FOURTH ANNUAL MEETING

of the

WESTERN WEED CONTROL CONFERENCE

HELD IN SALT LAKE CITY, UTAH

JUNE 27-28, 1941

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Minutes of the Fourth Annual Western Weed Control Conference

Newhouse Hotel, Salt Lake City, Utah

Friday Morning, June 27, 1941

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George G. Schweis of Nevada presided as Chairman.

Chairman Schweis: Gentlemen, the Fourth Annual Weed Control Conference will now come to order. We are especially honored this morning in having Mr. Earl J. Glade of the Salt Lake Chamber of Commerce with us. He has come here to give us a word of welcome.

Mr. Glade welcomed the group to Salt Lake City, stating that his group recognizes the importance of our work and desires to applaud our efforts. His address was interesting and inspiring.

Chairman Schweis: I am certain that Mr. Glade's talk will be an inspiration to all of us. It has been particularly difficult to get urban people to realize that they need help.

The next address will be by Mr. George L. Hobson, State Weed Supervisor for the State of Utah, who will welcome us to Salt Lake City.

Mr. Hobson: Mr. Chairman and gentlemen of this convention. You men are welcome to this Convention and to the hospitality of Salt Lake and Utah. I hope that the deliberations of this Conference will bring out a better course of procedure in weed eradication; we need it. We need a strong program, a convincing program. We need a weed program worked out for our guidance and I think the best brains of these Western States are in attendance this morning; we have a lot in store for us; we shall leave this conference better prepared to enforce the program of weed control. I think in the past we have been luke-warm toward weed problems. Gentlemen, make yourselves at home; we hope that our supervisors show you a good time.

Chairman Schweis: Thanks Mr. Hobson. To respond to your kind invitation we shall call upon Mr. Harry Spence, Jr., Extension Agronomist and Seed Commissioner of Boise, Idaho.

Mr. Spence: Mr. Chairman and friends. Mr. Schweis, I am sure that we all consider it a pleasure to have the opportunity of being guests of the State of Utah and to enjoy the friendliness of Salt Lake City. Salt Lake is often spoken of as the friendliest city in the country; I think it is pretty well named.

This is the Fourth Annual Meeting of the Western Weed Control Conference. Those of you who have followed it from its inception through all the steps to the present time appreciate your association with it. The Weed Conference group was organized for the

purpose of attempting to bring together in an annual symposium the workers who are dealing with the weed control problems throughout the Western States, in order that we may correlate and have a better understanding of each others' problems and take advantage of the work and developments which are being carried on in the neighboring States.

In weed control work, in order to carry out a successful program three elements are required: Research work, with proper methods under proper conditions; educational work; and the action phase. At this meeting I think we have a very good representation along all three lines. We have what we might call the brains and the brawn. We have research workers, and we have county men who are actually carrying out the findings of these various research stations under field conditions. I do not like to start out a conference of this type with a pessimistic attitude, but I think there are a number of problems which have been brought to our attention and on which we should do some thinking and attempt to formulate some plans toward their solution.

In the first place, as I see the picture, we are facing a time when national and international affairs are going to greatly overshadow a lot of our problems. If we size up the picture, we probably shall have to admit, although we do not like to, that maybe our problems are going to get pushed into the background when we consider defense needs and expenditures for other items, nationally and internationally. In order to keep it alive (and by all means I think we must keep it alive, because laxity for a year or two would probably cost us the ground we have gained in the last five years), it is going to take an immense amount of work on the part of all of us from the standpoint of developing better research methods and getting a better educational program, so that we can maintain the interest and emphasize the importance of the problem. We are going to have such problems as labor, probably a scarcity of materials of certain types, which may mean that we shall have to develop some newer methods. We shall probably have the difficulty of funds, both from the standpoint of research and action programs. I think that our problem for the next two or three years is twofold; First, the development of a program which will keep weed work alive and maintain the interest during what we might call this emergency period, when national and international affairs overshadow this work. Second, the development of a long-time plan for weed work. It appears to me that machinery must be set up in an attempt to follow up this work after the emergency period is over. One of the most heartening things to me today is that machinery for long-time planning is being set up. What can we do now, considering that we shall be in a slump similar to what followed the last war? We know that industry today, through the American Manufacturers' Association and others, is going to be prepared when that emergency comes, and they certainly will be ready to step in and do their share. Your engineers will have their blue-prints ready. I think that it is mighty important that agriculture give some deep thought to the types of problems that they feel should receive attention at that time.

Our officers have certainly planned an excellent program for us. We have one of the largest groups that we have had in the last four years and it is probably more representative of the entire area. I anticipate a mighty fine conference.

Chairman Schweis: Thank you very much Mr. Spence. I am certain that the members will derive much benefit from your talk.

We shall now ask the Secretary to call the roll.

Mr. Ball: Official state representative present:

Arizona	absent	
California	present	Walter S. Ball, representative
Colorado	absent	
Idaho	present	Harry L. Spence, Jr., representative
Montana	absent	
Nevada	present	George G. Schweis, representative
New Mexico	absent	
Oregon	present	L. E. Harris representing Dr. Hyslop
Utah	present	Earl Hutchings, representative
Washington	present	W. A. Harvey representing Mr. Gaines
Wyoming	absent	

Letters were received from Montana, Colorado and Wyoming; 87 attended.

Chairman Schweis: The next matter to receive consideration will be the report of the Secretary.

Mr. Spence: I moved that the reading of the minutes of the previous meeting be dispensed with. (Motion seconded and carried.)

Chairman Schweis: The next item to receive consideration will be the report of the Treasurer. Mr. Ball.

Mr. Ball submitted the following financial report:

1939-1940 Balance brought forward		$254.64
1940-1941 Amount received		80.00
Expended stamps and supplies	$ 41.69	
Balance on hand	292.95	
	$334.64	$334.64

Chairman Schweis: You have heard the report. Does anyone desire to have the report audited? If not, I shall entertain a motion that the report of the Treasurer be accepted.

(Mr. Earl Hutchings moved that the report of the Treasurer be accepted. Motion seconded and carried.)

Chairman Schweis: I shall now ask for the reports of the committees. Mr. Hyslop of Oregon, Chairman of the Seed Committee.

(Mr. Hyslop was not in attendance.)

The next committee is the W.P.A. Committee, with Mr. Kohout as Chairman.

Mr. Kohout: Our Committee is not ready to report. Since you have outlined a discussion on W.P.A. for tomorrow morning, I suggest that our committee be permitted to report at that time.

Chairman Schweis: The next committee is the Weed Classification Committee, Mr. Morris Chairman.

(Mr. Morris was not in attendance.)

Chairman Schweis: We shall now call upon Mr. Spence for the report of the Agricultural Conservation Program Committee.

Mr. Spence: I started to make this report before, and in the intermission the Committee still has not met. In fact, I think I am the only member on the Committee of A.A.A. weed practices at this meeting. I might report the results of the recent national convention in Washington, which took place on the 13th to 15th of June. I was placed on the Committee which considered the practices under the A.A.A. program. I think you all realize the problem that we have had in the past in selecting the type of weeds on which the law will permit working. There is a possibility that the state committees will be able to select the lists of weeds which are eligible for the A.A.A. practices. While it has not had administrative approval, yet I think we have made some headway. So far as the payments are concerned, there was a recommended change in that. The payments have been about $7.50 per acre, regardless of the type of treatment. The recommendations of the Committee for the 1942 program were that payments for A.A.A. would be $7.50 per acre for cultivation, with chemicals at 3¢ a pound. Also, the change in the way the money is being set up under the 1942 program will give the average farmer a little larger allowance which he can devote to weed control.

The other change that I think we were able to get through is what we call a pooling of allowances. We were able to get through a recommendation where members of a community may go together. Those who are within a community participating in A.A.A. will pool their allowances for a common project. That can be weed work or some other type of project. Those were the main suggestions that were made this year.

Chairman Schweis: We shall now have the reports of the state delegates. Mr. Ball, will report for California?

Mr. Ball: The California report will be brief, for much of the work was a continuation of about the same procedure on the same weeds and many of you heard this last year.

Progress on some of the large projects is worthy of mention. Klamath weed, the major range problem, has been held in check and many areas have been eradicated. In Mendocino, Sonoma, Humboldt, Shasta and Tehama Counties the work has been satisfactory. Borax and Borax-chlorate in combination have been used. A new development that looks promising as a summer application is a sodium metaborate spray. This can be prepared in the field by mixing 1 part of flaked

lye to 4 parts of granulated borax and 3 parts of water, applied at a rate equivalent to about 8 pounds of borax per square rod. This treatment kills the top growth at time of application and the roots after the first rains, which carry the borax into the soil.

The Artichoke thistle program has been completed in so far as the State, County and Landowner cooperative agreement is concerned. There remain only seedlings which will be the owners' problems and responsibilities. The State will continue to assist in obtaining WPA and AAA assistance for the owners, and the County will continue supervisorial work.

The Camel thorn program is now one of inspection and the treatment of occasional plants, carbon bisulphide being used. The State still aids financially in this program, but the expenditure is very small.

On Austrian field cress, the most recent of the State, County and Landowner cooperative programs, as reported last year, we are using a cultural program which is proving successful. Clean cultivation and croppings are working out satisfactorily.

Although it has taken several years to accomplish results these programs show the importance of organization, supervision and cooperation in carrying out to success any weed problem.

WPA assistance, as everywhere else and possibly more than in many states, has been greatly reduced due to the defense program. Another state-wide noxious weed project has been submitted to Washington and, if approved, plans will be made for further WPA weed control work, depending of course on the duration of the present emergency.

The AAA program has operated in many counties and has been very helpful. As indicated in the California Farm Handbook, a county or state official with knowledge of weed control work checks proposed practices and suggests methods for their execution and is often called upon to give final approval of the practice. Greater interest in weed work is instilled in the landowner or operator under this program and effects are quite noticeable.

As was reported last year, the California Seed Council had a committee working on a new seed bill, one that would be in line, so far as possible, with the Federal Seed Act. The committee continued its work and after numerous meetings with the trade and regulatory men it looked as though a new seed bill would be well on its way to the Governor's desk, and that by this time I would be able to give you some of the more important features. The bill failed to go forward, so there is nothing more to report. I hope that the Eleven Western States will work toward some sort of a uniform seed law.

The Agricultural Experiment Station at Davis has been carrying on experimental work with carbon bisulphide and has brought out some interesting points. They have also put out some demonstrations on

the use of Sinox. New herbicides are checked from time to time. These men are here, so they can tell their own story.

Our general weed program continues cultural practices where feasible; chemicals where other practices will not work.

The importance of education is fully recognized and is carried on by all those in weed control work through the various agencies and farm organizations.

Chairman Schweis: Since there is no one here from Montana, we shall call on Mr. Kohout for the report from Idaho.

Mr. Kohout: Our program has been practically the same as we reported at the last three conferences. We are using the same methods and our program is about the same size. During the last year we have gotten a new Commissioner of Agriculture of the State who is the ex-officio Weed Supervisor, Mr. Newport.

Chairman Schweis: Will you say a few words, Mr. Newport?

Mr. Newport: I have little to say other than that the group in Idaho, headed by Mr. Kohout, is doing a good job. I notice we have a full program. Speeches of any length, I think, are out of place.

Chairman Schweis: Thank you, Commissioner, for your remarks. The Nevada report will be given by myself.

We introduced two bills to our recent session of the legislature, one amending the Pure Seed Act, brining it into greater conformity with the Federal Seed Act and also tightening up some of the regulations which we found to be faulty in the administration of the Act. The principal item that was amended was as follows: Before we can condemn or withhold any seed from the market we must get an injunction from a competent court. We amended that part of the Act so as to allow us to seize and hold seed until such time as proper analysis was made; then it would be time for court action. In this way, we think we are going to obtain better results. We found in the past when we found contaminated seed, by the time we got an injunction the seed had already been distributed.

We also broadened our weed act. Formerly it was purely a police act, allowing us to go into property and control noxious weeds. We have amended it so that we are now allowed to enter into cooperative agreements with any of the state and federal agencies in control programs.

We feel more optimistic in Nevada over the weed situation during the past two years than we have ever been. Federal agencies, formerly not interested, are now very much interested in weed control programs. Through the efforts of our Secretary here, we are going to have Mr. Dan Foster of the Bureau of Indian Affairs at our meeting tomorrow. The control of noxious weeds on Indian land has been a problem in all the Western States. The Bureau of Reclamation

and the Forest Service are also interesting themselves in the noxious weed situation. The outlook is very promising.

Chairman Schweis: Next will be the State of Oregon. Mr. Harris will report.

Mr. Harris: I represent the Experiment Station and do not have too much to do with the actual field work. We have, in the State of Oregon, about all the weeds there are. In regard to a state weed law we have gone rather slowly. In practically all the Eastern Oregon counties there are programs under way; also many in the western section of the State. We are strengthening the chemical programs, using the chlorates and carbon bisulfide; also giving more attention to cultural practices. Near Pendleton we do have an experiment on Morning glory.

We have had several hundred acres of fiber flax fields this year that were badly infested with weedy annuals. They were practically all saved through selective sprays. Work has been started on poisonous plants and we have some promising results.

Chairman Schweis: Next will be the State of Utah. Earl Hutchings will give the report.

Mr. Hutchings: Mr. Chairman, our weed program has operated during the past year in a manner similar to that which has been reported at all of our conventions. There has been, however, a reorganization of our State Government. Our new Governor has promoted a reorganization program for all of the State Government, and therefore we no longer have a definite, ear-marked program which we have had heretofore for weed eradication. We have held, however, a series of meetings. At our last meeting with our agricultural commissioners we were assured from the Governor's office that we could go ahead with our weed program. The money will go into a general state fund, consisting of about five million dollars, and will be controlled by the Finance Department of the State. I feel that we have no need to fear that our program will not continue and that we shall not receive the support of the Finance Department and our Governor. We believe that this reorganization program is a big step forward in State Government, and I am sure that Utah is going to benefit by such a program.

The weed work in Utah is under the direction of the Division of Plant Industry, which will now be called the Plant and Tree Division. Mr. Hobson is our State Weed Supervisor, so I am going to ask him to report for Utah.

Mr. Hobson: I think that Mr. Hutchings has stated that the program is being conducted largely as it has been in the past. So far as the cultivation programs are concerned, we are conducting them in the past, with a 10 to 15% increase in the amount of land that we are cultivating. If we could obtain all the chemicals we desire, there would be a material increase in the use of chemicals.

We are conducting a program in every county of the State and

have a Supervisor in each of these counties, similar to the organization that we have in other parts of the State. These men are assisted by county organizations. You probably know that we have a County Weed Committee. If this weed committee is functioning properly, the Supervisor has a lot of assistance. We are getting fine cooperation from the railways and the highway officials. We have an understanding that when we treat with chemicals next to a property, they conduct a similar program; if we have isolated spots, they are under the same obligation as individual owners.

We have had a lot of trouble over the spread of noxious weeds through livestock migration. This is a serious problem with us, and probably is in your State also. We are not doing all we should in this phase. There is a big field here and we have to take hold of the situation and make some progress along this line.

We are conducting experimental weed work in this State. As a result of this experimental work, we are able to apply practices that are bringing good results. One of the greatest problems confronting us is land that is turned back or released to the owner. You probably have the same problem in your State. It is going to catch up with us if we do not make corrections. We have plenty of force, but we need considerable cooperation. I think we need greater cooperation and responsibility on the part of the landowner.

We attempted to make some changes in this State in the seed law, to formulate a law which would conform, as nearly as possible, to the federal seed law. In this we failed. I think there is much need for a uniform seed law. Our problems in these Western States are similar and we need to get together in all branches of this work.

The labor situation is also a troublesome problem. It does not seem as though there is any solution, although we have been able to get W.P.A. assistance sufficient to man our equipment. I think the farmers are willing to assume a greater responsibility in placing out the chemicals so that we could get along with a little less labor. It is a perplexing problem, because it eats into the appropriation of the counties.

I am happy that some of the States who have reported previously have not any new weeds to report to us, so I think that we can rest rather assuredly that we have not or will not have any in this State. We need to do something to control the movement of seed. However, I think we have made a lot of progress. We stand ready to correct any errors that have been made in this State that may affect the troubles in other States.

Mr. Spence said that we must place ourselves in a better position for the continuance of this program. We have to do a lot of advertising. We are launching a program of posting our ground. These signs have been prepared and approved by our new commission, and we hope they will be approved by the Counties of this State. We have worked out a color system: the red sign will represent the property that is in the program and is being actively worked. We hope that the color of this sign will be prominent enough so that

anyone passing by will not need to read the sign, but from the color can say that that is part of the weed eradication project. We have a blue sign for the fields that have been released to the owner. I think that if our Weed Supervisors put a label of approval on a certain farm by placing this sign on it, it will probably be given a little more care. We want the fields that have been redeemed in this program to be posted so that the owner will give it more thought and take care of it more. We are going to do considerable along the advertising line with these signs.

Chairman Schweis: The next State will be Washington. Mr. Harvey will report.

Mr. Harvey: This is the third year of our research program in Washington. As mentioned last year, most of our attention is being directed to weeds under irrigation, particularly White top, of which Lepidium repens and Hymenophysa pubescens are the most important species. Our work with chemicals is making some progress. We find that a divided application of sodium chlorate where 2 pounds are applied one fall and 6 the next gives a better kill than 8 or 10 pounds in a single application. It may be possible to make both applications the same year, but we have no definite proof of this point. Hymenophysa pubescens is definitely more resistant to chlorate than is Lepidium repens under our conditions. This year we are trying chlorate spray on White top, using both divided and single applications. Nothing new has been noted with carbon bisulphide this year. Diesel oil sprays have been used but with poor results on White top. Some work with borax in the eradication of bracken fern shows promise but has not progressed far enough to make definite recommendations possible. In some of the applications we seem to be getting an appreciable reduction in stand of the ferns without injuring the undercover of pasture grasses. Even a 50% reduction of the fern stand gives the grasses a chance to become better established and increases the value of the pasture.

On our cultivation plots we have a complete kill of the White top which was primarily Lepidium repens on the plots cultivated every week, every second week, every third week, and every fourth week for two seasons. The one week plots received about 23 cultivations a season, the two week plots 13, the three week 7, and the four week 5. These plots are in corn this year, but the crop is poor. The land is in poor physical condition and is difficult to irrigate, which may be due to lack of organic matter. I would suggest that fall sown rye at the end of the second season of cultivation might be a better choice of crop, especially if it was plowed under the next spring.

The work with competitive crops is progressing slowly, but we do have indications that the root reserves are being slowly depleted. However, we feel that cropping methods are important because they allow some returns from the land and hold the weeds in check even though they may be slow in killing the weeds. Some of you will remember that last year Dr. Robbins stressed the importance of good farming practices in weed control. We likewise feel that this is most important. On our plots we are getting good yields of alfalfa and corn and fair yields of potatoes and sugar beets on land that was so heavily infested with White top that it had been abandoned. The methods and practices used on these plots did not differ material-

ly from what would be good farming methods on similar non-weedy land. Such a cropping program will permit the farmer in many cases to handle his weed problem without outside help.

Experiments with flooding have shown that Russian knapweed may be completely killed and White top 95% killed by flooding for three months, August, September and October. This was the only time of flooding which we could use last year and is probably not the best time to flood. We hope to do further work this year on flooding at different seasons.

Some of you may be interested in some work done by Dr. E. C. McCulloch of the Veterinary Division of the Washington Station. He has been working on Hepatic Cirrhosis or "Hard Liver" disease of swine which causes extensive losses in the Walla Walla region. He found that many of the swine in this region were fed on wheat screenings which contained as high as 50% of seeds or nutlets of Amsinckia intermedia, tarweed. Experimentally he was able to produce the disease in healthy swine by feeding these seed or by injecting small quantities of an extract of the seed of the tarweed. He has not yet isolated the compound which is responsible for the disease, but it seems that he has definitely proved that tarweed is the agent responsible for the swine losses.

Chairman Schweis: We shall now hear from Dr. R. J. Evans, Agronomist, Utah State College, Logan. He will discuss "Utah Seed Problems and Recent Research."

Dr. Evans: The Utah Agricultural Experiment Station has periodically over the past thirty years conducted experiments on methods of weed control. The budget funds available for such work were so limited that the extent of the work was very limited until four years ago.

In 1929, the Utah legislature appropriated $100,000 for weed eradication work in Utah. This money was allocated to the State Board of Agriculture, and under the terms of the act, the money had to be matched two ways: the counties appropriating an equal sum and the local people providing another one-third, making a total of $300,000 in all, which was to be spent during the biennium.

Very little fundamental information had been developed by research up to that time and, as a result, the entire appropriation was spent in the purchase and application of chemicals. The effectiveness of the work done during this campaign was of very doubtful value because of the lack of proved methods. The reaction against such appropriations became quite strong for the 8-year period which followed, and no other such appropriations were made.

By 1937 the noxious weeds had spread so rapidly in the State that it became very alarming to all of the observant. As a result, a new bill was introduced into the legislature appropriating another $100,000 for weed work. By this time the State Agricultural Correlation Committee had become very active in a consideration of the weed problem, and decided to apply for WPA funds to be used in a new state weed eradication project. This Committee supported vigorously the appropriation, and when passed, formulated a state project and a supporting program of work, submitted the same to the local WPA office where it was approved, and finally received the O.K. of the Washington office.

The project and program was broken down into three general subdivisions: 1) research; 2) control of weeds at the source, namely; at the seed supply; and 3) general eradication. The funds allocated to the first phase amounted to $15,000 per biennium, to the second phase $5,000 per biennium, and to the third phase $80,000. In addition to this the State Land Board had appropriated $10,000 to be spent on state lands under the weed program. The allocation of the funds to research work was an outgrowth of the previous sad experience which the State had in going ahead on an extensive program without previous experimental background.

It was understood in this program that the Experiment Station was to establish experimental weed farms located over the State at places convenient to the weed committees and farmers. As a result, one station was established at Vernal, Utah, where heavy infestations of Perennial Sow Thistle were located, and the work dealt entirely with this weed. Another farm was located in Midway in Wasatch County where heavy infestations of Canada Thistle occur. A third field was located in Richfield, Utah, in the heart of one of the oldest White top infested areas in the State. A fourth field was located in Ephraim, Utah, in probably the most highly infested Wild Morning Glory area in the State. The fifth field was located in Fountain Green, in one of the higher elevations, an area infested with White Top. The sixth field was located at Bothwell, Boxelder County, another area with heavy infestations of Wild Morning Glory, and with quite a different soil type than that of Fountain Green.

In the following year, 1938, an additional experimental field was located at Manila in Utah County, where we found a heavy infestation of Wild Morning Glory on very heavy clay soil.

The work as originally planned at these seven experimental farms has all been carried through, and the data fairly well tabulated, ready, we hope, for early publication. I shall attempt to present herewith a few of the data which we feel will be most interesting to this Conference.

The work on the Perennial Sow Thistle plots was terminated at the end of the first year because all of the treatments except one were effective in destroying the Thistle, leaving the land in a condition to be returned to cropping. These treatments included clean cultivation at intervals of 1, 2 and 3 weeks; various chemicals applied at different seasons and different rates. The general conclusions drawn were that 4 pounds of sodium chlorate per acre were effective in killing the weed, made in either a single application or spread application. There was no difference between powder and spray applications. The 2-week intervals were found to be just as effective as any other interval. The carbon bisulfide applications were effective only when large quantities were applied because the water table was too close to the surface.

On the Canada Thistle plots all treatments were likewise effective except one, and the results were approximately the same as those with Perennial Sow Thistle. The recommendation is made that an application of dry sodium chlorate at 4 pounds per acre and cultivation intervals of 2 weeks be used for a one-year period.

It should be understood that in the case of both Thistles it was

necessary to begin cultivation in the early spring for effective control in one year. The results on the three Morning Glory plots are quite similar, although the work done at Manila was proportionately higher on cultivation methods.

We are presenting in table form a summary of the work on White Top and Morning Glory done at Richfield, Fountain Green and Ephraim. We believe that the results at these particular stations are so consistent with those at the other stations that it is necessary only to present these data.

In general, we have found that it has taken two complete, long years of cultivation of White Top or Morning Glory at 2-week intervals to effectively kill these two weeds at an approximate labor cost of $8.00 per acre per year; that it takes 4 pounds per square rod to kill Wild Morning Glory, and that the effectiveness when applied dry is fully equal to that of the liquid form. When soil and other conditions are ideal, carbon bisulfide at the rate of 2 gallons per square rod has been found very effective, but considerably more expensive than sodium chlorate.

On the White Top fields it has generally required 8 pounds of sodium chlorate to the square rod to destroy this weed. It is not much different when applied in a single application, or in spread applications. Since applications in the dry form are just as effective, we recommend its use because it is less of a fire hazard, and it is very much cheaper to so apply.

Carbon bisulfide has also been very effective when the soil and other conditions are right. This method is quicker but more expensive and the soil is not left sterile for such long periods of time as it is with the chlorates.

There seems to be no significant difference in the stage of growth of the White Top plant when sodium chlorate is applied. The time of application seems to have no significant difference and there is no difference between plots which were irrigated and those which were dry when chlorates were applied.

Results of Check-up on State Weed Eradication Program
Made by the Utah Agricultural Experiment Station
1940

Kind of Weed	Duration of Cultivation	Returned to Crops		Continued in Cultivation		Percent returned to crops	
		No. of Farms	No. of Acres	No. of Farms	No. of Acres	Farms	Acres
CANADA THISTLE	1 year			1	7.00	0.0	0.0
	2 years	3	21.13			100.0	100.0
MORNING GLORY	1 year	2	15.1	9	32.20	18.2	31.9
	2 years	47	173.83	33	140.74	58.8	55.3
	3 years	12	57.50	14	34.00	46.2	62.8
WHITE TOP	1 year			1	35.00	0.0	0.0
	2 years	15	423.27	6	24.00	71.4	94.4
	3 years	7	57.35	4	21.25	63.6	73.0
	4 years	1	13.00	2	12.25	33.3	51.5
QUACK GRASS	1 year	1	1.00	1	.20	50.0	83.3
RUSSIAN KNAPWEED	2 years			2	105.00	0.0	0.0
	3 years	2	55.00			100.0	100.0
Totals All Weeds		90	817.18	73	412.64	55.2	66.4

Chairman Schweis: The meeting is adjourned until this afternoon at 1:30.

Friday Afternoon, June 27, 1941.

The meeting was called to order by Chairman Schweis.

Chairman Schweis: The next matter of business before this body is the appointment of committees. On the Resolutions Committee I will appoint Mr. Hutchings of Utah as Chairman, Mr. Spence of Idaho and Dr. Robbins of California. On the Nominating Committee will be Mr. Harris of Oregon, Chairman, Mr. Kohout of Idaho and Mr. Schweis.

The next topic will be "Uniform Seed Legislation" by Dr. Hyslop of Oregon. Mr. Hyslop was not present but sent a paper, which follows

The report on Seed Legislation will be short.

The State of Washington passed a seed law following the so called uniform seed act very closely in its general terms. Attention is called to the sections applying to the disposition of screenings containing noxious weeds. This looks like a very good thing to the writer and serious consideration is recommended for the other States, including Oregon.

Oregon made no revisions in the seed or weed laws. It is my understanding that both Idaho and California had good seed laws proposed but that they failed to pass. I was told that the Idaho farmers did not push their law hard enough and that the California District Commissioners were responsible for killing a good law that took away some of their prerogatives.

The Uniform seed law for the states contains many good things and there is no question that uniformity in labelling, testing, collecting of fees is desirable. Greater uniformity in naming of noxious weeds will be a great help, but there are some real problems in that connection.

Seed legislation should keep the protection of the farmer or householder who plants seed in the foreground. We shall have to be on guard against the influence of the American grass seed trade association, whose interest seems to be to make for freer movement of seeds, a merchandising problem. If we stand for clean seed free from noxious weed seeds, the seed producers and cleaners will meet the market demands by producing just that.

It is my feeling that the Association should ask the Secretary of Agriculture for an amendment to the Federal Seed Act eliminating tolerance for <u>any</u> weed named as noxious in any State.

Weed Legislation

Wyoming, through its State Entomologist, Mr. B. T. Snipes, proposed an advanced step in weed control work in its proposed Noxious Weed Quarantine order. This order as proposed goes much farther than most legislation, but in my judgment is a definite step in the right direction if it is promulgated and enforced.

Similar national legislation, but not so farreaching, is contained in the Hook bill, H.R. 2086, which I hope gets the support of our association.

The Cooperative Weed Control bill, introduced by Hon. Walter M. Pierce, is a good bill that provides for Federal and State cooperation in noxious weed control and proposes to appropriate a reasonable sum of money for that purpose. In this respect I think it has a better chance than the former Clark bill, and Representative Pierce is in a much better position to get administration support. A resolution on this bill would be very helpful.

Chairman Schweis: The next item will be "Weed Control of the U. S. Reclamation District", by Mr. L. H. Mitchell of the U. S. Bureau of Reclamation at Washington. Mr. Mitchell was unable to be here, so Mr. Ball will read his paper.

WEED CONTROL ON FEDERAL RECLAMATION PROJECTS

by L. H. Mitchell
Irrigation Adviser, Bureau of Reclamation

One of the most encouraging developments in weed control on Federal Reclamation projects is the growing interest among farmers and leaders in organizing for a control program, either informally thru a Weed Committee or thru a Weed District. While a Weed Committee renders most valuable assistance in carrying on an educational campaign and in formulating cooperative weed programs, it has been our observation that under irrigation conditions the Weed District is the most effective weed control organization.

I should like to emphasize the importance of a Weed Committee or a Weed District for our new irrigation projects with practically weed-free land and also for those older projects which fortunately contain only scattered patches of noxious weeds.

An example of what may be accomplished by early organization is shown by the record of a project division opened to settlement in 1927. The new division comprised about 11,000 acres of weed-free land, but it was contiguous to lands which had been irrigated for some 20 years and which were infested with some of the worst noxious weeds. In the hope of preventing the spread of noxious weeds to the new lands, plans for weed control were formulated simultaneously with settlement. New settlers were warned to select seed carefully and to take every precaution to keep their farms free of noxious weeds. They were taken on tours to infested farms in the older areas to acquaint them with the different perennial weeds and the losses occasioned by those weeds. Ditch-riders were instructed to watch for the appearance of any perennial weeds along canals and laterals and to eradicate these patches promptly. A weed committee was organized to report to the county agent the discovery of any noxious weeds on the farms. The efforts of the weed committee, and later a Weed District, in cooperation with the Bureau and farmers have proved well worthwhile. A weed survey taken in 1940 showed only a few scattered clumps of weeds on ditches and a total of only one acre of noxious weeds on all farm lands.

Most of the Federal projects have been under irrigation for 30 or more years, but they have started weed control programs only within recent years. Weeds have gained quite a foothold on many of these older projects and now require a considerable eradication program, both on farm lands and along highways and ditches. As a basis for planning weed work and as a check on the progress of this work, we are urging all projects to make weed surveys. The Bureau has prepared a standard weed survey card which provides for a census of noxious weeds on farms, along highways and canals. Generally the County Extension Agent or Weed Specialist of the Extension Service instructs the crews in weed identification and, in some instances, supervises all of the field census work.

For the past five years practically all of the Federal projects have been carrying on right-of-way improvement work comprising weed eradication, bank renovation, seeding to weed-competing grasses and clovers, and mowing or grazing with livestock. Converting these right-of-way areas into pasture provides a practical, low-cost method of controlling weeds.

An extensive program has been conducted to rid our ditchbanks of water hemlock. In a field trip over Bureau projects in 1935 I was appalled to find so many canals and laterals lined with water hemlock. Since ditches infested with poisonous weeds cannot be pastured, instructions were sent to field officials to eradicate all water hemlock. At first, the method used was to handpull the clusters of tubers after loosening with a spade and then to remove root and plant to some place where they could be buried or burned. In 1938 searing was tried on this weed and found to give very good kills. Our experience up to the present time indicates that three or four timely searings will kill water hemlock.

Most of our projects also have a considerable eradication program on willows, tules and cattails since these weeds consume enormous amounts of water, tend to collect silt, and interfere with water deliveries. We are trying various methods of eradicating these weeds including chemicals, cutting, and burning. Indications are that searing may prove the most satisfactory eradication method.

Many projects this season will use the burning and searing methods for eradicating noxious weeds along ditchbanks. Ditchbanks on northern projects are infested with morning glory, knapweed, white top, Canada thistle and whorled milkweed; those on southern projects have Johnson and Bermuda grasses, horse nettle, nut grass, button willows, and bamboo. Observations will be made of the value of this method on different weed species. Tests will be made of the effect of searing and burning at different intervals. Several types of burning equipment and different fuels will be investigated and studies made of operating costs.

The program to convert rights-of-way from "weed seed nurseries" into profitable pastures is gaining considerable momentum. The work is undertaken at the request of farmers who agree to provide the fencing and take a lease of the area for pasture. CCC facilities are used to build roads and cattle guards, install fences, line up the banks, clear off weeds and seed the rights-of-way to grasses and clovers.

Considerable reaches of canals on southern projects are badly infested with Johnson and Bermuda grass. At present, we are recommending pasturing these areas, but since these grasses are considered weeds in fields and are weakened by a few seasons close grazing, we are searching for some native or pasture grasses to replace them. Several species of grasses are being tested this season in an attempt to discover a grass that will stand pasturing, be nutritious and palatable, and form a dense sod.

On northern projects brome grass, crested wheat grass and strawberry clover have proved satisfactory for ditchbank pasture. Brome and crested wheat grass are used for the drier sections of the ditchbank. Strawberry clover is used in the moist areas near the water line.

Indications are that strawberry clover will prove one of our most valuable weed-competing plants for moist soil provided it is properly grazed. It is highly relished by livestock, stands close pasturing, and forms a thick mat of vegetation. Once established, it spreads well up the ditchbank. On one project a three-year old stand was observed to spread up the bank some 8 feet. It gives weeds keen competition. A plot of strawberry clover planted in a dense growth of bindweed on a Colorado project in 1937 took almost complete possession of the ground the first year and has maintained control ever since. Observations are being made of its weed-competing characteristics among other low-growing weed species and its ability to prevent weeds from getting established at the water's edge.

Since ditchbanks should be mowed to prevent weeds from going to seed and as a control measure for annuals and biennials, we are investigating different types of mowing equipment. An ideal type of mowing machine for our work would be one with a side sickle for cutting either up or down a slope and a front sickle for mowing the tops of narrow banks. We hope to have such a machine perfected this season.

Weed seeds from upstream are among our unsolved weed problems. Experimental data indicate that seeds of some plants will germinate after being kept in mud and water for periods of several years. Since it would be valuable to learn how long the seeds of our worst noxious weeds will retain their viability in irrigation water, we are conducting some experiments to determine the effect of submergence on the viability of such weed seeds as bindweed, burdock, Russian knapweed, chicory, white top and water hemlock.

Considerable emphasis is given an educational program for weed control. Eradication work on rights-of-way and other government land serves as a demonstration of the effectiveness of recommended methods. Farmers are invited to visit these areas and observe methods and results. A number of these locations are generally included in the project Crop Tour.

A sound film "Noxious Weeds" showing the weed eradication work in progress on the various Federal projects and a set of colored slides "Noxious Weeds: Their Source, Spread and Control" have been prepared by the Bureau and are in continuous demand for presentation at farm meetings, schools and civic organizations.

Project officials, or the Weed Committee, together with the County Agents, keep their local papers informed of the progress of weed work and of new findings on control and eradication methods. These news items reach a wide group of project landowners. This year it is also planned to reprint the weed control articles published in the Reclamation Era so that the latest information on weed problems incidental to irrigation farming may be widely available to project farmers.

In closing, I should like to express to the members of this conference my appreciation of their contribution to and cooperation in the weed control programs under way on Federal irrigation projects.

Mr. Ball: Soil Erosion projects are very important, and in some of the areas in our State it is necessary to try to control and keep soil in place. When these officials think of plants for soil binding that will spread, such as the plant mentioned by Mr. Mitchell, 8 feet up a ditch, you have all the characteristics of a noxious weed. That is the trouble we are having in some of our irrigated areas. We are getting fine cooperation from our Soil Erosion officials. They have set up nurseries where questionable plant species are maintained for a year or two years, or until we can determine characteristics of growth and habits.

Question: Is the strawberry clover hard to eradicate after it has been started?

Mr. Harris: No, there is no trouble on that point.

Chairman Schweis: I may add that our relationship with the Soil Conservation Service is very good. We have an opportunity to pass judgment on any foreign plants that are shipped into the State.

The next paper will be by Mr. R. N. Raynor, an Associate in the California Agricultural Experiment Station at Davis.

We shall now have Mr. Raynor's paper.

(The following paper by Mr. Raynor was given, accompanied by slides. An additional paper, prepared by H. A. Hannesson of the Botany Division, was read by Mr. Raynor and discussed.)

TESTS OF SELECTIVE HERBICIDES

By R. N. Raynor
Botany Division, College of Agriculture
University of California, Davis, California

Field plot and greenhouse tests recently conducted at Davis have produced data on the toxicity and selectivity of several nitrated and chlorinated phenolic compounds. The materials used were as prepared for the tests of the Dow Chemical Company. The unadulterated compounds were used when sufficiently soluble in water. Those having low solubility in water had been combined with other materials, herbicidally inert, in order to produce a high degree of dispersion when added to water.

The sodium salt of dinitro-ortho-cresol was included in the tests as a reference standard of known herbicidal efficiency. The source was a preparation manufactured for weed-killing purposes by Standard Agricultural Chemicals, Inc.

All materials were applied as aqueous sprays to plots one rod square or larger. A knapsack sprayer was used on the smaller plots, and a field sprayer with fixed boom on larger ones.

The largest number of tests were on fireweed (Amsinckia Douglasiana) growing in oats. The size and growth stage of the weed varied between approximately 12 inches high and with only a few flower buds showing on February 22, to approximately 30 inches high in the late bloom and green seed stage on April 6. There was but little increase apparent in resistance of the weed during the course of the experiments. In the majority of cases, 2, 3, or 4 applications of a single dosage were made at different times but in a few cases, mostly at lower dosages, single determinations only were made.

The first slide (1) shows the toxicity of the dinitro phenols and their salts to fireweed. The dosage in pounds per acre refers to the amount of active ingredient after discounting the diluents, dispersing agents, and wetting agents wherever present.

When ranked according to the number of pounds per acre required to inflict 95% mortality --- this representing a commercially acceptable degree of control --- dinitro-ortho-cyclohexyl-phenol with sodium lauryl sulfate added as a wetting agent, is first at 2.3 pounds, and the same compound without wetting agent is second at 3.7 pounds. Next in order are the triethlanolamine salts of dinitro-ortho-cyclohexyl phenol, at 4.3 pounds, and of dinitro-ortho-cresol, at 4.8 pounds. Next in line is the reference material, sodium dinitro-ortho-cresylate, at 5.7 pounds. Sodium bisulfate was added to this as a so-called "activator," at the rate of one-half pound to each pound of cresylate, as is the usual practice with this herbicide. The reference material is followed by dinitro-para-cyclohexyl phenol plus sodium lauryl sulfate, at 12 pounds per acre. The final curve to the right is for the calcium salt of dinitro-ortho-cyclohexyl phenol. It reaches the 95% mortality point, not shown here, at approximately 12 pounds per acre.

Comparing the chemicals on the basis of chemical structure, these data show that on fireweed dinitro-ortho-cyclohexyl phenol is roughly twice as toxic as the corresponding para derivative; that it is also more toxic than either its triethanolamine or calcium salts; and that the triethanolamine salt of dinitro-ortho-cyclohexyl-phenol is more toxic than the corresponding salt of dinitro-ortho-cresol.

The next slide (2) gives the data for the sodium salts of two chlorinated phenols, with sodium dinitro-ortho-cresylate to the left for comparison. Sodium pentachlorphenate is the more toxic of the two, inflicting 95% mortality of fireweed at 14 pounds per acre. Twenty pounds of sodium tetrachlorphenate are required to give the same degree of control.

Observation of the oats among which the fiddleneck was growing showed an undesirable degree of injury where sodium lauryl sulfate

was added to dinitro-ortho-cyclohexyl-phenol, also from the triethanolamine dinitro salts and from the sodium salts of the chlorinated phenols. This injury was correlated with the amount of wetting of the oats by the sprays.

Dinitro-ortho-cyclohexyl-phenol without wetting agent was the most toxic of the materials tested that had adequate selectivity as between fireweed and oats.

In a comparison of dinitro-ortho-cyclohexyl-phenol and sodium dinitro-ortho-cresylate on young wild mustard (Brassica arvensis) in spring-planted barley, the relative positions of the two materials were the reverse of those in the fireweed tests.

Dinitro-ortho-cyclohexyl-phenol is the more toxic on fireweed; sodium dinitro-ortho-cresylate on wild mustard. This reversal may indicate either that one chemical is a specific toxicant for fireweed, the other for mustard; or it may indicate differences in the relative ease with which substances differing in fat solubility penetrate the cuticle of the two plants.

Evidence confirming the hypothesis of specific toxicity is found in the data, not shown on the slides, from plot tests on fireweed of two comparable preparations of dinitro-ortho-cresol and dinitro-ortho-cyclohexyl-phenol, and from pot tests on mustard of the sodium salts of the two compounds. On fireweed a dispersion of dinitro-ortho-cyclohexyl-phenol was slightly more toxic than a similar dispersion of dinitro-ortho-cresol. On mustard the sodium salt of dinitro-ortho-cresol was more toxic than the sodium salt of dinitro-ortho-cyclohexyl-phenol.

The evidence in favor of differing penetrative properties consists in the differing reactions of fireweed and of mustard when sodium bisulfate is added to sodium dinitro-cresylate. Sodium bisulfate adds hydrogen ion, which converts part of the water soluble sodium salt to the fat soluble parent cresol. Sodium bisulfate increased the effectiveness on fireweed considerably, but much less so on mustard. This suggests that the cuticle of mustard is almost equally permeable to water soluble and fat soluble compounds; and that the cuticle of fireweed is more permeable to fat soluble compounds than to water soluble ones.

An experiment to settle the question has been planned, in which both the fat-soluble parent compounds and their water-soluble sodium salts will be tested on both mustard and fireweed.

Experiments designed to show the influence of weather conditions at the time of spraying on the per cent mortality of a given dosage were conducted in the greenhouse on young weeds growing in pots. The data for young mustard growing in six-inch pots, 15 plants per pot, 2 pots per treatment, are plotted in the next slide (4). The pots were placed on the greenhouse walk and a measured area of walk uniformly sprayed with a knapsack sprayer with volume and concentration calculated to give 6, 8, and 10 lbs. of dinitro-ortho-cyclohexyl-phenol in 160 gallons per acre. They were then placed on a greenhouse bench, and some of them covered with inverted clay pots previously dampened by soaking in water and redampened at hourly inter-

vals. These covered pots are discussed under "High Humidity" conditions at the right of the slide. There was no visible drying of spray moisture on the foliate as long as the covers remained on. Other pots, not covered, are designated as "Low Humidity" conditions, and the results plotted at the left of the slide. There was no visible moisture on the foliage of these pots after approximately 40 minutes. The foliage of separate sets of "Low Humidity" pots was washed at intervals of 10 minutes, up to 60 minutes, with a fine water spray. Unwashed 6-pound check pots showed a mortality of 87%, and the low kill at 6 and 8 pounds is, therefore, not due to insufficient dosage but rather to lower penetration rate. It appears evident that rate of penetration is a function of the applied concentration.

Sets of "High Humidity" pots were uncovered at 1, 2, and 3 hours after spraying, and at each interval half were immediately washed with a water spray, and the other half dried by placing in the air stream of an electric fan. They dried in approximately 10 minutes.

The data show that a concentration of 6 pounds in 160 gallons of water had not completely penetrated after 3 hours, since when washed at the end of that time the mortality was only 70 per cent, whereas the corresponding unwashed pots had a mortality of 100 per cent.

At a concentration of 8 pounds in 160 gallons, penetration occurred more rapidly under high humidity and slow drying than when dried rapidly under low humidity, as shown by the per cent mortalities of 80% for high humidity and 64% for low humidity.

The dried 8-pound pots and both washed and dried 10-pound pots under high humidity conditions had a mortality of 100% for all intervals.

The conclusions to be derived from these data are that at minimum lethal dosages, a low rate of drying is essential for complete penetration and maximum kill, but that at superlethal dosages, a lethal amount penetrates before complete drying of the spray solution occurs.

The greenhouse experiments were supplemented by observations in the field of results under given weather conditions. A sample of the data is given in the next slide (5), showing the results of spraying mustard with dinitro-ortho-cyclohexyl-phenol at three different times within a 24-hour period. Curve A is for applications made at 3 o'clock in the afternoon, with a temperature of 68°, clear sky and bright sun, a strong wind, and relative humidity of 76%. The spray dried on the foliage in approximately 15 minutes. A second set of plots, curve B, on the slide, was sprayed at 6 o'clock the same evening. The wind had died down, the sun was low in the sky, and so temperature was falling and humidity rising. The sprayed foliage was not dry after 30 minutes, when observation was discontinued. A heavy dew fell during the night, apparently diluting and washing off the spray before penetration occurred. The next morning was warm and humid, with overcast sky, and no direct sun until about 2 o'clock in the afternoon. The third set of plots, marked C on the

slide, was treated at 10 o'clock in the morning while the foliage was still very wet with dew. The amount of water added by the spray, 80 gallons per acre, apparently resulted in run-off, carrying with it a part of the toxicant. A lower volume would probably have given better results. In an experiment made the previous afternoon on dry foliage, using dosages of 6 and 8 pounds per acre, no differences were evident at dilutions from 60 to 160 gallons per acre. Forty gallons per acre was insufficient for uniform coverage with the knapsack sprayer used.

Mr. Raynor: The next paper I shall read and discuss is on the

SORPTION OF CARBON DISULFIDE BY SOIL

Prepared by H. A. Hannesson
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Combined experiments carried on at Davis in the field, laboratory and greenhouse indicate that the effectiveness of carbon disulfide as a herbicide for controlling deep-rooted perennial weeds can be substantially increased if applied under favorable conditions.

The use of this material for such work is based primarily on the ability of its vapor to diffuse throughout the soil from points of injection several inches below the surface, so that direct contact with the roots will be made. One of these factors being studied is the sorption, or uptake, of the carbon disulfide by the soil, and this paper will deal only with this phase of the more general problem being studied.

Samples of Yolo surface soils taken from experimental plots were used, and direct sorption measurements were made by adding given amounts of liquid carbon disulfide to the soil in a container held at a constant temperature. After equilibrium conditions were reached, the pressures were observed, and from these measurements the amounts sorbed were determined. Since we are dealing with a volatile material, pressure is used in the same sense as concentration. By equilibrium conditions is meant that these pressures remained relatively constant, the final total pressure of the container reaching atmospheric pressure. Attention should be called to the fact that true equilibrium is not reached in a short period of time except in the case of the lowest pressures with oven-dry soil. To reduce experimental errors to a minimum, four kilograms of soil were used for each determination.

Four slides have been prepared to show the types of curves obtained for the sorption of carbon disulfide by both oven-dry and also by soil containing varying amounts of moisture. For these two conditions the effect of pressure, temperature and soil texture have been studied within the range of conditions generally met with in the field.

In the first slide the 10°C curve shows the effect of pressure on the uptake of the vapor by the oven-dry soil. As the pressure increases the amount sorbed increases, the curve being more or less similar to the S-shaped water-vapor pressure curves. The lower part of the curve probably represents the operation principally of the absorption mechanism, whereas at the higher pressures capillary condensation is the type of mechanism largely active.

Next, the three curves taken together reflect the influence of temperature. As the temperature is increased less carbon disulfide is taken up by the oven-dry soil at a given pressure; however, this effect is at a minimum at the lower pressures.

The next slide shows the effect of texture; the clay loam takes up a great deal more vapor than the fine sandy loam, so that with increasing clay content more carbon disulfide is sorbed by the oven-dry soil.

Since under field conditions we are working with soil containing more or less moisture, the next slide will have a more direct bearing from the standpoint of use of this material in the control of deep-rooted perennial weeds. In the soil the CS_2 pressures may vary from zero to 18 or 20 cm Hg at the point of injection, and for this reason the entire range of pressures was studied.

In contrast to the dry-soil carbon disulfide relationship, as shown on the next slide by broken line, the moist soil gives curves whose lower portion is unlike the oven-dry curve. This broken line represents the lower portion of the 10°C oven-dry curve for fine sandy loam shown in the first slide, but on a larger scale. With the addition of water to the soil, a relatively small amount of vapor is taken up when compared with oven-dry soil, and within a range from 10 to 20 per cent moisture content these amounts do not vary greatly.

At the average pressure of the vapor in the treated soil when moist at 10°C, approximately 20 per cent would be taken up by the soil, thus lowering the pressure of the carbon disulfide in the soil atmosphere by this amount. The upper half of the next slide shows the effect of temperature at a given pressure. It must be remembered that with increase in soil temperature the average pressure of the vapor will also be higher, with the net result, under field conditions, that temperature will not affect the sorption very greatly.

Now turning to the lower half of this slide, the effect of soil texture may be observed: This effect is great and the amount of the vapor taken up by a moist clay loam, when the soil temperatures are low, is significant and represents approximately 75 per cent of the dosage applied under the usual treatments. In practice, when treating deep-rooted perennial weeds and oak root fungus, it must be recognized that a moist soil is capable of taking up carbon disulfide and, therefore, lowering the pressure (or concentration) in the soil atmosphere. It must also be remembered that in the case of these low winter temperatures the vapor pressure of the carbon disulfide is correspondingly low. In addition to this as we go from the light to the heavy textures more of the material must be added in treating to offset these unfavorable effects. Furthermore, water restricts movement of the vapors when the moisture content of the soil is high.

In our plot test work at Davis in controlling Morning Glory we have found the most effective conditions to be the high midsummer temperatures on soils nearly at the wilting point.

Chairman Schweis: The next topic will be the "Kansas Bindweed Eradication Program" by Mr. T. F. Yost, State Weed Supervisor, Manhattan, Kansas.

May I bring you greetings from the State of Kansas and the Kansas State Board of Agriculture, which is the agency in charge of our noxious weed law and eradication program, and also from Mr. J. C. Mohler, Secretary of our State Board of Agriculture, who is the state official directly in charge of all weed work in our State.

I wish to thank the officials of your organization for inviting me to attend this your fourth annual meeting. I attended your second annual meeting in Denver in 1939. I have already gained valuable information from your program and hope to gain much more before the meeting closes.

May I congratulate the Eleven Western States in holding this annual conference to discuss the weed problem. Your States, I know, have made splendid progress in the important task of noxious weed eradication.

I have been asked to discuss the Kansas noxious weed law and program and the progress that has been made. The Kansas noxious weed law was enacted in February 1937. State appropriation was available July 1, 1937, and actual eradication was started in the spring of 1938. We have finished three seasons of eradication work and are starting on the fourth year. The Kansas noxious weed law requires the eradication of field bindweed (Convolvulus arvensis) on all land where it may exist in the State. The law at present designates only field bindweed as noxious. However, other weeds may be added later by legislative action. The Kansas law provided for a program in each county, city, and township in the State. Local programs were organized as soon as a state representative could assist the responsible officials in each municipality. The Kansas program is conducted on the basis of organization, education and cooperation. I shall deal more specifically with each of these phases.

Organization in our programs refers to the set-up provided by our law in each municipality, including each county, city and township. Suggested methods of procedure are provided by the State for each municipality. It is recommended that the program in each county be organized to include all townships and cities within the county.

Education is the keystone of our program. We feel that our program would fail if it did not stress education. Local tax funds may be used wherever needed to promote the educational phase. The state weed supervisor is responsible for directing the educational work with the various counties. He provides information for county commissioners and county weed supervisors for use in the local program. This information is used (a) in personal contacts with landowners, (b) in meetings, and (c) in publicity consisting of articles in local papers, distribution of printed material furnished by the State, circular letters from county officials to landowners, and through displays and exhibits at local fairs and other functions.

Cooperation in our program refers to several functions which are important to the landowner. The State cooperates with counties

by (a) paying a small part of the local weed supervisor's salary, (b) furnishing expert assistance in planning the activities of local programs, (c) furnishing free printed material which is distributed by counties to landowners, (d) guiding the programs along uniform lines. In this way, the counties all proceed to tackle the problem at hand in about the same manner. We have found that uniform procedure in the counties is desirable. Each county weed supervisor tries to contact each landowner who has bindweed on his farm at least once each year. With the non-cooperating landowner the weed supervisor tries to work out a mutually agreeable "farm plan" for the eradication of the bindweed on his farm, including cultivation work to be done each year and the chemicals to be used until the weed has been destroyed. With the cultivation cooperator, the county supervisor inspects the cultivation work three times during the season, once in the spring to see that proper cultivation is started sufficiently early in the season, once during mid-summer, and once late in the growing season to see that cultivation is continued until growth stops. The county supervisor also assists the landowner by suggesting a suitable cultivation tool and if necessary aids in its construction. He explains the proper use of such tools as to depth and frequency of cultivation, importance of thorough work, etc. The county provides a cultivation record card for the landowner's use. This record is inspected by the supervisor and turned over to the county committee at the close of the cultivation season with the supervisor's recommendations as to compliance for ACP payment.

The county weed supervisor assists the chemical cooperator by measuring and mapping the infestations to be treated. He advises with landowners as to the proper handling and preparation of the bindweed patches. The supervisor requires the landowner to sign an application blank requesting the cooperation of the county in applying the chemical. At the proper time the county supervisor directs the application of the chemical by trained men employed by the county. The landowner is then instructed as to the proper handling of the treated area.

All counties in our State use the same forms in farm planning work for eradication of bindweed and checking and recording information on cultivation inspection. The landowner form for use in recording cultivation dates, chemical application form, and the form for use in recording important information where county applies chemicals for landowners are also standard over the State. All counties have charged landowners the same price for chemicals. By that I mean there has been no variation in the charge made for sodium chlorate. The charge for the application of chemicals has been one cent per pound in all counties.

Under the heading of cooperation, I should state that the county cooperates with the landowner by (a) furnishing state-approved bindweed chemicals at half price which has been four cents per pound since the program started in 1938 and (b) by applying chemicals for landowners at a fee of one cent per pound, and (c) in the eradication of bindweed along all highways, railroads, and other public lands for the protection of adjoining landowners. In only eight counties of the 105 in the State is cultivation cooperation provided. We feel that the landowner should do his own cultivation work.

Thus far I have discussed only the fundamental application of our law, consisting of organization, education, and cooperation. I will now tell you more fully about the actual requirements of the law itself. As previously stated, all landowners are required to eradicate their bindweed. The county commissioners are designated as the responsible officials to see that the law is enforced outside of city limits, not including township highways and state-owned lands. State institutions and the state highway department are required to eradicate their bindweed from funds appropriated for their maintenance. Township boards are responsible for eradication on township roads, and city officials are responsible for eradication inside of city limits. Both county and city officials must (1) levy a tax necessary to conduct a program and pay its expenses, (2) eradicate bindweed on all city-owned lands, and (3) cooperate with private property owners and enforce the law where necessary. Local tax levying officials may levy not to exceed one mill for noxious weed eradication.

The State Board of Agriculture, which is the state agency in charge of the law and program, is empowered to adopt and enforce official methods of eradication and rules and regulations to facilitate the program. We have adopted official methods which must be used for eradication when public funds are spent and when enforcing the law. Regulations have been adopted designating state-approved chemicals and their proper use, as well as regulations providing for proper serving of legal notices in connection with the enforcement of the law.

As previously stated, the law provides that county and city must supply state approved chemicals for weed eradication at half price to all private landowners.

During the last three years this charge has been four cents per pound to all landowners in the State.

Our law provides that counties and cities may separately or jointly employ weed supervisors to conduct the weed eradication program. The county supervisors are employed by the county commissioners and approved by the State Board of Agriculture, which pays a portion of the weed supervisor's salary.

Our law provides that a representative of the State Board of Agriculture shall meet with responsible local officials to plan a program of eradication each year, which program is subject to the approval of the State Board.

County assessors must make a survey of bindweed once each year through the help of local deputy tax assessors. Reports of the compiled survey are made to local officials, as well as to the state office.

The penalty clause of this law provides for a fine of $50 to $500 for officials or individuals who fail to comply. Where landowners fail to eradicate, local county and city officials are required to eradicate the weed, charge the costs against land, and collect as taxes.

None of the enforcement features of the law has been attempted to date. Our aim has been to induce landowners to eradicate their bindweed of their own free will and without the force of law. Procedure by educational methods has given excellent results. Enforcement powers of the law will not be used except as a last resort and where all other methods have failed. It is expected that only a small amount of actual enforcement will be necessary. In one of our counties where legal notices were served on twenty landowners in the spring of 1941, eighteen immediately replied that they would cooperate, leaving only two cases in the whole county which will require the force of the law.

To our mind, the Kansas law requiring eradication is operating very satisfactorily, together with the program of organization, education and cooperation. As evidence I will give you a few facts and figures that will show the progress made in the Kansas program during 1938, 1939 and 1940.

I would first like to state that accurate records, consisting of survey maps in local county offices, show that there are approximately 250,000 acres of bindweed on 41,099 farms in the State. This does not include the weed located on railroads, highways and in cities. Bindweed is found in every county in the State, varying from lightly infested counties with less than 100 acres of bindweed on about 25 farms, to counties showing 28,000 acres of bindweed on 1800 farms.

The progress of the Kansas eradication program is the result of work done during the years 1938, 1939, and 1940. Not all of the counties have participated in a well organized manner since the beginning. This will be shown by the number of counties employing weed supervisors.

Employment of county weed supervisors:

1938.....54 counties
1939.....88 counties
1940.....99 counties
1941.....101 counties

Of the 54 counties that had programs in 1938, 27 counties still have the same weed supervisor. Of the 34 counties that started in the program in 1939, 24 counties still have the same supervisor. Eleven counties started in 1940. Of these six are still continuing the services of their original weed supervisor. Fifty-seven counties have never changed weed supervisors.

Participation by landowners should be the best indication of progress in any weed program. As stated before, our records show that 41,000 farms in the State have approximately 250,000 acres of bindweed.

Farm Participation for 1938, 1939, 1940:

I. Number of farms in State with all bindweed eradicated (11.3% of total) 4,532
II. Number of farms in State on which all bindweed is under treatment but where all eradication is not complete (not including No. I above) 10,410

NOTE: No. I plus No. II above constitute 39% of the total farms in the State with bindweed, which are either eradicated or where all bindweed is under control and eradication will be complete or practically so by the fall of 1941.

III. Number of farms cooperating by eradicating a part of their bindweed but where all bindweed is not under treatment 10,149

Total 25,091

		% of total
A. Total farms in program.....	25,091	60
B. Total farms not cooperating.	16,008	40
Total	41,099	100

Participation by landowners shows substantial progress. Our program has been based on the landowner doing his own cultivation work. Some argue that landowners generally cannot be depended upon to do their own cultivation work, because it needs to be done regularly and frequently, and because most landowners do not have satisfactory cultivation equipment with which to do the work. We feel that in Kansas the landowners have proved that they can and will do their own eradication work if they are given the proper information, leadership, and cooperation. We have asked farmers to do their own cultivation work, since our law really requires them to eradicate their bindweed. Through meetings, the farmers were told how the cultivation work had to be done to bring about eradication, with reference to frequency, regularity, depth, and thoroughness of cultivation work. Farmers were told to show what constituted a satisfactory or approved cultivation tool. The State printed and distributed to farmers, through the county programs, 40,000 copies of a publication entitled "Homemade Bindweed Tools." This publication showed how 15 different types of machines could be made by use of farm tillage tools already on farms, at only a small cost. County weed supervisors cooperated by displaying good types of homemade bindweed tools and in many cases assisted landowners in making and adjusting their bindweed cultivation tools.

To show that this cooperation was really effective and accepted by landowners, figures collected from county reports covering work done in 1939 show that 4,073 farmers made and used 15 types of homemade bindweed tools, as compared with 1,955 who already had or purchased factory-made duckfoot tools with which to do their work. Most counties also cooperated with landowners in the construction of homemade tools by furnishing worn out grader and maintainer blade material free or sold stalk cutter steel at cost for use in constructing blade type tools. In some cases duckfoot sweeps were sold or rented to landowners. This activity has proved that homemade tools, if properly constructed, will do effective eradication work. Thousands of acres of bindweed in Kansas have been eradicated by such tools.

Eradication Completed by Cultivation:

Year	Number Farms	Acres
1938	133	995
1939	839	7,104
1940	1,885	12,396
	2,857	20,495

Eradication Work by Cultivation in Progress during 1940: (Not including cultivation work where eradication was complete in 1938 or 1939, aggregating 8,900 acres on 972 farms.)

Year Cultivation Started	Number Farms	Acres Bindweed Cultivated
1938	1,090	6,525
1939	3,794	24,827
1940	3,439	20,637
	8,323	51,989

Participation by Farmers in Use Sodium Chlorate for Treatment Small Patches

	Farmers Cooperating	Pounds Chlorate Used on Farms	Acres Treated
1938*	7,015	1,386,230	2,166
1939**	6,761	1,217,645	1,902
1940***	7,138	1,051,534	1,643
	20,914	3,655,409	5,711

*Includes only original treatments by use of sodium chlorate. Does not include work done by highways, railroads, or in cities.

**Includes both original and follow-up work done on farms. Does not include salt work done by 612 farmers using 2,835,110 pounds of salt, nor chemical work done on highways, railroads, or in cities.

***Includes both original and follow-up treatment done on farms. Does not include use of 20,000 tons of salt work done on highways and railroads nor other chlorate work done on highways, railroads, or in cities.

Eradication Completed by Use of Sodium Chlorate:

Year	Number Farms	Number Patches Eradicated	Acres Involved
1938	970	1,978	553
1939	1,606	4,088	1,026
1940	1,912	5,237	991
	4,488	11,303	2,570

Recapitulation of Farmer Cooperation (3 Years' Work):
(Not including work done on highways, railroads, and in cities.)
*Includes duplication of farmers cooperating in more than one year.

	Number Farms Cooperating*	Acres Eradicated or Under Treatment
Cultivation	9,295	60,088
Sodium Chlorate	20,914	5,711
Salt	1,472	199
	31,681	65,998

Use of Salt in 1940: 1940 was the first year that salt was used as a state approved bindweed chemical. Following are the various ways in which salt was used during 1938, 1939 and 1940 and the amount used in each case.

	1938	1939	1940
1. No. Farms using salt	188	612	672
2. Lbs. salt used on farms: a. By farmers, purchased at full price.	1,074,770	2,835,110	2,100,565
b. By Farmers, under state regulation	xxx	xxx	1,996,842
3. Acres treated on farms	27	70	102
4. Lbs. used on Co. highways	812,106	519,395	2,706,819
5. Lbs. used on township highways	593,412	890,575	2,355,753
6. Lbs. used on railroads	No record	1,952,684	29,567,466
7. Lbs. used in cities	No record	283,390	525,991
8. Lbs. for other uses	xxx	xxx	557,765
Total Pounds	2,480,315	6,481,234	39,811,201
Total tons	1,240	3,241	19,905
Number Minimum Cars (22.5 Tons)	55	145	884
One Train Length			6.7 Mi.

It should be kept in mind that the use of salt was not approved by the State until 1940. We consider salt, when evenly applied, to be an excellent bindweed chemical for use on nonagricultural lands, such as highways, railroads, around buildings, irrigation and drainage ditches and ditch banks, around oil wells, filling stations, refineries, etc. We recommend that salt be applied evenly at the rate of one pound per square foot, or about twenty tons per acre. Under our special arrangements in Kansas, the final cost of eradication is considered about the same as with sodium chlorate. We have special arrangements with the salt producing companies in our State whereby they will furnish salt for bindweed use at $1.90 per ton when sold to municipalities in minimum cars of 45,000 pounds or more. Also the railroads operating in our State have agreed on a special, uniform rate of one dollar per ton to any shipping point in the State on salt used for bindweed eradication, in cars of 45,000 pounds or more, when purchased and paid for by municipalities and used according to state official methods. This salt is ordinary mine run, rock salt which has been crushed to about the same fineness of ordinary

barrel salt. It is 99 per cent pure and very satisfactory for treating bindweed. It should be remembered that salt should not be used near trees, nor where one desires to grow trees, shrubbery, flowers, grass or other vegetation at any future time. Generally salt kills the soil permanently.

Eradication by Railroads: All of the railroads but one have given splendid cooperation in the bindweed program since the beginning of the present program in 1937. The amount of salt and chlorate used by each of the railroads during the past three years is given below:

Railroad	No. Cos. Operating In	1938 Lbs. Salt	1938 Lbs. Chlorate	1939 Tons Salt	1939 Lbs. Chlorate	1940 Tons Salt	1940 Lbs. Chlorate
Burlington	8		3,328		3,454	96	3,497
Frisco	12		7,623		5,440	15	3,200
M K T	13		2,498		6,238		4,097
Mo. Pacific	58	220	13,365	254	56,272	1,148	19,605
Rock Island	35		9,700				7,350
Santa Fe	68	No Report		632		13,757	
Union Pacific	33		105,575		190,702	3	128,469
Total Pounds			142,089		262,106		166,218
Total Cars			3.5	38	6	683	4.5

In our opinion 75 per cent of the eradication work on railroad property in our State will be completed this year.

State Highway System: The State Highway Department started treating its bindweed several years before the present Kansas law was passed. The amount of chemical used on the state highway system during the past three years is here given:

Year	Pounds Chemical Used	Acres Treated	Amount spent
1938	166,000		
1939	225,191	292	$25,000
1940	306,033	261	35,000

County Highways: The work on county highways has progressed in an excellent manner. The following shows status and progress:

In 1940..... 59 counties treated 100% of known bindweed
In 1940..... 25 counties treated 75 - 99% of known bindweed
In 1940..... 21 counties treated less than 75% of known bindweed

	1938	1939	1940
Chlorate Used (Pounds)	218,266	406,339	254,100
Salt Used (Tons)	425	260	1,599

We feel that eradication work on county highways is now 75% complete.

Township Highways: Township officials in our State have given excellent cooperation. Of the 1,800 townships in the State, about 1,400 have charge of the roads within their limits. Their work we believe is already 75% completed. Both chlorate and salt have been used successfully. Generally townships are switching to the use of salt rather than sodium chlorate.

These facts and figures which I have given you will show what progress has been made in the Kansas bindweed eradication program.

I hope that I shall not be misunderstood on the use of the word eradication. In Kansas we fully realize the seriousness of the seedling problem. By eradication I refer only to the destruction of the underground part of the plant--the root system.

The recognition and intelligent handling of the seedling problem we think are very important to our progress. To meet this situation we are doing three things. (1) County weed supervisors are making accurate soil seed tests to obtain reliable data on the seedling problem. Tests are being made to determine seed population in the soil both before and after eradication. Tests already made show some surprising results. This information is being used in the educational phase of our program. (2) County weed supervisors, with the help of landowners and operators, are carefully inspecting all land formerly infested with bindweed. Weed supervisors are discussing this problem thoroughly with landowners so they will fully appreciate the danger from seedlings. Already a few areas in our State have become reinfested from seed after the original plants and root system were destroyed. (3) State printed literature on the seedling problem is being distributed to landowners once each year through county programs. It is our belief that the seedling problem will exist for ten years or more after eradication of the old root system.

Duties and Responsibilities of our County Weed Supervisors: Since there are a large number of county weed supervisors attending this meeting, I will take time to outline the work and duties of our county weed supervisors. In Kansas the noxious weed program has no connection with W.P.A. We do cooperate fully with county agents, all farm organizations, the AAA program, the federal shelter-belt program, and any others interested in the weed problem. May I enumerate some of the duties of our county supervisors.

A. The publicity work in the county is usually handled jointly by the county agent and county weed supervisors. We get considerable publicity in the local newspapers, consisting usually of stories on progress of the local bindweed program, program plans for the season, stories on successful eradication by landowners, or proper methods of eradication. We have quite a few circular letters that go out from the county office to landowners. State printed material is also distributed. The first year of the program we had a publication called the "Bindweed Blue Book." Forty-five thousand copies were printed by the State Department and distributed to the landowners and tenants through the county programs. The next year we published a bulletin on "Homemade Bindweed Tools." This last year we had a publication on experience stories, sent only to non-cooperative landowners and tenants in each county.

B. The county supervisor is also responsible for contacting absentee landowners who have bindweed on their land. It is the duty of our supervisors to write letters to all absentee landowners and line up whatever eradication work can be carried out on such farms. Under the Kansas law the landowners are responsible for the eradication of the bindweed on their land. The tenant has no direct responsibility. We have had very good success in getting cooperation from absentee landowners.

C. The weed supervisors frequently have bindweed displays and exhibits at local fairs. These displays help in creating interest in the county program.

D. It is the duty of the county supervisors in our State to go to farms where bindweed has been eradicated and inspect, with the landowner, the land that was formerly infested, for new bindweed from seedlings, and to talk over with the landowner the seriousness of the seedling problem. We believe this is a valuable service to landowners and an important part of our program. We believe that keeping the land free from bindweed is as important as getting rid of it in the first place. For the supervisor to talk with the landowner and make him conscious of the fact that he still has a bindweed problem is going to be important in holding the ground we have gained. We anticipate that inspection work of this kind will need to be continued for a number of years.

E. The county supervisors in the western part of the State usually conduct a number of moisture tests each year in order to show the detrimental effect of bindweed in taking moisture out of the ground. Eradication by means of cultivation will store moisture in the soil. Tests are also made to show the effect of bindweed on the yield of various crops.

F. The county agent and county weed supervisor usually harvest these tests, which are sent to the State College for threshing and computing yields and are reported back to each county. This year a number of our county supervisors, in connection with this seedling problem are making soil tests to determine the number of bindweed seeds remaining in the soil after the bindweed plant and root system have been eradicated. This will keep the bindweed seedling problem before the supervisors and the landowners. Our supervisors have found from these soil tests that where eradication had never been attempted there were as many as 255 bindweed seeds per square foot of soil, six inches deep. Even after the ground had been cultivated for two or three years and the old root systems had been eradicated, there were still bindweed seeds left in the soil. We believe that tests of that kind are going to be of material assistance in the educational part of our program.

G. County supervisors have made collections of the important weeds in their county, with special emphasis on the noxious perennial weeds. They have pressed samples on display in their offices. The state supervisor cooperated by holding regional meetings to educate supervisors in collecting and pressing weed specimens. County supervisors collected weeds, which were identified at the meetings. The State furnished mounting cards and folders free.

H. The supervisors in our State cooperate very closely with the county agents and local extension set-up. They also cooperate closely with the Federal Shelterbelt, the AAA, and various other federal or state agricultural agencies.

I. The supervisor makes a monthly report to the state office, and also a yearly report showing statistical facts in connection with all phases of the program. The yearly report is detailed and includes cultivation and chemical use listing sheets showing individual cases in the county.

The expenditure of tax funds raised by counties, cities and townships in the State will amount to about $300,000 per year, or slightly more. About one-third of this amount will be returned when chemicals are resold to landowners and one-half the cost of the chemicals is paid back to the municipality. The remainder of the funds are spent on (1) supervisors' salaries and travel allowances, (2) office help, equipment and supplies, postage and printing, (3) labor needed for applying chemicals and in some cases to do cultivation work.

The annual county noxious weeds budgets vary from $500 in the very lightly infested counties to $13,000 per year in the heavily infested counties. The average county budget will run about $3,000 per year, which is considered sufficient to meet the needs of the program.

The noxious weed situation in our State is vastly different from that existing in the mountain or pacific coast states. As I see it, the difference lies mainly in the fact that in Kansas we have very little Russian Knapweed, Hoary Cress and Canada Thistle. Our most important weed is bindweed. Also in Kansas we have only a very small acreage under irrigation, which I believe further simplifies our problem. We have no land owned by the federal government, except that occupied by federal buildings, such as post offices, that occupied by military posts, and a small acreage acquired through the Federal Land Acquisition Program which is located where we have practically no weed problem. These differences help to simplify our weed eradication program. However, we do have a larger acreage of bindweed and much of it is located on land which is rated low in valuation and we believe that our bindweed is just as hard to starve out or poison as that found anywhere.

In our State the legislature has given proper support to our program. At each session it has appropriated a fair sum for state administration. As previously stated, in Kansas the State pays a small portion of the county weed supervisor's salary. The last session passed special enactment which states that all local noxious weed tax levies may be made outside of statutory tax limitations. We believe that this was a very important victory which should assure permanent and proper financing of local weed eradication programs. Our legislature also made a special appropriation of $5,000 per year to conduct a special noxious weed experimental station under supervision of the State College.

During the past year we have also added new rules and regulations under our noxious weed law which will facilitate activities in

our program. The addition of salt as a state approved chemical for noxious weed eradication on nonagricultural lands we feel is an important change, which is being rapidly adopted by our local officials and landowners.

At the present time we have in the hands of our state printer the copy for a new weed book entitled "Weeds in Kansas." It will be available for distribution in about three months. Copy may be had without charge by writing Noxious Weeds Division, State Board of Agriculture, Topeka, Kansas. This book will be mainly for identification of 375 weeds found in our State. It is well illustrated, and the best methods of control and eradication for Kansas conditions are given. May I take this opportunity to congratulate Mr. Ball, of California, and the other authors for the splendid weed book which they have just issued.

In closing may I again thank you for the opportunity of attending your meeting and compliment you on the splendid program. Should any of you be going East some day, may I urge you to route your trip through Kansas, and call on some of our county weed supervisors, whose offices are generally located in the county court house, or visit the state weed office in the State House at Topeka.

Chairman Schweis: Are there any questions?

Question: Using one pound of salt per square food, do you get a permanent kill?

Mr. Yost: Yes, we do.

Question: What is your greatest spreader of the bindweed seed?

Mr. Yost: I believe the big combine harvesters and threshers are the biggest spreaders.

Question: If a man neglects to destroy his weeds, how do you compel him to do it? Does the county do it? Has anyone forcibly gone on private property and destroyed weeds and got away with it?

Mr. Ball: We enforce the eradication of weeds in California. At the present time we have had only three lawsuits and we have won all of them. We serve a legal notice, notifying the owner that he has a weed pest upon his property, and he is given a definite length of time to start control or eradication. If he does not start within the designated time, the County goes in and does the work and sends him the bill. If he does not pay the bill within a certain time limit, it is recorded and placed as a lien against his property.

Chairman Schweis: Nevada's noxious weed law is very similar to that of California. We work in conjunction with the quarantine law. In case it becomes necessary to go onto anyone's property and destroy a crop, it is mandatory that three appraisers shall be appointed, one by the State, one by the county and one by the landowner. They shall then appraise the crop, and if unable to agree, the State Quarantine officer will appoint a single official to appraise the crop, and his word is final. The cost is divided three ways: the State pays one-third, the County pays one-third, and the landowner pays one-third.

(The meeting was adjourned until 9:00 a.m. Saturday morning.)

Saturday Morning, June 28, 1941

The meeting was called to order by Chairman Schweis.

Chairman Schweis: The next subject that we were to discuss this morning was "Weed Control on Indian Reservations" by Mr. Dan C. Foster, but apparently something has held him up. At this time we shall call upon Dr. R. S. Rosenfels, Assistant Physiologist of the Bureau of Plant Industry of the U. S. Department of Agriculture, to give his paper, "Progress Report of Federal Weed Experiments under Irrigation."

Dr. Rosenfels: (Summary of the Fallon, Nevada, Project on Control of Whitetop.)

The Nevada project on control of whitetop was started in August 1938 by the Division of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, with the cooperation of the Agricultural Experiment Stations of Nevada and California, and of the Division of Irrigation Agriculture, also of the Bureau of Plant Industry. The aim of the project has been to develop effective methods for killing whitetop under conditions of western irrigation agriculture. The project is located at Fallon, center of the Newlands Reclamation Project which includes approximately 56,000 acres of irrigated land. The average annual rainfall is about 5 inches.

Alfalfa hay is the principal crop grown with grain next in importance. The whitetop occurs characteristically in scattered roughly circular patches in many of the alfalfa and grain fields. It is also present along the banks of the canals, head ditches, and drains, and along field levees, roadsides, and fence lines. Three species of whitetop are present in the Fallon region. Both Hymenophysa pubescens and Lepidium repens are abundant; Lepidium draba is much less prevalent.

The work is organized along two main lines, a) the eradication of open-field infestations, and b) the treatment of whitetop along ditches, levees, roadsides and fence lines. Considering first the treatment of relatively large open-field infestations, the most generally applicable method is probably the cultivation, or shoot-cutting method widely adopted in recent years for bindweed, whitetop, and other deep rooted perennials. In this method the soil is irrigated, and the plant is made to exhaust the food content of its roots by continual growth. The tops are cut off frequently enough to prevent the replenishment of the food supply of the roots by carbohydrates manufactured in the green leaves. Research of recent years has shown that considerable leafy growth may occur following a cultivation before carbohydrate storage begins. In working out a cultivation program, therefore, the practical problem is to determine how long an interval can be permitted between cultivations. It must be understood, however, that any fixed interval will at some time during the eradication period not be strictly correct, since soil and air temperatures and other factors which vary from time to time affect the growth rate and hence the speed with which the plant reaches the point at which carbohydrate storage in the root begins.

A set of cultivation interval plots was started with Hymenophysa pubescens in an alfalfa field in the spring of 1939. The soil

was first plowed and disced. As soon as the whitetop emerged, one plot was cultivated. Another was cultivated 4 days after emergence, and others 8, 12, and 16 days after. These intervals were continued during the 1939 season. Cultivation was done with a garden tractor using a 4-foot V blade operating at a depth of 3" to 4". The soil was irrigated every 3 or 4 weeks as was necessary for the alfalfa.

In the fall of 1939 samples of roots were dug from each plot and analyzed for sugars and starch. Whereas roots from an adjoining undisturbed area contained nearly 50% of starch, dry basis, in the 6" to 18" zone, roots from the cultivated plots contained from 5 to 10% starch, regardless of interval. Even the longest interval, (16 days after each emergence) had not been too long to prevent effective lowering of root reserves. The 16-day plot received 5 cultivations during 1939, the emergence plot 15.

Plants appeared on all plots in the spring of 1940, but after two or three cultivations grew very slowly and became spindly and few in number. By the middle of the summer eradication had apparently been obtained on all plots regardless of interval. These plots were 22'x50' and each was surrounded by undisturbed whitetop. In 1940 it became evident that the border effect was in places as great as eight to ten feet. This made it difficult to judge the exact date of eradication. However, these tests showed definitely that cultivating 16 days after each emergence was as effective as any shorter interval, and that eradication occurred during the second season. The average interval between cultivations on the 16 days after emergence plot was 24 days, and the shortest interval 22 days. These figures indicated that an interval of 3 weeks between cultivations would not be too long. A larger scale test of the 3-week interval on Hymenophysa pubescens is now in progress on a plot approximately 88'x114'.

In 1940 another set of cultivation interval plots was started again in an irrigated alfalfa field, but with Lepidium repens. These plots were arranged in a solid block so that at the conclusion of the tests there will be no border effect. Whitetop around the outer edges will be chemically treated. Each plot is duplicated. The intervals under trial are: emergence, 8, 12, 16, 20, and 24 days after emergence, and every 2, 3, and 4 weeks. Vigorous growth is still occurring, and it appears that a longer period of cultivation than a season and a half will be required.

A further test of the 3-week interval on Lepidium repens is now in progress. This patch of whitetop was cultivated at irregular intervals during 1939 and 1940 in connection with attempts to grow various grasses and clovers on the infested land. These attempts failed, and cultivation is now being performed every 3 weeks. The whitetop has recently shown signs of weakening, indicating it may possibly be destroyed in 3 seasons.

Tests are also in progress to determine the feasibility of growing a winter grain crop and cultivating during the period between grain harvest and planting. A 3-week interval between cultivations is being used. Rye and 3 varieties of wheat are now being tried. The whitetop species is Hymenophysa pubescens.

Flooding is another method of treating open-field infestations of whitetop which is very effective on the heavy soils which are adapted to its use. No experiments on this method have been performed under the cooperative project, but it has been possible to observe the method in operation. The customary practice is to apply the water in May and June and maintain a depth of several inches until about September 1st. The water is then removed and the land permitted to dry. It is essential that complete coverage be obtained. Whitetop on high spots barely or not quite submerged is apt to survive by regrowing from the crowns after the water is removed. It is also essential that the whitetop on the dikes holding the water be destroyed by some other method, or that the dikes be made of clean soil. Fields freed of whitetop by flooding can be reinfested in a few years from plants which survived on the dikes and were scattered when the dikes were levelled. The method is not applicable with light soils which permit too much seepage, and where soil productivity is reduced, it may be impractical. Some of the soils in the Fallon region are more productive after flooding than before.

The treatment of open-field infestations with chemicals has proved impractical for the most part. However, on light and medium textured soils carbon bisulfide is an extremely useful material for the destruction of resistant plants which have survived cultivation or other control measures, of stray plants which may have escaped detection during control operations, and of small infestations in general. It has, however, proved ineffective on heavy soils. Its high cost alone prevents it from replacing the cultivation method on soils adapted to its use.

Sodium chlorate is of little value because it gives uncertain results when used in amounts less than 16 to 20 pounds per square rod. This makes it more costly than carbon bisulfide.

Spraying the tops of the plants with sodium chlorate or acid arsenical sprays will, under certain conditions, cause killing of the roots, but it is very difficult to secure these conditions with open-field infestations in an irrigated region.

Still another method of controlling whitetop is to establish a sod of perennial grasses or clovers on the infested land. This method was tried with success near Elko by the Nevada Agricultural Experiment Station. The land was fallowed for a year or a year and a half before seeding the various grasses and clovers. Within 2 to 3 years after seeding excellent control, but not complete eradication, had been secured. These tests were repeated at Fallon on land infested with Lepidium repens. The land was fallowed (cultivated at intervals) during 1939, and several grasses and clovers seeded in duplicate plots of 2 square rods each in the fall. By the middle of the 1940 season the whitetop had been markedly suppressed in several cases. The most successful competitors were meadow fescue, brome grass, Ladino clover, strawberry clover, and alsike clover.

Although these tests show that perennial competitive crops can be very effective, other seedings of the same grasses and clovers on other land infested with the same species of whitetop, and also first fallowed for a year, did not give equally good results. On these plots the whitetop outgrew and finally suppressed the seeded crops.

In still another case, brome grass and meadow fescue were tried on land infested with Hymenophysa pubescens. The one season of preliminary fallow almost completely eradicated the whitetop, yet during the two seasons following seeding, both grasses permitted the whitetop to thoroughly reestablish itself. In this case it would have been better to continue the fallow for the additional half season or so that would apparently have been necessary for complete eradication.

With these various observations in view, it appears that factors such as the relative vigor or exhaustion of the competing species, and the adaptation of each to the prevailing soil conditions are of importance in addition to inherent competitive ability. This suggests the wisdom of preliminary testing, in a new locality, to determine how long the preliminary fallow should be, and what species are best adapted to local conditions. The length of time necessary for complete eradication by the cultivation method should also be considered. Where there is no more than two seasons, complete destruction of the whitetop by cultivation may be preferred since at least one season of preliminary fallow is usually necessary for the establishment of the seeded crop.

Experiments on the eradication of whitetop on ditch banks, levees, and similar situations were first started in the spring of 1939. One hundred fifty feet of the bank of a head ditch thoroughly infested with Hymenophysa pubescens was divided into 6 plots of 25 feet each. The whitetop was mostly on the outer side of the bank and extended down onto the alfalfa field adjoining. The soil was medium-textured. It received water from the inside when the ditch was periodically used, and the base of the bank on the field side received water when the field was irrigated. On one of these plots the whitetop was hoed off at each emergence, and on the 5 other plots hoeing was done at 4, 8, 12, 16, and 20 days after emergence. The plot hoed 20 days after each emergence was hoed 5 times during the 1939 season, and the emergence plot 14 times. Plants appeared on all plots in the spring of 1940, but after 2 hoeings the growth rate became very slow and by about the middle of the season eradication had been secured on all plots regardless of interval. The average interval between hoeings on the 20-day plot was 37 days and the shortest was 29, indicating that a 4-week interval is not too long. It should be emphasized at this point that in using hoeing or any other shoot-cutting method on a ditch bank type of situation, the interval that is best at one place may be unsuitable at another if the moisture content of the soil is considerably different. Particularly if the soil becomes so dry that dormancy occurs, the above indicated results will not serve as a guide to either the interval or the total time required for eradication.

A trial of hoeing every 4 weeks is now under way on a drain bank infested with Lepidium repens. Further repetitions of the work on hoeing are not now being performed because present interest is centered largely on the method of searing with a weed burner which, as will be later indicated, appears to have certain advantages over hoeing.

The grazing of ditch banks, and the planting of suitable pasture grasses thereon has for some time attracted the interest of Bureau of

Reclamation officials and others in irrigated regions. The establishment of grass on ditch banks has a twofold object, namely, the providing of pasture on otherwise unused land, and the control of noxious weeds. With these facts in view, preliminary trials of the seeding of grass were made in the fall of 1940 on the ditch bank plots freed of whitetop by the hoeing method. Twelve and a half foot strips of brome grass, crested wheat grass, and meadow fescue were seeded early in September and artificially watered until the end of October. During the winter, rainfall was the only source of water. During the current season the only water supply has been the filling of the ditch and irrigation of the adjoining field, neither of which brings water directly to the outer side of the bank. The brome grass and crested wheat grass, particularly the latter, have done fairly well, although neither has so far established a sod. Recent photographs of the outer side of the bank nevertheless show a sharp contrast between an untreated and still infested section, and the strips seeded to grass.

Trials of the method of searing for killing whitetop on ditch banks and similar situations were started in June and July 1940, shortly after the results obtained in Wyoming had appeared. These tests are still in progress. At present they are limited to Lepidium repens. Searing is being tried at 4 different growth stages: a) when the leaves are approximately 1" long, interval usually 10 days to 2 weeks; b) when the leaves are approximately 2" long, interval usually about 3 weeks; c) at the early bud stage with leaves about 3" long, interval usually about 4 weeks; and d) at the early to full bloom stage, interval usually 6 to 8 weeks. Each plot includes a minimum of 20' of infested drain bank. Three sets of plots, each set including the 4 intervals mentioned, are now under way. The original plan was to have one set in a relatively dry, one in a relatively wet, and one in an average situation, but environmental differences are not now very pronounced. One set also includes a plot being hoed every 4 weeks, already mentioned, and other plots being sprayed with acid arsenical, chlorate, and other sprays.

The experiments on the searing method are not yet completed since whitetop is still appearing on all the plots. The method has been of considerable interest and promise, especially in view of the success attained by hoeing and the limitations of hoeing. The latter cannot, for example, be performed on stony or riprapped ground, and is difficult on rough ground such as that formed by the construction or cleaning of drain ditches with a dragline bucket. Furthermore, repeated hoeing of a sloping bank tends to pull down the soil into the ditch. If searing can be substituted for hoeing these difficulties will be avoided and a more general method made available. Searing, furthermore, requires but approximately half the time of hoeing. This advantage is of course somewhat offset by the cost of fuel and equipment.

The use of chemicals causing relatively permanent soil sterility on ditch banks is objectionable if later seeding of grasses is contemplated. However, it is sometimes desirable to sterilize roadsides, fence lines, and similar places. On sandy soils whitetop can be killed with about 12 pounds per square rod of arsenic trioxide applied as sodium arsenite to the bare soil. Borax is a possible substitute for arsenic. On heavy soils, sterilization is impractical. Temporary

soil sterilization can be accomplished with sodium chlorate, but, as previously noted, the cost is prohibitive. Rock salt is another possibility in this connection.

Spraying the tops with sodium chlorate, acid arsenical, or other solutions with the object of securing translocation into the roots is a procedure meriting further trial for ditch-bank work. In the fall of 1940 a ditch-bank infestation of Hymenophysa pubescens was sprayed with sodium chlorate alone and sodium chlorate followed by sulfuric acid. In both cases extensive enough root killing occurred so that no growth has yet appeared this season. Other trials of the same treatment have not given equally good results. Work is needed to determine when the proper conditions for effective spraying are present.

A chance observation made in connection with the cooperative project illustrates the danger of spreading whitetop by passage of the seed through the digestive tracts of grazing animals. In the fall of 1939 a cow dropping was found near Fallon which contained many seeds of Hymenophysa pubescens. A few of the seeds had sprouted. The location was an open range area containing a very large whitetop infestation. This dropping was taken in to the greenhouse of the Newlands Field Station at Fallon, placed on soil, and kept moist for several weeks. More of the seeds sprouted during this period. When photographed the dropping was literally bristling with young whitetop plants, showing that it could easily have been responsible for introducing the weed into a non-infested area.

Other droppings containing whitetop seeds were found nearby. Wherever water had reached the droppings, seeds had sprouted, and some well established young plants were seen. Where the droppings had remained dry, the seeds had not sprouted, but were plainly visible.

Chairman Schweis: Dr. Rosenfels, how long will whitetop roots lie dormant in the ground and not make any top growth, but still be capable of propagation?

Dr. Rosenfels: I do not know the answer, but I am sure it would be quite a while, perhaps more than a year.

Chairman Schweis: From your observation, then, you are inclined to believe that one of the greatest possible sources of spread of noxious weeds is the grazing of livestock on infested areas and then taking the seeds back on cultivated areas?

Dr. Rosenfels. Yes, it certainly is.

Mr. Ball: Do you find that animals will graze whitetop except when they are contined to an area?

Dr. Evans: Sheep and horses will leave it alone, but cows won't; the cow will take anything. I have grazed sheep quite a lot; about the only time they will take it is when it is in seed. They will take the seed off and they certainly carry it. In one area in Southern Utah there was a 10-acre field in which a sheep man used to corral his sheep at night. Later, this land was plowed up and

used as dry farm land. The whole area is now infested and anyone that sees it is sure that the seed was carried through the digestive tracts of the sheep. If animals are well-fed and are not deficient in any of the elements, they ordinarily won't touch whitetop.

Chairman Schweis: I should like to make a statement on the passing of seeds through the digestive tracts of animals. Following the publication of a leaflet by Dr. Rosenfels, I asked the veterinarians of our district if it would be advisable to place the animals under quarantine after they had been grazing on infested areas before allowing them to go on to cultivated areas. I received very little encouragement. They did not give me any definite answer as to how long animals should be held in quarantine under such a situation. Owing to the construction of a cow's stomach, the seeds are likely to stay in there an indefinite length of time, and they did not consider the matter feasible at all.

Dr. Rosenfels: I asked one of our doctors at Davis that same question; he and his colleagues have done considerable work of that sort. In the study of metabolism they have to know pretty well how long it takes for food to go through. He said it was the customary practice to allow 4 days for the insides of an animal to clean out. There are two papers I should like to refer to in that connection---two articles in the Journal of the American Society of Agronomy. Both of these investigators felt that 4 days was sufficient time for the seeds to go through. It does depend, however, on the size and density of the seeds and the contents of the rumen.

Chairman Schweis: I think we had better get along with the program. If time will permit, we should like to show some pictures.

The next part of the program is to open the meeting for a discussion of topics in general. I want everyone present to feel perfectly free to enter the discussion. I shall ask Dr. Robbins to lead the discussion.

Dr. Robbins: There have been some questions about poisonous plants, so we shall start the discussion with this topic.

Question: What part of water hemlock is really poisonous to animals?

Answer: Under Washington conditions we get most of the kill in the spring, just when it is first coming up. I do not know whether it is the stage of growth or whether it is merely the fact that it is one of the first things to come up.

Question: There are two types of hemlock. I noticed that someone spoke of water hemlock and poison parsnip; the hemlock has a tuberous root.

Mr. Harris: We have made quite a survey and those plants we thought were parsnips turned out to be poison hemlock. They are more insidious because they will grow in more areas than water hemlock will. We found cases where stock were being poisoned and we could not figure out why. What we used to call parsnip was nothing more than poison hemlock. Poison hemlock has purple spots on the stems.

Mr. Ball: This one point has brought out the reason why we put this discussion on the program; it has very definitely brought out the fact that there is a lot we do not know about poisonous plants. When we refer to a publication to obtain information relative to a plant, or group of plants, we derive little definite information other than that the plants are suspected of being poisonous. That does not mean much. We cannot spend a great deal of money on the eradication of plants that we do not definitely know are poisonous. We could do a lot of work on poisonous plants. I have had the opportunity to O.K. projects under the AAA program, but I did not feel we should spend the money merely because the plant was suspected of being poisonous.

Chairman Schweis: I should like to ask men who are in the field much more than I am this question: In the Western States what plant, in their opinion, causes the greatest mortality among grazing livestock?

Answer: The whorled milkweed has been the only real important plant.

Mr. Hobson: In this State the milkweed infestation is localized in Washington, Iron and Kane Counties. There is a terrible loss in this State from that poisonous weed.

Dr. Robbins: We have many cases of poisoning from both the spotted hemlock and the water hemlock. The toxic material is evenly distributed throughout the plant, which has been shown by analysis.

Chairman Schweis: We do know that there are certain species of plants which are definitely poisonous, but no one seems to know which species they are. Bee-keepers often ask me that question; invariably I cannot tell them anything definite.

Dr. Robbins: There has been some call for a discussion on searing. What are your experiences with that? Are there any questions in regard to this method of burning?

Question: Is it as cheap as cultivation?

Answer: We were in Wyoming last week (a group from Idaho). They showed us their data and it ran as high as 90 cents a square rod for the eradication of whitetop over a three-year period. In some cases it was done in two years for 75 cents.

Question: How often did they sear and in what stage of growth were the plants?

Answer: About every 14 days during the early part of the program; they carried it on about the same as cultivation. They said there was not much difference between whitetop and morning glory, but morning glory is somewhat more stubborn than whitetop.

Question: What was their reaction to the effect of searing? Do they still think it is a good practice to follow?

Answer: They are increasing the size of their program all the time.

Question: Do their cost figures include that of labor?

Answer: Yes.

Question: Many projects are considered with and without the cost of labor. Are there any figures on the cost of searing without labor costs?

Answer: I understood that labor is about 50% of the total cost; material and equipment about one-half.

Comment: In my county we are doing some burning. An average cost for us on roadside burning, with fuel at 8 3/4 cents, is about 3 rods to the gallon. We are doing the second burning now and have been covering 4 rods per gallon. I think it will increase to a gallon for 5 or 6 rods as the season goes on.

Comment: In Salt Lake County we have used the burning system for three years. We do not consider it an eradication method at all; it merely prevents seed regrowth. We work on whitetop and morning glory.

Dr. Robbins: I think the Wyoming Station has a publication out on searing. Do you want to criticize any of the papers that have been read, or ask any questions?

Chairman Schweis: Concerning Dr. Rosenfels' paper, I should like to ask him a further question. Would you consider it favorable or desirable, after whitetop fails to make a growth, to plow that land up within a year or two and try to put it into another crop?

Dr. Rosenfels: It would be unwise for me to make a guess. I do not know.

Chairman Schweis: Do you now consider, Dr. Rosenfels, as far as you have gone, and from your own observations, that that is a practical and cheap method of control?

Dr. Rosenfels: It depends a great deal upon what the grower intends to do with the land. If it fits in with the scheme of farming the man had in mind---if he wanted to establish pasture grass and he had whitetop infested land---this would be an excellent way to deal with it. If he does not want grass, hay or pasture, I do not think it would be very desirable.

Mr. Ball: Relative to Dr. Rosenfels' paper, Mr. Spence, under your intensive cultivation program, have you observed any great differences between irrigated and non-irrigated areas so far as results are concerned?

Mr. Spence: I do not think we could say that we have had differences between the two conditions. So far as our irrigated ground is concerned, I think that the primary reason for irrigating during the cultivation period is not for the effect of the kill but more for the physical condition of the soil. Many lighter soils get so loose after 5 or 6 cultivations that they cannot do a good job of cutting. We do not feel that there is any particular advantage

to irrigate so far as kill is concerned.

Mr. Harris: In that connection I should like to make a few remarks in regard to our morning glory situation near Pendleton. We have 160 acres there that have been infested for 35 years; they had been abandoned at various times. The program has been going three years, and during that time we have instituted cultivation and crops and vertilization and grasses. Last year, and also this year, we have crops on one-year, two-year and three-year fallow. We found that, with fertilization and other practices along with it, our two-year lots yielded around 10 bushels per acre, and that section is normally around 40 bushels. Last year we received 42 bushels as against ten.

Comment: Mr. Harris, in our county the weeds are different at all elevations and in different types of soil. We are finding that different elevations and soils require different cultivation methods. One thing we are finding, however, is that we must hold the trash. Now we are developing the machinery and getting the type of machinery that will hold the humus in the ground.

Dr. Robbins: We should discuss two or three other topics. Any questions about carbon bisulphide?

Chairman Schweis: I think it should be stressed at this meeting, Dr. Robbins, that some of the data that were discussed in the papers yesterday made a point of the undesirability of using carbon bisulphide when the temperatures were low in the fall. I think that is very important, because we have all been more or less under the impression that it could be used in any and all conditions, other than in frozen ground.

Comment: (Gentleman from Idaho) We used carbon bisulphide in 1938. About Christmas time we had considerable frost. We had an area of three or four patches; one area was a little over an acre. Frost came and killed the crops off, and about 1 to 2 weeks later it thawed out. These areas were treated and we could not see any difference in the results on the area that was treated in the fall and on the area that we treated in the summer time. The results were about the same. If you have plenty of moisture in the fall, I cannot see any difference in the results, at least in our County. We have found though that in the spring you must irrigate before treating.

Mr. Spence: I should like to hear more discussion on this point; I do not think the information we got yesterday corresponds with the results obtained in Idaho. We have treated in every month in the year; we find that as a general rule we can use carbon bisulphide right up to the first of the year. About the only time that we do not get the results is starting too early in the spring.

Dr. Robbins: What do you think that is due to?

Mr. Spence: That is the point I do not understand. This does not check with the temperature data that has been presented. I should like to have Mr. Hunt comment on this.

Mr. Hunt: We have treated in every month in the year, including January and February and gotten just as good results as any other month in the year. We have found during the last two or three years in the spring, April or May, just before beginning to irrigate, we think the soil is just a little more open and there is perhaps more air in the soil, and this is the only time of the year that we have had poor results.

Mr. Ball: What is the soil type?

Mr. Hunt: It is rather light and sandy, the general Twin Falls type. It is a loose soil, with considerable air space.

Comment: We have had a little experience in treating in the winter time. I treated 700 square rods right at Christmas time; the soil was a heavy adobe type. We crowned all of the growth before treating. On about 50% of the ground we got a very bad crown growth in the spring, but it was easily eradicated with the spring treatment.

Comment: In Washington County, Idaho, we have some very heavy adobe soil. While we do not make a practice of using carbon bisulphide in frozen ground, in one case we did use it in a case where there was a 5-inch frost and we got a 100% kill.

Mr. Ball: The point that has bothered me in the use of carbon bisulphide is that we have gone on for 12 to 14 years and have consistently stayed with one dosage with a slight variation in depth of application. Any material, to me, that will kill everything so consistently under all conditions as you men have reported, leads me to believe that there are lots of places where we could use half as much and probably get a kill. We find that in some cases two ounces are not enough, but on some weeds, under favorable conditions, perhaps two ounces are too much.

Comment: In Twin Falls County we have changed somewhat. We have been putting it in shallower than we did before. I think that the size of the plant can determine how much carbon bisulphide is necessary. In many cases it might be false economy to try to cut down the dose.

Dr. Robbins: There has been a very strong realization over the years of the fact that there are variable results in the field in the use of carbon bisulphide. That has been the reason for the research work that we are doing at Davis, using carefully controlled experiments to determine what the various factors are that influence the diffusion of carbon bisulphide in the soil. The bisulphide kills when it comes in contact with the root; we find that there is no movement in the root or along it. If you apply it in one place, it does not enter the root; it kills where it touches. Therefore, the carbon bisulphide must diffuse in the soil and come in contact with the roots. We are, therefore, trying to determine those factors which influence the movement of carbon bisulphide in the soil. The research just mentioned was made possible through funds donated by the Wheeler, Reynolds & Stauffer Chemical Company.

Question: Do you find the kill more at the surface where it is

applied or down deep? Ninety per cent of our come-back is surface growth; most of our kill is deep.

Dr. Robbins: The carbon bisulphide diffuses downward and the rate and depth of diffusion depend chiefly on the texture and moisture of the soil.

Some of the boys have asked about chlorates and have expressed a desire to have chlorates shipped to them in certain sizes of drums. I understand that they are going to start manufacturing chlorate on the coast. What size of granules and in what kind of containers are desired by field workers?

Mr. Carr: I am with the Technical Department of the Pennsylvania Salt Company, and we are going to produce the chlorates. We are anxious to produce the kind of chlorates you want. I have some meshes here that I will pass around.

Comment: If you are using fine mesh in the spray gun, it is all right, but if you are trying to spread fine-mesh chlorate on a windy day, you cannot control it. So we should like a coarser mesh much better.

Mr. Carr: We want to find a good standard size that could be used in solution and also for dry application.

Comment: A larger mesh would also help prevent the caking in the barrels.

Question: Will the size of drum make any difference in the cost?

Mr. Carr: We are interested in a 200-pound drum, if there is any request for it.

Comment: The 100-pound drums are easier to handle.

Dr. Robbins: There have been some few questions about the use of borax. Do you wish to discuss the use of borax as an herbicide?

Mr. Ball: I should like to have some discussion on it, due to the fact that we probably use as much or more than any of the other States. We have learned of men in the field who have recommended this material for deep-rooted perennials. Our experience has not been that borax will effectively handle deep-rooted perennials at a competitive cost. When applied at a heavy enough dosage to effectively kill deep-rooted perennials, the cost is greater than that of carbon bisulphide or chlorates or other methods. There is a place for borax in our weed control program. We are using it as a spray now and it looks pretty good. Areas that go to seed are sprayed with borax in solution. The caustic kills the seeds and the borax remains on the soil until the fall rains, when it is carried to the shallow root systems of the plant. The major part of the borax is used on Klamath Weed.

Question: Is there any definite comparison between sprayed borax and that applied dry?

Mr. Raynor: On Klamath weeds it takes about the same number of pounds of borax per square rod, no matter how you apply it.

Chairman Schweis: How long will borax remain effective as a soil sterilizer?

Mr. Raynor: From a year or two to several years.

Dr. Robbins: How many pounds of borax did you have to apply to kill deep-rooted perennials?

Answer: I have applied up to 60 pounds on morning glory and I have not gotten any conclusive results. It has killed a small percentage, but that is all. I refer to dry land.

Question: If you get a two-year sterility, how much borax would you have to use?

Mr. Rayner: From 8 to 12 pounds per square rod under most conditions.

Dr. Robbins: Mr. Spence brought up a question yesterday. He said that during the period we are now going through, where the emphasis is on national defense, we have to keep our weed control program alive. We have to use every effort to keep this program before the public, or it will be side-tracked.

Question: I should like to ask Mr. Yost this question: Do you consider knapweed a secondary weed?

Mr. Yost: No; there is very little knapweed in Kansas.

Dr. Robbins: This concludes the informal discussion.

Chairman Schweis: Thank you, Dr. Robbins, for acting as the leader of this discussion.

I have been a member of the Western Plant Board for the last 18 years. While this Weed Conference is only 4 years old, I want to say that this has been one of the most interesting meetings I have attended.

(Applause.)

The next item will be the report of our Committees.

(Mr. Spence gave the report of the Resolutions Committee and moved its adoption. It was seconded and the motion carried. The resolution submitted was one expressing appreciation to the officers, to Utah representatives and to the hotel for a successful meeting.)

We will now hear the report of the Nominating Committee. Mr. Harris.

Mr. Harris: We nominate Dr. Robbins as Chairman, Earl Hutchings as Vice-Chairman, and Mr. Ball as Secretary-Treasurer. I move that they be elected unanimously. (Seconded, motion carried.)

Chairman Schweis: Any other matters to be taken up?

Mr. Ball: I am wondering as to the reaction of the group to this question: Do you think that these Standing Committees on special subjects should be appointed? I just question whether men appointed who are several hundred miles apart can become very active as a Committee.

Mr. Spence: I feel the same way about these Committees as I feel about resolutions: I am a disbeliever. I think the object of and the good this group can do is in bringing together the various people and divisions that are interested in weed control work. I think that should be more the primary purpose of this group. I think it is important that we bring in research groups, educational groups, and then bring in the people who probably have not had the technical training, but who are responsible for the work in the field. Their expressions can guide us in our research and in the development of educational programs. So far as the committees are concerned, I do not know what real good they do. I think a conference such as we have had this year is worth more than all the committees you can appoint.

Chairman Schweis: If there are no other matters to be taken up, the moving pictures will be shown now. The meeting is now adjourned.

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