssp. *Dalmatica* (L.) Maire & Petitmengin]	10,22,11
Toadflax, yellow (*Linaria vulgaris* Mill)	43
Velvetgrass, common (*Holcus lanatus* L.)	14
Velvetleaf (*Abutilon theophrasti* Medik.)	86
Vernalgrass, sweet (*Anthoxanthum odoratum* L.)	14
Waterhemp, common (*Amaranthus rudis* Sauer)	88
Waterhemp, tall [*Amaranthus tuberculatis* (Moq.) J.D.Sauer]	147
Wheat, winter (*Triticum aestivum* L.)	9,74,143
Windgrass, interrupted (*Apera interrupta L.*)	103
Windgrass (*Apera spica-venti*)	103
Windmillgrass, tumbel (*Chloris verticillata* Nutt.)	147
Witchgrass (*Panicum capillare* L.)	35, 1147
Yarrow, western (*Achillea lanulosa* Nutt.)	22

HERBICIDE INDEX

Herbicide — **Paper number**

acetic acid 14
acetochlor
2-chloro-*N*-(ethoxymethyl)-*N*-(2-ethyl-6-methylphenyl)acetamide 33
aciflurfen
5-[2-chloro-4-trifluoromethyl)pheonoxy]-2-nitrobenzoic acid 88
atrazine
6-chloro-*N*-ethyl-*N'*-(1-methylethyl)-1,3,5-triazine-2,4-diamine 53,85,86,124
azafenidin
2-[2,4-dichloro-5-(2-propynyloxy)phenyl]-5,6,7,8-tetrahydro-1,2,4-triazolo[4,3-*a*] pyridin-3(2*H*)-one 103
bensulide
0,0-bis(1-methylethyl) *S*-[2-[(phenylsulfonyl)amino]ethyl]phosphorodithioate 32,102
bentazon
3-(1-methylethyl)-(1*H*)-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide 100
bromoxynil
3,5-dibromo-4-hydroxybenzonitrile 30,34,66,69,76,83,92,132,144
carfentrazone-ethyl
α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1*H*-1,2,4-triazol-1-yl]-4-
fluorobenzenepropanoic acid 32,67,69,83,86,96,146
CGA362622 (trifloxysulfuron)
N-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-3-(2,2,2-trifluoroethoxy)-2-pyridinesulfonamide 51
chlorsulfuron
2-chloro-*N*-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide 25,71
citrus distillate 14
clethodim
(*E,E*)-(±)-2-[1-[[3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)
propyl]-3-hydroxy-2-cyclohexene-1-one 3,33,44,92
clodinafop-propargul
2-propynyl-(*R*)-2-[4-(5-chloro-3-fluoro-2-pyridyloxy)-phenoxy]-propionate 71,76,144
clomazone
2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone 31,61,132
clopyralid
3,6-dichloro-2-pyridinecarboxylic acid 108,144
cloransulam
3-chloro-2-[[(5-ethoxy-7-fluoro[1,2,4]triazolo[1,5-c]pyrimidin-2yl)sulfonyl]amino]benzoic acid 134,149
corn gluten meal 14,138
cycloate
S-ethyl cyclohexylethylcarbamothioate 32
DCPA
dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate 32
desmedipham
ethyl[3-[[(phenylamino)carbonyl]oxy]phenyl]carbamate 33,35,66
dicamba
3,6-dichloro-2-methoxybenzoic acid 33,108
dichlobenil
2,6-dichlorobenzonitrile 28
diflufenzopyr
2-[1-[[[[3,5-difluorophenyl]amino]-carbonyl]hydrazono]ethyl]-3-pyridinecarboxylic acid 22,33,47
dimethenamid
(1*RS*,a*RS*)-2-chloro-*N*-(2,4-dimethyl-3-thienyl)-*N*-(2-methoxy-1-methylethyl)-acetamide 30,46,103,104
diquat
6,7-dihydrodipyrido[1,2-a:2',1'-c]pyrazinediium ion 96

Herbicide **Paper number**

diuron
N'-(3,4-dichlorophenyl)-*N,N*-dimethylurea 3,24,82,133,149
endothall
7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid 96
EPTC
S-ethyl dipropyl carbamothioate 32,95,100,104
ethalfluralin
N-ethyl-*N*-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine 46,95
ethanmetsulfuron methyl
2-[[[[[4-ethoxy-6-(methylamino)-1,3,5-triazin-2-yl]amino]carbonyl]amino]sulfonyl]benzoic acid 32
ethofumesate
(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate 30,33,66,103
fenoxaprop
(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy] propanoic acid 7,76,132,144
fluamide 103
flucarbazone-sodium
4,5-dihydro-3-methoxy-4-methyl-5-oxo-N-
[[2-(trifluoromethoxy)phenyl]sulfonyl]-1H-1,2,4-triazole-1-carboxamide 71,76,87,128,132,144
flufenacet
N-(4-fluorophenyl)-N-(1-methylethyl)-2-[[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yl]oxy]acetamide 30,71
flumioxazin
2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2*H*-1,4-benzoxazin-6-yl]-
4,5,6,7-tetrahydro-1*H*-isoindole-1,3(2*H*)-dione 30,103
fluroxypyr
[(4-amino-3,5-dichloro-6-fluoro-2-pyridyl)oxy]acetic acid 38,80,121,123
fomesafen
5-[2-chloro-4-(trifluoromethyl)phenoxy]-*N*-(methylsuflonyl)-2-nitrobenzamide 88
glufosinate
2-amino-4-(hydroxymethylphosphinyl)butanoic acid 3,14,24,53,96,148
glyphosate
N-(phosphonomethyl)glycine 1,3,14,24,28,33,35,40,44,52,59,61,64,67,68,70,74,77,79,83,84,87,88,102,
..... 117,122,124,135,139,142,143,144,145,146,147,148,149
halosulfuron
methyl-3-chloro-5-(4,6-dimethoxypyrimidin-2-yl-carbamoylsulfamoyl)-1-
methyl-pyrazole-4-carboxylate 28,31,86,97,98
imazamethabenz
(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-
imidazol-2-yl]-4(and 5)-methylbenzoic acid (3:2) 132
imazamox
2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-5-
(methoxymethyl)nicotinic acid 71,73,78,79,87,92,100,121,130,134,140,141
imazapic
(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-
oxo-1*H*-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid 12,41,77,105
imazethapyr
2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-5-
ethyl-3-pyridinecarboxylic acid 59,88,92,140,148
iodosulfuron-methyl
4-iodo-2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]
benzoic acid methyl ester, monosodium salt (CAS) 128
isoxaben
N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide 14,24,103,138

Herbicide	Paper number
isoxaflutole	
(5-cyclopropyl-4-isoxazolyl)[2-(methylsulfonyl)-4-(trifluoromethyl)phenyl]methanone	33
lactofen	
(±)-2-ethoxy-1-methyl-2-oxoethyl5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate	88,100
MCPA	
(4-chloro-2-methylphenoxy) acetic acid	66,76,108,132,144
mesosulfuron-methyl	
2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-4-[[(methylsulfonyl)amino]methyl]benzoic acid (CAS)	126,128
mesotrione	
2-(4-mesyl-2-nitrobenzoyl)-3-hydroxycyclohex-2-enone	50
metolachlor	
2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)acetamide	30,32,53,95,100
metribuzin	
4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4*H*)-one	30,71,90,95,104
metsulfuron	
methyl 2-[[[[(4-methoxy-6-methyl- 1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]benzoate	108
MKH 6561	
methyl 2-({[(4-methyl-5-oxo-3-propoxy-4,5-dihydro-1H-1,2,4-triazol-1-yl)carbonyl]amino}sulfonyl)benzoate sodium salt (IUPAC)	26,32,108,118,128
MSMA	
mono sodium salt of methylarsonic acid	83
nicosulfuron	
2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-N,N-dimethyl-3-pyridinecarboxamide	127,134
oryzalin	
4-(dipropylamino)-3,5-dinitrobenzenesulfonamide1	4,24,138
oxyfluorfen	
2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene	30,34,83,103,55
paraquat	
1,1□-dimethyl-4,4□ bipyridinium ion	3,67,88,96,135
pendimethalin	
N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	24,30,83,95,104
phenmedipham	
3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate	33,35,66
picloram	
4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid	45,107
pine oil	14
plant essential oils	14
primisulfuron	
2-[[[[[4,6-bis(difluoromethoxy)-2-pyrimidinyl]amino]carbonyl]amino]sulfonyl]benzoic acid	29,127
prodiamine	
2,4 dinitro-N^3,N^3-dipropyl-6-(trifluoromethyl)-1,3-benzenediamine	82
prometryn	
6-methoxy-*N,N'*-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine	83,84
prosulfuron	
1-(4-methoxy-6-methyl-triazin-2-yl)-3-[2-(3,3,3-trifluoropropyl)-phenylsulfonyl]-urea	15,86,127
pyridate	
O-(6-chloro-3-phenyl-4-pyridazinyl) S-octyl carbonothioate	32

Herbicide **Paper number**

pyrithiobac
2-chloro-6-[(4,6-dimethoxy-2-pyrimidinyl)thio]benzoic acid 62,83
quinclorac
3,7-dichloro-8-quinolinecarboxylic acid 15,32,41,47
quizalafop
(+)-2-[4-[(6-chloro-2-quinoxalinyl)oxy]phenoxy]propanoic acid 3,28,44
rimsulfuron
N-[[4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-3-(ethylsulfonyl)-2-pyridinesulfonamide 59,95,104
sethoxydim
2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen -1-one 87,90,148
simazine
6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine 103
sodium chlorate 81
sodium chloride 81
sulfentrazone
N-[2,4-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-
5-oxo-1*H*-1,2,4-triazol-1-yl] phenyl]methanesulfonamide 32,67,88,103
sulfosate
N-phosphonamethylglycine trimethyl suflonium salt 28
sulfosulfuron
1-(4,6-dimethoxypyrimidin-2-yl)-3-[2-ethanesulfonyl-imidazo[1,2-a]pyridine-3-yl)sulfonylurea 20,71,128
sulfuric acid 96
thiazopyr
methyl 2-(difluoromethyl)-5-(4,5-dihydro-2-thiazolyl)-
4-(2-methylpropyl)-6-(trifluoromethyl)-3-pyridinecarboxylate 24,103
thifensulfuron
3-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]
amino]sulfonyl]-2-thiophenecarboxylic acid 59,69,76,88,132,144
tralkoxydim
2-[1-ethoxyimino)propyl]-3-hydroxy-5-(2,4,6-trimethylphenyl)-2-cyclohexen-1-one 71,76,132,144
triasulfuron
2-(2-chloroethoxy)-*N*-[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide 71
tribenuron
2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)-methylamino]carbonyl]amino]sulfonyl]benzoic acid
15,59,69,76,131,134
triclopyr
[(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid 45,108
trifloxysulfuron
N-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-3-(2,2,2-trifluoroethoxy)-2-pyridinesulfonamide 51
trifluralin
2,6-dinitro-*N*,*N*-dipropyl-4-(trifluoromethyl)benzeneamine 84
triflusulfuron
methyl-2-[[[[4-dimethylamino)-6-(2,2,2-trifluoroethoxy)-1,3,5-triazin-2-yl]
amino]carbonyl]amino]sulfonyl]-3-methylbenzoate 35,66
2,4-D
(2,4-dichlorophenoxy)acetic acid 12,58,64,68,69,74,86,106,107,142,146
2,4-DB
4-(2,4-dichlorophenoxy)butanoic acid 92

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