ELEVENTH ANNUAL

WESTERN WEED CONFERENCE

BOZEMAN, MONTANA

FEBRUARY 2, 3 AND 4, 1949

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Bozeman, Montana

The Eleventh Annual Western Weed Control Conference was called to order by President Bruce J. Thornton at 9:30 a.m. on Thursday, February 3, 1949 in the Ellen Theatre at Bozeman, Montana, before an audience rather larger than had been anticipated due to the unfavorable weather and travel conditions prevalent at the time.

The president called for roll call of official state representatives and the following responded:

Canada.....J. G. Davidson
Arizona.....H. P. Cords
California.....Walter S. Ball
Colorado.....Bruce J. Thornton
Idaho.....E. W. Whitman
Montana.....H. E. Morris
Nevada.....Lee M. Burge
New Mexico.....J. R. Spencer
Oregon.....Virgil H. Freed
Utah.....Ray Whiting
Washington.....Lowell W. Rasmussen
Wyoming.....George B. Harston
North Central Weed Control Conference..T. K. Pavlychenko

A total of 244 persons registered from 22 states, the District of Columbia and Canada.

REGISTRATION

ARIZONA

Fred H. Arle.....Bureau of Plant Industry, Phoenix
Howard P. Cords.....University of Arizona, Tucson
Kenneth C. Pearse.....U. S. Forest Service, Box 951, Tucson

CALIFORNIA

James S. Baker.....California Orchard Heater Co., 397 E. First St., Pomona
Walter S. Ball.....State Dept. of Agriculture, Sacramento
B. B. Boyer.....Cloroben Corp. 8215 DeLongpre Ave., Los Angeles
Cecil J. Graham.....U. S. Bureau of Reclamation, Calif. Fruit Bldg., Sacramento
Edward A. Harang.....Spraying Systems Co., San Francisco
M. M. Harris.....Braun-Knecht-Heimann Co., San Francisco
Murray D. Hess.....Friend Mfg. Co., 1702 So. First St., San Jose
G. R. Holmes.....Brady & Holmes, Rep. Hypro-Engineering, Box 856, Los Altos
Harold H. Merritt.....Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21
W. L. Norem.....Calif. Research Corp., 576 Standard Ave., Richmond
O. R. Olden, Jr.....Braun-Knecht-Heimann Co., 1400 16th St., San Francisco
R. N. Raynor.....The Dow Chemical Co., 310 Sansome St., San Francisco
W. W. Robbins.....University of Calif., Davis
David B. Scott.....The Sherwin-Williams Co., 1450 Sherwin Ave., Oakland
Art Swezey.....Dow Chemical Co., Box 245, Seal Beach
W. Bill Thomas.....Naco Mfg. Co., Huntington Park
Robert P. Watwood.....Monsanto Chemical Co., 111 Sutter St., San Francisco
Carroll D. Webb.....California Orchard Heater Co., 397 E. First St., Pomona
W. A. Westgate.....429 Forum Bldg. Standard Agricultural Chemicals, Sacramento

CANADA

J. G. Davidson.....Dom Exp. Farm c/o Dept. of Agriculture, Exp. Farms, National Weed Committee Indian Head, Sask.
D. W. Kirk.....Prairie Farm Rehabilitation, 910 McCallum Hill Bldg., Regina, Sask.
Thomas K. Pavlychenko.....Rep. North Central States Weed Control Conference, Agri. Research, American Chemical Paint Co., 1027 Temperance St., Saskatoon, Sask.

COLORADO

A. R. Downie.....American Crystal Sugar Co., Rocky Ford
R. J. Harrison.....National Aluminate Corp., 404 So. Downing, Denver
Frank P. Jasper.....Colorado Fuel & Iron Corp., Denver
Harvey P. H. Johnson.....The Beet Sugar Development Foundation, Fort Collins
John T. Maletic.....Bureau of Reclamation, Region 7, 318 New Customhouse Bldg., Denver 2
Donald E. A. Rogers.....D&RGW, R.R., Burnham Laboratory, W. 8th and Osage, Denver 4
B. W. Rubeck.....Food Machinery & Chemical Co., Loveland
Bruce J. Thornton.....Colorado Experiment Station, Fort Collins

IDAHO

R. E. Ames.....The Dow Chemical Co., 2700 Ponderosa Rd., Boise
S. Reed Andrus.....Idaho Falls
Boyd Baxter.....Union Pacific R. R., Pocatello
W. Dean Boyle.....U. S. Bureau of Reclamation, P. O. Box 937, Boise
V. A. Cox.....Box 576, Meridian
Lambert C. Erickson.....University of Idaho, Moscow
Arlon E. Frazier.....Weed Supervisor, Payette
H. S. Gault.....Twin Falls Co., Weed Bureau, Twin Falls
Oscar W. Grun.....Grun's Seed & Floral, 595 Broadway, Idaho Falls
Delano M. Hall.....Power County Weed Supervisor, American Falls
Robert B. Hammond.....Associated Seed Growers, Inc., St. Anthony
J. M. Hammond.....Cremant Co., Supervisor, Ashton
A. C. Hansen.....A. C. Hansen Co., Rexburg
Jesse M. Hodgson.....Bureau of Plant Industry, Meridian
D. L. Huey.....Gooding
Wilford L. Jensen.....Rexburg
J. W. Kinter.....Veith Chemical Co., Idaho Falls
W. L. Mason.....County Weed Supervisor, Lewiston
Gilbert Matson.....Extension Service, Payette
H. M. Mecham.....Blackfoot
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Albert Mylroie.....County Extension Agent, Pocatello
H. K. Schultz.....Pictsweet Foods, Inc., Moscow
C. I. Seely.....University of Idaho, Moscow

Kirt Skinner.....Van Waters & Rogers, Inc., Boise
M. B. Smith.....R.F.D. 2, North, Box 1472, Posatello
T. P. Strand.....California Spray Chemical, Boise
Eugene W. Whitman.....University of Idaho, Boise
George Whornham.....American Chemical Paint, Idaho Falls

INDIANA

R. M. Yoder.....Dobbins Mfg. Co., Elkhart

IOWA

Donald Dexheimer.....Dr. Salsbury's Laboratories, Charles City

KANSAS

C. W. Bothe.....Santa Fe Railroad, Topeka
G. L. McCall.....E. I. Dupont de Nemours, Manhattan

MARYLAND

L. W. Kephart.....U. S. D. A., Beltsville

MICHIGAN

Paul H. Kelly.....Acme White Lead & Color, Western Div., Detroit

MINNESOTA

Arden Aanestad.....Du Pont, Minneapolis
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Ernest Cook.....Hypro-Engineering, 410 Washington Ave., N., Minneapolis
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G. F. Worthington, Jr.....Spraying Systems Co., Hypro Engineers, Inc., Minneapolis

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U. F. Cherry.....Rohm and Haas Co., Kansas City
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Lloyd V. Sherwood.....Monsanto Cremical Co., 1700 South Second, St. Louis 4
H. F. Tomasek.....Pittsburgh Agricultural Chemical Co., 1027 Kuhlman Lane, Webster Groves

MONTANA

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Dick Bing.....Norine Motors, Bozeman
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R. M. Brandt.....Chem-Air, Inc., Lewiston
A. R. Broman.....Farmers Union Grain Terminal Ass'n., Great Falls
C. C. Butler.....Bureau of Reclamation, Region 6, Billings
Charles Chesarek.....Farmers Union Grain & Supply, Billings
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B. L. Clem.....Montana Flour Mills, Great Falls
E. E. Cockrum.....Montana State College, Bozeman
J. P. Corkins.....Occident Farm Science Dept., Billings
Kenneth Dahlquist.....Severson Air Activities, Cut Bank
D. B. Danforth.....Farmers Union Grain Term. Ass'n., Great Fallls
Lovell S. Davis.....Davis Custom Spraying, 417 13, Bozeman
R. N. DeNio.....U. S. Forest Service, Bozeman
Garner P. Elliott.....Dr. Salsbury's Laboratories, Park Hotel, Great Falls
Joe W. Eesenman.....Fairfield Feed & Seed, Fairfield
E. R. Ford.....Custom Spraying, Bozeman
George B. Glade.....Midland Impl. Co., Billings
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M. J. Hansen.....Hansen Kinney Co., Great Falls
Charles M. Hatch.....Charles M. Hatch, Inc., Miles City
Riley Hensley.....Veterans Instructor, Fairfield
Billy M. Hoblitt.....Misco Mills, Missoula
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Vince Hubbard.....North Montana State College, Havre
Clete Huff.....Columbus Flying Service, Columbus
Jim Huff.....Columbus Flying Service, Columbus

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Robert R. Johnson	President, Johnson Flying Service, Inc., Missoula
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Bob Lohof	Severson Air Activities, Cut Bank
George L. Loomis	Bureau of Reclamation, Fairfield
D. J. Luebbe	Bureau of Reclamation, Great Falls
Charles A. Lynch	Lynch Flying Service, Inc., Belgrade
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H. E. McIhay	Weed Supervisor, Lake County Ronan
Clyde McKee	Montana State College, Bozeman
Bill McNary	Severson Air Activities Co., Cut Bank
Gene Mitchell	Chem-Air Inc., Lewiston
H. E. Morris	Montana State College, Bozeman
George E. Mushbach	Fish & Wildlife Service, Moiese
D. H. Myrick	Farmers Union Grain Terminal Assn., Bozeman
Val Nelson	Agricultural Equipment Co., Great Falls
Wm. B. Nelson	Montana Agr. Exp. Station, East Montana Branch, Sidney
John O. Nordhagen	Chateau Flying Service, Inc., Chateau
M. C. Parker	Gallatin Vallley Seed Co., Bozeman
Jack F. Payne	Annin Weed Control Co., Columbus
John W. Peck	Fergus County Weed Board, Garneill
M. J. Peterson	Bureau of Reclamation, 2125 8th Ave., No., Great Falls
Donald W. Pierson	Acme White Lead & Color Wks., Great Falls
A. H. Post	Agronomy & Soils, Montana State College, Bozeman
Carl A. Rahn	Midland Implement Co., Inc., Billings
Ronald B. Ries	Midland Implement Co., Inc., Billings
Donald R. Ross	Grahson & Ross, Great Falls
Fred Sanborn	Great Northern Ry. Co., Great Falls
Clay Scott	508 So. Tracy, Bozeman
Albert R. Scranton	Occident Elevator, Billings
Chet Severson	Severson Air Activities, Cut Bank
James Severson	Severson Air Activities, Cut Bank
John M. Stephens	Blain Co. Weed Supervisor, Chinook
Penn Stohr	Johnson Flying Service, Missoula
R. E. Stuart	General Mills, Inc., Great Falls
Warren E. Sullivan	Harlo Flying Service, Box 254, Harlowton
Harry G. Sutherland	Great Falls Feed Supply Co., Great Falls
Oliver Thomilson	Montana Elevator Co., Great Falls
J. P. Verploegen	Havre Spraying Co., Havre
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Robert L. Warden	Montana State College, Bozeman
D. S. Welker	International Elevator Co., Great Falls
L. A. Wollam	International Elevator Co., Great Falls
Carl B. Yantis	The Carter Oil Company, Billings

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Joseph H. Robertson	University of Nevada, Reno

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Phil L. Quale	F. U. Grain &Supply, Williston

OREGON

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Gene Bates	Van Waters & Rogers, Inc., 3950 N.W. Yeon Ave., Portland
Leo W. Davis	Swift & Co., Plant Food Div., North Portland
R. D. Eichmann	Stauffer Chemical Co., North Portland
A. W. Evans	Du Pont Co., 3260 Jackson St., Corvallis
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V. H. Freed	Oregon State College, Corvallis
Lin Harris	Chipman Chemical Co., 6200 N.W. St. Helens Rd., Portland 10
Louisa Kanipe	Oregon State College, Corvallis
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NEBRASKA

Dean Schachterle	Bureau of Reclamation, Superior

NEW MEXICO

A. S. Curry	New Mexico A. & M. College, State College, Las Cruces
J. R. Spencer	New Mexico A. & M. College, State College, Las Cruces

PENNSYLVANIA

E. R. Sherwood	American Chem. Paint Co., Ambler

TEXAS

John G. Koogler	4245 W. 9th, Amarillo

UTAH

Glenn Baird	Extension Agronomist, Logan
W. Harold Hirst	Bureau of Reclamation, Salt Lake City
F. A. Holmes	Du Pont Co., Bushnell Homes, Brigham City
Morgan A. Regan	Steve Regan Co., Salt Lake City
Elmer Smith	The Denver Fire Clay Co., Salt Lake City
A. Stark	Wasatch Chemical Co., Salt Lake City
Lloyd N. Taylor	E. C. Olsen Co., 1527 Lake St., Ogden
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F. L. Timmons	U.S.D.A. Bureau of Plant Industry, Agricultural Ex. Station, Logan
M. D. Wallace	E. C. Olsen Co., Rt. 2, Box 203-A, Orem
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WASHINGTON

Richard M. Bailey	Rosalia Producers, Inc., Rosalia
M. J. Benjamin	Van Waters & Rogers, Inc., N. 809 Washington St., Spokane 11
Art Bonn	4000 1st Ave., So., Seattle 4
V. F. Bruns	B.P.I.S.A.E. U. S. Dept. of Agriculture, Irr. Exp. Station, Prosser
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Cecil Hagen	Pacific Northwest Farm, Spokane
Lee R. Hansen	Pacific Coast Borax Co., 1203 Western Ave., Seattle 1
Grant A. Harris	Forest Experiment Station, Spokane
Bob Hurford	W. S. C. Extension Service, Yakima
Cosby C. James	Du Pont Co., 123 W. Yakima Ave., Yakima
Richard H. Kube	Balfour-Cuthrie & Co., Ltd., Spokane
A. W. Lange	Weed Supervisor Spokane Co., Spokane
A. Hays McCoy	Pennsylvania Salt Mfg. Co. of Washington, Yakima
Virgil D. Moss	618 Realty Bldg., Spokane 8
J. L. Mulcahy	Central Aircraft, Box 1364, Yakima
Eugene W. Ogle	Sherwin-Williams Co., W. 906 Gordon, Spokane 12
W. Bert Peterson	Chemi-Serve, Inc., 7315 E. Marginal, Seattle
Lowell W. Rasmussen	State College of Washington, Pullman
John W. Scott	Van Waters & Rogers, Inc., N. 809 Washington, Spokane 11
Mr. Joe Seaman	Economy Pest Control, 210½ N. 31st Ave., Yakima
W. A. Shearing	The Sherwin-Williams Co., 103 West Yakima, Yakima

Louis P. Smith	Van Waters & Rogers, 909 N. Washington, Spokane
S. P. Swenson	State College of Washington, Pullman
C. J. Tjernagel	Polar Frosted Foods, Inc., Mt. Vernon
C. F. Trombley	Monsanto Chemical Co., 911 Western Ave., Seattle
Ed. L. Turner	Pictsweet Foods, Inc., Mount Vernon
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WASHINGTON, D. C.

R. B. Balcom	U.S.D.A., Washington D. C.

WYOMING

Charles E. Allen	State Dept. of Agriculture, Laramie
Howard S. Beaudoin	Dept. of Agriculture, Deputy State Entomologist, Powell
Dale W. Bohmont	University of Wyoming, Laramie
Frank S. Griffin	Big Horn County Pest Control, Lovell
George B. Harston	Acting Commissioner of Agric., Room 310 State Capitol, Cheyenne
I. N. Harvey	Pres. of Pest Board of Hot Springs Co., Thermopolis
E. W. Kinghorn	Big Horn County Pest Control, Basin
Roy A. Shaffer	Weed Spray Operator, Hot Springs County, Thermopolis
F. R. Smith	The Carter Oil Co., 408 W. Works, Sheridan

REPORT OF THE TREASURER

January 1, 1949

1947 balance		$426.04
1948 dues		638.00
Left over from get-together after conference		25.00
Registrations—Sacramento conference		1,908.00
		$2,997.04
Balance due on 1948 proceedings (printing)	$112.50	
Expenses of Sacramento Conference:		
Rental of Soundscriber amplifier	24.10	
Cost of printing programs	63.04	
Sound system	25.00	
Banquet	851.50	
Refund of registrations	9.00	
Rental of meeting hall	5.00	
Rental of transcriber for Soundscriber	10.00	
Loudspeaker	10.00	
Typing proceedings	20.00	
Printing proceedings	645.00	
Postage—mailing proceedings	15.00	
Expenses of secretary to N.C.W.C.C. at Springfield	175.55	
Bank service charges	3.21	
	$1,968.90	

RECAPITULATION

Gross receipts	$2,997.04
Expenses for 1948	$1,968.90
Cash on hand January 1, 1949	$1,028.14

President Thornton then called for State Reports requesting that they be brief and that new developments in each state should be emphasized. Although the State of Arizona was represented at the conference no official report was presented due to the lack of organized weed control work in the State. Following are the reports which were presented:

WEED WORK OF THE CANADIAN DEPARTMENT OF AGRICULTURE AND THE NATIONAL WEED COMMITTEE

J. H. Davidson, Assistant Superintendent, Dominion Experimental Farm, Indian Head, Sask.

On the invitation of your secretary, Mr. Walter S. Ball, Dr. Ripley, Dominion Field. Husbandman, has requested that I attend your meetings as the representative of the Canadian Department of Agriculture and the National Weed Committee. Weed control is of great importance to Canadian agriculture just as it is important to the agriculture of your western states. In many ways our problems are common.

In Canada a great deal of attention is being given to weeds and weed control methods. The Department of Agriculture, through the Botany Section of the Division of Botany and Plant Pathology, of Science Service has done much work on Weed Classification and Weed Surveys. Through the Plant Products Division, Production Service, it administers the Seeds Act. Through the Field Husbandry Division of the Experimental Farms Service, centered at the Central Experimental Farm, Ottawa, Ontario, a great deal of attention is being given to weed control experimentation and research.

The Experimental Farms Service has twenty-eight Experimental Farms and Stations and seven Substations at various points across the Dominion. From these parent stations many substations and illustration stations are operated through the Division of Illustration Stations. This comprehensive system of branch experimental farms makes possible a large measure of co-ordinated study of weeds, weed problems, and weed control measures in different locations and under varying conditions. Most of the Stations have active projects dealing with some phase of weed control experimentation or research.

Here, I will not attempt to go into detail concerning the various findings. Much information has been obtained, but the weed problems and methods of attack are in many ways different in eastern Canada and, say, the prairie provinces of Manitoba, Saskatchewan and Alberta. In the great grain growing prairie provinces, weeds are very serious competitors of any grain crop because in dry land farming soil moisture is usually very limited and weeds cause great reductions in yields. To illustrate, in the west at the Experimental Substation, Regina, Saskatchewan, a dense infestation of wild mustard. (Brassica arvensis) reduced the average yields of wheat over a nine year period by 53 per cent while at the Central Experimental Farm at Ottawa, Ontario, the loss over a five year period from the same weed was only 12.7 per cent.

In the three prairie provinces last year it is estimated that four million acres of grain crops were treated with some formulation of 2,4-D, 90 per cent is being applied as spray and 10 per cent as dust. We now know how to attack some of our more sensitive annual weeds such as some of the mustards and feel that on the prairies the time has come to give more attention to persistent perennial weeds such as Leafy Spurge and Hoary Cress. Further, we are no longer emphasizing immediate complete eradication as our main objective with perennial weeds, but are rather giving attention to their control, which is opening up new possibilities, particularly when they are present in growing crops.

The National Weed Committee of Canada is a body which has given study to the weed problem in its many phases across the Dominion for a number of years. At a meeting of this Committee held at Saskatoon, Saskatchewan, in June, 1945, the need was expressed for a full time secretary. In due time a full time secretary was appointed within the Botany Division of Science Service. Unfortunately, he resigned just recently to become Professor of Plant Physiology at Ontario Agricultural College. To understand the work of this Committee it might be well to outline some of the duties of the secretary. These are: to maintain familiarity with the weed problem throughout Canada; to keep posted on developments in weed experimentations and research and organized weed control programs in Canada and other countries; to work with other government departments, Dominion and Provincial, universities and other organizations engaged in weed control; and to assist in stimulating weed control investigation and the co-ordination of research.

Under the auspices of the National Weed Committee, conferences have been held both in eastern and western Canada. In western Canada particularly, two most successful weed control conferences have been held, the first in December, 1947 at Regina, Saskatchewan, and the second in November, 1948 at Winnipeg, Manitoba. These conferences have been of immense benefit to agriculture as a whole, to the research worker, to the farmer and to the people who supply material and implements. Our experimental findings have been pooled, and to some extent our viewpoints have been co-ordinated, clarified and crystallized. We are closely linked with the North Central Weed Control Conference. This is your eleventh annual conference. Your experience has extended over a much longer period than ours and there is much that we can learn from you. I am glad that I have been privileged to be with you.

CALIFORNIA STATE REPORT

Walter S. Ball
State Department of Agriculture

Mr. Chairman, my report is going to be rather brief as I wish only to mention a few of the problems we have in California that I feel are of interest to this group.

First, I would like to mention the problems in the misuse of 2,4-D. Undoubtedly you are aware that there was sufficient misuse of 2,4-D in California during 1948 to cause concern among official agencies and alarm among some of the farmers, especially cotton growers. Briefly I would like to relate one of the most outstanding cases of misuse.

In July, 1948, 1885 acres of mature barley in the Tulare Lake Basin of Kings County, located in the San Joaquin Valley, were sprayed by airplane with the ester form of 2,4-D to dry up the wild lettuce, and thus facilitate harvest of the grain. The spraying operations covered the period of July 4 to July 20. Large plantings of cotton were located to the north, northeast, east and southeast of the treated area, with some immediately adjacent thereto. Prevailing afternoon winds blow from the northwest to the southeast. Subsequent to the spraying operations, cotton plants over an extensive area began to manifest typical symptoms of 2,4-D injury with the most pronounced symptoms in the immediate vicinity of the scene of application, and with gradual lessening toward the periphery of the affected area. An area aggregating several sections of cotton was affected. Traces of 2,4-D injury

were found 21 miles southeast from the point of treatment with marked symptoms apparent in a field 15 miles distant. A striking result noted was the uniform degree of injury throughout entire sections—every cotton plant appearing equally distorted and depressed.

Much of the trouble that has arisen out of the misuse of 2,4-D may be ascribed to a number of causes, namely: lack of knowledge, inability to control conditions, promiscuous use, and the unpredictable behavior of the ester form of 2,4-D. I think several cases falling in the last category should be mentioned.

The ester form of 2,4-D was shown to be highly volatile when fumes from used containers of the ester form stored at an airport beside a cotton field caused severe damage to the cotton. This was one of those unpredictable incidents that illustrates another manner in which the fumes of 2,4-D may be released in sufficiently heavy concentrations to endanger susceptible agricultural crops.

A case at Fresno, California which does not involve the application of 2,4-D as an operation indicated that the pure 2,4-D acid (100% 2,4-dichlorophenoxyacetic acid) can be volatilized by intense heat. Empty barrels that had contained the pure 2,4-D acid were transported to a dump near the city for disposal with specific instructions that the containers be buried. Contrary to these directions, they were burned and within a few days cotton in a nearby field situated in the path of the prevailing winds manifested pronounced symptoms of 2,4-D injury over a considerable area.

Another unpredictable incident in Kern County in the southern San Joaquin Valley illustrates what we believe to be the effects of wind borne 2,4-D impregnated dust from areas treated with 2,4-D. In the Old River section in early May of 1948 a field infested with Russian knapweed was sprayed with amine form of 2,4-D. Cotton was being replanted in an adjoining field because of wind erosion damage. Also wind storms were frequent at this period and during the spring and summer months. The cotton plants showed symptoms of 2,4-D injury during the entire growing period and we believe that frequent wind storms in the area carried 2,4-D impregnated dust particles from the treated area to the adjoining cotton.

Another much discussed program has been that of preemergence weed control in sugar beets and truck crops with contact weed killers. During 1948 many users of aromatic oils for preemergence weed control in sugar beets and truck crops ran into trouble. Preemergence treatments in many cases resulted in either killing the emerging crop plants or seriously injuring them. In a number of incidences sugar beet plantings had to be reseeded one or more times, and involved rather large acreages. Less trouble was experienced with diesel oil fortified with the dinitros.

The killing of the seedling plants in this preemergence work with the aromatic oils evidently was coupled with adverse weather conditions. It is felt that a residual of the oil remained on the surface of the soil after treatment during the long drought period of the winter of 1947-1948 and when the delayed rains came a film of oil was deposited on the young crop plants from the splashing of the water on the surface of the soil by the falling rain.

The selective treatment of rice with 2,4-D proved to be one of the most successful programs during the year. Growers benefited by rectifying their errors of the previous season when the trend was towards skimping on material for the sake of economy. During 1948 the growers followed the advice given by official agencies; the important principal being that weeds vary in susceptibility to 2,4-D. Standng recommendations were that the easier to kill weeds such as water plantain and arrow head lily should be treated with 20 ounces of 2,4-D acid expressed as a nonester and the sedges would require at least 24 ounces of acid. The use of such spray adjuvants as light summer emulsive oil and proprietary sticker-spreaders proved valuable.

We have very little to report on electrical weed control. As a matter of fact there has been very little activity in this field. Field operations have been limited. Unfortunately, as yet there has been nothing done in the line of research concerning this method. A pest control operator near Sacramento has two Electrovators, one of which he has increased the electrical output in an attempt to reduce the number of treatments required for weed control. We are waiting to see some of his operations and the results of the work. As far as we know there has been little development in the field of electrical weed control.

The Klamath weed program has been one of protecting free areas, particularly range lands, and attempting to reduce the infested areas. In this program the federal government, through its Agricultural Conservation Program, has been a major contributor of weed control materials such as boron products, and more recently 2,4-D. The ACP program assists farmers who perform designated amounts of the practice for the purpose of encouraging them to follow a permanent program for soil conservation. Individual farmers participating in the Klamath weed program by agreement with the county and state committees of the federal agency may apply their materials under the supervision of the county agricultural commissioner. This arrangement has worked out satisfactorily as it has made possible the execution of a systematic and concerted program.

Of particular interest to many of you will be the report of the progress being made in the biological control of Klamath weed. In two rather widely separated locations in California very striking control was obtained with the Chrysolina beetle. In both cases several acres of the infested area were completely denuded; killing most of the Klamath weed. Colonies in both locations are now three years old. Seventeen counties in the state have well established colonies of either the gemellata or hyperici species or both. The biological program is now entering into the "control" phase or the third and last phase. It will take more time to properly evaluate this method of control, but at present the program has considerable promise.

This, gentlemen, does not cover all of our weed problems in California but touches on some that I thought would be of considerable interest to you.

COLORADO STATE REPORT

Bruce J. Thornton
In Charge Weed Control Investigations
Colorado A. & M. College

The weed control program is growing rapidly in Colorado and continues to be carried at the county level under the guidance of the Agricultural Extension Service in co-

operation with the Experiment Station and with the County Commissioners in its administration and implementation. More voluntary weed control districts are constantly being formed, the control work being carried for the most part by the individuals subject to whatever Soil Conservation payments may be available. No compulsory districts have been formed.

Many acres of small grain were treated with 2,4-D with generally gratifying results except in instances where spraying was delayed until almost harvest time. Airplane and ground equipment was used. Considerable corn was likewise treated. Numerous airplane demonstrations in spraying sage, willows, and other plants on range land were conducted by the Extension Service.

The Station research program in general was carried along much the same lines as in the past, the tests involving field bindweed, Canada thistle, leafy spurge, Russian knapweed, poverty weeds and white top. Comparison of relative effectiveness of esters and amine salts and of the different esters at a wide range of rates of application in varying amounts of water constituted one of the major studies. The time that must lapse before treated plants can be disturbed without reducing effectiveness of treatment and residual effect as related to future crop plantings were given consideration. A project to test the reaction of a wide range of commercial herbicides to the various type of water available in the field was initiated. The chemical control of poison weeds on range lands was also given consieration by the Station and by Federal research agencies.

Results from tests to date indicate that while low volume application is satisfactory for treating the weeds ordinarily found in grain fields the same may not be true in the treatment of perennial noxious weeds with heavy foliage and extensive root systems. Material applied to white top and bindweed at the 10 gallon per acre rate appeared definitely inferior in its effectiveness to the same material applied at the 20 gallon rate and this in turn appeared inferior to application at the 40 gallon rate. However, considerably more evidence is needed before definite conclusions can be drawn.

Leafy spurge continues to offer the greatest resistance to 2,4-D action with Russian knapweed a close second. However, one area of leafy spurge on the Western Slope was apaprently 100% killed by one application of the isopropyl ester. The treatment was made by the County Agent and exact data were not kept. However, it appeared that the 2,4-D was applied at about 4 pounds per acre at between 100 and 200 gallons per acre. It was a well established patch of many years duration, the plants being husky and vigorous. We are at a loss to explain the remarkable success of this treatment as compared to other results with this plant. Similarly in a few instances, Russian knapweed has been quite satisfactorily controlled but only by successive treatments over a period of years and never to our knowledge in a single treatment as in the above instance. Results with these persistent weeds as with the other perennial types continue to emphasize that more effective control is obtained when treatment is made in pastures or tolerant crops.

Not much attention was given experimentaly to attempting to substitute chemicals for cultivation in controlling annual weeds in crops, it being felt that the control of the perennial noxious weeds still constituted the major weed problem in the state. However, the Station did cooperate with the Beet Sugar Development Foundation in conducting some pre-emergence weed control tests on sugar beets, the major portion of the project being carried by the Foundation. Results were not too promising.

Equipment for applying spray solution to small experimental plots at low volume rates was developed and proved satisfactory.

Physiological Studies: The investigation of basic physiological changes in plants treated with synthetic plant hormones as herbicides to determine the toxic action was begun in 1945 under the direction of Dr. Jess L. Fults in cooperation with the Chemistry Section. Early in the study over 200 compounds were synthesized of which several, in laboratory tests, showed great regulation properties equal to or superior to the 2,4-D compounds. Unfavorable conditions nullified the first field tests with these compounds but it is hoped that opportunity for repeating the tests will be afforded in the near future.

Considerable time and effort has been expended in studying the fundamental mechanism of the herbicidal action of 2,4-D and similar synthetic plant hormones. This involved an exhaustive search of the literature before much actual work could begin but with that out of the way considerable progress is being made. The developments to date are not of particular interest to the general public but will be reported to the Research Section. Some eight papers have been published in connection with this work.

IDAHO REPORT

Eugene W. Whitman
University of Idaho

Several items are of interest in the past year's development in weed work in Idaho.

(1) Increased interest in weed control is evident in several ways. Counties in the state have increased their weed budgets somewhat to a total for the state of nearly $800,000. When one considers that in many cases these funds revolve the total money available for county weed work may exceed this total by a considerable amount. Farm organizations and others interested in agriculture, such as the Idaho State Farm Bureau, the Idaho Grange, Idaho Reclamation Association, Columbia Basin Interagency Committee and others, have included weed discussions as part of their programs. The Idaho State Farm Bureau has appointed a state weed committee. Attendance at weed meetings has been greater than ever before with more than 3,000 people attending meetings sponsored by University of Idaho Extension Specialists. This does not include meetings held by County Extension Agents and County Weed Supervisors. Two additional counties employed weed supervisors bringing the total to twenty-five counties. Thirty-three counties have weed budgets.

(2) The location of the Bureau of Plant Industry Weed Research Station in Idaho has been a valuable addition to our weed research work. Jointly sponsored by the Bureau of Plant Industry, Bureau of Reclamation, local reclamation and weed interests and the Experiment Station of the University of Idaho, valuable information has already come from the experimental work. While this station is a regional one and we share it with other states it is rounding out a research program in Idaho of which we were already proud.

(3) Increased interest in weed control has been shown by federal and state land governing agencies. At the

annual meeting of the Idaho Noxious Weed Association, representatives of the Forest Service, Reclamation Service, State Land Department and State Department of Agriculture were present to discuss their weed programs. The Forest Service indicated that that agency was interested in weed control work and could do work. Since that time a list of supervisors and rangers has been furnished for southern Idaho counties with the suggestion that these men be contacted by County Weed Supervisors for survey and control work. The State Land Department is including weed control clauses in sales and lease contracts. Direct weed control work on state lands is done by county weed crews with funds available through the State Department of Agriculture.

The Reclamation Service report indicated a satisfactory program on much of their area particularly on canals and laterals. The Bureau of Land Management was not represented at the meeting.

(4) One of the major projects in Idaho during the past two years has been to bring about greater recognition of the responsibility of individuals for weed control on their own lands. While new weed materials and methods have undoubtedly contributed to this trend it is of note that approximately 1,500 Idaho farmers either build or purchased some kind of weed control equipment during the year. More than 2,000 such units are now on farms in Idaho.

(5) Weed legislation in Idaho is sponsored by the legislative committee of the Idaho Association of County Commissioners and Clerks. This year's legislation suggested by the Idaho Weed Association will include strengthening control over feed, forage and fertilizers, improvement in salary restrictions of County Weed Supervisors and additional assistance in Extension work for weed control.

(6) Idaho people are supporting strongly the weed research program in the state. While recognizing the value of the program already being carried on there is demand for additional research on special weeds such as range and poisonous weeds, dry farm weed problems and others.

(7) Volume increase in weed work in Idaho is noted for the year. New materials and methods, particularly the use of 2,4-D in the cropping system, has been in no small way responsible for this increase.

MONTANA STATE REPORT

Robert L. Warden
Extension Weed Specialist

The large increase in the use of 2,4-D in Montana in 1948 was one of the significant features of the year in agriculture. Of approximately 8,000,000 acres of cereals grown in Montana close to 1,800,000 acres were treated selectively with 2,4-D for the control of annuals and perennials with generally highly satisfactory results. This figure represents approximately 22 per cent of the total acreage. Of the acreage treated approximately 1,000,000 acres were winter wheat. It is estimated that 60 per cent of the total winter wheat acreage was treated. Of the remaining 800,000 acres, about 500,000 acres of spring wheat were treated with the balance going to barley, oats, and rye. Nearly 180,000 gallons of ester and amine formulations were used as well as 650,000 pounds of dusts. This usage of 2,4-D resulted in a reduced amount of land under perennial weed control cultivation and a smaller consumption of soil sterilants.

County weed control programs were quite active in 1948 with total expenditures about $275,000. In general, counties worked on perennial weeds on roadsides and waste areas. However, activities were not limited to this type of work. At present 22 counties in the state have 49 legal weed districts. At least 5 more counties are organizing districts and several counties with districts are enlarging the area within their district. It appears at this time that the most distinct advantage of the weed districts is that of education and the coordinating of county weed control activities within a county. The effect of roadside control activities by counties has stimulated the interest and desire of producers to control their own weeds. Also counties with weed districts have been able to utilize the P.M.A. funds for weed control much more effectively than for non-district counties.

It is significant to note that the use of tillage and soil sterilants decreased in 1948 in favor of 2,4-D treatment for the perennial weeds. Many operators have turned to the use of 2,4-D as a selective herbicide and have grown cereals in areas of perennial infestaton so that some income could be derived from the land. The total infestation of perennial weeds in the state was probably not decreased by 1948 weed control activities.

The perennial weed situation in Montana is particularly serious on irrigated lands. The most serious of the perennial weeds are Canada thistle, whitetop, and wild morning glory. Quackgrass, leafy spurge, Russian knapweed, perennial sow thistle, and Klamath weed are serious in localized areas of the state. The Klamath weed infestation is at present limited to that part of the state west of the Continental Divide. No infestation east of the Continental Divide have been reported.

It appears at this time that custom sprayers will be doing an increased amount of spraying for weed control in 1949. The airplane sprayers within the state have shown a considerable degree of interest in this type of work and it appears that most of them will attempt to do a good job. There are many farmer-owned rigs in the state and it is believed that the number of sprayers will increase. Shortage of equipment which hampered a few operators in 1948 will not occur in 1949.

The research program has been as active as possible. Four of the State Experiment Stations did some weed control research this past year. It is planned to coordinate the activities of the various stations in 1949 so that the research program will be able to use its limited resources more effectively. Research work in 1948 was concerned primarily with the use of 2,4-D on small grains, flax, and perennial weeds. Some pre-emergence 2,4-D work was done on potatoes and corn with screening tests on other crops.

NEVADA STATE REPORT

Lee M. Burge
State Department of Agriculture

Interest in Nevada's weed control problems has continued to grow as is evidenced by the increased acreage sprayed on a voluntary basis. This trend is not only true in the case of grain acreages sprayed with 2,4-D, it applies as well to the development of control programs on ditch banks, canals, roadways, and large infestations of perennial weeds.

During the past season the largest grain area in the state has been virtually one hundred per cent sprayed for

the control of mustard, sweetclover, morning-glory, milk weed, bassia, white top, sunflower, poverty, and knapweed.

Those areas not employing a concentrated grain weed control program in 1948 have indicated, as a result of tests and demonstrations, an all out effort in 1949.

Surveys

Surveys show a continued rapid spread of halogeton into Nye, Mineral, and White Pine counties to the south and east, and westerly in Washoe, and the adjoining county of Lassen in California.

A reported infestation of Klamath weed was investigated and surveyed in Washoe County. This infestation was found to be confined to an area approximately one-half mile wide and three miles long.

Control

Ranchers in the Klamath weed area considered this infestation of sufficient importance that a local district for control was organized. The result was very encouraging in that no known plants were permitted to make seed, and many small spots were eliminated by grubbing.

The halogeton program in Mineral and Churchill counties was continued with the hope of preventing further spread in those areas.

Test plots on halogeton continue to show straight fuel oil or emulsions, and 2,4-D in oil to be the best spray materials. Two pounds of 2,4-D in water with one-half gallon of summer oil to 50 gallons of mix is giving promising results.

The best results on acreages of tules has been with plane application of 15 gallons per acre, composed of three pounds of 2,4-D acid, and two quarts of summer oil.

Late summer applications gave a 50% kill with the above formulation. Diesel oil, added at the rate of one gallon per acre gave a faster top burn, however, the total kill did not appear as satisfactory as the area sprayed with a summer oil spreader.

A question has been raised as to the possible damage to malting barley sprayed with 2,4-D. Brewers purchasing malting barley have complained of the high protein and relative hard quality of this grain. Test plots to study this problem are being planned for 1949.

Stock Losses

Authentic losses to cattle and sheep total 221 cattle, and 150 sheep divided as follows:

Halogeton	33 cattle
Larkspur	40 cattle
Hemlock	100 cattle
algae (nitrate poisoning)	47 cattle
arrowgrass	1 cattle
tetradymia	150 sheep

This is the first confirmed loss of cattle from halogeton although several suspects have been observed in the past.

Legislation

Several interested farm groups in the western and eastern counties have banded together for the purpose of fostering amendments to the state weed law permitting the creation of control districts upon petition of 65% of the property owners in a part of, or whole county. Upon receipt of such a petition, the County Commissioners shall appoint a board of directors, whose duties shall be, with the approval of the state to:

(a) Appoint a qualified weed supervisor.

(b) Designate the weeds to be controlled.

(c) Administer any funds made available within the district by county appropriations, donations, or assessments.

(d) Promulgate regulations governing the possible movement of weed seed or propagating parts intra state, and intra district.

It is believed that this legislation will result in a more effective control program.

NEW MEXICO STATE REPORT

James R. Spencer
Assistant Agronomist

Geographically, New Mexico can possibly be divided into three large regions, based on the ecological adaptations of the weeds from within the state. Roughly, the southern one-third of the state is similar to much of Arizona and portions of California in that the agronomic weeds are largely limited to irrigated lands and the irrigation systems. The extreme eastern portion of the state stretches into the Southern Great Plains and weeds of this region invade both irrigation and dry farm lands. The remaining portion of New Mexico is in large somewhat similar to Colorado and other northern states in that many of the same weeds and weed problems occur here as there.

In the fall of 1948 a survey of the most troublesome weed problems in each county was made through questionnaires returned from County Agents. The several most troublesome weeds invading cropland in the three regions in order of their effect upon crop production are as follows:

Southern New Mexico	Johnson Grass, bindweed, Texas blueweed, nutgrass, White Horse nettle.
Eastern New Mexico	Bindweed, Texas blueweed, White Horse nettle, Johnson grass, pigweed, sunflower.
North and Central New Mexico	Bindweed, cocklebur, pigweed, Russian thistle, White Horse nettle, whorled milkweed, poverty weed (Franceria tomentosa), Russian knapweed, whitetop, and sunflowers.

Both perennial and annual weeds have continued to infest additional acreage each year. During the past two or three years, however, most counties have developed a real interest in the problem. Many of the counties now have a county weed sprayer for farmer use and demonstration purposes. The Otero County weed sprayer, for example, sprayed 100,000 gallons of 2,4-D during 1948 with 90% satisfaction. Sandoval County plans to spend between $15,000 and $17,000 for such work during 1949.

Control of bindweed has been offered as an Agricultural Conservation Program practice for several years, though very few farmers participated in the practice until 1947 when 54 farmers applied 2,4-D to 3,251 acres. Most of this work was carried on in San Juan County where the County

Extension Agent, Soil Conservation Officials, and Agricultural Conservation Assocation Committeemen are attempting to develop an organized weed eradication program. Although conservation payment funds were limited during 1948, farmer interest in controlling weeds is greatly increasing throughout the state. For example, 375 farmers sprayed for bindweed alone in San Juan County in 1948.

Extension activity in weed control during 1948 has added much valuable information for local recommendations in the use of 2,4-D. Some important observations observed under Extension field trials in the wheat and sorghum growing areas of Eastern New Mexico are as follows:

(1) Bindweed and Texas blueweed can be controlled by applying 2,4-D; however, one or more applications of spray are necessary each year for approximately three years.

(2) The ester form of 2,4-D gives the most satisfactory results.

(3) Low gallonage applications are as effective as the higher rates with 20 gallons of liquid to the acre being satisfactory.

(4) Failure is almost certain when 2,4-D is sprayed when it is windy, dry, or when temperatures exceed 90 degrees Fahrenheit. Fall spraying appears to give the best results.

Bindweed control work at the New Mexico Agriculture Experiment Station during 1945, 1946, and 1947 have been largely confined to applications of 2,4-D. From this work several rather definite conclusions were made. Both salt and ester preparations of 2,4-D are satisfactory, the salts being preferable in respect to price and their non-volatility. On a parent acid basis one to two pounds to the acre rate is satisfactory, the heavier applications retarding regrowth for longer periods. Deep plowing of the bindweed infested fields, prior to emergence, results in higher percentage kills with fewer sprayings of 2,4-D. This is probably due to a smaller, broken-up root system containing limited root reserves, and which in large is effected by the translocated chemical. Bindweed growing in strong competition with Johnson grass and other weeds, or in crops planted at the heavier rates, is more readily controlled. The grazing by sheep of bindweed infested lands planted to small grains or Sudan grass seriously weakens the weed (reported by others and confirmed at this station). One properly applied spraying of 2,4-D often appears to be equivalent to one entire season of clean cultivation in thinning out the bindweed. Based upon these findings a seven page bulletin was published by the Experiment Station in 1948 describing methods of controlling bindweed by using 2,4-D with cultural practices. The recommendations permit a full crop production program while bindweed eradication is being carried on.

Two years experiments with 2,4-D as a pre-planting spray preclude its possible use with cotton and alfalfa, as germination and seedling survival are very low. Corn, Sudan, and sorghums do not appear to be effected seriously when the sprayed field is first irrigated prior to planting. The Sudan is stunted for a few weeks, finally catching up to the check plots.

Oil sprays for Johnson grass and other ditchbank weeds, when fortified with toxicants such as dinitro-o-sec-bulylphenol and pentachlorophenol, appear very promising. Although high percent kills of Johnson grass were not attained this first year, growth was controlled and greatly reduced in the better treatments. Cost figures indicate that the Johnson grass is controlled much better and at a little less cost than by hand hoeing. It can also be expected that near 100 percent kills of most ditchbank weeds will be attained at the end of the second year. Subsequent seasons should then require minimum time and cost for ditch maintenance as fewer sprays during the season will likely be sufficient. It is important to effect good coverage, supplying sufficient volume to cause the spray to run down the stems. Thirty to forty gallons of oil to the acre appear minimum, and this should be carried in water to make up about 100 gallons of spray. At no time should the plants be allowed to attain any very extensive growth. Heavy initial spray while the root reserves are low are probably advisable, followed by subsequent applications at not greater than four week periods. Depleting root reserves by adjusting the spray schedule to prevent replacement of reserves is unquestionably one important factor in successful kills. It is likely that 6 or 7 sprayings the first year are preferable.

OREGON STATE REPORT

Virgil H. Freed

Associate Agricultural Chemistry—Farm Crops Dept.

During the year of 1948 a gratifying increase in weed control activities was seen. During past seasons it has been estimated that nearly 400,000 acres of land has been treated for weed control. These figures breakdown somewhat as follows: selective spray in grain—300,000, selective spray in grass seed 25,000, selective spray in pastures and ranges—25,000, 30,000 perennial noxious plants, miscellaneous 20,000. These figures represent a tremendous increase over the amount of chemical weed control during the past several years. It is difficult to estimate the number of acres that were under cultivation for weed control this past season.

In early 1948 the Extension Services concluded their series of weed control equipment meetings. These meetings were held in some 25 of Oregon's 36 counties and were greeted with a great deal of interest by farmers and others working in the field of weed control. The pattern of these meetings consisted of a subject matter talk by extension specialists on weed control chemicals and equipment for weed control and then a demonstration of various items of equipment by representatives of the manufacturer's company.

A development in 1948 that has aroused considerable interest was the demonstration of the practical usage of I.P.C. on Ladino clover and certain other crops has made a substantial economic rate to the farmers employing it. It has enabled them to maintain their yields and stands for a longer period of time. It is expected that even more I.P.C. is going to be used in 1949, at its current high price.

In November of this year the Oregon Seed League included on their program a weed control conference for Oregon. It was estimated that over 250 were in attendance at this meeting. It is anticipated that this weed control conference will be held annually probably prior to the Western Weed Control Conference.

The Oregon Agricultural Experiment Station recognizing the importance of the chemical aspects of weed control has changed their weed program to a cooperative effort between the Departments of Farm Crops and Agri-

cultural Chemistry. Plans are under way to draft a master outline to serve as a guide for all weed research activity in the state. This would encompass a number of departments on the campus and on all of the Branch Experiment Stations. Trials concerning selective weed control in grain were conducted at three stations and an effort to establish the proper material, time of application, and rate of application for this purpose. Additional research has indicated the value of I.P.C. not only for the control of weedy annual grasses but also for such grasses as quackgrass. The station is now undertaking a research project under the auspices of the Atomic Energy Commission employing radio active isotopes to study all modes of action of plant growth regulators.

UTAH STATE REPORT

George Hobson
State Weed Supervisor

1948 has been a banner year in weed eradication, in that there has been a much greater participation, and better results than any of the twelve years previous, since this organization has worked on a cooperative plan between the state, county, and land owner. We have now quite fully recovered from the false wave of success or marvelous work that could be accomplished with 2,4-D. We have settled down to a realization, that it is another important aid to weed eradication; but we must not fail to recognize it is yet the best all-around chemical developed for weed eradication purposes.

In the immediate past, we have made special effort to eradicate new weed infestations and to center our task on areas which present serious threat to spreading over the state and which, also, are confined to small areas. Especially is this true in eradicating wild poppy and Chrosporah tenella D.C. In these areas, much has been accomplished. Three thousand acres of wild poppy have been reduced 85 percent in two seasons. Chrosporah tenella D.C. reduced in the same period 75 per cent.

Special effort has been expended on a Russian knapweed with very little success. 2,4-D has been used in each case. Education meetings were conducted in most counties in the state by the extension service giving results of experiment conducted by the agricultural college, and acquainting farmers with the various kinds of crops that are not affected seriously by the use of 2,4-D. This educational service was a part of our state program and we hope to also continue the educational work in 1949.

Cultivation: Cultivation has been less and less participated in year by year since the advent of 2,4-D. It is now only used by few counties in the state, and in eradication of grasses, mainly Burmuda and Quack. There are a few farmers who still cultivate for the dual purpose of weed eradication and building fertility of the soil.

Quarantine: Experience has shown that to concentrate on a serious infested area by use of the quarantine has been very successful. Results are by far more rapid than in areas where volunteer work is conducted. However, we do not quarantine an area without the consent of most of the land owners in the area. To do so otherwise would invite opposition. It is quite impossible to do the most effective work with 5 per cent of the land owners in opposition or luke warm to the program. Under the quarantine system, the parties in opposition can be required to cooperate. Experience has shown that when the work is thoroughly established in an area that even the people who first object to it offer no resistance. Our quarantines are usually lifted after the second year.

Chlorates: The use of chlorates has very much been diminished in comparison with the past. There is yet some demand for controlling grasses on ditch banks and areas where sterilization is not important. There are some land owners who use it in preference to other kinds of chemical. Last year 50 thousand pounds were used.

2,4-D: We have been using 2,4-D for the past four years. It has been extensively used in 1947 and 1948. Best results have been obtained on highways, canals, and waste land, and on areas which have not been disturbed by cultivation. On such areas, lands can be treated at proper maturity and stage of growth. An early and late season treatment in the same year has proven very successful. Fall applications of 2,4-D has been limited, except in 1948, special attention was given to applying it in the late season. We are looking forward to good results by this method in 1949. The use of 2,4-D in spraying crop land is doubling each year. The rate of kill is not as rapid as on waste ground. The application of 2,4-D to growing crops has been most effective in preventing the maturity of weed seeds, resulting, also, in reasonably good kills.

We have had better success in treating grain fields twice—first before the boot stage and the second after harvest than with one application. Following twice a year treatment for two seasons has resulted in almost complete eradication.

2,4-D has been used at the following rates:

White Top, Canada Thistle, Russian knapweed ..... 1½ to 2½ lbs. acid

Wild Morning Glory, Most other weeds ..... ½ to 1½ lbs. acid

Equipment: Most counties are pretty well supplied with weed equipment. We have tried wherever possible to encourage private ownership of equipment. Much has been accomplished in this effort. We have approximately 250 spray machines in operation at the present time. County equipment that was used in cultivation has been converted to spray purposes, and, in many cases, it is too large to do proper field spraying, but it is being changed as rapidly as possible to equipment that will do less damage to the crops. Most counties have difficulty in keeping up with the demand for weed control.

Research is being conducted by the Agricultural College at Logan, Utah, and new ideas are being embodied in weed eradication as thy eare being developed. We still feel that much can be accomplished by research and hope that such work will be increased.

WASHINGTON STATE REPORT

W. C. McMinimee
State Weed Control Supervisor

The following is a report of the progress and operations of the Weed Control Division during the past year:

I. Noxious weeds constitute a real menace to the farming industry of this state. Almost all lands are infested with one or more varieties of noxious weeds which cause a great loss to the farmers each year. In 1948-49 a survey of the State of Washington was made by the State Department of Agriculture, cooperating farm organizations,

and the Washington State College. The noxious weeds, primary, secondary, and poisonous were placed on a survey map by counties. The Washington State Grange, State Cattlemen's Association, and the State Farm Bureau has appointed weed committees to act in an advisory capacity in forming the weed control program in the state.

II. Soils in the State of Washington vary in moisture, drainage, texture, depth, and available plant food from farm to farm and from county to county, and since environment has a great influence on weeds, it was found that the different weed killing processes must be adapted to individual areas and counties.

III. The weed control program has been divided into four major problems:

1. Economic loss to farmers, lands and cattle in the state.
2. Weeds as a harbor of plant diseases.
3. Weeds as a harbor of insects.
4. Weeds constitute a public health menace.

IV. The State Weed Division of the State Department of Agriculture is cooperating, advising, and assisting counties, farm groups, commissioners, and public agencies in forming county weed programs, weed districts, and weed extermination areas. It was also found that after counties had formed county weed control areas, administrative officials of the railroads, public and federal agencies, had to be contacted and advised on the proper procedures to carry on their program of weed control as set up by the county commissioners of different counties. Weed control activity in the State of Washington was given a great push as a realization on the part of the farmers that recent development in herbicides for weed control have proven highly successful, also the labor cost saving, and increased crops in wheat areas. The most revolutionary of these has been the use of the herbicide known as 2,4-Dichlorophenoxyacetate as a weed killer. Other weed killing methods such as the control of weeds in Alfalfa with dinitro products, and the selective control of weeds in carrots with oil, and the contact pre-emergence sprays for weed control work in sugar beets and other slow germinating plant seeds have also been used.

V. **Quack Grass.** The herbicide ATA (ammonium trichloroacetate) and STA (sodium trichloroacetate) have been used very successfully in controlling and eradicating quack grass. These herbicides are new products placed on the market in 1948. Rates used were 1 pound to 1½ pounds per square rod with retreatments applied directly to the ground.

VI. **Control of Weeds in Grain.** During 1948-49 many wheat farmers used a selective herbicide, 2,4-D to control broad leafed weeds in wheat, oats, and barley. Many thousands of acres of wheat, oats, and barley fields were sprayed with the chemical 2,4-D by airplane and ground rigs. The elimination of such weeds as mustards, tar weed, Canadian thistle, yellow star thistle, and other broad leafed weeds in many cases increased the yield of the crop and also made it much easier to harvest.

VII. **Soil Sterilization by the use of Sodium Chlorate and Borax.** Another program of weed control was the use of sodium chlorate and borax to control weeds. The sodium chlorate and borax leaching into the soil by rainfall in the spring and fall killed the weed roots directly and thereby eradicated the growth of these noxious weeds.

VIII. **Electric Weed Control.** Electric weed control method was tried on various weeds and various types of soil. It was found that there was a too big return of noxious weeds by this method and very little was done in the year of 1948. Further experimentation and the change of the type of machinery may reveal the possibilities and the limitations of eradicating noxious weeds.

IX. **Special Weed Problems.** This past year biological control of Klamath weed has been tried by a species of an insect known as the Chrysolina beetle in Spokane County. This insect was brought into Spokane by the U. S. Department of Agriculture and eats only the leaves of the Klamath weed. However, since this is a new insect, and brought in from Australia, its life habits had to be changed so that it could eat in our summer. Since only a very few of these insects are available, the program has not been too extensive. The Klamath weed is probably one of the most noxious weeds in the state and is taking over more agricultural land each year. These lands are becoming unproductive. Borax will have to be used until some other method is found to control this weed. However, applications of Borax must be made at the rate of 12 to 15 pounds per square rod and sometimes the cost of this herbicide is more than the land is worth, causing farmers much concern.

X. **Poisonous Weeds on Ranges.** This past year the following poisonous weeds have been found in the state and on cattle and sheep ranges: tarweed, water hemlock, poison hemlock, jimson weed, low larkspur, foxglove, henbane, creeping buttercup, poison ivy, poison oak, cocklebur, death camas, and tall larkspur. The forest service and Agriculture Conservation Association of the Production and Marketing Administration range supervisors are assisting the state weed supervisor in eliminating such weeds that may be poisonous to cattle and sheep. There is much territory to cover and this will be a very important project.

XI. **State Highway and Railroad Weed Program.** The state highways and railroads within the state have been very cooperative in following the weed control program on their properties where weed control districts have been formed and have followed regulations made by the county commissioners in controlling their weeds. An established policy of both the state highway and the railroads has been to follow county regulations in the control of noxious weeds in counties where weed control areas have been formed. In some counties arrangements have been made between the county commissioners and the public utilities for the spraying of weeds on their right-of-ways under the supervision of the county weed supervisor. This arrangement has been very successful in that the county weed supervisor was able to spray the noxious weeds at the proper time and in many cases eliminated the further spread of such weeds as wind blown weeds and other noxious weeds that have been detrimental to farmers who have their own weed program.

XII. **Agreements in Weed Control, Discoveries, Surprises.** In some farm areas there is the:

1. **Method of Agreement** among farmers where soil textures, etc. are similar and farmers through farm organizations have had the opportunity to discuss the best methods of control and weed problems;
2. **Methods of Difference,** where soils are similar, circumstances are common except where unusual cli-

matic conditions such as rain or other elements have caused discovery (example) erosion caused by cultivation on hilly terrain).

3. **The Joint Method of Agreement** where soil and climatic conditions are similar, where terrain is the same, and the results of weed kill has been uniform.

Disagreements concerning the use of chemicals have caused discoveries. Ideas from farmers have been an important source of discovery. The finding of an application of 2,4-D directly to the roots in cranberry bogs is a good example of a farmer developed discovery and surprise.

XIII. **Agricultural Conservation Program.** The Agriculture Conservation Program of the U. S. Department of Agriculture has broadened its policy on weed control payment for farmers. The county committees set up weed control as farm practices and payments were made to farmers who complied with their weed control practice.

XIV. **County Weed Control Programs.** The State of Washington has two weed laws known as the 1929 law and the 1937 law. Weed districts may be established by the county commissioners upon request, by petition of over 50 per cent of the acreage desired to be included within the proposed district. At the present time, Kittitas County has three such districts and Grays Harbor, one. Yakima County farmers have petitioned for a district to cover the new Roza lands and Pacific County farmers have petitioned for a district to cover the lands near Menlo, Washington. The 1937 law is known as the control and eradication law which covers all lands within the county. The operation of this law is under the local county commissioners and county weed supervisor. The county commissioners make the regulations for the county. In most counties, the county commissioners have appointed an advisory committee of farmers to assist in an advisory capacity concerning regulations that should be made to control weeds within the county boundaries. Whitman, Spokane, Asotin, Garfield, Columbia, Walla Walla, Wahkiakum, Douglas, and Pend O'Reille Counties are operating under the 1937 law with Cowlitz County and Adams County planning their weed programs under the 1937 regulations. Several other counties' farm groups are meeting at the present time and are planning their weed programs either under the 1937 or the 1929 weed laws.

XV. **City Weed Program.** Several cities within the state are now working with the state weed supervisor in formulating plans to control weeds which will coincide with the over-all county weed control program. In some cities, mention has been made that there will be appointed a city weed supervisor to coordinate all the activities within the city boundaries.

XVI. **Recommendations.** Farm groups through their farm organizations are making recommendations to assist the state weed program, feeling that the spread of weeds is caused in many cases by the carrying of weed seeds in farm crops such as alfalfa, fertilizer, and machinery from one county to another, thus infesting the whole state with noxious weeds. In the last state weed survey with the assistance of farm organizations and the State College of Washington, it was found that 45,190 acres are now nonproductive because of noxious weeds. These farm lands were at one time productive. Also 1,194,643 acres of farm lands reported noxious weeds. One county (Kittitas) estimated that weeds cause a loss to farmers each year of over $600,000.00. Estimated loss to farmers, cattlemen, and others in the state of Washington is between $75,000,000 and $100,000,000 each year.

The farm organizations, such as the Washington State Farm Bureau, have recommended that the State Legislature appropriate matching funds for salaries of weed supervisors in counties having organized weed districts on a basis of 25 per cent from the state and 75 per cent from the county, such funds to be controlled by the County Commissioners. This legislation would assist low valuation counties to have county weed supervisors. Legislation for matching funds with counties and farms to eradicate new noxious weeds before infestation begins has been proposed.

The county weed supervisor shall make, by December 15, of each year, an annual weed control and eradication report to the State Department of Agriculture on a form supplied by the State Director of Agriculture and such other weed reports as requested by said Director or his duly authorized representatives. The state cost would be approximately 100 thousand dollars per year or 200 thousand dollars for the biennium.

State Supervisors Recommendations:

1. The State Department of Agriculture, through a State Weed Control Supervisor will be delegated to coordinate all agencies within the State into a strong action weed program.

2. A well organized county action weed program must be coordinated by the county weed supervisor. A county weed fund to be established in each county.

3. Continuance of a county weed advisory committee selected by farm organizations appointed by county commissioners who will act as a steering committee and act as an advisory committee to county commissioners.

4. That all counties form weed control areas under either the 1929 or the 1937 laws.

XVII. **Research and Experimentation.** Dr. Lowell Rasmussen, weed investigations from Washington State College and Mr. Victor Bruns, from the Bureau of Plant industry, U.S.D.A., Prosser, Washington, have started their research and experimentation programs at the two above mentioned stations. The results of their research and experiments have proved to be a great help to the weed program in the State of Washington. Dr. Rasmussen and Mr. Bruns have been very cooperative and the results of this past year's research for experiments have proved valuable to all the agencies involved in weed control work. Weed research men should be added to the Puyallup Experiment Station for the coastal areas to determine the best methods of control and eradication of noxious and annual weeds.

XVIII. **Environment and Evidence.** Environment has had a great influence on weeds and the importance of evidence and different kinds of evidence; weeds are complex organic compounds with the result that it is more difficult to determine always the elements of cause and effect, of different herbicides and other methods of weed control.

XIX. **Farm Machinery and Personal Factor.** Users of herbicides on the farm have shown great improvement in the knowledge of coordinating the different types of chemical spray machines and chemicals to be used on noxious weeds. Soils in the State of Washington vary in

moisture, drainage, texture, depth of soil, from farm to farm and from county to county with many different kinds of crops involved. To coordinate all the above mentioned factors must include small diversified, large wheat and pea farms, forests, railroads, and highways.

XX. The following bulletins have been published in 1948 by the State Weed Control Supervisor's Office:

1. "Excerpts from State Department of Agriculture in U. S. on their Weed Program."
2. "Summary of the Survey of Noxious Weeds in the State of Washington (1946)."
3. "Tillage and Chemical Methods Used (State weed control survey)."
4. "Weed-killing Equipment". (Suggested Aids).
5. "How to Start a County Weed Extermination Area and Its Operation".
6. "IPC (isopropyl-N-phenyl carbamate) and ATCA (ammonium trichloroacetate) as a Quack Grass Killer."
7. "Information on Chemical Weed Killing."
8. "2,4-D Information, Chemical Weed Killing (Dilution Table)".
9. "Pre-emergence Spray for Weed Control in Sugar Beets."
10. "Weed Control by Oil Spraying in Carrots and Related Crops."
11. "Weeding Onions with Diluted Sulfuric Acid and Other Chemicals."
12. "This is the News on Fighting Weeds in '48".
13. "This is How to Form a County Weed Control Area Under the 1937 Law."

13a. "How to Form a County Weed Control or Several District Within the County Under the 1929 Law."

14. "1948 Chemical Weed Control Sprayers."

XXI. **Report of State Weed Survey.**

Number of farms	79,787
Number of farms reporting noxious weeds	53,208
Farm lands reporting noxious weeds (acres)	1,194,643
Non-farm lands (acres) reporting noxious weeds	1,247,480
Number of farms on which weed control was conducted	22,772
Amount paid to farmers by A.C.A. for weed control	$114,759.50
Money spent by county for Weed Control (approximate)	$157,718.50

Summary of Weed Control Practices in the State of Washington as reported for the year ending 1948. The estimated chemicals used at the time of this report is three to one over 1948.

	County Agencies Reporting	Agric. Conservation Association Reporting
	1,308,552	1,999,444
Cultivation		
Farms	8,983	
Acres	511,797	1,424.9
Chemicals		
2,4-D		
Acres		9,432.3
Pounds	167,145	36,667.33
Gallons	340,741	373.95
Sodium Chlorate		
Pounds	1,308,552	1,617,809
Acres		297,517
Atlacide, pounds	31,650	
Carbon Bisulphide		
Acres		81.5
Gallons		1,270
Ammate,		
Pounds	128,800	198,945
Borax,		
Pounds		52,625
Paint Thinner,		
Gallons	65,769	80,077
Copper Sulphate,		
Pounds	4	300
Diesel Oil,		
Gallons		1,671
Iron Sulphate,		
Pounds	4	6,815

WEEDS SUSCEPTIBLE TO 2,4-D

These weeds have been effectively controlled by the use of 2,4-D:

Arrowhead lily
Austrian Field cress
Beggar ticks
Black medic
Blue lettuce
Bullthistle
Burdock
Bur-reed*
Buttercup
Canada fleabane
Canada thistle*
Cattail*
Cheese-weed
Chickweed
Chicory
Cocklebur
Creek nettle
Curly dock
Dandelion
Dog fennel
Fan weed
Hoary cress
Indian strawberry
Kelp*
Klamath weed (St. Johns' wort)
Knotweed
Lambsquarters
Milk thistle
Mouse-ear chickweed
Mustards
Nettle
Pennywort
Perennial dogbane*
Perennial ragweed*
Plantain
Poison hemlock
Poison oak
Prostrate pigweed
Prickly lettuce
Puncture vine*
Purslane
Red clover
Rough pigweed
Russian thistle (young)
Sedge
Sheep sorrel**
Shepherd's purse
Sow thistle (annual)
Sow thistle (Perennial)
Spiny clotbur
Spotted spurge
Star thistle (rosette)
Sweet clover
Teasel
Tules
Tumbling pigweed
Water hemlock*
Water hyacinth
Water plantain
Water primrose
Western ragweed
White horse nettle
Wild buckwheat
Wild carrot
Wild lettuce
Wild morning-glory*
Wild radish
Wild sunflower
Willows*
Yellow star thistle

WEEDS RESISTANT TO 2,4-D

These weeds are difficult to control by the use of 2,4-D:

Alkali mallow
Annual bluegrass
Baby tears
Mayweed
Milkweed
Mullein

Bermuda grass	Nutgrass
Blackberry	Oxalis
Bluegrass	Quackgrass
Bracken fern	Ripgut grass
Buttonwillow	Russian knapweed
Crabgrass	Sand bur
Foxtail	Soft chess
Goldenrod	Tansy ragwort
Goosegrass	Water grass
Horsetail	Wild barley
Italian ryegrass	Wild oats
Johnson grass†	Yarrow

These weeds have been divided into two main groups as a matter of convenience, but such a division is tentative, and the lists may change as more tests are conducted and more information becomes available. Weed response to 2,4-D depends upon various factors. Esters of the 2,4-D are more effective on **Hard to Kill Weeds.**

Borax: 15 to 20 pounds or 2 pounds of Sodium Chlorate plus 6 pounds Borax per square rod or more, provided enough rain falls during same season to leach it into the zone of absorbing roots. (apply in October and March).

** Sodium Chlorate: 3 to 4 pounds per square rod or more provided enough rain falls during same season to leach it into the zone of absorbing roots (apply in October and March.)

‡ Diesel Oil—Oil and 2,4-D.

† ATA and STA.

* Those marked by an asterisk(s) (*) (**) may require two or more treatments.

WYOMING WEED REPORT

George B. Harston

State Department of Agriculture

The Wyoming weed control program, during the past season and since the Sacramento meeting of the Western Weed Conference, has progressd as satisfactorily as could be expected with funds and facilities available.

State-County-Landowner Cooperation

The State Legislature made $52,000.00 available for weed control during the 1947 to 1949 biennium. The money was allocated and distributed to counties having legal weed and pest control districts. The counties appropriated and used at least one-third of the cost of the program, and the landowner contributed at least one-third of the total cost of the weed control work.

The Thirtieth Wyoming Legislature, which is now in session, has passed a bill providing for $58,000.00 to be distributed to participating counties. The same Legislature has amended and re-enacted the weed law to require the landowner to contribute at least 50%, the counties at least 30% and the State not more than 20% of the total cost of the program. This provision will make the state money go much farther in the control of noxious weeds.

In addition to the above weed control program in counties having legal weed and pest control districts, the Legislature made $7,281.00 available to the Department of Agriculture for use in spraying noxious weeds in counties where no legal district exists. This will largely be used on highways.

2,4-D

The popularity of 2,4-D formulations in Wyoming has been similar to that reported from other States, although some of our landowners are continuing to use carbon bisulphide, atlacide, cultivation and cultural practices under some conditions with relatively good success. The 2,4-D sprays have been very helpful in seed control and are promising eradication of the more susceptible weeds.

Research

Mr. Dale Bohmont, at the University of Wyoming, is now devoting the major portion of his time to weed control research. A weed control course is also offered at the University, and much interest is being shown in the weed control problems.

Weed Control Through Seed Law

We continue to place emphasis on the importance of planting only crop seeds free from weeds as a very important weed control measure. Mr. Charles Allen, State Seed Analyst at the State Seed Laboratory in Laramie, is doing splendid work in his analytical and cooperative regulatory work. He is successfully building on the foundation started by Mr. Lambert Erickson, our former Seed Analyst.

It is worth while to attend conferences such as this and to learn of the activities of other states. It is interesting to hear the report from Mr. Ball of California, and to learn that the electrovator does not satisfactorily do the job of weed eradication. This experiment has merit in the fact that failures enable us to turn our attention to other possible solutions.

Exchanging information and taking advantage of successes and failures of others enables us all to advance in this western and national problem of weed control. We think that continued efforts must be made to get adequate weed control on federally owned lands, such as the Forest Reserve and Indian reservations. Some of these federally owned lands in Wyoming are seriously infested with noxious weeds, which the State, counties and landowners are struggling to control. This federal weed menace cannot be ignored.

THURSDAY, FEBRUARY 3

Afternoon Session

The conference reconvened at 1:15 p.m. with the opening address by President W. W. Renne of Montana State College. This was followed by a talk by Albert S. Curry and two panel discussions, those of the Research Committee and the Education and Publicity Committee.

OPENING ADDRESS—ELEVENTH ANNUAL WESTERN WEED CONFERENCE

R. R. Renne, President Montana State College

Mr. Chairman and Mr. Morris, it gives me a great deal of pleasure to be here with you this afternoon. I am sorry we couldn't meet on the campus, but I am sure you appreciate the fact that in these times of very crowded conditions, it is just impossible to hold a conference while classes are in session. I should also like to welcome you to our campus. I am very glad to see so many of you—I understand each state is represented. It is also my understanding that this is the first time, in the eleven years that your Conference has been in existence, that it has met in Bozeman. The story is told of correspondence that took place between Winston Churchill and Bernard Shaw, the great playwright. Shaw had invited Churchill to attend one of his plays, enclosing two tickets, saying the "second ticket is for a friend, if you have a friend." Churchill, not to be outdone, wrote back promptly that he would be glad to attend the play the first evening it was presented, since he wasn't sure there would be a second performance. I hope that there will be a second

meeting of your Conference in Bozeman—even though I am not sure about the weather. As someone has commented, it has warmed up to zero today—a relatively warm day. I suppose that this cold weather that we experience in our northern states has its merits; it gives us an opportunity to reflect—to meditate on some of the problems that confront us. I had a great educator tell me once, about a very serious problem that we were discussing, "Now, I don't want you to be worried about this—I just want you to be concerned." I am not sure yet just what the difference might be. I expect that our weed problems do worry you—certainly they should be of some considerable concern.

Since I am not a specialist, I know that you do not expect a technical talk about weeds. I might, as a college president, tell you a little bit about how important I think your work is. Sometimes college presidents don't know too much about anything, especially when the legislature is in session, but certainly we do have an opportunity to appraise the different parts of our program of work.

Weed control is an extremely important part of our whole conservation effort. I hope that this meeting may impart to all of you a renewed enthusiasm, a deeper faith in your work, and an appreciation that after all your job is extremely important. I think it is tremendously important today for us each to have considerable vision and breadth of knowledge if we are to meet the problems of the future effectively.

Not so long after the turn of the last century, there was a wooden covered bridge over a river near Stanford, Connecticut. It was a fine bridge, 1200 feet long, 40 feet above the low water point, painted a deep red. One afternoon in late summer when the sun was getting ready to set, a farmer and his team came along with a big load of hay. The farmer looked at the bridge a moment, and then turned his team around and headed back for the farm. One of his neighbors asked him what the trouble was. "Well, I knew I could get in at this end all right—but I was pretty sure I couldn't make it through that little hole on the other end."

Breadth of knowledge is essential if we are to see the possibilities of ten or twenty years hence and not just those of the present.

We all need to know something about weeds and modern agriculture in a very general way. We need to know something about the efficiency of agriculture, not only in this country but abroad, and what the prospects are for the next quarter century, because that will be the period in which most of us will have our most productive years of service and we want to know what the need will be for our program of work.

There are two points of view with regard to agriculture and food supplies. One is that population increases faster than does our ability to produce food. The other holds that with the development of nuclear energy resulting from the invention of the atom bomb, with modern science and technology, we are fast learning how to produce more efficiently, so that soon prices will be ridiculously low and unprofitable, and we will have a distressing situation. These are two very different points of view.

In 1798 T. R. Malthus advanced the theory that population increases in a geometric ratio, while food supplies increase arithmetically. He argued that every 25 years the population tends to double itself, while food supplies do not increase in any such ratio and that sooner or later we are bound to be very much up against it because of starvation.

There are two recent books that I'd like to call your attention to: one is the "Plundered Planet," and the other, "The Road to Survival." You will find them interesting, and I think, significant, reading. Both have as their main theme the necessity for the best possible conservation practices, at the same time coupling these with the control of population increase through birth control and other devices if we are not to face serious food shortages.

What are the facts regarding the need for food? Before this last war, more than half of the world's population, which is more than two and a quarter billion had never experienced a diet of as much as 2250 calories per day. This last year we Americans enjoyed a diet of 3400 calories per day per capita. Studies conducted recently, one in Minnesota, show that when the diet gets much below 3000 calories, it is impossible to operate a democratic form of government. When the food supply is reduced below that figure, people become passive, listless, and then some individual in the bunch comes forward as a big promoter, and in that sort of listlessness, that "let George do it" attitude, the people allow the promoter to take over. It has been established that there was a very close relationship between the diet levels and the extent to which they could support and maintain a democratic, free enterprise economy. It is extremely important that satisfactory food levels be maintained.

During the past 10 years the world's population increased two hundred million people. Each year there are between fifteen and twenty million more people in the world. We shouldn't forget, however, that during the period since 1940 our population in the United States has increased from 132 million to an estimated 148 million—an increase of 16 million or 12 percent in less than a decade. By 1972, approximately a quarter of a century hence, it is estimated that the world's population will not be two and one-fourth billion but two and three-quarters billion, and it is estimated that our own population will be 175 million; in each case the world's total and that of the United States will be about one-fifth over the present levels. A fifth is a very sizeable increase. What about our ability to produce?

I have tried to give you a picture of our need. Our agricultural production is between one-fourth and one-third above the pre-war level. Our consumption per capita is up about 17 percent over that of pre-war. We have increased our efficiency, that is, our output per worker in agriculture, by 40 percent over the 1935-39 average, and in terms of output per worker we have doubled our efficiency in agriculture since 1910. It appears, then, that in the normal individual's lifetime, it is possble to quadruple the efficiency in our agricultural production.

Currently we are eating more, and we are sending a great deal of produce abroad.

Dr. Charles Kellogg—I am sure all of you know him—of the United States Department of Agriculture, who is one of the most eminent soil scientists in the country, says that we could increase our food production in this country at least one-fifth with more general use of farming practices already known. In other words, with no new

scientific knowledge but through a process of extensive education, getting more general use and practice of these techniques, we could increase our agricultural production by one-fifth. He concludes, then, and justifiably, that because so many countries are more backward than we are, extensive education—with no new research; just using the knowledge we have—would permit more than a fifth increase in other areas. Obviously they will require considerably more development than would be necessary in our own country if this increase of one-fifth is to be achieved without bringing any new lands into production. If we had general, wide-spread use of agricultural practices already known, we could feed the world's population and our own adequately in 1975 in such products as cereals, root crops, potatoes, and sugar. Dairy products, meat, fruits and vegetables, nuts, fats, and oils would require new lands in addition to the increase in production efficiency.

Dr. Kellogg goes on to point out that utilizing one-fifth of the present unused lands in Central and South America and Africa, we would have 900 million additional acres—that is twice the total crop acreage of this country. We could secure an additional 100 million acres from the great ocean islands like Madagascar and Borneo. Thus, only one-fifth of the currently unused lands in these tropical areas would bring into production one billion acres of land. Dr. Kellogg's conclusion is that the earth can feed her people. But, the fact that we **can** does not necessarily mean that we will.

Three very important things will be necessary to bring this about: (1) An almost miraculous statesmanship to achieve international understanding, confidence, good will, cooperation, and peaceful conditions; (2) along with this we will need to have a very broad and thorough education program; and (3) a fine, continuous, broad, expanding research program.

Those of us who are in land grant colleges and agricultural experiment stations have a big opportunity and responsibility in our educational and research work in soil fertility, maintenance, and conservation, including weed control. It is possible for the earth to feed her people adequately even with this considerable increase of one-fifth which is predicted for the next quarter century.

Some people work best under the threat of starvation. Others work best with a scientific interest in the program that will enable us to reach our maximum potential. Whichever type you happen to be, I am sure you will agree with me that conservation and the intelligent use of our soil resources must become a basic philosophy of living in order that we may practice these sound policies and utilization practices in poor times as well as good. I know that some of us wonder whether our farmers will follow these recommended practices when times get tough—because we have encouraged them through benefit payments, particularly the last eight or ten years, so that it has been very obviously economically practical for them to observe these practices. If the farmer has really grasped the philosophy of conservation—wise and intelligent use of resources—and will maintain good husbandry and use of the soil through thick and thin, we will progress.

I think we must avoid being misled in assuming that the bright prospects of the future are already achieved. I think there is little question but that the next twenty-five to fifty years will bring forth some startling innovations in agricultural production.

Scientists tell us that nine-tenths of the world's photosynthesis occurs in the oceans. If that is true, then through the development of atomic energy, with its tremendous source of power at not too expensive rates, we may be able to produce much food from sea water. From the oceans, we may be able to distill tremendous quantities of water for irrigation. In any case, we will probably be able to re-claim a great deal of soil nutrients from the oceans which have been washed off our land. In fact, with the promises of atomic energy, there are people who might question the value of all this talk about conservation and weed control.

We have not yet reached Utopia in the sense of having all these potentials made available for the present or immediate future. In the meantime, I think it is an important part of our job to give our attention to weed control which is an important part of our soil conservation program, and to wise and intelligent use of our basic resources. Of parallel importance is the wise and intelligent use of our human resources if we are to have a peaceful and progressive world, and if we are to realize just a few of the potentials of the next quarter or half century.

So I hope that each of you will get a great deal of technical and professional help from these meetings, and a renewed enthusiasm and faith in the job that you are doing.

WEED CONTROL PROJECT, R.M.A.

A. S. Curry, Associate Director
Agricultural Experiment Station
State College, New Mexico

I appreciate this opportunity to appear before your conference and give a brief description and explanation of our newly formed Regional Cooperative Project on Weed Control.

I believe, that had it not been for the untiring efforts that this group has spent in past years on this problem of weed control, we would not have made as much progress as we have relative to the program. I feel sure that a great deal of the progress is due to the Weed Control Conference.

The RMA was passed in 1946. It authorized that additional research be conducted on various agricultural problems and also authorized Congress to appropriate additional funds to support this research. I regret that Congress has not found it possible to appropriate as much money as the bill authorized it to appropriate.

One of the outstanding features of the R.M.A. is that it practically orders the experiment stations and various agencies in the Department of Agriculture to cooperate in certain research endeavors. It authorizes the various agencies to work together as best they can to properly utilize their personnel and facilities in their attempts to solve the various problems.

Prior to the passage of this act, the various experiment stations, and the federal agencies of the Department of Agriculture attempted to select lines of work that could be investigated under the provisions of the Act. The directors of the experiment stations had considerable correspondence in an attempt to bring up a series of programs

or projects to be ready if money became available. In September, 1946, the western directors met in Logan, Utah, for the purpose of planning a program specifically designed for operation in accordance with the provisions of this bill, that is, one possessing characteristics suitable for regional cooperation. At the time of the meeting, the western directors prepared in rough form about ten projects suitable for regional approach. When we analyzed them, we found that several hundred thousand dollars would be required for their support, maintenance and operation. Up to that point, we had not been informed as to the amount of money that would be available to start the program.

When we learned that we would have only a small amount of funds for this purpose as compared with the amount we had originally estimated as needed for our group of projects, it became necessary to revise the program downward to a large extent. That was done only to the extent that we felt was necessary. We kept a large number of projects on the program, although we recognized it was not possible to finance them adequately until Congress would appropriate additional funds.

At the time of the first meeting, the directors included a weed control project in their program. However, because of the pressure of other problems, it was not possible for us to assign any funds to that particular project. When the experiment station directors met in Washington last fall, it appeared that because of the possibilities of an increase in the R. M. appropriation beyond the amount of funds required for the projects already in operation, it might be possible that within a year or two we would be able to start some research in connection with the weed control problem.

Consequently, I was given the task of attempting to line up the various agencies interested in making a study of this sort. In the latter part of November, I sent a letter regarding plans for activating the project to interested persons and agencies. As a result, all the western states, the territory of Hawaii, and various agencies in the U.S.D.A. indicated their interest in participating in a study relative to weed control. In starting the project, it was necessary, of course, to carry on considerable correspondence. Letters were sent to the various technicians and various federal agencies interested in the program. The information so gathered was made available, as soon as it was assembled, to all the persons and agencies who had indicated their desire to initiate weed control studies. We called a meeting of the Technical Committee just prior to the meeting of this Conference. That was done because at the present time, no funds have been assigned to support this project and if men were to come to this meeting, some provision had to be made for their expenses. Two days were spent on the campus working on a proposed regional cooperative project on weed control. It will be identified as Western Regional Cooperative Research Project No. 11 on The Control or Eradication of Weeds.

Before this project can be activated, it will require the approval of various groups such as the Association of Western Directors, and the Committee of Nine—and the allocation of funds. It has the following objectives, as prepared by the group of technicians:

> To evaluate, improve and devise or discover means of controlling or eradicating w e e d s (undesirable plants) with maximum efficiency and minimum injury to associated plants, soils, animals and man. Problems included apply to field, fruit, vegetable and pasture crops on irrigated and non-irrigated land; to ranges, forests, drainage areas, irrigation and drainage ditches, right-of-ways, recreational, aquatic, waste and other areas having weed problems.

To a group, such as is represented by this Weed Conference, it is not necessary to advance any arguments, relative to the need for this work. However, the arguments in the project outline are intended to induce the uninitiated to give us the necessary financial support. We are contending that the thoughts mentioned below represent some of the reasons why support of a weed control project are necessary: weeds reduce the yield and quality of the crop, compete with crops for moisture and plant nutrients, increase the cost of processing crop seeds and other products, they cause livestock losses and harbour insect and disease pests.

Because of these effects on crop production, weeds tend to bring about a reduction in value of land and other property and are a hazard to the health of man. I believe this is one point that should be given considerable attention, more than it has been given in the past. I think the research people should give attention to this angle as well as to the livestock one. It might be as important to the welfare of the nation to study the various factors, problems, conditions, etc., which have to do with the health of our people as it is to study problems which affect our economic status.

The weed research problem is one that lends itself very well to the cooperative provisions of the Research and Marketing Act. Weeds are common to all states of the western region and Hawaii as well as in other parts of the country. Many of the technical problems associated with them can be studied in different areas by coordinating our efforts and combining the results so they will be generally applicable. It is a problem that lends itself well to cooperative and regional effort. In attempts to solve the problem, it is planned that such factors as various cultural methods for the control if weeds, their morphology and ecology, and the effectiveness of herbicides will receive further study than they have received up to this time. The economic factor is one that we plan not to overlook and it is hoped that some of the first work to be done will be approached from that angle.

These comments should indicate the type of studies that we think will be involved in carrying out this project. If regional cooperative projects are to be successful, it is necessary that the participants be organized so their objectives and efforts can be properly guided and directed.

We have, at this meeting, formed a technical committee composed of one representative from each of the experiment stations and the federal agencies for the purpose of initiating the studies covered in this project. Its functions will be to plan the program, review, and analyze the reports, from the various sub-projects, prepare progress reports and budget suggestions and revise the study program, if necessary, as the work develops.

Question: When do we get the money?

As the cooperative research program is set up now in the west under the 9b3 section of the R.M.A., we have 10 projects that have been officially approved for operation. One of those ten is inactive and Project No. 10 at this time has not received any funds with which the project could be operated. We anticipate that next year Congress

will appropriate additional funds. The increases will be used, I think, to support projects now active. It may be that Congress will appropriate more money than we think it will and if it does, I am rather sure that it will be possible for us to start work on W-11 project. It is of course, not possible to state positively at this time whether we will get the money for the coming fiscal year.

PANEL DISCUSSION—RESEARCH COMMITTEE

Lambert C. Erickson—Chairman
University of Idaho

Mr. Erickson, Chairman, introduced the other members of the panel: Mr. Grant A. Harris, Spokane Research Center, U. S. Forest Service; Mr. F. L. Timmons, Agronomist, U. S. Dept. of Agriculture; Mr. Lowell Rasmussen, Washington State College; and Mr. R. N. Raynor, Dow Chemical Company.

He asked them each to give a short summary of the objectives and scope of their work, and further to analyze the trends in research and operations that had developed in the past few years. Lastly, he asked them to express their personal opinions as to what trends in weed control or research would be or should be exploited to the greatest extent in the near future for the greatest good of the program as a whole.

ERICKSON: Mr. Timmons would you lead off in this panel with a discussion on research and trends in your branch of service?

TIMMONS: The principal objectives of the weed research project in the eleven western states which our Bureau of Plant Industry, Soils, and Agricultural Engineering is conducting in cooperation with the Bureau of Reclamation and several State experiment stations is to develop and improve methods of controlling aquatic weeds, ditchbank weeds and farmland weeds under irrigation. As our funds are allocated now, we are quite definitely restricted to weed problems on irrigated lands.

Our Bureau has four field stations located at strategic points in the west for the study of weed problems on a regional basis. The station at Phoenix, Arizona was established in January, 1947 by L. S. Evans and now is in charge of H. Fred Arle. J. M. Hodgson started the station at Meridian, Idaho in February, 1947, and V. F. Bruns began work at the Irrigation Experiment Station, Prosser, Washington, in June, 1947. My research at the Utah Experiment Station began in June, 1948, when I was transferred there from Kansas.

The research program at each field station has been planned primarily to study the problems of the area in which it is located, the area usually comprising parts of several states. However, the work of the four stations is coordinated in such a way as to supplement that at the other stations, provide some uniformity and geographical replication, and develop a region-wide approach to weed problems. The program at each station is integrated with the weed research work being carried on by the state experiment station in that state in order to supplement that work and avoid duplication of effort.

In addition to the four agronomists on field stations, our Bureau has a plant physiologist, Mr. E. T. Osborn, located at the Bureau of Reclamation Laboratories at Denver, Colorado. Mr. Osborn works with Mr. J. M. Shaw, Bureau of Reclamation chemist on physiological and chemical phases of weed problems in the western region.

At present the regional emphasis of our cooperative weed research program is on the control of aquatic weeds. Most of the studies at Denver have been on that phase and some work is being carried on at each of the field stations. Perhaps, after 2 or 3 years, the regional emphasis will be shifted to another phase.

Local emphasis at the Phoenix station is on the control of Johnson grass on irrigation ditchbanks and other noncultivated land, using aromatic oils and fortified diesel oil. Other experiments under way include control of annual weeds in cotton and flax, and eradication of white horse nettle.

One of the most important studies at Meridian, Idaho is on the effect of aromatic solvents used for controlling submerged water weeds in irrigation ditches on various crops. Another important experiment is on the control of white top by combination cultural and chemical methods.

The chief emphasis at the Prosser station is on studies of the control of quack grass and Canada thistle in orchards and the effect of herbicides used on various kinds of fruit trees. As at the other stations, a number of minor experiments are under way.

My work at Logan, Utah will emphasize the control of annual weeds in vegetables and legumes and the eradication of woody plants, with minor experiments on control of aquatic and ditchbank weeds.

Time does not permit my discussing here the preliminary results of our weed research work in the relatively brief time it has been under way. Reports on this work will be issued as rapidly as results appear to justify definite recommendations.

ERICKSON: People most frequently first ask a researcher what he is doing and, secondly, why he is doing it. Necessity is the mother of all research. It has been pointed out quite clearly this morning and at several times during this conference that weed control research has been delayed in its maturity as a science comparable to other fields of agricultural science.

It is a well recognized truth that the greatest obstruction to man's progress is man's vanity. Only in recent years has this nation become sufficiently realistic to recognize that weeds are one of agriculture's greatest problems. But more important still, society has recognized that there may be more efficient methods of weed control than the methods used for unknown centuries prior to and following the invention of the hoe. People will say today that there is no need for weed research. All you have to do to be free of weeds is to be a "good farmer". Using the same type of reasoning, we quickly reach the conclusion that there are no good farmers since every farmer has his particular weed problem.

Truth is slow to emerge and difficult to recognize. Consider how disillusioned our forefathers were when they were compelled to learn that not their powerful god of disease but little tiny invisible microbes were responsible for the deaths of their neighbors or their own family members. Consider too how disillusioning it was to learn that not the rusted wire fences or the rusted railroad tracks but the barberry bush was the mother host of our northern wheat rust epidemics.

Today in most states someone somewhere is doing something about weed control on intensive crop land but little is being done on our range land. In fact, there is still a possibility of some vanity in man's thinking for the statements made that the range is the best place some certain individuals can think of for all our weeds to grow.

I will now turn the discussion over to Mr. Harris who will discuss the range weed problem and some of the phases of weed research the Range Experiment Stations of the Forest Service are conducting or plan to conduct.

HARRIS: Our pincipal interest is in range land weeds. Since very few people are acquainted with the position of my organization in the weed control set-up, I will try to explain a little about it. I represent the Forest and Range Experiment Station of the Federal Forest Service.

The Forest Service as such has two major lines of work. There is the National Forest Administration which has to do with the sale of the timber, the rental of the grass lands, and the suppression of forest fires. The research branch conducts research for the various services: forest fire, timber management, range wood products, and range management. We have six principal branches in the western United States and the locations of the headquarters of each roughly correlates with the forest reserves: Missoula, Ft. Collins, Tucson, Berkeley, Ogden, and Portland. From these central headquarters emanate the research projects which are then conducted on the experimental ranges. Our research in the past on weed control has been adapting certain systems developed elsewhere to our particular problem; thus we might call it an empiric or "tried and true" type of work. Considerable work has been done more recently in the south on the control of mesquite. An effective but expensive control method has been developed using oil and arsenate powder around trees. The reason that we haven't gone deeply into the problem is because we have been short of money.

The Forest Service has also worked and conducted studies on range re-seeding. The usual method has been to remove the weeds and shrubs and then seed to a grass that would fit the particular range condition.

One of the obstacles in this program has been the cost of seed bed preparation. In Idaho and Utah, the burning has proved very effective. The use of the wheatland plow, moldboard plow, and other heavy equipment is effective but more expensive than burning. We hope to embark on a more fundamental research program. In the research in the southwest region on mesquite at the Arizona Experiment Station where the work is being carried on with R.M.A. funds, we have a basic research program under way. We have two ecologists and one plant physiologist, and we hope to come out with some cures for the actual cause of the plant infestation of the ranges rather than the cures for the symptoms.

ERICKSON: Next we move on to the state level. Lowell Rasmussen in his present job as chairman of our research section has made contact with most of the states through correspondence at least. I will ask him to discuss with you some of the research work that is in progress in some of the states now and what trends are apparent.

RASMUSSEN: The first thing that I would like to point out is that in weed research I believe the first responsibility lies with the individual states. I am definitely a states righter. I do believe that the states, through the experiment stations, must take the lead in weed research; of course they may seek help from other agencies, but they certainly are responsible for taking the initiative and carrying on as far as they possibly can. Such research has been very badly lagging in most of the western states. Various reasons for this failure have been cited, but the work will continue to lag unless the people of the states back the program and support increased progress in research. If we want the answers to all of the various problems, the only way to get them is to set up an adequate research program to determine these answers. It is about impossible for one or two workers to determine the information that is demanded under these current, numerous control methods. We must encourage states to expand and, in some cases, even to initiate research programs. Some of the states have had programs for a number of years—continuous programs are what we need. Many of the states have had programs of an "off and on" nature—intermediate studies—the programs might go a little while and then the man in charge of that work would leave and the work would stop for a little while. Most of the states are beginning to get set up so that they can work on the applied type of research usefulness of certain methods: they are also preparing to do basic or fundamental work on the effect of herbicides on plant life, information necessary in working out the applied form.

To get down to what is being done, we had a committee in our research section working on that phase, and I will give you a summary of the report that they submitted to give you a picture of the situation.

The committee asked for reports on weed research from all state, federal, and commercial workers known or thought to be doing research work. Replies were received from 24 investigators reporting 159 experiments under way. Only 7 of the 159 were concerned with cultural methods, while the remainder involved chemical studies. Most of the chemical experiments are the post-emergence type of treatments and include studies on both crop and weed plants. As yet, only minor emphasis has been placed on pre-emergence control studies in the western states.

Major emphasis is being placed on the response of perennial herbaceous weeds to chemical control methods. Morning glory, Canada thistle, Russian knapweed, and white top are receiving the most attention. Perennial grass weeds, especially quack grass, are being investigated by several workers.

The chemicals being most used in the experiments are 2,4-D, 2,4,5-T, TCA, dinitro compounds, and oils. Of these chemicals, 2,4-D is the most extensively used, being included in 92 of the 159 experiments reported.

ERICKSON: In this report Dr. Rasmussen has mentioned I am sure you will find a wide variation in results. Therefore, the committee has decided that it would not be beneficial or wise to outline general recommendations. For example, to date in Idaho we can find little promise for the 3/10 pound 2 4-D applications. We know from experience now that it is rather difficult to take the results from a specific test and apply them on a broad basis.

We know, for instance, that the average yield of a variety of wheat may be 20 bushels over a tremendously

wide area, and then you have another particular variety under your conditions that will yield 25 bushels. Under these conditions, we recommend the specific variety for the specific locality. It is this list of specific problems that we have still to solve.

Most of us are familiar with the nature of research under the states' set-ups so we haven't gone into that line in the discussion here. There are many, I know, who are not familiar with the nature and contribution of research from industrial organizations. That is why I have asked Dick Raynor of the Dow Chemical Company to tell us something about this.

RAYNOR: It should be obvious that I could not have been authorized to speak for all industry, nor even for the chemical industry. As a matter of fact, I have not even been authorized to speak for the company which I represent, as I did not know until yesterday afternoon that I was to be a member of this panel. What I am going to say is therefore solely on my own responsibility, and is based on my personal observations and thinking.

As I see it, the function of the chemical industry in weed control research is to furnish to the public research agencies new chemicals which preliminary tests have shown to have some merit—new chemicals to replace presently used chemicals if the new ones appear capable of doing a better job; new chemicals which might fill needs which are not taken care of by presently known chemicals. Such chemicals should preferably have specific properties with regard to their action on plants—the demand is for chemicals which will kill weeds without injuring crop plants.

The way that these new chemicals are developed is something like this: most large chemical manufacturers maintain organic research laboratories in which there is a staff of chemists whose job it is to synthesize new organic chemicals which have never been made before. After these chemicals have been synthesized, it is common practice to test them biologically, as bactericides, insecticides, fungicides, and now as herbicides. It is true that in the past, before the present great interest in herbicides developed it was not common practice to check specific plant killing properties of these chemicals. Of course, in making tests for insecticides and fungicides, herbicide qualities are noted, and any of those which do show plant killing properties are further tested to determine the nature of that action on plants—whether it is a general contact kill, whether the plant growth regulating action is specific for certain classes of plants, and so on. Following routine screening procedure, chemicals which show any merit whatsoever as plant killing agents are sent to the chemical company's field research division. It is not sufficient alone to have made laboratory and greenhouse tests. The product must be tested under field conditions to find out whether it will have any practical application. In the field plot technique certain chemicals will be thrown out because they just don't hold up under field conditions. What chemicals are left are turned over to public research agencies, the final arbiters, for their evaluation. This is one link between industrial and public research. Until a chemical has been tested and approved by public agencies, there is little chance of getting it registered by regulatory officials. The chemical industry, therefore, looks to public research agencies for the word on whether the chemical will do the job or not. The further course of events by which the new chemical finally reaches the consumer is this: after it has been given the okay by the public research agencies, there is some further development work in demonstrating the chemical to farmers in different areas, and finally a sales program.

In addition to the routine screening technique to which all new chemicals are subjected, there is another method by which chemicals of merit are discovered. The man in the biological laboratory may conceive of chemicals related to chemicals of known herbicidal value. He will then ask the organic chemist to synthesize them for him.

As a hypothetical example, the biologist may know that 2,4-dichlorophenoxy acetic acid is a good weed killer. He may then decide to test all the possible compounds in which one, two, three, four, or five chlorines are substituted in the benzene ring in the various possible positions. He will also want to test other halogen substituted phenoxyacetic acids. Some of them may have been made before, others not. So the chemist goes to work and makes them all for the biologist. As a result of his testing the biologist finds that 2,4,5-trichlorphenoxyacetic acid is also herbicidal, and so a new weed killer is born.

It is by this type of investigation that we gain knowledge of the relation between molecular configuration and biological activity. Eventually we may gain a sufficient background of knowledge to be able to plan "tailor-made" herbicides, but that is still a rather nebulous dream, and we in the meantime will have to stumble along as best we can using the empirical or "cut-and-try" approach.

Routine screening tests may sometimes miss chemicals that may be specific for certain plants or classes of plants, so specialized techniques are sometimes set up in a search for chemicals that may answer a certain problem. For example, there is a need for an herbicide that has the same type of action on grasses that 2,4-D has on nongrasses. Neither IPC nor TCA quite fit the requirements. So I suspect that most industrial laboratories are screening chemicals for their effect on grasses. A grass specific should provide a large market for the chemical industry, and would of course be a boon to the agricultural industry.

In conclusion, the role of industrial research in weed control, as I see it, is to discover chemicals that fill certain unfilled needs in agriculture, or that will do a better job than presently used chemicals; and then, working in cooperation with other agricultural research workers, to perfect their practical application so that farmers may use them effectively and safely.

I believe that the objectives, methods, and responsibilities of industrial researchers in the weed control program are the same as those of public agency researchers. Our mutual aim is to make agriculture more efficient and more productive, for the benefit of society.

ERICKSON: Without the chemical industry's development of these products, we would be nowhere today. Teamwork between industrial and public agency research gives promise of great progress.

Mr. Timmons, do you think there has been a tendency in recent years for weed research workers to abandon or neglect work on cultural methods of controlling weeds?

TIMMONS: Yes, I think perhaps many weed investigators, under pressure of lack of time and the public demand for information on new herbicides, have dropped their work on cultural phases and spent all or most of

their time on experiments with herbicides. The men in our Bureau have felt this pressure, also, and in most cases have shifted the emphasis to the chemical phases. However, we have avoided dropping our work on cultural methods and, wherever possible, have developed experimental studies of various combinations of chemical and cultural methods. Extensive studies at Hays, Kansas on the control of morning glory indicated that 2,4-D can be used much more effectively and profitably in combination with competitive crops and intensive cultivation than where control is attempted by spraying alone. The experiment which Jess Hodgson has under way at Meridian, Idaho on control of white top with combination methods of crop competition and intensive cultivation along with the use of 2,4-D applied either between crops or as a selective treatment in crops has given promising preliminary results.

It seems to me that we should not lose sight of the value of intensive cultivation alone in delivering a quick knock-out blow to a perennial weed. For a long time program, a properly designed crop rotation with judicious use of cultivation and spraying with 2,4-D, or other chemicals, appears to offer the most promise. Perhaps our research should be directed toward determining the most suitable rotations for such use and finding out when during the rotation chemicals should be used, whether in the crop or before it is planted, and in or before what crops.

PANEL DISCUSSION—EDUCATION AND PUBLICITY COMMITTEE

W. W. Robbins—Chairman
University of California

ROBBINS: In our panel discussion we are going to try to shed some light on the following topics:

1. Instruction in secondary schools and colleges.
2. Off-campus instruction, including weed schools, farm center meetings, etc.
3. The training of weed specialists in our schools.
4. The need for extension specialists in the different states.
5. Publicity.
6. Exhibit material.

I am going to ask each member of the panel who speaks to stand up and talk **loud.** (Applause from everybody). Chet Otis, Dow Chemical Co.

OTIS: Dr. Robbins as chairman of this panel has asked me to discuss exhibits and extension work. In many cases, these two things go together and we won't divorce them now. I hope no one will expect a series of revolutionary ideas—it's not in the cards. Instead, I want to give you a few thoughts that I have on extension methods and the philosophy of extension work.

When we use that term "extension" we usually refer to employes of the Cooperative Extension Service. But there are many others interested in weed control who are doing the extension type of work.

"B. C."—Before Chemicals—extension workers, employes of colleges and the U.S.D.A. carried the education ball pretty much alone—but now they have plenty of assistance if they want to take advantage of it.

The ultimate objective of this type of work is to control weeds. This is true if an individual's interest is in research, education, regulation, or commercial production and sales. The interest in each is essential, but certainly the others fail when we do not have education. The user must know about a program and how to apply it to his particular problem. Education programs have been successful. We only have to look to what has been accomplished—but there is plenty of room for improvement and expansion.

Interest in weed control is at the highest peak it has ever been. Farmers are studying and many, although well-read and informed, are still anxious to get the latest information to apply to their problems. We should capitalize on this interest—it is this type of interest that pays off.

One idea that I have is that the professional, extension type educators are salesmen whether they know it or not. They are selling information. Show me a good extension worker, and I will show you a good salesman. He may know his markets and he may know his product, but if he doesn't get the signed order his accomplishments at the end of a year won't amount to much. The extension man who is an aggressive, positive thinker and who uses proved sales techniques is the man to get results. By the way, reversing the situation, today's agricultural chemical salesman who leads in his field is also an educator. A glib tongue and fancy prices no longer suffice. He should know agriculture and its problems, his products, and how they're used. He must be able to advise his customers as well as sell them. The agricultural salesman is an extension type worker.

The good extension worker, or extension salesman, determines his problem, assembles available information. decides on a program, and puts it into action. Here's where a different approach comes in. The federal or state worker, instead of trying to fight the battle alone, create a team with himself and the county agents as the leaders, with the result that their efforts are multiplied many times over. This team can be made up of ertension workers, Soil Conservation Service employes, Smith-Hughes teachers, manufacturers, distributors, local dealers, and custom applicators. All of these groups are vitally interested in weed control and most will be anxious to cooperate. Certainly it is better to have them informed and helpful than uninformed and critical. They are anxious to know answers so they can properly advise their people. Any good leader or administrator knows that he, individually, can't do a big job alone, so he develops a program to utilize all who are interested in order to reach the maximum number of people, or customers.

Now for some details of extension type education, some of which point out ways in which the team-work philosophy can well be employed. I know two extension specialists who are holding regional and state meetings to which distributors, custom applicators, and agricultural chemical salesmen are invited. These two extension specialists feel that, since the salesman usually has the last word with the farmer, that man **had better be properly** informed—and these two men make a very consistent effort to keep salespeople informed. As a result, working together has been profitable for both of them.

At farmer meetings, schools, tours, and demonstrations, a number of extension specialists are taking advantage of cooperators. Let them help with publicity through

advertising, mail outs, and personal contacts. Let them help with refreshments. Also, in many cases for larger meetings, let them place exhibits. There again I might quote one extension worker in the Midwest who employs such a plan. This last year a series of meetings were planned with cooperation as mentioned at which the total attendance was 36,000—at one meeting alone they got 20,000 people out.

Another place where we have much of this type of cooperation is at state weed conferences. Many states are now setting up state weed organizations, and it is found generally that we can have a team-work philosophy operating there to good advantage. In addition to the usual extension-education mediums, many work with farm organizations, county commodity or advisory committees, county project leaders. Some conduct short courses for farmers, applicators, and others. Others offer weed identification service.

Demonstrations are the old tried-and-true method of selling agricultural information. Oregon has a new modification of the old plan. In this plan the experiment station man in charge of weed control work will sit down with the extension specialist who is in charge of the problem, draw up a series of projects which are sent out to county agents. The county agents will be furnished with materials necessary for the tests, and in case it is a chemical treatment, will be furnished with exact information as to how to establish the demonstrations. The extension specialist will observe the plots and take readings. Following their own and the farmer's observations, the conclusions are sent to the central office to be correlated with other information, and from these results they expect to get information which will be used as a basis for recommendations the following season.

I haven't much new to offer along the line of exhibits. Some of the more effective ones are composed of equipment, materials, pictures (movies, slides, mounted stills, etc.) that can be featured at fairs, institutes, larger county and district meetings, field days, and tours. I might say that I would like to see an expansion of the exhibits that we have at these meetings, with a conference committee on exhibits in charge.

PROFESSOR MORRIS: I told Dr. Robbins that we have the best and the most of everything here in the Gallatin Valley, and in one respect, at least, I know that he believes me. We may have weeds, too, but you certainly can't see them now; the snow has taken care of that.

The chairman has asked me to say a few words about what is necessary for the training of a weed specialist. It is a rather difficult undertaking, because of the fact that the idea of the weed specialist at the present time is a rather new one. Very few schools have set up any sort of training program for a weed specialist. I have listed a few qualifications which I think a weed specialist should have.

If you are going to be a weed specialist, you must have a rather good knowledge of systematic botany. Systematic botany, as you all know, is the naming of plants, and unless you know the name of the weeds, you cannot be a very good weed specialist.

I think you all have a good idea from just listening to the discussion on the research panel that there are a good many phases of knowledge on which a weed specialist needs to be informed. For instance, in applying certain chemicals, we expect those chemicals to affect the physiological processes of the plant. Therefore, a certain amount of plant physiology is necessary. I believe the time is coming when we will have to divide up the weed specialist's job into plant physiology, plant anatomy, and some of the other lines. I think also that the specialist should have a good working knowledge of the biological sciences and also of the crop sciences. For instance, he must not only have general information on the different crops, but the reaction of weeds on the different crops and the action of the different herbicides on the different crop plants as well as on the weed plants.

A weed specialist should have some knowledge of the chemistry, both organic and inorganic, of the herbicide that he is applying, and its action on different plants.

A weed specialist has to be of about the same caliber as a county agent who is supposed to answer practically all questions. In the application field, he needs to have considerable knowledge of mechanics—nozzles, booms, tractors, and all those things and he must familiarize himself with the mechanics of the application devices.

He must know something about soils, since the action of herbicides at least to a certain extent, is related to the soils in which the plants are growing.

It would seem to me that, in setting up a school for weed specialists the first thing to do would be to provide for fundamental training in both biological and the applied sciences.

DR. ROBBINS: We have at the present time a shortage of men trained to do weed research and weed extension work in the western states. It is difficult to find, at the present time, enough good research workers in the field of weed control. When we develop one of them, along comes one of the commercial companies and away he goes. But we will catch up with them some day and be ahead of them. We are proud of the fact that we are training men that the companies want—it is a compliment to us—although we regret it very much.

Nothing has been mentioned about weed courses given in western schools. How many colleges give a course in weed control?

(six, on count of hands.)

For the fourth year at our University Farm at Davis we have been giving a full semester course for the two-year students and a full semester course for the four-year students. At the present time the registration in these courses is approximately 200 students per year. Some of these boys are going into weed work; but the majority of them expect to use the knowledge gained on their own farms.

EUGENE WITTMAN, Extension Agronomist: I don't know whether it is an advantage to be the last one on the program or a disadvantage. Usually somebody has said most of the things you want to say, but you do have the advantage of having the last word.

The speakers so far have very adequately covered their subjects.

Chet has mentioned a good many plans of extension work that would apply not only to weed control work but other phases as well. I would just like to add a few things that have occurred to me. Chet mentioned this matter of

team work. Everyone who is interested in the Extension job would say "amen" to that, I'm sure.

Another point that Chet mentioned was the use of other folks than just extension people. We are fortunate in Idaho in having research people who are extension type of people as well. They do a good job in the field, this applies not only to state people but to federal people as well who are stationed at Meridian.

Our folks have asked for additional help in weed control. They want more help and you can realize why: our 44 counties are over a very large area. Certainly, the place for an extension specialist in weed control is in the picture now if it ever has been. A full time extension man working on nothing but weeds would have so many fields to cover and so many things to attend to that even one man spending full time couldn't keep up with all that is available in research and from the companies, both chemical and machinery companies, and the other information that is available.

The Noxious Weed Association, which represents the thinking of the weed people in the state, has asked definitely for weed control training courses to be included in the curriculum at the University this next year. In our secondary schools, our Smith-Hughes people have always been carrying on some weed work. Then, there is another phase that I believe is becoming, and in some cases it has become, quite important. That is, the veterans' group and veterans' classes. Both our state education people and our county weed supervisors have found that these have afforded a very fine outlet for our education work in weeds. I know of several instances of veterans getting weed programs started in communities in which they are beginning to farm. In one particular instance there had never been any interest in it until the veterans' interest was developed, partly through their weed classes, and partly through extension work.

We have used most of the methods that Chet has mentioned one way or another—crop tours, county agent group meetings—and we find in our state that conditions are so varied that training work in county agents' groups must be planned especially for the various groups. So we have four regional county agent conferences. We have been using research people and others at these conferences, with subject matter in any region adapted to that region.

We have done some work in preparing sets of slides and making these available to counties.

One interesting thing is that some of our counties have worked out a satisfactory plan in the use of 4-H weed programs as a means of obtaining educational material. By sponsoring 4-H Club work in weeds, some of them get very fine sets of mounts of the weeds in their particular areas.

ROBBINS: We cannot put too much emphasis on the need, in each of the states, for an extension specialist in weed control. Members of teaching and research staffs are spending a great deal of time answering correspondence regarding weeds and attending farm center meetings, and doing a lot of trouble-shooting.

We should strive to have an extension specialist in weed control in every state.

FRIDAY, FEBRUARY 4, 1949

Morning Session

The morning session convened at 9:30 a.m. Reports were presented by R. R. Balcom of the Bureau of Reclamation; L. W. Kephart of the United States Department of Agriculture; S. A. Swenson, Assistant Director, Washington State College; Thomas K. Pavlychenko and Walter S. Ball who reported on the North Central Weed Control Conference, and F. W. Timmons of the United States Department of Agriculture Experiment Station at Logan, Utah.

THE PURPOSE OF THE DEPARTMENT OF INTERIOR WEED CONTROL COMMITTEE

Robert B. Balcom, Agronomist

U. S. Bureau of Reclamation, Washington, D. C.

Mr. Chairman, Ladies and Gentlemen of the Western Weed Control Conference, I am certainly glad to be with you at another of your annual meetings. I look forward to attending each year because of the wealth of information which both myself and the other representatives of the Bureau of Reclamation receive. There are about 15 of us here today. I feel like a charter member because I was also at that meeting held in Denver on June 16, 1938 which your president, Bruce J. Thornton, mentioned in his letter to you last December, and have attended most of your annual meetings since.

I believe most of you are familiar with the Bureau's general weed control program of which various phases have been discussed here before so at this time I am going to discuss a broader phase of government weed work; that is, the progress being made in the cooperation between local weed programs and government agencies which have weed problems on public lands under their jurisdiction.

Perhaps the principal reasons why a more comprehensive weed control program has not been pursued in the past by some government agencies are because the importance of the problems may not have been fully recognized, few economical methods of weed control were known, and the public had not demanded that more work be done.

However, now the losses due to weeds are being recognized, research is giving promise of economically feasible methods, and the public is requesting more action on the part of government as well as state and other organizations.

This public opinion is being manifested in several ways. Bills were introduced in the last Congress for Federal aid in weed control, and to create a separate division of weed control in the Department of Agriculture. While those were not enacted into laws, it shows the growing interest by the public in weed control activities. Numerous resolutions have been passed by the various Weed Control Conferences, which now embrace all parts of the country, requesting Government agencies to initiate programs of weed control on lands under their jurisdiction. To accomplish the same purpose a resolution was passed by the Council of State Governments' Western Interstate Committee on Agriculture at its meeting on January 3, 1948, at Salt Lake City, Utah. The resolution reads in part:

"NOW, THEREFORE, BE IT RESOLVED, That the

Western Interstate Committee on Agriculture respectfully calls the attention of the Federal and state governments in the Eleven Western States to the necessity for noxious weed control upon lands under their jurisdiction, and urges that state and federal agencies immediately undertake weed control in cooperation with local agencies wherever such lands may be located in the Eleven Western States."

Government agencies are receiving more requests from local weed control organizations to cooperate in their programs where weed-infested public lands are adjacent to or located within agricultural lands on which organized weed control programs are in operation. Government agencies are also receiving more requests for advice on solving weed problems by individual farmers. The Bureau of Reclamation has gotten its share of such requests as has the other agencies in the Department of Interior.

It was well known in the department that several of its agencies have many weed problems in common and that some research was being conducted on certain special weed problems, particularly on aquatic and other weeds by the Fish and Wildlife Service. As you know, the Bureau of Plant Industry, Soils, and Agricultural Engineering, under the direction of its Senior Agronomist, Mr. L. W. Kephart, is cooperating with the Bureau of Reclamation in research on weed problems concerning irrigation projects. However, there had not been established a satisfactory method for the Interior groups to exchange the findings being made.

In keeping with the Department's desire and responsibility of serving the greatest number of persons in the best manner possible, an informal meeting was held on August 4, 1948 by representatives of Interior agencies to discuss means whereby a more coordinated program could be established. On that day the Department of Interior weed control committee was formed by the Office of Land Utilization, the Fish and Wildlife Service, the Bureau of Indian Affairs, the National Park Service, the Bureau of Reclamation, and the Bureau of Land Management. The latter organization being recently formed by combining the Grazing Service and the Public Land Office.

While the committee is still an informal group and has no official voice at this time in formulating Interior policies, it is, nevertheless, a very interested and active committee and can accomplish much toward helping establish a weed control policy and in coordinating the weed control activities of the various agencies involved. One of its principal functions is to exchange results of research on weed problems which are in common or related to those of other agencies in order to prevent duplication of work. In order to prevent further duplication the committee is working closely with the Department of Agriculture whose Bureau of Plant Industry, Soils, and Agricultural Engineering, as you know, has an active weed control research program for both land and water weeds.

Meetings have been held regularly each month since the first meeting in August and already much progress has been made. Mr. Kephart tells me that the Department of Agriculture has considered for some time the formation of a similar committee which may include his Bureau of Plant Industry, Soils, and Agricultural Engineering, the Bureau of Entomology and Plant Quarantine, the Bureau of Animal Industry, the Bureau of Dairy Industry, the Forest Service, the Soil Conservation Service, and the Production and Marketing Administration.

If and when Departments such as the Army and Navy and agencies like TVA find the need for forming similar weed control committees, it has been proposed that an Inter-Departmental Committee be formed with representatives from all agencies which are interested in weed control. Both Mr. Kephart and Mr. Evans have met with our Interior Committee several times and have given us considerable assistance.

It is also proposed that similar committees be formed by various Government agencies in the field to bring about better cooperation in weed control programs where the actual work is done. It is hoped that all government representatives here today will consider such a plan and discuss it with other field officials. This already has been done in some instances.

When all government agencies are thus organized and when the four weed control conferences in the United States form a committee, which we understand has been considered, it is believed that many benefits will be obtained by these committees working closely together.

The principal purposes of the Department of Interior of the weed control committee are set forth in the following eight points:

1. Work toward making lands under the jurisdiction of the Department more useful to the public and prevent, insofar as possible, the spread of weeds to other lands.
2. Understand each agency's responsibilities and functions better, as well as its weed problems, so that coordination of weed work can be obtained rather than working separately and possibly against the interests of another agency.
3. Propose weed control problems needing further study.
4. Decide which agencies should undertake research in specific weed problems common to more than one agency in order to prevent duplication of work.
5. Find more economical and permanent solutions to weed problems through research conducted by Interior agencies, or by, or in cooperation with Agricultural or other agencies.
6. Exchange results of research and other findings concerning solutions to weed problems.
7. Propose and advise on legislation needed for advancement of weed control work.
8. Work with Weed Control Conferences, Council of State Governments, and Federal, State, and local agencies interested in weed control.

I believe that the formation of our committee is a step forward in attaining better cooperation in weed control with other interested organizations such as yours. We already have had an opportunity to work with your new coordination committee, headed by Mr. Lee Burge, which has been given the responsibility of working with Government agencies.

As the subject of cooperation between state and local weed control programs and Government agencies which have public lands under their jurisdiction has been discussed several times in your meetings perhaps several of you are interested in learning that this progress has been

made. I am certain that you will find all government organizations, having weed problems, are anxious to cooperate and will do so insofar as funds and personnel will permit.

One of the main reasons for the inability of Federal Agencies to do more work in weed control, as I believe all of you know, is lack of money. When the people and the Congress become more interested in appropriating more money to the public agencies for weed control it is quite certain to improve this situation. Until money thus becomes available their hands are pretty much tied.

I hope that if there are any officials here from other government agencies they will try to establish committees to prevent duplication and have a coordinated program.

It is not surprising how little coordination there is—weed work is new and they haven't had an opportunity to develop the integration that is necessary.

MR. BALL: Should we in our state programs have a problem with some individual agency such as the Forest Service, could we get action through your committee?

MR. BALCOM: When you use the example of Forest Service—that's under the Department of Agriculture. Our committee wouldn't have much to do with that. Mr. Kephart would be able to tell you better how to proceed. Until our committees are made official administrative committees, such problems can best be met by taking them up with the individual agency—since objectives in the long run will probably be found to be the same, this situation should not be too difficult.

QUESTION: What procedure in dealing with such problems might be most productive of results?

MR. BALCOM: I believe you will find all government agencies interested in helping if they have the money. That has been the main reason for any curtailing of activities. If you are interested in weed control on public lands you should write to the agency concerned, either the local or Washington office.

MR. BALL: Are all these agencies in the various regions informed as to this committee and the actions of this committee?

MR. BALCOM: In most cases, Yes.

FUTURE NEEDS IN WEED CONTROL RESEARCH

L. W. Kephart[1]

A number of years ago, shortly after the Bureau of Plant Industry began its present program of weed control research, a prominent official of the government called me into his office and proceeded to give me his opinion of weed control as a science. His opinion was, to say the least, somewhat critical. In short, he had no use for such foolishness. Weed control, he declared, was not a science but an art and was simply a matter of good farming. If you had trouble with weeds you were nothing but a lazy farmer. It did not require research to prove that. "Why," he said, "My grandfather had a 160 acre farm and he never had a weed on the place. This research project is nothing but a waste of public funds".

[1] Senior Agronomist, Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Dept. of Agriculture.

Ten years later I saw the man again. By that time he was in charge of a large and important project which was dependent, in part, upon the production of a large acreage of corn. Someone asked him how his corn-growing was coming along. "Oh, fine," he said, "Just fine. That is, it would be coming along fine if it weren't for the blankety-blank weeds. But those weeds are killing us. If we don't find some way to handle those weeds they'll ruin us".

I tell this story to illustrate how difficult it is to get a true perspective on the need for weed control research. Considered from one point of view the need is almost nil. Considered from other points of view the need is so enormous that it frightens us. Somewhere in between lies the rational answer. The finding of that answer is of vital concern to every person in this room. How shall we appraise the future. What criteria shall we use. If you are an administrator of public funds you want to know how much money should properly be appropriated by state and federal governments for weed research and for weed extension and weed control programs. If you are an educator you want to know how many young men should be trained in our colleges as weed control specialists. If you are a manufacturer of chemicals or farm machinery you want to know how far you should go in preparing for future markets. An error of judgment in any of these determinations may have serious consequences all down the line.

The obvious, and certainly the easiest way, to evaluate this situation is to compare it with the similar situations involving the control of insects, rodents and plant diseases. Each of these situations has been intensively studied for many years and certain organizational patterns have been established as to finances, programs and personnel. Apparently all we need do is follow the same lines.

Unfortunately the answer is not as easy as that. We cannot say, as often has been done, that weeds cause more damage than insects, and diseases put together and therefore should have at least as much attention as these. The cold fact is that weeds do not need nearly as much attention as either insects or plant diseases and probably never will. And the reason is that my friend on whom I told the story a moment ago was right the first time, to a large degree. Weed control is, as he said, largely a matter of good farming. That is a sober and unexciting fact which lately we have tended to forget. In all the hullabaloo that has attended the discovery of 2,4-D and other new herbicides we have been bedazzled by the prospect of "workless weeding" and "chemical farming" and have lost sight of the fact that the best way by far to control weeds is not to have any weeds to control. Proof of that are the tens of thousands of farms on which weeds were under satisfactory control long before 2,4-D was ever heard of and on which it is highly doubtful whether chemical weed control would pay. I am afraid it is true, as my friend intimated, that the man who most urgently needs scientific help in his weed control problems, is the man who has not been too careful with his farming. If not lazy he is at least a careless farmer. The good farmer, with his native common sense and with the ordinary implements of farming, can to a very large extent, be his own weed control specialist.

That is the place where weed control differs from insect control and the control of plant diseases. You cannot control those latter organisms by the ordinary methods of good farming. You can't kill Colorado potato beetles with a cultivator nor keep down apple scab with a mowing

machine. If bugs and blights assail you you have no recourse but to call in the scientifically trained specialist and he will bring in his special remedies. There is no alternative. It is true, as I have myself often pointed out, that not every farmer nor even a very high percentage of farmers, has a serious insect or disease problem in any one year whereas every farmer on earth has weed troubles all the time. That means that there are always more people interested in weed control than in insect or disease control. Nevertheless, and because the weed-troubled farmer does not **have** to have a specialist at his elbow every time he wants to pull a weed, the nation does not need as high a ratio of weed specialists to farmers as it does of entomologists and plant pathologists.

I mention all this because we are now at the point in weed control research where there is a good possibility of developing the science to the place which it rightfully should fill in the national economy. There are prospects that considerably larger sums than heretofore may soon be available for weed research and control. This, therefore, is the time to stop, look and listen and be sure that we know where we are going and why. Before we speak in dizzy terms of tens of millions of dollars to be devoted to weed eradication let us see whether a million dollars would not do just as well. There is a tendency for us to want to do everything at once and to get involved in expensive and detailed studies that have only an outside chance of ever being useful. It is a fair criticism, I think, of some agricultural scientists that they specialize so intensively that it becomes absurd, and the money they spend is largely wasted. I know an entomologist, for instance, who has made a lifetime career of one bug. Not only that, he has confined his researches to that one bug in one state and in one county in that state. And the last time I saw him he was spending all his time studying that one bug in his own backyard. Some very profound and useful conclusions may come from that man's work and the time may come when we may find it desirable to attack some weed problems in a similar manner. But if we do let us come to that point gradually and not try to foresee all of tomorrows' problems on the spur of todays moment. We, in weed control, have been far behind the procession up to this point. No one knows that more poignantly than I. But let us not be like the man who waited until he had only ten minutes to make a twenty minute drive and then wanted to go there at 80 miles an hour.

As one means of helping us to decide which are the things that need doing now and which are the ones that may well wait awhile I have made a list of some major weed problems for which there are at present no adequate answers and for which no answers are immediately in sight. These are the weed problems for which ordinary good farming definitely does not suffice and for which scientific help is really needed. Not all of these are of primary concern to you in the western states. Nor is the list by any means complete. But if research could be begun on the ones on this list it would utilize all the resources for research that it seems are at present likely to be available.

(1) Perennial grasses. Probably no weed problem is of such worldwide interest or is farther from solution than that of perennial, creeping grasses. The list of these grasses is long and includes quack grass, Johnson grass, Bermuda grass, Para grass, Kikuyu grass, cogan grass, perennial panic grasses and perennial crab grasses. The damage caused by these grasses is almost impossible to compute. They are the chief bottleneck in production on vast areas of some of the most fertile soils on earth. Cogan grass or lalang is responsible for losses in semi-tropical regions of the world that exceed the losses from all the broad-leaved creeping perennials in the United States. The fact that many of these grasses are valuable for forage makes the control problem one of extraordinary complexity.

(2) Annual grasses in special crops. Annual weedy grasses, like crabgrass, pigeon grass and annual brome grass are so integral a part of all farming that it seems hopeless to think of ever bringing them under control. Yet recent economic studies have shown clearly that they are one of the worst obstacles to more profitable production in some of our most important crops. To cite a single instance the present rapid progress in the mechanization of cotton growing has come to a grinding halt in some areas because of crabgrass. All other items of production—planting, thinning, and harvesting have been successfully mechanized. But no mechanical or chemical way has yet been found to keep crabgrass out of the crop. At harvest time the mechanical pickers pick the crabgrass stems along with the cotton fiber. And as the two fibers cannot be separated the otherwise high-grade cotton is severely down-graded or ruined. Neither row crops nor broadcast crops compete successfully with annual grasses and we have no adequate answer to the problem.

(3) Soil sterilization. Strictly speaking this is not an agricultural problem for few farmers have reason to want to kill their soil. But for non-agricultural use there is very important need of some method of freeing soil from all vegetation. Since these users are taxpayers and since the problem is clearly allied to the work we are already doing it seems only fair that we give more consideration to this need. A well-financed project in which the biochemical rather than the purely chemical approach is featured would be a highly worth-while effort.

(4) Woody plants. One is tempted to think that the subject of woody plant control is already under sufficient scrutiny considering the not inconsiderable sums of money now devoted to research on **Ribes,** barberry, mesquite, and sagebrush. Progress, however, has been slow and much still remains to be done before a process is perfected that is economically suited to use on private lands. On some large items of woody plant control research has not even started.

(5) Ragweed and other allergy weeds. No weed problem is so insistently brought to the attention of the Department of Agriculture as that of destroying ragweed. The case here is not one of killing the plant. That is easy with 2,4-D or other chemicals. The problem is one of logistics. How and by whom are the enormous acreages of ragweed to be destroyed and where does the farmer fit into the picture. Publicity is undoubtedly an important part of the job. This is more weed extension and control than weed research but the research people still have to find a way to kill ragweed in a farmer's clover field.

(6) Aquatic weeds in still water. A fairly adequate research program is now underway on the control of aquatic weeds in flowing ditches but that does not seem to answer the demand for a method to use in lakes and ponds. More than 7000 lakes we are told are important recreation areas but are handicapped by the presence of

cattails, pondweeds and other objectionable water plants. Here again the protestants are not farmers so much as urban dwellers but they too are paying taxes and are entitled to some help. In addition to recreational areas there are thousands of farm fish ponds recently built, city water supply systems, industrial reservoirs and dam sites and other still water situations all lof which suffer greater or less damage through the growth of aquatic vegetation. So far little has been done to answer this need.

(7) The weed seeds in soil. A matter of intrigueing interest is the possibility that many of our weed troubles would disappear if some way could be found to kill the weed seeds already in the soil. Preliminary experiments indicate that this is a possibility. Yet the difficulties in the way of using a cheap, toxic seed-killer are very great and it is evident that much work and more advanced techniques will be needed before a satisfactory answer to this question will appear.

(8) The physiological action of herbicides. For five years a large part of the time of weed control research personnel has been devoted to the field testing of 2,4-D and other new herbicides. So far as we can see this will have to continue and on a considerable scale. Yet we are faced with the fact that this is not getting to the root of the problem and that until we know how these chemicals get into plants and what they do after they get there we are merely shooting blindly with a shotgun and hoping to hit something. A greatly expanded and highly integrated program of physiological research is a Number 1 priority need. The difficulties are great, perhaps so great that the prospective resources of all weed research agencies put together will not be sufficient to do the work adequately. It has been suggested that since the problem is essentially the same as that involved in the use of fungicides and insecticides a joint project be organized to study the matter concurrently. Whatever the organizational set-up it is hoped that some means will be found soon to short-cut the interminable cut-and-try testing and relieve our field personnel of this very onerous and not too productive activity.

(9) Cropping systems that control weeds. Since it is true that the best method of weed control is the proper adjustment of farming operations a systematic analysis should be made of successful weed-free farms to determine the factors that have made them so. It is not merely a matter of the farmer being more energetic than his neighbors. Either by accident or design he has hit upon a system of culture that takes care of the weeds in the course of his regular farming and with only limited recourse to special and expensive practices. Evidence is already at hand to indicate that this would be one of the most productive ways in which money for weed research could be used. It is a pedestrian and un-glamourous avenue of approch to the solution of weed problems but it may yield the highest return in the end.

Innumerable other items of weed research undoubtedly are in your minds. Many are unquestionably of real importance. The ones which I have enumerated are merely the ones which have been most urgently brought to my own attention. All of the four Weed Conferences and all of the regional committees under the Research and Marketing Act have presented their ideas on a program of weed research in considerable detail. In some respects these reports are similar and in other ways they are widely at variance.

It appears to me that because of this situation and for several other reasons the time has come when the often-discussed matter of a central or national committee representing all organized weed research groups should be made a fact. I am not prepared at this time to discuss the details of such a step. Perhaps that will be done by this Conference before it adjourns. It is an important matter. 1949 will be a climax year in the lives of weed control people everywhere. Events are coming to a head. The ideas for which so many of you have devoted the best years of your lives seem at last to be coming to fruition. Let us hope that the opportunity will not be missed. It would be a pity if the ball were fumbled at the very goal line.

REPORT OF THE NORTH CENTRAL STATES WEED CONTROL CONFERENCE A CONCERTED ACTION ON WEED CONTROL

Thomas K. Pavlychenko, Director, Agricultural Research,
American Chemical Paint Company,
Saskatoon, Sask., Canada

There is no need at this time and at this conference to follow a course of persuasion that the weed problem is important to agriculture. This was clearly realized by your group eleven years ago when the leading individuals in this area conceived the idea of the tactical necessity in mobilizing the official and private forces of the Western States for the purpose of developing a consistent and concerted approach to the economically most ruinous problem in agriculture.

As a delegate from the North Central States Weed Control Conference, I have a pleasant duty to extend our best, friendly wishes and greetings to our co-workers and friends in the West. Our President, Dr. R. S. Dunham, who was unable to be here at this time, sends you his personal good wishes for successful deliberations at Bozeman, and for a fruitful work in 1949.

The people of the North Central States Weed Control Conference, on both sides of the International Line, are fully aware of the practical significance of a concerted action in bringing the importance of the weed problem to the attention of wide administrative, industrial and agricultural circles.

The weed control organizations are of a relatively recent development, in spite of the weed problem being as old as agriculture itself. Even with the written records lacking, we can be reasonably assured that the first patch of native soil broken for agricultural purposes was as badly infested with weeds as is, in our days, any city lot where a prairie sod was destroyed and a family garden planted.

A simple recollection will illustrate with what pains the weed control organizations of the weed conference type were born. In Saskatchewan there is an important agricultural body known as the Advisory Committee on Agriculture. It consists of plant breeders, soils men, agricultural engineers, plant pathologists, entomologists, horticulturists, extension men, and also of the weed workers. This large body was subdivided into sub-committees along the specialized lines indicated. Only fifteen years ago the people would gladly participate with an air of dignity and importance on any of the sub-committees named, excepting one, the sub-committee on weeds. It was a daring task to persuade anybody to sit on this sub-committee, even to make it possible to have a formal protocol of the matters discussed.

One reason for the unwillingness of the people to spend their time on weeds was that there was no dignity attached to it; there was not sufficient research work done in this field to indicate that the problem may be effectively coped with by scientific methods. Only fifteen years ago a psychology of an appalling defeatism with regard to successful weed control was still widely prevalent among the majority of agricultural scientists. The slogan "Learn to live with weeds" was the guiding rule to the men on the land. The great task of weed control still was left to the practical farmer as his permanent headache. Only a few individual workers in different countries, inspired by personal vision and scientific interest, had carried the burden of weed research. Under most discouraging circumstances they have laid the foundation of a legitimate place for weed work in agriculture, for a justified existence of an organization of this type and for now highly technical and complicated science of weed control. Now through these initial efforts, and through the concerted action of your and other weed control conferences in the United States and Canada, the situation has radically changed. The weed problem has been successfully and effectively sold to the government institutions, universities, industry, and to the farmer. At this time not individual but hundreds of highly trained research workers are willingly giving their abilities, time and interest, for weed research. The result is that weed meetings and conferences are attended probably by more people than any other gatherings of similar nature. The weed research is better supported by the governments and industry than at any time in the past. There is no agricultural scientist at this time who may feel that he is too important to waste his time at the weed meetings, or he is too wise to offer a suggestion for possible improvement of the work as it stands now. Plant taxonomists, physiologists, chemists, soils men, as well as the best mechanical engineers are needed to keep pace with a rapidly growing new science of modern weed control.

To my knowledge, prior to 1944 there was no separate weed division at any institution in America. Since that time such division, or at least individual weed specialists, are well established at most State and provincial universities and the Departments of Agriculture in the United States and Canada. In recent years special courses on weeds have been outlined and put on the university curriculum in many State and provincial universities in both countries. More or less comprehensive projects on weed control are now carried out by most federal experimental stations both in the United States and Canada.

All these activities have been stimulated in great measure by the deliberations and actions of the weed conferences of this kind. This slowly but surely answers a painful need for technical personnel required to maintain and to raise as soon as possible the scope and standard of weed research to meet the demand of practical farming.

The fact that 527 technical reports were submitted to the Research Committee of the North Central States Weed Control Conference in 1948 at Springfield, Ill., is an impressive testimony of the work done. Instead of solitary individuals working under conditions of disheartening public indifference as in former years, now hundreds of highly qualified research workers are busy investigating various phases of the all-important problem of weed and brush control. At this time, however, the work goes on with the keenest public interest, and with more liberal approval and financial support from the governmental agencies.

These amazing advances in modern weed control are seemingly gratifying to many people. But of them all, the pioneers in the early weed research and pioneers in organizing the concerted action for its promotion should feel best rewarded for their initial efforts.

Until 1948 the modern weed control was passing through a hard screening test period of experimentation. In 1948 the million acres mark was passed for the first time in the commercially treated crops. The practical weed control by chemicals thus became a well rooted industry. The chemicals and machines involved in this new industry may be modified, improved, or even changed, but the method as such will never be discontinued.

In 1948 it was estimated that 4,000,000 acres of grain and flax were treated by the systematic herbicides in Western Canada, and probably much more in the United States. I was informed from good sources that up to 25 percent of the corn acreage was treated in the North Central States' corn area. The acreage in the Western and Eastern States and Provinces, of course, was smaller in absolute figures, but probably as high or higher in relative values. From this impressive research and practical record, a wide interest emanates not only in our own countries, but throughout the world, in Western Europe, Far East and South America.

From the information now available concerning the general acceptance of the method and on the prospective production of chemicals and equipment for the season of 1949, it seems safe to state that the acreage treated in 1948 was only a fair beginning. The fact that only unscrupulous use of volatile ester formulations in the proximity of susceptible crops has resulted in some damages; that reasonably careful applications had won the highest praise and hopes of the users, and that systematic herbicides give positive assurance of the possibility of successful growing of flax in weedy districts, forecast a more general spread of this practice as the years go by.

A great work for the great agricultural industry naturally involves even greater responsibility of those that promote and direct it. The regional weed conferences are definitely looked upon by everybody concerned as the leaders in this work. The responsibility for sound counsel and instructions, therefore, rests with them whether they like it or not.

The North Central States Weed Control Conference in 1948 was quite conscious of this fact and had conducted its work accordingly. The Research Committee, therefore, had worked for two full days before the conference met. In a quiet, serious, yet very inspiring atmosphere they had critically gone over the entire list of the research reports submitted for their consideration. The next step was to prepare tentative drafts of the recommendations to be submitted to the policy committee and the plenum of the conference. Due to the immense amount of new research information, it was felt that for the first time the conference was safe in approving quite specific recommendations with respect to rates on various crops, weeds and woody plants.

The idea, first implemented in 1947, of sub-dividing the work of the conference into field crops, horticultural crops, and woody plants divisions, proved to be very fruitful in

1948. The reports in all these sections were numerous and of high scientific and practical interest.

As a gratifying novelty in 1948, the work of our conference was featured with some papers dealing with fundamental studies of the systematic herbicides.

It was still more gratifying to notice a growing interest in these studies among the leading plant physiologists and biochemists in our area. It should be recognized that the research of empiric nature requires mainly a qualified man to run it. The fundamental projects, however, require a qualified man, and expensive precision equipment and a suitable laboratory.

We are fully aware of certain gaps and probably imperfections in our work. Yet we feel satisfied that at this time when practical weed control has assumed proportions of national industry, we have our regional conference backed by several years of actual field and laboratory experience to at least partially guard our field and garden crops from possible mistakes and dangers. This we try to achieve by making our Research Committee reports and the Policy Committee recommendations available to all the research co-operators, universities and agricultural offices in the conference areas. These reports are available also to commercial concerns and to the interested institutions and individuals in many foreign countries. It has been our pleasant experience and knowledge in the past that these reports were extensively used not only as a source of the most up to date information for practical purposes, but also as manuals for the research workers in planning their projects for the next growing season.

In view of the prospective increase in the acreage of treated crops in 1949 it seems extremely fortunate that the entire area of the North American continent is now served by regional weed conferences.

From the foregoing, it might appear as if the present status quo is reasonably satisfactory and we may relax in our efforts. Actually, we had made only a good beginning. There are many problems regarding chemicals, equipment, crops, dry land and water weeds and woody plants that require further studies. The problem of technical personnel for research and education is needing our prompt attention. The status of the weed work, and weed worker also has to be standardized and equalized with that of the related agricultural or biological sciences. To attract young talent into the new scientific endeavor, it is necessary to put it on equal footing with respect to its prestige and opportunities of employment with other lines of scientific studies such as plant breeding, plant pathology, entomology, soils, chemistry and engineering.

The standardization of the work itself, of the weed worker and of employment opportunities is probably the most pressing. Since many people fully aware of these difficulties feel shy to suggest certain possibilities, I want to take upon myself at this time an initiative in advancing a few suggestions along this line. If it is considered wise to call an insect pest worker an **entomologist**; a forage crops worker an **agrostologist**; a plant domestication worker an **ecologist**, and to regard these Greek names fully acceptable and "generally understandable", why a term **Herbology** for the weed work, and herbologist for the weed worker should be regarded as less understandable or desirable than the now accepted terms herbicide for a weed killer and entomologist, agrostologist and ecologist for their respective sciences.

With regards to employment in relation to the possibility of attracting new young talents into this field, I would say that a creation of definite civil service positions for the college graduate is an immediate necessity. A student taking his graduate, and particularly post graduate work in genetics, entomology, ecology, or engineering, has a clear concept of his prospects and the available civil service positions in these fields. A student specializing in the weed work has no such definite prospects. Under these circumstances, only a man with exceptionally "heroic" disposition sometimes takes a risk of putting long years of special studies in the hope that somebody will be interested in his work and create a "special" position for him. The majority are more "realistic" and choose to travel a "well trodden path". Hence the appalling shortage of trained personnel in "Herbology".

REPORT OF THE NORTH CENTRAL WEED CONTROL CONFERENCE

Springfield, Illinois, December 8, 9, 10, 1948

Walter S. Ball

Mr. Chairman, I am going to make the report of the North Central meeting rather brief inasmuch as proceedings of the meeting will be available. There are a few things, however, that I think are worthy of reporting to you. On the first evening of arrival Mr. Thornton and I were requested to attend a meeting of the Directors at which they discussed the possibilities of a joint meeting. Apparently the joint meeting had been discussed at some length by the directors of the North Central conference prior to the meeting inasmuch as I had had a letter from Dr. Willard, president of the organization, on this subject. The possible benefit of holding a joint meeting was discussed and most of the discussion appeared to be in opposition to such a meeting. Several points were brought up relative to the time of the meeting which was not wholly agreeable. The fact that it would possibly interfere with the regular annual routine of their meeting and that many of the problems were of no mutual interest also were brought up; however, I questioned this last point. Nevertheless when the question was brought to a vote it was noted not to have a joint meeting of the North Central and Western Weed Control Conferences.

I was later asked to attend the legislative committee meeting inasmuch as the committee was considering legislation relative to the control of 2,4-D. I discussed some of the problems that we have had here in the west, particularly in California, and urged that they refrain from putting the restrictive provisions in the law but rather that the Director of Agriculture be given enabling power to regulate through rules and regulations. I feel quite certain that if national legislation is to be considered that the actions taken by the various conferences will be given some consideration. It was agreed by the members of this committee that controlling legislation should be on a local basis and not a national basis.

On Wednesday the general session of the meeting opened with a welcome by the Mayor of Springfield. Discussion of the problems of pre-emergence treatments in corn and field crops took care of the rest of the morning. I am not going into each of these various speeches inasmuch as I feel that it will involve much repetition.

The afternoon session was divided into three sections and I found it very difficult to get to the various sections in order to get the information I would like to have got-

ten. The first section was on field crops and dealt primarily with the use of 2,4-D as a selective herbicide in corn and sorghums and the effects of 2,4-D on cereals and flax as well as the selectivity of the material. 2,4-D in legumes and on seedlings and established perennial grasses was also discussed. The second section was on horticultural crops and pre-emergence and 2,4-D was again discussed very fully.

Section Three was on non-tillable lands which took in the control of herbaceous trees and shrubs on non-cultivated lands. I was very much interested in this section, as well as two or three of the talks in the other two sections. The use of 2,4-D in orchard and ornamental plants by Glen Viehmeyer, Horticulturist, University of Nebraska Experiment Station, was very interesting. He very definitely felt that the 2,4-D's must be handled with care under these conditions and he made the statement "I may be sticking my neck out but whether you folks agree with me or not—the ester forms of 2,4-D are volatile". This, of course, ties in very closely with our cotton problem where we have felt that drift and volatility is a factor, although there seems to be some thought that the material moves in some other manner. The same comment was brought out many times during the meeting, however, and the care which should be taken in handling the material was stressed.

The evening session started at four o'clock in the basement of the Illinois State Armory where there was on exhibit a very fine display of equipment. There was almost everything conceivable relative to booms, nozzles and various mechanized and sectional booms for handling all phases of weed control work.

That evening the session again was divided into sections, the first section being an investigation of weed control methods in sugar beets, potatoes, soy beans, peas and similar crops. Here again we ran into pre-emergence and a repetition of the use of 2,4-D and oils, although the fact that we had additional information relative to the action of this material on the various crops proved of interest. The second section was a symposium on research on the eradication of woody plants.

Thursday's meeting was made up of two general sessions, one on perennial and annual plants where again 2,4-D and contact sprays were brought into the discussion but in addition the education and actional programs were given some time. Much of the morning session was along the regulatory and educational line as discussed by various state leaders. The afternoon session was on machinery and methods of application, bringing out some rather interesting work on testing nozzles. Application of herbicides by airplane and spraying equipment generally was discussed.

The evening session was a banquet with two addresses, one by George Metzger on "The place of a farm organization in activating a weed program" and the other was "1948 Observations" by President C. J. Willard.

The Friday program was again broken down into sections, the first section being on physiological and basic studies; the second section on educational problems in weed control, and the third section on the regulatory problems in weed control. The first section proved to be the most interesting of the entire meeting according to many who had an opportunity to hear it. I was requested to attend the regulatory section by Chairman W. L. Klatt and therefore did not have an opportunity to attend the other sections. The educational section and the regulatory section were not attended by very many of the representatives as the general interest throughout the entire program was research.

Just prior to closing the regulatory session Dr. Willard informed me that at their directors' meeting they had agreed to discontinue sending a representative to the Western Weed Control Conference and requested that we take the same action.

I was not called upon to make a report of the Western Weed Control Conference at this meeting although I have been asked to do so at all past meetings. As mentioned above, however, I was called in on some of the special committee meetings at which time I was able to give the group information relative to the activities of our group. Mr. Thornton attended this meeting with me and at this time, Mr. Chairman, I would like to have you add anything that you wish relative to the North Central meeting.

At the directors' meeting the first night the resolution approved by this group last year regarding a national organization was discussed. The board of directors favored the action taken by our Conference and it was suggested that the officers of the four Conferences meet for the purpose of organization. No time was suggested, however, as the other two groups had not reported their reaction relative to the national organization.

AIRPLANE APPLICATION OF HERBICIDES

F. L. Timmons, Senior Agronomist, Bureau of Plan Industry, Soils, and Agricultural Engineering, United States Department of Agriculture

The assignment to discuss airplane application of herbicides before this group has me somewhat embarrassed. Most of my personal experience and observations have been in the Southern Great Plains where conditions were considerably different from those in most sections of the western region. What I say will be based largely on those observations and may have limited application to situations in the west, except, perhaps, in central and eastern Montana and other extensive grain growing or range areas. I will attempt, however, to make my talk quite general in scope by taking into account the considerable secondhand information I have gained about results of airplanes spraying during rather extensive travels in the western states in 1947 and 1948 and from close contacts with weed research and control personnel in other sections of the country.

Although airplanes have been used for applying insecticides and fungicides for nearly 30 years, their use for spraying weed killing chemicals is a recent development. The Army was perhaps the first to apply herbicides by airplane in 1944 or 1945. The TVA did some early airplane spraying of 2,4-D for aquatic weed control using as little as one quart of solution per acre. Several commercial companies sponsored some of the first airplane spraying of 2,4-D for selective weed control in crops during 1946 and early in 1947. The discovery of the effectiveness of low volume spray applications of 2,4-D was the spark that set off the wild fire development of airplane spraying. During 1947 and 1948 the baby plans were being made for 1949. However, killing weeds by airplane is still an adolescent and perhaps over-exuberant industry. It has reached the stage now where it must come of age quickly and discipline itself or find itself disciplined and perhaps even frus-

trated by restrictive public legislation. As a matter of fact, restrictive legislation has already been imposed in cotton growing states and certain other areas and, as you know, airplane dusting of 2,4-D is prohibited everywhere in the United States. The airplane is a versatile and greatly needed device for applying herbicides and has economy, speed and many other advantages under certain conditions and within certain limitations. On the other hand, it is a dangerous hazard to agriculture when used improperly by inexperienced, careless, or irresponsible persons. Definite standards and policies must be adopted voluntarily within the industry itself or established by government action to protect the public from the hazards of misuse of the airplane in applying 2,4-D or similar chemicals.

The extensive use of 2,4-D and of airplanes for applying it did not develop in the Southern Great Plains until in 1948, which was a year later than in several other regions. Airplane spraying experiments at Woodward, Oklahoma and Higgins, Texas in 1947 indicated that 2,4-D was effective in controlling sand sagebrush which covers many millions of acres of rangeland in Oklahoma, Texas, New Mexico, eastern Colorado, and southwestern Kansas. This discovery touched off an airplane spraying campaign in 1948 that covered some 200,000 acres, even as new experiments were being carried on to check the accuracy of the results obtained in 1947. Concurrently with the sagebrush spraying operations in 1948 there occurred in Kansas and other southern plains states the rather spectacular airplane blitz attack on annual weeds in winter wheat. Perhaps some of you read the story of these operations in the article entitled "They Used Planes to Beat Weeds in Grain" that was published in the November, 1948 COUNTRY GENTLEMAN magazine.

We had a very unusual situation in the hard red winter wheat area of the Southern Great Plains in the spring of 1948. Ordinarily annual weeds cause little trouble in winter wheat that has been well started in the fall. However, because of extreme drought conditions during the last half of 1947, about 27,000,000 acres of wheat, or about 75% of that seeded in a six-state area from Texas to Nebraska, germinated unusually late and 11,000,000 acres did not sprout until December, 1947 and January, 1948. This set up ideal conditions for the development of annual weeds in the late thin wheat as soon as spring came. This prophet began making dire predictions of a serious weed problem as early as January and finally became bold enough to write an article on the subject which was published in the Kansas City Weekly Star March 31. However, it was somewhat like Moses crying in the wildnerness as far as most of the farmers were concerned. They had never seen a serious weed situation in winter wheat and few had had much previous experience with 2,4-D, especially for selective spraying in crops. Also, it appeared doubtful until late spring whether much of the late thin wheat would pay to leave for grain crop, weeds or no weeds. Many a farmer guessed wrong and thousands of acres of wheat were plowed up that would have made a good crop under the favorable conditions that developed later in the season. As a result of these circumstances, relatively few farmers purchased or devised ground spraying equipment or made definite plans for spraying.

Fortunately, in this instance at least, a number of airplane operators and companies were more credulous than farmers and did make preparations for extensive spraying operations. Some out-of-state operators arrived on the scene in early April before many of the weeds had emerged or before they were large enough to alarm the farmers and interest them in spraying. I received many long distance telephone calls almost every day from anxious or even irate airplane operators and chemical and equipment salesmen demanding "Where are your weeds?" About that time I was seriously considering a secret airplane flight to South America. However, the weather warmed up, the rains started and the weeds developed rapidly. I was almost guilty of the sin of being glad that a serious weed problem did develop. No doubt you have heard a quotation from someone, "I would rather be right than be president."

After a few venturesome farmers had tried 2,4-D the successful results started a stampede of farmers to get their wheat sprayed. All operators, both airplane and ground rig, soon had more than they could do and the situation actually became "Operation Frantic," as it was termed in the COUNTRY GENTLEMAN article. Eventually more than 500,000 acres were sprayed by airplane in Kansas in 1948. Probably considerably less than that was sprayed by ground rig equipment. Much of the airplane spraying was done just before harvest, as it was simply impossible after a late start to get around to spraying all of the acreage earlier with the equipment available. It was reported that 100,000 acres of good wheat in Kansas was not harvested because of weeds. Millions of acres of weedy wheat that probably should have been sprayed could not be sprayed because of lack of time and equipment. The difficulties and expense of harvesting this weedy wheat were considerable. Had more farmers fully sensed the situation earlier in the spring and contracted their crop or made preparations for doing their own spraying, perhaps two or three times as much acreage could have been sprayed by airplane, and, of course, many times as much could have been sprayed with ground equipment.

The job done by airplanes in Kansas and other parts of the southern plains in 1948 was more or less a rescue mission somewhat analgous to "Operations Victuals" to Berlin, or "Operations Haylift" to feed starving sheep, cattle and deer this winter. It was an emergency situation for which airplanes are especially adapted.

The situation in the spring wheat areas is considerably different than that which prevailed in the southern winter wheat region in 1948. In the spring wheat area annual weeds in small grains and flax are an every year occurrence. Farmers are used to the weed problem and have had a lot of experience spraying for weed control in early years with dinitros and during the last few years with 2,4-D. Ground rig spray equipment is common and the annual weed situation is handled more or less in stride without becoming an emergency. Airplane spraying fits into the picture, but not nearly as prominently as it did in the Southern Great Plains in 1948. For example, in South Dakota in 1948, 100,000 acres of small grain was sprayed by airplane, while 900,000 acres was sprayed by ground equipment. Also, much weedy grain in South Dakota was not sprayed because the use of swathers and wind row pickups on combines made it possible for farmers to harvest weedy grain with less difficulty, whereas farmers in the hard winter wheat areas where swathers were almost unknown were practically helpless. It appears, however, that airplane spraying is increasing in the spring wheat areas and that it may continue to increase in use if careless or inexperienced operators do not destroy the

confidence of farmers in the safety of airplane application.

Perhaps you would be interested in the details of the spraying methods used for the airplane applications in Kansas in 1948. The operations followed rather closely the dosage recommendations in the circular entitled "Controlling Weeds with 2,4-D in the Southern Great Plains," which was issued in February, 1948. In this publication the recommended dosage for selective spraying in small grains, sorghum and corn was ⅓ pound of 2,4-D in the ester form, or ⅔ pound of 2,4-D per acre in the form of amine or sodium salts. It was recommended that not less than 10 gallons per acre of water spray be applied, either by ground rig or airplane equipment, because of the normally low humidity and strong winds which cause rapid evaporation and tend to result in poor coverage with low volumes of water spray. No recommendation was made on the use of oils as carrier for 2,4-D, but attention was called to the experience in 1947 in other areas where as little as 1 gallon of diesel fuel per acre had been reported to give satisfactory results.

Many operators seized upon the possibility of using low volumes of oil rather than the much greater volumes of water needed as a carrier because of the much lower application costs. Early tests by the P-T Air Service at Hays, Kansas showed that 1 gallon of diesel fuel No. 2 per acre gave adequate coverage. That gallonage became more or less standard for most of the airplane applications. Since oil was used as the carrier by most operators, the esters of 2,4-D were used almost exclusively for airplane spraying.

One-third pound of 2,4-D as an ester in 1 gallon of diesel oil per acre gave such good results in earlier spraying work that the dosage was reduced to ¼ pound per acre of 2,4-D for small weeds and even to 1/6 pound by some operators. However, the results from these lighter dosages were not very satisfactory as regrowth of weeds occurred in many fields before harvest in the wet season. In the considerable amount of pre-harvest spraying done rates of ½ pound or more 2,4-D per acre in ester form were used, and in some cases the amount of oil was increased to 1½ gallons per acre in order to give better coverage and kill of the tall growth.

The recommendations were to spray the annual weeds as soon as possible after they emerged and when the wheat or other small grain was in the fully-tillered to jointing stage. Actually much of the wheat was sprayed at later stages of growth. Spraying continued full blast until the wheat began to head and after a brief lull was resumed again as soon as the grain was in the soft dough stage. In some cases wheat was actually sprayed during the heading and early bloom stages. While the results from spraying in the jointing and boot stages of growth and just before harvest were beneficial in most cases in Kansas in 1948, it should be emphasized that spraying done early when the wheat was tillered and the weeds were small gave much better results. The weed kill usually was better and the yield of wheat greater.

There probably were several reasons why so little apparent injury to wheat occurred in Kansas last year from 2,4-D spray applications made in the boot and even in the heading and early seed forming stages. In a large proportion of the sprayed fields the weed growth was very thick and actually as tall as the wheat so that the benefits from controlling the weeds, even at later stages, overshadowed any detrimental effects to the crop. A drought period in April and May appeared to make wheat less susceptible to 2,4-D injury. Also abundant rains that occurred in late May, June and early July enabled wheat that had been temporarily stunted and delayed in maturity by 2,4-D to recover completely and make a normal yield. In experimental trials in previous years such stunting and delay of maturity of even a few days had nearly always resulted in considerably reduced yields under the usual preharvest conditions of increasing drought and hot winds. What I am trying to emphasize is that the much publicized miracle results and absence of harmful effects from 2 4-D in the extensive airplane spraying of winter wheat in Kansas last year were due to an unusual set of conditions that are not likely to be repeated in full again in the Southern Great Plains or duplicated in any other region.

Before I left Hays, my successor, Mr. William Phillips, and I cooperated with the P-T Air Service in an airplane spraying experiment on weeds in wheat. For an account of this experiment I shall read an abstract submitted by Mr. Phillips to be published in the 1948 Research Committee Report of the NCWCC.

> "Spray applications of the methyl, isopropyl, and butyl esters at ¼ and ⅓ lb. 2,4-D per acre in one gallon of diesel fuel; ¼ and ⅓ lb. isopropyl ester in 2 gallons of water; ⅔ lb. amine in 5 gallons and 2 gallons of water; and ½ lb. amine in 5 gallons of water were made May 21, 1948, on winter wheat in the late boot stage. Four replications were used. No significant change in yield was obtained from any of the treatments as compared to the no treatment plots. The value of controlling the weeds, however, was evident at the time of harvest. Plots which were weed free were combined in less than half the time required to cut the unsprayed plots. The quality of grain from the clean plots was superior to that which was harvested from the weedy plots. Weed control was nearly equal for the various esters applied in oil, none having a distinct advantage over another. ⅓ lb. appeared to be enough more effective than ¼ lb. to warrant the slight additional cost. None of the amine treatments were as effective as the ester, although ⅔ lb. amine in 5 gallons of water gave satisfactory weed control and was nearly equal to the esters. It was evident that 2 gallons of water did not result in sufficient coverage to give adequate weed control either with the ester or the amine. Some of the plots sprayed with 2 gallons of water were still badly infested with weeds at harvest. Germination of all samples was excellent."

The weeds in this field were plentiful, but were never ahead of the wheat and were not a factor in the yield of wheat under the conditions of abundant soil moisture that prevailed. However, the experiment does serve to give information on the relative effectiveness of th amine and ester forms of 2,4-D, of different dosages, and of water as compared with oil as a carrier for airplane applications.

In other more humid areas water has proved satisfactory as a 2,4-D carrier at low gallonages. Some flight operators claim to have had good results with water in quantities as low as 2 or 3 gallons, and even one gallon, per acre. Water has been used more commonly than diesel oil as a carrier for airplane applications of 2,4-D in the northern plains and many other regions. Wherever a low

rate of evaporation makes it possible to obtain adequate coverage with as little as 2 or 3 gallons of water mixed spray per acre, its use may be more economical than that of oil. Also, it permits the use of either the amine or ester forms of 2,4-D.

It should be pointed out that the type of farming, kinds of crops grown, land topography, and most other conditions in the Southern Great Plains are ideal for airplane spraying when weeds are a problem. There are vast acreages of rangeland and of cropland used almost exclusively for growing wheat, other small grains and sorghums—all relatively tolerant to 2,4-D. Fields are large and crops sensitive to 2,4-D are not commonly grown except in the few rather isolated stream valleys and small irrigated sections. Even shelter-belts and other tree plantings are rare in the western part of the region. The land is mostly level or only moderately undulating. The frequent moderate to strong winds are the chief problem to airplane spraying in the southern plains. There usually is enough wind to cause considerable drift of spray. When there are no sensitive crops or tree plantings in the vicinity this is not serious. When such a field or planting is present, spraying can be delayed until the wind is blowing away from the sensitive crop. On many days the wind velocity becomes too great for safe flying close to the ground.

In 1948 spraying operations usually were underway from daylight until about 10 a.m. and were resumed about 4 or 5 p.m. and continued until dark. On quiet days spraying could be continued throughout the day, but on windy days no spraying at all could be done. Crosswind flying was continued up to wind velocities of 15 mph. Above this velocity, some operators changed to upwind flight until the velocity of the wind became too great for safe flying. The best height for crosswind flight, according to one company which sprayed 200,000 acres in 1948, appeared to be 10 to 20 feet, depending on wind conditions, and 5 to 15 feet for upwind flight. When Stearmans flew close enough to the ground to show a wake in the crop, they sometimes caused breaking of the wheat at the top joint, if it was in the jointed stage. The height of flight on rolling fields and rangeland usually was 20 feet or more. In such areas it was found that much better spray coverage resulted from flying a level flight even with the tops of the low hills or dunes rather than by flying contours.

The planes most commonly used for spraying weeds in wheat in the southern plains were small craft such as Aeroncas or Cubs with 85 to 95 H.P. motors. These planes carried a maximum load of 40 gallons of spray solution, but the load was reduced under conditions of high wind velocity or "soft" air. Larger planes were used to some extent on grain and a few helicopters were used, chiefly in the vicinity of oil wells and on small fields. Typical planes used for applying 2,4-D on sagebrush were "souped up" Stearmans with 300 to 450 horsepower engines. These higher powered planes are also popular in certain other sections of the country where they must be able to lift 100 to 200 gallons of material (800 to 2,000 lbs.) suddenly over buildings, power lines and trees that often obstruct the flight at the ends of fields. Helicopters do not seem able to compete on a cost basis with conventional planes in open area flying. However, their maneuverability and ability to travel at reduced and varying speeds make them ideal for some types of aerial spraying such as in small fields surrounded by trees or structures and along irrigation ditches, river banks, power lines and highways. The driving force of the spray from a helicopter rotor blade may be advantageous in giving better coverage of willows and similar tall, dense growth.

The spray pattern and width of flight strip appears to be determined by such factors as the type of plane, type of spray equipment, spray solution used, discharge rate, height of flight, wind velocity, and the direction of flight with reference to the wind. Small planes with spray booms extending the full length of the wings usually were able to cover strips 50 to 60 feet wide in crosswind flights and 30 to 40 feet wide in upwind flight at the height of flight used in Kansas last year. The width of strip that could be covered adequately appeared to decrease as the wind velocity increased. The width of strip in flying 2,4-D on sagebrush in the southern plains usually has been less than the figures given above for spraying small grain.

The airplane spraying techniques used successfully for applying 2,4-D in the Southern Great Plains probably would not be satisfactory or even safe in areas where fields of sensitive crops, shelter belts and other sensitive plantings occur commonly interspersed among grain fields, pastures and other areas which might be sprayed by airplane for weed control. According to Dr. L. M. Stahler, coordinator of BPISAE Weed Investigations in the north central states, the recommended height of flight for airplane spraying in the northern spring grain area is 2 to 8 feet, never higher. He recommends that fliers stop spraying when wind velocities reach 8 miles per hour or more. He does not recommend spraying upwind under any circumstances. With this closer to the ground flying the maximum width of swath in crosswind flight is 45 feet, and 40 feet is considered the optimum width. Dr. Stahler, who is now stationed at South Dakota State College, Brookings, has made extensive observations of airplane spraying for weed control on grain and rangelands during 1947 and 1948.

No let us consider briefly some of the future possibilities for airplane application of herbicides, particularly in the western states. I shall mention only two or three of these. Weeds usually are a factor of some importance every year in spring planted small grains. The problem may or may not justify 2,4-D spraying, depending upon the density and vigor of the weed infestation and crop conditions. Under average conditions small grains will compete effectively with a considerable population of annual weeds without much reduction in yield, especially if the growth of grain is well ahead of the weed growth. It is only when the crop is unusually late or thin and the weeds thick and ahead of the crop that wholesale spraying is justified. In the relatively low rainfall grain growing areas the soil moisture is usually exhausted by the maturing crop so that only in unusually wet years do the weeds in a normal crop develop and cause trouble at harvest time. It appears likely that in average years there may be a tendency for farmers to apply 2,4-D for weed control in grain fields where its use would not be justified. However, since spraying should be done at earlier stages of growth, the decision as to whether to spray or not must be made before all of the determining factors are known. In such situations judicious spraying is often an inexpensive form of insurance.

When one considers the millions of acres of rangeland in the five-state area of Texas, Oklahoma, New Mexico, Colorado and Kansas which are covered with sand sagebrush, the possibility of airplane application of 2,4-D

in that area appears almost unlimited as long as the increased production of beef will pay the bill. The problem of big sage brush on intermountain range lands apparently is not as well adapted to airplane spraying. There are some indications that big sage (Artemesia tridentata) is rather easily killed by 2,4-D. However, killing the big sage with spray applications would accomplish little in many situations since it is necessary to reseed much of the sagebrush covered areas with improved strains of grasses. Thus far it has been found necessary to drill the grass seed or broadcast it in connection with some soil renovation program in order to obtain satisfactory stands. Burning of the sage brush is one relatively economical method of removing it and making drilling of grass seed possible. Burning is reported to cost as little as 25c per acre.

The dead sagebrush left after spraying with 2,4-D would interfere about as much with seeding operations as the live sagebrush. It would thus appear that airplane spraying will have a somewhat limited use on the extensive areas of big sage brush in the intermountain region. However, in areas where killing of the sage brush and temporary protection from grazing would permit desirable native species of grass to develop a satisfactory stand and enough increased forage to justify the expense, airplane spraying may prove to be a paying practice. I have no definite information on the extent of such areas in the west.

In closing, I shall make a few comments and offer some suggestions for whatever they may be worth, primarily to airplane spraying companies and flight operators. Airplane application of herbicides is not just an opportunity for a profitable adventure for anyone who happens to own a plane and can rig it up with some sort of a spray boom. It is a highly technical business requiring considerable training and experience in operating airplane spraying equipment and a thorough understanding of the hazards involved, both to personnel and to crops. No operator or company should attempt commercial spraying operations until he has this training and understanding, and is financially able to assume the risks of loss of equipment or personnel and damage to crops, or has adequate insurance to cover such risks. I know of one spraying service company that gives a very intensive course of ground school and flight training each year to all of its pilots and those of sub-contractors. This training extends over several weeks and covers all essential phases using the equipment that actually will be used in doing commercial spraying.

Convenience and accuracy of adjustment to the exact rate of discharge desired within a considerable range of rates is an important essential in aerial spraying equipment. The equipment should have a positive shut-off that will stop discharge of spray instantly and prevent dripping from nozzles. Thorough testing of airplane spraying equipment to determine the spray pattern, width of strip covered and actual dosages applied at different speeds, discharge rates, highlights of flight, wind velocities and crosswind or upwind flight appears to be highly important. Checking the droplet size and distribution across the entire flight strip under different conditions is a simple but necessary procedure in studying the performance of the equipment. Strips of adding machine tape at right angles across the flight path are excellent for showing the droplet distribution of oil mixed sprays. Watch glasses, pieces of window pane or other glass distributed across the flight strip are suitable for studying the droplet distribution of either water or oil sprays. An operator who knows what his equipment will do under various conditions and can control its performance should nearly always be able to apply the desired dosage and obtain uniform coverage under most of the conditions encountered.

If spraying during upwind flight is done occasionally, it is extremely important in changing from crosswind to upwind flight that the rate of spray discharge be reduced to compensate for both the narrower strip covered and the reduced groundspeed.

The plane operator or at least the person who schedules the flight operations should thoroughly understand the relation of wind velocity, height of flight and other factors on spray drift, and the hazards of such drift to sensitive crops. The location of all sensitive crops and tree plantings in the vicinity should be determined in advance and the spraying operations scheduled so as to avoid spraying on the windward side of such crops closely enough to permit drift to come in contact with them. If esters of 2,4-D are being used it should be remembered that a change of wind direction a few hours, or even a day or two after the spray application, may drift volatilized fumes on to sensitive crops located near by. One almost has to be a weather prophet to be able to use the esters safely in close proximity to sensitive crops.

The width of safety zone that should be left on the windward side of sensitive crops or plantings will depend upon the height of flight, wind velocity, air temperature, and the crop. When temperatures are not over 80° F, a safety zone of ¼ to ½ mile downwind should be ample for most legumes, vegetables and similar sensitive crops, unless the wind velocity is above 8 mph. When temperatures are higher than 80° F, thermal currents may carry the 2,4-D drift farther than this. When flight is 10 to 20 feet from the ground or at higher wind velocities, as is commonly practiced in the Southern Great Plains, wider safety zones will be necessary. For highly sensitive crops such as cotton, much wider zones must be maintained. In Texas the official regulations prohibit spraying within one mile of susceptible crops downwind when the wind is 0 to 5 mph and within two miles when the wind is 6 to 10 mph. Spraying is prohibited within ¼ mile of sensitive crops upwind when the wind is 0 to 5 mph, and within ⅛ mile when the wind is 5 to 10 mph. The use of esters of 2,4-D is prohibited. This probably represents the extreme of caution that will be found necessary anywhere in an airplane spraying of 2,4-D.

WESTERN WEED CONTROL CONFERENCE RESEARCH SECTION

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ABSTRACTS

of

Papers presented

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Quackgrass control in orchards with ammonium and sodium trichloroacetates, Bruns, V. F., (Contribution of Division of Cereal Crops and Diseases, Bureau of Plant Industry, U.S.D.A., cooperating with Washington Agricultural Experiment Station).

Applications of ATCA on quackgrass **(Agropyron repens)** were made in an orchard at rates of 54.5, and 218 lbs./A. (active ingredient basis) on July 18, July 28, September 2, and October 3, 1947. July applications were made under peach trees while later treatments were made under adjoining apricots. Throughout the remainder of the season 90 to 99% quackgrass control was obtained with the two heaviest rates of application. In the spring of 1948 considerable regrowth occurred on all plots treated in July and on plots receiving 54.5 and 109 lbs./A. in the fall. Retreatments with ATCA and STCA made on all plots as necessary in the spring of 1948 proved less effective than the original treatments although excellent quackgrass control was maintained on plots receiving original applications in September and October, 1947, at rates of 163.5 and 218 lbs./A. Leaf injury on apricot trees became apparent 30 days after the retreatments in the spring of 1948. No injury to peach leaves could be detected.

Applications of ATCA and STCA to quackgrass under Italian prune trees at rates of 109, 163.5, and 218 lbs./A. beginning May 14, 1948, and on the fifteenth of each month thereafter through November showed best results from fall applications. Preliminary results showed ATCA and STCA to be about equal in effectiveness. Prune tree leaves began to show injury similar to that noted on apricots aprpoximately 30 days after each series of treatments, except fall treatments.

Waterweed control in irrigation channels with solvent naphthas, Bruns, V. F., (Contribution of Division of Cereal Crops & Diseases, Bureau of Plant Industry, U.S.D.A., Cooperating with Washington Agricultural Experiment Station).

So Cal Solvents #2 and #3 were tested in four separate channels in the Yakima Valley for aquatic weed control during 1948. Introducing So Cal #2 for 58 minutes at a concentration of 192 ppm gave only partially satisfactory results. Introducing the same material for 65 minutes at 256 ppm was more effective. Poor results were obtained with a treatment of So Cal #3 at 144 ppm over a 60.5 minutes period. So Cal #3 at 181 ppm for 92 minute periods was ineffective before but very effective after the material had passed over a weir. Oronite Purified Sulfonate L at 5% by volume of So Cal was used as an emulsifier in all tests. This material was very viscid and difficult to handle, but the emulsion held well for at least one mile of channel.

Thorough dispersion of the chemical in the water by passing over a weir or similar device before coming into contact with weed growth rendered the treatment much more effective. **Potamogeton richardsonii** and **P. Nodosus** were more difficult to eliminate than **P. pectinatus, P.**

foliosus, P. interruptus, and **Zannichellia palustris.** Although all treatments effected leaf injury, not all treatments were sufficiently injurious to stem tissue to cause disarticulation or to prevent new leaf growth. Moreover, roots of aquatic weeds showed no injury in the actual tests. Concentrations of 250-275 ppm should be used in this region due in part to the influence of water temperatures.

In greenhouse tests soil applications of solvent naphtha at concentrations feasible for aquatic weed control caused no injury to potted lettuce, lima beans, ladino clover, and orchard grass.

Aerial and ground methods of spraying willows with 2,4-D on irrigation systems. C. C. Butler, Head, Regional Land Use Section, Bureau of Reclamation, Region 6, Billings, Montana.

The increasing presence of willows on irrigation canals, laterals and drains is causing serious operation and maintenance problems on many irrigation projects in Region 6. Research conducted by various agencies has proven that willows can be effectively controlled by spraying with 2,4-D. The most economic methods of applying 2,4-D to willows under various conditions and the minimum amount of solution necessary have not been well established. Due to the extensive infestations of willows and the lack of definite knowledge of economic application techniques the Bureau of Reclamation has found it desirable to conduct field trials using various methods of applying 2,4-D at various rates. The equipment used included a helicopter, a turbine and conventional ground sprayers. The trials were conducted on the Milk River Project near Malta, Montana on July 7, 8 and 9, 1948, in cooperation with the Phillips County Weed District.

The helicopter was used to apply 2,4-D at the rate of two pounds per acre using 2.4, 5.0, 6.5, 7.5, 10.0, 12.0 and 28.0 gallons of solution per acre. The amine formulation mixed with water was used for all rates of application of five gallons per acre and above. The ester form mixed with diesel oil was applied at 2.5 gallons per acre. The helicopter was equipped with a spray boom having nozzles three inches apart. Only 15 feet of the boom was used. The rate of discharge was approximately .08 gallons per minute at 50 pound pressure. Two 25-gallon tanks carried the chemical mixture. The speed of the plane ranged from 25 to 35 miles per hour. Because of the relatively high speed and small nozzles, it was necessary to make from one to six flights over the trial areas to apply the various rates.

Two weeks following the application of 2,4-D, practically all willow leaves were dead on all treated areas. Six weeks later, regrowth had developed on 30 to 40 per cent of the willows. Ten weeks following spraying, regrowth had developed on 60 to 70 per cent of the willows. Most of the regrowth appeared from the base with a few scattered branches of unnatural looking growth in the upper portion of the willows. Little or no regrowth appeared where the willows were relatively thin or where they were approximately eight feet or less tall, providing there was no tall trees or power lines to interfere with the helicopter flying just above the tops of the willows. Very little difference could be observed between the various rates of solution applied.

A Buffalo turbine was used to apply 2,4-D at approximately the same rates as applied by the helicopter. The rates of application varied somewhat due to operational difficulties; however, they approached the helicopter rates. A truck was used to transport the turbine sprayer. The turbine had a 50-gallon tank and rates of application were controlled by a number of trips, (depending on the height of the willows) speed of travel, and valve control from the pump.

Two weeks following spraying, the willow leaves were dead on all treated areas as far as the spray reached. Six weeks later, no regrowth was evident where the leaves were once dead. Ten weeks following the application of 2,4-D, no regrowth had appeared except on one area which had been treated with one pound of 2,4-D in five gallons of water. At this location a small amount of regrowth appeared on 20 to 30 per cent of the plants that had previously appeared dead.

The ground sprayer used consisted of a decontamination unit from army surplus on which was mounted a power take-off high-pressure sprayer. Spraying was accomplished with a hand-operated power gun nozzle attached to 100 feet of high-pressure hose. At 400 pounds pressure the spray stream could be directed 40 to 50 feet away from the nozzle. Two pounds of 2,4-D in 250 to 300 gallons of solution per acre were applied. Observations made at different times during the spraying season showed the results to be almost 100 per cent effective.

Final results of willow kill for any of the treated areas cannot be determined until after the coming growing season.

The Effect of Pre-Planting Treatments with 2,4-D upon Alfalfa, Beans, Corn, Oats, and Potatoes. Lambert C. Erickson, Associate Agronomist in Weed Research, University of Idaho.

This experiment was designed for determining the duration of the residual effect of 2,4-D in the absence of supplemental irrigation water, and for determining the relative sensitivity of different crops to 2,4-D in the soil.

The soil treatments were made at 45 day intervals and the plantings were made at intervals of 15 days in treated and untreated plots.

The soil treatments were applied at rates varying from 2 to 8 pounds of acid equivalent per acre, using the amine and ester forms. Plantings of alfalfa, beans, corn, and potatoes were made at intervals of 15, 30, and 45 days after treating in an effort to determine the duration of toxicity.

It was learned time and temperature, in the absence of supplemental moisture, were insignificant factors in the breakdown of 2,4-D over a 45 day period.

A comparison of Toxicity of some Unsubstituted Aryl Carbamic Alkyl Esters. V. H. Freed, Associate Agronomist, Oregon Agri. Exp. Sta., Corvallis, Oregon.

A number of carbamates were prepared in the conventional manner from the suitable isocyanate and alcohol. These were repurified by recrystallization and the melting point checked. The material was ground to a 1 per cent dust for use in the greenhouse. Application of the material was made at 1 pound active ingredient per acre to 8-inch gallon cans of the material thoroughly worked under the surface ½ inch of soil. Twenty seeds of grey winter oats were planted in each can. Each can was planted in triplicate. After 1 month of growth the per-

centage then was determined and yield weight taken. The isopropyl-n-phenyl carbamate, was by far the most toxic, followed by ethyl phenyl carbamate and the meta-chloro derivatives.

Statement on IPC for the control of quackgrass. V. H. Freed, Associate Agronomist, Oregon Agri. Exp. Sta., Corvallis, Oregon.

In the summer of 1947 three different trials on the control of quackgrass were established employing as a toxicant IPC, or isopropyl-n-phenyl carbamate. Experiment No. 1 the land had previously been worked to seed bed preparation, immediately following wettable IPC was applied to the soil at the rate of 0, 4, 8, and 12 lbs. per acre using water as a carrier spray. A factorial design was used. In each case 6 replications were used. Following each application the plots received tillage as rototilling harrowing, discing and none. Experiment No. 2 the grass land had previously been worked down to seed bed preparation and IPC was applied at the rate of 5 lbs. per acre in a total of 120 gallons of solution per acre. The two forms applied were wettable and emulsifiable. Using, in each case 0, 40, 80, and 120 gallons of oil as spray. In those treatments less than a 120 gallons, water was added to bring the final volume up to 120 gallons. One-half of each plot was disked. Three replications of each treatment were used. In Experiment No. 3, the quackgrass was 12 inches high. The IPC was applied at 5 pounds per acre. The IPC was applied as the wettable and emulsifiable forms accompanied by 0, 40, 80 and 120 gallons of oil, and in most treatments where the volume was not 120 gallons of oil, water was added to make the final gallonage 120.

It was found by the above trials that the most effective treatment was IPC with oil, preferably applied with straight oil. Sprays of 120 gallons of oil per acre gave significantly better results than anything else. Where the quackgrass had previously been worked down to seed bed preparation, little reduction or no reduction was noted. Where the application was made to the quackgrass 8-12 inches high in oil, reductions as high as 85% were obtained.

The comparative longevity of sterilization of trichloracetic acid in greenhouse trials. H. E. Bierman, Oregon Agric. Exper. Sta., Corvallis, Oregon.

Three salts of trichloracetic acid were tried in greenhouse for longevity of sterilization. They were: Calcium salt, ammonium salt, and the sodium salt. The applications were made at the following rates: 0, 40, 80, 160 and 320 pounds per acre to 8-inch gallon cans. Ten seeds were planted in quadruplicate in each can immediately after treatment and at approximately 40 day intervals thereafter. In general, it was found that the ammonium salt retained the highest toxicity for the longest period of time, followed by the calcium, and the sodium salt least toxic. As would be expected, 320 lbs. lasted for considerably longer than at any of the other rates. Sterility at the highest rates lasted up to four months.

The control of weeds in alfalfa by differential contact spray. H. E. Bierman, Oregon Agri. Exp. Sta., Corvallis, Oregon.

A number of contact spray materials were applied to alfalfa in a dormant condition. The principal weeds were annual grasses and China lettuce. Yields as high as twice the combined weight of the alfalfa and grass were obtained on the best treated plots. In general dinitro-phenol at a quart and a half plus diesel oil, 30 gallons and IPC at 3 lbs. per acre was the most effective treatment.

Correlation of physical constants of alkial esters and N-phenyl carbamic acids with their phyto-toxicity. V. H. Freed, Associate Agronomist, Oregon Agri. Exp. Sta., Corvallis, Oregon.

The homologous series of n-phenyl carbamates from methyl through amyl were prepared and purified by recrystallization. Density and refractive index determinations were made. Molecular re-fractivity was determined and a function calculated from this value by multiplying molecular refractivity by the melting point of the derivative divided by the boiling point of the alcohol. A high degree of correlation was found between this value and phyto-toxicity. This trial is significant because it is one of the few times a physical measurement could be correlated with biolgical activity.

Comparison of the Toxicity of 2,4-D and 2,4,5-T to Ribes. H. R. Offord, and V. D. Moss. Contribution from Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Berkeley, California.

Chief objective of the 1948 blister rust control work for improving chemical eradication methods was to test new formulations of growth-regulating substances on **Ribes** species not readily killed by 2,4-D. On 446 plots in Seven Far Western states, 14 **Ribes** species were treated with 2,4-D, 2,4,5-T and 2,4-D plus 2,4,5-T. Salts, esters, and pure acid formulations of the phenoxy compounds were used in appropriate oil and water diluents, and both 2,4-D and 2,4,5-T were tested in combination with Ammate, Geon Latex, ammonium trichloroacetate, sodium trichloroacetate, pentachlorophenol, sodium pentachlorophenate, and tributyl phosphate. Methods of applying the herbicides were as follows: Spraying leaves and stems of intact plants, decapitating plants near the ground line and applying phenoxy concentrate in oil or water to the freshly cut surface of the root crown, and applying phenoxy concentrate in Diesel oil or kerosene to the intact basal stems. Most Ribes species were killed effectively by all methods of treatment, 2,4,5-T proved to be significantly better than 2,4-D as a general purpose herbicide, being much less selective than 2,4-D. **Ribes lacustre, R. binominatum, R. inerme**, and **R. lobbi** can be killed by spraying with 2,000 p.p.m. of 2,4,5-T, whereas these same species were not significantly damaged by equivalent dosages of 2,4-D. Variation in kill with seasonal growth changes of **Ribes** was less marked with 2,4,5-T than with 2,4-D. Relationship between concentration and optimum kill appears to be more critical for 2,4,5-T than for 2,4-D. This minimum concentration of 2,4,5-T needed to kill the several **Ribes** species varied from 250 p.p.m. for **R. binominatum.** The two phenoxy compounds can be combined with good results on **Ribes** provided the percentage of 2,4,5-T in the mixture does not drop below 50.

Tests of the helicopter over mountain terrain for spraying woody perennials (Ribes) with 2,4-D. H. R. Offord, Contribution from Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Berkeley, California.

First tests of the helicopter for spraying **Ribes** with 2,4-D were made on the Sierra National Forest, California, June 21-25, 1948. The objectives of these tests were to demonstrate (1) the effects of ground cover, terrain, ele-

vation, and weather on the operating efficiency of a helicopter being used for spraying, and (2) the volume of diluent and weight of 2,4-D needed to kill **Ribes spp.** in various ecologic sites. A Bell model 47 B3 equipped with a 44-nozzle boom was effectively flown within 30 feet of the ground at elevations of 5200 to 6000 feet. The maximum load carried was 20 gallons. Sixteen plots (from 1 to 5 acres) were sprayed with the following 2,4-D formulations. Isopropyl ester in Diesel oil, aqueous isophopyl ester plus a sticker-spreader, aqueous alkanolamine, and aqueous ammonium salt plus summer oil plus sticker-spreader. Dosages per acre were from 5 to 30 gallons and from 3½ to 40 ounces of 2,4-D acid. Observations 6 weeks after treatment showed that 2,4-D ester in Diesel oil was generally more toxic to **Ribes** and associated brush than were the esters or salts diluted with water. Oil solutions apparently settle and wet the vegetation more uniformly than aqueous solutions. The apparent kill could be correlated with the dosage of 2,4-D used. Sixteen ounces of 2,4-D acid or more per acre resulted in uniform damage of **R. roezli, A. nevadense,** and other susceptible plants growing on the plots. In general the apparent kill of **Ribes** and susceptible brush is closely correlated with the density of spray deposit recorded by test plates. Discs of filter paper gave an excellent record of spray deposit for aqueous solutions dyed red; glass plates were best for recording oil solutions. Most uniform coverage was obtained on plots where slope and ground obstructions permitted spraying from two opposing directions.

The effect of 2,4-D on the respiration of morning glory roots. L. W. Rasmussen, Assistant Professor in charge of weed investigations, Division of Agronomy, The State College of Washington, Pullman, Washington.

A test was set up on an area heavily infested with morning glory (Convoloulus arvensis) to determine the effect of 2,4-D on the rate of respiration in the roots during the fall months. A randomized block design with 4 replicates was used with two 2,4-D formulations and a contact oil as treatments. Root samples were taken at random within the plots and composited into 2 or more samples per treatment for respiration measurements. Check samples were taken from untreated border areas. The treatments were applied on September 14, 1948 and the first respiration determinations were made on roots from the first foot on November 17, 1948. A second set of respiration determinations were made on roots from the 2nd foot depth from some of the plots on November 29, 1948.

The contact oil caused very little increase in respiration, but caused a decrease in the dry weight of the roots which could be largely the result of the rapid top kill stopping photosynthesis during the late season. The 2,4-D treatments increased the rate of respiration in the roots from the first foot 3 to 5 times over the checks. The dry weights of the 2,4-D treated roots decreased approximately 50 per cent. The samples from the second foot showed respiration rates for 2,4-D treatment 2 to 3 times higher than checks and a 30 to 40 per cent decrease in dry weight.

The respiratory quotient was very close to 1.00 for all roots regardless of treatment or depth.

Control of annual weeds in sweet corn by pre-emergence treatment with 2,4-D. T. L. Timmons, Contribution of Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A. cooperating with the Utah Agricultural Experiment Station.

This experiment compared a sodium salt and an ester of 2,4-D at 0, 1, 2, and 4 pounds of 2,4-D acid per acre in applications made one day after planting and 5 days later, or just before emergence of the sweet corn. Immediate and delayed irrigation after the chemicals were applied were compared with working the chemical into the surface soil mechanically. All chemical treatments were replicated 3 times at each date of application and for each method of irrigation, and all dates and methods were replicated 3 times on cultivated and non-cultivated series of plots.

None of the treatments, including the heaviest application of 2,4-D, caused any reduction in stand of corn. The heaviest rates gave nearly 100 per cent control of pigweed, lambsquarters, purslane and other broad-leaved annual weeds during the entire season, while the light dosages gave less complete, but in most cases, satisfactory, control. Only the heavier rates gave satisfactory control of weedy grasses.

Average ear yields of sweet corn on the uncultivated series ranged from 6.1 to 7.2 T/a of fresh weight as compared with 4.4 T/a on untreated plots. There was no consistent trend for rate of 2,4-D treatment. On the series which were cultivated twice, the ear yield ranged from 6.6 to 7.5 T/a on untreated plots and those receiving light rates of 2,4-D. Plots receiving 4 pounds of 2,4-D per acre averaged slightly less than 6 tons of ears per acre, or about 0.5 tons less than the same treatments when not cultivated.

Yields of cured stover followed the same trends as ear yields. They ranged from 2.4 to 2.6 T/a on all treated plots in uncultivated series as compared to 2.2 T/a on untreated plots. On the cultivated series dry stover weights ranged from 2.5 to 2.7 T/a on untreated plots and those receiving lighter rates of 2,4-D. Plots receiving 4 pounds of 2,4-D per acre averaged slightly more than 2 T/a which was 0.3 T/a less than the same treatments when not cultivated.

Effect of 2,4-D on weed control, yield and quality in dry land winter wheat. D. C. Tingey, Professor of Agronomy, Utah State Agricultural Colelge and Experiment Station, Logan, Utah.

Two experiments were conducted during the past season on the use of 2,4-D in weed control in dry land winter wheat. One experiment, located at Beaver Dam, Utah, was on wheat infested with Romeria poppy **(Romeria refracta)** and a number of other weeds common to winter wheat, most of which were false flax, green tansy mustard, tumbling mustard, cow cabbage, and wild lettuce. There averaged 12.3 Romeria poppy and 2.3 other species per square foot. The other area was at Cove, Utah, where the wheat was infested with biscuitroot **(Lomatium leptocarpus),** and two species of mustards, tumbling and green tansy. There was an average of 2.9 biscuitroot and 9.2 other species per square foot. Such a heavy weed population should provide a good test of the value of 2,4-D in weed control under such conditions.

The experiment on the Romeria poppy area consisted of three 2,4-D's, one of which was the powder of ethyl ester. The other two were triethanolamine salt and ethyl ester liquid. Rates of application were 0, ⅛ ½ 1 and 3 pounds per acre of active ingredients.[1] The liquid 2,4-D's for the various rates were applied in two amounts of water, namely 5 and 80 gallons per acre.

On the biscuitroot area, the same treatments were used as on the poppy area except sodium salt of 2,4-D was used in place of the ethyl ester powder.

On the poppy area, the wheat was well stooled and the weeds were in early bud to bud stage of growth when treated. At Cove, the wheat was aprpoaching the late stooling or early booting stage and the weeds were in the early bloom to bloom stage when treated. Each treatment was randomized in blocks and replicated 4 times. Plots were 12′x28′ 8″ in area. Weed counts were made on 4 areas (6″x3′) in each plot. Wheat yields were determined from 4 meter samples taken from each plot and a sample of wheat from each plot was used in determining the percentage protein.

Data from the two experiments showed that 2,4-D reduced considerably the number of weeds in wheat on the poppy area for the heavier rates and more so for the liquid ester, but such was not the case on the biscuitroot area. On this latter area, the weeds showed some dwarfing especially with the heavier rates. The amount of water used in applying the 2,4-D had no differential affects.

There was no difference in acre yield of wheat weight per bushel of grain or percentage protein for 2,4-D treated as compared with untreated plots except at Cove where there was a slight increase in the latter character for the 2,4-D treatment of ½ pound or more per acre. At the ½ and 1 pound rates, the increase in protein over the non-treated was 0.4± .17 per cent and at the 3 pound rate, the increase over non-treated was 0.5± .17 per cent.

[1] Active ingredients not acid equivalent.
Acid equivalents approximately: ethyl ester 0, 1.8, 7.2, 14.4, 43.2 oz. acre. Triethanolamine 0, 1.2, 4.8, 9.6, 28.8 oz. per acre.

Research Section

Committees were set up within the research section of the conference to make special studies of interest and value to the research workers. Some of these committees presented their reports at the opening meeting of the research section.

A committee on fundamental studies consisting of W. A. Harrey, Chairman, Dr. J. M. Fults, D. J. Van Overbeek, and Mr. J. M. Shaw made a survey of the work being done and made suggestions on future needs. Following is the summary of the committee's report.

1. New Chemicals

There has been considerable work on tests for new chemicals. One of the major problems in such work has been the development of adequate screening tests. Mr. Shaw of the Denver Laboratory of the Bureau of Reclamation has developed such tests for aquatic herbicides. The method includes preliminary screening of the chemical on leaf sections of pond weed **(Potomogeton foliosus)** under the microscope. Further screening is carried out with those chemicals which show promise in the microscopic screen. These later tests are with pond weed plants in breakers with a concentration series of the chemical under test.

Dr. Fultz has reported the use of the pea-stem test and the use of castor beans as test plants in evaluating herbicides of the hormone type.

It has been brought out that screening tests with new chemicals must take into account the formulation used. Chemicals should be compared in similar formulations and the effect of the additives eliminated if accurate comparison of the chemicals under test is to be made.

2. Absorption of Herbicides

Dr. Crafts has proposed a theory of herbicidal action based in the main on the degree of polarity of the molecules. In brief he postulates that non-polar chemicals are more readily absorbed through the leaf cuticle than are polar molecules because of the relatively non-polar nature of the cuticle itself. Conversely, high polar chemicals are readily absorbed by the roots and less readily through leaf cuticle. Many of the herbicides are neither strongly polar or non-polar, but can be formulated to facilitate either leaf absorption or root absorption. Here again formulation is of importance in obtaining the proper type molecule for the particular job it is to do.

3. Translocation

Little new information on translocation has developed this year.

4. Action of Herbicides

This problem has received attention from a number of workers during the past year. Dr. Rasmussen has continued his work on respiration of 2,4-D treated plants. Dr. Fults has sent me a report of the work at Colorado in which they are investigating the possibility that the effect of the hormone is to break down proteins to peptides, polypeptides and amino acids. It has already been established that polysaccharides are hydrolyzed to reducing sugars. The killing action then may be due indirectly to a reaction product of certain amino acids with reducing sugars. Dr. Fults and his group are working on the isolation of such reaction products from plants treated with 2,4-D. At Davis, Olsen is working on the effect of 2,4-D on certain enzyme systems in plants. There is undoubtedly considerable work of a fundamental nature being carried out at most of the experiment stations.

5. Suggestions by the Committee

A. Our committee suggests that the Research Section lend its support to a proposal setting up a bibliographic service on weed and weed control literature in the U. S. Department of Agriculture. Such a service would be of great assistance to all the research workers.

B. Dr. Van Overbeek has suggested that one of the functions of this committee might well be to organize a symposium on Fundamental Studies in which everyone could be brought up to date on the current status of such work. A section of submitted papers on the same topic should also be considered.

A committee on experimental design and techniques composed of Prof. D. C. Tingey, chairman, Lambert Erickson, and W. A. Harvey was asked to discuss the use of statistical methods in weed research. Mr. Tingey presented a report pointing out considerable variability in the types of experimental designs being used. He emphasized the value and need for appropriate experimental designs as an aid in making conclusions.

The effect of replication as a means of gaining precision necessary for the measurement of small differences was presented. When working with such variable material as weed stands it is impossible to measure reliably differences in the effectiveness of different treatments unless the treatments are replicated several times. Randomization of the plots is essential to remove the bias from comparisons.

A committee headed by Mr. F. L. Timmons with Lee Burge, C. E. Otis, and W. L. Norem assisting made a study of the types of research work being conducted or planned to be done in the Western states. The report of this committee follows:

A committee was set up to make recommendations for establishment of some uniformity in the nomenclature of herbicidal chemicals. This committee was also asked to furnish some information on chemical composition and characteristics. Dr. J. F. Kagy served as chairman with Dr. A. S. Crafts, Mr. Virgil Freed, and Mr. H. W. Evans assisting on the committee. The report follows.

NOMENCLATURE

It is recommended that the United States Department of Agricultural Research Agency concerned with weed control, with the aid and consent of a terminology committee appointed from all of the various weed conferences, adopt such names as will indicate the composition of chemicals and further that it be recommended that in both scientific or technical papers and popular papers the adopted name be used.

Technical papers:

It is our feeling that in technical papers the full chemical name of a herbicide should be given in the first reference to the material and thereafter the use of a coined name would be appropriate. It is our feeling that this coined name should be approved by a committee such as this one. Moreover we are against the use of any trade name unless accompanied by the indicated composition. The indicated composition should include the full name of the active ingredient, for example, it should show Sodium Acid Arsenite and then express this in equivalent of AS2O3; or indicate the presence of the Isopropyl ester of 2,4-D and express this in equivalents of 2,4-D acid. In any event the trade name of the product is to be used only where no coined name is available.

Interim measures:

It is suggested that as an interim measure we adopt the names as set forth in North Central Weed Control Conference report with such changes as may be decided upon by this committee. Section. Composition and physical properties of compounds.

Chemical Names and Designations:

The name of the chemical is given in (a) followed in (b) by the forms adopted for common usage. In some instances materials are well known by trade names, but all such designations have been omitted.

1. (a) 2,4-dichlorophenoxyacetic acid
   (b) 2,4-D, acid (indicate carrier or solvent)
   2,4-D sodium salt
   2,4-D amine salt (indicate which)
   2,4-D, ester (indicate which)
2. (a) 2,4,5-trichlorophenoxyacetic acid
   (b) 2,4,5-T, acid
   2,4,5-T, salt (indicate which)
   2,4,5-T, ester (indicate which)
3. (a) 2-methyl-4-chlorophenoxyacetic acid
   (b) MCP, acid
   MCP, salt (state which)
   MCP, ester (state which)
4. (a) Trichloroacetic acid
   (b) TCA, acid
   TCA, ammonium salt
   TCA, sodium salt

It is further suggested that the dosages of this material shall be stated as TCA acid equivalent the same as with 2,4-D.

5. (a) pentachlorophenol
   (b) PCP, phenol (state "in oil" or other carrier)
   PCP, sodium salt
6. (a) 4,6-dinitro-o-cresol
   (b) DNOC, phenol (state carrier)
   DNOC, ammonium salt
   DNOC, sodium salt
7. (a) 4,6-dinitro-o-hexylphenol
   (b) DNOCHP, phenol (state form or carrier)
   DNOCHP, salt (state which)
8. (a) 4,6-dinitro-o-sec-butylphenol
   (b) DNOSBP-phenol (state carrier)
   DNOSBP-amine salt
   DNOSBP-ammonium salt
9. (a) A,6-dinitro-o-sec-amylphenol
   (b) DNOSAP, phenol (state carrier)
   DNOSAP, salt (state which)
10. (a) isopropyl N-phenylcarbamate
    (b) IPC
11. (a) ammonium sulfamate
    (b) use full name as in (a)
12. (a) sodium tetraborate
    (b) borax
13. (a) sodium chlorate
    (b) use full name as in (a)
14. (a) sodium arsenite
    (b) use full name as in (a)
15. (a) sodium chloride
    (b) salt
16. (a) methyl bromide
    (b) use full name as in (a)
17. (a) carbon bisulphide
    (b) use full name as in (a)
18. (a) sodium thiocyanate
    (b) use full name as in (a)
19. (a) calcium cyanamide
    (b) use full name as in (a)
20. (a) sodium cyanamide
    (b) use full name as in (a)
21. (a) potassium cyanate
    (b) use full name as in (a)
22. (a) allyl chlorophenyl carbonate
    (b) use full name as in (a)
23. (a) sodium isopropyl xanthate
    (b) use full name as in (a)
24. (a) allyl alcohol
    (b) use full name as in (a)

DEFINITIONS OF TERMS

1. **Preplanting Treatment.** An application made to the soil before the crop seeds or plants are placed in the soil.

2. **Preemergence Treatment.** An application made to the soil after crop is planted but before it has emerged. It may be sub-divided into (a) **pre-emergence, contact,** usually applied just before the crop emerges, to kill seeds that have emerged and (b) **preemergence, residual,** to kill weeds as they emerge or as the seeds germinate. Some rsidual sprays may also kill by contact. The term as used here is governed by the crop and not by the seed.

3. **Soil Sterilant.** A material which renders the soil incapable of supporting plant growth. Sherilization may be temporary or relatively permanent.

4. **Contact Herbicide.** A chemical or combination of chemicals that kills by contact with plant tissue but is not appreciably translocated. SDES-WS-10

PROPERTIES OF HERBICIDES

Inorganic compounds:

1. Arsenical compounds.

Various arsenical compounds are used as herbicides. Generally speaking, only the trivalent arsenicals are used since it has been shown that the trivalent arsenicals possess a higher degree of phyto toxicity than other forms.

a. Arsenic trioxide, AS2O3

Arsenic trioxide is a grayish white to white crystalline powder. This form of arsenic may exist in three crystalline forms, the cubic or fibrus form, monoclinic and the amorphous form. It has a relatively low solubility in water, but is soluble in alkalies and acid. It is probably the most long lasting arsenic compound from the standpoint of soil sterility. All arsenic compounds tend to be absorbed or sorbed by soil colloid complexes.

b. Sodium arsenite

Sodium arsenite has three possible compositions Na3AsO3, Na2HAsO3, NaH2AsO3. This material may be sold either as a powder or in liquid form and is completely water soluble. By treating this material with an excess of acid, Arsenious Acid, H3ASO3 is formed.

The toxicity of arsenicals appears to be of a nature of contact poison though it has been shown that the sulfur containing proteins of plants are affected by arsenic and this action may result in the death of the plant.

2. Boron compounds.

There are a number of Boron compounds available for herbicidle work. They vary in composition from straight compounds in anhydrous forms to complex mixtures of Boron compounds in fully hydrated form. In general there are three basic types of Boron compounds. Boric acid, of which we have ortho mieta and pyro boric acids and Sodium Borates, and Calcium Borates. All various types of Borates are in some measure water soluble though the Calcium Borate tends to be the least soluble of any.

The Boron compounds are used nearly entirely as soil sterilents for herbicidle purposes.

3. Chlorates

The various Chlorate compounds have the general formula MCLO3 where M is a metalic ion of single valence. Where we have a divalent cation the formula becomes M(C1O3)X.

The various metalic chlorate derivatives are at least in part water soluble and tending slightly toward the alkaline side. This is especially true of the potassium and sodium and lithium salt. The Calcium salt tends to be less alkaline than do the others.

Chlorates are used in a large part as soil sterilents against perennial noxious weeds. Their phytotoxic action appears to be due in part at least through their effect on plant roots. While the chlorates act as contact killers to aerial portions of the plant, little translocation seems to occur and the final action in killing roots and perennial noxious plants come in leaching material into the soil where it toxifies the roots. The mode of toxic action appears in inhibition of catalase activity giving rise to liberation of nascent oxygen.

It should be remembered that Sodium Chlorate or any Chlorate compound is a strong oxidizing agent. Therefore it is essential to be particularly careful around organic matter which has become saturated with solugions of Chlorate and dried organic matter mixed with Chlorate. Moreover, reducing compounds such as Sodium arsenite and others should not be mixed with Chlorate for danger of fire or explosion.

4. Cyanate

The Sodium and Potassium salts of Cyanate have been recently introduced into the field of weed control. These materials are being exploited for selective weed control of liliaceous crops.

These materials are water soluble compounds having a gray to white crystalline appearance.

5. Cyanamid

Calcium Cyanamid and certain other derivities have been employed and are being employed as herbicide agents. They are used principally as pre-emergent treatment on vegetable crops and as selective materials on grain crops. Generally speaking they are applied dry because of their low solubility in water accompanied by decomposition.

6. Ammonium Sulfamate

Ammonium Sulfamate is a crystalline water soluble compound commonly employed as a contact herbicide for brushy plants, certain grasses and perennial weeds and may be used as a temorpary soil sterilent. It forms a slightly acidic aqueous solution and is extremely hygroscopic. Some evidence to indicate that it possible translocates in brushy plants.

7. Thiocyanates

Monovalent salts of thiocyanic acid have been employed as contact herbicides. Of most general importance has been the Ammonium salt. These materials are crystalline water soluble and extremely hygroscopic.

8. Miscellaneous materials

Various other inorganic substances have been employed as herbicides at one time or another. These include:

a. Iron sulfate
   Formerly used as a selective spray in grain, now used to a limited extent in cranberries.
b. Copper compounds
   Find some use as control measures of moss in lawns.

c. Sodium chloride

Used selectively in beets.

Organic chemicals:

1. 2,4-Dichlorophenoxyacetic acid

a. **Physical properties of the acid.**

2,4-Dichlorophenoxyacetic acid is an organic acid having the following properties: It is a white crystalline product, melting point 138° C., solubility in water at 20° C., is about .49 gram per liter. The PH of this solution at 20° C. is 3.5, the ionation constant (Ki) is about 4.6 x 10-5. The pure acid is strongly absorbed by soil colloids and certain ion exchange resins.

b. **Sodium salt.**

The solubility of the Sodium salt of 2,4-D is about 3.8 percent 20° C. The PH of the solution of this material is 6.5 for a .1 of 1 percent solution.

c. **Triethanolamine salt of 2,4-D.**

The Triethanolamine salt of 2,4-D has a solubility in water of about 68.9 percent at 23° C.

d. **Esters of 2,4-D.**

The esters of 2,4-D are generally not soluble in water but soluble in organic solvents. The Methyl ester is a greasy solid melting at about 40° C. Certain of the other esters are liquid at temperatures above 25° C. Vapor pressure of 2,4-D ester decreases through the series of Methyl to Amyl. Vapor pressure of the Methyl ester is in the order of .0004 mm. of mercury at 62° C.

2. 2,4,5-Trichlorophenoxyacetic acid

2,4,5-Trichlorophenoxyacetic acid may be expected to behave in a manner similar to that of 2,4-D. Solubility is somewhat less than 2,4-D because of a higher molecular weight. Similarly the vapor pressure of its derivatives would be less. Full eluciation of its chemical properties will be made at a later date.

3. MCP

MCP is the abbreviation of 4-Chloro-2-Methyl-Phenoxyacetic Acid. Again this is the material that behaves analogous to 2,4-D though its properties are slightly modified with the introduction of the Methyl group. The pure acid melts at 119 to 120° C., its solubility in water is approximately that for 2,4-D. The PH of this material in a aqueous solution is somewhat higher than that of 2,4-D. The Sodium salt dissolves in water to about the extent of 20 percent at 20° C.

4. Isopropyl N-phenyl Carbamate

Isopropyl N-phenyl Carbamate also known as IPC, INPC, and IPPC is a new chemical introduced into the field of weed control for the suppression of weedy grasses. Its preferred designation is IPD. Technically IPC may be designated O-Isopropyl-N-phenyl Carbamate or as Isopropyl carbinilate.

Isopropyl N-phenyl Carbamate is a white crystalline powder melting 88 to 90° C. and having molecular weight of 179.2 gm. This material has a refractive index of 1.4989 at 91° C. It is very soluble in ether, alcohol, dioxane, acetone, butyl cello solvent, tributyl phosphate, and ethyl acetate. It is slowly soluble in aromatic oil, benzene, petroleum ether, and Stoddard solvent. It is insoluble or practically so in water.

Isopropyl N-phenyl Carbamate as other carbamates acts as a mitotice poison inhibiting cell division. Its chief action appears to be against the dividing cell at the metaphase. The cell becomes hyperplastic and eventually dies from the effects of this chemical. The evidence to date strongly indicates that it does not translocate in the plant and must be brought into contact with the dividing tissue before it causes death.

5. Trichloracetic Acid

The various salts of Trichloracetic Acid have been tested for their toxicity to various species of grasses. This material appears to be effective against both annual and perennial weedy grasses in varying concentrations. The salts of this acid as well as the straight acid itself is extremely water soluble generally forming a slightly acid solution. Trichloracetic acid is a strong sodium precipitant and even in dilute concentrations has a very marked inhibitory effect on certain enzyme systems.

6. Phenolic Compounds

In the realm of Phenolic compounds we have two major classes. The nitrated phenols and chlorinated phenols. These materials are used principally as contact herbicides. As salts, they are used as contact herbicides killing all types of vegetation. As a general rule the salts of the various phenolic derivatives are water soluble whereas the free phenol has a very low solubility in water but a high solubility or miscibility with oil except in the cases of the solid phenol where a co-solvent is necessary.

Phenols generally act as cytoplasmic coagulants and increase the respiratory rate prior to colligation.

7. Soil fumigants

There are three materials used as soil fumigants. Namely: Carbon bisulphide, chloropicrin, and the chlorinated derivatives of propane and propene. A number of other soil fumigants are used for insecticidal purposes but these three mentioned above have predominant roles in the field of weed control.

Such soil fumigants are generally liquid with high vapor pressure, hence when the material is injected into the soil it forms a toxic gas or vapor which kills the root of the plant.

Generally speaking the material having a vapor pressure below 40 mm of mercury at 40° Centigrade may arbitrarily be classified as ineffective for weed control. There may be exceptions to this rule but in general it applies. Molecular weights over 180 usually prevent a material from functioning properly. This is due both to lack of vapor pressure and strong absorption on soil colloids. In dealing with soil fumigants the diffusion pattern is probably the most important item other than inherent toxicity of the material of any of the factors encountered. The rate of diffusion, solubility, etc. is of less importance than the pattern it forms in its diffusion. The diffusion pattern is dependent to a large extent on the molecular weight of the compound.

Factors of importance pertaining to chemical properties of herbicides.

In general it has been our experience that such things as solubility behavior including the solubility in various solvents, the ionization and of free acid, PH of aqueous solution and adsorption from solutions by colloids as well as physical characteristics which modify or influence the toxicity of the material are important in weed work. It

might be cited for example the close correlations between certain physical and chemical properties of oils and their toxicity.

FRIDAY, FEBRUARY 4, 1949

Afternoon Session

The afternoon session convened at 1:30 p.m. This was a business session and the president called for the reports of the following committees:

Executive Committee, Organization Study Committee, Legislative Committee, Coordinating Committee, Hope-Flanagan Committee, Committee on a Joint Meeting with the North Central Weed Control Conference, Resolutions Committee, and Recommendations Committee.

REPORT OF COMMITTEE ON COORDINATION OF WEED RESEARCH IN WESTERN WEED CONTROL CONFERENCE

A questionnaire was mailed December 10, 1948 to all investigators or agencies in the eleven western states who were known or believed to be conducting research on weed control. Each investigator was invited to list the types of weed research he had carried on in 1948 and also the new studies planned in 1949 if he approved a plan of preparing a classified summary of all weed control studies underway in the region or planned for 1949. Four questions on different suggested types and degrees of cooperation and coordination of weed research in the WWCC were asked in order to determine the thinking of our research group on this problem. The questionnaires sent and replies received are classified below by states and agencies:

State	Question sent	Replies received
Arizona	3	1
California	17	5
Colorado	8	3
Hawaii	2	0
Idaho	4	4
Montana	4	2
Nevada	3	3
New Mexico	1	1
Oregon	3	1
Utah	4	3
Washington	2	2
Wyoming	1	1
	53	26

Agency	Question sent	Replies received
State Experiment Stations	19	13
State Depts. of Agriculture	2	2
USDA, Bur. of Plant Industry, Soils & Agr. Eng.	5	5
Other Federal Agencies	7	4
Commercial Companies	20	3
	53	26

Following are listed the questions asked and summaries of the replies received:

I Do you favor having classified summaries made of the weed research activities conducted by state, federal and commercial agencies in 1948 and planned for 1949, and copies distributed to all weed research workers in the region?

Yes — 25 No — 1

II Do you think some plan of coordinating weed research activities and dividing responsibilities should be developed and suggested for the use of agencies that wish to cooperate? **If so, please attach specific suggestions.**

Yes — 14 No — 6 W.R. or N.C.* — 6

III Do you favor developing suggested uniform plans for certain types of weed experiments as geographical replications within the WWCC? **If so, please attach specific suggestions.**

Yes — 15 No — 7 W.R. or N.C.* — 4

IV Do you favor developing a coordinated program of suggested regional plans for most phases of weed research in our region as the North Central Weed Control Conference has done?

Yes — 20 No — 5 W.R. or N.C.* — 1

V Do you think the Research Committee of the WWCC should assemble brief abstract reports of results of completed experiments submitted each year by individual investigators to be mimeographed and made available to research personnel?

Yes — 24 No — 2

To all in attendance at the annual conference meeting?

Yes — 17 No — 9

* Voted "yes" with reservations or were non-committal.

The 26 replies received were only 49 percent of the total of 53 questionnaires sent out, but were 70 percent of those sent to investigators in state and federal agencies. Replies were received from only 15 percent of the commercial workers or companies to whom questionnaires were sent. While the response was far from complete it appears probably that the opinions reported are fairly representative of all state and federal weed research men in the conference. Federal and state workers voted about alike on all questions.

All of those reporting voted in favor of the preparation of a classified summary of weed research underway in the region in 1948 and of new work planned in 1949 and most of them submitted the necessary report of their own work for such a summary. Condensed summary tables and a brief discussion based upon the information reported are given later in the report.

Considerable difference of opinion was expressed in the replies to questions II, III and IV regarding a program of cooperation and coordination of weed research in the region to be sponsored by our Conference Research Section. A majority favored all three suggested plans but a sizeable minority was opposed in each case. Strangely enough, there was a definitely stronger vote of approval for the comprehensive NCWCC plan designated in question IV than for the simpler partial plans suggested in questions II and III. Probably the exact meaning of these three questions and their interpretation was not clear to many. Perhaps after thorough explanation and discussion a vote of research personnel would be considerably different than that tabulated above.

About 95 percent of those voting approved a plan of assembling abstract reports of weed investigations each year and making them available to research personnel. Only 65 percent were in favor of making the abstracts available to all persons in attendance at the conference annual meeting.

Only a few of those voting favorably on questions II and III listed any specific suggestions. Because of this and the strong minority opinion against a conference sponsored regional plan of cooperation and coordination in weed research the committee is not submitting a suggested regional plan. However, the committee does urge that the whole problem be thoroughly discussed in the meetings of the Research Section and a decision reached on future policy and procedure.

A regional technical committee has been assigned by the directors of the agricultural experiment stations in the eleven western states to prepare a plan for a proposed cooperative weed research project under Public Law 733, Sections 9b3 and 10b. Thus it appears probable that a regional program of cooperation in weed research with perhaps a certain amount of coordination will be adopted in a year or two. If the Research Section of the WWCC as such wishes to take any supplementary or supporting action with respect to regional cooperation in weed research the decision should be made and plans initiated at the 1949 annual meeting. Also, if abstracts are to be assembled and made available to research personnel or to all in attendance at the annual meeting in 1950, the committees should be appointed and responsibilities designated at the 1949 meeting. Experience in the NCWCC has shown that planning for, assembling, organizing and processing such a body of abstracts is a task requiring sustained efforts of several working committees in making careful preparations well in advance and in doing the intensive and time consuming work of finally getting the assembled abstracts ready for distribution.

Summary of Weed Control Research in the Western Weed Control Conference

The summary is based on reports from 24 investigators who are listed on an attached sheet. The reports covered all of the work being conducted by the Bureau of Plant Industry, and probably a major part of that being carried on by state experiment stations and other federal agencies. While the survey was not complete, the data assembled afford some interesting information on the amount and kinds of weed research underway in the region.

The task of classifying and summarizing the mass of reported data on a wide range of experimets proved difficult. The two tables given below were condensed from an extensive detailed tabulation sheet and attempt to classify the information reported into logical and significant categories. The information given on some reports was insufficient to permit identification of the weeds being studied, the herbicides being tested or the crops involved. No doubt a more suitable questionnaire can be designed for any future surveys that will insure getting all of the information necessary for complete classification. This summary does not show where or by whom the various kinds of weed research are being done. Such a report was prepared by a member of the committee, but it is so large that it has been decided to make general distribution of such a detailed summary to all research personnel in the region.

Most of the experiments reported were for studying the effect of herbicides on weeds or crops or both. Only 7 of the 159 reported experiments underway in 1948 involved cultural methods such as cultivation and crop competition. Reports showed only a few tests of pre-emergence application of herbicides and indicated much less interest in this phase than has been shown by investigators in eastern and central parts of the United States where heavy rainfall and wet soil conditions often make post-emergence weed control difficult. The relatively large number of experiments on the effects of post-emergence applications of herbicides on annual weeds and crops indicates that considerable information should be forthcoming from that phase of investigation.

Control of herbaceous perennial weeds appears to be the most common kind of weed research in the region. The 41 experiments with herbicides on broadleaved weeds included 10 on morning glory, 7 on Canada thistle, 7 on Russian knapweed and 17 on other perennials such as white top, ground cherry, toad flax, dandelion, larkspur and herbaceous range species. Eight of the 12 experiments on perennial weedy grasses were on quackgrass and 3 on Johnson grass.

Most of the experiments on control of aquatic weeds are being carried on by the Bureau of Plant Industry, Soils and Agricultural Engineering and the Bureau of Reclamation. These agencies also have several studies underway on the control of woody plants as do several state experiment stations and other federal agencies. The species of woody plants being studied include willow, wildrose, barberry, blackberry, sagebrush, rabbit brush and several species of trees. Most of the chemical and physiological studies reported are being carried on at one federal and one state station, with a few experiments reported by other state stations. It is believed that considerable research of this type is being carried on by one or two state stations that did not report.

2,4-D was the most popular chemical in the reported experiments, with considerable interest shown in other selective herbicides. Chlorates and other general herbicides were hardly mentioned. Small grains were involved more frequently than other crops in the experiments, although there appeared to be considerable interest in weed control in and effects of herbicides on corn, alfalfa and clovers, and vegetable crops. It would appear that research on weed control in vegetables, potatoes and sugar beets might well be expanded in the region. In many of the reports the number of crops involved was given but they were not identified, thus making it impossible to classify them in the table.

The reports on new experiments planned for 1949 indicated that the new work will follow about the same pattern as that underway in 1948 with respect to both the chemicals used and the crops involved. However, there apparently will be relatively less emphasis on 2,4-D and more on 2,4,5-T and the oils in the new work. Also, less attention will be given to weed control in small grains and relatively more to alfalfa and clovers and to vegetable crops.

The total amount of weed research being conducted appears to be considerable. Considering the wide range and complexity of the weed problems, present research probably is not nearly adequate to develop solutions to the problems as rapidly and completely as the public interest demands. However, if all of the information from weed control experiments conducted in the past and now underway could be made available to the public throughout the region in understandable and usable form, it probably would add greatly to our present knowledge on weed control.

Table 1. Summary of Weed Research Reported in WWCC by Type of Experiment, Kind of Weed and Kind of Herbicide Used.

Type of Experiment and Kind of Weed	NUMBER OF TIMES VARIOUS CHEMICALS WERE USED IN DIFFERENT EXPERIMENTS										
	No. of Expts.	2, 4-D	2, 4, 5-T	IPC	TCA		Dinitros	Oils	Aromatic Solvents	Ammate	Other or unspecified
Experiments in 1948:											
Control of annual weeds											
Pre-emergence	5	3	....	....	1	....	....	2	....	....	....
Post-emergence	11	8	....	....	1	1	2	4	....	....	1
Effect of herbicides on crops											
Pre-emergence	4	4	....	....	....	....	1	1	....	....	....
Post-emergence	37	28	1	4	4	....	8	4	2	....	1
Control of perennial weeds											
By herbicides											
Broadleaved species	41	29	4	1	1	....	....	....	....	....	27
Grass species	12	....	....	3	6	....	1	6	....	....	3
By cultural methods	7	....	....	....	....	....	....	....	....	....	3
Control of aquatic weeds											
Emergent—cattail, etc.	4	4	3	....	1	....	....	....	....	1	....
Submerged—Pondweed, etc.	8	7	5	....	....	....	....	....	7	....	1
Control of woody plants	12	9	6	....	....	....	....	1	....	2	4
Miscellaneous experiments (mostly chemical and physiological studies)	18	....	....	....	....	....	....	....	....	....	....
TOTALS	159	92	19	8	14	1	12	18	9	3	37
New Work Planned for 1949:	43	15	5	3	4	2	3	9	1	1	9
Continue same experiments	9	....	....	....	....	....	....	....	....	....	....
Miscellaneous (mostly chemical and physiological studies)	13	....	....	....	....	....	....	....	....	....	....

Table 2. Summary of Weed Research Reported in WWCC by Type of Experiment, Kind of Crop.

Type of Experiment	NUMBER OF TIMES VARIOUS CROPS USED IN DIFFERENT EXPERIMENTS								
	Total	Small Grains	Flax	Corn	Alfalfa and Clovers	Sugar Beets	Vegetable Crops	Fallow	Others or unspecified
Experiments in 1948:									
Control of annual weeds									
Pre-emergence	5	1	1	2	....	....	....	....	1
Post-emergence	11	3	1	1	2	1	....	....	3
Effect of herbicides on crops									
Pre-emergence	4	....	1	....	....	....	2	....	1
Post-emergence	37	21	....	4	8	....	7	....	47
Control of perennial weeds									
Cultural methods	7	2	....	1	....	1	....	3	3
TOTAL	64	27	3	8	10	2	9	3	55
New work for 1949:	26	8	1	1	9	1	4	....	2

LIST OF INVESTIGATORS AND AGENCIES SUBMITTING REPORTS ON WEED CONTROL RESEARCH

State Experiment Stations:

California.....L. G. Jones, Dept. of Agronomy, Agr. Exp. Sta., Davis, California
Colorado.....B. J. Thornton, Botany Dept., Colo. A. & M. College, Fort Collins
Idaho.....Lambert Erickson, Agronomy Dept., Univ. of Idaho, Moscow, Idaho
C. I. Seely, Agronomy Dept., Univ. of Idaho, Moscow, Idaho
Montana.....V. C. Hubbard and T. S. Aasheim, North Montana Branch Station, Havre, Montana
R. L. Warden, Dept. of Agronomy and Soils, Montana State College, Bozeman, Montana
Nevada.....J. H. Robertson, Dept. of Agronomy, Agr. Exp. Sta., Reno, Nevada
New Mexico.....James R. Spencer, Dept. of Agronomy, State College, New Mexico
Oregon.....V. F. Freed, Agr. Exp. Station, Corvallis, Oregon
Utah.....D. C. Tingey, Agronomy Dept., Utah State Agric. College, Logan
Washington.....L. W. Rasmussen, Agronomy Dept., Washington State College, Pullman
Wyoming.....Dale W. Bohmont, Agronomy Dept., Univ. of Wyoming, Laramie, Wyo.

Government Agencies:

Bureau of Plant Industry, Soils and Agricultural Engineering:
H. Fred Arle, Room 24, Post Office Bldg., Phoenix, Arizona
V. F. Bruns, Irrigation Experiment Station, Prosser, Washington
J. M. Hodgson, Box 576, Meridian, Idaho
E. T. Oborn, c/o Bur. of Reclamation, Bldg. 35, D.F.C., Denver, Colorado
F. L. Timmons, Agricultural Experiment Station, Logan, Utah
Bureau of Reclamation:
Cecil J. Graham, Region 2, Box 2511, Sacramento, California
C. W. Bowser, Region 3, Boulder City, Nevada
E. O. Larson, Reg. Director, Region 4, P.O. Box 560, Salt Lake City 8, Utah
Bureau of Entomology and Plant Quarantine:
H. B. Offord, 4 Forestry Bldg., Univ. of Calif., Berkeley, California

Commercial Companies:

Coulson Parrish, The Amalgamated Sugar Company, Twin Falls, Idaho
Russell T. Nelson, The Great Western Sugar Co., Longmont, Colorado
Luther W. Norem, California Research Corp., 200 Bush St., San Francisco, California

REPORT OF THE EXECUTIVE COMMITTEE

WALTER BALL—Secretary

Your executive committee met at 4:15 p.m. on February 2nd with the following members present: Bruce J. Thornton, Lowell Rasmussen, V. A. Cox as proxy for Harry Jucksch, Chet Otis and Walter S. Ball.

A registration fee of $2.50 was approved.

The Organization Committee submitted its report to the executive committee for consideration and approval before submitting the report to the Conference. The report was discussed and amended and was then moved, seconded and carried that the report be approved as read and amended.

The approval of this report necessitated amendments to the Constitution and By-Laws. The amendments to the Constitution and By-Laws were submitted by the Organization Committee; read, discussed, amended and approved.

The executive committee recommends that a delegate from the Western Weed Control Conference be designated at each annual conference to attend one of the other conferences. The executive committee suggests that a representative be sent to the North Eastern Weed Conference and it was further suggested that Walter S. Ball be the representative.

The executive comittee further suggests that the president be authorized to designate any member attending other conferences as official delegate when attending on state or funds other than those of the Western Weed Control Conference.

The committee further suggests that the name of this organization be changed to Western Weed Conference. I submit this report for your consideration and move it be approved.

The report was discussed, seconded and approved.

REPORT OF THE WESTERN WEED CONTROL CONFERENCE ORGANIZATION STUDY COMMITTEE

Chet Otis, Chairman

This committee was appointed March 31, 1948 by Mr. Bruce Thornton, president of the Western Weed Control Conference. According to President Thornton, its function was to, "study the present organization set-up with a view to suggesting such changes or modifications as will take care of our future growth and development in an orderly manner and permit efficient and effective functioning at our meetings without becoming too involved and complex and losing its present character."

The committee conferred and corresponded with many members of the Western Conference and corresponded with several representatives of the North Central, North Eastern and Western Canadian Conference in order to obtain a broad background for its determination, after which it drew up the following two-fold report:

Section I

The committee feels that the prime objective of the Western Weed Control Conference, as expressed in Article II, Item 1, of the Conference constitution, is to function as a clearing house for all weed control matters of interest to western agriculture. Such a broad objective encompasses many fields of diverse interests and therefore it is proper and necessary that the Conference serve all such interests.

The Committee suggests that these interests may be better served and the Conference goals better attained by modifying the Conference committees and programs and reorganizing the membership and official delegates as follows:

I. Conference Committees and Sections.

A. Sections

1. Research (this section to be an open meeting or meetings where subjects of research or new information nature are presented and discussed).
2. Education and Regulatory (this section to be an open meeting where subjects of an educational and regulatory nature are presented and discussed).

B. Permanent committees

1. Major committees
   a. Research
   b. Education (To include college residence instruction, youth education, extension education, and other things that may be designated).
   c. Regulatory (To include organized state and county weed control activities, legislation, the study of weed prevention, and other things that may be designated).

2. Minor committees
   a. Resolution
   b. Nomination (to submit two candidates for each elective office).
   c. Auditing
   d. Membership

C. Temporary committees.
   1. Coordinating (To coordinate weed control activities of public agencies).
   2. Hope-Flanagan (To investigate all possibilities of obtaining Hope-Flanagan funds for western weed control studies).
   3. Publication
   4. Others, as need arises

D. Adherence to the following suggestions should make the committee operations more effective:
   1. The chairman of the research committee should also be chairman of the research section, and the chairmen of the regulatory and education committees should be co-chairmen of the regulatory and education sections.
   2. The committees should be more or less self-sufficient, that is, the chairmen and members with the aid of the Conference officers and executive board should be primarily responsible for committee agenda and proper organization of their work and discharge of their duties.
   3. If the individual committees and the Conference itself are to succeed, the committees must be active. Their programs must be organized well in advance of the annual conference and, in fact, through correspondence, much of their preliminary work should also be done in advance.
   4. Each committee should prepare and submit a written report to the Conference secretary at the annual meeting. (See program suggestions for additional details on this point).
   5. At least one full day should be allowed for committee and section meetings at each annual meeting. (See program suggestions for additional details on this point).
   6. To better utilize available personnel, to create wider interest in Conference activities, and to provide for smoother functioning of committees, more different individuals should be requested to serve as committee members. This might best be accomplished by restricting individuals to membership on not more than one major committee and a total of three committees altogether.

II. Program Suggestions

A. General suggestions:
   1. Allow at least one full day for committee and section meetings.
   2. Summarize state reports. (See following detailed suggestions for further points).
   3. Encourage the use of visual aids to accompany talks.
   4. Request that individual talks or papers be made brief and pointed.
   5. Feature more panels and symposiums.
   6. Diversify the program.
   7. Instruct all speakers appearing on the program to use in so far as possible generic terms instead of trade names when referring to chemicals or products.

B. Detailed suggestions:
   1. First day of annual meeting
      a. A.M.-Research committee meeting and regulatory and education section.
      b. P.M.-Research section and regulatory and education committee meetings.
      c. Registration all day.
   2. Second day of annual meeting.
      a. Summary of state reports (suggest submitting all state reports in advance so they can be summarized and this summary presented by one individual; the complete reports to be published in the proceedings).
      b. Panels, symposiums or forums.
         (1) Two of a research or new information nature
         (2) One of a regulatory nature
         (3) One of an education nature
      c. Guest speakers
   3. Third day of annual meeting.
      a. Committee reports (all committees should submit a written report to the secretary at the meeting).
      b. Business meeting
      c. Guest speakers and panels, etc. as needed to fill out the day.

III. Suggested membership and official delegate changes.

A. Enlargement of voting membership. Enlarge the official, voting membership to include all state and county public agency representatives actively engaged in weed control work, these members to be eligible for office. If this change is made the secretary should prepare each year separate lists of voting and non-voting members.

B. Provision for election of state delegates. Whenever a vacancy in the list of official state delegates occurs, the voting membership from that state should elect a new state delegate. It is further suggested that when a delegate is elected to fill a vacancy in the present list, he be elected for a limited term. Furthermore, there should also be elected an alternate delegate who will, in the event the delegate vacates his office, fill out the delegate's unexpired term.

Section II.

It seems to your committee that regional weed organizations such as the Western Weed Control Conference have become large and unwieldy. This situation may be corrected in part by adopting the foregoing suggested changes. An additional helpful move would be the organization of state weed conferences in the individual western states on a basis similar to the Western Weed Control Conference set up, that is on the basis of cooperation

among public agencies, growers, and commercial interests. These state conferences could meet ahead of the Western Weed Control Conference to hear papers and panels and draw up reports and resolutions. This would not only remove much of the burdensome detail now swamping the regional conference but at the same time would handle it more effectively at the state level. Following the state sessions, the Western Weed Control Conference could then, at its annual meeting, properly function as the parent organization and a broad clearing house.

In addition to streamlining and strengthening the Western Weed Control Conference such state organizations would provide an excellent medium for disseminating information and developing support for state weed programs.

There now appears to be sufficient interest in weed control to justify a conference in almost every one of the western states. A few of the states are already either organized or in the process of organizing.

Therefore your committee recommends that this conference adopt the suggestions outlined in Section I of this report and, furthermore, that it encourage the organization of state conferences, and, if requested, assist in the formation of such conferences.

PROPOSED WESTERN WEED CONTROL CONFERENCE CONSTITUTION CHANGES OR AMENDMENTS

1. Article II, Item 2.

It is proposed that Article II, Item 2 be changed to read as follows: "To foster state and regional organizations and a national organization of weed control agencies to act as state, regional, and national clearing houses in connection with weed problems."

2. Article III.

It is proposed that Article III be changed to read as follows: "Any person, cooperative association, governmental agency, corporation, or other organization operating within the region covered by the Conference and actively interested in weeds and weed control shall be eligible to one of the following types of membership:

1. Voting membership (for state and county public agency workers).
2. Associate membership.
   a. Individual (for other than state or county public agency workers).
   b. Organization.
3. Sustaining membership."

3. Article IV.

It is proposed that the heading of Article IV be changed to read as follows: "Officers, Executive Board and Official State Delegates."

4. Article IV, Paragraph 3, last sentence.

It is proposed that the last sentence of paragraph 3, Article IV be changed to read as follows: "All voting members of the Conference shall be eligible to hold an elective office."

5. Article IV.

It is proposed that the following paragraph be added to Article IV, following paragraph 3: "Official state delegates shall be elected from among the voting membership of each state concerned by the voting members of that particular state. Whenever a vacancy occurs in the present list of state delegates a replacement shall be elected and shall serve for three years beginning at the annual meeting where the election takes place and concluding at the close of the annual meeting three years hence. Alternate delegates shall also be elected in the same manner. It shall be the duty of the alternate delegate to fill out the delegate's unexpired term in the event the delegate vacates his office."

6. Article V.

It is proposed that the heading of Article V be changed to read as follows: "Sections and Committees".

7. Article V.

It is proposed that Article V be changed to read as follows: "The president shall appoint all committee chairmen and committee members. The chairman of the research committee shall also be chairman of the research section. The chairmen of the education and regulatory committees shall be co-chairmen of the education and regulatory section. All voting members and individual associate members shall be eligible for committee duty, providing, however, that no one person may hold membership on more than three committees of which not more than one may be a major committee. The sections and committees shall be as follows:

1. Sections.
   a. Research (this section will be conducted as an open meeting or meetings where subjects of a research or new information nature are presented and discussed).
   b. Education and Regulatory (this section will be conducted as an open meeting where subjects of educational and regulatory natures are presented and discussed).
2. Permanent Committees.
   a. Major Committees.
      (1) Research, with sub-committees as desired.
      (2) Education, with sub-committees as desired.
      (3) Regulatory, with sub-committees as desired.
   b. Minor Committees.
      (1) Resolution
      (2) Nomination (to submit 2 candidates for each elective office).
      (3) Auditing
      (4) Membership
3. Temporary committees as the need arises."

8. Article VI.

It is proposed that Article VI be changed to read as follows: "Officers shall be elected separately and they shall also be elected by ballot."

9. Article VII.

It is proposed that Article VII be changed to read as follows: "All voting members in good standing shall be eligible to vote for officers and on all matters brought to a vote in the Conference."

10. Article IX.

It is proposed that Article IX be changed to read as follows: "Annual dues for the classes of membership shall be as follows:

1. Voting membership ..... $ 3.00
2. Associate membership
   a. Individual 3.00
   b. Organization 25.00
3. Sustaining 50.00

11. By-Law I.

It is proposed that the following item No. 4 be added to By-Law I, following item 3: "The official state delegates shall:

a. Be the liason between the Conference officers or executive board and conference members within each delegates state.

b. Promote Conference activities within the various states as requested by the Conference officers or executive board.

c. Be responsible for preparation of state reports to the conference."

WESTERN WEED CONFERENCE
Constitution and By-Laws
CONSTITUTION

ARTICLE I—Name

The name of this organization shall be "Western Weed Conference", hereafter referred to as the "Conference". It shall include the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming and such other States and Provinces of Canada that may become members.

ARTICLE II—Objects

The objects of the Conference shall be:

1. to function as a clearing house on weed matters.

2. To foster state and regional organizations and a national organization of weed control agencies to act as state, regional, and national clearing houses in connection with weed problems.

3. To cooperate with other regions and with governmental, private, and commercial agencies in the solution of weed problems.

4. To foster educational work in weeds and weed control through all appropriate agencies.

5. To foster plans for organized weed research and control programs.

6. To encourage national and state research in weed control and foster legislation to that end.

7. To assist in the development of uniform state weed and seed regulations and quarantine legislation.

8. To foster adequate national weed and seed regulations and quarantine legislation.

ARTICLE III—Membership

"Any person, cooperative association, governmental agency, corporation, or other organization operating within the region covered by the Conference and actively interested in weeds and weed control shall be eligible to one of the following types of membership:

1. Voting membership (for state and county public agency workers).

2. Associate membership.
   a. Individual (for other than state or county public agency workers).
   b. Organization

3. Sustaining membership.

ARTICLE IV—Officers, Executive Board and Official State Delegates.

The officers of the Conference shall be: President, Vice-president, Secretary-Treasurer.

The Executive Board shall be: President, Vice-President, Secretary-Treasurer, Immediate Past-President, Chairman of the Research Committee and one associate member to be appointed by the other members of the Executive Board.

The officers shall be elected at the annual meeting of the Conference and, unless otherwise provided, shall serve for one year beginning at the close of the annual meeting and ending with the close of the next annual meeting or until successors have been elected. All voting members of the Conference shall be eligible to hold an elective office.

Official state delegates shall be elected from among the voting membership of each state concerned by the voting members of that particular state. Whenever a vacancy occurs in the present line of state delegates a replacement shall be elected and shall serve for three years beginning at the annual meeting where the election takes place and concluding at the close of the annual meeting three years hence. Alternate delegates shall also be elected in the same manner. It shall be the duty of the alternate delegate to fill out the delegate's unexpired term in the event the delegate vacates his ofice.

ARTICLE V—Sections and Committees.

The president shall appoint all committee chairmen and committee members. The chairman of the research committee shall also be chairman of the research section. The chairmen of the education and regulatory committees shall be co-chairmen of the education and regulatory section. All voting members and individual associate members shall be eligible for committee duty, providing, however, that no one person may hold membership on more than three committees of which not more than one may be a major committee. The sections and committees shall be as follows:

1. Sections
   a. Research (this section will be conducted as an open meeting or meeting where subjects of a research or new information nature are presented and discussed).
   b. Education and Regulatory (this section will be conducted as an open meeting where subjects of educational and regulatory natures are presented and discussed.

2. Permanent Committees.
   a. Major committees

(1) Research, with sub-committees as desired.
(2) Education, with sub-committees as desired.
(3) Regulatory, with sub-committees as desired.

b. Minor committees
(1) Resolution
(2) Nomination (to submit 2 candidates for each elective office).
(3) Auditing
(4) Membership

3. Temporary Committees as the need arises.

ARTICLE VI—Election of Officers.

Officers shall be elected separately and they shall also be elected by ballot.

ARTICLE VII—Voting.

All voting members in good standing shall be eligible to vote for officers and on all matters brought to a vote in the Conference.

ARTICLE VIII—Vacancies.

Should a vacancy occur in the Presidency, the Vice-President shall become President. In case of a vacancy in any other elective office the same may be filled for the unexpired term by a person appointed by the President.

ARTICLE IX—Dues.

Annual dues for the classes of membership shall be as follows:

1. Voting membership ..... $ 3.00
2. Associate membership
   a. Individual 3.00
   b. Organization 25.00
3. Sustaining 50.00

ARTICLE X—Meetings.

The annual meeting shall be held at such time and place as shall be determined by the Executive Board.

Special meetings of the Conference or the Executive Board may be held at the call of the President, subject to the approval of the Executive Board.

ARTICLE XI—By-Laws.

The Conference shall adopt By-Laws.

ARTICLE XII—Amendments.

The Constitution and By-Laws may be amended by a three-fourths vote of the members present at any regular meeting.

BY-LAWS

BY-LAW I—Duties of Officers.

1. It shall be the duty of the President to preside at all meetings of the Conference, to perform the usual duties of such office and in addition:

a. Serve as Chairman of the Executive Board.
b. Appoint all Committee Chairmen.
c. Appoint all Committee Members, with the advice of the respective Chairmen of the Executive Board if he so desires.

2. The Secretary-Treasurer shall perform the duties common to that office.

3. The Executive Board shall:
a. Transact the business of the Conference when the Association is not in session.
b. Be responsible for the program at the annual meeting.

4. The official state delegates shall:
a. Be the liaison between the Conference officers or executive board and conference members within each delegates state.
b. Promote Conference activities within the various states as requested by the Conference officers or executive board.
c. Be responsible for preparation of state reports to the Conference.

BY-LAW II—Membership.

1. All members in good standing in the year of adoption of this Constitution shall automatically become members of the Conference.

2. Application for membership shall be submitted to the Membership Committee. If approved applicant shall become a member of the Conference upon payment of dues.

BY-LAW III—Publications.

The annual proceedings shall embrace reports, papers and the minutes of the annual meeting. Copies of the "Proceedings of the Conference" shall be furnished to members in good standing. Other copies may be distributed or sold as the Executive Board shall direct.

BY-LAW IV—Order of Business.

Business at all regular meetings of the Conference will be conducted according to Robert's Rules of Order.

BY-LAW V—Quorum.

A quorum at any regular meeting shall consist of representation of five states, including two members of the Executive Board.

BY-LAW VI

All previous rules and regulations of the Conference shall become null and void with the adoption of this Constitution and By-Laws.

REPORT OF THE COORDINATING COMMITTEE

Lee M. Burge, Chairman

MEMBERS: Warden, Swenson, Chisholm, Graham.

The duties of this committee, established by the Western Weed Control Conference, are as follows: (1) Make recommendations as to State and Federal participants in weed control programs, payments for control efforts, etc. (2) Urging an effective Federal program of weed control on all Federal land including forest reserves, Indian reservations, Taylor grazing land, national parks, etc., and encouraging the coordinating of these programs with local programs. (3) Study of organization and administration of weed control districts, methods of making charges and amount of charges, and such other matters as may be involved in setting up and operating weed control districts with a view to providing some basis of uniformity over the Conference area.

The Committee met three times during 1948 and gathered a considerable amount of data concerning the above duties from various state and Federal agencies through

questionnaires. These data will not be included in their entirety in this report but can be obtained from the Committee chairman by any interested Conference member.

Most states in the Conference area when questioned concerning State and Federal participation in cooperative weed control programs urged that all Federal, State and County agencies who administer the management of public lands on which noxious weeds exist be represented on local County weed committees or weed districts. By having all public agencies concerned represented in such local organizations, greater mutual support for weed control effort can be developed between private land owners and these agencies. Private land owners would benefit by having noxious weeds controlled on public lands near their property and in turn the public agencies would have greater support from land owners in their efforts to obtain weed control money from Federal and State legislatures.

The Committee therefore recommends that each State in the Conference area make a concerted effort to get the participation of all State and Federal agencies concerned on the local weed committees or weed districts that now exist. Furthermore, where such local weed committees and weed districts do not exist and where there is a definite need for such organization, it is urged that these local organizations be created as soon as possible.

Concerning the matter of payment for weed control effort, the Committee has the following to report: All states in the Conference area were questioned concerning payment programs in effect in each state; a certain amount of diversity was noted. One common practice is a three-way cooperative program in which the State, County, and landowner each appropriate one-third of the funds necessary for a particular job.

Apparently landowners in the Conference area are using only a small proportion of money available for weed control payment programs under the Production and Marketing Administration. A survey shows that, during 1947, a total of $5,141,746.00 was spent for tillage and chemical weed control under the P.M.A. program in the entire U. S. Of this amount, only $548,320 or approximately ten per cent, was spent in the eleven Western States. The States of Minnesota and North Dakota alone spent $2,523,794 and $1,075,509, respectively. Lack of use of this money may stem from the attitude in the Conference area that landowners and public agencies should assume more responsibility and should appropriate their own weed control funds rather than depend on subsidization.

If the Conference feels that greater use should be made of P.M.A. money in the Western States for weed control there is definite need for considerable educational work on the benefits to be derived from use of this money. This point should be considered by the Conference Committee on Education. The Extension Service is the proper agency to conduct this educational work.

Several States believe that better use could be made of P.M.A. money if a full time supervisor was employed by each weed district, and if a certain definite percentage of the P.M.A. money, was set aside each year in each county or district; also that an educational program be carried on in conjunction with the work to create more interest. Although the Committee believes that more effective use can be made of P.M.A. money, it believes that property owners and land use agencies should assume more responsibility for controlling weeds on their lands rather than depend upon payment programs.

A survey was conducted with State and Federal agencies concerning the matter of weed control programs by Federal agencies on Federal lands.

It was determined that Federal agencies control and manage approximately 357,000,000 acres of public lands in the conference area. During 1948 only two of these agencies reported that they had appropriated money for weed control and the amount totalled only $10,000. It can be assumed that only part of this public land is infested with noxious weeds, but it is known that certain range depleting plants such as Klamath weed, Canadian thistle, larkspur, and Hologeton, are reducing the carrying capacity of the ranges, and is a constant source of infestation to private land.

The Committee suggests that the first step in the development of weed control work by federal agencies on these public lands is a cooperative survey conducted jointly by the state and federal agencies to determine the type and extent of noxious weed growth present, the amount of control work that should be accomplished, and an estimate of the cost. The Committee recommends that the Secretary of the Conference write a letter to federal agencies, and the Department of Interior, Weed control committee or other committees that may be in the federal departments urging that they request additional appropriations from Congress for such a survey. This survey would logically result in the second step in the development of a program on public lands; the appropriation of funds by Congress for the accomplishment of control work shown to be necessary by the survey.

All federal agencies managing public lands should have at least one man on a regional basis who is familiar with weeds and weed control and who could plan and develop cooperative weed control projects with other agencies, landowners, and state and local weed committees.

The Committee made a definite effort to study the organization and administration of weed control districts with a view to providing some basis of uniformity over the 11 Western states. The commttee found a wide diversity of procedure in the organization and administration of weed districts over the Conference area. To arrive at an ideal uniform system for the 11 Western States, it would require a thorough study of the effectiveness of each particular type of procedure. With the time and funds available it was impossible for this Committee to adequately measure this effectiveness. Therefore, the Committee is not able to report fully on this subject at the present time. It is questionable whether any appointed committee could arrive at an acceptable uniform weed district organization for the Conference area without several years of study.

It is suggested that the Conference give careful consideration to the possibility of requesting that some responsible and unbiased agency such as the Bureau of Plant Industry, Soils, and Agricultural Engineering have one man spend not less than one year traveling from state to state and actually comparing how weeds are being killed under each set of control district regulations, and under each type of organization, and submit for con-

sideration by the conference, a suggested uniform system of weed control districts.

In addition to its assigned duties, the Committee wishes to present the following for consideration by the Conference membership:

The Committee urges that the necessary steps be taken to establish uniform weed seed regulations for the Conference area concerning the interstate movement of feed grain and seed screenings.

The Committee also recommends that the necessary steps be taken to urge State Civil Aeronautics Boards to develop educational programs to acquaint pilots with the hazards involved in the use of 2,4-D and other herbicides.

It is also urged that states use sound judgment in the development of restrictions on the use of 2,4-D and not legislate this valuable chemical completely out of the field of weed control.

FEDERALLY CONTROLLED LANDS IN THE ELEVEN WESTERN STATES

	National Park Service	Forest Service	Indian Service	Land Management	Reclamation Service
California	4,626,220	19,708,861	480,229	5,844,324	
Oregon	160,770	14,740,042	1,706,191	11,978,370	
Washington	13,349,968	9,658,102	2,726,617		
Idaho	79,671	20,160,314	935,000	11,819,933	
Nevada	976,619	5,052,961	494,065	39,778,786	
Utah	4,971,278	7,764,928	**	27,066,242	
Colorado	389,307	13,704,830	**	7,100,755	
Montana	1,165,162	16,523,759	6,436,417	3,116,908*	
Wyoming	2,039,216	8,565,764	2,080,625	13,697,034	
Arizona	2,628,868	11,496,304	**	9,651,778	
New Mexico	246,283	8,939,562	29,030,835** (Dist. 4)	14,017,142	
Total	30,633,362	136,315,427	43,889,979	144,071,272	2,000,000

* Districts 2-3-6 not included

** Utah, Colorado and Arizona included in Dist. 4

GRAND TOTAL: 356,910,040

Weed Control by Use of Chemicals and by Tillage Carried out Under the 1947 Agricultural Conservation Program, by States

(Preliminary)

WEED CONTROL — BY CHEMICAL

State & Region	Counties	Farms excluding duplication	Sodium Chlorate			Agricultural Mesh Borax			Borax, Special Undried Concentrates			2,4-D		
			Farms	Pounds	Credit earned	Farms	Pounds	Credit earned	Farms	Pounds	Credit earned	Farms	Pounds	Earned
Montana	25	582	288	193,096	10,897	17	7,610	136	....	....	....	218	6,986	6,014
Idaho	41	6,204	3,110	1,984,536	95,885	34	38,995	780	....	....	....	3,961	65,924	65,166
Wyoming	16	351	44	6,531	461	6	10,900	218	45	248,300	4,345	244	2,233	2,662
Colorado	38	1,899	170	88,291	4,413	....	....	....	....	....	....	1,734	42,902	51,315
New Mexico	7	63	....	....	....	....	....	....	....	....	....	63	1,902	1,587
Arizona	1	1	....	....	....	....	....	....	....	....	....	....	....	....
Utah	29	2,078	....	....	....	....	....	....	....	....	....	1,973	21,000	31,205
Nevada	3	16	....	....	....	....	....	....	....	....	....	16	154	199
Washington	23	1,814	1,320	1,502,457	82,634	12	26,650	533	....	....	....	683	26,324	38,750
Oregon	33	2,807	915	441,408	30,079	....	....	....	....	....	....	1,819	50,705	64,038
California	38	1,007	5	17,280	1,728	95	503,200	10,064	395	3,605,310	63,105	505	41,437	41,437
West	254	16,822	5,852	4,233,599	226,097	164	587,355	11,731	440	3,853,610	67,450	11,216	259,567	302,373
* Total	746	72,831	20,302	7,764,693	419,293	1,717	1,663,039	33,244	440	3,853,610	67,450	50,656	686,864	847,543

* Total includes other states not listed here.

WEED CONTROL — BY TILLAGE

State and Region	Carbon Bisulphide			Other						
	Farms	Pounds	Credit earned	Kind	Farms	Extent	Credit earned	Counties	Farms	Acres	Credit earned
					937		19,638	538	63,804	1,157,050	5,141,746
Montana	46	16,236	916	Atlacide	37	30,760 lbs.	1,668	28	1,255	20,533	163,387
Idaho	1,285	525,654	15,357	....	....	....	....	35	1,011	17,248	73,890
Wyoming	1	50	5	Atlacide	18	10,072 lbs.	247	11	63	564	5,641
Colorado	....	....	....	....	....	....	....	23	98	1,293	7,018
New Mexico	....	....	....	....	....	....	....	....	....	....	....
Arizona	1	600	45	....	....	....	....	1	9	138	1,380
Utah	....	....	....	Atlacide	105	35,770 lbs.	1,304	21	406	2,781	26,920
Nevada	....	....	....	....	....	....	....	1	3	66	127
Washington	9	10,000	627	....	....	....	....	18	374	10,871	46,223
Oregon	26	10,008	452	Atlacide	47	15,450 lbs.	968	23	837	19,857	145,459
California	21	180,656	5,515	Di-Nitros	29	35,301 lbs.	3,284	23	273	8,258	78,275
West	1,389	743,204	22,917	....	236	....	7,471	184	4,329	81,609	548,320
* Total	1,389	743,204	22,917	....	937	....	19,638	538	63,804	1,157,050	5,141,746

REPORT OF THE HOPE-FLANNAGAN COMMITTEE

Virgil Freed, Chairman

The Hope-Flannagan Committee was appointed by President B. J. Thornton to prepare a regional weed project for the 11 western states and Hawaii with the U. S. Department of Agriculture cooperating and submit that for consideration to the experiment station directors with the object of encouraging the establishment of this regional weed project to be supported by Research and Marketing Act funds. Such a regional or proposed regional weed project was prepared and submitted to Director A. S. Curry of the New Mexico Station who had been designated by the directors of the experiment stations of the 11 western states to act upon the formation of a regional technical committee to administer a regional weed project.

The technical committee for a regional weed investigation project was appointed and met in Bozeman, Montana, February 1, 1949 to draft a regional weed project. The project as prepared by the Committee of the Western Weed Conference was one of several which was combined to form the over-all project. The better features of most of these projects, including that of the Hope-Flannagan Committee, of the Western Weed Conference was used as a pattern for this project. At the present time the regional weed project awaits only appropriation of funds to begin work.

REPORT OF THE COMMITTEE ON A JOINT MEETING WITH THE NORTH CENTRAL WEED CONTROL CONFERENCE

Mr. Ball reported on the action taken by the North Central Weed Control Conference relative to a joint meeting of the two conferences. He reported that the North Central Conference opposed such a meeting stating that they felt that the specific problems of the two conferences differed and that the people attending a joint meeting would not gain as much as if they had attended their own regional conference.

REPORT OF THE RECOMMENDATIONS COMMITTEE

The subject of Recommendations was given a great deal of consideration and much time was spent discussing the value of the general recommendations given by the Research Committee or the Recommendations Committee.

Many arguments were presented for and against such recommendations which resulted in the president appointing a committee and it was finally decided that general recommendations would not be submitted but rather that recommendations would be given on the state level.

Due to the various points which arose in the discussion, the president appointed a committee made up of Chairman Lee Burge, L. R. Hansen, C. I. Seely and Robert S. Warden, to be known as the Summarizing Committee. Following is its report.

REPORT OF SUMMARIZING COMMITTEE

Lee Burge, Chairman

This committee was born during the business session of the Conference at which time considerable discussion developed in connection with the reorganization program, recommendations from the Conference relative to the use of herbicides, and the general value of the Conference meeting.

The Summarizing Committee was consequently appointed to evaluate the eleventh Conference meeting. Following is the committee report:

EDUCATION

It is recognized by the Conference that education is fundamental in sound weed control. Education to be effective must follow these points.

1. The necessity for weed control.
2. Weed damage to crops and animals, including man.
3. Use of Production and Marketing Administration funds for weed control.
4. Federal-state relations.
5. Weed identification.
6. Active promotion of latest approved weed control methods.

RESEARCH

I. Review of Projects

The Western Weed Control Conference research committee sent questionnaires to some fifty workers in the western area; of this number only 44 per cent replied. However, considering this number as a fair cross section, it has been determined that only 26 per cent of the research projects now under way deal with perennial noxious weeds. Of this number only four per cent of the projects are based on cultural practices.

Seventy per cent of the research conducted during the past year was directly concerned with the effects of herbicides on crops, annual weeds, aquatic weeds, woody plants, and miscellaneous tests.

2. It was the consensus of opinion of the summarizing committee, and the general Conference that too great an emphasis in weed research has been placed upon problems other than those concerned with the control of perennial weeds, and on herbicides, especially 2,4-D. Any good weed control program must of necessity be based upon good farming practices and many different kinds of control methods. Many of the older methods of weed control are more effective under certain conditions than the new herbicides, and should be used. These methods include: Proper rotations, cultivation, soil sterilants, semi-soil sterilants, selective herbicides and combinations of the foregoing. Other herbicides which have a definite place in many weed control programs are ammate, borax, chlorates, carbon bisulphide, arsenicals, dinitros, oils, cyanate compounds, substituted phenolic compounds, organic mercury compounds, chlorinated hydrocarbons, chloropicrin, ethylene dibromide and others. Combinations of the foregoing, such as chlorate-borax, borax-carbon bisulphide and chlorate-carbon bisulphide, likewise have a place.

3. The field of range weed control has been badly neglected, but research on this phase is planned.

4. The general opinion of the research group was that the newer materials such as 1 PC TCA, 2,4,5-T and PCP show promise as weed killing agents; however, no specific recommendations can be made until after further tests. The committee wishes to point out that research men in

the chemical industry may have information on these materials that have not been made available at this meeting.

5. It was the general opinion of the Conference that consumers of herbicides should consult their local authorities for specific recommendations for use of said herbicides. There was a division of opinion relative to a general over-all recommendaton for use of herbicides.

REGULATORY MEASURES

The Conference was in general agreement that strong practical regulatory measures are essential. Uniformity among the various states was recommended on the following points:

I. Labeling of herbicides.

1. (a) Labels to include pounds of 2,4-D acid per gallon of liquid compounds.

   (b) Maximum and minimum storage temperatures.

2. Interstate shipments of farm products such as seeds, feed grain, screenings, and natural fertilizers.

3. Control laws governing weed districts insofar as local laws and conditions will permit.

II. Survey and control of range weed problems should be begun immediately on the 357,000,000 acres of federally controlled land within the eleven western states. Federal agencies are urged to take immediate steps to set up cooperative surveys on weed conditions in cooperation with local agencies.

It was strongly urged that state and county weed district regulations be coordinated as closely as possible to allow for stronger organized control projects. It was further urged that states use sound judgment in formulating regulations governing the use of 2,4-D and related herbicides and governing the operation of airplane equipment.

COMMITTEE REPORTS

Your Summarizing Committee believes that certain standing and special committees working throughout the year should give their preliminary reports to the general session on the first day following final committee meetings. These comittees would include:

1. Research
2. Education
3. Coordinating
4. Legislative
5. Organization

COMMERCIAL EXHIBITS

Considerable criticism developed at the Eleventh Conference because of the poor attendance at commercial exhibits. Commercial men feel that their time and expense were hardly justified. People in attendance who desired to visit and talk with the commercial men were in many cases unable to do so due to the full schedule of meetings. Your Summarizing Committee recommends that the commercial men be alloted a definite time of approximately one-half day in which to present their exhibits. The following suggestions are offered:

1. Commercial concerns be given one full afternoon if they so desire to begin with a buffet lunch at place of exhibits. The afternoon being given to them to explain equipment and materials with those interested.

2. A night session be turned over to the commercial interests.

REORGANIZATION

Opinion was divided on the advisability of the reorganization program. The general opinion was that said reorganizaton should be tried for a year, and necessary adjustments made next year. A considerable, but minor opinion was that it might be desirable to hold the regulatory and extension interests in the present organization and allow the research group to organize separately with the understanding that each group would call on the other for desired speakers.

REPORT OF THE RESOLUTIONS COMMITTEE

W. A. Harvey, Chairman

The following resolutions were adopted by the Conference:

RESOLUTION NO. 1

WHEREAS, the various federal agencies have a total of some 350,000 acres of land under their control in the eleven western states, and

WHEREAS, there has been to date no satisfactory weed program developed for these lands

NOW, THEREFORE, be it resolved that the Western Weed Conference assembled at Bozeman, Montana, February 2, 3, and 4, 1949, asks that adequate weed surveys of these lands be made in cooperation with proper state agencies and that control programs be developed for poisonous plants and perennial noxious weeds.

RESOLUTION NO. 2

WHEREAS, State and Federal research agencies are now developing information on weed control methods, and

WHEREAS, such information is often not immediately available to other workers

NOW, THEREFORE, be it resolved that the Western Weed Conference assembled at Bozeman, Montana, Februarl 2, 3, and 4, 1949, asks that such information be made available as rapidly as possible and that State and Federal personnel be encouraged to cooperate more freely in extension and educational programs and to present the results of experiments.

RESOLUTION NO. 3

WHEREAS, there is great need for weed control research in the Western region, and

WHEREAS, the State funds available for this research are inadequate, and

WHEREAS, the problem lends itself to regional investigation

NOW, THEREFORE, be it resolved that the Western Weed Conference assembled at Bozeman, Montana, February 2, 3 and 4, 1949, requests that funds be made available for regional weed research through the Research and Marketing Act of 1946.

RESOLUTION NO. 4

WHEREAS, legislation pertaining to weed control districts varies widely in the different states, and

WHEREAS, such legislation is the basis for weed control programs

NOW, THEREFORE, be is resolved that the Western Weed Conference assembled at Bozeman, Montana, February 2, 3 and 4, 1949, recommends that the United States Department of Agriculture, Bureau of Plant Industry, Soils and Agricultural Engineering assign personnel and provide funds for a study of the existing legislation on weed control districts and make recommendations for more uniform and workable legislation after personal contact with the states.

RESOLUTION NO. 5

WHEREAS, the published information on weed control has become voluminous and

WHEREAS, such information is presented in many different periodicals and publications

NOW, THEREFORE, be it resolved that the Western Weed Conference assembled at Bozeman, Montana, February 2, 3 and 4, 1949, recommends that the United States Department of Agriculture, Bureau of Plant Industry, Soils and Agricultural Engineering, assign personnel and provide funds to compile and summarize such research data, and print and make available such summaries and compilations.

RESOLUTION NO. 6

WHEREAS, many farmers, leaders and public agencies in the northern sections of the Region have experienced difficulty in the precipitation of 2,4-D from commercial formulations in their possession during cold periods, and

WHEREAS, this precipitation has resulted in the loss of valuable material, and

WHEREAS, this could have been prevented had the holder known the minimum safe storage temperatures for the material

NOW, THEREFORE, be it resolved that the Western Weed Conference requests the manufacturers to state on the label of all liquid herbicides the minimum and maximum safe storage temperatures of their products.

RESOLUTION NO. 7

WHEREAS, the success of the 11th Annual Western Weed Control Conference at Bozeman, Montana, February 2, 3, and 4, 1949, has been in large measure due to the efforts and facilities furnished by the following organizations

NOW, BE IT RESOLVED, that the Western Weed Conference assembled at Bozeman, Montana, February 2, 3, and 4, 1949, expresses its appreciation to:

Montana State College
Bozeman Chamber of Commerce
Baxter Hotel
Ellen Theatre
Montana State Armory Board

The report of the recommendations committee was followed by a general discussion.

REPORT OF THE NOMINATIONS COMMITTEE

Mr. Lee Burge, chairman of the nominations committee, made his report but before action was taken it was moved by Mr. Seely and seconded, that two candidates be submitted by the Nominating Committee for each office and that the vote be made by secret ballot. This motion was carried and the committee adjourned to return later with two candidates for each office.

The officers elected were:

President—E. W. Whitman

Vice-President—W. W. Robbins

Walter S. Ball—Secretary-Treasurer

It was then moved and seconded that the 1950 meeting be held in Denver, Colorado, the tentative dates to be February 1, 2 and 3, 1950.

The meeting then adjourned.

WALTER S. BALL
Secretary-Treasurer