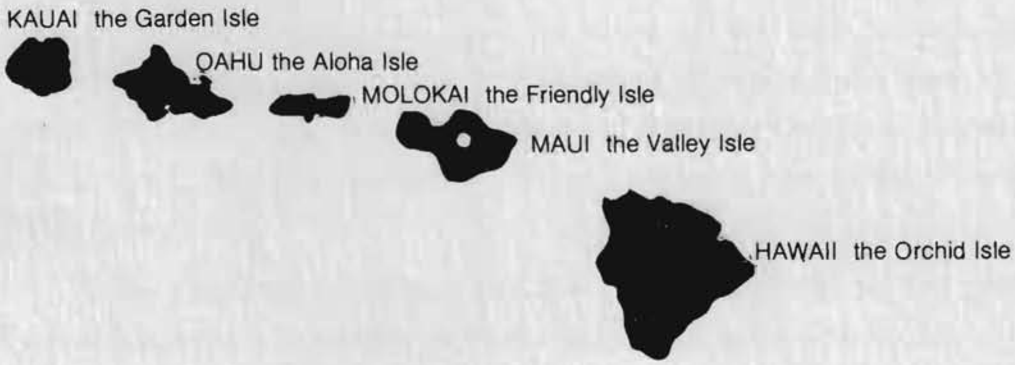
RESEARCH PROGRESS REPORT



WESTERN SOCIETY OF WEED SCIENCE
Maui, Hawaii March 11, 12, and 13, 1974

FORWARD

The 1974 Annual Research Progress Report of the Western Society of Weed Science consists of summaries and abstracts of recent investigations in weed research. These reports have been submitted voluntarily by the Society's members who are engaged in research, extension, regulatory and commercial work. This report will be supplemented by the Proceedings from the Western Society of Weed Science meeting to be held in March 1974 at Maui, Hawaii.

The Research Committee consists of seven Research Project Chairmen and a Committee Chairman. The assembling and summarizing of information in each of the seven areas has been the responsibility of the Project Chairman. All reports were edited for conformity as to chemical and weed nomenclature, abbreviations, and for corrections of obvious errors. Information contained in the Research Progress Report should be considered tentative and NOT FOR PUBLICATION. Abstracts should not be reproduced without permission of the authors. Reports printed in the Progress Report do not constitute prior publication.

This report does not contain recommendations for herbicides, nor does it imply that the uses discussed in the text are registered by the Environmental Protection Agency. Registered trade names have been used occasionally for informative purposes only and does not imply endorsement of any commercial product by the author.

The common and botanical names of weeds suggested by the Subcommittee on Standardization of Names of Weeds of the Weed Science Society of America has been used. The common names of herbicides have followed the report of the Terminology Committee of the Weed Science Society where possible. The full chemical name of numbered compounds, if known, also has been given.

The Research Committee extends their gratitude to all those who have contributed reports on their research and findings. The Chairman also extends his thanks to each Research Project Chairman for assembling and summarizing his section and meeting the deadline imposed upon him.

Edward E. Schweizer
Chairman, Research Committee
Western Society Weed Science

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PROJECT 1. PERENNIAL HERBACEOUS WEEDS

W. G. Purdy, Project Chairman

SUMMARY

Of the nine papers submitted for publication in this year's Research Progress Report, seven are based mainly on results obtained from use of the compound glyphosate. One paper concerns soil active compounds and one the results of tests of asulam.

Species on which glyphosate were tested included yellow nutsedge, perennial pepperweed, johnsongrass, Dalmatian toadflax, quackgrass, bermudagrass, Russian knapweed, and Canada thistle.

Rates of 2 to 4 lb/A of glyphosate generally gave control on the order of 85-95%. Research on Canada thistle indicated timing greatly influences control with glyphosate. One test showed poor control of field bindweed at two rates and stages of growth in contrast to success on the same species with glyphosate by the same researchers. Indications are that differential susceptibility may be a function of ecotype and/or climatic conditions.

Asulan showed excellent activity on several species of weeds, including western bracken, broadleaf dock, and bull thistle at 2 to 4 lb/A. Severe inhibition and growth repression were obtained on bentgrass, velvetgrass, and Canada thistle at similar rates. Little or no activity was observed on wild carrot or broadleaf plantain.

Alfalfa, white clover, orchardgrass, ryegrass, and fescue all exhibit tolerance to asulan.

The herbicides bromacil, karbutilate, tebuthiuron, and metribuzin exhibited no activity on scouringrush at either 4 or 8 lb/A.

A numbered compound GK 40 shows a high degree of activity on field bindweed.

Fallow treatment of yellow nutsedge with MSMA or glyphosate. Kempen, H. M. Foliar treatments of MSMA, paraquat or glyphosate on yellow nutsedge (*Cyperus esculentus* L.) were compared in a well-irrigated area of a cotton field. Yellow nutsedge plants were well flowered when treated initially on 7/27/72. A second application was made to selected plots on 9/6/72; regrowth was 2-8 in tall. Ratings, tuber counts and viability, and regrowth evaluations were made the next spring.

Results showed that single or dual treatments of glyphosate or MSMA provided significant tuber reduction but insignificant effect on regrowth the next spring (see table). They indicate that two fallow treatments with these herbicides are not feasible. Such conclusions are corroborated by grower results in Kern County. (University of California Agr. Ext. Serv., Bakersfield, California.)

Fallow foliar treatment of yellow nutsedge with MSMA and glyphosate 1/

Treatment	Rate (lb/A)	Yellow nutsedge control 2/ 9/7/72	5/8/73	Tubers/ sample 3/	Shoots/flat 4/ 1/24	2/15
paraquat check	1 + 0	2.0	2.0	404	290	506
glyphosate	2 + 0	8.0	2.5	304	42	71
glyphosate	2 + 2	8.0	3.0	374	33	54
untreated	-			509	196	431
MSMA	2 + 0	7.5	2.0	126	49	55
MSMA	2 + 2	7.0	2.0	89	20	34
paraquat	1 + 0	3.0	1.5	177	102	243

1/ Treated 7/27/72; retreated indicated plots on 9/7/72. Two replications.

2/ Rated 0 to 10 on regrowth; 0 = no effect; 10 = 100% reduction in stand.

3/ Number or tubers screened from 2/3 cubic feet of soil taken from the upper 4 inches in each plot.

4/ Shoots counted after planting tubers from each plot into flats in the greenhouse in January 1973.

Johnsongrass (Sorghum halepense (L.) Pers.) control with glyphosate and MSMA. McHenry, W. B.[1], N. L. Smith[1] and R. Gripp[2]. Mature johnsongrass along a Shasta County roadside was selected to test the response to glyphosate and MSMA. The experimental site was adjacent to a flood irrigated pasture and received ample moisture during the summer months. Johnsongrass was in full flower, vigorous and 3 to 6 ft tall and in full bloom when treated June 25, 1973. Treatments consisted of glyphosate at 1, 2 and 4 lb/A and MSMA at 4 lb/A applied in 40 gpa with a knapsack sprayer and 3 nozzle boom. Air temperature was 105 F. Both glyphosate and MSMA contained surfactant in the formulation. MSMA was retreated August 8, 1973, and glyphosate on September 18, 1973.

Results with glyphosate were excellent at all rates, with 4 lb/A giving near eradication. Control with two MSMA treatments was considerably less effective. (Cooperative Extension, University of California, Davis[1] and Shasta County, Redding[2].)

Response of johnsongrass to glyphosate and MSMA

Herbicide	Rate (lb/A)	Control (10 = 100%) 8/21/73	Control (10 = 100%) 11/1/73
glyphosate	1	9.1	9.2
glyphosate	2	9.4	9.9
glyphosate	4	9.7	9.9
MSMA	4	1.5	4.3
control	-	0.5	0.0

Control of Canada thistle with glyphosate. Zimdahl, R. L., P. E. Heikes and J. M. Foster. Three separate experiments were established in 1972 to evaluate glyphosate for the control of Canada thistle (*Cirsium arvense* (L.) Scop.). In Experiments A and B, rates of 1.5 and and 3.0 lb/A were applied in the spring at the rosette, pre-bud, and early bloom stages of growth. A randomized block design with four replications was used and the herbicide was applied in water at 15 gpa. The same rates were also applied in mid-October of 1972 at the rosette stage of growth. Experiment C included two replications and rates of 1, 2, and 4 lb/A in the spring followed by an overspray of 2 lb/A in the fall. No abnormal conditions were encountered at the time of application. The soils in Experiments A and B were clays with 1.5 and 2.8% organic matter respectively and a pH of 8.0.

The data in the table show control from different rates applied in the spring regardless of the stage of growth. However, with the notable exception of Experiment A, the stand counts in spring treated plots were as large as those in the check in the succeeding spring. Experiment A is inconsistent with all of our work. The control persists to date but has not at any other location. In opposition to these results, fall application, with or without spring treatments, has shown consistently excellent control with almost no regrowth. Therefore, we conclude that glyphosate should be applied in the fall as opposed to spring for control of Canada thistle.

Canada thistle stand count

Stage of growth when sprayed 1972	Rate of glyphosate (lb/A)	Live Canada thistle plants/2 sq ft 1/ — 1972 — 7/7		10/10		1973 — 5/14		6/8	7/19
Experiment		A	B	A	B	A	B	C 2/	C 2/
rosette	1.5	0.3	3.5	3.0	6.1	0.1	7.4		
	3	0.1	1.4	0.5	4.0	0.0	5.1		
pre bloom	1							4.5	14.0
	1.5	1.3	6.4	2.3	6.0	0.7	9.5		
	2							2.0	10.0
	3	0.0	5.0	0.0	6.5	0.0	6.3		
	4							0.5	4.5
late bud	1							4.5	10.0
	2							1.5	13.0
	4							0.5	2.0
early bloom	1.5	11.3	8.3	7.1	6.1	7.8	7.9		
	3	10.5	4.1	0.6	1.8	0.9	4.5		
late blossom	1							6.0	12.5
	2							1.5	8.0
	4							0.5	2.5
fall rosette	1								
	1.5			11.3	6.0	1.3	0.5		
	2							2.0	4.0
	3			11.3	6.0	0.6	1.0		
check		11.0	6.1	11.3	6.4	12.8	7.9	100.0	100.0

1/ Experiments A and B average of 2 - 2 sq ft counts in 4 reps.
Experiment C average of 1 - 32 sq ft count in 2 reps.

2/ Note: These plots were treated with the designated rate in the spring followed by 2 lb/A in the fall.

Influence of stage of growth of Canada thistle on activity of glyphosate. Alley, H. P. and G. A. Lee. Response of Canada thistle (*Cirsium arvense* (L.) Scop.) to applications of glyphosate applied at three stages of growth were evaluated in a test established in Converse County. Picloran, picloram + 2,4-D, and dicamba + 2,4-D were included in the test for comparisons.

The test site was a heavily infested pasture. Applications were applied in a total volume of 40 gpa water, with a three nozzle knapsack sprayer on three separate stages of growth. On the first date of application, 6/1/72, the Canada thistle was in the early bud stage of growth, on the second date of application, 7/26/72, the Canada thistle was in full bloom, and on the third date, 8/23/72, it was past bloom.

Percentage reduction in Canada thistle stand and associated vegetation response was evaluated 8/23/73, approximately one year following treatment, and is included in the attached table.

Although the rates of application were too light for effective reduction in Canada thistle stand, application at the full bloom stage of growth appeared to be the most optimum stage for the activity of glyphosate toward Canada thistle than either earlier or later stages of growth. The Canada thistle plants growing in the plots treated with glyphosate were retarded in growth and exhibited herbicidal damage.

Information gained from this set of tests would indicate that higher rates of glyphosate are needed, and there is a difference in the activity as influenced by stage of growth when the compound is applied. (Wyoming Agricultural Experiment Station, Laramie, SR-540.)

Reduction in stand of Canada thistle resulting from three dates of application of glyphosate

Treatment	Rate (lb/A)	Evaluation
1st treatment date 6/1/72 (early bud)		
glyphosate	0.5	10% stand reduction - grass stand reduced
glyphosate	1.0	20% stand reduction - grass stand reduced
glyphosate	1.5	20% stand reduction - grass stand reduced
picolinic acid + 2,4-D[1/]	0.25 + 0.5	100% stand reduction - grass stand reduced
2nd treatment date 7/26/72 (full bloom)		
glyphosate	0.5	20% stand reduction - grass stand reduced
glyphosate	1.0	40% stand reduction - grass stand reduced
glyphosate	1.5	40% stand reduction - grass stand reduced
picloram	1.0	100% stand reduction
dicamba + 2,4-D	1.0 + 2.0	95% stand reduction
3rd treatment date 8/23/72 (past bloom)		
glyphosate	0.5	0.0% stand reduction - some grass stand reduction
glyphosate	1.0	0.0% stand reduction - some grass stand reduction
glyphosate	1.5	20% stand reduction - some grass stand reduction
picloram	1.0	100% stand reduction
dicamba + 2,4-D	1.0 + 2.0	40% stand reduction with reduced vigor

1/ Tordon 212

Perennial weed control with glyphosate. Burr, R. J. Evaluations, at least 12 months after application, of control of a number of perennial weeds species indicated good to excellent control with glyphosate. Applications to all species were made in the bud or heading stage of growth. Glyphosate applications at 4 lb/A were giving 90% control of Dalmatian toadflax (*Linaria dalmatica* (L.) Mill.), 95% control of leafy spurge (*Euphorbia esula* L.), 99% control of johnsongrass (*Sorghum halepense* (L.) Pers.), 75% bermudagrass (*Cynodon dactylon* (L.) Pers.) control, and 92% desert saltgrass (*Distichlis stricta* (Torr.) Rydb.) control. Applications made on yellow nutsedge (*Cyperus esculentus* L.) prior to seedhead emergence resulted in only 60% control. Many remaining plants had not emerged at the time of application.

Applications of glyphosate at 2 lb/A provided 85% hoary cress (*Cardaria draba* (L.) Desv.) control, 98% control of quackgrass (*Agropyron repens* (L.) Beauv.), and 98% control of Canada thistle (*Cirsium arvense* (L.) Scop.). The Canada thistle control trial area was tilled approximately 3 months after application and rye (*Secale cereale* L.) was planted. Picloram and dicamba, included for comparative purposes, severely injured the rye, but no adverse effects were observed in the glyphosate plots.

Plots established during 1973 on reed canarygrass (*Phalaris arundinacea* L.), tuber oatgrass (*Arrhenatherum elatius* var. *bulbosum* (Willd.) Spenner.), and Russian knapweed (*Centaurea repens* L.) were showing good initial control with 2 lb/A glyphosate applications. The underground reproductive systems were showing signs of decay when initial evaluations were made 2 months after application.

Applications of glyphosate made before the bud or heading stage of growth were less effective, probably due to inadequate foliage growth and translocation.

On Dalmatian toadflax, leafy spurge, and hoary cress plants not killed by glyphosate, dormancy of lateral buds appeared to be broken. Meristematic tissue on some of these buds appeared to be severely damaged and plants did not develop from these buds. (Crop Science Department, Oregon State University, Corvallis.)

Control of field bindweed resulting from two new compounds. Alley, H. P. and G. A. Lee. Two new compounds, glyphosate and GK 40 (chemistry unavailable), a product of Wellgro, Inc., Wellington, Colorado, were applied to a replicated series of plots in the early fall of 1972 and the summer of 1973. The field bindweed (*Convolvulus arvensis* L.) was past bloom at the time of the 1972 treatment date and in full bloom on the 1973 treatment date.

The treatment of GK 40 resulted in 93 to 99% reduction in field bindweed stand as evaluated one year following treatment and also showed good activity when evaluated approximately six weeks following the 1973 treatments. The presence of annual weed species on the one-year old plots would indicate limited soil persistence or high solubility and leaching from the top soil profile.

Glyphosate was not effective, at the rates applied, at either of the dates and stages of growth when the chemical was applied.

Since effective control has been obtained with glyphosate at other locations within the state, there may be considerable differences in the susceptibility of ecotypes and/or climatic conditions. (Wyoming Agricultural Experiment Station, Laramie, SR-533.)

Field bindweed control

Treatment[1/]	Rate/A	Evaluation[2/]
GK 40	1 gal	93% control - annual weeds present
GK 40	2 gal	98% control - annual weeds present - severe damage to kochia
GK 40	3 gal	99+% control - annual weeds present - severe damage to kochia
glyphosate	1.0	30% control - annual weeds present
glyphosate	2.0	20% control - annual weeds present
picloram	1.5	100% control - kochia and witchgrass in plots

1/ 9/18/72 - Mature stand - few small flowers on plants.

2/ 8/ 8/73 - Average of three replications.
Annual weeds: kochia, Russian thistle, wild buckwheat, buffalobur, green foxtail, prickly lettuce.

Treatment[3/]	Rate/A	Evaluation[4/]
GK 40	1 gal	99+% control - green foxtail emerging - all other annuals absent
GK 40	2 gal	99+% control - green foxtail emerging - all other annuals absent
GK 40	3 gal	99+% control - green foxtail emerging - all other annuals absent
glyphosate	2.0	30% control - limited number of annuals present
glyphosate	3.0	30% control - limited number of annuals present
glyphosate	4.0	20% control - limited number of annuals present

3/ 6/22/73 - Full bloom.

4/ 8/ 8/73 - Average of three replications.

Perennial pepperweed (Lepidium latifolium L.) control with foliar applied herbicides. McHenry, W. B.[1], D. E. Bayer[2] and N. L. Smith[1]. A Yolo County roadside was selected to test the response of perennial pepperweed to glyphosate, glyphosate + 1% non-phytotoxic oil (Red Top Mor-Act), 2,4-D isooctyl ester, 2,4-D 2-ethylhexyl ester invert, 2,4-D dodecyl-tetradecyl amine, silvex isooctyl ester, and MSMA. Treatments were applied June 29, 1972 in 40 gpa with a plot size of 225 sq ft and four replications. Perennial pepperweed was in full bloom, 1.5 to 3 ft tall, but in a droughty condition due to lack of winter rainfall. Retreatments were made July 2, 1973 on all plots except glyphosate which were retreated August 24, 1973; again perennial pepperweed was in full bloom.

Perennial pepperweed response to glyphosate was superior to the three 2,4-D acid derivatives and silvex included in this study. MSMA was the least effective. Although the glyphosate formulation used contained surfactant, the addition of a low phytotoxic emulsifiable oil at 1% by volume appeared to improve control. (Cooperative Extension[1] and Agricultural Experiment Station[2], Botany Department, University of California, Davis.)

Response of perennial pepperweed to glyphosate, 2,4-D, silvex and MSMA

Herbicide	Formulation (ae/gal)	Rate (lb/A)	Control (10 = 100%) 5/14/73
glyphosate	3 lb	1	0.3
glyphosate		2	5.0
glyphosate + 1% oil		2	7.0
glyphosate		4	9.2
2,4-D isooctyl ester	4 lb	2	3.6
2,4-D isooctyl ester		4	4.6
2,4-D 2-ethylhexyl ester	2 lb	2	2.0
2,4-D 2-ethylhexyl ester	invert	4	6.6
2,4-D dodecyl-tetradecyl amine	3 lb	2	1.6
2,4-D dodecyl-tetradecyl amine		4	2.6
silvex	4 lb	2	4.6
silvex		4	4.0
MSMA	6 lb	4	1.6
control	-	-	0.0

Asulam activity on several weed species. Burr, R. J. and D. R. Harper. Asulam has provided good control of several weed species in replicated field trials in western Oregon. Bentgrass (Agrostis tenuis Sibth.) and velvetgrass (Holcus lanatus L.) were severely inhibited at asulam rates of 2 or 4 lb/A, applied when there was 3 to 6 in of vegetative growth. Western bracken (Pteridium aquilinum var. pubescens Underw.) was completely killed, when 4 lb/A of asulam was applied to fully expanded fronds, when evaluated 13 months after application. Asulam at 2 lb/A provided 95 to 98% control of broadleaf dock (Rumex obtusifolius L.), tansy ragwort (Senecio jacobaea L.), and bull thistle (Cirsium vulgare (Savi) Tenore) when applied to these plants in the rosette stage of growth. Season-long suppression of Canada thistle (Cirsium arvense (L.) Scop.) was obtained with asulam applications of 2 lb/A. Application was most effective after the Canada thistle had at least 6 in of vegetative growth above ground.

Little or no asulam activity was observed on wild carrot (Daucus carota L.) or broadleaf plantain (Plantago major L.) at rates up to 4 lb/A. Wild carrot was in the 3 to 5 in rosette stage while broadleaf plantain was in the early flower stage.

Carrier volume (10, 20, and 40 gpa) did not influence asulam activity on tansy ragwort or velvetgrass.

Adsee surfactant (product of Rhodia Inc.) added at 0.2% (v/v) increased asulam activity on velvetgrass but did not affect tansy ragwort control.

Alfalfa (Medicago sativa L.) tolerated up to 16 lb/A of asulam with no visible injury. White clover (Trifolium repens L.), orchardgrass (Dactylis glomerata L.), ryegrass (Lolium sp.), and fescue (Festuca sp.) are crop species exhibiting some tolerance to asulam. (Crop Science Department, Oregon State University, Corvallis.)

Response of scouringrush (Equisetum hyemale var. robustum L.) to four soil active herbicides. McHenry, W. B. and N. L. Smith. Four herbicides, bromacil, karbutilate, tebuthiuron and metribuzin were applied at 4 and 8 lb/A January 7, 1973 to a dense stand of scouringrush in Yolo County. Plot size was 150 sq ft with three replications. A knapsack sprayer with a 3 nozzle boom was used to apply materials in 108 gpa. Rainfall following application totaled 7 in for the season.

Plants were observed numerous times during the following summer. No phytotoxicity or control was noted in any of the treatments. (Cooperative Extension, Botany Department, University of California, Davis.)

PROJECT 2. HERBACEOUS WEEDS IN RANGE AND FORESTS

M. Dale Christensen, Project Chairman

SUMMARY

Eleven papers from six authors were received. Chemical and cultural methods of controlling problem weeds on rangeland and forestland were discussed as well as factors affecting seed germination and the effect of naturally occurring toxins on the vegetation of forestlands.

Ground applications of atrazine, terbacil, metribuzin and cyanazine gave satisfactory control of annual vegetation and increased forage production of native perennials. Aerial applications gave similar results.

Late winter applications of atrazine, 2,4-D, atrazine plus 2,4-D and terbacil for control of competitive grasses and forbs did not appear to be warranted on the cooler and wetter sites of the Coast Ranges where Douglas-fir seedlings had been recently planted; however, in the dry interior valleys, survival and tree condition was improved with herbicide treatments.

Squarrose knapweed was controlled best with picloram; 2,4-D ester and 2,4-D amine were effective only at the higher rates.

A mixture of picolinic acid plus 2,4-D gave outstanding control of scurfy psoralea and common sagewort; 2,4-D gave fair control of scurfy psoralea and silvex looked fair on common sagewort.

Picloram and a mixture of picolinic acid plus 2,4-D maintained near perfect control of Geyer larkspur for two years. Paraquat gave good knockdown but there was considerable regrowth in the second year. Forage production during the second year was equal to or better than the untreated plots in most cases.

Glyphosate and dalapon looked promising for the eradication of desert saltgrass, alkali sacaton, western wheatgrass, blue grama and sedge in preparation for seeding a more desirable forage crop.

Dicamba was more effective than bromacil for controlling western swordfern. Asulam was more effective than dicamba for controlling western bracken and was not phytotoxic to Douglas-fir.

The germination of common yarrow seeds was affected by the length of storage and presence of light. Temperature variations had little effect.

An unidentified water soluble toxin found in the fronds of western braken inhibited the germination and growth of Douglas-fir, salmonberry, and western thimbleberry.

Fall versus spring applications of herbicides for annual grass control on rangelands. Alley, H. P. and G. A. Lee. Rangeland sites which were heavily infested with downy brome (Bromus tectorum L.), Japanese brome (Bromus japonicus Thunb.), and minor infestations of annual broadleaf weeds were selected for the treatment areas. The Symons ranch site was a western wheatgrass - blue grama complex, whereas, the Burgess ranch site was a blue grama - threadleaf sedge - western wheatgrass complex. Each rangeland site was located east of Sheridan, Wyoming.

Herbicide treatments, attached table, were applied with a truck-mounted spray rig on November 8, 1972 on the Burgess range and April 5, 1973 on the Symons range in a total volume of 17 gpa water. All plant species were dormant at time of the fall treatment; downy brome and Japanese brome had 0.25 to 0.5 in growth at the time of the spring treatment.

Observations made in early summer indicated that spring treatments were more phytotoxic to the native forage species than the fall applied treatments. Considerable leaf tip burning and browning was apparent on the terbacil and metribuzin treated plots. This condition was not apparent at time of harvest.

Forage and weed production were determined by clipping three randomly placed 2.5 ft diameter quadrats from each treatment area. Native grass and weed species were separated before air-drying for production determinations.

Total weed control ranged from 80 to 100% on the Burgess range and 16% to near complete control on the Symons range. Atrazine applied at 0.8 lb/A resulted in only a 16% reduction in weed production on the Symons ranch and 82% on the Burgess ranch site. This difference may be due to the abundance of the annual broadleaf weed infestation between the two sites, mainly field pepperweed (Lepidium campestre (L.) R. Br.).

Increased grass production was greater on the Symons ranch than on the Burgess site. Production was in excess of a three-fold increase on the terbacil and cyanazine treated plots and near this level where atrazine at 0.8 lb/A and metribuzin was applied.

Disregarding the weed species complex and the two different sites, the fall applications resulted in a higher percentage weed control. (Wyoming Agricultural Experiment Station, Laramie, SR-536.)

Native grass and weed production on herbicide treated native rangeland

Treatment	Rate (lb/A)	lb air-dry/A[3/] grass	weeds
	Symons Ranch[1/]		
atrazine	0.8	533	173
atrazine	1.6	393	53
terbacil	0.5	646	34
metribuzin	0.75	540	trace
cyanazine	2.0	666	34
check	-	193	233
	Burgess Ranch[2/]		
atrazine	0.8	360	47
atrazine	1.2	387	47
atrazine	1.6	573	7
terbacil	0.5	407	0
metribuzin	0.75	353	7
cyanazine	3.2	327	53
check	-	340	266

1/ Ground rig applied April 5, 1973.

2/ Ground rig applied November 8, 1972.

3/ Symons Ranch harvested August 16; Burgess Ranch harvested August 3, 1973.

Evaluation of aerial applied, soil persistent herbicides for annual grass control on rangelands. Alley, H. P., G. A. Lee and A. F. Gale. Information pertaining to native forage response and weed species control resulting from the use of soil persistent herbicides on rangelands of the western United States is limited.

In the fall of 1972, two range sites, each heavily infested with downy brome (*Bromus tectorum* L.), Japanese brome (*Bromus japonicus* Thunb.), and monor infestations of annual broadleaf weeds, were selected for treatment. The plots were 200 x 870 ft or four acres in size. Fifty-foot buffer strips were left between each treatment.

All herbicides, attached table, were applied by fix-wing aircraft on November 7, 1972, in a total volume of 2 gpa water, except atrazine at 1.6 lb/A which was applied in 4 gpa water. The vegetation at time of treatment was in a dormant stage of growth.

Observations early in the 1973 growing season showed some leaf-margin and tip burn on blue grama (*Bouteloua gracilis* (H.B.K.) Lag.) and threadleaf sedge (*Carex filifolia* Nutt.). No burning was noted on western wheatgrass (*Agropyron smithii* Rybd.). As the season progressed all forage species recovered from the damage and remained green for a longer period of time than on the untreated range.

Forage and weed production were determined by clipping three randomly placed 2.5 ft diameter quadrats in each treatment area and the untreated check. Native grass species and weeds were separated before air-drying and weighing for production determinations. At harvest the weed spectrum was predominately annual grass. On the Burgess ranch the weed composition was 85% annual grass (60% Japanese brome and 40% downy brome) and 15% field pepperweed (*Lepidium campestre* (L.) R. Br.); whereas on the Symons ranch, the weed composition was 90% annual grass (90% Japanese brome and 10% downy brome) with 10% field pepperweed.

All treated plots on both experimental sites, except the terbacil treated area on the Burgess ranch, produced grass equal to or in excess of the untreated rangeland. The greatest response was recorded from the rangeland treated with 1.6 lb/A atrazine. On both sites there was near complete control of the annual grass and broadleaf weed infestation and a two to three-fold increase in native grass production. There is no explanation at this time for the increased grass as well as increased weed production on the area treated with 0.8 lb/A atrazine on the Symons ranch location.

This research definitely indicates that the compounds applied in this study show promise for annual grass control on rangelands. More information is needed on the species complex change, vegetative response, longevity of control, and the economics of such practices. (Wyoming Agricultural Experiment Station, Laramie, SR-537.)

Native grass and weed production on herbicide treated native rangeland

Treatment[1]	Rate (lb/A)	lb air-dry/A[2] grass	weeds
		Symons Ranch	
atrazine	0.8	440	673
atrazine	1.2	320	73
atrazine	1.6	713	trace
terbacil	0.5	520	20
metribuzin	0.75	600	73
check	-	193	233
		Burgess Ranch	
atrazine	0.8	326	0
atrazine	1.2	386	0
atrazine	1.6	680	0
terbacil	0.5	273	0
metribuzin	0.75	380	0
check	-	340	266

1/ Aerially applied 11/7/72.

2/ Symons Ranch harvested 8/16/73; Burgess Ranch harvested 8/3/73.

Effect of atrazine plus 2,4-D on survival of Douglas-fir seedlings. Gratkowski, H. and R. Stewart. In a cooperative study with National Forests in southwestern Oregon, grass control did not appreciably increase survival of planted young Douglas-firs on the cooler and wetter west slope of the Coast Ranges in southwest Oregon. In the dry interior Umpqua Valley, however, tree survival was increased by grass control.

Seven replications were involved in a small-plot experiment to determine whether sprays of atrazine and low volatile esters of 2,4-D damage newly planted Douglas-fir seedlings. Five replications were on coastal slopes of the Coast Range and Siskiyou Mountains; two were on drier sites in the Umpqua River valley between the Coast and Cascade Ranges. Five treatments were tested: (1) an untreated control, (2) 4 lb/A of atrazine, (3) 2 lb/A of 2,4-D, (4) 4 lb/A of atrazine plus 2 lb/A of 2,4-D, and (5) 2 lb/A of terbacil. One hundred and twenty-five Douglas-fir seedlings were planted in each treatment area of each replication -- a total of 875 trees per treatment in the seven replications; 6,125 trees in the experiment. The chemicals were applied as foliage sprays in water carriers directly over newly planted trees during March 1971.

Survival in June 1971 was 90 to 98% on all replications. Since tree survival was high and condition good on all plots at the beginning of the dry summer, it seems logical that the chemicals alone had little effect on the young Douglas-firs. However, some sprays combined with drought appear to have increased mortality on the dry interior sites and reduced vigor of surviving trees on both coastal and interior areas.

The data also indicate that grass control did not increase tree survival on coastal sites enough to warrant the expenditure of silvicultural funds and effort. On dry inland sites, however, grass control appreciably increased first-year survival of planted Douglas-firs and the expenditure of funds appears worthwhile.

On the dry inland plots, atrazine at 4 lb/A applied during late February to early March was the best grass control treatment for application over newly planted Douglas-fir seedlings. Not only did more trees survive the first dry summer season, but 50% of the trees were healthy where atrazine was applied. In the unsprayed control, a smaller percentage of trees survived and only 20% of the live trees were healthy.

Except for the unsprayed control, mortality was greatest and condition of surviving trees poorest on plots sprayed with the combination of atrazine and 2,4-D. Use of 2,4-D in combination with atrazine does not seem advisable in sprays over newly planted Douglas-firs. (Pacific N. W. Forest and Range Exp. Sta., Forest Service, U. S. Dept. of Agriculture, Roseburg, Oregon.)

Survival and condition of Douglas-fir seedlings after application of herbicides for grass and forb control[1/]

Survival and condition	Beginning of summer					End of summer				
	Control	Atrazine	2,4-D	Atrazine + 2,4-D	Terbacil	Control	Atrazine	2,4-D	Atrazine + 2,4-D	Terbacil
	Percent									
					Coastal sites					
survival	97	98	97	97	97	82	88	82	87	86
condition										
healthy	83	78	73	74	70	74	74	68	69	72
weak	15	20	24	22	26	8	14	14	18	14
dead	2	2	3	4	4	18	12	18	13	14
					Inland sites					
survival	98	92	98	92	90	45	65	54	52	57
condition										
healthy	66	75	74	60	68	20	50	31	21	36
weak	31	19	23	31	21	22	17	21	30	21
dead	3	6	3	9	11	58	33	48	49	43

1/ Survival data for all trees on each site; condition data for 40% of the trees.

Response of squarrose knapweed (Centaurea squarrosa Roth) on rangeland to picloram and 2,4-D. McHenry, W. B.[1], W. R. Spivey[2] and N. L. Smith[1]. A study was initiated in 1973 to compare 2,4-D dimethylamine salt, 2,4-D isooctyl ester, and picloram for the control of squarrose knapweed on Lassen County rangeland. Spray volume was 80 gpa, plot size 200 sq ft with three replications. Squarrose knapweed population consisted of established plants 6-12 inches tall and immature rosettes 3-5 inches in diameter. Materials were applied with a knapsack sprayer fitted with a 3 nozzle boom.

Picloram gave excellent control at rates tested. The ester formulation of 2,4-D was more effective than the amine at 1 and 2 lb/A. Treatments would have to be continued annually for eradication due to new seedling emergence. (Cooperative Extension, Botany Department, Davis[1] and Shasta County[2], University of California.)

Squarrose knapweed control with 2,4-D amine, 2,4-D ester and picloram

Herbicide	Formulation (ae/gal)	Rate (lb/A)	Control (10 = 100%) 6/23/73
2,4-D amine	4 lb	1	3.0
2,4-D amine		2	6.7
2,4-D amine		4	9.9
2,4-D ester	4 lb	1	4.7
2,4-D ester		2	9.7
2,4-D ester		4	9.9
picloram	2 lb	0.5	9.8
picloram		1	10.0
control	-	-	0.0

Preliminary investigations of scurfy psoralea control on Wyoming rangeland. Alley, H. P., G. A. Lee and A. F. Gale. Scurfy psoralea (Psoralea tenuiflora Pursh.), or sometimes referred to as wild alfalfa, is a herbaceous, perennial legume which is becoming an undesirable component of the range vegetation in many sections of Wyoming. Scurfy psoralea is of low palatability for livestock except when plants are young. It is reported poisonous to horses and cattle but seldom is a problem because of low palatability.

The invasion of this plant has caused considerable concern among range managers and livestock producers who have requested control methods.

Herbicide trials were established in 1972 on a heavily infested pasture in Niobrara County of southeastern Wyoming for evaluation of potential herbicide treatments. Plots were three sq rods in size with treatments applied in a total volume of 40 gpa water. Scurfy psoralea was in the early bud stage of growth at the time of treatment.

Visual evaluations were made approximately fourteen months following treatment and are included in the attached table.

Picolinic acid + 2,4-D (Tordon 212) was the only treatment that resulted in effective control. Mixtures of 0.25 + 0.5 and 0.5 and 1 lb/A of picolinic acid + 2,4-D gave near complete elimination of the stand. The 2,4-D amine treatment at 2 lb/A reduced the stand by 70%. Dicamba, dicamba + 2,4-D, silvex, picloram and glyphosate were not effective at the rates applied. It is interesting to note that the 0.25 lb/A application of picloram was an ineffective treatment, whereas, the mixture of 0.25 lb/A of picolinic acid plus 0.5 lb/A of 2,4-D was an outstanding treatment.

Forage production was not determined, but observations did not indicate increased population, vigor or production of the native grass species. Plots treated with glyphosate were taken over by almost a pure stand of western wheatgrass (Agropyron smithii Rybd.). (Wyoming Agricultural Experiment Station, Laramie, SR-552.)

Scurfy psoralea control evaluations

Treatment[1/]	Rate (lb/A)	Evaluations[2/]
2,4-D amine	2.0	70% control scurfy psoralea - some reduction in stand of sagewort[3/]
picolinic acid + 2,4-D[4/]	0.25 + 0.5	98% control scurfy psoralea - 98% control sagewort
picolinic acid + 2,4-D	0.5 + 1.0	98% control scurfy psoralea - 98% control sagewort
dicamba	1.0	no control
dicamba + 2,4-D	0.5 + 1.0	50% control scurfy psoralea
silvex	2.0	40% control scurfy psoralea - some reduction in stand of sagewort
picloram	0.25	40% control scurfy psoralea
glyphosate	0.5	no control - western wheatgrass dominated treated area

1/ Treated 6/20/72.

2/ Evaluated 8/21/73.

3/ common sagewort (Artemisia campestris L.)

4/ Tordon 212

Evaluation of common sagewort control on Wyoming rangelands. Alley, H. P., G. A. Lee and A. F. Gale. Common sagewort (Artemisia campestris L.) are native, perennial, or infrequently, biennial forbs which often take on a small shrubby appearance. Throughout the Great Plains, the occurrence of the sageworts is normally scattered, increasing with deteriorating range condition. In the western range states, the sageworts are considered practically worthless as a forage species.

The sageworts are becoming a serious component of many of the rangeland and pasture sites in Wyoming. Livestock producers and range management personnel are concerned and want information on control methods.

Herbicide trials were established in 1972 on heavily infested rangeland in Niobrara County in southeastern Wyoming for evaluation of potential herbicide treatments. Plots were three sq rods in size with treatments applied in a total volume of 40 gpa water. Common sagewort had six to eight in of vegetative growth at the time of treatment.

Visual estimates of control were made approximately fourteen months following treatment and are included in the attached table.

An application rate of a mixture of 0.5 lb/A of picolinic acid plus 1 lb/A of 2,4-D was required to effectively control sagewort. This application rate resulted in 98% reduction in stand, whereas, the application rate of 0.25 lb/A of picolinic acid plus 0.5 lb/A of 2,4-D resulted in only 35% reduction. Silvex at 2 lb/A reduced the sagewort stand by 70%. None of the other herbicide treatments were effective. (Wyoming Agricultural Experiment Station, Laramie, SR-539.)

Common sagewort control evaluations

Treatment1/	Rate (lb/A)	Evaluations2/
2,4-D amine	2.0	no apparent reduction in stand of sagewort
picolinic acid + 2,4-D3/	0.25 + 0.5	35% reduction in sagewort stand
picolinic acid + 2,4-D	0.5 + 1.0	98% reduction in sagewort stand
dicamba	1.0	no apparent reduction in stand of sagewort
dicamba + 2,4-D	0.5 + 1.0	no apparent reduction in stand of sagewort
silvex	2.0	70% reduction in stand of sagewort
picloram	0.25	50% reduction in stand of sagewort
glyphosate	0.5	no apparent reduction in stand of sagewort

1/ Treated 6/20/72.

2/ Evaluated 8/21/73.

3/ Tordon 212

Geyer larkspur (Delphinium geyeri Greene) control and native grass production two years following herbicide treatment. Alley, H. P. and G. A. Lee. A time of application and rate of application series were established in the spring of 1971 to evaluate and compare the initial as well as the longevity of Geyer larkspur control resulting from various rates of paraquat, paraquat + 2,4-D, 2,4-D LVE, picloram, and picloram + 2,4-D.

Percent Geyer larkspur control was determined by counting all plants within the replicated series of plots before herbicide application and each year following the initial treatment. Forage production (native grasses) was obtained by clipping a 2.5 ft diameter quadrat from each plot.

Forage production, obtained in 1971, the year of treatment was severely reduced regardless of treatment date or rate of paraquat application as compared to the untreated, 2,4-D or picloram treated plots.

Initial Geyer larkspur control, as determined the year of application, ranged from 88 to 100% for all treatments except 2,4-D. The optimum time of treatment for activity of paraquat was shown to be when the flowering stalk of Geyer larkspur was emerging above the vegetative portion of the plant, which was the last week of May.

Since histological examination of the Geyer larkspur roots indicated live tissue and possible recovery of paraquat treated plants, stand counts have been obtained over the past two years to determine the actual kill and longevity of control. Forage production has been taken during the same period to determine the recovery period necessary after initial burn down and phytotoxicity to the native grass species caused by paraquat.

Presented in the attached table are percentage Geyer larkspur control and forage production figures two years after initial treatment. The native grass species, on the paraquat treated plots, have recovered from the initial burn down and phytotoxicity and are producing equal to the untreated areas. Geyer larkspur control ranges from 7 to 82% where paraquat and paraquat + 2,4-D was used; whereas, picloram and picloram + 2,4-D is maintaining 98% Geyer larkspur control and forage production is equal to or greater than the untreated plots. (Wyoming Agricultural Experiment Station, Laramie, SR-534.)

Geyer larkspur control and forage production two years following treatment

Treatment[1/]	Date	Rate (lb/A)	Percent control[2/]	Oven dry grass[3/] (lb/A)
paraquat	4/29	0.5	54	420
paraquat	4/29	1.0	56	400
paraquat	4/29	2.0	51	540
paraquat	5/7	0.5	55	500
paraquat	5/7	1.0	64	353
paraquat	5/7	2.0	67	413
paraquat	5/22	0.5	54	427
paraquat	5/22	1.0	49	327
paraquat	5/22	2.0	73	587
paraquat	5/28	0.5	64	353
paraquat	5/28	1.0	60	433
paraquat	5/28	2.0	68	473
paraquat	6/5	0.5	32	460
paraquat	6/5	1.0	7	573
paraquat	6/5	2.0	43	253
2,4-D + paraquat[4/]	5/22-5/28	1.0 + 0.5	70	540
2,4-D + paraquat	5/22-5/28	1.0 + 1.0	73	467
2,4-D + paraquat	5/22-5/28	1.0 + 2.0	70	573
2,4-D + paraquat	5/22-5/28	2.0 + 0.5	72	513
2,4-D + paraquat	5/22-5/28	2.0 + 1.0	65	507
2,4-D + paraquat	5/22-5/28	2.0 + 2.0	58	740
2,4-D + paraquat	5/22-6/5	1.0 + 0.5	56	460
2,4-D + paraquat	5/22-6/5	1.0 + 1.0	53	480
2,4-D + paraquat	5/22-6/5	1.0 + 2.0	80	620
2,4-D + paraquat	5/22-6/5	2.0 + 0.5	82	633
2,4-D + paraquat	5/22-6/5	2.0 + 1.0	48	520
2,4-D + paraquat	5/22-6/5	2.0 + 2.0	64	500
picloram	5/7	0.25	98	533
picloram	5/7	0.5	98	740
picloram + 2,4-D[5/]	5/7	0.25 + 0.5	99	560
picloram + 2,4-D	5/7	0.50 + 1.0	99	693
2,4-D	5/22	1.0	0	487
2,4-D	5/22	2.0	14	573
check				401

1/ Treatment dates: 4/29/71 larkspur 1 in growth; 5/7/71 larkspur 3 in growth; 5/22/71 larkspur 4-5 in growth; 5/28/71 larkspur 5-6 in growth; 6/5/71 larkspur early bloom 6-8 in tall. All treatments, except picloram and picloram + 2,4-D, contained X-77 at a rate of 8 oz/100 mix.

2/ Percent control determined by counting all larkspur in plots and comparing to untreated check 7/21/73.

3/ Average of three replications. Clipped 7/23/73.

4/ The 2,4-D was applied on the early date and paraquat on the later date.

5/ Tordon 212

Chemical eradication of desert saltgrass (*Distichlis stricta* (Torr.) Rydb.) for seedbed preparation. McGinnies, William J. In many bottomland areas in northern Colorado, desert saltgrass is the major species. Desert saltgrass is low-yielding and unpalatable to livestock and dominates the site to the extent that improvement by management alone is not possible. However, many of these bottomlands could produce a higher yielding, more palatable forage crop if desert saltgrass could be eradicated and better forage species seeded. Seedling on desert saltgrass areas has been hampered by the extreme difficulty of eradicating desert saltgrass by cultivation or chemicals.

An experimental plot area was established in November 1971 on the Central Plains Experimental Range, north of Nunn, Colorado. Long strip-plots, totaling 50% of the area, were plowed 8 in deep. In 1972, plant counts showed that plowing had eradicated alkali sacaton (*Sporobolus airoides* Torr.), western wheatgrass (*Agropyron smithii* Rydb.), blue grama (*Bouteloua gracilis* (H.B.K.) Lag. ex Steud.), and sedge (*Carex* sp.). Desert saltgrass regrew profusely from the large and abundant rhizomes.

During the winter of 1971-72, greenhouse trials showed that both dalapon and glyphosate might be effective for eradicating desert saltgrass.

Plots on unplowed desert saltgrass areas were sprayed on July 11, 1972 with glyphosate (4 lb/A) and dalapon (8 lb/A); both chemicals were mixed with water and applied with a field sprayer at a rate of 50 gpa. Numbers of live shoots of desert saltgrass per sq ft were counted in late August of 1972 and 1973.

Dalapon reduced the number of "live" desert saltgrass shoots counted in 1972, but by 1973, the number of shoots nearly equaled those found on the untreated plots (see table). Dalapon controlled alkali sacaton, but it did not significantly reduce the number of western wheatgrass plants. The glyphosate reduced the number of desert saltgrass shoots in 1972, and there was a further reduction in 1973. In 1973, the glyphosate plots were almost devoid of perennial vegetation, but they did support a stand of Russian thistle (*Salsola kali* L. var *tenuifolia* Tausch).

Number of desert saltgrass plants per square foot in late August 1972 and 1973 on plots at Central Plains Experimental Range

Date of plant counts	Treatment			
	Glyphosate 4 lb/A 1/	Dalapon 8 lb/A 1/	Plow 2/	Check
1972	5.9	7.7	6.6	19.2
1973	0.4	12.2	7.8	14.8

1/ Sprayed July 11, 1972.

2/ Plowed November, 1971.

In a greenhouse test, pots of desert saltgrass were sprayed with 4 lb/A of glyphosate in water at 30 gpa and 8 lb/A of dalapon at 30, 60, and 90 gpa. Four months later, top kill was estimated to be 93% from the glyphosate treatment, and 52, 59, and 72% from the dalapon treatment applied at 30, 60, and 90 gpa, respectively. Desert saltgrass control with dalapon might be improved with a higher application rate than the 50 gpa used in the field test. (Agricultural Research Service, Crops Research Laboratory, Colorado State University, Fort Collins, Colorado 80521.)

Herbicides for control of western swordfern and western bracken. Stewart, R. E. Previous studies have shown that western swordfern (*Polystichum munitum* (Kaulf.) Presl) can be controlled with late spring foliage sprays of 4 lb aehg dicamba or 12 lb aehg bromacil; western bracken (*Pteridium aquilinum* (L.) Kuhn var. *pubescens* Underw.) can be controlled with foliage sprays of 4 lb aehg dicamba. Lower dosages of herbicides or carriers other than water may be effective on swordfern. Although dicamba is effective on bracken, dicamba sprays damage conifers associated with bracken communities. Therefore, additional tests were installed to: (1) evaluate lower dosages of dicamba and bromacil on western swordfern, and (2) determine effect of asulam, a selective herbicide, on western bracken.

During May of 1972, 10 individual western swordfern plants were sprayed to drip point with each herbicide when fronds were at an early- to late-hook stage. Most sprays were applied in water carriers. However, old fronds are also present during early stages of growth, and older fronds are resistant to herbicides applied in water carriers. Therefore, an oil-soluble dicamba formulation applied in diesel oil was also tested. Results observed at the end of the second growing season show that dicamba is more effective than bromacil (table 1); maximum control with either herbicide is obtained at 3 lb aehg. A 1 lb aehg dicamba spray applied in oil was more effective than that applied in water. This indicates that optimum dosage of dicamba for western swordfern control should be lower with oil than with water carriers.

Asulam and dicamba treatments were applied to three 1/100-acre plots each of western bracken in mid-July after complete frond elongation. Results were observed at the end of the following growing season, 14 months after treatment. Even at 1 lb/A, asulam was more effective than 4 lb/A of dicamba (table 2). Effects of dicamba are apparent during the first growing season after treatment. In contrast, asulam treatments did not show effects until the following year. Sprays containing 1 lb/A of asulam were nearly as effective in preventing emergence of western bracken as those containing 3 lb/A. Dicamba severely damaged Douglas-firs present on the plots at the time of treatment; asulam did not damage trees at rates up to 3 lb/A. (Pacific N. W. Forest and Range Exp. Sta., U. S. Dept. of Agric., Roseburg, Oregon.)

Table 1. Effects of foliage sprays on western swordfern

Herbicide, rate, and carrier (lb aehg)	Plants dead (%)	Average number of height of fronds per plant (no)	(in)
untreated	0	50	36
1 lb dicamba (oil)	10	16	20
1 lb dicamba (water)	0	34	29
2 lb dicamba (water)	40	14	21
3 lb dicamba (water)	90	6	22
1 lb bromacil (water)	20	29	25
2 lb bromacil (water)	50	12	17
3 lb bromacil (water)	70	22	20
6 lb bromacil (water)	70	8	18

Table 2. Effects of foliage sprays on western bracken

Herbicide	Current bracken cover	Average number and height of fronds (stems/ft)	(ft)
untreated	90	1.33	5.2
4 lb/acre dicamba	57	1.20	2.5
1 lb/acre asulam	12	0.13	2.8
2 lb/acre asulam	8	0.10	2.3
3 lb/acre asulam	5	0.03	2.0

Germination of seeds of common yarrow. Robocker, W. C. Seeds of common yarrow (Achillea millefolium L.) collected in 1963, 1971, and 1972 were taken from dry storage at room temperature in September 1972 and tested for germinability as affected by age and differences in temperature and light. Seeds were tested in petri dishes each month for 12 months under two conditions of lighting: (1) 8 hr light (L) and 16 hr dark (D), or (2) no light; and two conditions of temperature: (1) constant, or (2) alternating (with the higher temperature concurrent with the period of light). The following regimes, with 50 seeds per dish and 4 replications, were used: 15 C, L-D; 25-15 C, L-D; 25-15 C, no light; and 25 C, L-D.

The average germination over the 12 months was 35, 81, and 83% for 1963, 1971, and 1972 seeds, respectively (see table). The 1963 seeds, after 9 years of storage, had only 42% of the germinability of the 1972 seeds. The effect of light on increasing germination at a given temperature regime (15-25 C) was significant in all years, while the temperature range of 10 C caused no difference in total germination. A significant difference in germination between seasons was found with the highest percentage occurring in spring. Germination of 1971 and 1972 seeds was often over 80% at the three highest temperature regimes by the fourth day from the start of a trial. In treatments with light, average monthly germination of 96 to 100% for the four replications of 1971 and 1972 seeds was common. (Western Region, Agr. Res. Serv., U. S. Dept. of Agr., and Wash. Agr. Exp. Sta., Washington State Univ., Pullman, cooperating.)

Percentage germination of yarrow seeds as affected by age and four light-temperature regimes

Year matured	Light-temperature regimes 1/ 15 C, L-D	25-15 C, L-D	25-15 C, no light	25 C, L-D	Avg
	---------- Percent ----------				
1963	37	40	27	37	35
1971	83	84	75	83	81
1972	84	87	76	84	83
average	68	70	59	68	-

1/ LSD for light-temperature regimes at 5% for 1963, 2; for 1971, 2; for 1972, 3.

Phytotoxic potential of western bracken on Douglas-fir, salmonberry, and western thimbleberry. Stewart, R. E. Plant communities dominated by western bracken (Pteridium aquilinum (L.) Kuhn var. pubescens Underw.) usually contain fewer species than adjacent communities without bracken. This reduction in community diversity in the presence of bracken has been attributed to competition, to smothering of seedlings by bracken litter, or to feeding activities of animals associated with bracken habitats. However, recent studies show that bracken fronds collected in the fall, after annual senescence, contain water-soluble chemicals toxic to some herbaceous species. The study reported here was designed to determine if this phytotoxic effect was active on three woody species that do not readily become established in western bracken communities.

Douglas-fir, salmonberry (Rubus spectabilis Pursh), and western themblebery (Rubus parviflorus Nutt.) seeds were soaked overnight and then stratified in moist vermiculite at 38 F. After stratification, 10 replications of 50 seeds each were sown in pots containing: (1) 1500g of a coastal Oregon forest soil (control), (2) 1500g of soil covered with 15g of ground bracken fronds (unincorporated), or (3) 1500g of soil containing 15g of incorporated ground fronds (incorporated). Seeds were covered with bracken litter (treatment 2) or an equivalent depth of sterile expanded pumice (treatments 1 and 3). Pots were placed in a greenhouse and watered periodically. Drainage water from each pot was collected and added back to the pot. After 30 days, each pot was thinned to the five largest seedlings; new seedlings were counted and removed thereafter. Oven-dry weights of seedling roots and tops were measured after 110 days in the greenhouse.

Cumulative emergence and root and top dry weights of seedlings were as follows:

		Cumulative emergence (%)	Average dry weight of root (g)	Average dry weight of top (g)
Douglas-fir -	control	68	0.067	0.103
	unincorporated	58	0.056	0.104
	incorporated	69	0.063	0.093
salmonberry -	control	14	0.025	0.088
	unincorporated	2	0.019	0.078
	incorporated	19	0.016	0.053
western thimbleberry -	control	65	0.090	0.272
	unincorporated	29	0.085	0.289
	incorporated	75	0.055	0.144

Both germination and growth were affected by the presence of bracken litter, but Douglas-fir was much less sensitive to the phytotoxin than salmonberry or western thimbleberry. This confirms field observations that suggest Douglas-fir will slowly become established on bracken dominated sites. In contrast, salmonberry and western thimbleberry are rarely found in western bracken communities.

Because of the placement of seed in relation to source of phytotoxin, leaching from unincorporated litter should affect germination more readily than incorporated litter. After germination, however, seedling roots will be in close association with bracken litter in the soil, and incorporated litter should affect seedling growth. These data indicate that the three species do show this relationship. (Pacific N. W. Forest and Range Exp. Sta., Forest Service, U. S. Dept. of Agric., Roseburg, Oregon.)

PROJECT 3. UNDESIRABLE WOODY PLANTS

G. Ron Oliver, Project Chairman

SUMMARY

Frill and basal oil treatments using 2,4-D; 2,4,5-T; ammonium sulfamate, glyphosate and silvex were evaluated for sprout control of eucalyptus which had suffered top winter kill. All axe-frill treatments were acceptable and more effective than the basal sprays, with the exception of the 2,4,5-T ester. Dilution of 2,4-D; 2,4,5-T; and glyphosate with 50% water did not reduce effectiveness.

Soil-applied picloram and karbutilate were evaluated in southern Arizona for control of velvet mesquite, catclaw acacia, cholla species and Engelmann pricklypear. Picloram was more effective against catclaw acacia, cholla species and Engelmann pricklypear, while karbutilate was more effective against velvet mesquite. Tabular karbutilate and granular picloram gave similar result on the grass stand. Granular karbutilate significantly reduced grass stand.

Studies on stratification requirements and soil temperature effects on germination were conducted on wedgeleaf ceanothus. Stratification of 12 weeks gave maximum germination with periods of 8 to 10 weeks being almost as effective. Seeds buried for 22, 31 and 40 minutes at 75 C and 4 and 13 minutes at 90 C gave maximum germination.

Control of sprouting eucalyptus stumps. Radosevich, S. R.[1], W. B. McHenry[1], W. D. Hamilton[2], and N. L. Smith[1]. An experiment was initiated April 4, 1972 to determine a method of preventing successful resprouting of cut-over blue gum (Eucalyptus globulus Labill.). The trees had been cut, because of winter-kill of the tops, about one month prior to initiating the study. Stump height varied from 30 to 90 cm, the diameter from 2-60 cm. Water soluble herbicides applied to frills cut immediately above the soil line were applied in full formulated strength or diluted 50% with water. Oil soluble herbicides were applied in diesel oil in a 20 to 30 cm band to the basal circumference of the stumps in sufficient volume to flow to and moisten the soil.

A treatment unit consisted of ten stumps; three replications were employed. Percent control was determined by counting the stumps with no live sprouts compared to the number with one or more sprouts.

All axe-frill treatments appear to be giving acceptable control at this time. Dilution of 2,4-D; 2,45-T; and glyphosate with 50% water did not reduce effectiveness. With the exception of 2,4,5-T ester, basal spray treatments were not as satisfactory.
(Cooperative Extension, University of California, Botany Department, Davis[1] and Alameda County, Hayward[2].)

Eucalyptus stump sprout control

Herbicide	Formulation (ae/gal)	Concentration	Percent sprout control 7/19/73
frill treatments			
2,4-D dimethylamine	4 lb	100%	100
2,4-D dimethylamine	4 lb	50	97
2,4,5-T trimethylamine	4 lb	100	93
2,4,5-T trimethylamine	4 lb	50	92
ammonium sulfamate	95% w.s.	5 lb/gal	89
glyphosate	3 lb	100%	92
glyphosate	3 lb	50	100
basal oil treatments			
2,4-D isooctyl ester	4 lb	16 lb aehg diesel	67
2,4,5-T butoxyethanol ester	4 lb	16 lb aehg diesel	93
2,4-D butoxyethanol ester + dichlorprop butoxyethanol ester	2 lb + 2 lb	16 lb aehg diesel	87
silvex propyl glycol butyl ether ester	4 lb	16 lb aehg diesel	77
control	-	--	0

Evaluation of soil-applied herbicides for control of woody plants in southern Arizona. Morton, H. L., H. M. Hull, and R. D. Martin. Granular formulations of picloram and karbutylate were broadcast by hand on plots 40 x 40 ft at rates of 1.12, 2.24, and 4.48 kg/ha on July 31, 1971. Most of the plots contained catclaw acacia (Acacia greggii A. Gray), velvet mesquite (Prosopis juliflora var. velutina (Woot.) Sarg.), spiny cholla (Opuntia spinosior (Engelm. & Bigel.) Toumey), and jumping cholla (O. fulgida Engelm.). Engelmann pricklypear (O. engelmannii Salm-Dyck) was growing on some of the plots at the time of treatment. All plots supported perennial grasses, primarily Rothrock gramma (Bouteloua rothrockii Vasey), Arizona cottontop (Trichachne californica (Benth) Chase) and spidergrass (Aristida ternipes Cav.). Stands of grasses on each plot were estimated on August 25, 1972 by comparing grass stands in the plots with stands on adjacent, untreated areas. Percentage of woody and succulent plants killed on each plot were evaluated on October 10, 1973.

Picloram was the most effective herbicide for control of catclaw acacia, cholla species and Englemann pricklypear but was not effective for control of velvet mesquite. Picloram did not cause significant injury to grasses at the 1.12 and 2.24 kg/ha rates but caused injury to grasses at the 4.48 kg/ha rate. Both the 10 and 60% formulations of karbutylate gave fair control of velvet mesquite at 2.24 kg/ha and excellent control at the 4.48 kg/ha rate. The 10% granular formulation of karbutylate caused significant reductions in grass stands at all rates; however, the 60% tablet formulation caused significant injury only at 4.48 kg/ha. Both herbicides are being further evaluated for rate, season of treatment, soil type, and other factors influencing control of woody plants on rangelands. (Agricultural Research Service, U. S. Dept. of Agriculture, Tucson, Arizona.)

Percentage control of catclaw acacia, velvet mesquite, cholla and Englemann pricklypear and stands of grasses on plots treated with three herbicides

Herbicide and formulation		Rate (kg/ha)	Control[1/2/]				Grass stand[2/3/]
			Catclaw acacia	Velvet mesquite	Cholla	Engelmann pricklypear	
picloram	2% gran.	1.12	63 abc	20 cd	50 b	--	88 a
picloram	2% gran.	2.24	93 a	25 cd	93 a	40 b	97 a
picloram	2% gran.	4.48	99 a	--	90 a	90 a	52 bc
karbutilate	10% gran.	1.12	33 bc	42 bc	17 c	7 c	35 cd
karbutilate	10% gran.	2.24	45 bc	55 bc	28 bc	3 c	37 bcd
karbutilate	10% gran.	4.48	73 abc	100 a	--	0 c	13 d
karbutilate	60% tablet	1.12	32 cd	2 d	27 bc	0 c	70 ab
karbutilate	60% tablet	2.24	70 abc	75 ab	24 bc	10 c	90 a
karbutilate	60% tablet	4.48	77 ab	95 a	47 b	0 c	33 cd
check		0	10 d	3 d	13 c	0 c	98 a

1/ All values are average of 3 replications and are percentage of plants killed 26 months after treatment.

2/ Values in same column followed by same letter are not significantly different.

3/ 0 = all grasses dead; 100 = no injury.

Stratification requirement of wedgeleaf ceanothus seeds. Gratkowski, H. The 1948 edition of the Woody-Plant Seed Manual, U. S. Dept. Agric. Misc. Pub. 654, states that stratification "moderately improves" germination of wedgeleaf ceanothus (Ceanothus cuneatus (Hook.) Nutt.) seeds. A test of one lot of wedgeleaf ceanothus seeds from southwest Oregon, however, showed that they definitely required stratification as a pregermination treatment.

In a replicated experiment, heat-treated wedgeleaf ceanothus seeds were stratified in moist vermiculite for 0, 2, 4, 6, 8, 10 or 12 weeks at 3 to 5 C. Few seeds germinated after stratification 0 to 4 weeks. Maximum germination was obtained after stratification for 12 weeks, but periods of 8 to 10 weeks appear to be almost as effective.

Seeding of wedgeleaf ceanothus has been considered for soil stabilization and deer browse on estremely dry sites in southwestern Oregon. If such projects are attempted, it would be advisable to provide for either natural or artificial stratification as a pregermination treatment. For late autumn sowing, seeds can be steeped in hot water (75 C) for 5 to 10 minutes and sown immediately to stratify naturally in the cold, wet soil during winter. For spring sowing, however, seeds should be heat-treated and stratified for 8 to 12 weeks before sowing. (Pacific N. W. Forest and Range Exp. Sta., Forest Service, U. S. Dept. of Agric., Roseburg, Oregon.)

Effect of high soil temperatures on germination of wedgeleaf ceanothus seeds. Gratkowski, H. Germination of wedgeleaf ceanothus (Ceanothus cuneatus (Hook.) Nutt.) seeds after burial in heated soil indicates that fire may not be as important in origin of wedgeleaf stands as in the life cycle of other Ceanothus species. Temperatures that induced maximum germination can be produced by solar radiation on the soil surface.

The 50-seed replicates were buried in fine sand preheated to temperatures of 30, 45, 60, 75, 90, 105, and 120 C for periods of 4, 13, 22, 31, or 40 minutes. Each treatment was replicated four times in a factorial experiment in a randomized block design. After heat treatment, the seeds were stratified in moist vermiculite for 12 weeks, then germinated in a greenhouse.

Approximately one-third of the wedgeleaf ceanothus seeds in this lot had permeable coats and germinated after exposure to ordinary soil temperatures of 30 or 45 C. Maximum germination was obtained from seeds buried 22, 31, or 40 minutes in soil heated to 75 C and after 4 and 13 minutes at 90 C. Longer burial in soil heated to 90 C killed many seeds and reduced germination. The 105 C soil temperature killed almost all seeds; the 120 C soil temperature was completely lethal.

In similar tests, seeds of other *Ceanothus* species required exposure to 90 or 105 C soil temperatures to induce maximum germination. Evidently, wedgeleaf ceanothus seeds are not as heat-resistant as those of snowbrush, deerbrush, varnishleaf, redstem, and other *Ceanothus* species.

Seeding of wedgeleaf ceanothus has been suggested to stabilize shallow soils and to provide browse for big game on extremely dry sites. Pregermination treatments for other *Ceanothus* seeds usually prescribe steeping in water preheated to 80 or 90 C. Lower water temperatures would be advisable for pregermination treatment of wedgeleaf ceanothus seeds. (Pacific N. W. Forest and Range Exp. Sta., Forest Service, U. S. Dept. of Agric., Roseburg, Oregon.)

PROJECT 4. WEEDS IN HORTICULTURAL CROPS

K. W. Dunster, Project Chairman

SUMMARY

Results from 26 trials are presented in 20 reports received from investigators working in California, Colorado, Oregon, Texas, Utah, Washington and Wyoming. Row crop, tree fruit and vine and ornamental categories received attention in 18, 4 and 4 trials respectively.

Row Crops - Continued interest is evident in combination or sequential application for improved spectrum weed control and/or crop tolerance. Combination benefit was reported in several instances. Treatment effectiveness was somewhat variable, probably as a result of diverse weed populations. Herbicide application failed to effectively replace cultural operations in no-tillage pea trials conducted in Washington. Work of this nature probably warrants increased emphasis considering current and anticipated concerns relative to fuel supply. Directed application of glyphosate demonstrated considerable promise for bermudagrass control in California onions. This result should create interesting speculation and effort relative to perennial weed control potential in other high value crops.

Peas - 3 reports/5 trials

Narrow tolerance levels were reported with metribuzin while diuron combination with dinoseb provided effective, selective control in Washington trials. Linuron alone and nitrofen or chloroxuron combination with metribuzin preemergence or chloroxuron postemergence provided good results in California.

Onions - 4 reports

DCPA remains the standard preemergence treatment with considerable emphasis on nitrofen or chloroxuron alone and in combination. Methazole demonstrated postemergence promise in Colorado while VCS 438 was the only post treatment with adequate selectivity in Texas trials.

Spinach and Broccoli - 3 reports/5 trials

Strong emphasis was placed on combination and nitrofen formulation evaluation. Several substituted urea compounds failed as a suitable replacement for norea in Washington spinach trials. Combinations of nitrofen + DCPA show considerable promise when compared with either material alone in California trials. Emulsifiable concentrate formulations provided increased preemergence weed control but decreased postemergence broccoli tolerance.

Potatoes - 2 reports/3 trials

Yield benefit was derived from all treatments in Wyoming trials with good exhibited tolerance at rates required for nearly complete control. Napropamide, alachlor and U 27267 demonstrated good selectivity with sprinkler irrigation in California.

Cucumbers - 1 report

Contrary to previous indication asulam failed to provide effective postemergence control in Washington evaluation.

Tree Fruit and Vine Crops - Individual reports were received relative to weed control in walnuts, pears, newly planted grapes and an extensive screening trial including several tree fruit species. Multiple application of napropamide and several combination treatments provided effective and selective control in 2 walnut varieties. Glyphosate effectively controlled swamp smartweed, was less effective on field bindweed and demonstrated good selectivity when foliage contact was avoided in pear trials. Good selectivity with directed application was verified in the screening trials on several species. Considerable emphasis was placed on comparative evaluation with simazine in grape and tree fruit screening trials. Several singular and combination treatments have demonstrated promise for prescription situations.

Ornamental Species - Reports were received relative to shade tree nursery stock at two Oregon locations, container grown Pyracantha in California and mistletoe control in California Sycamore trees. Methazole provided encouraging weed control and selectivity in the shade tree trials. Oxadiazon provided good residual control and most treatments improved Pyracantha growth when compared with non-weeded controls. Mistletoe trials confirmed the need to confine glyphosate to target areas. Foliage application produced effective mistletoe control with 2,4-D, but was ineffective with glyphosate.

Herbicide evaluation in a comparison between the tillage and non-tillage farming techniques in green pea production. Peabody, Dwight V. Jr. Success of the non-tillage method depends upon several interrelated factors, not the least of which is a planter or drill that will place the seed in a condition where it will germinate rapidly and uniformly. Furthermore, herbicides must be used which will eliminate the vegetation (cover-crop and weeds) before planting, as well as the weeds that will germinate later as the crop grows. None of these conditions were well satisfied in the non-tillage portion of this test, hence peas grew poorly and yielded considerably less than peas that were planted under conventional tillage methods but treated with the same postemergent herbicides. For these reasons (inadequate planting equipment and unsatisfactory selective herbicides) as well as others, the non-tillage method is not well suited for green pea farming in western Washington.

Several conclusions can be drawn from the results obtained from the conventional tillage portion of this test: (1) preemergence applications of the "basic phenol" formulation of dinoseb are as effective and safe as pre- and post-applications of dinoseb amine (2) postemergence applications of metribuzin resulted in good selective weed control only at the lowest rate; at 2x rates and higher pea injury was severe and extensive (3) diuron plus dinoseb "phenol" combinations were selective and effective in this test; however, cost of these treatments would be considerably more than certain other promising treatments and (4) bentazon, although selective toward peas, did not result in the best overall control of the broadleaved weed population present. (Washington State University, N. W. Res. and Ext. Unit, Mt. Vernon.)

<u>Preemergence weed control in peas</u>. Ashton, F. M., R. Kukas, E. E. Stevenson, P. Osterli and E. Roncoroni. Two preemergence trials were established in Stanislaus County for the evaluation of several herbicides and herbicide combinations for annual weed control in peas.

Trial P-1-73 was applied December 15, 1972 with a compressed air sprayer using 36 gpa of water carrier on a loam soil. When the plots were evaluated on March 9, 1973 the following weed species were present: shepherdspurse (<u>Capsella bursa-pastoris</u> (L.) Medic.), chickweed (<u>Stellaria media (L.) Cyrillo</u>), pineappleweed (<u>Matricaria suaveolens</u>) and prostrate knotweed (<u>Polygonum aviculare</u> L.). Excellent broad spectrum weed control was obtained from linuron at 1 lb/A, nitrofen + metribuzin at 4 + 0.25 lb/A and chloroxuron + metribuzin at 2 + 0.25 lb/A without causing objectional crop injury (see table 1). A number of treatments resulted in excellent control of all the weeds except prostrate knotweed which seemed to be quite resistant to most of the herbicides. The combination of 0.25 lb/A of metribuzin + 2 lb/A of nitrofen helped increase the overall weed control considerably compared to the single application equivalent rates.

Trial P-4-73 was established February 29, 1973 with a compressed air sprayer in 28 gpa of water carrier on a sandy loam soil. The plots were evaluated on April 24, 1973 and only pea phytotoxicity was rated since no weeds were present in the untreated controls. Linuron at 0.5 and 1 lb/A, chloroxuron at 2 and 4 lb/A, nitrofen at 4 lb/A and MBR 8251 (1,1,1-trifluoro-4'-(phenylsulfonyl) methanesulfono-<u>o</u>-toluidide) at 1 lb/A did not vary significantly from the control with regard to pea injury (see table 2). The MBR 8251 plots at 2 and 4 lb/A were showing a definite darkening of the pea color and stressing plant growth. (University of California.)

Table 1. Preemergence weed control in peas   Experiment P-1-73

Treatment	Rate (lb/A)	Phytotoxicity 1/	Shepherds-purse	Chick-weed	Pineapple-weed	Prostrate knotweed	Avg
pronamide	1.0	1.7 a-e 2/	8.7 de	10.0 e	0.0 a	10.0 h	7.2
pronamide	2.0	0.7 a-b	10.0 e	10.0 e	0.7 ab	10.0 h	7.7
prynachlor	4.0	1.3 a-d	5.7 c	10.0 e	6.0 d-f	4.0 a-f	6.4
prynachlor	6.0	0.7 ab	7.0 cd	7.7 de	7.3 d-g	3.0 a-e	6.3
DNBP (preemergence)	9.0	1.0 a-c	10.0 e	4.7 cd	4.3 d	1.3 a-c	5.1
fluorodifen	4.0	6.0 h	10.0 e	6.7 de	10.0 g	10.0 h	9.2
nitrofen	4.0	1.0 a-c	9.3 e	3.3 bc	4.3 d	6.7 d-h	5.9
nitrofen	6.0	1.7 a-e	9.7 e	3.3 bc	5.7 de	10.0 h	7.2
linuron	0.5	0.7 ab	10.0 e	10.0 e	10.0 g	0.7 ab	7.7
linuron	1.0	1.3 a-d	10.0 e	10.0 e	10.0 g	9.3 h	9.8
prometryne	1.0	0.0 a	8.0 de	10.0 e	10.0 g	6.0 c-h	8.5
propachlor	5.0	1.0 a-c	1.0 ab	1.0 ab	1.0 a-c	0.0 a	0.8
cyanazine	0.75	1.7 a-e	10.0 e	10.0 e	10.0 g	6.3 d-h	9.1
cyanazine	1.5	3.3 d-g	10.0 e	10.0 e	10.0 g	10.0 h	10.0
metribuzin	0.25	1.3 a-d	8.3 d-e	10.0 e	8.7 e-g	0.0 a	6.8
metribuzin	0.5	4.7 gh	10.0 e	10.0 e	10.0 g	2.7 a-d	8.2
metribuzin	1.0	6.0 h	10.0 e	10.0 e	10.0 g	8.0 fh	9.5
chloroxuron	2.0	1.0 a-c	10.0 e	10.0 e	10.0 g	5.0 b-h	8.8
chloroxuron	4.0	0.7 a-d	10.0 e	10.0 e	10.0 g	7.3 e-h	9.3
cyanazine + metribuzin	0.75 + 0.25	5.0 gh	10.0 e	10.0 e	10.0 g	10.0 h	10.0
linuron + metribuzin	0.5 + 0.25	2.0 a-f	10.0 e	10.0 e	10.0 g	6.7 d-h	9.2
nitrofen + metribuzin	4.0 + 0.25	1.7 a-e	9.7 e	9.0 e	9.0 e-g	9.7 h	9.4
chloroxuron + metribuzin	2.0 + 0.25	1.3 a-d	10.0 e	10.0 e	10.0 g	9.3 h	9.8
control	-	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0

1/ Phytotoxicity and weed control are an average of 4 replications where 0 = no injury or weed control and 10 = dead plants or 100% control.

2/ Means with the same letter are not significantly different at the 0.05 level.

Table 2. Preemergence weed control in peas   Experiment P-4-73

Treatment	Rate (lb/A)	Phytotoxicity[1/]
pronamide	1.0	2.3 b-d[2/]
pronamide	2.0	8.3 h
linuron	0.5	0.8 a
linuron	1.0	1.0 ab
chloroxuron	2.0	0.8 a
chloroxuron	4.0	1.0 ab
metribuzin	0.25	6.0 f-g
metribuzin	0.5	8.8 h
nitrofen	4.0	0.8 a
DNBP (amine)	9.0	5.3 f
nitralin	1.5	2.3 b-d
MBR 8251	1.0	2.0 a-c
MBR 8251	2.0	2.3 b-d
MBR 8251	4.0	3.3 c-e
control	-	1.0 ab

1/ Phytotoxicity is an average of 4 replications where 0 = no injury and 10 = dead plants.

2/ Means with the same letter are not significantly different at the 0.05 level.

Postemergence weed control in peas. Ashton, F. M., R. Kukas and E. E. Stevenson. Two postemergence trials were established in Stanislaus County to evaluate several prospective herbicides and herbicide combinations for annual weed control in peas.

Trial P-2-73 was applied February 2, 1973 with a compressed air sprayer using 44 gpa of water carrier on a sandy loam soil. Weed species present at spraying time were: tansy phacelia (*Phacelia tanacetifolia* Benth.), ranging from 0.5 to 2 in tall; chickweed (*Stellaria media* (L.) Cyrillo), up to 1 in tall, and prostrate knotweed (*Polygonum aviculare* L.), up to 1 in tall. The peas were about 2 in tall when sprayed.

Chloroxuron at 6 lb/A was the only treatment resulting in broad spectrum control by giving satisfactory control of all weed species without objectional crop injury (see table 1). The 2 and 4 lb/A rates of chloroxuron and bentazon at 1, 2 and 3 lb/A were quite weak in prostrate knotweed control but gave satisfactory control of the tansy phacelia and chickweed present. A number of other herbicides gave excellent weed control but were quite phytotoxic to the peas under the extreme amount of rainfall received this past spring.

Trial P-3-73 was applied on February 2, 1973 with a compressed air sprayer using 30 gpa of water carrier on a sandy loam soil. Weed species present at spraying time were shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.), with 2 to 4 leaves and chickweed, 0.5 to 1 in tall. The peas were about 2 in tall at spraying time.

Chloroxuron at 2, 4 and 6 lb/A resulted in excellent weed control of both species present (see table 2). Again excellent weed control was obtained from other treatments but they were extremely phytotoxic to the peas. (University of California.)

Table 1. Postemergence weed control in peas Experiment P-2-73

Treatment	Rate (lb/A)	Phytotoxicity[1/]	Tansy phacelia	Chickweed	Prostrate knotweed	Avg
MCPA	0.75	0.8 ab[2/]	0.3 ab	0.3 ab	0.3 ab	0.3
MCPA	1.5	1.3 a-d	0.8 a-c	1.0 a-c	0.5 a-c	0.8
cyanazine	0.5	3.0 g	10.0 h	10.0 f	9.8 j	9.9
cyanazine	1.0	5.5 kl	10.0 h	10.0 f	10.0 j	10.0
metribuzin	0.37	3.5 g-i	10.0 h	10.0 f	10.0 j	10.0
metribuzin	0.75	4.3 h-j	10.0 h	10.0 f	10.0 j	10.0
bentazon	1.0	1.0 a-c	8.5 d-h	10.0 f	1.0 a-d	6.5
bentazon	2.0	0.8 ab	9.0 e-h	10.0 f	3.0 ef	7.3
bentazon	3.0	1.3 a-d	8.3 d-e	9.0 f	2.0 b-e	6.4
fluorodifen	4.0	0.9 o	10.0 h	4.0 d	10.0 j	8.0
chloroxuron	2.0	1.8 b-f	9.3 e-h	10.0 f	7.0 hi	8.8
chloroxuron	4.0	1.5 a-e	10.0 h	10.0 f	5.3 gh	8.4
chloroxuron	6.0	1.3 a-d	9.8 f-h	10.0 f	8.8 ij	9.5
metribuzin + chloroxuron	0.37 + 2.0	3.3 gh	10.0 h	10.0 f	10.0 j	10.0
linuron	0.5	4.5 i-k	8.5 d-h	10.0 f	8.5 ij	9.0
linuron + metribuzin	0.5 + 0.37	7.5 m	10.0 h	10.0 f	10.0 j	10.0
cyanazine + metribuzin	0.5 + 0.37	7.8 mn	10.0 h	10.0 f	10.0 j	10.0
dinoseb (NH_4)	0.75	1.8 b-f	7.5 d	6.0 e	4.5 fg	6.2
control						

1/ Phytotoxicity and weed control are an average of 4 replications where 0 = no phytotoxicity or no control and 10 = dead plants or 100% control.

2/ Means with the same letter are not significantly different at the 0.05 level.

Table 2. Postemergence weed control in peas Experiment P-3-73

Treatment	Rate (lb/A)	Phytotoxicity 1/	Shepherds-purse	Chick-weed	Avg
MCPB	0.75	0.3 ab 2/	0.0 a	0.0 a	0.0
MCPB	1.5	0.5 a-c	1.0 a-c	1.0 a-c	1.0
cyanazine	0.5	1.8 de	9.5 f	10.0 g	9.8
cyanazine	1.0	2.8 ef	10.0 f	10.0 g	10.0
metribuzin	0.37	5.0 ij	10.0 f	10.0 g	10.0
metribuzin	0.75	7.0 ij	10.0 f	10.0 g	10.0
bentazon	1.0	0.3 ab	8.5 ef	8.3 fg	8.4
bentazon	2.0	0.0 a	6.8 de	6.8 d-f	6.8
bentazon	3.0	0.3 ab	5.5 d	5.5 d	5.5
fluorodifen	4.0	6.5 i	9.5 f	9.3 g	9.4
chloroxuron	2.0	0.3 ab	9.5 f	10.0 g	9.8
chloroxuron	4.0	0.8 a-d	10.0 f	10.0 g	10.0
chloroxuron	6.0	0.5 a-c	9.8 f	10.0 g	9.9
metribuzin + chloroxuron	0.37 + 2.0	5.0 h	10.0 f	10.0 g	10.0
linuron	0.5	3.5 fg	10.0 f	10.0 g	10.0
linuron + metribuzin	0.5 + 0.37	8.3 k	10.0 f	10.0 g	10.0
cyanazine + metribuzin	0.5 + 0.37	6.5 i	10.0 f	10.0 g	10.0
dinoseb (NH_4)	0.75	0.5 a-c	5.5 d	5.8 de	5.7
control	-	0.0 a	0.3 ab	0.3 ab	0.3

1/ Phytotoxicity and weed control are an average of 4 replications where 0 = no injury or weed control and 10 = dead plants or 100% control.

2/ Means with the same letter are not significantly different at the 0.05 level.

Shielded applications of glyphosate for bermudagrass (*Cynodon dactylon* (L.) Pers.) control in onions. Kempen, H. M. and S. R. Radosevich. Glyphosate has been shown to provide exceptional control of many hard-to-kill perennial broadleaf weeds and grasses. However, this herbicide is also nonselective in most crops. Shielded applications of glyphosate in crops grown in rows might therefore impart selectivity to the crop while providing acceptable control of perennial weeds.

A study was initiated in a bermudagrass infested onion field in Kern County, California to determine if a shielded application of glyphosate might provide selective control in this crop. The application was made on May 30, 1973 to onions planted 6 months earlier. At that time bermudagrass was completely covering the trial area. Treatments were applied in water at 63 gpa.

Glyphosate rates applied, and visual evaluations are presented in the accompanying table. Shielded treatments of 2,4 and 8 lb/A of glyphosate significantly controlled bermudagrass without injuring the crop. (Cooperative Extension, University of California, Kern County and Davis.)

Bermudagrass control and onion injury resulting from shielded application of glyphosate (averages of 4 replications)

Rate (lb/A)	Evaluation date 6/21/73 Bermudagrass control (avg)	Onion injury (avg)
0	0.0	0
2	4.0	0
4	5.0	0
8	7.3	0

0 = no control or injury; 10 = complete control.

Evaluation of two preemergence herbicides, followed with postemergence herbicides for weed control in direct seeded onions. Heikes, P. Eugene. This experiment was designed to evaluate postemergence herbicides applied over preemergence application of DCPA, bensulide and no-preemergence herbicide. The onions were planted March 23 (Colorado #6 variety). DCPA and bensulide were applied to the soil before planting and soil incorporated with a rotary hoe. An area approximately 17 ft wide, the length of the field, was treated ppi with DCPA and with bensulide. A similar 17 ft strip received no preplant herbicide. Postemergence herbicides were applied at right angle to the ppi herbicide applications when the onions were in a 2 to 3-leaf stage. Postemergence plots were 20 x 50 ft, applied over the DCPA, bensulide and no ppi herbicide areas. Postemergence herbicides were applied with a plot sprayer in water at 40 gpa, or in a water/oil emulsion, using a herbicide oil at 1% by volume.

Visual observations were made June 21 when the onions were 4 to 6 in high and August 10.

PREPLANT HERBICIDES: There was a dense stand of kochia (*Kochia scoparia* (L.) Schrad.), common sunflower (*Helianthus annuus* L.), and Russian thistle (*Salsola kali* L. var. *tenuifolia* Tausch) in the no-preplant herbicide area. DCPA controlled kochia and Russian thistle, but was not effective on common sunflower. There was no visible phytotoxicity of either preplant herbicide on onion vigor or stand.

POSTEMERGENCE HERBICIDES: Chloroxuron (water carrier and water/oil emulsion) at 1.5, 2, 3 and 4 lb/A, caused more stunting where applied in oil/water emulsion, than were applied in water alone. However, weed control was better with oil/water than water alone. There was 15% to 20% stunting and tipburn with oil/water; there was no crop injury with any of the rates in water alone. The 3 lb/A rate in water looked comparable with 1.5 lb in water/oil, but there was less stunting and tipburn and in general the onions looked thriftier where no oil was used. The 4 lb/A rate in water looked no better than the 3 lb/A rate - no crop injury. Chloroxuron looked weak on common sunflower. Chloroxuron + nitrofen at 2 + 2 and 3 + 3 lb/A was better for control of common sunflower but was no better on kochia or Russian thistle. There was no visible crop injury at the high rate combination. This did not compare with 1.5 lb of chloroxuron in oil and was no better than 3 lb of chloroxuron in water. The 3 + 3 lb/A rate of chloroxuron/nitrofen showed good control of Venice mallow (Hibiscus trionum L.). Nitrofen at 3 and 4 lb/A caused no crop injury. Both rates controlled common sunflower but 4 lb was required to control kochia. DS 21376 (chemistry unavailable) at 2 lb/A caused tip burn early in the season and onion leaves were deformed resulting in minor stunting. There was no evidence of stunting by late July. This herbicide controlled Russian thistle and was partially effective on common sunflower but did not control kochia although the kochia was stunted. This herbicide controlled all weeds at this location except kochia. Methazole at 1, 2 and 3 lb/A looked promising as a postemergence herbicide for onions. Methazole appeared to have good crop tolerance and was one of the most effective herbicides in the series for control of emerged Russian thistle and kochia. It left some kochia at the 1 lb/A rate but what was left was stunted. The 2 lb/A rate looked optimum. (Colorado Extension Service, Colorado State University, Fort Collins, Colorado.)

Effects of post-plant herbicides on weed control in onions. Anderson, J. L. and M. G. Weeks. Until recently the most common treatment for weed control in bulb onions in Utah was a preplant soil incorporated application of DCPA. Studies in 1972 indicated that of the herbicide treatments applied post-plant, only DCPA gave appreciable weed control without onion phytotoxicity. Treatments selected for evaluation in 1973 were primarily DCPA combinations and herbicides that might offer weed control in onions at the flag stage of development. Yellow Sweet Spanish onions were planted April 16, 1973. DCPA was applied April 23; other herbicides were applied in early June. Spring temperatures in Utah during 1973 were cooler than normal and all crops were late in their development. By the time the onions had reached the flag stage there was a good stand of seedling annual grasses, primarily witchgrass (Panicum capillare L.) and green foxtail (Setaria viridis (L.) Beauv.), in the non-DCPA-treated plots. Few subsequent treatments controlled these grasses. Only DCPA, DCPA + nitrofen, and DCPA + nitrofen and chloroxuron gave appreciable weed control allowing the onion bulbs to develop a commercially acceptable size. Future studies will be directed toward the evaluation of herbicide combinations. (Utah Agriculture Experiment Station, Utah State University, Logan.)

Effects of herbicide treatment on onion yield and weed control

Treatment[1/]	Rate (kg/ha)	Onion yield (kg/plot)	Weed control[2/]	Primary weeds in plots
chloroxuron	4.48	< 1	1.4	grasses, black nightshade
chloroxuron + oil	4.48 1.2 l/ha	< 1	2.9	grasses
DCPA	8.96	10	5.6	black nightshade, common lambsquarters
DCPA + nitrofen	8.96 4.48	15	5.8	shepherdspurse
DCPA + nitrofen + chloroxuron	8.96 4.48 4.48	17	6.9	shepherdspurse, common lambsquarters
methazole	1.12	2	2.7	grasses
methazole	2.24	2	2.4	grasses
nitrofen	4.48	< 1	1.6	grasses
oryzalan	1.12	1	2.4	grasses, black nightshade
oxadiazon	0.56	1	1.9	grasses, shepherdspurse
oxadiazon	1.12	< 1	2.0	grasses
pronamide	1.12	< 1	1.3	grasses, broadleaves
napropamide	1.12	4	4.0	black nightshade
hand weeded control		42	10.0	
weedy control		< 1	1.3	common lambsquarters, redroot pigweed, grasses, shepherdspurse

1/ DCPA was applied post-plant 4/24/73; all other herbicides were applied 6/1/73 when onion seedlings were in the flag stage except chloroxuron and oryzalan which were applied 6/8/73.

2/ Rated 1-10; 1 = no weed control, 10 = complete weed control. Figures are averages of ratings taken 6/25/73 and 8/8/73.

<u>Postemergence applications of herbicides for weed control in onions.</u> Menges, Robert M. Under unusually cold temperatures, VCS 438 (2-(dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione), controlled common purslane (*Portulaca oleracea* L.), failed to control London rocket (*Sisymbrium irio* L.) and common sunflower (*Helianthus annuus* L.), and was the only herbicide tested which had no effect on the yield of onion. Bromoxynil controlled London rocket and common sunflower but reduced the

yield of onion. Chloroxuron at lower rates of application with Shellflex 210 oil controlled weeds but yields were reduced regardless of the adjuvant. RP 2929 (dimethyl amino-4-thiocyanobenzene) controlled only common purslane. RP 2929 and chloroxuron were unaided by foam adjuvants. No treatment persisted 6 months in the soil to reduce the growth of field-grown sorghum (Sorghum vulgare L.) or Japanese millet (Echinochloa frumentacea (Roxb.) Link). (Subtropical Texas Area, So. Region, Agric. Res. Ser., U. S. Dept. Agric., P. O. Box 267, Weslaco, Texas 78596.)

An evaluation of several different substituted urea herbicides in combination with propham and chloropropham for selective weed control in spinach. Peabody, Dwight V., Jr. Since norea is no longer being manufactured, and since western Washington spinach growers rely upon this herbicide (in combination with propham) to obtain safe and selective annual weed control, a field test was undertaken this year in order to determine efficacy and safety of several other substituted urea herbicides in this crop.

Chlorobromuron, fluometuron, chloroxuron, linuron, diuron and tebuthiuron were applied in combination with propham at 4 lb/A and with chloropropham at 0.5 lb/A. Substituted urea herbicide rates ranged from 0.25 to 1.0 lb/A. All treatments were applied three days after planting, well before emergence. None of the treatments resulted in selective control of annual weeds and almost all treatments adversely affected spinach growth either by severe seedling vigor loss or by stand reduction. (Washington State University, N. W. Wash. Res. and Ext. Unit, Mt. Vernon.)

Preemergence weed control in broccoli. Ashton, F. M., R. Kukas and E. E. Stevenson. Two trials were established in Stanislaus County to evaluate several herbicides for annual weed control in Medium Late 423 broccoli. In both trials herbicide combinations were applied to achieve a broader spectrum of weed control, due to the resistance of certain weed species not adequately controlled when the herbicide is applied separately. Both formulations of nitrofen were applied to compare the difference in broccoli phytotoxicity and weed control.

Trial B-1-1972 was applied on August 16, 1972 with a compressed air sprayer in 38 gpa of water carrier on a loam soil type. The plots were evaluated on September 12, 1972 with the following weed species present: hairy nightshade (Solanum sarachoides Sendt.), downy groundcherry (Physalis pubescens L.), common lambsquarters (Chenopodium album L.), and barnyardgrass (Echinochloa crus-galli (L.) Beauv.). The emulsifiable concentrate formulation of nitrofen at 6 lb/A and combinations of DCPA + nitrofen resulted in satisfactory weed control (see table 1). In general the DCPA treatments were weak in hairy nightshade control and the nitrofen treatments resulted in poor common lambsquarters control. There

Table 1. Preemergence weed control in broccoli Experiment B-1-72

Treatment	Rate (lb/A)	Crop phytotoxicity 1/	Weed control: Hairy nightshade & downy groundcherry	Weed control: Common lambsquarters	Weed control: Barnyard-grass	Weed control: Avg
nitrofen (EC)	2.0	0.6 a-d 2/	5.0 a-c	4.6 b-e	9.0 bc	6.2
nitrofen (EC)	4.0	1.6 d	8.2 c-e	6.6 d-h	9.8 bc	8.2
nitrofen (EC)	6.0	1.0 a-d	9.6 f	8.4 f-h	9.0 bc	9.0
nitrofen (WP)	2.0	0.4 a-c	4.2 a-d	0.0 a	8.2 bc	4.1
nitrofen (WP)	4.0	1.0 a-d	6.6 c-f	2.8 a-c	7.0 bc	5.5
nitrofen (WP)	6.0	0.8 a-d	8.2 c-f	4.4 b-d	8.6 bc	7.1
DCPA	3.0	0.8 ad	5.8 c-f	10.0 h	8.8 bc	8.2
DCPA	6.0	1.0 a-d	4.0 a-c	10.0 h	9.4 bc	7.8
DCPA	9.0	0.4 a-c	6.2 c-f	9.6 h	8.6 bc	8.1
nitrofen (WP) + DCPA	2.0 + 3.0	1.0 a-d	6.4 c-f	9.6 h	8.8 bc	8.3
nitrofen (WP) + DCPA	3.0 + 5.0	0.6 a-d	6.2 c-f	10.0 h	10.0 c	8.7
nitrofen (WP) + DCPA	4.0 + 6.0	0.2 ab	8.0 c-f	9.8 h	9.0 bc	8.9
nitrofen (EC) + DCPA	3.0 + 5.0	0.0 a	7.6 c-f	9.8 h	9.2 bc	8.9
bensulide	3.0	0.0 a	1.2 a	6.0 c-g	6.6 ab	4.6
bensulide	6.0	0.2 ab	1.4 ab	5.8 c-f	9.0 bc	5.4
control	-	0.4 a-c	1.2 a	1.8 ab	2.0 a	1.7

1/ Phytotoxicity and weed control are an average of 5 replications where 0 = no injury or no control and 10 = dead plant or 100% control.

2/ Means with the same letter are not significantly different at the 0.05 level.

was no significant difference in broccoli injury between the two nitrofen formulations but when comparing equivalent rates of each the emulsifiable concentrate resulted in better overall weed control than the wettable powder formulation.

Trial B-3-72 was applied on September 26, 1972 with a compressed air sprayer in 38 gpa of water carrier on a loam soil type. The plots were evaluated on October 24, 1972 with the following weed species present: shepherdspurse (Capsella bursa-pastoris (L.) Medic.), chickweed (Stellaria media (L.) Cyrillo) and burning nettle (Utrica urens L.). All of the combinations resulted in satisfactory weed control except the combination of benthiocarb + DCPA at 3 + 6 lb/A which did not control the burning nettle (see table 2). The nitrofen treatments gave excellent control of the shepherdspurse and burning nettle but did not provide commercially acceptable control of the resistant chickweed. DCPA treatments were quite weak in controlling burning nettle and the combinations resulted in a broader spectrum of weed control than when each herbicide was applied separately. The wettable powder formulation of nitrofen at 6 lb/A did result in commercially acceptable control giving fairly good control of the resistant chickweed. (University of California.)

Postemergence weed control in broccoli. Ashton, F. M., R. Kukas, and E. E. Stevenson. Two trials were established to evaluate the two formulations of nitrofen for broccoli phytotoxicity and annual weed control. The trials were applied in Stanislaus County on August 29, 1972 (B-2-72) and October 26, 1972 (B-4-72) with a compressed air sprayer in 35 gpa of water carrier. The variety of seed was Medium Late 423 planted on a loam soil. The broccoli was in the 2-leaf stage of growth in trial B-2-72 with no weeds present at application time. In trial B-4-72 the broccoli was in the 4-leaf stage and the weeds consisted of burning nettle (Utrica urens L.) and shepherdspurse (Capsella bursa-pastoris (L.) Medic.).

The results presented in tables 1 and 2 show that the emulsifiable concentrate formulation was more phytotoxic to the broccoli than the wettable powder. The 2 and 4 lb/A rates were relative non-phytotoxic with the 6 lb/A rate resulting in some malformation of the broccoli leaves in trial B-4-72. All of the treatments gave 100% control of the burning nettle present and resulted in poor control of shepherdspurse. (University of California.)

Table 2. Preemergence weed control in broccoli Experiment B-3-72

Treatment	Rate (lb/A)	Crop phytotoxicity1/	Weed control1/ Shepherds-purse	Burning nettle	Chickweed	Avg
nitrofen (EC)	2.0	0.3 ab2/	10.0 d	10.0 k	4.0 a-d	8.0
nitrofen (EC)	4.0	0.0 a	10.0 d	10.0 k	6.3 c-h	8.8
nitrofen (EC)	6.0	0.0 a	10.0 d	10.0 k	5.0 b-f	8.3
nitrofen (WP)	2.0	0.0 a	10.0 d	10.0 k	4.5 b-e	8.2
nitrofen (WP)	4.0	0.0 a	10.0 d	10.0 k	4.0 a-d	8.0
nitrofen (WP)	6.0	1.0 cd	10.0 d	10.0 k	7.0 d-i	9.0
DCPA	3.0	0.0 a	8.3 cd	1.8 a-c	9.3 g-i	6.5
DCPA	6.0	0.0 a	8.0 cd	3.8 c-g	7.5 d-i	6.4
DCPA	9.0	0.0 a	8.3 cd	2.0 a-d	8.8 g-i	6.4
nitrofen (WP) + DCPA	2.0 + 3.0	0.3 ab	10.0 d	10.0 k	8.8 g-i	9.6
nitrofen (WP) + DCPA	4.0 + 5.0	0.0 a	9.8 cd	10.0 k	9.5 g-i	9.8
nitrofen (EC) + DCPA	3.0 + 5.0	0.0 a	10.0 d	9.8 k	8.3 f-i	9.4
bensulide	3.0	0.0 a	2.5 b	3.3 b-f	1.8 ab	3.4
bensulide	6.0	0.0 a	2.5 b	5.5 gh	3.3 a-c	3.8
benthiocarb	4.0	0.0 a	10.0 d	1.5 ab	6.0 c-g	5.8
benthiocarb	8.0	0.8 bc	10.0 d	7.5 ij	9.0 g-i	8.8
chloropropham	2.0	7.5 e	10.0 d	6.5 hi	10.0 i	8.8
benthiocarb + nitrofen (WP)	4.0 + 2.0	0.0 a	10.0 d	10.0 k	9.0 g-i	9.7
benthiocarb + nitrofen (WP)	4.0 + 4.0	0.0 a	10.0 d	10.0 k	6.8 c-i	8.9
benthiocarb + DCPA	4.0 + 3.0	0.0 a	10.0 d	7.5 ij	10.0 i	9.2
benthiocarb + DCPA	3.0 + 6.0	0.0 a	9.8 cd	3.0 b-e	9.8 hi	7.5
control	-	0.0 a	0.0 a	0.0 a	0.8 a	0.3

1/ Phytotoxicity and weed control are an average of 4 replications where 0 = no injury or no control and 10 = dead plant or 100% control.

2/ Means with the same letter are not significantly different at the 0.05 level.

Table 1. Postemergence weed control in broccoli with nitrofen
Experiment B-2-72

Rate (lb/A)	Crop phytotoxicity 1/
2 (WP)	0.2
4 (WP)	0.0
2 (EC)	1.0
4 (EC)	2.0
control	0.0

Table 2. Experiment B-4-72

Treatment	Rate (lb/A)	Crop phytotoxicity 1/	Weed control 1/ Burning nettle	Weed control 1/ Shepherds-purse
nitrofen (EC)	2	3.5 d 2/	10.0 b	0.3 a
nitrofen (EC)	4	3.8 d	10.0 b	1.0 a
nitrofen (EC)	6	4.0 d	10.0 b	2.0 a
nitrofen (WP)	2	0.8 b	10.0 b	1.0 a
nitrofen (WP)	4	0.8 b	10.0 b	1.5 a
nitrofen (WP)	6	2.0 c	10.0 b	1.8 a
control	-	0.0 a	0.0 a	0.0 a

1/ Phytotoxicity and weed control are an average of 4 replications where 0 = no injury or control and 10 = dead plants or 100% control.

2/ Means with the same letter are not significantly different at the 0.05 level.

Preemergence weed control in potatoes. Lee, G. A., K. E. Bohnenblust and H. P. Alley. Preemergence trials were established May 25, 1973, at Pine Bluffs, Wyoming. The potatoes (*Solanum tuberosum* var. Russet Burbank) were planted four days previous to herbicide applications. The plots were 9 x 30 ft and replicated three times in a randomized complete block design. Herbicides were applied with a knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume. The herbicides were incorporated immediately after application with a flex-tine harrow operated at 4-5 mph. The soil type at the location is a sandy loam, and small clods were prevalent at the time of herbicide application. The study site was furrow irrigated throughout the growing season.

The weed population consisted of redroot pigweed (*Amaranthus retroflexus* L.), kochia (*Kochia scoparia* (L.) Schrad.), Russian thistle (*Salsola kali* L. var. *tenuifolia* Tausch), and green foxtail (*Setaria viridis* (L.) Beauv.). Crop yields were determined by harvesting potato tubers from 10 ft of row in each replicate.

No herbicide treatment resulted in potato stand reduction (accompanying table). All herbicide treatments controlled 95.3% or more of the redroot pigweed present except Amex 820 (*N*-*sec*-butyl-4-*tert*-butyl-2, 6-dinitroanalin) + EPTC at 1 + 2 lb/A and CGA 10832 (*N*-*n*-propyl-*N*-cyclopropylmethyl-4-trifluoromethyl-2,6-dinitroaniline) at 0.75 lb/A. The kochia population was satisfactorily reduced by all herbicides tested in the study. CGA 10832 at 0.75 lb/A was the only treatment which did not provide 95% or better control of Russian thistle. Satisfactory green foxtail control was obtained with all herbicide treatments. Potato yields from herbicide treated plots ranged from 80 to 129 cwt/A greater than yields from the nontreated area. Yields from all herbicide treated areas were significantly higher than the yields from the nontreated check. Slight chlorosis and stunting was observed in potato vines growing in plots treated with CGA 10832 at 1.5 lb/A; however, no significant potato yield reduction was recorded at harvest time. (Wyoming Agricultural Experiment Station, Laramie, SR-549.)

Effect of preemergence herbicides on weed population and potato yields at Pine Bluffs, Wyoming - 1973

Treatment	Rate (lb/A)	% Stand potatoes	Percent control: Redroot pigweed	Percent control: Kochia	Percent control: Russian thistle	Percent control: Green foxtail	Yield (cwt/A)
metribuzin	0.5	100 a	99.3 a	99.3 a	100.0 a	96.7 a	259 a
metribuzin	0.75	100 a	98.7 a	100.0 a	100.0 a	98.3 a	269 a
EPTC	4.0	100 a	96.7 ab	90.0 b	100.0 a	95.0 a	271 a
trifluralin + EPTC	0.5 + 2.0	100 a	97.0 ab	96.7 ab	96.7 a	100.0 a	227 a
nitralin + EPTC	0.75 + 2.0	100 a	97.6 ab	100.0 a	100.0 a	100.0 a	274 a
Amex 820 + EPTC	1.0 + 2.0	100 a	88.2 b	91.7 ab	95.0 ab	98.3 a	225 a
Amex 820	1.5	100 a	95.3 ab	100.0 a	100.0 a	100.0 a	259 a
CGA 10832	0.75	100 a	71.7 c	96.7 ab	85.0 b	95.0 a	252 a
CGA 10832	1.5	100 a	98.3 a	98.3 ab	98.3 a	100.0 a	247 a
CGA 10832 + EPTC	1.0 + 2.0	100 a	98.3 a	96.7 ab	95.0 ab	100.0 a	240 a
nontreated check	-	100 a	-	-	-	-	145 b

Preplant and sequential herbicide applications on Kern County potatoes. Kempen, H. M. Several herbicides were applied prior to listing and planting of White Rose potatoes. Treatments were made 2/7/73 and were incorporated by double discing 5 in deep. Potatoes were planted on 2/15/73.

A second test, including EPTC and alachlor, was applied preplant only, preplant + post-plant preemergence and only post-plant preemergence. Unfortunately all treatments of both tests were treated postemergence 3/30/73 with EPTC at 3 lb/A through the sprinklers.

Tolerance results and yields appear in tables 1 and 2. No yellow nutsedge (Cyperus esculentus L.) populations developed. Only MBR 8251 (1,1,1-trifluro-4'-(phenylsulfonyl) methylsulfono-o-toluidide) caused injury to potatoes. No yield depression was noted in harvested plots.

The results suggest U 27267 (3,4,5-tribromo-N,N,α-trimethylpyrazole-1-acetamide), alachlor and napropamide are truly selective in potatoes. (University of California Agricultural Extension Service, Bakersfield, California.)

Table 1. Preplant herbicides on White Rose potatoes 1/

Treatment	Rate (lb/A)	Injury rating 2/	Harvest data 3/ lb/plot	Harvest data 3/ lb/tuber
EPTC	3	0	52.8	.30
EPTC	6	0	51.2	.25
EPTC + napropamide	3 + 0.5	0	37.3	.22
EPTC + napropamide	6 + 1	0	45.7	.28
napropamide	1	0	57.3	.30
U 27267	1	0	61.2	.24
U 27267	2	0	53.8	.27
alachlor	2	0	54.7	.30
alachlor	4	0.3	54.8	.31
MBR 8251	2	6.0	-	-
MBR 8251	4	8.0	-	-
untreated	-	-	49.7	.27
		LSD .05	12.9	.066

1/ Applied 2/7/73; planted 2/15/73; EPTC at 3 lb/A through sprinklers applied 3/30/73.

2/ Rated 0 to 10; 0 = no effect; 10 = kill; average 3 replications. Evaluated 4/4/73.

3/ Harvested 6/12/73.

Table 2. Sequential treatments of alachlor and EPTC on White Rose potatoes[1/]

Treatment	Rate (lb/A) PPI		Rate (lb/A) PoPl	Injury rating 4/4/73	Harvest data[2/] lb/plot	Harvest data[2/] lb/tuber
alachlor	2		-	0	-	-
alachlor	2	+	2	0	51.9	.31
alachlor	-		2	0.7	-	-
untreated	-		-	0	54.5	.31
EPTC	2		-	0	-	-
EPTC	2	+	2	0	-	-
EPTC	-		2	0	-	-
untreated	-		-	0	-	-

1/ Applied (PPI-2/7/73) (PoPl-3/2/73); postemergence EPTC at 3 lb/A through sprinklers applied 3/30/73.

2/ Other yield data were not obtained because of lack of grower cooperation.

Evaluation of asulam as a selective, postemergent herbicide in cucumbers. Peabody, Dwight V., Jr. Based on the results of the field test undertaken in 1972, an experiment was undertaken this year wherein asulam was applied postemergence to cucumbers to determine (1) optimum rate and time of application for broadleaf annual weed control and (2) the effect of these rates and timings on cucumber growth and vigor.

Asulam resulted in poor annual weed control and extensive cucumber injury. This year cucumbers were treated at later growth stages which evidently led to more injury. Annual weeds were also further advanced and although they were injured and some control was evident they were present in sufficient numbers to afford a high level of competition to the damaged cucumbers resulting in extensive injury and stand thinning.

There was a companion experiment to this trial wherein the various postemergent asulam treatments were applied to cucumbers planted in a nontilled seed bed that had been sprayed with glyphosate and paraquat. Although cucumbers were planted successfully and good seedling stands were obtained, asulam resulted in poor control and the extensive weed population present soon crowded out the cucumbers. (Washington State University, N. W. Wash. Res. and Ext. Unit, Mt. Vernon.)

Control of annual weeds in established Hartley and Ashley variety walnuts. Elmore, C. L., D. M. Holmberg and E. J. Roncoroni. A preemergence herbicide trial was established on 5-year-old Hartley and Ashley walnuts under sprinkler irrigation beginning November 17, 1970 with subsequent treatments, December 16, 1971 and April 5, 1973. All treatments were applied to a non-cultivated soil surface with a Champion backpack sprayer at 30 psi in 100 gpa water. The soil was a Yolo clay loam with an analysis of organic matter 1.5%, sand 24%, silt 46% and clay 30%.

Simazine at the 2 lb/A rate gave good control early in 1971 but did not give effective control of little mallow (Malva parviflora L.) and barnyardgrass (Echinochloa crus-galli (L.) Beauv.) in the summer. Early control was again evident in 1972, however when applied in the spring of 1973, poor control was apparent because of lack of sufficient leaching.

Napropamide gave good to excellent weed control throughout the year, with control improving after successive applications.

Oxadiazon did not control chickweed (Stellaria media (L.) Cyrillo). Oxadiazon gave good control on the remaining weed species including little mallow and California burclover (Medicago polymorpha L. var. vulgaris (Benth.) Shinners).

All herbicide combinations gave effective over-all weed control in this trial.

No phytotoxicity was observed from any of the treatments. (Cooperative Extension, University of California, Davis, Yolo County and Davis.)

Annual weed control evaluations in walnuts

Herbicide	Rate (lb/A)	1971 3/9	1971 7/29	1971 9/7	4/6/72	7/19/73
simazine	2	7.2	6.5	1.5	9.0	3.3
simazine + nitralin	2 + 4	8.5	7.5	8.3	7.8	8.1
napropamide	4	8.5	7.0	5.5	7.8	8.8
napropamide	8	8.8	7.5	8.9	9.1	9.5
simazine + napropamide	2 + 4	8.9	8.0	5.5	9.9	9.6
oxadiazon	2	6.2	2.0	2.8	6.0	5.8
oxadiazon	8	8.0	4.5	7.4	8.0	9.6
simazine + oxadiazon	2 + 4	-	-	-	10.0	8.6
simazine + oryzalin	2 + 4	-	-	-	10.0	9.3
norflurazon + oxadiazon	2 + 4	-	-	-	9.1	8.0
norflurazon + oxadiazon	4 + 8	-	-	-	9.6	9.5
control	-	0.0	0.0	0.0	0.0	0.8

Swamp smartweed control in Bartlett variety pears. Elmore, C. L., G. W. Morehead and E. J. Roncoroni. Three herbicides were applied as postemergence treatments in 5 ft x 20 ft plots on October 2, 1972 in a four-year-old Bartlett pear orchard. Treatments were applied with a CO_2 pressure sprayer in 25 gpa water. The swamp smartweed (Polygonum coccineum Muhl.) was 2 ft in height at time of application. Field bindweed (Convolvulus arvensis L.) was not uniform in all plots.

Glyphosate at the 2 and 4 lb/A gave excellent swamp smartweed control with little or no regrowth eleven months after application. At the 1 lb/A rate glyphosate gave good control but new growth was apparent. One application of glyphosate did not effectively control field bindweed at 1, 2 or 4 lb/A.

The herbicides 2,4-D O.S. amine and asulam did not give effective swamp smartweed control. Field bindweed control was good with 2,4-D the year following a fall application.

Phytotoxicity was apparent on one of the Bartlett pear trees from glyphosate at 4 lb/A where the spray was applied directly to the foliage. No injury was apparent when the spray was applied to the orchard floor or weed foliage. (Cooperative Extension, University of California, Davis, Sacramento County and Davis.)

Control of swamp smartweed and field bindweed

Herbicide	Rate (lb/A)	Swamp smartweed 5/11/73	Swamp smartweed 8/23/73	Field bindweed 5/11/73	Field bindweed 8/23/73
glyphosate	1	7.7	7.7	2.3	4.0
glyphosate	2	8.3	9.0	5.3	4.7
glyphosate	4	8.8	9.3	7.3	5.7
2,4-D O.S. amine	4	1.7	3.0	6.3	8.7
asulam + X-77*	3 + .5%	1.3	3.7	0.7	4.3
asulam + X-77*	6 + .5%	2.7	4.7	0.0	1.7
control	-	0.7	3.3	0.0	6.0

*applied in 50 gpa water

Screening herbicides for weed control in young grape cuttings. Lange, A. H., B. B. Fischer and J. Schlesselman. Eighteen preemergence herbicides were compared with simazine for annual weed control and safety to young grape cuttings and rootings. One postemergence herbicide was compared with paraquat for safety to grape cuttings. The cuttings were planted in a Hanford sandy loam (OM 0.6%, sand 58%, silt 72%, clay 10%) on 2/9/73 and irrigated on 3/8/73 and 3/12/73. About 1 month later on 3/7/73 the herbicides were applied to moist soil tilled prior to application because of excessive weed growth. Some weeds were not killed by the tillage and therefore postemergence activity on partially killed weeds was observed in the early ratings. These weeds were primarily redmaids rockpurslane (_Calandrinia caulescens_ (R. & P.) DC. var. _menziesii_ (Hook.) Macbr.), willowweed (_Epilobium_ spp.), pigweed (_Amaranthus_ spp.), and shepherdspurse (_Capsella bursa-pastoris_ (L.) Medic.).

In general the triazine herbicides were less safe than simazine on a pound-for-pound basis with the exception of terbutryn. As would be expected, the combination of simazine and terbutryn was safer than simazine alone but not as safe as terbutryn alone. Similarly, the combination of simazine and GS 14254 (4-ethyl-amino-2-methoxy-6-_s_-butyl=amino-1,3,5-triazine) was not safer than simazine alone although the differences were not great. However, the combination of GS 14254 and simazine gave outstanding weed control. Most of the other new compounds showed excellent safety on grape cuttings. These included oryzalin, RH 2915 (chemistry unavailable), cyanazine, Amex 820 (_N-sec_-butyl-4-_tert_-butyl-2,6-dinitroanalin), USB 3153 (chemistry unavailable), EMD 70610 (chemistry unavailable) and IMC 3950 (_S_-(4-chlorobenzyl)-_N,N_-diethyl=thiolcarbamate). Bifenox and SN 45108 (chemistry unavailable) were particularly toxic to grape cuttings and showed little promise for selective weed control in vineyards. The phytotoxicity ratings for MBR 8251 (1,1,1-trifluoro-4'-(phenylsulfonyl) methanesulfono-_o_-toluidide) appeared to be due to the extremely poor weed control under the conditions of this experiment.

Glyphosate showed some symptoms at 16 lb/A which may have been due to root uptake or bud uptake as these cuttings were beginning to swell at the time of herbicide application. A low order of activity was apparent in the summer ratings. (San Joaquin Valley Agricultural Research and Extension Center, University of California, 9240 S. Riverbend Avenue, Parlier, California 93648.)

A comparison of 18 herbicides and 4 combinations on weed control, phytotoxicity and vigor in young grape cuttings and rootings (average of 3 replications)

Herbicide	Rate (lb/A)	Weed control[1/]	Phyto.[2/]	Grape vigor[3/]	Grass control[1/]	Pig-weed[1/]
simazine	2	10.0	0.3	9.3	9.0	6.0
simazine	4	10.0	0.7	6.3	9.6	7.0
terbutryn	4	10.0	0.0	9.6	9.0	3.3
simazine + terbutryn	2 + 2	10.0	0.0	8.6	8.3	3.3
GS 14254	4	10.0	0.3	5.6	10.0	10.0
simazine + GS 14254	2 + 2	10.0	0.0	5.0	9.6	8.6
metribuzin	½	6.7	0.0	8.0	5.6	4.3
metribuzin	2	8.7	1.7	5.3	5.6	4.0
oryzalin	2	7.3	1.0	8.0	10.0	6.0
oryzalin	4	8.9	0.7	7.6	10.0	8.0

(continued)

Herbicide	Rate (lb/A)	Weed[1/] control	Phyto.[2/]	Grape[3/] vigor	Grass[1/] control	Pig-[1/] weed
metribuzin + oryzalin	½ + 2	10.0	1.3	9.3	10.0	9.6
metribuzin + oryzalin	1 + 4	10.0	1.0	9.3	9.3	8.6
norflurazon	2	8.3	0.3	8.0	10.0	4.3
norflurazon	8	10.0	1.7	5.6	10.0	7.6
simazine + napropamide	1 + 4	10.0	1.7	7.6	9.0	9.0
simazine + napropamide	2 + 4	10.0	0.3	9.3	10.0	9.6
RH 2915	1	7.7	0.0	7.6	5.6	4.3
RH 2915	4	9.5	0.0	7.6	10.0	9.3
RP 20810	1	3.3	0.0	8.0	6.3	3.3
RP 20810	4	8.7	0.3	8.3	10.0	4.6
cyanazine	2	7.0	0.0	9.6	7.3	3.6
cyanazine	8	9.3	2.0	9.0	8.0	5.3
Amex 820	4	8.3	0.0	9.3	9.6	5.0
Amex 820	16	9.3	1.3	9.3	10.0	9.6
MBR 8251	2	6.0	2.3	5.6	5.0	4.0
MBR 8251	8	6.7	2.7	4.3	10.0	3.0
USB 3153	4	9.3	2.7	8.6	10.0	8.6
USB 3153	16	10.0	0.3	8.0	10.0	10.0
EMD 70610	4	4.7	0.0	7.3	7.3	1.0
EMD 70610	16	9.8	1.3	9.0	10.0	9.3
IMC 3950	4	8.3	1.0	9.0	9.0	5.6
IMC 3950	16	10.0	3.7	8.3	10.0	10.0
bifenox	2	7.0	0.0	7.3	9.6	2.6
bifenox	8	6.0	0.0	7.3	8.6	8.3
SN 45108	2	10.0	3.0	0.6	9.6	8.0
SN 45108	8	10.0	6.7	0.0	10.0	10.0
glyphosate	4	3.3	0.7	8.0	5.0	3.0
glyphosate	16	4.7	4.3	6.0	5.3	5.0
paraquat	½	6.3	0.0	6.6	5.6	2.3
check	-	5.3	0.3	6.6	4.3	3.6

1/ Weed control: 0 = none; 7 = commercially accepted; 10 = no weeds. Grasses included crabgrass, barnyardgrass and witchgrass. Rated 5/14/73.

2/ 0 = no effect; 10 = complete kill. Rated 5/14/73.

3/ Grape vigor where 0 = no growth; 10 = most vigorous. Rated 8/16/73.

Herbicide screening trials for deciduous fruit and nut trees. Lange, A. H. and B. B. Fischer. Fifteen new preemergence herbicides were compared with simazine for annual weed control and safety to newly planted fruit and nut trees including Malling 7 apple, Santa Rosa on Myrobalan 29 C, Texas on Nemaguard, Fay Elberta on Nemaguard, Late LeGrand on Nemaguard, Bing on Mahaleb, Hartley on Black walnut, Wonderful pomegranate, French prune on Marianna 2624 and pistachio. One post-emergence herbicide was compared with paraquat for safety to young fruit and nut trees. The trees were planted on February 9, 1973. Alfalfa and barley were seeded 2/15/73. The herbicides were applied on 3/7/73 and evaluated 4/20/73, 5/24/73 and 8/8/73. The soil was a Hanford sandy loam (O.M. 0.3%, sand 53%, silt 35%, clay 12%). At and immediately after application the soil moisture was near the maximum available moisture level because of late season rains. Therefore the amount of sprinkler irrigation applied immediately after application was approximately 1 in. Subsequent irrigations were made as needed by individual plot-basin irrigation (flood).

Most of the preemergence herbicides gave good broadleaf winter annual weed control comparable to simazine. Many of the herbicides showed poorer grass control than simazine. These included terbutryn, metribuzin, RH 2915 (chemistry unavailable), RP 20810 (chemistry unavailable), cyanazine, MBR 8251 (1,1,1-trifluoro-4'-(phenylsulfonyl) methanesulfono-o-toluidide), EMD 70610 (chemistry unavailable) and bifenox. Of the triazine herbicides terbutryn was considerably safer than simazine, GS 14254 (4-ethyl-amino-2-methoxy-6-s-butylamino-1,3,5-triazine) and metribuzin. GS 14254 was safer on apples and cherries than simazine. Metribuzin was comparable to simazine on a pound-for-pound basis but gave much shorter weed control. It was markedly safer on cherry than simazine. The combination of oryzalin and metribuzin appeared to be somewhat safer than metribuzin alone and greatly enhanced the grass control. Norflurazon repeated its earlier performance giving excellent weed control into August and adequate safety for young orchard trees. The combination of simazine and napropamide also repeated earlier good results. RH 2915 showed excellent safety and winter broadleaf annual control. It was somewhat weaker on summer grass control than simazine. The compound has also shown excellent initial foliar kill of standing weed growth in other tests including nutsedge (*Cyperus* spp.), puncturevine (*Tribulus terrestris* L.) and bindweed (*Convolvulus* spp.). RP 20810 showed safety on the trees and good broadleaf winter weed control but some weakness on summer grass control. Cyanazine did not show outstanding safety for the amount of weed control, being weak on grasses, but giving excellent annual broadleaf winter weed control. Amex 820 (N-sec-butyl-4-tert-butyl-2,6-dinitroanalin) gave excellent safety and adequate winter annual weed control but appeared to dissipate too early to get the summer weeds. MBR 8251 showed excellent tree safety but inadequate summer grass control. USB 3531 (chemistry unavailable) repeated the excellent safety on the earlier trial and gave adequate weed control except at the low rate for grasses. EMD 70610 showed adequate safety up to 16 lb/A and winter weed control but did not provide residual grass control. Glyphosate showed excellent safety when applied to the base of the trees and soil surface. (San Joaquin Valley Agricultural Research and Extension Center, University of California, 9240 S. Riverbend Avenue, Parlier, California 93648.)

Relative toxicity of 17 preemergence and 2 postemergence herbicides on 10 tree fruit species in relation to annual weed control[1]

Herbicides	Rate (lb/A)	Almond	Apple	Cherry	Nectarine	Peach	Pistachio	Plum	Pomegranate	Prune	Walnut	Weed control[2]
simazine	2	3.0	0.0	8.3	3.3	3.3	2.3	5.0	0.0	7.0	0.0	5.0
simazine	4	7.6	6.6	6.0	5.3	5.3	3.3	5.0	3.3	6.0	0.0	8.0
terbutryn	4	0.0	0.0	0.3	2.6	1.3	0.0	0.3	0.0	0.0	0.0	3.6
simazine + terbutryn	2 + 2	5.6	1.3	3.6	5.0	4.3	3.0	7.6	0.6	4.6	0.0	6.3
GS 14254	4	8.6	4.6	2.3	6.3	6.0	2.3	6.3	5.3	8.0	0.0	9.6
simazine + GS 14254	2 + 2	8.0	7.0	6.3	4.6	5.6	1.6	7.3	4.6	7.3	3.0	7.6
metribuzin	½	2.0	0.0	0.0	2.0	0.3	0.0	0.0	0.0	1.3	0.0	0.0
metribuzin	2	3.3	1.3	4.6	4.3	3.6	3.0	4.6	0.0	5.0	0.0	1.0
oryzalin	2	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	9.0
oryzalin	4	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.0	1.6	0.0	9.3
metribuzin + oryzalin	½ + 2	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.6	8.6
metribuzin + oryzalin	1 + 4	2.6	0.0	1.0	2.0	3.6	1.0	4.6	0.0	3.6	0.6	9.0
norflurazon	2	2.3	0.0	0.0	0.0	0.0	2.0	1.3	0.0	1.6	0.0	8.6
norflurazon	8	4.5	1.6	1.6	4.0	4.6	7.0	6.6	1.0	3.6	1.0	9.6
simazine + napropamide	1 + 4	4.0	0.6	3.6	2.6	2.0	0.0	2.6	0.0	3.3	3.3	8.0
simazine + napropamide	2 + 4	5.0	3.3	3.3	5.0	4.0	1.6	3.6	1.0	6.0	0.0	8.6
RH 2915	1	1.3	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6
RH 2915	4	2.0	0.3	0.0	1.0	1.0	1.0	2.3	0.0	1.0	0.0	6.3
RP 20810	1	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	4.0
RP 20810	4	1.6	0.0	2.0	2.0	0.6	2.0	2.0	0.0	2.0	0.0	7.0

(continued)

Herbicides	Rate (lb/A)	Almond	Apple	Cherry	Nectarine	Peach	Pistachio	Plum	Pomegranate	Prune	Walnut	Weed control 2/
cyanazine	2	1.5	1.0	1.6	3.0	3.0	0.0	1.6	0.6	2.0	0.0	0.3
cyanazine	8	3.6	1.0	3.3	4.3	4.0	1.3	4.0	0.0	3.3	2.0	1.3
Amex 820	4	0.0	0.0	0.0	1.6	1.3	0.0	0.0	0.0	0.0	0.3	6.0
Amex 820	16	0.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.5	0.0	6.6
MBR 8251	2	0.6	0.0	0.6	3.6	4.0	0.0	0.6	1.3	1.3	0.0	0.0
MBR 8251	8	5.0	1.3	2.3	5.0	5.3	4.6	4.0	2.3	3.0	2.6	3.6
USB 3153	4	0.3	0.0	0.3	1.3	0.6	0.6	1.0	0.0	0.6	0.0	7.6
USB 3153	16	1.3	0.0	0.0	1.3	1.6	2.3	1.3	0.0	1.3	0.0	9.3
EMD 70610	4	3.0	0.0	2.6	2.0	2.0	0.6	1.0	0.0	1.3	0.0	0.3
EMD 70610	16	5.0	1.0	5.6	3.6	2.0	0.3	5.0	1.0	3.3	2.3	4.0
ICS 3510	2	10.0	7.3	10.0	9.0	10.0	8.3	8.0	3.6	8.6	8.6	8.3
ICS 3510	8	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	9.3
bifenox	2	1.0	1.0	0.3	3.3	3.0	0.0	0.6	0.0	0.0	0.0	0.3
bifenox	8	2.0	1.6	2.5	1.0	3.0	0.0	0.6	0.0	0.0	1.6	3.0
SN 45108	2	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	9.3
SN 45108	8	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
glyphosate	4	1.6	0.6	0.6	1.3	1.6	0.0	0.0	0.0	1.6	0.6	0.0
glyphosate	16	1.6	0.6	1.3	2.6	2.0	1.0	1.3	1.0	3.0	0.0	0.0
paraquat	½	0.0	0.0	0.0	2.0	1.6	0.3	1.3	0.0	1.0	1.6	0.3
check	-	0.0	0.0	1.0	2.6	3.6	0.3	0.0	0.0	1.0	0.0	0.0

1/ Average of 3 replications, where 0 = no effect; 10 = complete kill.

2/ Primarily annual grasses including barnyardgrass, crabgrass and lovegrass. Treated 3/7/72, evaluated 8/8/73.

Herbicides for establishment of field grown shade tree nursery stock. Collins, R. L. Several new herbicides were evaluated on two soil types to determine their effectiveness for establishment of five species of shade trees. The trees are Red Maple (Acer rubrum), Golden Chain Tree (Laburnum vossi), Linden (Tilia sp.), Hawthorn (Crataegus oxycantha), and Tulip Tree (Liriodendron tulipifera). One foot tall, $\frac{1}{4}$ inch caliper, rooted trees were lined out in April 1972. The rootstocks were budded in July 1972. The rootstocks were cut off above the bud in April 1973, staked, and the new bud growth trained up the stake.

Those herbicides listed in tables 1 and 2 were applied as directed sprays to the base of the trees except for granular dichlobenil. Application dates, weed control evaluation dates, and weed species are listed in each table. In most cases three applications of each herbicide was made. The soil at Sauvie Island is Burlington fine sand with less than 0.5% O.M. The soil at Portland is Linton silt loam with 1% O.M. Plot size was 25 sq ft usually containing 8 to 11 trees per plot. The Maple trial had four replicates. The Linden trials had two replicates at Portland and one at Sauvie Island. All remaining tree species were single replicates at each location. Tree height and caliper measurements along with visual tree tolerance ratings were taken July, 1972, May and October, 1973. The tree tolerance ratings are a summary of those dates.

Pronamide and napropamide appear to have excellent tree tolerance with good grass control but poor to fair broadleaf weed control. Methazole appears to have adequate tree tolerance at 2 and 4 lb/A with moderate phytotoxicity at 8 lb/A on Tilia in sand. Ratings of 2 or less showed leaf margin chlorosis of bottom leaves. Ratings of 3 or more showed stand and tree growth reductions. Methazole gave excellent weed control. The rates of terbacil may have been applied too high as injury was significant, but with excellent weed control. The standard herbicides, dichlobenil, diphenamid, diuron, simazine, and trifluralin showed good to excellent weed control. Trifluralin appeared to cause delayed growth of Hawthorn, enough so that they could not be budded at the normal time. Dichlobenil caused moderate injury to Tilia and Laburnum with only one application. (Pest management consultant, Hillsboro, Oregon.)

Table 1. Summary of tree tolerance and weed control ratings on a silt loam soil at Portland, Oregon (All herbicides applied three times preemergence to weeds on following dates: 4/8/72, 9/29/72 and 3/31/72)

Treatment	Rate (lb/A)	Tree tolerance			Weed control (5/4/73)[1/]		
		Tilia	Laburnum	Liriodendron	Grass	Broadleaf	Weeds remaining[2/]
pronamide 50 W	2	0.0	0.0	0.0	10.0	4.5	H M V S
pronamide 50 W	4	0.0	0.0	0.0	10.0	4.0	M V
napropamide 50 W	2	0.0	0.0	0.0	9.8	5.2	H S R
napropamide 50 W	4	0.0	0.0	0.0	10.0	5.2	H
methazole 75 W	2	0.5	0.0	0.0	8.0	6.8	M A R
methazole 75 W	4	0.5	0.5	0.0	9.8	10.0	A
methazole 75 W[3/]	8	1.0	0.0	1.0	10.0	10.0	
dichlobenil 4 G	4	10.0	6.0	0.0	10.0	10.0	
dichlobenil 4 G	6	10.0	10.0	6.0	10.0	10.0	
trifluralin 4 EC[3/]	4	0.0	0.0	0.0	9.8	8.0	M S A V
diphenamid 80 W	5	0.0	0.0	0.0	10.0	6.7	M V
diuron 80 W	1.5	0.0	0.0	0.0	10.0	10.0	
check	-	0.0	0.0	0.0	0.0	0.0	H M S A V R

1/ 0 = no effect; 10 = complete elimination.

2/ Weed species: A = annual bluegrass (*Poa annua* L.); R = ryegrass (*Lolium* sp.); H = henbit (*Lamium amplexicaule* L.); V = hairy vetch (*Vicia villosa* Roth); M = mayweed (*Anthemis cotula* L.); and S = shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.).

3/ Methazole applied 6 lb/A 4/8/72, trifluralin applied 1 lb/A preplant incorporated 4/8/72.

Table 2. Summary of tree tolerance and weed control ratings on a fine sand soil at Sauvie Island, Oregon (Experiment A)

Treatment	Rate (lb/A)	Application dates 1/	Tree tolerance (Acer)	Weed control 11/30/73 2/ Grasses and broadleaves	Weeds remaining 3/
pronamide 50 W	2	1-2-3	0.0	5.2	B G
pronamide 50 W	4	1-2-3	0.0	6.2	B G
napropamide 50 W	2	1-2-3	0.0	8.6	B S
napropamide 50 W	4	1-2-3	0.0	8.6	B S
methazole 75 W	2	1-2-3	0.0	10.0	
methazole 75 W	4	1-2-3	0.0	10.0	
methazole 75 W 4/	8	1-2-3	0.5	10.0	
dichlobenil 4 G	4	1-2	0.0	10.0	
trifluralin 4 EC 4/	4	1-2-3	0.0	7.5	M G B
diphenamid 80 W	5	1-2-3	0.0	8.7	B S
diuron 80 W	1.5	1-2-3	0.0	10.0	
terbacil 80 W	2	-	-	-	
simazine 80 W	2	-	-	-	
check	-	-	0.0	0.0	B G S A

1/ Application dates: 1 = 4/21/72; 2 = 9/28/72; 3 = 4/5/73.

2/ 0 = no effect; 10 = complete elimination.

3/ Weed species: A = annual bluegrass (*Poa annua* L.); M = mayweed (*Anthemis cotula* L.); G = common groundsel (*Senecio vulgaris* L.); S = shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.) and B = mustard (*Brassica* sp.).

4/ Date 1 methazole 6 lb/A; date 1 trifluralin 1 lb/A preplant incorporated.

(Table 2 continued on next page)

Table 2. Summary of tree tolerance and weed control ratings on a fine sand soil at Sauvie Island, Oregon (Experiment B)

Treatment	Rate (lb/A)	Application dates 1/	Tree tolerance			Weed control 11/30/73 2/	
			Tilia	Crataegus	Laburnum	Grasses and broadleaves	Weeds remaining 3/
pronamide 50 W	2	1-2-3	0.0	0.0	0.0	5.0	B G M
pronamide 50 W	4	1-2-3	0.0	0.0	0.0	5.0	B G S
napropamide 50 W	2	1-2-3	0.0	0.0	0.0	9.3	B S
napropamide 50 W	4	1-2-3	0.0	0.0	0.0	9.5	S
methazole 75 W	2	1-2-3	0.0	0.0	0.5	9.8	B
methazole 75 W	4	1-2-3	2.0	0.0	0.5	10.0	
methazole 75 W 4/	8	1-2-3	4.0	0.5	1.0	10.0	
dichlobenil 4 G	4	1-2	10.0	0.0	1.0	10.0	
trifluralin 4 EC 4/	4	1-2-3	0.0	3.0	0.0	9.1	A G B
diphenamid 80 W	5	-	-	-	-	-	
diuron 80 W	1.5	1-2	0.0	0.0	0.0	10.0	
terbacil 80 W	2	2-3	10.0	0.0	1.0	10.0	
simazine 80 W	2	1-2	1.0	0.0	0.0	10.0	
check	-	-	0.0	0.0	0.0	0.0	A G B S M

1/ Application dates: 1 = 5/3/72; 2 = 9/28/72; 3 = 4/5/73.

2/ 0 = no effect; 10 = complete elimination.

3/ Weed species: A = annual bluegrass (Poa annua L.); M = mayweed (Anthemis cotula L.); G = common groundsel (Senecio vulgaris L.); S = shepherdspurse (Capsella bursa-pastoris (L.) Medic.) and B = mustard (Brassica sp.).

4/ Date 1 methazole 6 lb/A; date 1 trifluralin 1 lb/A preplant incorporated.

Lesser-seeded bittercress (Cardamine oligosperma Nutt) control in container grown Pyracantha coccineum Roem. Elmore, C. L. and W. A. Humphrey. A study was initiated on the control of Cardamine oligosperma Nutt in young container planted ornamentals October 26, 1972. Ten replications of single container Pyracantha coccineum Roem. were treated with six preemergence herbicides applied in 100 gpa with a CO_2 pressure sprayer. The test containers were seeded with weed seed and the soil lightly worked prior to herbicide application.

Control of Cardamine oligosperma was recorded at approximately 1, 2 and 6 months. Established weeds were pulled after each evaluation except in the non-weeded control. A growth index (GI) was calculated for each plant indicating growth.

$$\text{Growth Index (GI)} = \frac{\text{height (cm) x diameter (cm)}}{2}$$

The difference between the GI at the beginning and ending of the experiment gives an indication of growth. Fresh weight of the plant shoots were taken at the termination of the experiment.

Preemergence control of Cardamine oligosperma was excellent with oryzalin, simazine, alachlor and oxadiazon through the first 3 months of the experiment. Oxadiazon at 2 or 4 lb/A was the only treatment giving good control for the full six months.

All herbicide treatments increased growth over the non-weeded control as expressed by the GI except alachlor at 4 lb/A. This result is difficult to explain since the 8 lb/A rate exhibited a higher shoot weight increase.

Fresh weight of Pyracantha coccineum Roem. was not significantly reduced at 2 lb/A, but was at 4 lb/A. (Cooperative Extension, University of California, Davis and Orange County.)

Control of *Cardamine oligosperma* Nutt. and affect of six preemergence herbicides on fresh weight and growth of *Pyracantha coccineum* Roem.

Herbicide	Rate (lb/A)	Weed control 1/ 12/1/72	Weed control 1/ 1/18/73	Weed control 1/ 4/24/73	Fresh weight (gms)	GI difference
trifluralin	4	4.4	6.1	1.0	80.6 bc	1389.8 abc
oryzalin	4	8.4	9.6	5.7	98.0 ab	1183.9 abc
oryzalin	8	8.8	10.0	7.0	93.4 abc	1246.5 abc
simazine	2	9.9	9.9	2.9	94.6 abc	1162.3 abc
simazine	4	9.9	10.0	4.3	105.6 a	1410.3 abc
simazine + charcoal	2 + 2 lb/gal dip	9.3	9.7	2.8	75.3 cd	1878.4 a
alachlor	4	9.7	9.7	5.5	90.5 abc	685.8 c
alachlor	8	10.0	9.8	6.5	85.5 abc	942.3 bc
napropamide	4	6.8	8.4	5.0	98.0 ab	955.3 bc
napropamide	8	8.1	9.7	6.6	93.7 abc	1625.2 ab
oxadiazon	2	9.9	9.9	7.9	106.3 a	1030.4 bc
oxadiazon	4	10.0	10.0	9.7	99.3 ab	1025.5 bc
control - weeded	-	8.0	2.6	1.7	82.6 bc	873.6 bc
control - nonweeded	-	1.2	1.7	0.0	57.3 d	643.0 c

1/ Weed control: 0 = no control; 10 = complete kill.

Mistletoe control in dormant sycamore trees. Kempen, H. M. Applications of glyphosate and 2,4-D amine were made 2/8/73 in three different ways: (1) convenional water sprays, (2) foam nozzles with foam wetting agent at ½% and (3) treating cut stumps of the parasite. Both spray treatments were applied by means of a spray nozzle attached to the end of a telescoping pruning pole. The spray was then forced through the nozzle with carbon dioxide propellent. Spray was directed onto the foliage of the broadleafed mistletoe (Phoradendron spp.) clumps at 4 lb/aihg.

In the third treatment the mistletoe clumps were cut off as close as possible to the branch using a pole pruner. The chemical was then applied to the fresh cut by means of a sponge attached to the reverse side of the pole pruner.

Glyphosate was ineffective as a foliar spray whereas 2,4-D amine was excellent in controlling mistletoe. Both controlled regrowth where stumps of mistletoe were treated with 1:5 chemical water solutions. Inasmuch as drift of sprays of either chemical would be hazardous to turf or ornamentals below trees, the latter treatment seems most logical. Glyphosate spray drift caused moderate injury to tree growth below treated mistletoe clumps and to winter annuals growing in dormant bermudagrass (Cynodon dactylon (L.) Pers.) turf. Spring growth of bermudagrass was normal. (University of California Agricultural Extension Service, Bakersfield, California.)

Glyphosate and 2,4-D on broadleafed mistletoe in dormant sycamore trees[1/]

Treatment	Lb aihg	Mistletoe control 4/11	5/22	11/25	Tree injury 4/11	5/22	Turf injury 4/11
(1) Water spray							
2,4-D amine	4	6.7	8.3	10.0	1.7	1.3	0.0
glyphosate	4	4.0	3.5	4.0	1.5	0.5	8.5
(2) Foam spray							
2,4-D	4	10.0	10.0	9.5	1.0	3.0	0.0
glyphosate	4	4.0	6.0	2.5	4.5	2.5	7.5
(3) Mistletoe stump treatment							
2,4-D	1:5	10.0	10.0	10.0	0.0	0.0	0.0
glyphosate	1:5	-	10.0	10.0	-	1.0	-
untreated	0	0.0	0.0	0.0	0.0	0.0	0.0

1/ Treated 2/8/73; 2 trees per treatment. Injury and control ratings 0 to 10: 0 = no effect; 10 = kill.

PROJECT 5. WEEDS IN AGRONOMIC CROPS

L. C. Burrill, Project Chairman

SUMMARY

Thirty-six abstracts were submitted for the Agronomic Crops section. Nine crops from 5 states are represented by the abstracts. Only two papers are concerned with factors influencing herbicidal activity. The remaining papers are involved directly with comparing standard and experimental herbicides for crop safety and control of weeds.

Alfalfa. Seven reports on weed control in established alfalfa were submitted from four states. Problems with winter weeds were common, and mustards, downy brome, and common dandelion were mentioned in nearly every report.

Barley. Wild oat control in spring barley is the subject of one report from Wyoming and Colorado.

Dry Beans. Two papers from Wyoming and one from Colorado discuss the efficacy of certain dinitroanilins, acetanilides, and other herbicides in dry beans. Nightshade spp., common purslane, redroot pigweed, and foxtails were common species.

Corn. All the weed problems in corn apparently are not solved. One paper from Colorado and three from Wyoming compare a large number of experimental and standard herbicides on their ability to control weeds in corn.

Cotton. Weed control in cotton is getting quite sophisticated as evidenced by the type of papers submitted. Directed sprays, combinations, shielded applications, special weeds and glyphosate were the subject of six papers from Arizona and California.

Sorghum. One paper from Colorado discusses results of 10 standard herbicides on 9 weeds in sorghum. Another paper from California is concerned with barnyardgrass control in grain sorghum.

Sugarbeets. Papers on weed control in sugarbeets were submitted from five states. Most are discussions on comparisons of 2 or 3 new herbicides with standards. One paper from California is concerned with leachability of four herbicides.

Wheat. Two papers were submitted on the subject of downy brome control in wheat and fallow. Metribuzin gave good results in both cases. A third paper was submitted from Arizona on control of *Brassica japonica* in irrigated wheat.

Milkvetch. A paper from Wyoming compared 12 herbicide treatments on 11 weeds in Cicer milkvetch.

Glyphosate. A greenhouse study on soil activity of glyphosate is discussed in a paper from California.

Pronamide. The effect of various rates of irrigation on the activity of pronamide is reported in a paper from California.

Longevity of weed control and alfalfa production resulting from herbicide use in dormant-dryland alfalfa. Alley, H. P. and G. A. Lee. The herbicides terbacil, cyanazine and GS 14254 (2-*sec*-butylamino-4-ethylamino-6-methoxy-*s*-triazine) used as dormant treatments to established alfalfa have resulted in outstanding annual grass and annual broadleaf weed control for one to two growing seasons. Data has not been presented to show how long effective weed control can be expected past the one to two-year period. The data presented in the table are from plots which were treated in the spring of 1971, therefore, giving weed control and alfalfa production over a three-year period following the original treatment.

An old established stand of dryland alfalfa on the Sheridan Experimental Station was selected for the study site. The predominant weed species at the time of treatment was downy brome (*Bromus tectorum* L.), with a lighter population of tansymustard (*Descurainia pinnata* (Walt.) Britt.), blue mustard (*Chorispora tenella* (Willd.) DC.), meadow salsify (*Tragopogon pratensis* L.), and field pepperweed (*Lepidium campestre* (L.) R.Br.).

Plots were one-half acre in size, and the herbicides were applied with a truck-mounted spray rig in a total volume of 27.5 gpa water. The downy brome had $\frac{1}{4}$ to $\frac{1}{2}$ inch growth, blue mustard was in the 2-leaf stage, tansymustard 2 to 4-leaf, and alfalfa just breaking dormancy at time of treatment.

Alfalfa and weed yields were determined by harvesting three subsamples from each treated plot, separating the plant species, oven drying, and recording respective weights for alfalfa production and weed control determinations.

All three herbicides resulted in 100% control the year the compounds were applied. By the second growing season, GS 14254 and terbacil were maintaining 92 and 94% weed control, respectively; cyanazine was giving only 14% weed control. Weed control evaluations after three growing seasons following application showed that only GS 14254 was effective.

Although there is considerable variation in alfalfa production between years, the alfalfa production on the GS 14254 plots was double that of the untreated plots three years after application.

This data indicates that cyanazine can be expected to effectively control weeds for only one growing season, terbacil for two growing seasons, and GS 14254 for at least three growing seasons. (Wyoming Agricultural Experiment Station, Laramie, SR-535.)

Oven-dry alfalfa and weed production

Treatment[1/]	Rate	Lb air-dry/A						%		
		Alfalfa			Weeds			Weed reduction		
	(lb/A)	1971	1972	1973	1971	1972	1973	1971	1972	1973
GS 14254	2.0	2513	1420	2792	0	66	200	100	92	83
cyanazine	1.6	2767	752	1812	0	720	892	100	14	22
terbacil	1.0	3327	1552	2400	0	52	692	100	94	40
check	-	1627	960	1320	2447	840	1147	-	-	-

1/ Treated 4/7/71.

Evaluation of spring applied herbicides for weed control in dormant dryland alfalfa. Alley, H. P. and G. A. Lee. The herbicide evaluation studies were established on a heavily weed-infested, low productive dryland alfalfa field on April 5, 1973 at Sheridan, Wyoming. The weed species complex consisted mainly of downy brome (*Bromus tectorum* L.) with lesser populations of tansymustard (*Descurainia pinnata* (Walt.) Britt.), blue mustard (*Chorispora tenella* (Willd.) DC.), field pepperweed (*Lepidium campestre* (L.) R.Br.), and meadow salsify (*Tragopogon pratensis* L.). Downy brome was 0.75 to 1.0 in tall, tansymustard 0.5 in (rosette), blue mustard 1 in growth - 3 to 4-leaf, and field pepperweed 0.5 in growth at time of herbicide treatments. Alfalfa showed some green growth near the crown of the plant.

All the herbicides at the rates included in the table were applied with a three-nozzle knapsack sprayer in a total volume of 40 gpa water. Treatments were one sq rd in size, randomized, with three replications. Total alfalfa and weed production was determined by harvesting a 2.5 ft diam quadrat in each replicated plot, separating the weeds and alfalfa before oven drying, and weighing for production determinations.

Fourteen of the individual and/or combinations resulted in 95% or better total annual grass and broadleaf weed control. The R 7465 (2-(a naphthoxy)-N-N, diethylpropionamide) + pronamide and bifenox treatments were excellent for downy brome control but were not effective on the broadleaf spectrum, especially field pepperweed. Formulated terbacil + diuron, bifenox, R 7465 and R 24191 (chemistry unavailable) caused considerable damage to the alfalfa resulting in chlorosis, burning and reduced stand. The 4.0 lb/A formulation of terbacil + diuron was the most phytotoxic to the alfalfa, reducing the alfalfa stand by 75%.

The highest pure alfalfa production was harvested from plots treated with the 1.0 lb/A formulation of terbacil + diuron, and terbacil at 0.4 lb/A. These plots yielded 3,253 and 3,053 lb/A air-dry alfalfa as compared to 1,320 lb/A from the untreated plots. Alfalfa production was more than doubled in eight other treated plots. (Wyoming Agricultural Experiment Station, Laramie, SR-538.)

Oven-dry production of alfalfa and weeds from herbicide treated plots

Treatment[1]	Rate (lb/A)	Pounds air-dry/A[2] Alfalfa	Weeds	% Weed reduction
pronamide	0.5	2280	280	76
pronamide	0.75	2353	167	85
pronamide	1.0	1680	153	87
terbacil	0.4	3053	47	96
terbacil	0.8	2967	40	97
terbacil + diuron[3]	1.0	3253	133	88
terbacil + diuron[3]	2.0	2160	40	97
terbacil + diuron[3]	4.0	513	7	99
terbacil + diuron[4]	0.5 + 2.0	2687	53	95
metribuzin	0.5	2900	40	97
metribuzin	0.75	2747	0	100
bifenox	1.0	2433	413	64
bifenox	2.0	1640	960	16
R 7465	2.0	1667	600	48
R 7465	4.0	2020	240	79
R 7465	6.0	1973	293	74
R 7465 + terbacil	2.0 + 0.5	2533	20	98
R 7465 + terbacil	4.0 + 0.5	2720	13	99
R 7465 + pronamide	2.0 + 1.0	2007	267	77
R 7465 + pronamide	4.0 + 1.0	2147	220	81
R 24191 + X-77	1.0	1487	400	65
R 24191 + X-77	2.0	2120	220	81
R 24191 + X-77	4.0	2067	13	99
GS 14254	1.2	2360	27	98
GS 14254	1.6	2420	27	98
cyanazine	1.6	2627	20	98
cyanazine	2.4	2827	0	100
check	-	1320	1147	-

1/ Treatments applied 4/5/73.
2/ Clippings taken 6/20/73.
3/ Formulated Zobar I.
4/ Tank mix.

Alfalfa weed control. Burr, R. J. Replicated field trials were established in seven locations throughout central and eastern Oregon to evaluate the relative effectiveness and alfalfa tolerance of currently registered herbicides and some promising new herbicides. Metribuzin, GS 14254 (2-sec-butylamino-4-ethylamino-6-methoxy-s-triazine), cyanazine, carbetamide, and a glyphosate formulation containing no surfactant were compared with diuron, simazine, propham, and pronamide.

Metribuzin at 0.5 lb/A and GS 14254 at 1.6 lb/A provided excellent (95 + %) control of downy brome (Bromus tectorum L.), annual barley (Hordeum spp.), shepherdspurse (Capsella bursa-pastoris (L.) Medic.), and redstem filaree (Erodium cicutarium (L.) L'Her). GS 14254 also showed excellent (95 + %) control of tansymustard (Descurainia pinnata (Walt.) Britt.) while metribuzin was much less effective. Both herbicides showed good (70-80%) activity on common dandelion (Taraxacum officinale Weber). Some alfalfa chlorosis was observed when metribuzin was applied at 1.5 lb/A.

Cyanazine at 2.0 lb/A provided excellent (95 + %) control of foxtail barley (Hordeum jubatum L.), shepherdspurse, and tansymustard, good to excellent (85-95%) control of downy brome, good (85-95%) control of redstem filaree, and little or no activity on common dandelion. Carbetamide at 2.0 lb/A provided excellent (95 + %) grass control with little or no activity on the broadleaf weeds.

The special glyphosate formulation gave excellent control of the weeds that were emerged at the time of application. Many new weeds had emerged at the time of evaluation. Severe alfalfa injury occurred from these applications.

GS 14254 appeared to be more effective than simazine on soil types lighter than a loam; however, on heavier soils simazine appeared to be more effective. No significant injury was observed when GS 14254 was applied to a blow-sand soil. (Crop Science Department, Oregon State University, Corvallis.)

Evaluation of several herbicides for weed control and phytotoxicity in established alfalfa. Heikes, P. Eugene. Herbicides were applied on a stand of dormant alfalfa on the Northern Colorado Research Development Center at Greeley, Colorado, November 10, 1972 and March 31, 1973. The major weeds were tansymustard (Descurainia pinnata (Walt.) Britt.), common dandelion (Taraxacum officinale Weber) and downy brome (Bromus tectorum L.). The soil is a sandy clay loam. Plots were 20 x 25 ft, with two replications. The field was flood irrigated.

None of the fall applications showed effect on the alfalfa and only some of the higher rates of the spring applications caused phytotoxicity. The EC formulation of GS 14254 (2-sec-butylamino-4-ethylamino-6-methoxy-s-triazine) at 1.6 lb/A caused leaf necrosis and minor stunting.

Terbacil plus diuron at 1.6 + 0.8 lb/A caused minor stunting and deformed alfalfa leaves. In general there was not as much difference between fall and spring applications as was expected. Comparative performance data are shown in the table. (Colorado Extension Service, Colorado State University, Fort Collins, Colorado.)

Weed control in alfalfa with fall and spring herbicide applications (Northern Colorado Research and Demonstration Center, Greeley, Colorado)

Herbicide	Rate (lb/A)	Fall applications (11/10/72)			Spring applications (3/31/73)		
		Tansy-mustard	Common dandelion	Downy brome	Tansy-mustard	Common dandelion	Downy brome
metribuzin	0.50	100	95	100	100	90	100
metribuzin	0.75	100	94	100	100	96	100
terbacil	0.50	100	98	100	100	87	100
terbacil	1.0	100	97	100	100	99	100
cyanazine	1.5	91	45	85	100	50	90
cyanazine	2.0	95	52	90	100	65	100
GS 14254 (WP)	1.6	100	80	100	100	70	100
GS 14254 (WP)	2.0	100	95	100	100	80	100
GS 14254 (EC)	1.2	100	95	100	100	90	100
GS 14254 (EC)	1.6	100	99	100	100	92	100
simazine	2.0	100	75	100	100	35	100
methazole	1.5				92	22	27
methazole	4.0				95	57	40
terbacil + diuron	0.4 + 0.4				100	90	100
terbacil + diuron	0.8 + 0.8				100	96	100

Winter annual weed control in dormant alfalfa. Norris, R. and R. Lardelli. Winter annual weeds in established alfalfa reduce yield and quality. Several new herbicides are being developed that could provide better weed control than can be attained with currently registered herbicides.

An experiment was established on February 2, 1973, in a field of dormant 'Lahonton' alfalfa in Yolo county, near Davis, California. Herbicides were applied with a CO_2 pressurized back-pack sprayer, at

30 gpa. Weed oil plus dinoseb was applied as a mixture of 50 gpa of weed oil with 40 gpa of water with 1.25 lb/A of dinoseb added. Paraquat was used with 0.5% of X-77. Plot size was 8 ft x 25 ft, arranged in a three times replicated randomized block design. Weed species present included annual bluegrass (Poa annua L.), chickweed (Stellaria media (L.) Cyrillo), shepherdspurse (Capsella bursa-pastoris (L.) Medic.), common groundsel (Senecio vulgaris L.) with lesser quantities of prickly lettuce (Lactura serriola L.) and birdseye speedwell (Veronica persica Poir.).

The alfalfa stand was not affected by any of the herbicides, and there was no consistent effects on crop vigor either. Crop selectivity did not appear to be a problem on this clay loam soil. Weed control ratings are presented in the accompanying table, which also shows the herbicides used, and their rates. The rating for overall weed control includes the above mentioned species in addition to those that were rated on an individual basis.

Diuron or the weed oil plus dinoseb treatments as standards provided only moderate weed control; weed oil would seem the better choice in view of its ability to suppress Egyptian alfalfa weevil larvae in addition to controlling weeds. The ratings for GS 14254 (2-sec-butylamino-4-ethyl=amino-6-methoxy-s-triazine) showed unexpectedly low levels of weed control, except at 4 lb/A. This was attributed to poor control in one replication which lowered the average control ratings. Two lb/A equalled the weed oil plus dinoseb treatment in respect to weed control. No difference was observed between the two formulations of GS 14254 in terms of weed control; the emulsifiable concentrate was much easier to handle. Metribuzin, cyanazine, or paraquat all provided excellent weed control. The most noticeable difference between the weed control with these latter compounds and those discussed previously was their ability to effectively control the annual bluegrass. (Botany Dept., Univ. of Calif., Davis, 95616.)

Herbicides for winter weed control in dormant alfalfa, Yolo county, California

Treatment	Rate (lb/A)	Weed control: Overall	Common groundsel	Shepherds-purse	Chickweed	Annual bluegrass
diuron	2.4	5.0	6.0	7.8	4.3	4.7
weed oil + dinoseb	(see text)	6.8	8.0	8.0	6.7	6.3
GS 14254 (60WP)	0.5	4.0	4.3	5.7	3.3	3.7
GS 14254 (60WP)	1.0	4.7	5.5	5.3	3.7	4.3
GS 14254 (60WP)	2.0	6.7	9.3	7.3	6.0	5.8
GS 14254 (60WP)	4.0	8.1	8.3	10.0	8.0	8.7
GS 14254 (3.2EC)	0.5	3.3	4.7	4.7	4.0	1.7
GS 14254 (3.2EC)	1.0	4.3	3.0	6.7	4.7	3.8
GS 14254 (3.2EC)	2.0	6.7	9.7	8.2	5.8	7.3
GS 14254 (3.2EC)	4.0	8.8	8.8	8.7	9.7	8.3
metribuzin	0.5	9.2	9.7	10.0	9.6	9.0
metribuzin	1.0	9.7	7.7	10.0	10.0	9.9
metribuzin	2.0	9.9	10.0	9.9	10.0	10.0
cyanazine	1.0	9.8	8.8	10.0	10.0	9.8
cyanazine	2.0	9.4	9.8	9.3	9.5	9.3
cyanazine	4.0	10.0	10.0	10.0	10.0	10.0
paraquat	0.5	9.5	10.0	9.0	9.7	10.0
paraquat	1.0	9.6	10.0	9.4	9.3	9.8
untreated check	-	0.0	0.0	0.0	0.0	0.0
untreated check	-	0.0	0.0	0.0	0.0	0.0

Control: 0 - no effect, 10 - complete kill.

All data are means of three replications.

Treated: 2/2/73, assessed 3/6/73.

Weed control in established alfalfa grown for seed production in northeastern California. Radosevich, S. R., L. Allen and C. Rimbey. A preemergence weed control experiment was established in dormant alfalfa grown in Lassen County. The objective of this trial was to determine the effectiveness and selectivity of several soil-applied herbicides under the environmental conditions of northeastern California. Herbicides were applied to a sandy loam at two different times (12/4/72 and 3/8/73). All herbicide treatments, except DNBP + weed oil, were made in water at 27 gpa. DNBP + weed oil was applied at total volume of 100 gpa. Treatments were applied broadcast over 30-in rows. On December 4 it was cold (20 F) and treatments were applied to frozen soil covered by 0.25 in of snow. The experiment was conducted as a randomized block design with four replications. Three visual evaluations of weed control and alfalfa injury were made.

This experiment was evaluated on March 8, June 6, and September 6, 1973. During the first and second evaluation grass weeds, ripgut brome (*Bromus rigidus* Roth.) and cheat (*Bromus secalinus* L.) predominated. Satisfactory control of these weeds was obtained by highest rates of all herbicides tested except diuron and dinoseb + oil. In addition 2 lb/A of pronamide provided excellent cheat control. However, little advantage was observed for any treatment when compared to repeated cultivation over the remainder of the field. No significant alfalfa injury was noted at the two earliest evaluation dates. By the third evaluation date the weed spectrum had changed from winter grasses to summer broadleaf species primarily Russian thistle (*Salsola kali* L. var. *tenuifolia* Tausch), mustard (*Brassica* spp.) and prickly lettuce (*Lactuca serriola* L.). Since cultivation was impossible this late in the growing season (2 weeks before harvest) the field was extremely weedy. Simazine, GS 14254 (2-*sec*-butylamino-4-ethylamino-6-methoxy-*s*-triazine), and diuron provided acceptable control of these weeds at this time. Napropamide, SAN 9789 (4-chloro-5(methylamino)-2(α,α,α-trifluoro-*m*-tolyl)-3(2*H*)-pyridazinone), pronamide, carbetamide and dinoseb + oil did not control at least one weed species present in the trial. It was also noted that winter application of GS 14254 was more injurious to alfalfa than spring applications. (Cooperative Extension, University of California, Davis and Lassen County.)

Visual evaluations of weed control and alfalfa injury, Susanville, California (average of 4 replications)

Herbicide	Treatment date	Rate (lb/A)	6/6/73 Cheat	6/6/73 Mustard	6/6/73 Alfalfa	9/6/73 Russian thistle	9/6/73 Mustard	9/6/73 Prickly lettuce	9/6/73 Alfalfa
simazine	12/4/72	0.8	2.5	5.5	0.8	3.0	7.5	8.0	1.0
simazine	12/4/72	1.6	4.3	8.2	0.0	8.1	6.9	7.5	0.1
simazine	12/4/72	2.4	8.6	9.5	0.0	8.6	9.3	8.6	0.0
GS 14254	12/4/72	0.8	2.7	6.6	0.0	9.7	6.6	7.6	0.0
GS 14254	12/4/72	1.4	5.6	6.2	0.0	5.0	4.9	9.9	0.8
GS 14254	12/4/72	2.4	7.6	8.8	0.3	5.3	7.5	9.0	1.3
GS 14254	3/8/73	0.8	3.0	3.4	0.8	8.4	6.3	6.8	0.0
GS 14254	3/8/73	1.6	4.5	10.0	0.0	9.6	9.9	9.5	0.0
GS 14254	3/8/73	2.4	7.2	9.2	0.0	9.6	9.9	9.8	0.3
diuron	12/4/72	1.6	0.0	1.7	0.0	8.3	7.9	7.0	0.0
diuron	12/4/72	2.4	1.3	9.1	0.0	8.3	9.1	8.1	0.5
napropamide	12/4/72	4.0	4.3	5.3	0.8	7.4	5.5	5.8	0.3
napropamide	12/4/72	16.0	9.5	0.8	0.0	7.3	2.8	7.0	0.3
SAN 9789	12/4/72	2.0	2.3	8.3	0.0	8.4	9.0	1.8	0.0
SAN 9789	12/4/72	4.0	3.5	9.5	0.0	6.8	8.8	4.8	0.0
pronamide	12/4/72	2.0	9.5	8.6	0.0	8.9	8.0	3.4	0.1
pronamide	12/4/72	4.0	10.0	9.0	1.0	4.0	6.0	0.0	0.0
carbetamide	3/8/73	2.0	3.8	4.3	0.0	9.9	3.2	3.5	0.0
carbetamide	3/8/73	8.0	9.6	7.0	0.0	8.0	5.4	4.5	0.0
dinoseb + oil	3/8/73	1.25 + 50 gpa	2.7	8.3	0.0	5.5	7.3	6.4	0.0
check		-	1.5	0.0	0.0	6.0	1.3	0.5	0.0

0 - no control or injury, 10 - complete control.

Winter weed suppression by applications of dinoseb plus weed oil. Radosevich, S. R., R. T. Petersen and V. E. Burton. A study was initiated in 1973 to evaluate the effectiveness of dinoseb alone and in combination with weed oil for control of annual winter weeds in forage alfalfa. Applications were made on February 1, 1973 to an established stand of NK 919 alfalfa in Colusa County, California. The alfalfa was 3 in tall and just beginning to grow. Weeds present included Italian ryegrass (*Lolium multiflorum* Lam.), annual bluegrass (*Poa annua* L.), foxtail barley (*Hordeum jubatum* L.), shepherdspurse (*Capsella bursa-pastoris* (L.) Medic.), chickweed (*Stellaria media* L. Cyrillo) and common groundsel (*Senecio vulgaris* L.).

The clay loam soil was at field capacity at application. A backpack sprayer was used. The rate of dinoseb, volumes of weed oil and water applied, visual evaluations of weed control, and yield data are shown in the table.

Visual evaluations 33 days (3/5/73) after application indicated that all treatments of weed oil greater than 35 gpa with or without dinoseb caused some alfalfa injury. However evaluations 71 days (4/13/73) after application did not reveal any appreciable injury by any treatment to alfalfa plants. Treatments of weed oil alone at volumes greater than 50 gpa were necessary to control grassy weeds present in the trial. Dinoseb without the addition of weed oil did not effectively control foxtail barley, annual bluegrass, or Italian ryegrass. Dinoseb alone or in combination with weed oil effectively controlled all the broadleaf weeds in the study.

The results of this study indicate that significant increases in alfalfa quality can be obtained by applications of 50 gpa or more of weed oil. (Cooperative Extension, University of California, Davis, Colusa County and Davis.)

Annual weed control in established alfalfa at two evaluation dates

Dinoseb (lb/A)	Weed oil (gpa)	Water (gpa)	Weeds[1/] %	Alfalfa injury[2/] 3/5	Alfalfa injury[2/] 4/13	Weed control[2/] Annual ryegrass 3/5	Annual bluegrass 3/5	Foxtail barley 4/13	Shepherds-purse 4/13	Common groundsel 4/13
1.25	20	80	49.2	0.0	0.0	2.6	2.3	0.6	7.3	7.3
1.25	35	65	41.0	1.3	0.0	6.0	6.3	4.0	8.3	4.6
1.25	50	50	1.6*	2.6	0.0	8.5	9.0	8.0	9.0	8.6
1.25	65	35	8.0*	2.0	0.0	8.6	9.0	7.7	10.0	10.0
1.25	20		58.6	0.0	0.0	0.0	0.0	1.0	6.0	6.0
1.25	35		30.2*	0.6	0.0	5.6	5.6	5.7	6.6	5.6
1.25	50		28.9*	2.0	0.0	6.3	6.6	6.0	8.6	8.6
1.25	65		3.0*	2.3	0.3	8.3	8.5	8.0	9.6	8.6
	20	80	46.8	0.0	0.0	2.0	1.3	1.3	5.0	6.2
	35	65	34.7	1.0	0.0	5.3	5.0	5.0	8.6	6.3
	50	50	35.7	2.6	0.0	8.3	8.0	6.3	9.3	9.0
	65	35	5.7*	3.0	0.0	9.5	9.6	8.2	9.0	8.6
	20		51.2	0.0	0.0	0.3	0.3	2.3	1.6	1.6
	35		42.1	0.6	0.0	4.3	4.3	4.3	8.0	7.6
	50		22.7*	1.0	0.0	7.0	6.0	6.0	7.6	7.3
	65		10.0*	1.6	0.0	7.8	7.3	7.0	9.0	6.0
1.25		100	63.1	0.0	0.0	0.3	0.3	0.6	7.6	7.6
control	-	-	53.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1/ = average values determined by dry weights of weeds and alfalfa separated from 7.2 sq ft sample from each plot, three replications.

2/ = visual observations on two dates of evaluation: 0 = no control, 10 = complete control.

* = values significantly different from control LSD (0.05) = 24.0%.

Wild oat control in barley. Lee, G. A. and H. P. Alley. A post-emergence screening trial was established on a dryland site at Sheridan, Wyoming to evaluate the potential of several herbicide treatments for wild oat (Avena fatua L.) control in barley (var. Unitan). The location consists of a loam soil from the Wyarno Series. Herbicide treatments (following table) were made May 16, 1973, and May 22, 1973, when wild oats were in the 2-leaf and 4 to 5-leaf stage of growth, respectively. The plots were 9 x 20 ft and each treatment was replicated three times in a randomized complete block design. The herbicides were applied with a hand-carried knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume.

The wild oat population was estimated to be approximately 100 plants/sq ft. The combination of molinate + propanil at 2.1 + 1.3 and 4.2 + 2.6 lb/A resulted in substantially greater control of wild oats when treated in the 4 to 5-leaf stage of growth than in the 2-leaf stage. The high rate of the combination applied May 22, 1973, did result in moderate vigor reduction of the barley and reduced the yields slightly compared to the earlier treatment. SD 29762 (chemistry unavailable) at all rates did not give satisfactory kill of wild oats at either treatment date; however, the vigor of the wild oats was reduced when treated at the 2-leaf or 4 to 5-leaf stage of growth. AC 84777 (1,2-dimethyl-3,5-diphenylpyrazolium methyl sulfate) at 2 lb/A resulted in 90 and 93% control applied at the 2 and 4 to 5-leaf stage of growth, respectively. Wild oat plants which remained were severely stunted and produced few seeds. AC 84777 at all rates of application was most active on wild oats in the 4 to 5-leaf stage of growth. Some barley vigor and yield reduction occurred in the later established plots. (Wyoming Agricultural Experiment Station, Laramie, SR-544.)

Effect of postemergence herbicides on percent kill and vigor reduction of wild oats and percent kill, vigor reduction and yield of barley at Sheridan, Wyoming, 1973

Treatment	Rate (lb/A)	Treated May 16, 1973 1/					Treated May 22, 1973 2/				
		Wild oats		Barley			Wild oats		Barley		
		% kill	vig. red.	% kill	vig. red.	yield/ acre	% kill	vig. red.	% kill	vig. red.	yield/ acre
molinate + propanil	2.1 + 1.3	15	33	0	15	24.4	42	55	0	0	23.0
molinate + propanil	4.2 + 2.6	67	53	0	0	29.8	85	73	0	28	24.0
SD 29762	0.5	0	37	0	0	20.3	0	43	0	0	20.2
SD 29762	1.0	7	53	0	0	26.0	0	37	0	0	25.0
SD 29762	2.0	0	27	0	0	20.9	22	27	0	0	24.6
AC 84777 + W.A.*	0.5	22	38	0	0	20.1	82	80	12	17	21.6
AC 84777 + W.A.*	1.0	41	53	7	13	21.5	87	87	3	7	20.5
AC 84777 + W.A.*	2.0	90	83	0	27	24.3	93	83	0	20	18.7
AC 84777 + 2,4-D + W.A.*	0.5 + 0.5	52	40	0	0	26.2	72	72	0	0	21.3
Check		-	-	0	0	25.0	0	0	0	0	26.4

* W.A. = Tritan X-100 at 0.5% v/v.

1/ Wild oats in the 2-leaf stage of growth on May 16, 1973.

2/ Wild oats in the 4-to 5-leaf stage of growth on May 22, 1973.

Wild oat control in barley. Zimdahl, R. L. and J. M. Foster. Two field experiments were established to evaluate six herbicides for the control of wild oats in Moravian brewing barley. All treatments were replicated four times in 6 x 30 ft plots in a randomized block design. Location A had a clay loam soil with 1.6% organic matter and a 7.9 pH. Location B had a sandy loam soil with 1.1% organic matter and the same pH. Location A was irrigated by sprinkler and B by flooding. A very dense wild oat stand was established by seeding the previous fall at A and a less dense natural stand was present at B.

The combination of molinate and propanil at 2.1 + 1.3 and 4.2 + 2.6 lb/A failed to control wild oats at either location. Barban did control wild oats but the long period of emergence precludes adequate control. Triallate gave the greatest stand reduction and the plot yields were highest. It was best when applied preplant and incorporated but still performed adequately when applied preemergence in the granular form. Preplant 1.5 lb/A is optimal but preemergence 2.0 lb/A were required. AC 84777 (1,2-dimethyl-3,5-diphenylpyrazolium methyl sulfate) was applied at 0.50, 0.63, 0.75, and 1.0 lb/A at the 3-5 leaf stage of the wild oat. With the exception of the highest rate it did not effectively kill the wild oat and did severely restrict growth and development. It was difficult to distinguish the middle two rates in terms of visual ratings or barley yield. The 0.5 lb/A rate gave slightly less growth suppression but a comparable yield of barley. Some yield reduction was obtained at the highest rate.

The effect of location occurred with SD 29762 (chemistry unavailable). It was applied at the 3-5 leaf growth stage and on separate plots at the 6-7 leaf growth stage of the wild oat. At location A it was totally unsatisfactory but it was equal to triallate in barley yield and superior in visual control at location B. At the later application time 90% control was obtained. We cannot explain why this occurred. (Weed Research Laboratory, Dept. of Botany and Plant Pathology, Colorado State University, Fort Collins.)

Preplant weed control in field beans in Wyoming. Lee, G.A., H. P. Alley and A. F. Gale. Preplant screening trials were conducted at the Torrington Agricultural Substation to evaluate new and established herbicide treatments for annual weed control in field beans (var. Wyo. 166). The location consists of a sandy loam soil (71% sand, 19% silt, 10% clay, and 1.25% organic matter). Herbicide treatments were applied May 15, 1973, and the field beans planted May 20, 1973. Each plot was 9 x 30 ft and treatments replicated three times in a randomized complete block design. The herbicides were applied with a hand-carried knapsack sprayer equipped with a three nozzle boom calibrated to apply 40 gpa total volume.

The weed population consisted of black nightshade (*Solanum nigrum* L.), common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.) and green foxtail (*Setaria viridis* (L.)

Beauv.). A lesser population of wild buckwheat (Polygonum convolvulus L.), Russian thistle (Salsola kali L. var. tenuifolia Tausch), common purslane (Portulaca oleracea L.) and ladysthumb (Polygonum persicaria L.) were classified as others. The actual number of each species growing in treated plots was recorded within an area 10 ft x 6 in and compared to the nontreated check plot to obtain percent weed control (accompanying table). Yields were obtained by harvesting field beans from 10 ft of row in each plot.

The population of black nightshade was reduced 90 percent or more by 17 of the 29 herbicide treatments. Common lambsquarters was eliminated by all herbicides included in the study. EPTC at 3.0 lb/A and H 22234 (N-chloroacetyl-N-(2,6-diethylphenyl)-glycine ethyl ester) + EPTC at 2.0 + 2.0 lb/A resulted in significantly less control of redroot pigweed compared to all other treatments. Species categorized as others were eliminated by 14 of the 29 herbicide treatments. The green foxtail infestation was reduced 95 percent or better by 19 of the herbicide treatments. Alachlor + dinitramine at 2.0 + 0.33 and 2.0 + 0.5 lb/A were the only treatments which provided 100 percent control of all species present. Several treatments resulted in 95 percent or better control of all species present. EPTC at 3.0 lb/A and AC 92553 (N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine) at 0.5 lb/A significantly reduced the field bean stand. Yields from herbicide treated plots were significantly higher than yields from the nontreated check plots. Even though the nontreated plots were hand weeded, weed infestation re-occurred during the growing season. Yields of 3,763 lb/A and 3,713 lb/A were obtained from plots treated with H 22234 + Amex 820 (N-sec.-butyl-4-tert.-butyl-2,6-dinitroanalin) at 3.0 + 1.0 lb/A and AC 92553 + EPTC at 0.75 + 2.0 lb/A, respectively, compared to yields of 1,980 lb/A produced on areas receiving no herbicides. (Wyoming Agricultural Experiment Station, Laramie, SR-543.)

Effect of preplant herbicide treatments on field bean stands, percent weed control of individual species and bean yields at Torrington, Wyoming in 1973

Treatment	Rate (lb/A)	Percent bean stand	Percent control: Black night-shade	Common lambs-quarter	Redroot pigweed	Others	Green foxtail	Yield (lb/A)
Amex 820	1.5	100 a	67 b-e	100 a	100 a	100 a	47 b	2970 fg
Amex 820 + EPTC	1 + 2	100 a	98 a	100 a	100 a	100 a	100 a	2426 hi
trifluralin	.5	98 ab	79 a-d	100 a	100 a	75 ab	95 a	2822 gh
trifluralin + EPTC	.5 + 2.0	98 ab	91 ab	100 a	100 a	100 a	100 a	3070 e-g
nitralin	.75	96 ab	96 a	100 a	100 a	100 a	90 a	3070 e-g
nitralin + EPTC	.75 + 2.0	90 ab	88 ab	100 a	100 a	100 a	79 ab	3218 c-f
EPTC	3.0	86 b	84 a-c	100 a	75 b	84 ab	72 ab	3466 bc
fluchloralin	.75	98 ab	91 ab	100 a	100 a	92 a	100 a	3169 c-f
fluchloralin	1.5	98 ab	87 ab	100 a	100 a	67 ab	100 a	3168 c-f
H 22234 + EPTC	2 + 2	100 a	95 a	100 a	75 b	75 ab	95 ab	2921 f
H 22234 + trifluralin	3 + .5	95 ab	89 ab	100 a	100 a	92 a	100 a	3168 cd
H 22234 + Amex 820	3 + 1	100 a	96 a	100 a	100 a	92 a	97 a	3763 a
H 22234	3.0	96 ab	100 a	100 a	100 a	50 b	92 a	3020 ef
CGA 10832	.5	100 a	58 c-e	100 a	100 a	100 a	92 a	3366 b-e
CGA 10832	.75	100 a	75 a-e	100 a	100 a	100 a	69 ab	3664 a
CGA 10832	1.0	100 a	84 a-c	100 a	100 a	75 ab	100 a	2872 fg
CGA 10832 + EPTC	.5 + 1.5	98 ab	82 a-c	100 a	100 a	50 b	100 a	3366 b-e
CGA 10832 + EPTC	.5 + 2.0	100 a	93 ab	100 a	100 a	67 ab	75 ab	3367 b-e
alachlor + trifluralin	2.0 + .5	100 a	99 a	100 a	100 a	92 a	97 a	3268 c-e
alachlor + dinitramine	2.0 + .33	92 ab	100 a	100 a	100 a	100 a	100 a	3169 c-e
alachlor + dinitramine	2.0 + .5	100 a	100 a	100 a	100 a	100 a	100 a	3367 b-e
dinitramine	.33	98 ab	95 a	100 a	100 a	100 a	97 a	3268 c-e
dinitramine	.50	89 ab	100 a	100 a	100 a	100 a	97 a	3367 b-e
dinitramine + EPTC	.33 + 2.0	100 a	100 a	100 a	100 a	92 a	97 a	3218 c-f
dinitramine + EPTC	.5 + 2.0	100 a	97 a	100 a	100 a	100 a	100 a	3466 b
AC 92553	.5	86 b	52 e	100 a	100 a	67 ab	78 ab	3118 d
AC 92553	.75	96 ab	90 ab	100 a	100 a	100 a	100 a	3565 ab
AC 92553	1.0	98 ab	86 ab	100 a	100 a	92 a	86 ab	3466 bc
AC 92553 + EPTC	.75 + 2	95 ab	97 a	100 a	100 a	100 a	100 a	3713 a
check		100 a						1980 i

Preemergence weed control in field beans. Lee, G. A., H. P. Alley and A. F. Gale. Preemergence screening trials were established at the Torrington Agricultural Substation to evaluate the effectiveness of several herbicides for annual weed control under sprinkler irrigation. The location is primarily a sandy loam soil (71% sand, 19% silt, 10% clay, and 1.25% organic matter). Plots were 9 x 30 ft and each treatment was replicated three times in a randomized complete block design. The herbicides were applied full coverage with a hand-carried knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume. The field beans (var. Wyo. 166) were planted May 14, 1973, and the herbicides were applied May 15, 1973.

The weed population was black nightshade (*Solanum nigrum* L.), common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). A lesser infestation of kochia (*Kochia scoparia* (L.) Schrad.), common purslane (*Portulaca oleracea* L.) and wild buckwheat (*Polygonum convolvulus* L.) were classified as others. Actual weed counts were taken from an area 10 ft x 6 in within the treated areas and the number of each species compared to counts from the nontreated check plots to determine percent weed control.

Bifenox at 2.0 and 4.0 lb/A resulted in a significant reduction in stands of field beans. Bifenox + alachlor at 1.0 + 1.5 lb/A did not reduce the field bean stand. Fluorodifen at 3.0 and 4.5 lb/A resulted in excellent control of redroot pigweed but only the high rate gave adequate control of black nightshade, green foxtail and weeds classified as others. The combination of alachlor + fluorodifen at 1.5 + 3.0 lb/A and alachlor at 2.5 lb/A resulted in 92 percent or better control of all weed species except those classified as others. Bifenox at 2.0 and 4.0 lb/A did not give satisfactory control of black nightshade and green foxtail. The combination of bifenox + alachlor at 1.0 + 1.5 lb/A increased the control of green foxtail compared to bifenox alone; however, black nightshade control was not adequate with the combination. (Wyoming Agricultural Experiment Station, Laramie, SR-550.)

Effect of preemergence herbicide treatments on field bean stands and weed control at the Torrington Agricultural Substation, 1973

Treatment	Rate (lb/A)	Percent bean stand	Percent control: Black night-shade	Common lambs-quarters	Redroot pigweed	Others	Green foxtail
fluorodifen	3.0	95 a	64 a	89 b	98 a	61 ab	78 b
fluorodifen	4.5	100 a	92 a	83 ab	100 a	98 a	85 ab
alachlor + fluorodifen	1.5 + 3.0	96 a	95 a	97 a	100 a	67 a	96 a
alachlor	2.5	100 a	96 a	98 a	94 a	56 ab	92 ab
bifenox	2.0	63 b	59 a	93 a	95 a	100 a	53 c
bifenox	4.0	31 b	53 a	95 a	100 a	100 a	81 ab
bifenox + alachlor	1.0 + 1.5	100 a	82 a	98 a	97 a	100 a	90 ab
check		100 a	0 b	0 c	0 b	0 b	0 d

Evaluation of several soil applied herbicides for weed control and phytotoxicity in dry field beans. Heikes, P. Eugene. Herbicides were field tested on the Northern Colorado Research Demonstration Center at Greeley, Colorado. There were 36 different treatments replicated twice. These included preplant herbicides incorporated by double disking and once over with a spike-tooth harrow, preplant with spike-tooth harrow incorporation only, and post-plant with no incorporation. All herbicides were applied broadcast with a plot sprayer in water at 40 gpa. Plots were 20 x 25 ft.

Preplant herbicides were applied June 4; pinto bean (var. Idaho 111) was planted June 5; post-plant herbicides were applied immediately after planting and the field was irrigated the same day.

There was a dense stand of redroot pigweed (Amaranthus retroflexus L.) common purslane (Portulaca oleracea L.), and barnyardgrass (Echinochloa crus-galli (L.) Beauv.); there was also black nightshade (Solanum nigrum L.).

Observations were made July 3 when the field beans were in full bloom, and August 16 when the field beans were nearing maturity. Percent control for each of the four above mentioned weeds were observed each time, also crop injury - stunting and stand reduction. Yield samples were taken at harvest time.

PREPLANT SOIL INCORPORATED HERBICIDES: Alachlor at 3 lb/A was excellent on grasses, good on black nightshade and controlled common purslane but left some redroot pigweed. Weed control was nearly as good in August as in July. This year, the performance of alachlor was as good when applied on the surface as with incorporation. Alachlor plus trifluralin at 2 + 0.5 lb/A was weak on black nightshade; generally, 2 lb/A of alachlor is on the borderline of good black nightshade control. Weed control was not as good with the combination as alachlor alone. Alachlor plus chlorbromuron was weak on both broadleaf and grass weeds late in the season. Black nightshade control was good in July but poor in August. There was stunting early in the season and some stand loss; the stunting was not evident in August. Metribuzin did not show crop selectivity for dry field beans; there was near 100% stand loss. A combination of alachlor plus metribuzin at 2.0 + 0.25 lb/A caused 80% stand loss. Cyanazine plus linuron, caused almost complete stand loss. Dinitramine was tested at 0.33, 0.50 and 0.67 lb/A. Black nightshade control ranged between 90 and 82 percent early and 82 and 45 percent in August. Weed control was better at 0.5 lb than 0.67 lb/A. There was no crop injury at the 0.33 and 0.5 lb/A rates, but there was stunting and stand loss at the 0.67 lb/A rate. Dinitramine was good on grasses, and redroot pigweed, but was somewhat weak on common purslane. In August weed control was down in these plots; dinitramine did not appear to carry through the summer as well as trifluralin. A combination of dinitramine plus EPTC at 0.33 + 1.5 lb/A, provided almost perfect weed control and was better than the low rate of dinitramine alone with better crop tolerance. Dinitramine plus alachlor at 0.33 + 2 lb/A looked promising but not as good as the EPTC combination - weaker on black nightshade. This combination looked better than dinitramine alone.

Trifluralin ppi + bifenox preemergence at 0.5 + 1 and 1 + 2 lb/A was good with both combinations with some better black nightshade control at the higher rate. There was no visible crop injury at the lower rate but stunting and stand loss at the higher rate. AC 92553 (N-(1-ethyl= propyl)-2,6-dinitro-3,4-xylidine) at 0.75, 1 and 1.5 lb/A, was weak on black nightshade at all rates, redroot pigweed control was fair and grass control good. Dry field beans showed good tolerance to this herbicide; there was no crop injury with any of the rates. AC 92553 would probably be better combined with a black nightshade herbicide, such as EPTC or alachlor. The 1 lb/A rate looked optimum. EPTC at 3 lb/A was the standard herbicide in this series; weed control was near perfect including control of black nightshade. CGA 10832 (N-n-propyl-N-cyclopropyl-methyl-4-trifluoromethyl-2,6-dinitroaniline) at 0.75 and 1 lb/A was extremely weak on black nightshade; there was good control of grasses and redroot pigweed. This herbicide looked comparable with equal rates of trifluralin, but should be combined with a black nightshade herbicide for use in dry field beans. CGA 10832 plus EPTC at 0.5 + 1.5 and 0.5 + 2 lb/A provided excellent weed control including black nightshade. The low rate combination was superior to 0.75 lb of CGA 10832 alone. The 0.5 + 1.5 lb combination looked optimum. EPTC + trifluralin at 1.5 + 0.5 lb/A has consistently provided good weed control and is commonly used by dry bean farmers.

PREPLANT - SHALLOW INCORPORATED HERBICIDES: Alachlor at 3 lb/A performed the same as where double disk incorporated. Linuron at 0.75 lb/A caused about 70% stand loss of field beans and remaining plants were badly stunted. There was good black nightshade control but was weak on grasses. Alachlor plus linuron at 2 + 0.75 lb/A was less phytotoxic than linuron alone. This combination has looked promising for several years with excellent weed control but crop tolerance appears marginal. Alachlor plus chlorbromuron at 2 + 0.75 lb/A caused more crop injury than the linuron combination - both stand loss and stunting. Fluorodifen at 4.5 lb/A provided good broadleaf weed control early in the season, including black nightshade, but was weak on barnyardgrass. It fell off later in the season on redroot pigweed and black nightshade and by mid-August these plots looked very ragged. There was no crop injury.

POSTPLANT - SURFACE APPLIED: Bifenox at 2 and 4 lb/A, caused minor stunting at the 2 lb/A rate and significant stunting and stand loss at 4 lb/A. There was fair control of black nightshade early but poor control by late summer. Bifenox showed fair to good crop tolerance. Bifenox plus alachlor at 1 + 2 lb/A looked better than bifenox alone, with good control of grasses and black nightshade. Fluorodifen at 4.5 lb/A performed much the same as with shallow incorporation; broadleaf weed control was good early, but by mid-August these plots were heavily infested with redroot pigweed, black nightshade and barnyardgrass. (Colorado Extension Service, Colorado State University, Fort Collins, Colorado.)

Dry bean yields (Northern Colorado Research Demonstration Center, Greeley, Colorado)

Herbicides	Rate (lb/A)	Yield (lb/A)	Percent of check
Preplant - disk incorporated			
alachlor	3.0	1499	604
alachlor + trifluralin	2.0 + 0.50	1418	571
alachlor + chlorbromuron	2.0 + 0.75	1453	585
metribuzin	0.50	172	69
alachlor + metribuzin	2.0 + 0.25	401	161
alachlor + metribuzin	2.0 + 0.50	122	49
cyanazine + linuron	1.0 + 0.50	237	96
dinitramine	0.33	1244	501
dinitramine	0.50	1507	607
dinitramine	0.67	1150	463
dinitramine + EPTC	0.33 + 1.50	1559	628
dinitramine + alachlor	0.33 + 2.0	1392	560
trifluralin ppi + bifenox pre	0.50 + 1.0	1501	604
trifluralin ppi + bifenox pre	1.0 + 2.0	1603	646
AC 92553	0.75	1533	618
AC 92553	1.0	1242	500
AC 92553	1.50	1390	560
EPTC	3.0	1620	653
CGA 10832	0.75	1531	617
CGA 10832	1.0	1472	593
CGA 10832 + EPTC	0.50 + 1.50	1466	590
CGA 10832 + EPTC	0.50 + 2.0	1492	601
trifluralin + EPTC	0.50 + 1.50	1281	516
Preplant - shallow incorporated			
alachlor	3.0	1499	604
linuron	0.75	216	87
linuron + alachlor	0.75 + 2.0	1577	635
alachlor + chlorbromuron	2.0 + 0.75	1531	617
fluoridifen	4.50	453	182
Postplant - surface applied			
bifenox	2.0	1507	607
bifenox	4.0	366	147
alachlor + bifenox	2.0 + 1.0	1557	627
metribuzin	0.25	1204	485
metribuzin	0.50	1340	539
fluorodifen	4.50	1424	574
check	average of 5	248	100

Evaluation of several preplant, preemergence and postemergence herbicides for weed control and phytotoxicity in corn. Heikes, P. Eugene. Herbicides were evaluated at four locations in Colorado; three sites were furrow irrigated and one was irrigated with a center pivot sprinkler. The soil at two of the locations is classified as sandy loam with 0.6% OM and sand ranging from 67 to 74%. One location was a clay loam soil with 1.3% OM and the fourth location a clay with 1.2% OM. The pH range was between 7.5 and 7.7.

The major weed species in these fields were field sandbur (*Cenchrus incertus* M. A. Curtis), redroot pigweed (*Amaranthus retroflexus* L.), kochia (*Kochia scoparia* (L.) Schrad.), common lambsquarters (*Chenopodium album* L.) and foxtail species (*Setaria* spp). Field sandbur is a major weed problem in Eastern Colorado and two of the sites were selected specifically because of their field sandbur history.

APPLICATION OF HERBICIDES AND SOIL INCORPORATION: All herbicides were applied broadcast with a plot sprayer in water at 40 gpa. Preplant herbicides were incorporated with the farm equipment at hand, and corn was seeded the same day. Preemergence herbicides were applied immediately after planting and postemergence herbicides were applied when the corn was in a 2 to 3-leaf growth stage. Plots were 20 x 25 ft, with 2 replications at two locations.

PREPLANT HERBICIDES: Preplant soil incorporated herbicides have been more consistent under Colorado conditions than ones applied on the surface with no incorporation. However, in 1973 the difference was not as great as some years previous, probably because of better moisture in the spring and rainfall or sprinkler irrigation soon after application.

Outstanding preplant herbicides were atrazine, alachlor, atrazine/alachlor and atrazine/butylate. Atrazine provided good field sandbur control at 2 lb/A; broadleaf weed control was excellent. Atrazine plus alachlor at 1.25 + 2 lb/A provided slightly better field sandbur control than atrazine alone and was better than alachlor at 3 lb/A. The combination provided better control of redroot pigweed and other broadleaf weeds than alachlor alone. This combination was outstanding in the series with almost 100% weed control. A combination of S 6176 (cyprazine and *S*-ethyldiethylthiocarbamate) showed promise as a preplant soil incorporated corn herbicide. This combination was as good as atrazine for control of broadleaf weeds and better than atrazine for grass control. AC 92553 (N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine) was phytotoxic to corn with stunting at all locations and stand loss ranging from 0 to 75% when soil incorporated in sand. When applied on the surface without incorporation, AC 92553 did not cause serious crop injury. Grass and broadleaf weed control was acceptable.

PREEMERGENCE HERBICIDES: These herbicides were applied on the soil surface immediately after planting with no incorporation. There was little difference in performance of atrazine where soil incorporated compared with surface applied. There was no crop injury at 1.2 lb/A, but there was stunting and minor stand reduction in sandy loam soil at the 2 lb/A rate. Alachlor looked good at both 3 and 4 lb/A with near perfect field sandbur control; there was minor stunting early in the season at the 4 lb/A rate. This year, there was almost no difference where surface applied as compared with preplant incorporated. Alachlor/atrazine and alachlor/cyanazine looked good for control of most weeds in corn, including field sandbur, but there was evidence of some stunting at one of the light soil locations and there was significant stunting and stand loss where cyanazine was used on sand. The cyanazine combination does not show promise for use on light soils. Alachlor/dicamba gave good weed control but there was evidence of weakened plants and stunting at one of the light soil locations - weakened stock and leaves curled showing hormone symptoms. At the one light soil location, these symptoms were evident until mid-July, but at the other locations, symptoms were not evident after July 1. Weed control was good to excellent including good control of field sandburs. Cyanazine at 2 lb/A caused severe crop injury at both of the light soil locations; there was almost complete loss of crop and remaining plants were reduced 60 to 70% in size. The remaining plants had almost no root system until later in the season and brace roots were underdeveloped. The plants were chlorotic until mid-July. There was only minor stunting to no crop injury with cyanazine on the heavier type soils. Metribuzin caused almost complete elimination of corn at both light soil locations and more than 25% stand loss at both of the heavier soil locations. Combination with alachlor did not reduce phytotoxicity. Bifenox was evaluated at 1.5 and 3 lb/A. This herbicide caused phytotoxic symptoms early in the season -- necrosis of the lower leaves causing the leaf to break about midway the length of the leaf. About 25% of the corn plants showed symptoms and these plants were stunted 20 to 30% at the 3 lb/A rate. Stunting and herbicide symptoms were not in direct proportion to the rate of herbicide. By mid-season, the corn was healthy with good color, but still showed minor stunting. This herbicide was good on redroot pigweed and most other broadleaf weeds but was weaker on grasses. A combination with alachlor at 1 + 2 and 2 + 3 lb/A gave near perfect field sandbur control. Stunting was about the same as with similar rates of bifenox alone. There was more stunting at the two light soil sites than the heavier soil sites.

POSTEMERGENCE HERBICIDES: Nearly all of these caused either severe stunting or stand reduction at the rates that controlled weeds.

Three formulations of cyanazine were evaluated, these included the wettable powder (WP) in water, the wettable powder in a tronic/water solution, and a water dispersible liquid (WDL) in water carrier. These were applied at 0.8, 1.2 and 1.6 lb/A when the corn was in a 2 to 3-leaf stage of growth. Cyanazine caused stunting and stand loss at all rates when used on sand, with more crop injury where tronic was used and least with WP. There was little difference in weed control where tronic or water was used; in general, weed control was comparable with each of the three formulations and was acceptable with the 1.2 and 1.6 lb/A rates. The 0.8 lb/A rate appeared to be light and weed control marginal. The WP and water looked safe at all rates on medium or heavier textured soils; however, both tronic and WDL formulations caused significant crop injury on all soils.

Alachlor + atrazine was evaluated at 2 + lb/A in a water and water/oil carrier. Crop injury was less with water than in oil emulsion, with no difference in weed control. This combination looked good as a postemergence treatment, but there was some stunting and stand loss when applied in oil/water emulsion. Dicamba at 0.4 lb/A controlled some field sandburs early but was not effective by mid-summer. Crop injury was in the form of weakened corn plants; plants not standing upright and minor necrosis. It appears that dicamba should be applied early in the growth stage of corn and becomes more phytotoxic as the corn plant matures. A combination of alachlor + dicamba at 2 + 0.4 lb/A showed promise and looked better than the same rate of dicamba alone. However, there was stunting on sand with sprinkler irrigation; there was only minor crop injury on sand with row irrigation. Cyprazine was the outstanding post-emergence herbicide with only minor stunting early in the season at the two light soil locations and no crop injury on the heavier textured soils. (Colorado Extension Service, Colorado State University, Fort Collins, Colorado.)

Preplant weed control in corn in Wyoming. Lee, G. A., H. P. Alley and A. F. Gale. Preplant screening trials were established at the Torrington Agricultural Substation to evaluate the efficiency of several herbicides alone and in combination for annual weed control in corn. The soil at the location is a sandy loam type (78% sand, 12% silt, 10% clay, and 1% organic matter). The herbicides were applied May 8, 1973, and the crop was planted May 11, 1973. The corn (var. PX-466) was planted on 36 in row spacing and furrow irrigated. Herbicide treatments were applied with a hand-carried knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume. The plots were 9 x 30 ft and each herbicide treatment was replicated three times in a randomized complete block design. All herbicides were incorporated 1 to 1.5 in deep with a flex-tine harrow immediately after application.

The weed population consisted of black nightshade (*Solanum nigrum* L.), redroot pigweed (*Amaranthus retroflexus* L.), green foxtail (*Setaria viridis* (L.) Beauv.) and a lesser infestation of Russian thistle (*Salsola kali* L. var. *tenuifolia* Tausch), common lambsquarters (*Chenopodium album* L.), common purslane (*Portulaca oleracea* L.) and wild buckwheat (*Polygonum convolvulus* L.) were classified as others. Actual weed counts were made in an area 10 ft x 6 in, and the number of each weed species in herbicide treated plots was compared to the number growing in the non-treated plots to determine percent control.

No significant differences in corn stands were measured among herbicide treatments (accompanying table). All EPTC and vernolate treatments without antidote resulted in moderate to severe malformation and stunting of corn plants. Black nightshade was eliminated by 27 of 33 herbicide treatments. Cyanazine + H 22234 (N-chloroacetyl-N-(2,6-diethylphenyl)-glycine ethyl ether) at 1.0 + 2.0 lb/A was the only treatment which controlled significantly less black nightshade than the other herbicide treatments. All treatments, except a tank mix of *cis*-2,5-dimethyl-1-pyrrolidinecarboxanilide + propachlor at 4.1 lb/A and cyanazine at 2.5 lb/A, resulted in 100% control of redroot pigweed. Control of 97% or better of species classified as others was obtained with 25 of the

Effect of preplant herbicides on corn stand and percent control of weed species at Torrington, Wyoming, 1973

Treatment	Rate (lb/A)	Percent corn stand	Percent control			
			Black night-shade	Redroot pigweed	Others	Green foxtail
metribuzin + alachlor	0.25 + 2	83 a	67 ab	100 a	97 a	98 a
atrazine + H 22234	0.75 + 2	89 a	100 a	100 a	100 a	90 a
atrazine + H 22234	0.50 + 3	83 a	100 a	100 a	100 a	94 a
cyanazine + H 22234	1 + 2	96 a	63 b	100 a	100 a	85 a
cyanazine + H 22234	1 + 3	87 a	67 ab	100 a	100 a	93 a
H 22234	3.0	94 a	100 a	100 a	100 a	99 a
atrazine	1.2	98 a	83 ab	100 a	100 a	88 a
atrazine + alachlor	0.75 + 1.5	96 a	100 a	100 a	100 a	100 a
atrazine + alachlor	0.50 + 2.0	98 a	100 a	100 a	100 a	100 a
DS 5328	3.0	82 a	95 ab	100 a	100 a	81 a
DS 5328 + propachlor	4.1	92 a	95 ab	92 b	100 a	91 a
DS 5328 + propachlor	4.8	89 a	100 a	100 a	100 a	93 a
EPTC + R 25788 (mix.)	4.0	92 a	100 a	100 a	88 ab	100 a
EPTC + R 25788 (mix.)	6.0	94 a	100 a	100 a	93 a	100 a
EPTC	4.0	88 a	100 a	100 a	57 b	98 a
EPTC	6.0	84 a	100 a	100 a	76 ab	100 a
vernolate + R 25788 (mix.)	4.0	94 a	100 a	100 a	97 a	96 a
vernolate + R 25788 (mix.)	6.0	98 a	100 a	100 a	100 a	100 a
vernolate + R 25788 (mix.)	8.0	89 a	100 a	100 a	100 a	100 a
vernolate	4.0	87 a	100 a	100 a	77 ab	100 a
vernolate	6.0	82 a	100 a	100 a	97 a	99 a
vernolate	8.0	92 a	100 a	100 a	97 a	100 a
vernolate + R 25788 + atrazine	2 + 1	100 a	100 a	100 a	100 a	83 a
vernolate + R 25788 + atrazine	3 + 1	96 a	100 a	100 a	100 a	100 a
butylate + atrazine	3 + 1	96 a	100 a	100 a	100 a	97 a
butylate + atrazine	4 + 1	98 a	100 a	100 a	100 a	100 a
butylate	4.0	89 a	100 a	100 a	67 ab	93 a
cyanazine	2.5	98 a	100 a	92 b	100 a	59 b
vernolate + R 29148 (Tank)	4.0	90 a	100 a	100 a	87 ab	97 a
vernolate + R 29148 (Tank)	6.0	84 a	100 a	100 a	100 a	98 a
vernolate + R 29148 (Tank)	8.0	94 a	100 a	100 a	97 a	99 a
EPTC + R 29148 (Tank)	4.0	84 a	100 a	100 a	97 a	100 a
EPTC + R 29148 (Tank)	6.0	86 a	100 a	100 a	85 ab	100 a
check		100 a				

herbicide treatments. Green foxtail was eliminated by 13 of the 33 treatments in the screening trial. Atrazine + alachlor at 0.75 + 1.5 lb/A and 0.5 + 2.0 lb/A, vernolate + R 25788 (N,N-diallyl-2,2-dichloroacetamide) at 6.0 + 0.5 lb/A and 8.0 + 0.66 lb/A, vernolate + R 25788 + atrazine at 3.0 + 0.25 + 1.0 lb/A and butylate + atrazine at 4.0 + 1.0 lb/A resulted in 100% control of all species infesting the study area. Several herbicide treatments gave 96% or better control of the weed spectrum. (Wyoming Agricultural Experiment Station, Laramie, SR-545.)

Preemergence weed control in corn in Wyoming. Lee, G. A., H. P. Alley and A. F. Gale. A preemergence screening trial was established under sprinkler irrigation at the Torrington Agricultural Substation. The purpose of the study was to determine the activity of several surface applied herbicides on annual weed species and corn tolerance under sprinkler irrigation. The location is predominately a sandy loam soil type (71% sand, 19% silt, 10% clay, and 1.25% organic matter). The herbicides were applied May 8, 1973, with a hand-carried knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume. The corn (var. XP-446) was planted immediately prior to the herbicide treatment. Supplemental moisture was delivered through an overhead sprinkler system on a seven to ten day interval.

The weed infestation consisted of black nightshade (*Solanum nigrum* L.), common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). A lesser population of kochia (*Kochia scoparia* (L.) Schrad.), common purslane (*Portulaca oleracea* L.) and Russian thistle (*Salsola kali* L. var. *tenuifolia* Tausch) were classified as others. Actual counts of each species were taken in an area 10 ft x 6 in over the corn row. Percent control was determined by comparing numbers of each species in the treated plots to the numbers growing in the nontreated area. Silage yields were determined by harvesting 10 ft of row when the corn was in the dent stage of growth.

Cyanazine + linuron at 1.5 + 0.75 lb/A and AC 92553 (N-(1-ethyl=propyl)-2,6-dinitro-3,4-xylidine) at 1.5 lb/A significantly reduced the corn stand compared to the nontreated check. All herbicide treated plots, however, produced significantly higher silage yields than the nontreated check plots. Plots treated with cyanazine + alachlor at 1.0 + 2.0 lb/A, cyanazine + propachlor at 1.0 + 4.0 lb/A and bifenox at 2.0 lb/A produced 25.0, 25.2 and 25.1 tons of silage/A, respectively, compared to 12.3 tons harvested from the nontreated check plots. The overall performance of the herbicide treatments was outstanding under sprinkler irrigation. Black nightshade was eliminated by 11 of the 20 preemergence treatments. All treatments except four resulted in 100 percent control of common lambsquarters. Redroot pigweed was effectively controlled with all herbicide treatments with a 93 percent or better kill. Species classified as others were eliminated by all herbicide treatments except four. Green foxtail control of 92 percent or better was obtained with all except one treatment. Supplemental moisture from the overhead

Effect of preemergence herbicide treatments on corn stands, silage yields and percent weed control at the Torrington Agricultural Substation, 1973

Treatment	Rate (lb/A)	Corn: Percent corn stand	Corn: Tons silage per acre	Percent control: Black night-shade	Percent control: Common lambs-quarters	Percent control: Redroot pigweed	Percent control: Others	Percent control: Green foxtail
cyanazine + linuron	1.5 + 0.75	81 b	22.3 cd	100 a	100 a	100 a	100 a	100 a
cyanazine	1.5	85 ab	22.0 d	98 ab	100 a	95 ab	100 a	92 ab
cyanazine	2.5	96 ab	20.8 e	100 a	88 b	93 b	100 a	92 ab
cyanazine + alachlor	1 + 2	89 ab	25.0 a	100 a	100 a	100 a	100 a	99 a
cyanazine + alachlor	1.5 + 1.5	90 ab	21.5 d	100 a	100 a	95 ab	100 a	97 ab
cyanazine + propachlor	1 + 4	88 ab	25.2 a	100 a	100 a	98 ab	100 a	97 ab
cyanazine + propachlor	0.75 + 4	89 ab	23.2 b	100 a	100 a	100 a	100 a	99 ab
cyanazine + butylate	1 + 3	95 ab	20.2 ef	100 a	100 a	99 ab	100 a	96 ab
cyanazine + butylate	0.75 + 3	90 ab	23.4 b	100 a	100 a	100 a	100 a	99 ab
atrazine	1.2	88 ab	18.3 g	100 a	100 a	100 a	100 a	92 ab
alachlor	2.0	89 ab	20.8 e	99 ab	98 ab	100 a	91 ab	97 ab
alachlor + atrazine	2.0 + 0.75	92 ab	19.7 f	100 a	100 a	100 a	100 a	100 a
alachlor + dicamba	2.0 + 0.50	86 ab	18.5 g	98 ab	100 a	100 a	92 ab	99 ab
atrazine + propachlor	5# form.	89 ab	24.7 a	100 a	100 a	100 a	100 a	99 ab
bifenox	2.0	89 ab	25.1 a	98 ab	94 ab	100 a	100 a	89 b
bifenox	4.0	83 ab	22.7 bc	85 b	100 a	100 a	100 a	99 ab
alachlor + bifenox	1.5 + 1.0	91 ab	20.8 e	88 ab	92 ab	98 ab	87 b	96 ab
alachlor + bifenox	1.5 + 1.5	93 ab	22.6 bc	97 ab	100 a	100 a	100 a	100 a
alachlor + bifenox	2.0 + 1.25	86 ab	22.7 bc	98 ab	100 a	100 a	100 a	96 ab
AC 92553	1.5	81 b	19.8 ef	92 ab	100 a	96 ab	93 ab	96 ab
check		100 a	12.3 h	0 c	0 c	0 c	0 c	0 c

sprinkler system appeared to enhance the activity of the herbicide treatments without observable phytotoxic effects on the corn. (Wyoming Agricultural Experiment Station, Laramie, SR-547.)

Postemergence weed control in corn. Lee, G. A., H. P. Alley and A. F. Gale. A postemergence screening trial was established at the Torrington Agricultural Substation to study the effect of non-phytotoxic oil on the activity of atrazine and cyanazine alone and in combination.

The herbicide treatments were applied when the corn (var. PX-446) was in the 3-5 leaf stage of growth and the weed species were in the 2-4 leaf stage of growth. Applications were made June 22, 1973. The herbicides were applied directly over the corn plants with a knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume.

The weed population was comprised of common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), kochia (*Kochia scoparia* (L.) Schrad.), green foxtail (*Setaria viridis* (L.) Beauv.) and a lesser infestation of Russian thistle (*Salsola kali* (L.) var. *tenuifolia* Tausch), wild buckwheat (*Polygonum convolvulus* L.) and common purslane (*Portulaca oleracea* L.). Actual weed counts were made within an area 10 ft x 6 in for the determination of percent control.

Although no significant corn stand reduction occurred, atrazine + oil at 1.5 lb/A + 1.0 gpa resulted in an 11 percent decrease in corn population. Moderate stunting and chlorosis of corn plants were observed in plots which included nonphytotoxic oil.

Common lambsquarters was eliminated by eight of the postemergence treatments; whereas, four treatments resulted in 91 percent or better control of redroot pigweed. Cyanazine + oil at 2.5 lb/A + 1.0 gpa and atrazine + cyanazine + oil at 0.75 + 2.0 lb/A + 1.0 gpa gave 100 percent control of kochia. Species classified as others were eliminated by five of the herbicide treatments included in the trial. No herbicide alone or in combination resulted in satisfactory control of green foxtail. The erratic control of the more difficult to control species may be explained by the dry soil conditions prior to and immediately after the herbicide application. Stunting of the corn plants observed early in the growing season persisted throughout the growing season. (Wyoming Agriculture Experiment Station, Laramie, SR-548.)

Effect of postemergence herbicides on corn stands and weed species at the Torrington Agricultural Substation, 1973

Treatment	Rate (lb/A)	Percent corn stand	Percent control: Common lambs-quarters	Redroot pigweed	Kochia	Others	Green foxtail
cyanazine	1.5	100 a	35 b	57 a-d	0 c	0 d	32 ab
cyanazine	2.5	98 a	100 a	67 a-c	53 b	100 a	34 ab
cyanazine + oil[1/]	1.5 + 1 gal	96 a	100 a	69 a-c	75 b	89 ab	56 a
cyanazine + oil[1/]	2.5 + 1 gal	100 a	100 a	91 ab	100 a	100 a	59 a
atrazine	1.0	100 a	90 a	50 c	54 ab	77 a-c	34 ab
atrazine	1.5	100 a	100 a	68 a-c	79 a	59 c	49 a
atrazine + oil[1/]	1.0 + 1 gal	100 a	94 a	32 cd	25 bc	70 bc	37 ab
atrazine + oil[1/]	1.5 + 1 gal	89 a	78 a	69 a-c	85 a	100 a	45 a
atrazine + cyanazine	1.0 + 1.0	100 a	100 a	87 ab	89 a	82 a-c	60 a
atrazine + cyanazine	0.75 + 2.0	100 a	100 a	98 a	89 a	93 ab	38 ab
atrazine + cyanazine + oil[1/]	1.0 + 1.0 + 1 gal	96 a	100 a	96 a	96 a	100 a	40 a
atrazine + cyanazine + oil[1/]	0.75 + 2.0 + 1 gal	100 a	100 a	94 a	100 a	100 a	32 ab
nontreated check		100 a	0 c	0 d	0 c	0 d	0 b

1/ oil - nonphytotoxic oil (Agri-Plus)

Height of postemergence applications of herbicides in cotton. Arle, H. F. and K. C. Hamilton. The effects of postemergence applications of herbicides directed to the (1) base of cotton plants or (2) the lower half of cotton plants were studied during 1972 at the Cotton Research Center, Phoenix, Arizona. Trifluralin (0.5 lb/A) was applied to the soil in February and disked in before furrowing for the preplanting irrigation to reduce populations of annual weeds. Cotton (var. Deltapine 16) was planted in moist soil under a dry mulch in March. All plots were cultivated four times and weed-free checks were hoed as needed to control weeds. Postemergence herbicides were applied on June 16 (cotton 22 in tall) as directed sprays covering the furrow and (1) only the base of cotton plants or (2) the lower half of cotton plants. Herbicides were applied in 40 gpa of water containing 0.5% of a blended surfactant. Treatments were replicated four times on 4-row plots 41 ft long. Weeds present included browntop panicum (*Panicum fasciculatum* Sw. var. *recticulatum* (Torr.) Beal), junglerice (*Echinochloa colonum* (L.) Link), barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.), Wright groundcherry (*Physalis wrightii* Gray), and Palmer amaranth (*Amaranthus palmeri* S. Wats.). Weed control was estimated on each plot after cotton was defoliated and the center rows of each plot were machine-picked in November.

Applications of linuron and prometryne to the lower half of cotton plants caused severe chlorosis and burning of cotton foliage. Late-season growth of cotton appeared normal with all treatments. The best weed control was with the directed application of diuron following the preplant application of trifluralin. There was no significant difference in yield due to herbicide treatments but cotton having herbicides applied to lower half of plants tended to yield less than cotton where herbicides were applied only to the base of plants. (Cooperative investigations of Agricultural Research Service, U. S. Department of Agriculture, Phoenix, and Arizona Agr. Exp. Sta., Tucson.)

Weed control and cotton yield after postemergence applications of herbicides directed to base and lower half of cotton plants at Phoenix, Arizona

Postemergence treatment			Weed control percent estimated 10/11/72		Yield of seed cotton
Herbicide	Rate (lb/A)	Direct to:	Broadleaf	Grass	lb/A 1/
cultivated			0	48	1,960 a
cultivated and hoed			96	98	3,060 a
linuron	1	base	100	93	3,080 a
linuron	1	lower half	99	83	2,110 a
diuron	1	base	98	97	2,930 a
diuron	1	lower half	100	91	2,470 a
prometryne	1	base	100	98	3,000 a
prometryne	1	lower half	90	85	2,550 a

1/ Values followed by the same letter are not significantly different at the 5% level of probability.

Herbicide combinations applied over-the-top of cotton. Arle, H. F. and K. C. Hamilton. The effects of one and two over-the-top applications of herbicide combinations on cotton were studied during 1972 at the Cotton Research Center, Phoenix, Arizona. Cotton (var. Deltapine 16) was planted in moist soil under a dry mulch in March. Bensulide was applied preplanting, diuron was applied directed postemergence, and all plots were cultivated four times to control annual weeds. DSMA at 2 lb/A and diuron, prometryne, and fluometuron at 0.5 lb/A (alone and in combinations with DSMA) were applied over-the-top of cotton on April 26 and May 17 when untreated cotton was 4 or 10 in tall. Herbicides were applied in 40 gpa of water containing 0.5% of a blended surfactant. Treatments were replicated four times on 4-row plots 41 ft long. Treated cotton was observed each week. Before harvest, 10-boll samples were taken from each plot for boll component and fiber property analyses. The center rows of each plot were machine-picked in November.

Over-the-top applications of DSMA caused temporary discoloration of cotton stems and foliage. Prometryne and diuron caused chlorosis of cotton foliage and stunting of cotton plants. Addition of DSMA to applications of diuron or prometryne appeared to reduce the stunting and chlorosis caused by diuron and prometryne. Fluometuron did not affect the growth of young cotton. There was no apparent difference in late-season growth of cotton due to herbicide treatments. A single application of herbicides over-the-top of cotton did not affect yield (see table).

Boll weight, percent lint, seed per boll, fiber strength, fiber length, and fiber fineness were not affected by two applications of herbicides. (Cooperative investigations of Agricultural Research Service, U. S. Department of Agriculture, Phoenix, and Arizona Agr. Exp. Sta., Tucson.)

Yield of cotton treated with one or two over-the-top applications of herbicide combinations at Phoenix, Arizona

Treatments				Yield of seed cotton in lb/A[1/] treated	
Herbicide	Rate (lb/A)	Herbicide	Rate (lb/A)	4/26	4/26 & 5/17
untreated				3,520 a	3,040 c
		DSMA	2	3,500 a	3,270 bc
diuron	0.5			3,820 a	3,630 ab
prometryne	0.5			3,690 a	3,800 a
fluometuron	0.5			3,610 a	3,780 a
diuron	0.5	DSMA	2	3,350 a	3,440 abc
prometryne	0.5	DSMA	2	3,500 a	3,540 ab
fluometuron	0.5	DSMA	2	3,500 a	3,230 bc

1/ In a column, values followed by the same letter are not significantly different at the 5% level of probability.

DSMA and MSMA applied over-the-top of cotton. Hamilton, K. C. and H. F. Arle. The effects of single and repeat, over-the-top applications of DSMA and MSMA in cotton at rates used to control annual weeds were studied during 1972 at the Cotton Research Center, Phoenix, Arizona. Cotton (var. Deltapine 16) was planted in moist soil under a dry mulch in March. Bensulide was applied preplanting, diuron was applied directed postemergence, and all plots were cultivated four times to control annual weeds. DSMA and MSMA at rates of 2 lb/A were applied over-the-top of cotton on April 26, May 24, and (or) June 20 when untreated cotton was 4, 12, or 26 in tall. DSMA and MSMA were applied in 40 gpa of water containing 0.5% of a blended surfactant. Treatments were replicated four times on 4-row plots 41 ft long. Treated cotton was observed each week. Before harvest, 10-boll samples were taken from each plot for analyses of boll components and fiber properties. The center rows of each plot were machine-picked in November.

All applications of DSMA and MSMA caused temporary discoloration of cotton leaves, petioles, and stems. MSMA caused greater and more persistent discoloration than DSMA. Both herbicides caused temporary stunting of cotton plants. There was no apparent difference in late-season growth of cotton due to herbicide treatments. One, two, or three applications of 2 lb/A of DSMA or MSMA did not affect yield of seed cotton (see table). Boll weight, percent lint, seed per boll, fiber length, fiber strength, and fiber fineness were not altered by applications of DSMA or MSMA. (Cooperative investigations of Arizona Agr. Exp. Sta., Tucson, and Agricultural Research Service, U. S. Department of Agriculture, Phoenix.)

Yield of cotton treated with over-the-top applications of DSMA or MSMA at Phoenix, Arizona

Dates of application - 2 lb/A at each date	Yield of seed cotton in lb/A 1/ treated with:	
	DSMA	MSMA
untreated	3,020 a	3,100 a
4/26	3,380 a	3,350 a
4/26, 5/24	3,190 a	3,500 a
4/26, 5/24, 6/20	3,270 a	3,460 a
5/24	3,120 a	3,480 a
5/24, 6/20	3,250 a	3,350 a
4/26 6/20	3,160 a	2,890 a
6/20	3,230 a	3,330 a

1/ In a column, values followed by the same letter are not significantly different at the 5% level of probability.

Shielded applications of glyphosate for field bindweed control in cotton. Fischer, Bill B. and Steven R. Radosevich. Glyphosate has been shown to provide exceptional control of many hard-to-kill perennial broadleaf weeds and grasses. However, this herbicide is also nonselective in any crop. Shielded applications of glyphosate in crops grown in rows might therefore impart selectivity to the crop while providing acceptable control of perennial weeds.

A study was initiated in a field bindweed (*Convolvulus arvensis* L.) infested cotton field in Fresno County to determine if a shielded application of glyphosate might provide selective control in this crop. The application was made on May 29, 1973 when the cotton was about 6 in in height. At that time the field bindweed was twining on the cotton plants and the center between rows was completely covered. Applications were made in water at 63 gpa. Glyphosate rates applied, visual evaluations (June 21, 1973 and September 19, 1973) and cotton heights are presented in the two tables. Shielded treatments of 4 and 8 lb/A of glyphosate significantly released the cotton from field bindweed competition without causing cotton injury or height reduction. (Cooperative Extension, University of California, Fresno County and Davis.)

Evaluations of field bindweed control and cotton injury from shielded application of glyphosate, average of 4 replications (evaluation date: 6/21/73)

Herbicide	Rate (lb/A)	Field bindweed control	Cotton injury	Cotton height[1/] (in)
glyphosate	4	8.5	0.9	12.5*
glyphosate	8	9.1	0.9	16.1
check	-	0	0	15.7

1/ = each value is an average of four measurements.
* = significant at 5% level of probability $LSD_{0.05}$ = 1.9 in.
0 = no control or injury, 10 = complete control.

Evaluations of field bindweed and cotton injury from shielded application of glyphosate, average of 4 replications (evaluation date: 9/19/73)

Herbicide	Rate (lb/A)	Field bindweed control	Cotton height (ft)
glyphosate	4	6.8	3.6
glyphosate	8	8.0	3.8
check	-	0	1.6

0 = no control or injury, 10 = complete control.

Perennial weed control studies with glyphosate in cotton. Kempen, H. M. Since glyphosate shows little selectivity on plants, studies were established to evaluate applications on bermudagrass (Cynodon dactylon L. Pers.) in cotton at layby and at defoliation time. Studies at defoliation included applications one week prior to defoliation, alone at defoliation and with a defoliant. At layby, studies evaluated shielded equipment, various treatment widths of non-shielded sprays between 40 in cotton rows, and timing in relation to bermuda stolon length.

On johnsongrass (Sorghum halepense L. Pers.), studies were done one week prior to aerial defoliation by applying glyphosate at 2 or 4 lb/A with or without defoliant. On field bindweed, (Convolvulus arvensis L.) applications were made after harvest (October 2, 1972).

Results to date indicate that bermudagrass kill can be achieved with 2 lb/A at layby and control can be achieved with applications at defoliation. Equipment to shield cotton from layby sprays seems feasible on farms.

Glyphosate applied with defoliant aids in defoliation by killing immature cotton leaves and prevents regrowth. Cotton must be mature when treated because immature seeds are injured by glyphosate. Johnsongrass topkill is complete and rhizome control appears to be excellent at this date from 2 lb/A applications with or without defoliant.

On field bindweed, post-harvest applications can be made because field bindweed foliage is more tolerant to frost and defoliants. One application of glyphosate at 3 lb/A resulted in over 99% control in the following sugarbeet crop without evidence of injury to the sugarbeets. Further evaluation of very late season applications are underway. (University of California AES, Bakersfield, California.)

Yellow nutsedge control in California cotton. Kempen, H. M. Studies with two candidate herbicides for control of yellow nutsedge (*Cyperus esculentus* L.) in cotton were made during 1973. Applications of EMD 70610H (chemistry unavailable) and MBR 8251 (1,1,1-trifluro-4'-(phenylsulfonyl) methanesulfono-o-toluidide) were made preplant, at planting and postemergence. Rates of EMD 70610H were between 3 and 16 lb/A whereas MBR 8251 rates were 1.5 and 3 lb/A.

Application variables and results included these: (1) Preplant disced in 4 to 6 in on 3/29/73. Cotton was planted into moist sandy loam soil on 4/2/73; first sprinkler irrigation was on 5/14/73.

Excellent control of yellow nutsedge occurred with MBR 8251; good control with EMD 70610H (Table 1). Slight cotton injury occurred from MBR 8251; none from EMD 70610H. No differences between MBR 8251 rates of 1.5 and 3.0 lb/A occurred, nor between EMD 70610H rates of 4 and 8 lb/A. (2) At planting application on 4/13/73. EMD 70610H at 4 and 8 lb/A, MBR 8251 at 1.5 and 3 lb/A and alachlor at 1 and 2 lb/A were applied ahead of a rolling cultivator-sled planter. Two gangs of Lilliston rolling cultivators incorporated the herbicide into loamy sand soil 1-2 in over the cotton seed. A 0.25 in rain occurred immediately after treatment.

Yellow nutsedge control was poor with EMD 70610H, fair with MBR 8251 and good with alachlor (Table 2). Cotton injury was severe with alachlor and moderate with MBR 8251; both reduced cotton stand about 50%. (3) Surface applications over listed beds. Applied 4/20/73, beds were then sprinkler irrigated the next day (about 4 acre in). Bed tops were removed while planting cotton into moist soil. Control of yellow nutsedge was excellent with MBR 8251 at 2 and 4 lb/A but was inadequate with EMD 70610H at 4 or 8 lb/A. Cotton injury was too severe at 2 lb/A; no injury occurred from EMD 70610H. (4) Postemergence applications. Bands 12 in wide were applied 5/3/73 over cotton at the one true leaf stage when yellow nutsedge was 4 in tall. Two of 4 replications were immediately cultivated. One trial was furrowed irrigated the following day; then sprinkler irrigated 5/20/73. The second trial was applied and sprinkler irrigated 5/4/73. Two of 4 replications were sprayed with MSMA at 1.5 lb/A the day of application, to kill emerged yellow nutsedge.

Results were impressive with EMD 70610H initially. Yellow nutsedge turned white but recovery was rapid a week after irrigation. Economic control was obtained where the two irrigations were made or where MSMA was combined with 6 lb/A of EMD 70610H. Rates of 6 lb/A were better than 3 or 4 lb/A. No cotton injury occurred from EMD 70610H. MBR 8251 at 1.5 or 3 lb/A suppressed cotton more than yellow nutsedge while alachlor at 2 or 4 lb/A suppressed both equally.

EMD 70610H efficacy seemed greatly affected by frequency of irrigations. Results could be expected to vary considerably if commercially used. However, best results would occur during years of rainfall after planting. This is when yellow nutsedge control is most difficult. MBR 8251 and alachlor showed insufficient selectivity in these trials. (University of California Agr. Ext. Serv., Bakersfield, California.)

Table 1. Preplant disced in herbicides on yellow nutsedge in cotton1/

Treatment	Rate (lb/A)	Injury ratings2/		Cotton counts3/	
		cotton	yellow nutsedge	bad row	good row
MBR 8251	1.5	0.8	9.0	43	58
MBR 8251	3.0	1.5	9.5	33	57
EMD 70610H	4.0	0.5	7.5	45	59
EMD 70610H	8.0	0.0	7.0	56	65
untreated	-	0.0	4.5	48	59
LSD .05				18	10

1/ Applied 3/29/73; planted 4/2/73.

2/ Rated 0 to 10: 0 = no effect; 10 = kill; average of 4 replications.

3/ The bad row was apparently planted more deeply and emergence was more seriously affected by MBR 8251.

Table 2. Herbicides incorporated with 2 rolling cultivator gangs at cotton planting for yellow nutsedge control[1/]

Treatment	Rate (lb/A)	Nutsedge control rating (5/2/73)[2/] Stand	Injury	Cotton Plants/ plot (5/14/73)	Cotton Injury rating[2/] (6/6/73)
EMD 70610H	4.0	3.5	6.0	83.0	0.3
EMD 70610H	8.0	3.0	6.3	84.0	0.3
alachlor	2.0	7.5	8.8	23.0	4.0
alachlor	4.0	6.0	8.8	42.0	6.0
MBR 8251	1.5	5.5	8.5	40.0	1.8
MBR 8251	3.0	5.5	8.3	45.5	2.0
untreated	-	3.3	7.8	78.5	0.0
untreated	-	3.5	8.0	88.3	0.3
LSD .05		2.6	1.8	31.3	

1/ Applied 4/13/73; rain of 0.25 in occurred immediately thereafter; Hesperia loamy sand.

2/ Rated 0 to 10: 0 = no effect; 10 = kill; average of 4 replications.

Evaluation of several preemergence and postemergence herbicides for weed control and phytotoxicity in sorghum. Heikes, P. Eugene. Herbicides were evaluated on the Northern Colorado Research Demonstration Center at Greeley, where the soil is a sandy clay loam, and on the Arkansas Valley Research Center at Rocky Ford where the soil is a clay. The major weeds in these fields were kochia (*Kochia scoparia* (L.) Schrad.), redroot pigweed (*Amaranthus retroflexus* L.), Russian thistle (*Salsola kali* L. var. *tenuifolia* Tausch) and foxtail spp. (*Setaria* spp). All herbicides were applied with a plot sprayer in water at 40 gpa. Plots were 20 x 25 ft, with 2 replications at each location.

PREEMERGENCE HERBICIDES: Propachlor at 6 lb/A was fair on grasses but left several broadleaf weeds. Combined with 2,4-D applied postemergence at 4 + 0.25 lb/A was better on broadleaf weeds but weak on grasses. The 4 lb/A rate of propachlor was not enough to control foxtail species. Propachlor + cyanazine at 3 + 1 lb/A was better than propachlor alone with good control of foxtail species and Venice mallow (*Hibiscus trionum* L.). It was weak on barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) and redroot pigweed. Methazole at 2 and 3 lb/A was good on broadleaf weeds but caused stunting and maturity was delayed. This herbicide shows promise for sorghum but does not appear to have good crop tolerance; phytotoxicity would be tolerable at the 2 lb/A rate on loam or heavier type soils. Bifenox at 1.5 and 2 lb/A, showed promise for sorghum, although it caused some stunting and delayed maturity. There was little difference in phytotoxicity between the two rates. Bifenox + propachlor at 1 + 3 lb/A looked good with near perfect weed control. There was no effect on the crop. Bifenox + cyprazine at 1 + 0.75 lb/A caused stunting and stand loss at Greeley, and at Rocky Ford there was delay in maturity. This combination was only fair on grasses. Propazine at 1.2 lb/A did not control foxtail or Venice mallow; there was no crop injury. Terbutryn at 1.6, 2 and 2.4 lb/A caused minor stunting at the high rate but no crop injury at the two lower rates. There was also a delay in maturity at the high rate. Weed control was good at 2 and 2.4 lb/A but was weak on grasses at 1.6 lb/A. Based on these series, the 2 lb/A rate looked optimum under most field conditions. Terbutryn + propazine at 1.6 + 0.4 and 1.6 + 0.8 lb/A provided better grass control than terbutryn alone. At Greeley, there was minor stunting at the 0.8 lb/A rate of propazine and at Rocky Ford stunting and delayed maturity at both rates of propazine. Neither terbutryn alone or with propazine controlled nutsedge (Cyperus spp.). Propachlor + atrazine at 2.4 + 1 lb/A was weak on grasses. There was no crop injury or delay in maturity.

POSTEMERGENCE HERBICIDES: These herbicides were applied when the sorghum was 4 to 6 in high and weeds were 1 to 2 in high. Cyanazine at 0.8, 1.2 and 1.6 lb/A caused stunting at the high rate at Greeley, but at Rocky Ford no injury at any of the rates. Cyanazine has shown fair to good crop tolerance for sorghum applied postemergence, but marginal weed control. It did not control redroot pigweed; it was only fair on other broadleaf weeds and grass control was poor. Methazole at 2 lb/A caused stunting in both series. Broadleaf weed control was good but it was only fair on grasses. There was delay in maturity at Rocky Ford. Cyprazine at 0.75 lb/A caused stunting and stand reduction at Greeley and stunting and delay in maturity at Rocky Ford. Cyprazine has not shown as much selectivity for sorghum as corn. Alachlor + atrazine at 2 + 1 lb/A was evaluated in a water carrier and a water/oil emulsion carrier. Weed control was only fair with these combinations. There was stunting at Greeley with the oil emulsion; there was no stunting with water alone. Alachlor plus atrazine looked better than propachlor + atrazine. (Colorado Extension Service, Colorado State University, Fort Collins, Colorado.)

Barnyardgrass control in grain sorghum. Norris, R., S. Radosevich, R. Lardelli. The control of barnyardgrass (Echinochloa crus-galli (L.) Beauv.) in grain sorghum is frequently inadequate, especially in situations that require irrigation to germinate the crop. Uncontrolled barnyardgrass can substantially reduce, or eliminate yield.

A trial was established on June 28, 1973 on a Yolo loam soil at the University of California on the Davis farm. Herbicides were applied preplant incorporated with a Marvin Rowmaster bed-shaper incorporator. The depth of incorporation is noted on the table. The soil was dry and cloddy at application. A heavy stand of barnyardgrass germinated, but was not completely uniform. A single cultivation of the sides of the beds and furrows was made on July 25; directly following this a side dressing of 200 lb/A of nitrogen (as ammonium sulfate) was applied. No other cultural practices were performed, except irrigation as needed. Plot size was 4 rows by 40 ft in a four times replicated randomized block design. The center two rows were hand harvested, dried, threshed and weighed. Moisture determinations were made and all yield data are presented as corrected to 14% moisture.

No herbicide provided complete barnyardgrass control, but substantial yield increases were realized. This emphasized the degree to which grain sorghum yields can be suppressed by weeds. One replication of the untreated check #2 yielded three-fold higher than the other three replications; not including this one replication in the mean reduced the untreated check #2 to 2500 lb/A.

Weed control provided by all chemicals, except propazine, declined between the 7/18 and 8/28 assessment dates; this reflected the relatively short length of soil life of these compounds. The largest yield increases were realized by the treatments that provided the highest early weed control; correlation between the later weed control evaluation and yield was not close. This demonstrated the need for early rather than late weed control as being the more important factor in determining crop yield. At current grain sorghum selling prices several of these treatments would have resulted in net profits in the region of $20 to $30 per acre. (Botany Department and Cooperative Extension Service, University of California, Davis. 95616.)

Barnyardgrass control in grain sorghum (average of four replications)

Treatment	Rate (lb/A)	Incorp. depth. (in)	Sorghum vigor (7/18/73)	Barnyardgrass control 7/18/73	Barnyardgrass control 8/28/73	Yield 1/ (lb/A) (11/16/73)
propachlor	3	2.0	9.1	7.2	5.2	3700 cd
propachlor	3	3.5	8.7	7.4	5.4	3400 abcd
propachlor	3	5.0	8.6	6.5	5.5	3100 abc
propachlor	6	2.0	9.0	6.2	6.4	3400 abcd
propachlor	6	3.5	9.5	9.0	6.5	4000 d
propachlor	6	5.0	9.0	8.8	6.1	3400 abcd
propazine	3	2.0	8.6	6.8	7.8	3500 bcd
terbutryn	1	2.0	9.4	6.4	5.9	3500 bcd
terbutryn	2	2.0	9.4	7.8	6.1	4000 d
terbutryn	4	2.0	8.0	6.4	7.5	3500 bcd
prynachlor	3	2.0	9.4	7.0	6.6	3600 bcd
prynachlor	6	2.0	9.8	8.0	7.1	3700 cd
untreated check 1	-	-	8.4	2.2	1.5	2700 a
untreated check 2	-	-	8.0	1.2	1.5	2800 ab

1/ Data within a column followed by different letters are significantly different at the p = 0.05 level.

Vigor: 0 = none, all plants dead; 10 = full or normal growth.

Control: 0 = no control; 10 = complete control.

Herbicide combinations in sugarbeets. Arle, H. F. and K. C. Hamilton. Two methods of applying herbicides to the soil preplanting followed by postemergence herbicide applications were evaluated in sugarbeets (var. US H9B) planted to a stand in two rows, 12 in apart, on vegetable beds spaced on 40-inch centers at Mesa, Arizona. Before bedshaping, barley and mustard (*Brassica japonica* (Thunb.) Sieb.) seed was disked into the soil (sand 49%, silt 29%, clay 22%, and organic matter 1%). On September 27, 1972, preplanting herbicides (see table) were (1) applied and disked into the soil before bedshaping or (2) applied over rough shaped beds and incorporated with power-driven equipment before the final bedshaping. Planting sugarbeet seed close to the soil surface was followed by a germination irrigation. Postemergence applications were on October 16 (sugarbeets 2 to 4 in tall) and herbicides were applied in 40 gpa of water. Treatments were replicated four times on four-bed plots 30-ft long. The test was cultivated twice and tops of weeds were removed four times with a stalk chopper. Checks were hand weeded seven times. Development of sugarbeets and weeds were observed every few weeks and sugarbeets were harvested in July of 1973.

Preplanting applications of propham and NC 8438 (2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulphonate) had little effect on sugarbeet emergence and seedling development. Herbicides disked into the soil before bedshaping caused more injury than herbicides incorporated into rough shaped beds. Preplanting applications of NC 8438 followed by postemergence applications of phenmedipham gave the best selective weed control. Yield of sugarbeets treated with herbicide combinations did not differ significantly from the hand-weeded checks and all yielded higher than the cultivated checks. Herbicide treatments did not affect the sucrose content of sugarbeets in these tests. (Cooperative investigations of Agriculture Research Service, U. S. Department of Agriculture, Phoenix and Arizona Agr. Exp. Sta., Tucson.)

Response of weeds and sugarbeets to herbicide combinations at Mesa, Arizona

Treatments				Percent weed control and crop injury estimated 11/8/72			Yield of sugar-beets[1/]
Preplant		Postemergence					
Herbicide	Rate (lb/A)	Herbicide	Rate (lb/A)	Barley	Mustard	Sugarbeets	T/A
before furrowing							
cultivated check				0	0	0	1.6 a
handweeded check		(136 hr/A)		100	100	0	21.0 bc
propham	3	phenmedipham and pyrazon	1 3	91	98	19	19.9 bc
propham	6	phenmedipham	1	94	85	10	19.6 bc
propham and pyrazon	3 2	phenmedipham	1	99	100	39	21.6 bc
cycloate	3	phenmedipham and pyrazon	1 3	97	100	48	23.5 c
NC 8438	1	phenmedipham	1	100	100	20	25.0 c
U 27267	6	phenmedipham	1	96	100	88	21.5 b
over rough beds							
cultivated check				0	0	0	2.0 a
handweeded check		(136 hr/A)		100	100	0	23.3 ab
propham	3	phenmedipham and pyrazon	1 3	90	80	9	22.4 ab
propham	6	phenmedipham	1	99	77	6	24.5 ab
propham and pyrazon	3 2	phenmedipham	1	95	100	38	26.2 ab
cycloate	3	phenmedipham and pyrazon	1 1	90	100	24	28.2 ab
NC 8438	1	phenmedipham	1	100	100	6	29.5 c
U 27267	6	phenmedipham	1	91	100	60	17.9 b

1/ Within each method of preplanting application, values followed by the same letter are not significantly different at the 5% level of probability.

Preplant and preemergence applications for weed control in sugarbeets. Frey, C. R. and E. E. Schweizer. Experimental herbicides, N-chloroacetyl-N-(2,6-diethylphenyl)-glycine ethyl ester (H 22234) and 2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulphonate (NC 8438), applied alone or as mixtures, were compared to cycloate for the control of grasses (*Setaria* spp.) and redroot pigweed (*Amaranthus retroflexus* L.) in sugarbeets.

The experiment was conducted on a sandy loam soil, with a pH of 7.7 and an organic matter content of 2.2%. Each plot was 2 rows wide and 40 ft in length. Herbicide treatments were replicated four times. On April 23, the herbicides were sprayed in water on a 7-inch band and incorporated 1.5 in deep with a power-driven incorporator or applied as a surface treatment to an 8.5-inch band immediately after planting. Sugarbeets were planted at the same time the herbicides were applied. Precipitation totaled 1.50 and 3.33 in within 7 and 14 days, respectively.

The response of sugarbeets and weeds to the herbicides was determined by counting the number of plants and by visually assessing crop vigor and weed control. Weeds were counted in six quadrats, each 4 in by 3 ft, per treatment. The stand of weeds present is expressed in the table as a percentage reduction from the weedy, uncultivated plots that were not treated with herbicides.

Herbicide treatments reduced the stand of sugarbeets by 2% or less. Top growth was suppressed moderately by all herbicide treatments on May 25, but by June 8 the tops had recovered nearly completely in all plots.

With few exceptions, weeds were controlled similarly by either method of herbicide application, because precipitation was timely. All treatments, except where 2 lb/A of H 22234 was incorporated, controlled foxtail as well as did cycloate. All treatments, except where 2 lb/A of H 22234 was incorporated, controlled redroot pigweed better than cycloate. By July 6, scattered plants of common lambsquarters (*Chenopodium album* L.) and kochia (*Kochia scoparia* (L.) Schrad.) also appeared above the sugarbeet canopy. At this time, weed control was considerably better in plots treated with mixtures of H 22234 plus NC 8438 or NC 8438 alone than in plots treated only with cycloate. (Western Region, Agricultural Research Service, U. S. Department of Agriculture, Fort Collins, Colorado 80521.)

Response of sugarbeets and weeds to herbicides applied preplanting and preemergence (Fort Collins, Colorado)

Treatments			Sugarbeets		Weeds		
					Stand reduction		
Herbicides	Rate (lb/A)	Method of application 1/	Injury rating (5/25)	Injury rating (6/8)	Foxtail (5/28)	Redroot pigweed (5/28)	Weed control rating 2/ (7/6)
			(%)		(%)		(%)
H 22234	2	pre	26	2	96	95	84
H 22234	2	pplt	22	3	76	72	70
H 22234	4	pre	31	6	99	99	85
H 22234	4	pplt	30	7	93	95	82
H 22234	6	pre	36	9	99	100	82
H 22234	6	pplt	25	3	98	99	81
H 22234 + pyrazon	2 + 3	pre	20	7	97	100	93
H 22234 + pyrazon	2 + 3	pplt	31	8	85	98	86
H 22234 + NC 8438	1.5 + 1.5	pre	39	11	100	100	95
H 22234 + NC 8438	1.5 + 1.5	pplt	29	1	98	99	94
H 22234 + NC 8438	3 + 1.5	pre	39	6	100	100	97
H 22234 + NC 8438	3 + 1.5	pplt	37	4	99	99	96
NC 8438	2	pre	36	6	98	100	96
NC 8438	2	pplt	29	3	95	100	92
cycloate	3	pre	21	2	99	75	70
cycloate	3	pplt	34	6	97	79	69

1/ pplt = preplanting, soil-incorporated; pre = preemergence, surface-applied.

2/ 0 = no control and 100 = complete control.

Preemergence weed control in sugarbeets. Lee, G. A., H. P. Alley and A. F. Gale. A study was conducted at the Torrington Agricultural Substation to determine the performance of soil surface applied preemergence herbicides under a sprinkler irrigation system. The soil at the location is classified as a sandy loam (71% sand, 19% silt, 10% clay, and 1.2% organic matter). Sugarbeets (var. HH-19) were planted in 22 in rows on April 17, 1973. Immediately after planting, the herbicides were applied with a hand-carried knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume. The plots were three rows x 50 ft. Each herbicide treatment was replicated three times in a randomized complete block. Supplemental moisture was applied to the study area every seven to ten days depending upon rainfall patterns.

The weed infestation was comprised of common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), black nightshade (*Solanum nigrum* L.) and green foxtail (*Setaria viridis* (L.) Beauv.). Percentage weed control was obtained by comparing actual counts of each species in the herbicide treated areas to numbers of the species in the nontreated check plots. An area 20 ft x 3 in over the sugarbeet row was used to obtain species counts. Plots were weeded and thinned on June 14, 1973. The tonnage yields of sugarbeets were obtained by harvesting 20 ft of row from each plot. Percent sucrose and yield weights were determined at the Holly Sugar Corp. factory, Torrington, Wyoming.

H 22234 (N-chloroacetyl-N-(2,6-diethylphenyl)-glycine ethyl ester) and NC 8438 (2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methane=sulphonate) at all rates gave satisfactory control of one or two weed species but did not give adequate control of the entire weed spectrum. AC 92390 (N-*sec*-butyl-2,6-dinitro-3,4-xylidine) at 2.0 and 3.0 lb/A did not give satisfactory control of any weed species present. H 18467 (chemistry unavailable) at 1.0 lb/A and H 22234 + H 18467 at 3.0 + 0.5 and 3.0 + 0.75 lb/A resulted in 93 percent or better control of all weed species present. H 18467 at 1.0 lb/A caused moderate stunting and chlorosis to the sugarbeet plants; however, no phytotoxic symptoms were noted at rates of 0.5 and 0.75 lb/A when applied alone or in combination. NC 8438 at 2.0 and 3.0 lb/A resulted in moderate stunting of weed species remaining in the treated areas.

Yields of sugarbeets from plots treated with H 18467 at 0.5 lb/A and NC 8438 at 3.0 lb/A were significantly higher than yields from all other treated areas. The nontreated check plots produced significantly less sugarbeet tonnage than plots treated with herbicides. The percent sucrose and total sugar/A from plots treated with NC 8438 at 3.0 lb/A were significantly higher than all other treatments. All herbicide treated plots produced significantly more pounds of sugar/A than the nontreated check plots. Production of 6322 pounds of sugar/A or more was recorded from six of the herbicide treated plots. All herbicide treated plots produced 443 to 4080 pounds of sugar/A more than the nontreated check plots. (Wyoming Agricultural Experiment Station, Laramie, SR-551.)

Effect of preemergence herbicides on sugarbeet stands, tonnage yields, percent sucrose, total sugar produced per acre and percent control of annual weed species at the Torrington Agricultural Substation, 1973

		Sugarbeets				Percent control			
Treatment	Rate (lb/A)	Percent sugarbeet stand	Tons/A	% Sugar	Total sugar (lb/A)	Common lambs-quarters	Redroot pigweed	Black night-shade	Green foxtail
H 22234	2.0	87 a[1/]	18.0 h	15.3 b	5549 ef	26 cd	100 a	41 bc	86 ab
H 22234	3.0	90 a	18.6 g	15.3 b	5697 c	4 de	100 a	4 d	85 ab
H 22234	4.0	91 a	31.6 d	14.6 cd	6322 d	30 cd	89 a	19 cd	81 ab
H 18467	0.5	98 a	25.1 a	14.6 cd	7366 b	96 a	64 b	56 b	38 cd
H 18467	1.0	87 a	17.1 i	14.6 cd	4964 g	98 a	100 a	96 a	93 a
H 22234 + H 18467	3.0 + 0.50	99 a	22.7 c	15.1 bc	6869 c	98 a	100 a	96 a	100 a
H 22234 + H 18467	2.0 + 0.75	91 a	23.7 b	13.7 e	6420 d	100 a	100 a	98 a	96 a
NC 8438	1.5	92 a	18.7 g	14.9 b-d	5569 ef	0 e	97 a	4 d	83 ab
NC 8438	2.0	87 a	20.8 e	15.5 b	6426 d	0 e	100 a	16 cd	73 ab
NC 8438	3.0	97 a	25.1 a	17.2 a	8601 a	49 bc	100 a	35 b-c	94 a
AC 92390	2.0	90 a	19.4 f	15.1 bc	5822 e	74 b	30 c	0 d	53 bc
AC 92390	3.0	94 a	17.8 h	14.9 b-d	5289 fg	64 b	17 cd	2 d	17 de
nontreated check		100 a	15.9 j	14.3 de	4521 h				

1/ Figures with the same letter or letters are not significantly different at the .05 level.

Preplant incorporated herbicides for spring weed control in sugarbeets. Norris, R., R. Lardelli, and J. Brickey. Control of barnyardgrass (Echinochloa crus-galli (L.) Beauv.) remains as a problem in spring sown sugarbeets in the Sacramento valley. Currently used herbicides provide adequate early control but do not persist as long as desired; injury to sugarbeets also occurs. Tests were again conducted in 1973 to evaluate herbicides for controlling barnyardgrass, and other weeds, in sugarbeets.

A trial was established on May 4, 1973, on a clay loam soil near Dixon, California. The herbicides were applied with a compressed air sprayer that was mounted on a tractor and mechanically incorporated with a Marvin Rowmaster rotary tiller, set 11 cm deep for cycloate and pebulate, and set 6 cm deep for all other herbicides. Plot size was 4 rows by 50 ft, replicated 4 times in a randomized block design. An even, but light sugarbeet stand developed in the field along with a severe infestation of barnyardgrass; moderate stands of redroot pigweed (Amaranthus retroflexus L.) and nightshade (Solanum spp.) also germinated.

There were no consistent effects of herbicides on sugarbeet stand. Variations in sugarbeet vigor were slight; based on visual impressions, it was doubtful that any treatment consistently altered vigor.

Pebulate at 6 lb/A was superior to either pebulate or cycloate at 4 lb/A; the latter treatments were essentially identical in performance. The grass control ratings for these treatments were relatively low; many grass seedlings survived and explain the low rating, but they were severely distorted and were of low vigor and thus offered essentially no competition to the sugarbeets. NC 8438 (2-ethoxy-2,3-dihydro-3,3-dimtheyl-5-benzofuranyl methanesulfonate) at 3 lb/A provided good control of broadleaf weeds, but was much less active against grass. Although barnyardgrass control ratings were moderate to good the overall impression of the plots was less favorable, because the vigor of the remaining plants was high. In view of the crop vigor and the weed control attained it seemed probable that 4 lb/A would have been preferable for this soil.

H 22234 (N-chloroacetyl-N-(2,6-diethylphenyl)-glycine ethyl ester) provided outstanding barnyardgrass control; the seedlings did not emerge or were very severely stunted. Four lb/A in this soil type also controlled most of the broadleaf weeds. Nightshade was relatively resistant to the chemical, except at the highest rate; redroot pigweed, however, was very sensitive to the herbicide.

Combinations of NC 8438 or H 22234 with pyrazon provided relatively poor results in this trial. Most control ratings were lower for the combination than for the herbicides used singly. This 'antagonism' has been observed in other tests of combinations containing pyrazon. (Botany Dept., Univ. of Calif., Davis, and Spreckels Sugar Co., Woodland, Calif.)

Preplant incorporated herbicides for weed control in sugarbeets, Dixon, California (average of 4 replications)

Treatment	Rate (lb/A)	Sugarbeets #/50 ft	Sugarbeets Vigor	Barnyardgrass Control	Barnyardgrass Vigor	Redroot pigweed control	Nightshade control
cycloate	4.0	73.8	8.6	7.8	2.5	7.2	8.0
pebulate	4.0	75.5	8.1	7.8	2.8	7.3	8.3
pebulate	6.0	77.8	7.9	8.6	2.0	8.7	8.3
NC 8438	1.5	59.8	8.5	6.0	7.3	7.7	7.0
NC 8438	2.0	65.3	8.1	7.6	7.3	9.0	5.8
NC 8438	3.0	67.3	8.4	8.8	5.8	9.3	7.3
H 22234	1.0	63.3	7.8	8.0	3.0	7.5	4.0
H 22234	2.0	72.8	8.0	9.0	2.3	9.0	3.0
H 22234	3.8	68.5	7.3	9.7	1.5	9.9	8.3
pyrazon	4.0	60.5	8.4	2.3	9.0	7.0	7.8
pyrazon + NC 8438	3.0 + 2.0	56.8	8.0	8.1	6.3	6.9	7.6
pyrazon + H 22234	3.0 + 1.0	59.3	8.5	7.6	6.8	8.0	4.3
pyrazon + H 22234	3.0 + 2.0	76.3	8.0	8.3	3.0	4.5	2.5
untreated check	-	56.0	8.5	3.0	9.8	2.4	3.0

Treated 5/4/73; assessed 5/31/73.

Control: 0 = no effect, 10 = complete kill. Vigor: 0 = dead, 10 = normal vigor.

Comparative leachability of preplant incorporated sugarbeet herbicides. Norris, R. and K. Soliman. The mobility of soil-applied herbicides in soil must be known in order that they may be utilized for their fullest effect with maximum safety. Two new herbicides are being developed for use in sugarbeets; their mobility in soil in comparison with the currently used herbicides was tested.

A slotted tube bioassay technique was used. Five cm inside diameter plexiglass tubes with a 35 by 1 cm slot, taped over, were filled with fine screened Yolo sandy loam. Mechanical packing was used for data obtained on 9/17/73 and 10/9/73. The columns were pre-leached with 0.5x Hoagland's solution until excess drained from the bottom. Twenty mg active ingredient of each herbicide was mixed into approximately 20 ml of dry soil; this was then placed on top of a column. The herbicides were leached with 20 cm (approx. 8 in) of 0.5x Hoagland's solution. The tubes were allowed to drain for 24 hr, the tops sealed, and the tubes turned on their side. The tape was removed from the slot, barnyardgrass (Echinochloa crus-galli (L.) Beauv.) seeds were sowed into the slot, and covered with fine sand. The tubes were wrapped in clear plastic to keep the seed moist, and placed in a growth chamber maintained at 24 C night and 30 C day and 16 hr photoperiod. The plastic wrap was removed as the grass germinated. The distance that each chemical moved was assessed by measuring the distance from the treated soil line to the point of 95% control of the barnyardgrass. Four replications were used for each date. The herbicides tested were cycloate, pebulate, NC 8438 (2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesolfonate), and H 22234 (N-chloracetyl-N(2,6-diethyl=phenyl)-glycine ethyl ester).

Herbicide leaching in sandy loam soil

Herbicide	Experiment number 1 (8/28/73)	2 (9/17/73)	3 (10/9/73)1/
	Distance leached - cm		
cycloate	7.7 ab	10.4 b	8.3 b2/
pebulate	11.7 bc	12.2 c	9.6 bc
H 22234	17.8 cd	15.6 d	10.6 bc
NC 8438	23.0 d	18.3 e	11.0 c
untreated check	0.0 a	0.0 a	0.0 a

1/ Assessment dates.

2/ Data, within a column, followed by different letter significantly different at P = 0.05 level.

Actual distances leached varied by experiment. This was attributed to difficulties in obtaining even packing of the columns. The most variable data were obtained on 8/28/73 when the soil was loaded by hand; mechanical packing improved reliability considerably. Relative differences in the mobility of the herbicides was, however, essentially similar in each of the three experiments. Cycloate was the least mobile, and pebulate was only slightly more mobile. H 22234 varied from about 25% to 100% greater in mobility than cycloate. NC 8438 was the most mobile of the four compounds, ranging from about 40% to almost three times as mobile as cycloate. None of these compounds can be considered as readily mobile in this sandy loam soil; the maximum distance that any compound leached was 23 cm in response to a 20 cm addition of the Hoagland's solution. An initial trial was conducted using 5 cm of Hoagland's solution; leaching was slight and no differences could be detected between compounds. (Botany Dept., University of California, Davis, 95616.)

Preemergence mixture evaluations on sugarbeets. Sullivan, E. F. and L. K. Fagala. Preemergence tank-mix herbicides were evaluated on sugarbeets at Longmont, Colorado, and Scottsbluff, Nebraska, during 1972 and 1973. Applications were made logarithmically. Plots were 100 ft long by two rows at 22-in spacing. Half-dosage distance measured 23.5 ft. Chemicals were applied in a 7-in band to the soil surface immediately after sowing sugarbeet seed var. GW Mono-Hy D2 at a 1-in depth. Spray volume was 43.7 gpa when the spray rig was operated at 2.25 mph at 32 psi with ES-4 nozzle tips. Seedbed and soil moisture conditions provided satisfactory crop emergence and seedling growth. Surface irrigation, when required, supplemented natural precipitation. The Longmont sites (clay soil, 1.5% OM, pH 7.9) were treated on April 11 and May 17 and received 1.80 and 1.28 in of precipitation within three weeks of treatment, while Scottsbluff (clay loam, 1.6% OM, pH 7.7) which was treated on April 17 and April 21, received 2.02 and 1.98 in in 1972 and 1973, respectively. Soil temperatures at establishment averaged 73 F at Longmont and 63 F at Scottsbluff. Major weeds in the untreated controls were redroot pigweed (*Amaranthus retroflexus* L.), kochia (*Kochia scoparia* (L.) Schrad.), common lambsquarters (*Chenopodium album* L.), black nightshade (*Solanum nigrum* L.), foxtail species (*Setaria* spp.), and barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.). Plant counts were taken five weeks after sowing within a 3-in by 48-in quadrat at a place in each row estimated to have the highest weed control with the least crop injury (optimal response). Results were analyzed statistically by computer. Average data for selected treatments are reported herein as percentages of the untreated controls. (Contribution of the Great Western Agricultural Research Center, Longmont, Colorado. Published with approval of the Director as Abstract No. 15H, Journal Series.)

Effect of preemergence mixtures on sugarbeets and weeds at Longmont, Colorado and Scottsbluff, Nebraska, spring 1972-1973 (Two replications each site)

Herbicide	Max. rate (lb/A)	Optimum rate (lb/A)	Beet injury	Beet stand	Weed control RPw	Ko	CLq	BNs	Bl	Gr	Tot
				(Scores and seedling counts as % of control)							
NC 8438 + H 22234	8 + 8	2.3 + 2.3	10	107	100	78	86	92	90	100	95
pyrazon + NC 8438	12 + 8	3.9 + 2.6	10	102	95	83	93	94	88	94	90
NC 8438 + TCA	8 + 16	2.5 + 5.0	10	110	98	68	66	63	85	98	90
pyrazon + endothall (283)	12 + 8	5.3 + 3.5	12	89	87	79	96	83	85	87	84
pyrazon + H 22234	12 + 8	6.3 + 4.2	10	96	93	27	88	91	70	87	77
pyrazon + TCA	12 + 16	5.7 + 7.7	12	93	86	62	78	83	79	73	75
Plant counts/sq ft (untreated check)				4.3	12.2	12.1	5.5	8.6	33.7	18.4	52.1

Note: Pyrazon + endothall (283) is standard. Tot (total weed control); Bl (total broadleaf weed control); Gr (total grass control including foxtail spp. and barnyardgrass); RPw (redroot pigweed); Ko (kochia); CLq (common lambsquarters) and BNs (black nightshade).

Downy brome (Bromus tectorum L.) control in a wheat fallow system in Wyoming. Lee, G. A., H. P. Alley and A. F. Gale. Herbicide treatments applied postemergence to downy brome and early emerging broadleaf weed species were studied for initial weed control as well as residual control during the summer months prior to planting winter wheat in early September. Downy brome utilizes moisture in spring and early summer months and becomes a problem to control mechanically in periods of high precipitation.

A study was established at the Archer Agricultural Substation on April 13, 1973. This location has a loamy sand soil which received 12 to 14 in precipitation annually. Plots were 9 x 30 ft in size. Herbicide treatments were replicated three times in a randomized complete block design. Applications were made with a hand-carried knapsack sprayer equipped with a three nozzle boom calibrated to deliver 40 gpa total volume.

The major species in the study area was downy brome. A limited infestation of prickly lettuce (*Lactuca serriola* L.), Russian thistle (*Salsola kali* L. var. *tenuifolia* Tausch), common lambsquarters (*Chenopodium album* L.), meadow salsify (*Tragopogon pratensis* L.) and skeletonweed (*Lygodesmia juncea* (Pursh.) D. Don.) were present at the location.

Cyanazine at 2, 3 and 4 lb/A did not give satisfactory control of downy brome, Russian thistle or skeletonweed. Cyanazine + paraquat at 4 + 0.5 lb/A controlled 90 percent of the downy brome and satisfactorily reduced the broadleaf infestation. The combination of cyanazine + glyphosate at 2 + 0.5, 3 + 0.5 and 4 + 0.5 lb/A resulted in 90, 95 and 99+ percent control of downy brome, respectively. Glyphosate at 0.5 lb/A in 10 gpa and 20 gpa diluent resulted in similar control of downy brome; however, a greater reduction in vigor of the remaining broadleaf weeds was observed in plots where 20 gpa of diluent was applied. Outstanding annual grass control was obtained when glyphosate at 0.5 lb/A was applied ten days prior to atrazine at 1 lb/A or cyanazine at 3 lb/A. Atrazine + cyanazine at 0.75 + 1.5 and 1 + 2 lb/A gave excellent control of the entire weed spectrum. The best overall weed control was obtained with metribuzin at 0.75 and 1 lb/A. At the rates used, metribuzin did not completely eliminate the volunteer winter wheat. (Wyoming Agricultural Experiment Station, Laramie, SR-546.)

Effect of spring applied herbicide treatments on percent downy brome control in winter wheat fallow at the Archer Agricultural Substation, 1973

Treatment	Rate (lb/A)	% control downy brome[2/]	Remarks
cyanazine	2.0	75	Russian thistle and skeletonweed escaped
cyanazine	3.0	60	Russian thistle and skeletonweed escaped
cyanazine	4.0	80	Russian thistle and skeletonweed escaped
cyanazine + paraquat	2.0 + 0.5	60	Russian thistle and skeletonweed escaped
cyanazine + paraquat	3.0 + 0.5	75	Russian thistle and skeletonweed escaped
cyanazine + paraquat	4.0 + 0.5	90	good control of broadleaf weeds
cyanazine + glyphosate	2.0 + 0.5	90	good control of broadleaf weeds
cyanazine + glyphosate	3.0 + 0.5	95	good control of broadleaf weeds
cyanazine + glyphosate	4.0 + 0.5	99+	few Russian thistle and skeletonweeds
glyphosate + W.A.* (10 gpa)	0.5	65	stunted broadleaf weeds
glyphosate + W.A.* (20 gpa)	0.5	75	less stunting of broadleaf weeds than low volume
glyphosate + atrazine[1/]	0.5 + 1.0	99+	no control of Russian thistle and skeleton-weed
glyphosate + cyanazine[1/]	0.5 + 3.0	99+	no control of Russian thistle and skeleton-weed
atrazine + cyanazine	0.75 + 1.5	95	some small downy bromegrass emerging
atrazine + cyanazine	1.0 + 2.0	98	good broadleaf weed control
metribuzin	0.75	99	only few volunteer wheat plants remain
metribuzin	1.0	99+	only few volunteer wheat plants remain

(Table continued on next page)

Effect of spring applied herbicide treatments on percent downy brome control in winter wheat fallow at the Archer Agricultural Substation, 1973 (continued)

nontreated check	-	-

* W.A. = Mon-0011 produced by Monsanto Co. applied at .75% v/v.

1/ Herbicides applied as split application. Glyphosate applied 4/13/73, atrazine and cyanazine applied 4/23/73.

2/ Downy brome had 0.75 to 1.0 in growth at the time of treatment on 4/13/73.

<u>Downy brome control in winter wheat with metribuzin.</u> Zimdahl, R. L. and J. M. Foster. Metribuzin was applied at 0.5 and 0.75 lb/A to 6 x 30 ft plots in a randomized block with four replications on March 17 and April 5. On the early date the wheat and downy brome were dormant. On the latter date the wheat was green but showed no growth and the downy brome was still dormant. The air temperatures were 54 and 43 F respectively. Metribuzin was also applied at 2 lb/A at the early date on two replications. This rate resulted in excellent control of downy brome and a complete kill of the wheat. The data in the table indicate that 0.75 lb/A gave control of downy brome and was more effective when applied early in the spring. The level of wheat injury was unacceptable on the early date and marginal on the later date. Metribuzin at 0.5 lb/A gave the best control when applied early but the injury was a little high. The check plots had a vigorous stand of downy brome and it is interesting to note the minimal effect on yield even with the high visual control ratings in the treated plots. Although specific observations were not made, there was some evidence that tillering was inhibited especially at the higher rate.

From these results we conclude that fall postemergence and very early spring postemergence applications should be tried at a rate of 0.5 lb/A or lower. There is no doubt that metribuzin will control downy brome but the specific rate required and the proper timing of the application are not yet known. (Weed Research Laboratory, Dept. of Botany and Plant Pathology, Colorado State University, Fort Collins.)

Treatments, downy brome control ratings, wheat injury and yield

Metribuzin (lb/A)	Downy brome control[1/]	Wheat injury[2/]	Wheat yield (bu/A)[3/]
March 17			
0.50	7.8	2.8	16.7
0.75	8.2	5.8	11.1
2.00	8.7	8.7	0.0
April 5			
0.50	6.1	1.8	17.7
0.75	6.6	2.4	12.7
check	0.0	0.0	19.4

1/ 0 = no control; 10 = complete control. Rating is an average of five separate visual evaluations.

2/ 0 = no injury; 10 = complete kill. Rating is an average of five separate visual evaluations.

3/ Yields calculated from two adjacent hand harvested 8 ft rows.

Herbicides in row-planted, border-irrigated wheat. Hamilton, K. C. and H. F. Arle. Preemergence and postemergence applications of herbicides were made in row-planted wheat grown with flood-irrigation at Mesa, Arizona during 1972-73. Mustard (*Brassica japonica* (Thunb.) Sieb.) was seeded on the test areas. On December 19, 1972, wheat (var. Siete cerros) was planted in rows spaced 12 in apart. On December 20, linuron, terbutryn, chlorobromuron, and methazole were applied to the soil (sand 40%, silt 40%, clay 20% and organic matter 1%) as preemergence treatments. The area was then flood-irrigated. On January 23, linuron, terbutryn, chlorobromuron, bromoxynil, 2,4-D, dicamba and bifenox were applied to emerged wheat (4 in tall) and mustard (1 in tall). Herbicides were applied in 40 gpa of water containing 0.25% of a blended surfactant. Treatments were replicated four times on 13.3 by 30-ft plots. Development of wheat and mustard were observed every few weeks and plots were harvested by combine in June, 1973.

Preemergence applications of the higher rates of linuron, terbutryn, and methazole retarded growth of wheat. Best weed control was with linuron, chlorobromuron and methazole. There was no significant difference in yield between preemergence treatments, however, those causing the most injury to wheat tended to have lower yields.

Postemergence applications of linuron, terbutryn, and chlorobromuron caused yellowing of seedling wheat and bifenox caused a rapid, temporary burning of leaves. Dicamba and bifenox failed to control mustard. Postemergence treatments did not affect grain yields. (Cooperative investigations of Arizona Agric. Exp. Sta., Tucson, and Agricultural Research Service, U. S. Department of Agriculture, Phoenix.)

Response of wheat and mustard to preemergence and postemergence applications of herbicides at Mesa, Arizona in 1973

Treatments Herbicide	Rate (lb/A)	Percent crop injury and weed control estimated 3/1/73 Wheat	 Mustard	Yield of grain[1/] (lb/A)
Preemergence				
linuron	0.37	6	100	4,610 a
linuron	0.75	25	100	4,150 a
terbutryn	0.37	2	45	5,050 a
terbutryn	0.75	20	85	4,020 a
chlorobromuron	0.75	5	96	4,960 a
methazole	0.75	0	93	5,070 a
methazole	1.50	18	100	4,160 a
untreated check		0	0	4,680 a
Postemergence				
linuron	0.25	1	100	4,780 a
terbutryn	0.25	3	100	5,180 a
chlorobromuron	0.25	5	100	4,960 a
bromoxynil	0.25	0	100	5,510 a
2,4-D, amine	0.25	0	99	5,150 a
dicamba	0.25	0	35	5,310 a
bifenox	0.50	0	12	5,100 a
untreated check		0	0	4,970 a

1/ For each method of application, values followed by the same letter are not significantly different at the 5% level of probability.

Evaluation of several herbicides for weed control in established Cicer milkvetch (Astragalus cicer L.). Alley, H. P. and G. A. Lee. A two-year old stand of Cicer milkvetch which was heavily infested with annual grass and annual and perennial broadleaf weeds was selected for the treatment site. The weed infestation, which seriously limited establishment and growth of the Cicer milkvetch consisted of: green foxtail (Setaria viridis (L.) Beauv.), downy brome (Bromus tectorum L.), Russian thistle (Salsola kali L. var. tenufolia Tausch), meadow salsify (Tragopogon pratensis L.), kochia (Kochia scoparia (L.) Schrad.), prickly lettuce (Lactuca serriola L.), common lambsquarters (Chenopodium album L.), tansymustard (Descurainia pinnata (Walt.) Britt.), clammy groundcherry (Physalis heterophylla Nees), yellow fieldcress (Rorippa sylvestris (L.) Bess.) and common dandelion (Taraxacum officinale Weber).

Plots were established on April 2, 1973 as a dormant, soil surface application. The Cicer milkvetch had from 0 to 1 in vegetative growth and annual weeds had not germinated at time of treatment. Plots were 9 x 30 ft in size, with three replications. Applications were applied with a three nozzle knapsack sprayer in a total volume of 40 gpa water.

Visual evaluations were made on June 15, 1973. The weed control and phytotoxic activity, as recorded, is presented in the table.

Several herbicides and combinations of herbicides resulted in excellent control of the weed infestation with only minor toxicity to the crop. Terbacil at 0.8 lb/A appeared to be the outstanding treatment, resulting in excellent weed control and no apparent damage to Cicer milkvetch. The 2 lb/A formulation of terbacil + metribuzin at 0.75 lb/A, bifenox at 2 lb/A, GS 14254 (2-sec-butylamino-4-ethylamino-6-methoxy-s-triazine) at 1.2 and 1.6 lb/A, and R 24191 (chemistry unavailable) at 1 lb/A also gave excellent weed control but resulted in varying degrees of chlorosis and stunting to the Cicer milkvetch. (Wyoming Agricultural Experiment Station, Laramie, SR-532.)

Treatments, weed control, and herbicide damage in Cicer milkvetch

Treatment[1/]	Rate (lb/A)	Evaluation (weed control - crop response)[2/]
R 7465	2.0	poor - no damage to vetch - outstanding control of annual grass - poor control of kochia, common lambsquarters and perennials
R 7465	4.0	poor - moderate stunting of vetch - outstanding grass control - no broadleaf weed control
R 7465	6.0	fair - moderate stunting of vetch - annual broadleaf weeds stunted - no perennial weed control
R 7465 + terbacil	2.0 + 0.5	excellent - moderate stunting of vetch - few stunted annual and perennial weeds
R 7465 + terbacil	4.0 + 0.5	excellent - moderate stunting of vetch - chlorosis and leaf margin burn on vetch - meadow salsify not controlled - dandelion chlorotic

Treatments, weed control, and herbicide damage in Cicer milkvetch (cont.)

Treatment[1]	Rate (lb/A)	Evaluation (weed control - crop response)[2]
R 24191 + X-77	1.0	excellent - no damage to vetch - perennials not controlled
R 24191 + X-77	2.0	excellent - slight stunting of vetch - kochia in plots
R 24191 + X-77	4.0	excellent - moderate stunting and chlorosis of vetch - removed all weeds except dandelion
paraquat + X-77	0.5	poor - treatment made too early for good weed control
2,4-D amine	0.75	fair - no damage to vetch - activity and dandelion - late emerging weeds not controlled
glyphosate	0.5	good - no damage to vetch - 100% control downy brome - 80% control dandelion - poor control late emerging weeds
pronamide	0.5	fair - slight stunting of vetch - good annual grass control - no broadleaf weed control
pronamide	0.75	fair - slight stunting of vetch - excellent grass control - no broadleaf weed control
pronamide	1.0	fair - slight stunting of vetch - excellent grass control - no broadleaf weed control
terbacil	0.4	good - no damage to vetch - excellent grass control - few kochia plants in plots
terbacil	0.8	excellent - no damage to vetch - best treatment in series
terbacil + diuron[3]	1.0	good to excellent - vetch moderately stunted with chlorosis of upper leaves - excellent grass control - kochia in plots
terbacil + diuron[3]	2.0	excellent - vetch moderately stunted - chlorotic - some activity on perennial weeds
terbacil + diuron[3]	4.0	excellent - severe stunting and chlorosis of vetch

Treatments, weed control, and herbicide damage in Cicer milkvetch (cont.)

Treatment[1/]	Rate (lb/A)	Evaluation (weed control - crop response)[2/]
terbacil + diuron (tank mix)	0.5 + 2.0	good - no damage to vetch - kochia and common lambsquarters escapes - no activity on perennials
metribuzin	0.5	good - no damage to vetch - dandelion, Russian thistle, meadow salsify and green foxtail in plots
metribuzin	0.75	excellent - no damage to vetch - few green foxtail in plots
bifenox	1.0	poor - no control
bifenox	2.0	excellent - no damage to vetch - control of both grass and broadleaf weeds except meadow salsify
GS 14254	1.2	excellent - lower leaves of vetch chlorotic and some stunting - perennials not affected
GS 14254	1.6	excellent - lower leaves of vetch chlorotic and stunted - perennials not affected

1/ April 2, 1973. Dandelion rosettes and winter annual mustard present. Cicer milkvetch 0 to 1 in growth.

2/ June 15, 1973. Visual readings. Excellent = 95-100%; good = 85-95%; fair = 70-85%; poor = less than 70% weed control.

3/ Formulated Zobar I.

<u>A greenhouse study on the soil activity of glyphosate</u>. Smith, N. L. and W. B. McHenry. A greenhouse study was initiated on April 13, 1972, to determine the effects of glyphosate concentrations in the soil on Kanota oats and sugarbeets (var. US H9B). Concentrations used were 1, 10, 100, 1000, and 10,000 ppmw. Yolo fine sandy loam was used. Treatments were made by spraying a known amount of glyphosate over a known weight of soil and mixed by rolling for 5 minutes in a polyethylene gallon container to assure uniform distribution. A No. 2 food can was then filled with 600 g of the soil mixture. Four replications were employed. Cans were immediately planted to oats or sugarbeets and watered. Since no drainage was provided, soil moisture was maintained with a weighed amount of water to avoid soil saturation. All irrigations were made with half strength Hoagland's solution.

Phytotoxicity ratings were made May 15, 1972. The soil was then allowed to dry until July 11, 1972, when the containers were emptied and the soil crushed and mixed with the chopped plant residue from the original planting. This was returned to each can and replanted to the same crop. These were evaluated August 8, 1972.

Glyphosate at 1 and 10 ppmw had no effect on oats or sugarbeets with either planting. At 100 ppmw, oats exhibited slight chlorosis in the first planting but none in the second. Sugarbeet injury was severe at 100 ppmw in the April planting but there was no effect in the subsequent seeding. The 1000 and 10,000 ppmw levels resulted in almost complete toxicity with both seedings. (Cooperative Extension, Botany Department, University of California, Davis.)

Soil activity of glyphosate

Soil concentration (ppmw)	Phytotoxicity (0 = no control; 10 = complete kill) Oats		Sugarbeets	
	5/15/72	8/24/72	5/15/72	8/24/72
1	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
100	0.5	0.0	6.0	0.0
1,000	10.0	9.5	10.0	10.0
10,000	10.0	10.0	10.0	10.0
control	0.0	0.0	0.0	0.0

The effect of irrigation on the activity of pronamide. Lange, A. H. Pronamide at 4 rates was applied 10/31/72 to prepared soil. Sugarbeets and alfalfa were seeded just prior to herbicide application. The irrigation treatments were applied by an automatic hydraulic rain simulator within 2 hr after herbicide application. The lowest level of irrigation was adequate to incorporate the pronamide in this sandy loam soil as seen by the effect on sugarbeet and alfalfa stands. The effect on weed control was related only to the rate of herbicide and not to the amount of irrigation. This and previous work suggested that the phytotoxic concentration moved past the depth of weed and crop seed (1 in) germination. (San Joaquin Valley Agricultural Research and Extension Center, University of California, 9240 South Riverbend Avenue, Parlier, California 93648)

The effect of initial irrigation level on the activity of pronamide as measured by phytotoxicity to sugarbeets, alfalfa and weeds

Pronamide (lb/A)	Average phytotoxicity (5/14/73)[1/]								
	Sugarbeets			Alfalfa			Weeds		
	Precipitation (in)								
	0.3	0.9	1.5	0.3	0.9	1.5	0.3	0.9	1.5
0.5	1.7	3.7	4.3	0.0	1.7	2.3	3.3	2.0	3.3
1.0	5.3	1.7	4.7	2.3	3.3	2.0	5.0	5.0	3.3
3.5	9.0	5.7	5.0	5.0	5.0	5.0	6.0	6.7	7.0
5.0	10.0	7.3	8.0	8.0	5.3	5.7	8.0	7.0	7.0
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1/ Average of 3 replications where 0 = no effect; 10 = complete kill. (organic matter 0.6%, sand 58%, silt 32%, clay 10%) Weeds: sowthistle (*Sonchus* spp. L.), horseweed (*Conyza canadensis* (L.) Cronq.), pigweed (*Amaranthus* spp. L.) and lambsquarters (*Chenopodium* spp. L.).

The residual activity of 26 herbicides at 3 months. Lange, A. H., B. B. Fischer and J. Schlesselman. Twelve herbicides were preplant (ppi) and incorporated 2-3 in deep by a straight-toothed power tiller on 4/11/73 and all plots were seeded with cotton, millet, and sugarbeets. On 4/12/73 fourteen herbicides were applied preemergence in a randomized block design with the previously applied ppi treatments. One inch of sprinkler irrigation was applied immediately after the final herbicide application. After evaluation of the initial activity on 6/1/73 the plots were mowed, knifed and allowed to dry. Three months after herbicide application the beds were reworked with the same incorporator and seeded to millet, cotton and sugarbeets.

The residual activity at 3 months on crops was apparent at most high rates except MBR 8251 (1,1,1-trifluoro-4'-(phenylsulfonyl) methanesulfono-*o*-toluidide), glyphosate, bifenox, H 22234 (N-chloroacetyl-N-(2,6-diethyl=phenyl)-glycine ethyl ester), terbutryn, pronamide, alachlor, EPTC, cyanazine, fluometuron, desmedipham, NC 8438 (2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulphonate), cacodylic acid, and bromoxynil. Those with significantly longer residual activity included trifluralin, metribuzin, EMD 70610 (chemistry unavailable), VCS 3438 (chemistry unavailable), bifenox, napropamide, GS 14254 (2-*sec*-butylamino-4-ethylamino-6-methoxy-*s*-triazine), norflurazon, methazole and chlorobromuron.

The comparative residual activity of 26 herbicides at 3 months after application and incorporation[1/]

Herbicides		Rate (lb/A)	Millet	Cotton	Sugar-beets	Redroot pigweed control	Barnyard-grass control
trifluralin	I[2/]	1	7.2	1.5	5.8	8.2	9.5
trifluralin		4	10.0	1.2	9.8	9.8	10.0
metribuzin	I	1	0.5	1.5	2.5	2.2	5.0
metribuzin		4	1.2	4.5	9.5	5.2	7.2
bentazon	P	1	3.0	2.5	8.8	5.0	3.5
bentazon		4	4.2	3.5	6.0	3.2	4.8
EMD 70610	I	4	2.0	1.8	8.3	6.5	7.2
EMD 70610		16	4.0	2.2	9.8	6.0	6.8
prynachlor	P	4	3.0	2.0	4.0	4.0	8.0
prynachlor		16	1.2	1.8	5.5	4.2	8.0
MBR 8251	I	2	2.2	2.2	7.2	3.8	7.5
MBR 8251		8	1.0	1.8	6.8	4.2	5.8
VCS 3438	I	2	0.8	6.2	7.0	5.5	6.8
VCS 3438		8	4.2	8.8	7.2	8.5	8.2
glyphosate	P	4	2.5	3.0	8.5	5.2	4.2
glyphosate		16	3.8	3.0	5.2	4.2	6.2
bifenox	I	1	4.8	2.5	5.5	5.0	5.8
bifenox		4	2.5	1.5	10.0	3.2	5.8
H 22234	I	2	2.2	0.5	4.0	4.2	8.2
H 22234		8	0.5	2.0	7.5	6.0	6.5
napropamide	I	½	6.5	2.2	5.0	6.8	6.8
napropamide		2	10.0	4.0	6.2	9.0	8.5
terbutryn	P	1	4.8	1.2	4.8	5.5	7.2
terbutryn		4	1.8	1.0	8.0	4.2	5.8
oryzalin	P	1	1.2	0.2	6.0	5.2	6.0
oryzalin		4	8.8	6.2	10.0	9.5	10.0
pronamide	P	1	2.8	1.5	4.0	4.5	7.0
pronamide		4	0.5	0.5	5.2	3.0	8.8
GS 14254	P	1	2.5	1.2	8.2	4.0	6.5
GS 14254		4	8.5	8.5	10.0	9.8	9.8
norflurazon	P	½	1.2	1.8	7.2	4.0	7.0
norflurazon		2	4.2	1.0	9.8	5.5	7.8
alachlor	I	2	0.8	0.0	4.5	3.8	5.8
alachlor		8	2.5	0.5	2.8	4.5	8.5
EPTC	I	8	0.0	0.0	3.8	3.2	8.2
EPTC + R 25788		8	2.0	2.2	3.2	3.8	5.5

The comparative residual activity of 26 herbicides at 3 months after application and incorporation[1] (continued)

Herbicides		Rate (lb/A)	Millet	Cotton	Sugar-beets	Redroot pigweed control	Barnyard-grass control
cyanazine	I	1	4.0	2.0	8.5	4.2	5.5
cyanazine		4	2.5	1.5	7.0	3.8	7.0
fluometuron	P	1	1.0	0.8	7.0	5.8	6.0
fluometuron		4	1.2	1.2	7.0	6.2	8.5
desmedipham	P	2	2.5	2.5	7.8	5.0	2.2
desmedipham		8	4.5	3.5	8.2	4.5	2.5
methazole	P	2	6.2	2.2	8.5	8.5	8.8
methazole		8	8.0	1.0	9.5	9.5	9.8
NC 8438	I	1	1.8	2.5	7.5	6.5	7.5
NC 8438		4	0.0	2.2	6.0	4.8	5.2
cacodylic	P	16	3.2	2.0	7.5	7.2	4.2
cacodylic		64	0.8	2.5	6.2	3.0	7.0
chlorobromuron	P	2	2.0	0.5	4.5	8.5	9.5
chlorobromuron		8	6.5	3.0	9.8	10.0	9.0
bromoxynil	P	2	3.2	2.2	8.0	4.2	5.8
bromoxynil		8	3.8	2.5	6.5	2.0	2.8
check		-	4.8	1.5	5.2	5.0	4.8
check		-	1.8	3.2	5.8	4.2	5.8

1/ Average of four replications, where 0 = no effect; 10 = complete kill. Treated 4/11/73, planted 7/13/73, evaluated 8/23/73.

2/ I = incorporated; P = preemergence.

PROJECT 6. AQUATIC AND DITCHBANK WEEDS

N. E. Otto, Project Chairman

SUMMARY

The introduction of the herbivorous fish, Tilapia Mossambica Peters, to Hawaiian sugar cane irrigation canals has resulted in a program of excellent submersed aquatic weed control reducing annual weed control costs to zero. A similar introduction of Tilapia Melanopleura was not successful.

Experiments on a dense stand of alligatorweed growing on the banks of the Los Angeles River showed that neither glyphosate, at rates of 1 to 6 lb/A, nor silvex, at 6 lb/A, produced adequate control.

Glyphosate was the only herbicide producing appreciable control of hardstem bulrush in a drainage ditch when compared with a low volatile ester of 2,4-D. An oil adjuvant enhanced the activity of glyphosate.

A ditchbank infestation of swamp smartweed was controlled by glyphosate both with and without the addition of surfactants with herbicide rates of 1 to 4 lb/A. Asulam exhibited some degree of control while 2,4-D failed to provide effectiveness.

A herbicide response study evaluating the influence of spray volume and surfactant mixtures with glyphosate suggests that surfactant concentration may be important to producing the best control on johnsongrass.

The effects that canal aquatic weed treatments might have on desirable aquatic biota were evaluated using a biological index. The diversity of populations of non-target organisms, such as diatoms and macroinvertebrate animals, were used to calculate a mathematical species diversity index on treated and untreated canals.

Controlling of aquatic weeds by fish at Kekaha Sugar Company, Limited. Hee, Hong Min. Kekaha Sugar Company, Limited, has 3,500 acres of sugarcane under cultivation on swamp lands. To insure good drainage, Kekaha laid out an extensive network of drains, ditches and canals. With this system, arose the inevitable problem of aquatic weeds. Many methods were used to rid the drainage system of aquatic weeds. Hand labor, chains, molasses applications, copper sulfate and even live turtles were employed. Up to 1950, machines with dragline buckets and rakes were used to rip these aquatic weeds.

In 1950 Kekaha Sugar used aromatic solvents. This reduced the cost considerably, but the solvents were detrimental to marine life.

As early as April 15, 1955, Kekaha, with much skepticism, experimented with a dozen fish, known as Tilapia Mossambica Peters. At the time of planting, most of the drains were fairly clean from previous treatment by aromatic solvents. However, a few drains were heavily infested with aquatic weeds. The weed growth was so thick that the dirt at the bottom of the drains could not be seen. Flows of water were hampered by the dense growth. Six months after the planting of Tilapia, the weeds were destroyed and the drains became clean, so clean that the dirt and sand in the bottom could now be seen.

After this experiment, approximately 75,000 fishes were planted in Kekaha's drains, ditches, canals and reservoirs. The average size of the fish at planting was 3 to 4 in in length. The plantings were concentrated in reservoirs which served as good breeding places and distribution was made through irrigation waters when the reservoirs were well stocked. This experiment turned out to be very successful; Tilapia Mossambica Peters is really earning its keep, by keeping the drainage system free of aquatic weeds.

Tilapia Mossambica Peters is a herbivorous fish. It was introduced to Hawaii by the Territorial Board of Agriculture and Forestry (now known as the Hawaii State Board) for the purpose of destroying aquatic weeds and for its use as a substitute for Nehu fish bait in the tuna industry. The Tilapia originated in South Africa. Indonesia, Java, and Philippines use the Tilapia as a source of protein food. This fish is a mouth breeder and is highly prolific. Spawning begins at the age of 3½ months (about 50 eggs) and continues every 1½ months thereafter; the number of eggs increasing with subsequent spawn until a maximum of 2,000 eggs per spawn is reached. Theoretically estimating, one pair, after a year of spawning, will net 1,500,000 offspring. Tilapia thrives in either fresh or brackish water or in water of high salinity and not in temperature below 50 F. It will also thrive in clean or muddy waters; this peculiar fish is not particular in its choice of food; it devours almost anything.

Our observation of the Tilapia has given us an interesting study of how this fish destroys the aquatic weeds. The Tilapia builds mud holes, similar to a saucer, all along the bottom of the ditch or reservoirs. These saucer holes, which range from 6 in to 3 ft in diameter and 2 to 10 in in depth, serve as nests. The prolific fertility of this fish keeps it busy digging or building saucers or seeking food which it does by scooping the mud with its mouth with the result that the aquatic weeds are thus destroyed. Another species, Tilapia Melanopleura was introduced, approximately 3 yr later. This species did not emerge as prolific as Tilapia Mossambica Peters.

For comparative costs of controlling aquatic weeds by different methods, including chemical application, hand and machine and Tilapia, refer to table.

In summarizing, I can say that Tilapia Mossambica Peters does an excellent job of keeping Kekaha Sugar's drainage system clean and unclogged and this is a contributing factor to the increase of sugar yields. (Kekaha Sugar Company, Limited, Kekaha, Kauai, Hawaii 96752.)

Kekaha Sugar Company, Limited annual expenditure in aquatic weed control

Year	Method	Annual cost
prior to 1951	hand and machines	$50,000 - $75,000 (estimated)
1951	chemical	$ 3,373 (labor and chemical)
1952	chemical	$ 3,729 (labor and chemical)
1953	chemical	$ 5,016 (labor and chemical)
1954	chemical	$ 5,194 (labor and chemical)
1955	chemical	$ 3,290 (planting of Tilapia 4/15/55)
1956	chemical	$ 25 Tilapia
1957 - 1973	none	none to date - only periodically cleaning of silt

Alligatorweed (Alternanthera philoxeroides (Mart.) Griseb.) response to glyphosate and silvex. McHenry, W. B. and N. L. Smith. A study was initiated May 29, 1973 on a dense stand of alligatorweed growing on the bank of the Los Angeles River to determine its sensitivity to glyphosate and silvex. Three replications were used with a plot size of 200 sq ft and spray volume of 40 gpa. Applications were made May 29, 1973 at 75% bloom on growth 18 to 30 in in height with a knapsack sprayer and 3 nozzle boom.

None of the treatments gave satisfactory control. Alligatorweed growing at the waterline exhibited no stand reduction from either herbicide. All plots were retreated August 8, 1973 and further evaluations will be made in 1974. (Cooperative Extension, University of California, Davis.)

Control of alligatorweed with glyphosate and silvex

Herbicide	Rate (lb/A)	Formulation (gal)	Control (10 = 100%) 8/8/73
glyphosate	1	0.3	1.7
glyphosate	2	0.7	2.3
glyphosate	4	1.3	2.0
silvex	6	1.5	2.0
control	-	-	0.0

Response of hardstem bulrush (Scripus acutus Muhl.) to glyphosate and 2,4-D. McHenry, W. B.[1/], N. L. Smith[1/], and L. L. Buschmann[2/]. An experiment was established along a Sutter County drainage ditch containing a heavy stand of hardstem bulrush approximately 6 ft tall on July 31, 1972 at early bloom stage. Four replications were employed with a plot size of 160 sq ft. Applications were made with a knapsack sprayer with a single nozzle boom using 40 gpa for all herbicides. Herbicides tested were glyphosate, glyphosate + spray oil (Red Top Mor-Act), 2,4-D isooctyl ester + 1% diesel and 2,4-D 2-ethylhexyl ester invert (Visko Rhap).

Glyphosate was the only herbicide giving any appreciable control, approaching near eradication at the 4 lb/A level. The addition of oil appeared to enhance glyphosate activity. Both 2,4-D derivatives desiccated the shoot tissue but had no effect on stand reduction presumably due to inadequate coverage of 40 gpa. (Cooperative Extension, University of California, Davis[1/] and Sutter County, Yuba City[2/].)

Hardstem bulrush control with glyphosate and 2,4-D

Herbicide	Formulation (ae/gal)	Rate (lb/A)	Control (10 = 100%) 5/11/73	9/17/73
glyphosate	3 lb	1	0.3	3.5
glyphosate	3 lb	2	7.7	6.6
glyphosate	3 lb	4	9.9	9.9
glyphosate + oil	3 lb	2 + 1%	8.9	8.1
2,4-D LVE + diesel	4 lb	2	0.0	1.0
2,4-D LVE invert	2 lb	2	0.0	0.3
control	-	-	0.0	0.5

Control of swamp smartweed (Polygonum coccineum Muhl.) on a ditchbank with glyphosate, 2,4-D and asulam. McHenry, W. B.[1/], N. L. Smith[1/], and L. L. Buschmann[2/]. A solid stand of swamp smartweed along a Sutter County canal was selected to test the effects of glyphosate with and without additional surfactant, 2,4-D isooctyl ester, 2,4-D 2-ethylhexyl ester (Visko Rhap) and asulam + 1% oil (Chevron Spray Stock Z) + 0.25% surfactant (Surfax). Plot size was 300 sq ft with four replications. Swamp smartweed exhibited less than 1% bloom and an average height of 18 in. Spray volume was 40 gpa with the exception of glyphosate treatment at 20 gpa. Applications were made with a knapsack sprayer and 3 nozzle boom August 30, 1972. In winter of 1972-73, 6-12 in of soil was deposited on top of all plots as the result of a ditch cleaning operation.

Glyphosate at all rates gave excellent control. Lower spray volume or additional surfactant with glyphosate appeared to increase weed control. Asulam exhibited some degree of control, but varied widely between replications. The two 2,4-D derivatives failed to provide acceptable control.
(Cooperative Extension, Botany Department, Davis[1/] and Sutter County[2/], University of California.)

Swamp smartweed response to glyphosate, 2,4-D and asulam

Herbicide	Formulation (lb/gal)	Rate (lb/A)	Spray volume (gpa)	Control (10 = 100%) 5/11/73	9/17/73
glyphosate	3	1	40	9.9	8.4
glyphosate	3	2	40	9.8	8.5
glyphosate + Surfax	3	2	40	9.7	9.5
glyphosate + X-77	3	2	40	9.9	9.8
glyphosate	3	2	20	9.9	9.5
glyphosate	3	4	40	9.9	9.7
2,4-D isooctyl ester	4	4	40	0.0	0.3
2,4-D 2-ethylhexyl ester	2	4	40	0.0	1.3
asulam	3.3	3	40	6.5	5.0
asulam	3.3	6	40	6.5	4.0
control	-	-	-	0.0	0.3

Influence of spray volume and surfactant concentration on the response of johnsongrass (*Sorghum halepense* (L.) Pers.) to glyphosate. McHenry, W. B.[1/], D. E. Bayer[2/], and N. L. Smith[1/]. A Sutter County ditchbank heavily infested with johnsongrass was chosen to study the efficacy of glyphosate applied in spray volumes of 20, 40 and 80 gpa and surfactant concentration of 1.25, 2.5 and 5 lb/100 gal. Surfactant used was the same as that used with formulated glyphosate. Plot size was 240 sq ft with four replications employed. Treatments, applied June 15, 1973, consisted of glyphosate applied at 2 lb/A applied in 20, 40 and 80 gpa. Using glyphosate formulated with surfactant resulted in concentrations of 5, 2.5, 1.25 lb of surfactant per 100 gal. Other treatments in the study employed additional surfactant added to 40 and 80 gpa treatments increasing the concentration to 5 and 2.5 lb/100 gal respectively. An MSMA treatment was added at 4 lb/A applied in 40 gpa as a standard. All treatments applied with a knapsack sprayer fitted with a 3-nozzle boom.

The decreasing concentration of glyphosate and surfactant attendant with increasing application volume resulted in reduction of johnsongrass response. The addition of surfactant with the higher volumes appeared to have a marked restorative effect on performance. Results of 20 and 40 gpa treatments with equal surfactant concentrations, suggest increased efficacy at the higher volume possibly arising from more adequate coverage. Surfactant concentration may be quite important to achieve best results using glyphosate. MSMA response was similar to what has been observed following one application.

(Cooperative Extension[1/], Agricultural Experiment Station[2/], Botany Department, University of California, Davis.)

Johnsongrass response to glyphosate and MSMA

Herbicide	Rate (lb/A)	Formulation (gal)	gpa	Surfactant lb/100 gal	Control (10 = 100%) 10/31/73
glyphosate	2	0.67	20	5.0	4.8
glyphosate	2	0.67	40	2.5	3.8
glyphosate	2	0.67	80	1.25	3.0
glyphosate	2	0.67	40	5.0	7.5
glyphosate	2	0.67	80	2.5	4.8
MSMA*	4	1.00	40	*	2.5
control	-	-	-	-	1.0

* Ansar 529

<u>Use of biological index to determine impact of aquatic weed treatments on nontarget organisms</u>. Otto, N. E. Increasing concern is being expressed about the potential harm that aquatic plant pest control chemicals might have on desirable aquatic biota, particularly where herbicide contaminated irrigation water returns to natural streams. Field studies were conducted on four irrigation canals involving two separate river systems within the Colorado-Big Thompson Project, Colorado. These tests were designed to monitor the various parameters of the environment and to ascertain if the diversity of nontarget aquatic species could be used to detect conditions of the aquatic habitat, particularly any adverse conditions caused by aquatic herbicide use.

Rockfilled wire basket and microscope glass slide sampling devices were placed strategically throughout the reach of the canals from river source downstream to where drainage water returns to the rivers. These introduced growth substrate samplers were monitored monthly and populations of diatom algae and macroinvertebrate animals were determined.

Two of the four canals studied received low-rate copper sulfate and/or xylene treatments. Two were untreated. Invertebrate animals, i.e., snails, caddisfly, mayfly, midge, crayfish, clam, etc., and diatom population data obtained were used to calculate a Species Diversity Index (SDI) using a variation of the Shannon and Weaver function:

$$\text{Estimate of Mean Species Diversity} = \sum_{r=1}^{s} p_r \log_2 p_r \qquad \text{where s is}$$

the total number of species in a sample and p_r is the observed individuals that belong to the r-th species (r = 1, 2, 3.....s).

Preliminary results show that sampled biota rapidly respond to environmental changes as reflected in SDI. The immediate adverse impact of a xylene treatment on the nontarget aquatic organisms was easily detected by significant lowering of calculated SDI values as exhibited in table 1. However, recovery of the aquatic organism occurred rapidly, particularly with invertebrate animals. Low-rate copper sulfate treatments produced minimal effect on species diversity as shown in table 2. Untreated canal water habitats exhibited some decline in SDI moving downstream, but were not greatly different than river water moving the same distance as table 3 shows.

These preliminary results suggest that biological indices (SDI) are indicators of the conditions occurring in the aquatic environment and may be of use in monitoring canal water. The determination of SDI in canals and drains could be a useful sensing method to detect adverse conditions developing in canals either from use of aquatic pesticides or other agricultural activities. (Cooperative investigations of the Division of General Research, Bureau of Reclamation, and the Bureau of Sport Fisheries and Wildlife; U. S. Department of the Interior and the Plant Sciences Division, Agricultural Research Service, U. S. Department of Agriculture, Denver, Colorado.)

Aquatic biological indices in irrigation canals and source rivers

Table 1. Effects of one xylene treatment on canal species diversity[1/]

	Monthly species diversity index			
	June	July	August	September
			Diatoms	
South Platte Supply Canal sampled at head, 4, and 10 miles	2.36	2.20	0.62*	1.73
			Invertebrate animals	
	1.79	1.64	1.76*	2.51

* Sampled 4 days' post-treatment - all organisms appeared to be dead 1 day after treatment.

Table 2. Effects of continuous seasonal low-rate copper sulfate treatment[1/]

Farmers Ditch	Seasonal species diversity index	
	Diatoms	Invertebrate animals
canal head (Big Thompson River)	1.64	2.05
4 miles downstream in canal	1.64	1.03
10 miles downstream in canal	1.92	1.14
Big Thompson River (10 miles downstream)	2.13	1.69

Table 3. Canal not treated with aquatic herbicides[1/]

Greeley-Loveland Canal	Seasonal species diversity index	
	Diatoms	Invertebrate animals
canal head (Big Thompson River)	2.10	1.87
12 miles downstream in canal	1.84	1.73
16 miles downstream in canal	1.25	1.66
Big Thompson River (16 miles downstream)	1.31	1.21

1/ Code to index: 1 or less = poor aquatic habitat; 2 = moderate habitat; 3 or > = excellent habitat.

PROJECT 7. CHEMICAL AND PHYSIOLOGICAL STUDIES

Robert L. Zimdahl, Project Chairman

No papers submitted for this section.

PROJECT 8. NONCROP-INDUSTRIAL WEED CONTROL

Mowing vs. cultivation for the control of annual weeds in vacant lots. McHenry, W. B. and N. L. Smith. Many communities have ordinances requiring that vacant lots be kept free of weeds to reduce the fire hazard. Since some people prefer not to use chemical methods, a Sacramento County vacant lot was selected to determine the best means of mechanical control. The two methods employed were mowing, with a rotary mower to a 2½ in height, and cultivation with a rotary tiller to a depth of 4-6 in. Plot size was 250 sq ft with four replications. Soil type was a sandy loam. Treatments consisted of either mowing or cultivating once, twice, or three times as needed to control weed growth. All treatments were mowed or tilled initially on March 29, 1973; those receiving 2 and 3 treatments were redone May 7, 1973 and those receiving 3 treatments were repeated on August 2, 1973.

Cultivation was superior to mowing in controlling annual weeds. Mowing only reduced weed height for a short period, followed by rapid regrowth of existing plants. (Cooperative Extension, University of California, Davis.)

Cultivation vs. mowing for control of annual weeds in 1973

Treatment	Date			Control (10 = 100%)	
	3/29	5/7	8/2	5/7	7/31
cultivate	x			7.0	6.0
cultivate	x	x		6.0	9.6
cultivate	x	x	x	7.5	9.7
mow	x			0.0	0.5
mow	x	x		0.0	6.8
mow	x	x	x	0.0	5.0
control				0.0	0.3

Nonselective control of annual weeds with three soil-applied herbicides in combination with amitrole and glyphosate. McHenry, W. B. and N. L. Smith. Three soil-applied herbicides, diuron, simazine and tebuthiuron each applied at 2 lb/A were compared alone and in combination with amitrole at 1 and 2 lb/A and glyphosate at 0.5 and 1 lb/A for control of general annual weeds. Four replications were used with a plot size of 150 sq ft. Materials were applied with a knapsack sprayer and three nozzle boom in 40 gpa. Surfactant (Surfax) at 0.5% by volume was added to all treatments except those containing glyphosate (formulated with surfactant). Treatments were made February 22, 1973 when weed growth was 6-12 in tall. Principal weed species were wild oat (Avena fatua L.), Italian ryegrass (Lolium multiflorum Lam.), and yellow starthistle (Centaurea solstitialis L.). Rainfall total was 3.25 in following application until date of last evaluation.

Both amitrole and glyphosate enhanced the weed control efficacy of diuron and simazine and to a lesser degree tebuthiuron. Amitrole tank mixed individually with the three soil-active herbicides were consistently more effective than combinations with glyphosate. In the presence of diuron and simazine and to a degree with tebuthiuron, glyphosate activity appeared to be reduced. (Cooperative Extension, Botany Department, University of California, Davis.)

Annual weed control with three soil-active herbicides in combination with amitrole and glyphosate

Herbicide	Rate (lb/A)	Percent topkill 3/16/73	Control (10 = 100%) 5/14/73
tebuthiuron + amitrole	2 + 1	8.8	10.0
tebuthiuron + amitrole	2 + 2	8.5	10.0
tebuthiuron + glyphosate	2 + 0.5	6.3	9.2
tebuthiuron + glyphosate	2 + 1	6.3	9.9
tebuthiuron	2	6.5	9.0
diuron + amitrole	2 + 1	8.3	8.4
diuron + amitrole	2 + 2	7.8	8.6
diuron + glyphosate	2 + 0.5	4.3	5.8
diuron + glyphosate	2 + 1	4.0	6.7
diuron	2	1.3	0.8
simazine + amitrole	2 + 1	6.0	9.8
simazine + amitrole	2 + 2	7.3	9.9
simazine + glyphosate	2 + 0.5	1.5	7.1
simazine + glyphosate	2 + 1	6.3	8.5
simazine	2	0.5	4.3
amitrole	1	5.5	3.3
amitrole	2	5.8	3.3
glyphosate	0.5	6.3	3.3
glyphosate	1	8.5	4.5
control	0	0.0	0.0

NOMENCLATURE AND ABBREVIATIONS

Tables 1 and 2 below are approved nomenclature and abbreviation lists adopted by the Weed Science Society of America (Nomenclature, WEED SCIENCE 22(1), 1974). Authors are urged to use this terminology and abbreviation whenever applicable.

Table 1. Common and chemical names of herbicides[1/]

Common name or designation	Chemical name[2/]
AC 84777	1,2-dimethyl-3,5-diphenylpyrazolium methyl sulfate
AC 92390	N-sec-butyl-2,6-dinitro-3,4-xylidine
AC 92553	N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine
alachlor	2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide
Amex 820	N-sec-butyl-4-tert-butyl-2,6-dinitroanalin
amitrole	3-amino-s-triazole
AMS	ammonium sulfamate
asulam	methyl sulfanilylcarbamate
atrazine	2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine
barban	4-chloro-2-butynl m-chlorocarbanilate
bensulide	O,O-diisopropyl phosphorodithioate S-ester with N-(2-mercaptoethyl)benzenesulfonamide
bentazon	3-isopropyl-1H-2,1,3-benzothiadiazin-(4)3H-one 2,2-dioxide
benthiocarb	(chemistry unavailable)
bifenox	methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate
bromacil	5-bromo-3-sec-butyl-6-methyluracil
bromoxynil	3,5-dibromo-4-hydroxybenzonitrile
butylate	S-ethyl diisobutylthiocarbamate
CGA 10832	N-n-propyl-N-cyclopropylmethyl-4-trifluoro=methyl-2,6-dinitroaniline
cacodylic acid	hydroxydimethylarsine oxide
carbetamide	D-N-ethyllactamide carbanilate (ester)
chlorobromuron	3-(4-bromo-3-chlorophenyl)-1-methoxy-1-methylurea

Table 1. Common and chemical names of herbicides (continued)

Common name or designation	Chemical name
chloroxuron	3-(*p*(*p*-chlorophenoxy)phenyl)-1,1-dimethylurea
chloropropham	isopropyl *m*-chlorocarbanilate
cyanazine	2-((4-chloro-6-(ethylamino)-*s*-triazin-2-yl)=amino)-2-methylpropionitrile
cycloate	*S*-ethyl *N*-ethylthiocyclohexanecarbamate
cyprazine	2-chloro-4-(cyclopropylamino)-6-(isopropylamino)-*s*-triazine
DS 5328	*cis*-2,5-dimethyl-1-pyrrolidinecarboxanilide
DS 21376	(chemistry unavailable)
dalapon	2,2-dichloropropionic acid
DCPA	dimethyl tetrachloroterephthalate
desmedipham	ethyl *m*-hydroxycarbanilate carbanilate (ester)
dicamba	3,6-dichloro-*o*-anisic acid
dichlobenil	2,6-dichlorobenzonitrile
dinitramine	N^4,N^4-diethyl-α,α,α-trifluoro-3,5-dinitrotoluene-2,4-diamine
dinoseb	2-*sec*-butyl-4,6-dinitrophenol
diphenamid	*N*,*N*-dimethyl-2,2-diphenylacetamide
diuron	3-(3,4-dichlorophenyl)-1,1-dimethylurea
DNBP (see dinoseb)	
DSMA	disodium methanearsonate
EMD 70610	(chemistry unavailable)
endothall	7-oxabicyclo(2,2,1)heptane-2,3-dicarboxylic acid
EPTC	*S*-ethyl dipropylthiocarbamate
ethiolate	*S*-ethyl diethylthiocarbamate
fluometuron	1,1-dimethyl-3-(α,α,α-trifluoro-*m*-tolyl)urea
fluorodifen	*p*-nitrophenyl α,α,α-trifluoro-2-nitro-*p*-tolyl ether
GK 40	(chemistry unavailable)

Table 1. Common and chemical names of herbicides (continued)

Common name or designation	Chemical name
GS 14254	2-sec-butylamino-4-ethylamino-6-methoxy-s-triazine
glyphosate	N-(phosphonomethyl)glycine
H 18467	(chemistry unavailable)
H 22234	N-chloroacetyl-N-(2,6-diethylphenyl)-glycine ethyl ester
ICS 3510	(chemistry unavailable)
IMC 3950	S-(4-chlorobenzyl)-N,N-diethylthiolcarbamate
karbutilate	tert-butylcarbamic acid ester with 3-(m-hydroxyphenyl)-1,1-dimethylurea
linuron	3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea
MBR 8251	1,1,1-trifluoro-4'-(phenylsulfonyl) methylsulfono-o-toluidide
MC 4379 (see bifenox)	
MCPA	((4-chloro-o-tolyl)oxy)acetic acid
MCPB	4-((4-chloro-o-tolyl)oxy)butyric acid
methazole	2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione
metribuzin	4-amino-6-tert-butyl-3-(methylthio)-as-triazine-5(4H)one
molinate	S-ethyl hexahydro-1H-azepine-1-carbothioate
MSMA	monosodium methanearsonate
NC 8438	2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulphonate
napropamide	2-(α-naphthoxy)-N,N-diethylpropionamide
nitralin	4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline
nitrofen	2,4-dichlorophenyl-p-nitrophenyl ether

Table 1. Common and chemical names of herbicides (continued)

Common name or designation	Chemical name
norea	3-(hexahydro-4,7-methanoindan-5-yl)-1, 1-dimethylurea
norflurazon	4-chloro-5-(methylamino-2-(α,α,α-trifluoro-m-tolyl)-3(2H)-pyridazinone
oryzalin	3,5-dinitro-N^4,N^4-dipropylsulfanilamide
oxadiazon	2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl) - Δ^2-1,3,4-oxadiazolin-5-one
paraquat	1,1'-dimethyl-4,4'-bipyridinium ion
pebulate	S-propyl butylethylthiocarbamate
phenmediphan	methyl m-hydroxycarbanilate m-methylcarbanilate
picloram	4-amino-3,5,6-trichloropicolinic acid
prometryne	2,4-bis(isopropylamino)-6-(methylthio)-s-triazine
pronamide	N-(1,1-dimethylpropynyl)-3,5-dichlorobenzamide
propachlor	2-chloro-N-isopropylacetanilide
propanil	3',4'-dichloropropionanilide
propazine	2-chloro-4,6-bis(isopropylamino)-s-triazine
propham	isopropyl carbanilate
prynachlor	2-chloro-N-(1-methyl-2-propynyl)acetanilide
pyrazon	5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone
R 7465 (see napropamide)	
R 24191	(chemistry unavailable)
R 25788	N,N-diallyl-2,2-dichloroacetamide
R 29148	(chemistry unavailable)
RH 2915	(chemistry unavailable)
RP 2929	dimethyl amino-4-thiocyanobenzene
RP 20810	(chemistry unavailable)
S 6176 (see ethiolate)	
SAN 9789 (see norflurazon)	

Table 1. Common and chemical names of herbicides (continued)

Common name or designation	Chemical name
SD 29762	(chemistry unavailable)
SN 45018	(chemistry unavailable)
silvex	2-(2,4,5-trichlorophenoxy)propionic acid
simazine	2-chloro-4,6-bis(ethylamino)-s-triazine
TCA	trichloroacetic acid
tebuthiuron	1-(5-tert-butyl-1,3,4-thiadiazol-2-yl)-1, 3-dimethylurea
terbacil	3-tert-butyl-5-chloro-6-methyluracil
terbutryn	2-(tert-butylamino)-4-(ethylamino)-6- (methylthio)-s-triazine
triallate	S-(2,3,3-trichloroallyl)diisopropylthio= carbamate
trifluralin	α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p- toluidine
U 27267	3,4,5-tribromo-N,N-α-trimethylpyrazole-1- acetamide
USB 3153	(chemistry unavailable)
VCS 3438	(chemistry unavailable)
VCS 438	2-(dichlorophenyl)-4-methyl-1,2,4- oxadiazolidine-3,5-dione
vernolate	S-propyl dipropylthiocarbamate
2,4-D	(2,4-dichlorophenoxy)acetic acid
2,4,5-T	(2,4,5-trichlorophenoxy)acetic acid

1/ Herbicides no longer in use in USA are omitted. Complete listing, including these, is in WEEDS 14(4), 1966.

2/ As tabulated in this paper, a chemical name occupying two lines separated by an equal (=) sign is joined together without any separation if written on one line.

Table 2. Abbreviations of terms used in weed control

Abbreviations	Definitions
A	acre(s)
ae	acid equivalent
aehg	acid equivalent per 100 gallons
ai	active ingredient
aihg	active ingredient per 100 gallons
bu	bushel(s)
cfs	cubic feet per second
cu	cubic
diam	diameter
fpm	feet per minute
ft	foot or feet
g	gram(s)
gal	gallon(s)
gpa	gallons per acre
gph	gallons per hour
gpm	gallons per minutes
hr	hour(s)
ht	height
in	inch(s)
l	liter(s)
lb	pound(s)
mg	milligram(s)
mi	mile(s)
min	minute(s)
ml	milliliter(s)
mm	millimeter(s)
mp	melting point
mph	miles per hour
oz	ounce(s)
ppmv	parts per million by volume
ppmw	parts per million by weight
ppt	precipitate
psi	pounds per square inch
pt	pint(s)
qt	quart(s)
rd	rod(s)
rpm	revolutions per minute
sp gr	specific gravity
sq	square
T	ton(s)
tech	technical
temp	temperature
wt	weight
w/v	weight per volume (Do not use this abbreviation; instead give specific units, such as g/l or lb/gal)

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