H.E. Rea

LIST OF PERSONS ATTENDING SOUTHERN WEED CONTROL CONFERENCE DELTA BRANCH EXPERIMENT STATION

June 10, 1948

Name	Address
1. Albert, W. B.	S. C. Experiment Station, Clemson, S. C.
2. Anderwald, Frank R.	Range & Forestry Dept., Texas A & M, College Station, Texas
3. Broussard, Whitney P.	Breaux Bridge, Louisiana
4. Brown, Clair A.	Botany Dept., Louisiana State Univ., Baton Rouge 3, La.
5. Campbell, R. S.	Southern Forest Exp. Sta., 1008 Federal Office Bldg. New Orleans 12, La.
6. Carr, R. B.	Delta Exp. Station, Stoneville, Mississippi
7. Carter, Edward P.	U.S.D.A., c/o Georgia Agr. Exp. Sta., Experiment, Ga.
8. Cottier, Edwin F.	Pacific Coast Borax Co., Auburn, Ala.
9. Cowan, E. Karl	Standard Agr. Chem., Inc., Interlaken, N. Y.
10. Cowart, Linton E.	c/o Botany Dept., Louisiana State Univ., Baton Rouge, La.
11. Creasy, Lawrence E.	Agr. Engineering Dept., L. S. U., Baton Rouge, La.
12. Crowder, Loy V.	Georgia Agr. Exp. Station, Experiment, Ga.
13. Cummings, R. W.	N. C. Agr. Exp. Station, Raleigh, N. C.
14. Danielson, L. L.	Virginia Truck Exp. Sta., P. O. Box 2160, Norfolk, Va.
15. Davis, William C.	Texas Agr. Exp. Sta., Substation 4, Box 232, Beaumont, Texas
16. Donald, Leroy	Lion Oil Co., Chemical Division, El Dorado, Arkansas
17. Duncan, T. E.	Georgia Agr. Exp. Station, Experiment, Ga.
18. Easley, Tildong	American Cyanamid Co., 1207 Donaghey Bldg., Little Rock, Ark.
19. Elder, W. C.	Agronomy Dept., Oklahoma A & M, Stillwater, Oklahoma
20. Evans, L. S.	Div. of Cereal Crops & Diseases, Beltsville, Md.
21. Farish, L. R.	Delta Exp. Station, Stoneville, Miss.
22. Forbes, I. L.	Louisiana Agr. Exp. Station, Baton Rouge, La.
23. Gantz, H. L.	Dallas 2, Texas
24. Garman, W. H.	Dept. of Agronomy, Univ. of Arkansas, Fayetteville, Ark.
25. Gibson, J. W.	Dow Chemical Co., Commerce Bldg., Houston 2, Texas
26. Hagood, Edward S.	L. S. U. Experiment Sta., Baton Rouge, La.
27. Harnden, R. C.	Chapman Chemical Co., 707 Dermon Bldg., Memphis, Tenn.
28. Harris, V. C.	State College Exp. Station, Mississippi
29. Hedden, O. K.	Box 107, Station E, Toledo 9, Ohio
30. Henderson, R. G.	Virginia Agr. Exp. Station, Blacksburg, Va.
31. Hildebrand, E. M.	Biology Dept., Texas A & M College, College Sta., Texas
32. Johnson, Howard W.	Delta Branch Exp. Station, Stoneville, Miss.
33. Johnston, J. E.	Blackland Exp. Station, Box 414, Temple, Texas
34. Jones, Melvin D.	Agronomy Dept., Oklahoma A & M College, Stillwater, Okla.
35. Jones, T. N.	Mississippi Agr. Exp. Station, State College, Miss.
36. Klingman, Glenn C.	Agronomy Dept., N. C. State College, Raleigh, N. C.
37. Lancaster, R. R.	College Station, Texas
38. Leonard, O. A.	Plant Pathology and Physiology Dept., Miss. Agr. Exp. Station, State College, Miss.
39. Loustalot, Arnaud J.	Federal Exp. Station, Mayaguez, Puerto Rico
40. McDaniel, C. L.	Lion Oil Co., Chemical Division, El Dorado, Ark.
41. McMurray, Sam F.	Dept. of Agronomy, Univ. of Tenn., Knoxville, Tenn.
42. McNamara, H. C., Jr.	Drew Sales Co., Drew, Miss.
43. Maisenhelder, Louis C.	Delta Branch, Southern Forest Exp. Sta., Stoneville, Miss.
44. Makin, E. C., Jr.	Research Division, Lion Oil Co., El Dorado, Ark.
45. Meek, William E.	Delta Branch Exp. Station, Stoneville, Miss.
46. Millar, Paul H.	State Plant Board, Little Rock, Arkansas
47. Morgan, Leland E.	Gotcher Engr. & Mfg. Co., Clarksdale, Miss.

Name	Address
48. Nation, Hoyt A.	Dow Chemical Co., 242 So. Gay St., Auburn, Ala.
49. Palmer, Thomas P.	Standard Oil Co., P. O. Box 221, Jackson, Miss.
50. Perkins, Wheeler R.	Univ. of Arkansas, College of Agriculture, P. O. Box 391, Little Rock, Arkansas
51. Presley, John T.	Dept. Plant Pathology and Physiol. Mississippi State College, State College, Miss.
52. Quisenberry, K. S.	U. S. Dept. of Agriculture, Beltsville, Md.
53. Rea, H. E.	Dept. of Agronomy, Texas A & M College, College Sta., Texas
54. Robinson, I. R.	Georgia Coastal Plain Station, Tifton, Ga.
55. Ryker, T. C.	Botany Dept., Louisiana State Univ., Baton Rouge, La.
56. Sandal, P. C.	Agronomy Dept., Univ. of Arkansas, Fayetteville, Ark.
57. Scarbrough, E. N.	N. C. State College, Raleigh, N. C.
58. Schember, Victor E.	Dept. of Agronomy, Texas A & M, College Sta., Texas
59. Schell, J. M.	Experiment Station, Auburn, Ala.
60. Sell, O. E.	Georgia Exp. Station, Experiment, Ga.
61. Shear, G. M.	Virginia Agr. Exp. Station, Blacksburg, Va.
62. Skold, L. N.	Dept. of Agronomy, Univ. of Tennessee, Knoxville, Tenn.
63. Smith, T. J.	Virginia Agr. Exp. Station, Blacksburg, Va.
64. Soday, Frank J.	Lion Oil Co., El Dorado, Arkansas
65. Southwick, Lawrence	Dow Chemical Co., Midland, Michigan
66. Tabor, Paul	Soil Conservation Service, Spartanburg, S. C.
67. Talley, Paul J.	Delta Station, Stoneville, Miss.
68. Tullis, Edgar C.	U. S. Dept. of Agriculture, P. O. Box 2967, Beaumont, Texas
69. Turner, Arthur W.	Bureau of Plant Industry, Soils & Agr. Eng. Washington, D.C.
70. DallaValle, J. M.	Dept. of Chem. Eng., Ga. School of Technology, Atlanta, Ga.
71. Eiles, J. E.	Arkansas State Plant Board, Little Rock, Ark.
72. Wooten, O. B., Jr.	Delta Branch Station, Stoneville, Miss.
73. Young, Vernon A.	Dept. Range & Forestry, P.O. Box 24 F.E. College Station, Texas

Industry - 10
Chemical companies - 6
Universities - 57
and Experiment
Stations

Return to H.E. Rea

PROGRAM FOR SOUTHERN WEED CONFERENCE
Delta Branch Experiment Station, Stoneville, Mississippi
June 10, 1948

Page

SOUTHERN WEED CONFERENCE

DELTA BRANCH EXPERIMENT STATION

Stoneville, Mississippi

June 10, 1948

With Dr. Ralph W. Cummings, Associate Director of North Carolina State College of Agriculture and Engineering, Raleigh, North Carolina in charge, the Weed Control Conference was officially opened.

Dr. Charles R. Sayre, Superintendent of the Delta Branch Experiment Station, gave a few welcome remarks:

"We are pleased that the first meeting of Weed Control research workers in the South is being held here in Mississippi and at the Delta Branch Experiment Station. I shall take about two minutes to appraise our weed control problems in the Delta.

In our small grains, we have serious infestation of curley dock, cheat, and darnell. They are, in many instances, driving many small grains actually off of many acres of land in the alluvial areas of Mississippi, Arkansas and Louisiana. In our row crops, the main focal point of this meeting, it is worthwhile to review our proving grounds last year with cotton. We attempted to fully mechanize three or four field-sized cuts, keeping accurate time, cost, and performance records of each operation. We had 39 man hours of labor used on those tests, 32 of that 39 man hours were hoe labor for weed control. That will give you some idea of just how important weed control is to farmers in this area. Again, we are most happy to have you here. I want to see you get off to a quick start so I will not take more of your time."

Dr. Cummings: "Thank you, Dr. Sayre. We will proceed with the program as outlined and as I have not contacted every one who is on the program since they arrived, I hope every one is here that is on the program. The first paper scheduled is on "The Effect of 2,4-D on Cotton Plants" to be given by Dr. E. C. Tullis of Beaumont, Texas. Dr. Tullis."

THE EFFECT OF 2,4-D ON COTTON PLANTS
E. C. Tullis, Beaumont, Texas

The reaction of some species of hibiscus and cotton to 2,4-D, in my experience, has been very different from that of other plants with which I have had occasion to work. I have been working on rice for a good many years. Because of the extreme interest in the control of rice field weeds, which are numerous and difficult to control. 2,4-D appears to be one of our best tools that we can use in cleaning up weeds and also to help increase our rice production.

Cotton is much more sensitive than the average broadleaf plant to 2,4-D, and it is also much harder to kill. Because of the fact that the rice and the cotton are grown almost interplanted in many sections along the Gulf Coast, the problem of injury to the cotton is very important. Furthermore, the cotton plants are more sensitive to injury and much harder to kill than other plants in which symptoms are easily produced. For example, the usual dosage for rice field weeds will not exceed 1-1½ pounds acid 2,4-D per acre but known dosages up to 7 pounds per acre of ester in a closed system have been used by Mr. Davis in volatility studies, not all of this being effectively put onto the plant, however, without killing the cotton. The cotton was severely injured, however, at these high dosages and the one pound rate will cause severe injury if applied directly to cotton. No doubt you have all heard of the injury caused to cotton in the vicinity of Bay City, Texas, in 1947, when drift from fields dusted with 2,4-D and the leak from a defective hopper on a plane spread 2,4-D over a large part of two counties. The actual amount of 2,4-D that was accidentally applied to the cotton, can only be guessed at but from the severity of the symptoms, it would appear to have been about one to two pounds acid equivalent per acre. The symptoms indicate that there are perhaps three levels of response by the cotton plant. At 1000/ppm extreme injury with dwarfing and necrosis is found, and this is more severe than the injury produced with 1 pound to 2 pound rates of application with exposure at 150 feet in our drift tests in which malformation is the main symptom. The lowest level of response is at 550 to 1350 feet and here the indications are that only one to several droplets of the solution have produced the effect. Note the blister-like spots on the leaves of the plants so affected. As to the threshold at which injury can be produced, Dr. Ergle, at Texas A. & M. made up dilutions of one to ten ppm and applied a drop on individual leaves of plants in the greenhouse and got no response at these levels.

Using cucumber seedlings, a technique worked out at Camp Detrick, Maryland, root inhibition was shown at concentrations up to one one thousandth part per million. The maximum reduction was at 10 ppm or above. In our tests, smaller amounts of 2,4-D than 1000/ppm as shown on the chart have produced a stimulation of root growth of the cucumber and by comparison of these results with symptoms on cotton, we can arrive at the conclusion that the lowest level of injury response in cotton is well below one one thousandth of a part per million. Some work has been done by Mr. Davis on the reaction of physiological action of 2,4-D on the cotton plant. One of the most significant facts obtained from early observations was that the cotton plants were not killed with 2,4-D even though extremely severe symptoms were produced. Also it was noted that the plants given proper environmental conditions recovered in varying lengths of time, but as noted by Dr. Dunlap, occasionally a shoot or leaf might develop symptoms even after a considerable time had elapsed and recovery had begun. Dr. Dunlap also found that the 2,4-D was carried into the seed of plants injured in early stages of growth, i.e., late in July and early August.

<u>Questions</u>: "How did you get that seed, from the pre-emergence treatment?"

"No, these seeds were from plants that were injured when they were in the three, four and five leaf stage. Seed was harvested last fall and the seed germinated from those bolls."

"Where you got those injuries using the 1 pound per acre at about 160 feet away, was that dust or spray?"

"All the work that we have done so far this year down there in our test has been with spray. We have not used dust because of the extreme difficulty of handling it and the fact that we cannot control the drift."

"What forms have you used?"

"We have used alkanolamine salts entirely."

"Did you say one to a thousandth or one and one thousandth part per million?"

"On these cotton plants that I am passing around, the injuries were as far as we can tell from the results on our cucumber plants, at less than a 1000th part per million."

"Those most severely injured were one 1/1000th ppm?"

"No! they were a pound to the acre put on at 150 ft. In the drift test we have been flying at right angles to a line of plants exposed at given intervals and the extreme injuries were produced on plants at 150 ft. from the line of flight, which means that they are probably getting about a pound to the acre."

"What was concentration, you said, of the 2,4-D in parts per million?"

"1/1000 ppm - less than a 1000th ppm will cause injury to cotton as indicated by the results we obtained in our last test."

WILD GARLIC AND BITTERWEED CONTROL
O. E. Sell, Experiment, Georgia

I. Wild Garlic.

General - Wild garlic produce underground bulblets while wild onions do not. The former is thus more difficult to eradicate and it is far more prevalent. First measure of control should be prevention of aereal bulblet and seed formation.

First Year Results. Control was disappointing in early experiments due to (a) use of Na salts, (b) use of too dilute concentrations, (c) fall applications of 2,4-D. Six formulations of 2,4-D were then applied in late January at concentrations from 500 to 4,000 ppm of 2,4-D at rates of 100 to 120 gallons per acre. As much as 4 pounds per acre of the Na salt gave poor control of wild garlic while 3,000 to 4,000 ppm of the ester or amine forms of 2,4-D gave 93 per cent kill.

Second Year Results. The ester and amine forms of 2,4-D were applied at concentrations from 1,500 to 6,000 ppm at 3 to 4 week intervals, starting in December and ending in March. Late January through February applications gave a kill of 80 to 87 percent, earlier and later applications were less effective. Concentrations of 3,000 to 4,500 ppm of 2,4-D were necessary for good control. Counts of surviving plants above ground gave no true index of degree of control - surviving underground bulblets had to be counted.

Counts were made of germinated and ungerminated bulbs and bulblets and of new bulblets underground during the winter season. About 25 percent of bulblets had not yet germinated by January 1, but less than 10 percent were ungerminated by February. By mid-March 30 percent of the bulbs were already forming new bulblets. Best time to apply 2,4-D thus apparently was between late January and early March.

Third Year Results. New equipment and plot technique was used. Instead of hand sprayers and conventional three gallon spray cans, a small spray boom was mounted on a three-wheeled spray rig with motor driven pump. Pressure was regulated and speed of travel gauged by a mounted bicycle speedometer. The rig was pushed manually. A by-pass valve allowed agitation of the spray material in the container. A one-gallon tin can was used for spray container. Plots were made 8 feet by 90 feet and not replicated. Several experiments were conducted.

A. Sticking and Wetting Agents. Various concentrations of the Na salt and ester formulation of 2,4-D were applied with the materials in (1) water, (2) with the addition of a wetting agent, (3) with the addition of wetting and sticking agent. It was hoped that the use of wetting or sticking agents or both might make 2,4-D applications more effective and/or reduce the amount of 2,4-D needed for control of wild garlic. These hopes have not been realized so far.

B. Use of Low-Gallonage Nozzles. Varying amounts (from 0.2 to 8.8 pounds 2,4-D acid equivalent per acre) of the ester formulation of 2,4-D were applied with nozzles using 5, 10, and 50 gallons per acre. The use of 2.2 pounds 2,4-D equivalent was notsufficient for high kill and 4.4 pounds per acre appeared more than necessary. Just as much 2,4-D had to be applied with a five gallon per acre nozzle as with a 10 to 50 gallon per acre nozzle.

C. New Formulations. An ester form of 2,4-D T was no more effective at various concentrations than an ester form of 2,4-D.

D. Treatment by hand of individual wild garlic plants in clumps in the field with 0.4 percent 2,4-D in ester form and at different times indicated that: (1) Some underground bulblets can develop successfully if they have started growth before the mother plant is treated. This needs verification and it is not known to what extent these bulblets must be developed before they apparently become resistant to 2,4-D effects through the mother plant. (2) Some effective kill of untreated adjacent plants in a clump is obtained. It should be emphasized that such results might not be obtained where clumps or individual plants of wild garlic are grown under artificial greenhouse conditions. Previous experience with greenhouse experiments gave such indications.

II. Bitterweeds.

Bitterweeds can be controlled through proper pasture improvement practices that encourage aggressive growth of winter pasture legumes and crowd out the bitterweeds. However, when bitterweeds occur on lespedeza pastures, mowing or chemical control methods may be required. All herbicides tested killed bitterweeds easily but 2,4-D was more selective than most others. All formulations of 2,4-D are highly effective. Concentrations of 500 ppm of 2,4-D acid equivalent gave 100 percent control of bitterweeds. This same concentration of 2,4-D killed from 20 to 33 percent of the lespedeza present. Using the same total amount of 2,4-D and other herbicides and varying the amount of water used per acre from 100 to 150 to 200 gallons did not change the effectiveness of the herbicide.

CONTROL OF CORAL BERRY AND STICKWEED IN PATURES

USE OF DINITRO WEED KILLER ON ALFALFA

G. M. Shear, Blacksburg, Virginia

If you don't think these weeds are hard to kill, look what they did to me! (His arm was in a sling). I want to spend most of my time talking about Coral Berry or Devil's Shoe String, (Symphoricarpos orbiculatus), which is fairly widely distributed in the eastern part of the United States, but apparently in certain sections it is better adapted than in others.

I might say a word regarding the general distribution of this weed in Virginia and how it is spread. Most of the heavily infested pastures, amounting to several thousand acres, are good mountain pasture land, much of the infested pasture being on limestone soil. In some instances the soil is shallow and there are rock outcrops which make it impossible to use cultivation as a means for destroying this plant. One reason for its prevalence in certain pastures is that they have been neglected for a number of years. The people who keep up a continuous fight against this plant seem to be able to keep ahead of it. The day I took these pictures we saw one farmer out with a grubbing hoe, digging coral berries. He had scattered, individual plants in his pasture. Now, a word as to how these plants spread. If you go into the area and look over the location where the plant is found, it is very easy to see how this plant spreads. One of the chief means of spreading it are birds. They eat the berries and then right along the fence rows you get a solid stand of this shrub. In the winter time, when the grass is not too good, the cattle will eat the branches and get a lot of the fruit, and if you go around looking at the cattle droppings, you will find them full of coral berry seed. They are scattered all over the pasture, which is a very good means of fertilizing and distributing at the same time. In some cases the seeds are carried by water. When there is a clump of coral berries at the top of a hill with a drainage channel running down from it, one is quite apt to see smaller clumps along the drainage channel. Another means of spreading this pest has been the State Highway Department. It is a good plant for holding the soil on road cuts and the Highway Department has planted it along the road cuts, which has helped in distributing it. Some people in the area where they are having so much trouble with this pest attribute all of the spread of this plant to the Highway Department. This is a false accusation because they did not start using it until fairly recently, and you can see that a lot of these areas have been infested for many years. However, they have finally convinced the Highway Department that it is a bad practice to use this shrub for holding road cuts. At the first request for a coral berry control program, our Director was a little hesitant, he did not have the money at the time for doing it, but the farmers in one county were determined to do something. They put the heat on the County Agent and had him running around with a sprayer trying to control it. When it got to that stage, the Director thought it was time to put some money into it and see what could be done.

We started experimenting last year on a pasture that was completely covered with this shrub. When this shrub is alive, it is possible to cut it with a mowing machine, but it is a little hard on the blade because some of the stems, on long established plants, get as big around as your thumb. When the plants are dead they are much more difficult to cut. Mowing the new growth off every year is one way that farmers have attempted to control it, which is not very effective. Instead of killing the shrub, mowing has a tendency to spread it. When you mow off the top of this shrub, it spreads by long string-like runners, some of these runners will be 6 or 8 feet long, lying flat on the ground. They root at the nodes and new plants develop. This is one reason why this shrub tends to grow in clumps, and explains how it acquired the name Devil's Shoe String. The problem of removing the bushes from the land is being studied. One method which we have used, which looks as though it might be successful, is to mow the shrub and wait until it develops 6 to 10 inches of new growth and then spray it. Last year we tried four 2,4-D treatments, two dust forms, a 5% ester dust, and a 10% sodium salt dust. We also used a 40% ester at the rate of 2 pints per 100 gallons and applied this to the plants so as to completely wet the foliage. These treatments were made in July to young sprouts that developed after mowing and to unmowed areas. The 4th treatment was ester in oil, applied with a fog machine to uncut coral berries. This was probably too late in the season to attempt to kill the uncut plants since practically all the growth on them was mature. We got the best results where the 2,4-D ester with oil was used and last fall it appeared that we had a complete kill in that area. In the other areas with other treatments, our kill was irregular. We had some places where we completely killed the above ground parts, but next to them would be some live growth that didn't seem to be particularly injured. This spring we obtained some low gallonage spray equipment and made further applications. We applied the material at the rate of 3 gallons to the acre, and a pint of 40% 2,4-D to the gallon, both as a water and an oil spray. We applied it on the areas that were mowed early last summer and had some new growth on them; also on areas that were mowed in late winter which had new growth on them and to areas that had not been cut. At the present time, these plots look very promising, and we are hoping that by the end of this season, we will have a 100% kill, particularly on plots that were treated last year and sprayed again this spring. We have no idea how long it is going to take to completely eradicate coral berries from a heavily infested pasture, since there are probably millions of seeds in the soil and we do not know how long they will remain viable. The chances are it will be a number of years. The farmers in this area are very enthusiastic over this program since it is the first indication they have had that they will be able to clear up this pasture land, which is practically out of production. Just a word about Stickweed, or River weed (Verbesina occidentalis). It is a composite, that grows about three or four feet high and has a winged stem and small yellow flowers. It is a perennial and produces stolons that run underground, and in some cases, I have seen pastures that were almost as badly infested as some of those with the coral berries. We know that we can kill the tops back, with 2,4-D, but we cannot completely kill it with one spraying. I shall say a few words about the work that we have done on alfalfa.

As you know, there has been some information in the literature about the use of some of the Dinitro materials for weed control in alfalfa. We have been getting a lot of inquiries on this subject. Last winter we tried some preliminary treatments in Eastern Virginia where we had a very bad infestation of Chickweed and German Knotweed, and we apparently got very good control in this work. Then at Blacksburg, we had a planting of young alfalfa seeded last fall which was very heavily infested with German Knotweed, and one of the pepper grasses, and corn camomile. We applied treatments early in April to this alfalfa, using Dow general weed killer at the rates of 1, 2, and 3 pints plus 5 gallons of oil, per 100 gallons, and another treatment using 2 pints of weed killer and 20 gallons of oil per 100 gallons. I am sorry to report that the results of this test were not very encouraging, as we got injury to all the plants on the plots, including alfalfa, and they all seemed to be injured to about the same extent. The plant growth was stunted, particularly on the plots receiving the heavy applications. We got very little kill of the weeds. I think this was probably due to the fact that the weeds we were trying to kill were fairly old at the time and the alfalfa was very succulent since it had just started the spring growth.

<u>Questions:</u> "What did you use? Ordinary fuel oil or kerosene?"

"In this particular case, we used spray oil."

"In your first test you used ester plus the oil, approximately what was the concentration of the oil per 100 gallons when you got your best results?"

"Where we put that material on this spring, we used just the oil. We put it on at the rate of about 3 gallons to the acre."

"Was that with machine or hand treatment?"

"It was with a low gallonage knapsack spray applicator."

PROGRESS REPORT ON WEED CONTROL

A. J. Loustalot, Mayaguez, Puerto Rico

Experiments to Control Nutgrass

1. Comparison of Ethylene dibromide and chloropicrin as soil fumigants.

Nutgrass Cyperus rotundus L. is one of the most serious weed pests in many of the tropical and temperate regions of the world. Because of its extensive root system of tubers, rhizomes, and bulbs it is very difficult to control. Cultivation is not only ineffective but it seems to increase the population by propagation of the tubers or nuts. Chemical weed control trials to date have been disappointing in their results. It has become evident that any efficient method of controlling nutgrass must be one which will not only destroy the growing tubers but also those that are dormant and deeply embedded in the soil. Otherwise, they will germinate later.

Soil fumigation is one method which seemed likely to achieve this objective.

In January 1948 an experiment was started in which two fumigants, chloropicrin and ethylene dibromide were tested each at three rates 3, 6, and 12 ml. per square foot. An area heavily infested with nutgrass was plowed and then thoroughly disced. Plots 7 x 8 feet were marked off in duplicate for each treatment, including check plots. The fumigants were applied in furrows about 6 inches deep and 6 inches apart. The furrows were then covered and the fumigant sealed by watering the soil. There were several heavy rains during the month following the treatments, but there was little or no rainfall during the second month. Records of the relative stand of nutgrass and other weeds in the various plots were made at 1 and 2 months after treatment. These data, presented in table 1, indicate that ethylene dibromide is far superior to chloropicrin in controlling nutgrass. Ethylene dibromide applied at 6 ml. per square foot was almost as effective as at 12 ml. per square foot. These plots are practically free of nutgrass and are covered with "verdolaga" Portulaca oleracea. The plots treated with ethylene dibromide at 3 ml. per square foot have a solid stand of nutgrass and are indistinguishable from the check plots. Apparently the ethylene dibromide at this rate is inadequate for control. The plots in which 3, 6, and 12 cc of chloropicrin per square foot were applied all have a luxuriant stand of nutgrass, indicating that this fumigant not only failed to control the nutgrass but rather stimulated the growth.

Table 1.- Relative stand of nutgrass and other weeds 1 and 2 months after treating soil with chloropicrin and ethylene dibromide

Treatments	ml./sq. ft.	Stand of Weeds 1 month after treatment1/		Stand of Weeds 2 months after treatment1/	
		Nutgrass	Others	Nutgrass	Others
Chloropicrin	3	+++	0	++++	+
	6	+++	0	++++	+
	12	+	0	++++	+
Ethylene dibromide	3	+	0	++++	+
	6	0	0	+	++++
	12	0	0	+	++++
Check	-	+	0	++++	+

1/ + very little, ++ light infestation, +++ moderate infestation, ++++ heavy infestation.

Although the ethylene dibromide applied at 6 and 12 ml. per square foot gave excellent control of nutgrass, it does not appear practical for use on a large scale because of the expense involved. The cost of the fumigant alone at the 6 ml. per square foot rate would amount to about $495 per acre.1/ The cost of labor required for application would also be considerable. Unless the cost of ethylene dibromide is reduced appreciably, the use of this fumigant for controlling nutgrass is limited to small areas like seed or nursery beds and small graden plots.

2. Experiments with Sodium trichloroacetate and 2,4-d trichlorophenoxy acetic acid.

In an attempt to find a method for controlling nutgrass, an experiment was started in January 1948 in which two herbicides, sodium trichloroacetate and the iso-propyl ester of 2,4-5 trichlorophenoxy acetic acid were tested.

Twelve plots, each 15' x 10', were marked off in an area heavily infested with nutgrass. The sodium trichloroacetate was applied at the rate of 218 pounds per acre to four of the plots. The 2,4-5 trichlorophenoxy acetic acid was applied at the rate of 5.2 pounds per acre to four other plots, and four plots remained as checks. To two of the plots in each treatment, half of the herbicide was applied, then the land was disced and the remaining half of the herbicide applied. To the other two plots in each treatment the full amount of herbicide was applied directly to the undisturbed nutgrass. Both chemicals were applied in aqueous solution with knapsack sprayers. Several heavy rains fell during the month following treatment. There was no apparent effect of the chemicals on the nutgrass until the second month. At this time, the nutgrass began to die out in the plots treated with sodium trichloroacetate, and at the present time the nutgrass in these plots is greatly reduced. Those plants that remain appear chlorotic and unthrifty. Apparently considerable time is required for this chemical to affect the tubers. There is no significant difference between plots in which the chemical was applied in split applications with discing and those in which it was applied in one application to the undisturbed soil. The plots on which 2,4-d trichlorophenoxy acetic acid was applied, either on disced or undisced soil, appear no different from the check plots, which have heavy stands of nutgrass and other weeds. Before sodium trichloroacetate can be recommended as a practical means of controlling nutgrass, considerable experimental work will be required to determine the minimum effective rates of application under different climatic and soil conditions and the length of time required before crops can be planted on treated soil.

3. 2,4-D - Tillage and Smother Crop combination to eradicate nutgrass.

The object of this experiment was to control nutgrass with a combination of 2,4-D applications and tillage followed by a smother crop.

An area heavily infested with nutgrass, was divided into 18 plots 30' x 15'. The 18 plots were grouped into three series each containing 6 plots. Within each series, two plots were designed as checks, two received 2,4-D at 1.3 lb.2/ per acre and two received 2,4-D at 2.6 lb. per acre. The 2,4-D was applied at two week intervals followed by tillage to one series of plots for a month, to another series for two months and to the third series for three months. Velvet beans were planted as a smother crop two weeks after the last 2,4-D application in each series. Because of the drought during the experimental period the velvet beans failed to germinate in any of the plots until recent heavy rains stimulated the growth both of the velvet beans and the nutgrass. At present there is no appreciable difference in the stand of nutgrass regardless of rate or frequency of applications. Plots that received 6 applications of 2,4-D at 2.6 lb. per acre at two week intervals have as heavy a stand of nutgrass as the check plots.

Pre-Emergence Trials

An experiment was initiated in January 1948 in which 10 pre-emergence weed control treatments were compared. The experimental area was first plowed then thoroughly disced and marked off into plots 25' x 16'. Each plot was planted to four rows of field corn, four rows of Centrosema sp., four rows of pigeon peas and one row of squash. The following weed control treatments were each applied to duplicate plots the following day. (1) 2,4-D at 1.3 lb. per acre alone and (2) with 1 lb. of IPC[3] (3) 2,4-D at 2.6 lb. per acre alone and (4) with 2 lb. of IPC (5) 2,4-D at 5.2 lb. per acre alone and (6) with 4 lb. of IPC (7) Dow contact at 6 gallons per acre and (8) at 12 gallons per acre, (9) Santobrite (Sodium pentachlorophenate) at 30 lb. per acre and (10) Santophen (pentachlorophenol dissolved in alcohol) at 30 lb. per acre. Several good rains fell during the following two weeks and germination of the crop seed was good. However, little or no rain fell in the next three months, and neither crops nor weeds grew vigorously. Counts on the relative stand of weeds and crops were made at 2 and 4 months after treatment. These data are presented in table 2.

The Santobrite treatment gave excellent weed control and had no adverse effect on any of the crops tested. Santophen at the same rate had no effect on the crops but did not control the weeds. Dow Contact either at 6 or 12 gallons per acre as a pre-emergence spray had no noticeable effect on the crops and likewise did not effectively control the weeds. 2,4-D alone at 1.3 lb. per acre had no appreciable effect on nutgrass or Bermuda grass but did control the broadleaf types fairly well. At 2.6 lb. and 5.2 lb. per acre the 2,4-D not only controlled the broadleaf plants but gave good control of Bermuda and other grasses and also suppressed nutgrass to a certain extent. The addition of IPC particularly at the higher rates appeared to have a beneficial effect in reducing the infestation of Bermuda and other grasses.

The crops, particularly the centrosema, pigeon peas and squash, were affected adversely by all 2,4-D applications.

The results of these preliminary trials indicate that Santobrite applied as a pre-emergence spray at 30 lb. per acre was the best treatment under the conditions of the experiment. However, these results are considered as indicative rather than conclusive because of their limited value in terms of weather, soil, and crop variation.

1/Calculated on cost of ethylene dibromide at $1.45 per 1000 grams (sp. gr. = 2.180).

2/The sodium salt applied with a knapsack sprayer was used in all 2,4-D treatments.

3/The IPC was applied dry with sand as a carrier. All other herbicides were applied in aqueous solution with a knapsack sprayer.

Table 2. Relative stand of crops and weeds in 10 pre-emergence weed control treatments

Treatment	Application rate per acre	Relative stand of weeds 2 and 4 months after treatment[1/]: Nutgrass 2 mo.	Nutgrass 4 mo.	Commelina sp. (cohitre) 2 mo.	Commelina sp. (cohitre) 4 mo.	Bermuda grass 2 mo.	Bermuda grass 4 mo.	Amaranthus sp. 2 mo.	Amaranthus sp. 4 mo.	Others 2 mo.	Others 4 mo.	Relative stands of crops[2/] 2 months after treatment: Corn	Centro-sema	Pigeon peas	Squash
Sodium 2,4-D	1.3 lb.	+++	++++	0	+	++	++++	0	+	++	+++	G	F	F	F
Sodium 2,4-D	2.6 lb.	+++	+++	0	+	0	+	0	0	+	+	G	P	F	G
Sodium 2,4-D	5.2 lb.	++	++	0	0	0	+	0	+	+	++	G	P	P	F
Sodium 2,4-D IPC	1.3 lb. 1 lb.	+++	++++	0	+	0	+	0	++	+	+	F	P	G	F
Sodium 2,4-D IPC	2.6 lb. 2.0 lb.	++	++	0	0	0	0	0	0	+	+	G	F	G	F
Sodium 2,4-D IPC	5.2 lb. 4.0 lb.	+	+	0	0	0	0	0	0	+	+	F	P	P	P
Dow Contact	6 gal.	+	+++	++	++	+++	+++	++	++++	++	++++	G	G	G	G
Dow Contact	12 gal.	++	+++	0	+	0	+++	+	+++	+	++	G	E	E	E
Santo-brite	30 lb.	+	++	0	0	0	0	0	0	0	+	G	E	E	G
Santophen	30 lb.	+	++++	+	++	++++	++++	++	+++	++++	++++	G	E	E	G
Check		+++	++++	+++	++++	+++	++++	+	++++	++++	+++++	G	G	E	G

1/ + indicates very little, ++ = light, +++ = moderate. ++++ = heavy, +++++ = very heavy infestation.
2/ E = excellent, G = good, F = Fair, and P = poor. stand.

Harvest Results in a Chemical Weed Control Experiment in Sugar Cane

A. J. Loustalot and R. Ferrer, Puerto Rico

An experiment was initiated in the fall of 1946[1/] in which nine herbicidal treatments were compared with hand hoeing in controlling weeds in sugarcane. Each treatment was replicated five times in 1/40 of an acre plots arranged in a modified Latin square. The plots were planted with the POJ-2878 variety of sugarcane in September 1946, and the weed control treatments were started a month later when the cane was 6 to 8 inches high. The field was heavily infested with "cohitre" Commelina longicaulis Jacq., and "bejuco de puerco," Ipomea tiliacea (Willd.) Choisy. Nutgrass, Cyperus rotundus L., and other miscellaneous weeds were also present. Three applications of each treatment were made as required until the cane growth shaded out the weeds.

2,4-D was outstanding in eliminating the main broadleaf pests as cohitre and bejuco de puerco, but was not sufficient for complete weed suppression. Although the arsenicals and fortified oil emulsion were effective in suppressing most of the weeds they have certain disadvantages.

The results with the changeable plots which were first sprayed with 2,4-D and later with an oil emulsion fortified with butylphenol demonstrated the necessity of suppressing grasses and other weeds not affected by 2,4-D in their early stages of development. The first application of a herbicide in sugarcane should be made thoroughly while the weeds are small.

The most satisfactory sprays were those made with Dow Contact herbicide and oil emulsion fortified with butyl phenol. These sprays were also the most expensive, although the third application was not actually necessary at the time. The Dow Contact has the advantage of being already prepared by the manufacturer for easy mixture in the field. The oil emulsion on the other hand requires time and machinery for preparation. Both of these herbicides are less poisonous than arsenicals, do not accumulate in toxic amounts in the soil, and are non-irritating to the skin of workers.

The accumulated cost of the various treatments, including materials, and labor for hoeing and spraying were recorded. In January 1948 the 50 plots were harvested, and the yield of each individual plot was obtained. These data are presented in table 1, as well as the accumulated cost per acre of weed control for the various treatments.

An analysis of variance indicated that there was no statistically significant difference in yield among the various treatments. The plots that were hand-hoed had the highest average yield, but this apparently was due to the fact that one replicatio[n] of this treatment yielded abnormally high because of some factor or factors other than that due to weed control. The yield of the four other replications of this treatment is more or less in line with yields of plots in other treatments. Since the cost of weed control in the various treatments varied considerably and there was no significant difference in yield among treatments, the logical choice of a weed control practice would be the least expensive method. The two cheapest treatments were Penite 6 ($21.26 per acre) and 2,4-D alone ($23.19 per acre). Since the Penite 6 is an arsenical, it has a disadvantage of being poisonous, irritating to the workers, and may accumulate in toxic amounts in the soil. The 2,4-D on the other hand has none of these disadvantages, but it is specific for broadleaf type weeds only. There is a danger that continued use of this material may result in heavy infestations of hard-to-eradicate grasses. A weed control program in which 2,4-D

[1/] By D. G. White and J. C. Mangual. The Use of Herbicide in Sugarcane. Sugar, pp. 31-35. April 1948.

occasionally is used with a general herbicide, such as oil and Santophen or dinitro compounds, might be the most economical and most efficient in the long run. From a weed control standpoint, the Dow Contact was the most effective herbicide tested in this experiment, but it was also the most expensive ($66.46 compared to $42.04 per acre for the check or hand-hoed plots).

Table 1.- Yield of sugarcane and cost of weed control in 10 herbicidal treatments.

Treatment	Yield of sugarcane/1 Replications					Average yield per plot	Accumulated cost per A. of weed control/2
	1	2	3	4	5		
	Tons	Tons	Tons	Tons	Tons	Tons	Dollars
Hand-hoed	1.03	1.16	1.12	1.13	1.78	1.24	42.04
2,4-D alone (0.1 percent as amino salt)	0.96	1.20	1.27	1.50	0.92	1.17	23.19
Penite 6 (0.84 percent AS_2O_3)	1.19	1.34	1.27	0.84	1.11	1.15	21.26
Concentrate 40 (0.42 As_2O_3, 0.25 percent Santobrite and 0.25 percent sodium chlorate)	1.21	1.33	1.08	0.95	1.02	1.12	26.93
Concentrate 40 and 0.1 percent 2,4-D as Amino salt	1.22	1.19	1.06	0.97	1.13	1.12	35.32
Dow Contact (5 percent)	1.05	1.12	0.98	1.25	1.43	1.17	66.46
6 percent Texaco 445 Diesel oil and 0.25 percent 2-4 Dinitro Sec. Butylphenol	1.05	1.08	1.12	1.44	0.95	1.13	42.32
10 percent Diesel oil and 0.7 percent Santophen	1.17	1.27	1.39	1.10	0.98	1.18	29.43
10 percent Diesel oil and 0.7 percent Santophen 0.1 percent 2,4-D	1.22	1.33	1.15	1.02	1.00	1.15	38.25
Changeable/3	1.38	1.14	1.04	1.15	1.23	1.19	42.77

/1 Plots 1/40 of an acre.
/2 Includes cost of materials and labor for hoeing and spraying.
/3 First sprayed with 2,4-D, then later with oil emulsion fortified with butylphenol.

EVIDENCE OF VOLATILITY OF SOME 2,4-D COMMERCIAL PRODUCTS

William C. Davis, Beaumont, Texas

There are certain limitations on my work which I would like to point out. All the work that I am reporting was done under greenhouse and laboratory conditions with cotton plants of various ages. These limitations are pointed out since I am confident, and feel that quite a number of you will agree with me, that the response pattern of cotton plants to 2,4-D is different from that of many other kinds of plants, and that 2,4-D experimental results under greenhouse and laboratory conditions may vary from those found under field conditions.

My topic is in reference to the volatility of 2,4-D; I wish to distinguish between volatility and droplet or mist drift from airplane as discussed by the earlier speakers on this program. 2,4-D vapor as used in my discussion has reference to the active ingredient of 2,4-D that vaporizes or passes into a gas form from a liquid state. I have not tried exposing crystals to determine if there is any vaporization from them.

The exposed cotton plants, as Dr. Tullis has already pointed out, show different degrees of reactions in relation to the intensity of the exposure. These general symptoms may be used as indicative of the intensity of variations in the vapor in the air or the length of exposure. It would be very difficult to say how much 2,4-D we have in the air under our technique. In the early work segments of metal cylinders were used for exposure chambers and an air tunnel. It was soon found that this type of equipment while giving a measure of volatilization was, nevertheless, very cumbersome to operate and time consuming because of the periods that the equipment had to be out of use while it was being cleaned. Activated charcoal was used for cleaning the equipment between individual runs. Later in the studies we switched from these time consuming contrivances to paper tents. We made up new paper tents for each exposure and threw the used tents away at the end of each test. The 2,4-D used was from commercial lots. Concentrations used were one to one, that is, one cc. of the commercial to one cc. of water, 1 to 10, and 1 to 100. Volumes of 10 and 20 cc. of different dilutions were measured into beakers and were allowed to stand in the closed chambers with cotton plants, for various period of time - a half to six hours.

All forms used (esters, sodium and ammonium salts and triethanolamine) showed some degree of vaporization. A rough estimate of what concentrations we may have been dealing with can be gotten from the fact that in some trials the amount of liquid exposed was equivalent to what would be put down on a unit area at the rate of 3/4 pound per acre and then the plants were exposed to the vaporized portion for a period of one hour within an air volume of 15 cubic feet. The dosage is obviously very small. I might also add that further evidence of the very small dosage needed to give response in cotton plants was evidenced by the fact that with the ester form using 20 cc. volumes of 1 to 10 dilutions of the commercial grade responses were shown even though no weight loss (weighed to .000 grams) was recorded from the exposed liquid.

The comparisons between the different materials which is one of the items we are primarily interested in shows or indicates that the esters are most volatile. These conclusions are based on symptoms within established time limits. The sodium and ammonium salts were far less volatile than the esters, and the triethanolamine was the least volatile.

Questions: "What was the air temperature?"

"We tried to use different air temperatures and also varied humidity. The air temperatures used varied from 16 degrees centigrade to 38, and we got volatization or evidence of volatization as indicated by cotton plant reactions at 16° C with exposures of 6 hours."

RESPONSES OF JOHNSON GRASS AND NUTGRASS TO SOIL APPLICATION OF 2,4-D AND I. P. C.

W. B. Albert, Clemson, S. C.

The publication, about a year ago, of results with quack grass rhizomes when treated with solutions of isopropyl-N-phenyl carbamate led to the experiments outlined in this paper.

Superficially, at least, there are certain comparable habits of growth and propagation between Johnson grass and the quack grass of the Northern States. It only remained to discover whether I.P.C. affected the growth habits of Johnson grass.

Greenhouse metal baxes, holding approximately 0.6 cu. foot of soil were placed outdoors on benches. A clay loam soil was steamed and after about a week planted with 50 rhizomes of Johnson grass and in another set of flats 50 tubers or "nutlets" of nutgrass were planted. This was on August 8, 1947. I.P.C. dissolved in proplylene glycol and ethyl alcohol was mixed with a small amount of soil and applied to the surface of the flats at rates up to 8 lbs. per acre. Other flats were treated with the sodium salt of 2,4-D up to 8 lbs. per acre which was also applied to the surface of the soil. The flats were watered with a sprinkling can with sufficient water to insure good growth. Figures 1 and 2 show the appearance of the flats treated with 8 lbs. per acre of the sodium salt of 2,4-D on August 27, 19 days later. Considerable inhibition of sprouting and growth had occurred.

The Johnson and nut grass flats treated with comparable rates of I.P.C. were, in every visible respect, as vigorous and normal-appearing as the untreated flats.

A second set of flats was then prepared and nutgrass tubers and Johnson grass rhizomes were planted on August 20, 1947. The I.P.C. and sodium salt of 2,4-D were thoroughly mixed with the entire mass of the soil, before planting the grasses at rates of 4 and 8 lbs. per acre.

Two months later, on October 22, the photographs shown in Figures 3, 4 and 5 were taken. It will be seen in figure 3, that the 4 lb. per acre rate of 2,4-D application, with the exception of one stunted, chlorotic sprout, which later died, completely suppressed the growth of nutgrass. Figure 4 shows a marked inhibition of growth of Johnson grass for the 4 lb. per acre treatment. In figure 5, we have one abnormal sprout where the rate was 8 lbs. per acre of the sodium salt of 2,4-D.

The flats treated at comparable rates with I.P.C. were not, in visible appearance, less vigorous or normal-appearing than the untreated flats. The results with I.P.C., then, were completely negative, under these conditions. Whether different solvents or a different method would have yielded different results, I don't know.

The experiments did show, however, that both nutgrass and Johnson grass were markedly affected by 2,4-D when well mixed with the soil. The mixing with the soil was important. This was a laboratory scale experiment, where it was possible to have conditions where 2,4-D would be expected to have maximum effectiveness. It does not follow that discing 4 to 8 lbs. per acre of 2,4-D into a soil will result in eradication of nut or Johnson grass, where tubers and rhizomes are at varying soil depths, and mixing more or less imperfect.

Another question is whether the rhizomes and tubers were dead when the pictures were made.

As is known, the 2,4-D would become ineffective in moist warm soil in from 30 to 60 days. I planted cotton and snap beans in flats 70 days after treatment with 8 lbs. of 2,4-D and growth was vigorous and appeared normal.

We had, however, a warm, wet November and several weeks after the picture of figure 3 was made I was surprised to note two vigorous sprouts in the nutgrass flats. There were none in the Johnson grass flats.

To summarize briefly:

1. 4 lbs. per acre soil applications of the sodium salt of 2,4-D suppressed growth of nutgrass, but it required 8 lbs. of 2,4-D to produce a comparable effect in Johnson grass.

2. Thorough mixing of the chemical with the soil was necessary to insure full effectiveness of 2,4-D. Whether such mixing would be possible or practicable under field conditions is doubtful.

3. I.P.C. yielded zero results. However, in view of the results from this chemical that have been reported under certain conditions, it should not be completely discounted without further trials, using various solvents. The relative insolubility of I.P.C. may be the reason for the variable results that have been obtained at various places.

Questions: "What salts did you use?"

"I used the sodium salt of 2,4-D. I used propylene glycol and ethyl alcohol to dissolve the I.P.C. They were not toxic by themselves, as indicated by the growth in a check flat."

"Do I understand that these nuts were separated individually?"

"Yes, I dug them out of the field, counted and planted them. Of course, there were all kinds, big and little ones, some were more or less dormant and did not start growing until real late in the fall."

"Was there any form of difference with I.P.C. shown or proved from past experience that will or would indicate any difference in their form when they are separated and when they are joined together?"

"No, no difference, as I found found that I.P.C. had no effect when sprayed or dusted on plants in these flats up to 8 lbs. per acre."

J. M. DallaValle
Georgia School of Technology
1948

THE DYNAMICAL BEHAVIOR OF DROPLETS AND MISTS

In the following paragraphs we shall show that:

1. The inertial forces of a droplet leaving a jet are rapidly dissipated and do not affect significantly their further diffusion.

2. The scatter of droplets leaving a jet conform to a Gaussian distribution.

3. The diffusional forces soon after leaving a jet are in direct proportion to the magnitude of the droplet cloud.

4. There is a limiting diameter of droplet which may be formed on leaving a jet.

5. Droplets rotating about an axis though their center of gravity become unstable and subdivide into finer droplets.

Dissipative Forces

We introduce immediately two parameters--Reynold's number, N_R, and the coefficient of resistance denoted by C.

$$N_R = \rho_o \frac{vd}{\mu}$$

$$C = \frac{2\mathcal{R}}{\rho_o A v^2}$$

where the terms are as follows:

ρ_o and μ the density and viscosity, respectively, of the medium through which the droplet moves, v_1 the velocity of the droplet, $\mathcal{R}$ the resistance encountered to motion and d and A the diameter and cross-sectional area of the droplet. Both N_R and C are dimensionless and are directly derivable from the equation

$$\phi(\mathcal{R}, \rho_0, \mu, d, v) = 0$$

whence

$$C \propto \frac{\mathcal{R}}{\rho_0 d^2 v^2} = \psi(N_R)$$

Explicitly, from experiment

$$\sqrt{C} = 0.63 + 4.8/\sqrt{N_R}$$

For streamline motion, $C = 24/N_R$, $N_R < 2$, and for turbulent motion, $C = 0.44$, $N_R > 500$. The intermediate region, N_R between 2 and 500, is not well established. For most conditions encountered in the field, N_R will be < 2. Thus, taking a water droplet of diameter 10 microns (10^{-3} cm), we have for a jet velocity for such a droplet propelled in air ($\mu = 178 \times 10^{-6}$, $\rho_0 = 1.1 \times 10^{-4}$), so that

$$v = \frac{2 \times 178 \times 10^{-6}}{10^{-3} \times 1.1 \times 10^{-4}} \approx 3240 \text{ cm/sec}$$

This is a jet velocity roughly 1/10 the velocity of sound. Hence, for most practical cases involving fine droplets, the jet velocity must be exceedingly high to create a turbulent motion of the droplet in flight.

Consider a one-dimensional type of motion, the jet being horizontal. This amounts to an analysis of motion in the absence of a gravitational field. If m denotes the mass of a droplet

$$m \frac{dv}{dt} = -\mathcal{R}$$

$$\mathcal{R} = \tfrac{1}{2} \rho_0 v^2 C A$$

and if the motion is streamline, $v = N_R \mu / \rho_o d$.
Hence

$$\frac{dN_R}{CN_R^2} = -\frac{\mu A}{2md}\, dt$$

also,

$$24/N_R = C,$$

so that we obtain the following for the velocity and distance traversed in time t $(t = 0,\ S = 0,\ v = v_0;\ t = t,\ s = s,\ v = v)$:

$$v = v_0 \exp\left(-12\mu At/md\right)$$

$$s = \frac{mv_0 d}{12\mu A}\left[1 - \exp\left(-\frac{24\mu At}{md}\right)\right]$$

If the droplets are spherical or quasi-spherical, $A = \pi d^2/4$. The value of m is, of course, $(\pi d^3 \rho)/6$, where ρ is the density of the droplet. Under such conditions the equation for s, which is of most concern to us, is

$$s = \frac{\rho d^2 v_0}{18\mu}\left[1 - \exp\left(-\frac{36\mu t}{\rho d^2}\right)\right]$$

Consider an extreme case for a water droplet 2 microns in diameter issuing from a jet with a velocity of 3000 cm per second in air. Let t be infinite, then

$$s = \frac{(2 \times 10^{-4})^2 \times 3 \times 10^3}{18 \times 178 \times 10^{-6}} = 0.02 \text{ cm (approx.)}$$

Thus, for a fine droplet, the energy or momentum possesssed on leaving the jet is completely dissipated in a fraction of a centimeter. Larger droplets will possess momentum in proportion to the square of their diameters, other things being equal. Hence we conclude that the jet velocity does not affect the diffusion of the droplets when they are sufficiently small to be so affected.

Diffusional Pattern

EDDY diffusion can take place only if there exists a velocity potential. Suppose, therefore, a jet producing a spray of fine drops is pointed downstream to a wind having a velocity v_x. Let x be the direction of the jet, y any distance perpendicular to the jet in a horizontal plane. If $\mathcal{D}_e$ denote the coefficient of eddy diffusion, the concentration on a horizontal plane xy, C is

$$\frac{dc}{dx} = \frac{\mathcal{D}_e}{v_x} \frac{d^2C}{dy^2}$$

a solution of which is (for either side of the jet axis on the horizontal plane)

$$C = \frac{C_t}{\sqrt{2\pi v_x kx}} \exp\left(-\frac{y^2}{2k^2x^2}\right)$$

$$= \Phi(y, kx)$$

where C is the quantity of droplets issuing from the jet per unit time, k is von Kármán's constant (≈ 0.5) and denotes the probability function. Herein we have placed $\mathcal{D} = kv_x x$.

Above the horizontal plane of the axis of the jet, at a height (or depth), z, the distribution is given by

$$C = \frac{C_t}{kv_x x} \exp\left(-\frac{z}{kx}\right)$$

If the droplets are ejected by compressed air, the above equations are subject to modification, especially near the jet. Otherwise, for still air we may approximate v_x in terms of the volume of air emitted by the jet.

As an example of the diminuation of droplets with distance, put z in the last equation equal to zero; then

$$C = C_t/kv_x x$$

so that all things being equal, the concentration of droplets varies inversely as the distance. Suppose at the jet $C_t = 10^6$ per minute, $v_x = 7.5 \times 10^2$ cm/min, and $k = 0.5$, then at a distance of 5 meters (500 cm)

$$C = \frac{10^6}{0.05 \times 7.5 \times 10^2 \times 5 \times 10^2} = 66 \text{ droplets}$$

Diffusional Velocity Inside of Cloud

Suppose there exists a mass of fine droplets attracting or repelling each other. Let W denote the potential energy and T the kinetic energy of the system. Then

$$2T + W = 0$$

Let the mean velocity of the elements of the cloud (the diffusional elements) be $\overline{v}$ and let ϕ denote a potential function of the Newtonian form. If m denotes a small mass of the cloud

$$T = \tfrac{1}{2} \sum m\overline{v}^2$$

$$W = -\tfrac{1}{2} \sum m \phi$$

whence

$$\sum m(\overline{v}^2 - \tfrac{1}{2} \phi) = 0$$

or the average value of v squared averaged over all the separate masses is equal to the average value of $\frac{1}{2} \phi$. The average value of $\frac{1}{2} \phi$ will be of the order GM/R, where

G is the gravitational constant, M the total mass of the cloud, and R its radius. Hence

$$\bar{v}^2 \simeq GM/R$$

or to a first degree of approximation

$$\bar{v} \propto \sqrt{M/R} \propto \sqrt{\rho V/R} \propto \sqrt{\rho R^3/R} \propto R,$$

where ρ is the density and V the volume of the cloud. We conclude, therefore, that the internal velocity of agitation (diffusional velocity) varies directly as the magnitude of the cloud.

The above is perfectly general and applies to charged droplets equally well.

Size Distribution of Droplets

Unlike problems associated with the crushing and grinding of solids, the predetermination of the size distribution of droplets issuing from a jet cannot be accomplished. Breakage or shattering of a large droplet into many small ones depends on the strength of cohesive forces and on the motion of the globule. For, the essential difference between the fracturing of a solid and a liquid requires that motion be imparted to the latter of such magnitude that the separation is final and complete. If we have a drop of radius R and surface tension σ (with respect to air, say), then the binding force is $2\pi R\sigma$. Suppose now that this droplet is broken up into "n" droplets. We then have for the average radius r of a single droplet

$$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi n r^3$$

$$r = R/\sqrt[3]{n}$$

The total binding force of these n droplets is

$$2\pi n R\sigma / \sqrt[3]{n}$$

Thus, the binding force is greater than originally by an amount $n/\sqrt[3]{n} = n^{2/3}$

On the other hand, the work done in extending the surface is greater by an amount

$$n^2/n^{3/2} = \sqrt{n}$$

Droplets tend to combine when in close proximity to each other. Two droplets with radii r_1 and r_2 will cohere when the force F between them is given by the expression

$$F = 4\pi \frac{r_1 r_2}{r_1 + r_2} \sigma$$

or, for droplets of equal diameter

$$F = 2\pi r \sigma$$

which is the same as the binding force between two hemispheres.

In general, the break-up of a droplet depends upon the destruction of its surface binding energy, which can be accomplished by distortion of the envelope of the droplet when projected at high velocities or by a rapid spin induced by some tangential force. We may say that, although there are infinite possibilities for generating any given size of droplet, the actual probability is quite small. Hence, we may apply the Poisson relationship

$$\Phi(n) = \frac{1}{n!} \lambda^n \exp(-\lambda)$$

where $\lambda = r/r_{av}$, r being the actual radius of the droplet and r_{av} the average of the distribution. Subject to this condition no radius less than r will be found when

$$\Phi(0) = \exp(-\lambda)$$

and for a finite but large number of droplets N, we have that the number n of droplets greater than r is

$$n = N \exp(-\lambda)$$

Thus, the number of droplets increases as their size decreases.

There is, however, a lower limiting size of droplet which can be created mechanically, since the creation of a droplet of given size depends on the ratio σ/p where p is the difference between internal and external pressure acting on it. Furthermore, the term of evaporating a complete drop of diameter d is

$$t = \frac{d^2}{K(\rho'_v - \rho_v)}$$

where K is a constant which for water is roughly 1.6, ρ_v the density of gas at a great distance from the droplet and ρ'_v the density of the vapor close to the drop (saturated). We may, therefore, select a term t which is short enough to be consistent with needs and calculate d.

Rotational Effects

If tangential forces act on a droplet, there will be a spin imparted to it. This spin will cause a flattening or distortion of the droplet.

If a droplet is rotating at such a rate that it is about to split into two droplets of radii r_1 and r_2, and if this separation is due to the disruption of surface forces alone, then as the droplets take shape we must have

$$\frac{4}{3}\pi\rho\omega^2(r_1^4 + r_2^4) = 4\pi\frac{r_1 r_2}{r_1 + r_2}\sigma$$

where the term on the left is the centrifugal force of two droplets touching each other and the term on the right the force resisting separation. When $r_1 = r_2 = r$

$$\omega^2 = \frac{3\sigma}{\rho r^3}$$

For $r = 1$ cm, $\sigma = 60$ dynes, and $\rho = 1$, $\omega = 13$ rps approximately. However, it is obvious that for smaller droplets the speed required for separation will be much greater.

EFFECTS OF 2,4-D ON WINTER WHEAT - TWO STAGES OF GROWTH
USE OF I.P.C. (ISOPROPYL N PHENOLCARBAMATE) AND AMMONIUM
TRICHLOROACETATE FOR THE CONTROL OF BERMUDA GRASS AND JOHNSON GRASS

W. C. Elder, Stillwater, Oklahoma

We have some abstracts of experiments that we presented to the North Central Weed Control Conference last year and these are reports or information that we turned in on our work on our last year's crop as we planned and formulated the year before by the conference, so they are a little behind date. Whenever you are one year behind in 2,4-D, you are quite a long ways behind now. To stay within the time limits, I shall give you the procedure that we carried out last year, or that is, carried out in the spring of last year on wheat.

An ester type and a salt type of 2,4-D were applied at the rate of 1-1/2 gal. per square rod each of 1/2 lb., 1 lb., 1-1/2 lbs. and 2 lbs. per acre on Pawnee wheat just at the start of the jointing stage. The same procedure was used on the wheat at the start of the heading stage. The last application was made at the time considered best of 2,4-D applications on bindweeds in spring.

Only slightly higher yields were harvested on tests made at the start of the jointing stage compared with treatments made at the start of the heading stage. There was no difference in yields from the acid type and ester type of 2,4-D applications.

The one-half lb. per acre applications gave a slight decrease in yield compared with check plots. The 2 lb. per acre applications gave a 15% decrease in yields.

An application of 2,4-D was made on wheat in the fall months at stooling stage. It appears that this early application is more severe on wheat yields than spring applications. Fall applications produced poor stools and delayed maturity.

Now just a word about the effect of ammonium trichloroacetate on Johnson and Bermuda grasses. Twenty percent ammonium trichloroacetate was applied at monthly intervals, beginning in June, at the rate of 1/4 lb. and 1/2 lb. per 100 square feet on Johnson grass and Bermuda grass in 1947. The material was mixed with water and sprayed on the grass at the rate of 1 gallon per 100 square feet. All vegetative growth was killed in 4 or 5 days after application. June treatments seemed to give much better results than later applications. This was probably due to good moisture conditions in June. All other treatments were made when soil was very dry. June treatments gave almost 100% kill on Bermuda grass. Johnson grass made a 50% re-growth from roots 50 to 60 days after treatment. There seems to be little difference between 1/4 lb. and 1/2 lb. treatments. Weaker concentrations should be tried on Bermuda grass. Winter cereals and legumes were planted on the plots 90 days after June treatments and all crops are making normal growth. Some of the winter cereals and legumes planted on the plots 70 days after the July treatments did not germinate.

Questions: "Did you have very much encouragement in applying 2,4-D on wheat at these different stages?" (This question was asked Mr. Klingman).

"Well, yes! we used 2,4-D several times, but we had rain drops trouble with batchelor buttons here in North Carolina. We also applied it on thistles, and where we applied the stuff, we had some very good results. In one early plot that we treated, we had no ill effect or very little effect on wheat and barley, but the oats were small and we were getting all kinds of malformation in that plot. The wheat was only an inch tall. We got a lot of malformation and quite a number of injuries there."

"You did not get injuries when you treated in various parts of the spring?"

"No, we got very good weed control and no injuries. We used about 1/2 lb. of the two salts and about 1/3 lb. of Ester."

THE CONTROL OF SCRUB OAK ON RANGE LANDS IN CENTRAL TEXAS BY CHEMICAL TREATMENTS

V. A. Young, College Station, Texas

I am delighted to be present this morning and to listen to these interesting papers setting forth ways and means of eradicating and controlling various species of noxious weeds. Furthermore, I am especially pleased to have this opportunity to discuss a topic dealing with chemical treatments of the scrub oak which we hope to either eradicate or control on a large acreage of our Texas range lands.

First, I wish to generalize for two or three minutes concerning the brush eradication and control problem on all of the ranges of the United States and especially those of Texas. This is not a new phase of noxious weed control, since thousands of ranchmen throughout the South, Southwest, and West are deeply concerned as to how to eradicate or even control the brush that is multiplying on their grazing lands. There are in the United States today approximately one billion acres of range lands, and conservative estimates list 250 million of these acres as supporting noxious brush species. This brush acreage is increasing each year; therefore, very drastic action by ranchmen must be the order of the day.

Texas is the leading state in range livestock production; nevertheless, the ranchmen of Texas have been battling the invasion of brush for a number of years to maintain the forage level on 93 million acres of range land. Today approximately 60 million acres of Texas range land are supporting various species of noxious brush which have reduced the grazing capacity anywhere from 5 to 95 percent of their potential yield.

Texas ranchmen between 1941 and 1946 expended ten million dollars of their own money and the Federal government has contributed another ten million dollars to eradicate or control various noxious brush species on their lands, and yet little eradication headway has been made. Range management specialists are quite generally agreed that brush on Texas ranges is costing the ranchmen in livestock production and in livestock and their by-products approximately one hundred fifty million dollars annually.

The approximate acreage of the principal noxious brush species on Texas range lands are:

Mesquite (pure & mixed stands)	55 million acres
Cedar spp.	18 million acres
Creosote bush	16 million acres
Tar bush	12 million acres
Huisache, black bush, white bush, and others	7 million acres
Sand Sagebrush	6 million acres
Scrub oak	5 million acres
Shinnery oak	3 million acres
Rose	3 million acres
Cactus spp. (widely distributed among brush species)	?

Due to the abundance of scrub oak (principally post oak, <u>Quercus stellata</u>, with a low percentage of blackjack oak, <u>Quercus marylandica</u>) in the immediate vicinity of College Station, Texas, an opportunity presented itself to study the lethal effect of such chemicals as Sodium arsenite, 2,4-D, and plain kerosene, both as single units or in certain combinations on both the stumps and sprouts of the two oak species.*

A series of plots were selected with 15 to 20 young, thrifty trees in each plot. The trees were felled with a cross-cut saw at heights of ground level, 6 inches, and 18 inches above the ground to permit experimentation with the chemical treatment of both stumps and sprouts. The cutting of the trees and application periods for the chemicals were set for spring, summer, and fall in order to compare seasonal effects of the treatments. Stump height differences were included to determine the translocation and lethal qualities of a given chemical treatment at varying heights. A number of plots were treated each season with the following chemicals and mixtures:

1. Sodium arsenite - This was a standard paste and was applied to the fresh-cut stumps in a paint-like fashion.

2. Esteron No. 1 - This compound contained one part of Esteron 44 to 99 parts of water and was painted or sprayed on the freshly cut stumps. Esteron 44 is a 2,4-D weed killer produced by Dow Chemical Company. The active ingredient is dichlorophenoxyacetic acid and isopropyl ester.

3. Esternon No. 2 - A compound comprised of one part of Esteron 44 to 99 parts of kerosene made up to the emulsion which was also painted or sprayed on the freshly cut stumps.

4. Kerosene - Commercial kerosene was painted or sprayed as in 2 and 3 above.

5. Check - Check plots were cut only and allowed to sprout in order to compare the sprouted stumps with stumps treated under other units of the series.

6. Sprouts of both treated and untreated stumps on the various plots were treated with the above solutions except that in treating with Sodium arsenite, 10 parts of water to one of the stock solution was made up as a spray solution. All solutions were applied with a hand spray, using 90 pounds pressure.

RESULTS

A final inspection of the chemical treatments applied to the oak stumps and sprouts in 1947 was made in late May, 1948, for the results now reviewed in this paper. These are listed in Tables 1 and 2; however, the results are subject to revision because they represent only one year's observations. It is evident that a higher or lower percentage of kill in each case may occur during the next two or more years.

---

*Other than the supervision of the preliminary research of this problem, I am indebted to Mr. David S. Schwinn, a former graduate student in the Department of Range and Forestry, A. & M. College of Texas, for the data I shall present. The field research was financed during the first year by the Texas Agricultural Experiment Station. The continuation of the project will be financed by the Dow Chemical Company, and the research will be carried on by T. E. Hendrix, a graduate student in the Department

Table 1. The percentage of kill due to chemical treatments on freshly cut oak stumps at different height levels by seasons in 1947-48.

	Spring: Per cent at			Summer: Per cent at			Fall: Per cent at		
	Gr. level	6"	18"	Gr. level	6"	18"	Gr. level	6"	18"
Sodium arsenite	14	5	0	17	26	0	95	33	14
Esteron No. 1	7	5	7	4	0	0	42	0	37
Esteron No. 2	0	12	0	0	0	0	75	60	50
Kerosene	0	0	0	0	0	5	9	6	0

Table 2. The percentage of kill due to chemical treatments on oak stumps sprouts at different height levels by seasons in 1947-48.

	Spring: Per cent at			Summer: Per cent at			Fall: Per cent at		
	Gr. level	6"	18"	Gr. level	6"	18"	Gr. level	6"	18"
Sodium arsenite	No readings			6	18	0	37	8	27
Esteron No. 1	" "			75	35	53	63	43	21
Esteron No. 2	" "			9	13	44	80	79	71

In general, it was found that all chemicals used on the freshly cut oak stumps had some retarding action on sprouting. The stumps treated at ground level sprouted the least. Chemical treatments applied in the fall to freshly cut stumps were much more effective than when treated in the spring and summer. This was especially true for sodium arsenite and Esteron No. 2. Thus it is apparent that the season of treatment plays an extremely important role in the effectiveness of a given chemical.

The results of Table 2, with the exception of the summer treatment of Esteron No. 1, show that the treatment of the chemicals on sprouts was most effective when applied in the fall.

Height of sprouts played a minor role as to effectiveness of a given chemical because the sprouts were less than 4 feet tall. Sodium arsenite was of little value in the eradication of the sprouts because of the burning effect on the leaves which apparently reduced the conduction of the chemical greatly. Both Esterons showed promise of some practical value in controlling the oak sprouts if used during a specific season. This would especially apply to Esteron No. 1 if used in the summer on ground level stump sprouts. From general appearances, the percentage of kill listed in Table 2 (75%) may become even larger, since certain stumps showed but a few small deformed sprouts which may die during the next year. In addition, Esteron No. 1 is a comparatively cheap spray, and with a further price reduction in the 2,4-D fraction, it might become an economical and practical method for the control of scrub oak sprouts.

It is highly possible that Esteron No. 1 may prove quite effective, even in less concentrated form, in the control of oak sprouts by a second spraying whereby the additional physiological disturbance may prove lethal. Furthermore, the conduction of the less concentrated solution into the roots, where the actual kill must occur, may be more complete where length of time may be the limiting factor. In most instances, those working with eradication and control of brush expect lethal results too quickly with large, healthy species.

The use of Esteron No. 2 for the treatment of sprouts may be of value as a control method; however, more than one spraying would be necessary. This added expense would no doubt prove uneconomical.

The best results in spraying of sprouts with the Esterons were obtained at relatively high temperatures and fairly low relative humidities.

The results of kerosene treatment on the oak stumps were of little or no value on the prevention of sprouting. This was probably due to the fact that only the upper portions of the stumps were thoroughly wet and not enough kerosene was applied to penetrate the soil around a given stump.

In general, the results obtained in this experiment pointed to the fact that there is a great need for further research in the field of brush eradication and control. This is especially true because of numerous species involved, together with the many chemicals recommended for treatment, the many methods advocated, and the economic factor associated with each step.

PREEMERGENCE SPRAYING OF CORN WITH 2,4-D

Glenn C. Klingman, Raleigh, N. C.

In helping to line up this program, I had hoped that someone would volunteer "preemergence work". Since none came in, I wish to report on a preliminary experiment conducted in North Carolina during the summer of 1947.

The test was planted in late June to hybrid corn N. C. 27. The soil was a sandy loam. The plots were treated the day following planting. It has been reported by New Jersey that better results were obtained where treatment was delayed 5-7 days after planting. The different types of 2,4-D used included sodium salt, diethanolamine, triethanolamine, butyl ester, and ethyl ester. All chemicals were applied at the rates of 2 and 4 pounds acid per acre. The 4-pound rates showed some reduction in early growth. Howevever, by the time of harvest there were no significant differences in any of the types or rates.

Yields of corn in the treated plots averaged 64 bushels, check plots not treated and not cultivated 29.2 bushels, and the farmer's field where he was able to cultivate only once due to wet weather yielded 56.2 bushels. Where not treated, the corn was yellow and small due to competition with weeds, particularly crabgrass and cocklebur.

Walking through a field of preemergence treated corn, plants may be noted that show injury alongsideother normal plants. With depth of planting as a possible answer, such a test was conducted in the greenhouse. Corn, peanuts, soybeans, and cotton were planted at depths of 1/4 inch, 3/4 inch, and 1-1/4 inch. The plots were planted and immediately treated. They were kept moist from then until the experiment was discontinued. In all cases injury was most severe on the shallow plantings with the least or no injury showing on the deep plantings. Very few of the cotton and soybean plants survived, however, a perfect stand of the corn and peanuts resulted from the deep planting. All four of the shallow planted crops showed serious injury. The corn in the treated flat germinated more rapidly than in the check flat.

Ernest Scarbrough working on cotton at N. C. State College has tried 2,4-D, 2,4-5 Tri, and several others. The 2,4-5 appears to have caused no injury to the cotton and gave good weed control for the first part of the season.

It appears that preemergence weed control has almost unlimited potentialities. It may be that chemicals need to be found that remain longer in the soil than 2,4-D to give weed control through more of the season. Work needs to be done studying the effect of soil moisture, texture, structure, organic matter, temperature, etc.

If the year is one that weeds become numerous after six weeks to 2 months, the area can be cultivated, or if the weeds are other than grasses and are susceptible a post-emergence spray can be applied.

(Colored slides illustrating the discussion were shown)

REVIEW OF WEED CONTROL STUDIES IN LOUISIANA

Clair A. Brown, Baton Rouge, Louisiana

I wish to review the experimental work on weed control at the Louisiana Agricultural Experiment Station. We have had very fine results through the cooperative efforts of Messrs. Q. L. Holdeman, E. S. Hagood, L. Cowart, and Dr. T. C. Ryker.

We have run the gauntlet of the various studies such as the use of 2,4-D in parts per million, pounds of acid per acre, use of dusts, high and low gallonage sprays, comparison of different formulations and equipment. I am going to run through a series of slides showing the results of our studies and comment on them briefly.

Alligator Weed Control

The results from the use of 2,4-D to control alligator weed in sugarcane were such that this weed is no longer a problem to the planters. Field scale tests were applied with a three-row sprayer with a boom 18 feet long. The alligator weed turned yellow within 15 days after treatment and then died. We found one spraying a season was all that was needed to give a good, practical control. In fact, regrowth was so slow that by the time the alligator weed was ready for the second spray treatment, it was not possible to pull equipment through the field without breaking the sugarcane.

We tried some low volume applications by using a sizz-weeder. It was converted into a sprayer by removing the burner head. We were able to apply six quarts of solution per acre. Both nozzles were directed to the drill, but the atomization and drift was such that any weeds in the furrow were also hit. The reason for showing this slide is to suggest a means of getting the spray nozzles close to the ground for a differential application rather than a blanket spray. We purchased a high velocity air turbine sprayer and found it was not satisfactory for row crops because of the uneven distribution of the spray.

Alligator weed in water is more difficult to control than on land. This series of slides shows a canal that was treated. The alligator weed turned yellow and some regrowth started when a five-inch rain washed the mat out of the canal. The alligator weed was cut loose from the canal. The last slide, taken six months later, shows the regrowth along the margin of the canal. Alligator weed in water can be controlled if the water levels can be regulated.

Rice Weeds

Many weeds in rice have been controlled by the use of 2,4-D. Last year 40,000 acres of riceland was sprayed or dusted. We found that by controlling these weeds in very weedy fields, increases of from three to five barrels of rice per acre were obtained. Full details on these experiments can be secured from our bulletins.

Johnson Grass

Johnson grass is the number one weed in Louisiana. The sugar planters have worked out a method of fallow cultivation which costs from $12 to $25 dollars per acre, depending upon the efficiency of their operations. They can eliminate the old, mature plants very nicely and what seedlings that develop between cultivations. Fields which have been fallow cultivated give increases in yields. In one instance, the overall plantation yield was 11 tons of cane per acre, whereas on the fields that were fallow cultivated, the yield increased to 22 tons. One set of cuts yielded 33 tons last year in spite of the dry weather. This increase in yield has paid off the cost of the cultivation. However, the grower has lost one soil improvement crop.

The next phase of Johnson grass control is to eliminate this plant from the ditchbanks and headlands. Several of the growers are using chlorates as a means of keeping down the reinfestation of their fallowed fields. Atlacide at the rate of one and one-half pounds per 100 square feet or 600 pounds per acre has done a fine job.

We have tried a large variety of chemicals on Johnson grass which gave a surface kill of the stems and foliage, such as pentachlorophenol. We have tested ammonium and sodium trichloroacetate at rates of from one-fourth to one pound per 100 square feet. One month after application the one-half to three-fourths pound levels looked satisfactory. Two months after treatment, the kill from the one-fourth pound level was good. You can still pick out the plots and it is nearly a year since they were treated.

The seedling phase of Johnson grass control is going to be one of our big problems. On one area Johnson grass seedlings came up at the rate of four million per acre. This condition at St. Delphine plantation is not typical for the sugarbelt, but indicates the potential danger. Post-emergence sprays on small plots with ammonium trichloroacetate and Sinox General have given good control of the seedlings. We used pentachlorophenol with and without 2,4-D on field plots. In this test, the seedlings were too large and we did not obtain a satisfactory kill.

Bioassay Studies

Preemergence application of herbicides for weed control is going to be one of the major ways of controlling weeds. We have developed a bioassay for determining the relative toxicity of different herbicides which may be indicative of their effectiveness for preemergence use. We have germinated a variety of seeds in contact with the herbicide in Petri dishes. This slide shows a comparison of cucumber and rice seedlings in 2,4-D solutions. In the control, rice produced a primary root about 25 mm. long in four to five days. At one-half ppm. the primary root was six to seven mm. long and at one ppm. the growth of the root usually was inhibited. We think that rice is far more sensitive than most other seeds used for bioassay studies. We found that there are difficulties in consistently measuring the root growth of cucumber, whereas the inhibition in rice is clear cut. We have tested a number of herbicides and this slide shows the effect of Sinox W and illustrates the results. At the 50 ppm. level the cucumber, rice and radish seeds were barely pipped. At 25 ppm. the cucumber germinated, whereas the rice did not. At 10 ppm. there was a fair growth of rice, cucumber and radish. We can see the types of responses of the seedlings in contact with the chemicals. This technique gives us some explanation of what is taking place when we use these compounds for preemergence weed control.

Weed Control in Forest Nursery

The forest nursery has a hand weeding problem which is costing the Forestry Commission between six and seven thousand dollars an acre. We put out a series of preemergence treatments. Good weed control was obtained for six weeks with Sinox General at the rate of one-half gallon in 50 gallons of water per acre. Sodium pentachlorophenate and Sinox W likewise gave good control. We did not have a good germination of the pines as the seeds were taken out of stratification three days before they were planted. Thus we did not have a good stand of pines and do not know the effect of these chemicals on them.

Post-emergence application of Varsol has been recommended for the control of weeds in the nursery. Applications at the rate of 100 gallons and at 50 gallons of Varsol killed the longleaf pine seedlings. At the 25 gallon level there was about a 50 percent kill. Good control of the weeds was obtained at the 10 gallon level when the pines were two to three inches tall and the weeds in the rosette stage, with less than a two percent kill of the pines. Applications two weeks later were not so effective in the control of weeds. Thus it seems that as the weeds increased in size, their resistance to Varsol increased.

Pre-emergence Control in Cotton

We had our agricultural engineer build us an outfit consisting of an air compressor, gasoline motor, an ordinary compressed air spray tank, a manifold with hose leading to individual nozzles on a boom so arranged that the spacing of the nozzles can be varied. We designed this sprayer to push over the plots, but later attached it to a tractor. It is very nice for treatment of 1/50 acre plots. We are going ahead with preemergence treatments in cotton. This slide illustrates the results on our sodium pentachlorophenate plots, which were fairly good. (Later tests showed that we cannot recommend sodium pentachlorophenate for cotton at the levels used). Some of our preemergence work in cotton does not look too good because we had a two-inch rain right after application. Sodium trichloroacetate was highly toxic to weeds and cotton. Certain of the dinitro compounds have given good results under certain conditions.

Questions: "What rate and effect did sodium trichloroacetate have?"

"I think we started our spraying with sodium trichloroacetate at 15, 25, and 35 pounds per acre and then computed the amount needed to a 100 percent active ingredient basis. The slide I just showed you was at the rate of 35 pounds of 76% trichloroacetic acid.

WEED CONTROL IN VEGETABLE CROPS

L. L. Danielson, Norfolk, Virginia

The use of selective weed killing chemicals on vegetable crops is the hope of practically every grower at the present time. Use of these materials for this purpose is very limited today and will continue to be so until extensive research can be conducted. A brief report of some results obtained in our work is given here.

Strawberry Weed Control

The problem of weed control in strawberries is one of great interest to the growers in our area because of the cost of hand labor required for this operation. The cost of hand weeding usually runs between $75 to $150 per acre. These costs can be met in seasons when high yields and high prices prevail, but we have reason to believe that the present price level will not be maintained for any long period of time. The grower will be able to stay in the strawberry business when lower prices come if he can reduce the cost of production. Our work with the use of chemicals for weed control in this crop has been stimulated by these considerations.

Our work has been concerned with the use of 2,4-D and Sinox on the Blakemore variety of berries which is the principal variety grown in this area. Preliminary experiments begun in the fall of 1945 have shown that this variety is quite resistant to injury by 2,4-D except when this chemical is applied during flowering or fruiting. Applications made at that time cause serious reductions in yield and quality due to the dropping of blossoms and misshapen and dry, seedy fruits. Even these applications do not permanently injure the vegetative part of the berry plant. Applications made when the berry plants are in the vegetative condition usually check growth of the crop for a period of 2 to 3 weeks afterwhich a normal or even stimulated growth takes place.

In one experiment in 1947, a 27 acre field of old berries was treated immediately after the beds were made up for the setting of new runners and had been hand weeded to remove all broadleaf and grass weeds on July 26. This application was made at the rate of 2 pounds of the 70% sodium salt of 2,4-D applied in 100 gallons of water per acre at a total cost for material and application of $5 per acre. The spray was applied in such a way that the entire soil area as well as the berry plants received a good coverage with the chemical. This treatment controlled the growth of crabgrass and bull grass as well as broadleaf weeds for the remainder of the growing season provided the treated area was not cultivated. Hand weeding was not required again until the winter growing weeds such as chickweed and henbit appeared in late October. The control of these grasses is attributed to the method of application which is essentially a soil treatment. This apparently kills the grasses of this type in the germinating stage. Yield results of the treated areas and 4 acres of untreated berries in this experiment showed no significant differences.

Preliminary trials on the use of chemicals for the control of winter growing weeds in strawberries have shown very promising results. We have found that a November application of 2,4-D of the same rate and type used for summer growing weeds effectively controlled chickweed and henbit throughout the winter without affecting yields. More extensive trials using Sinox and Sinox General for the winter weed problem in berries have given excellent control. The latter two materials were used after the berry plants became dormant in the fall and before growth was resumed in the spring. Applications made before the weeds had reached a height of 3 inches were most effective. Sinox at the rate of 2 gallons applied in 100 gallons of water per acre was found to be satisfactory. A spray mixture containing one pint of Sinox General, 25 gallons of diesel fuel and 75 gallons of water applied at the rate of 100 gallons per acre was also very effective when applied at this time.

In summing up the results of our experiments on the use of chemicals for control of weeds in strawberries up to the present time, it appears that two pounds of the 70% sodium salt of 2,4-D, applied in 100 gallons of water per acre in the period from June 1st to the end of July may prove practical on a field basis for the control of summer weeds. The same rate of application made in late October or November may prove practical for control of winter weeds. The use of Sinox and Sinox General also has promise for this purpose. Experimental work is being continued to obtain additional information on response to these treatments in seasons of varying climatic conditions.

Control of Weeds in Corn With 2,4-D

Trials of preemergence 2,4-D soil treatments on sweet and field corn have proved very successful in trials to date. No lodging or brittle stalk conditions have been observed in pre-emergence trials. Treatments applied in this way appear to offer the farmer a method of controlling crabgrass and broadleaf weeds during the first three to four weeks after the corn is up when it is often impossible to cultivate due to wet weather. Approximately 500 acres of corn treated in this way under our supervision this year has produced very satisfactory results with much of this acreage being cultivated only once, that being when it was sidedressed and laid by. The rate of application was two pounds of the 70% sodium salt, or its equivalent, applied in 100 gallons of water the day of planting.

Spray applications of 2,4-D on growing corn have shown that concentration is a critical factor in preventing injury to the crop and this appears to be especially true of 2,4-D oil formulations. Arrangement of spray nozzles so that solution does not enter the crown of the plant and collect around the leaf sheaths is importnat in preventing brittle stalk development. Cultivation just prior to spraying so as to cover the lower nodes has been found to be important in preventing injury to the brace root system which may cause lodging in even moderate winds of a gusty character.

Weeding Parsley With Stoddart's Solvent

Experimental trials on the weeding of parsley with oils early in the 1947 season resulted in the use of this method on a commercial field basis last year throughout the parsley growing section of our territory. Hand weeding costs are usually about $90.00 per acre in this crop, but the use of either Shell Weed Killer No. 110 or Esso Varsol has reduced weeding costs to approximately $20.00 per acre. Rates of 50, 75, 100, and 120 gallons per acre of these materials were tried before emergence and at various growth stages of the crop. The lowest rate which gave good results was 75 gallons per acre. Treatments were not applied beyond the 6-leaf stage. Injury to the crop occurred only when the oil was applied to the wet foliage in early morning. Crabgrass and broadleaf weeds, with the exception of ragweed and Galensoga, were controlled very effectively.

Conclusions

The use of chemicals for the control of weeds in vegetable crops offers great promise as a method of lowering production costs. Work on a number of other vegetable crops not reported here is underway. Much fundamental research will be necessary before any general expansion of the use of the weed killing chemicals will be possible. We are undertaking some of this work on physiological response of the plant to 2,4-D and on the effect of various soil conditions on the results obtained with soil treatments with this chemical.

UNSOLVED WEED PROBLEMS

L. S. Evans, Weed Investigations, B. P. I. S. A. E.

For convenience of classification, unsolved weed problems may be grouped in the following categories: (1) Fundamental problems, (2) Agronomic or applied problems, (3) Economic, and (4) Administrative. The administrative problem is of particular significance since it may in some cases be the overriding consideration.

Fundamental problems include the following consideration: (a) nature and mode of action of herbicidal compounds, (b) physiological mechanisms involved in absorption, transport, and killing action, (c) screening or evaluation of phytotoxic chemicals, (d) refinement and standardization of technics and terminology,

(e) synergism, antagonism, and compatability of chemical combinations, (f) relationship of ecological adaptation of weed species to control measures, and (g) biological control.

Biological control is the ideal but rarely the simple solution to a weed problem. It is of necessity a long-range objective and for the moment it possibly remains, "A distant shore, dimly seen". There is, however, a good precedent for consideration of biological control methods. Favorable results have been reported in California in the control of St. Johnswort by the use of insects. Two species of insects are being propagated with some success for the control of this range pest. These results are preliminary rather than conclusive. Naturally a long-term project to discover the feeding habits of these insects had to precede the actual field propagation. It would be unwise to devote major emphasis to a consideration of propagation of insects or diseases which might be useful in an all out attack on weed problems. We are all laboring under varying degrees of compulsion, either imaginary or real, to produce concrete results now. It is to be expected that the immediate goals can best be realized through examination and exploitation of methods now at our disposal. It should be noted that this same sense of urgency has sometimes resulted in hastily contrived schemes and premature conclusions. An objective consideration of the "why" of things might avoid future embarrassment. Some people maintain that killing weeds is both an art and a science. Unquestionably it involves certain elements of each, but our purposes will best be served by a contemplation of the scientific rather than the artistic features.

At some point, yet to be determined, weed control reaches a point of diminishing returns; beyond which further efforts are either uneconomical or otherwise undesirable. Some critics insist that we have already passed this limit at least in some fields, however, such cases are relatively rare. We should all be aware of the hazards of tampering with the balance of nature. We will be well advised to consider the interests of biological conservation to the extent that we at least keep our destructive impulses, constructive.

To say that any weed problem is solved is either a misuse of the word or a sign of stagnation or both. If we are to accept this philosophy, then the weed control picture is still a wide open field, which it is. However, some problems are more urgent than others. Among those which are of primary importance are: (1) aquatic weeds in potable or fish bearing waters, (2) weed control in vegetable crops, (3) soil sterilization for non-agricultural land (herbostatic chemical perhaps is a better term than soil sterilant), (4) brush control, (5) weedy perennial grasses, and (6) wild garlic.

An important consideration which shows the intimate relationship between the field of weed control and other biological fields is the problem of weeds which harbor insects and plant diseases. In some instances this phenomena has been put to practical beneficial use as in the case of allowing nematode resistant weeds to occupy infested ground until the nematodes were starved out. In the case of weeds which harbor virus diseases in vegetable growing areas this interrelationship has been clearly detrimental.

Substantial progess has been made in chemical control of water hyacinths and alligator weed (when growing on land). In the case of water hyacinths an unsolved problem is the perfection of equipment for penetrating the mass of vegetation itself or to reach inaccessible and remote breeding grounds in the swamps of the Gulf Coast and inland areas. Some ingenious devices for propelling spray equipment have developed for this purpose. Perhaps to a lesser degree other weed problems require specifically designed applicators. Unfortunately converted equipment designed for other purposes is not always satisfactory. Certainly a desirable goal would be the perfection of multiple purpose equipment. The low gallonage technic which is becoming popular in the Mid-West called for radical modifications in equipment. Perhaps there will not be the same wide acceptance of the low volume sprayer in the South that it has had in areas where water is less abundant.

So far, progress has largely been confined to relatively simple considerations from the standpoint of control of individual weed species and more recently from the standpoint of specific crops. Until technics are developed which can be integrated with practical farming systems, the overall objective will not be gained. In this search care must be taken so as not to overlook some of the best possibilities which might be overshadowed by new methods. We must remember that there are other interests which have a stake in our weed control problem. If we affect a serious upset in the balance of nature or cause serious destruction to adjacent crops we may, in the long run, defeat our general purpose. The potential hazards of these new and powerful chemicals should be thoroughly examined and applied with discrimination. This involves careful consideration of cumulative effects and other associated factors.

It is not sufficient in itself to develop a new chemical control method, however effective it may be, unless that method has some chance of being a future economic actuality. The pure scientist may frown on such commercial inclinations. But the fact remains that it is placing an unfair burden on the manufacturing chemist to simply say, "If the chemical is good enough, industry can make it cheap". Such an attitude completely ignores certain economic facts, and in some cases has given rise to false hopes. On this point, at least, we must be practical.

Weed control is, in most cases, a community problem. This fact has been recognized in some states by the passage of regulatory statutes which provide for compulsory weed control. Such a campaign can only be successful if it has widespread public support. In many instances this calls for some expert salesmanship supported by substantial and proved control methods.

A workers conference of this type can serve a highly useful function in providing for a frank discussion of the problems and methods of attack. This not only serves as an incentive to the individual research worker but if we can profit by the example of the important and influential position enjoyed by similar regional weed conferences elsewhere it will also serve to bestir our somewhat indifferent public opinion. This very fact should call for some sober consideration of the objectives and plans of this organization. You may expect an almost explosive rate of growth and it would be wise at this time to lay the foundation firmly and soundly for future programs.

The word coordination is one of the most abused and over-worked words in the English language, but call it integration or coordination or by any other name, but let us have a good measure of it now. The weed situation in any state is probably so great and so diverse that with existing appropriations and facilities a wholesale attack on all weed fronts simultaneously is impossible. Most weed problems don't recognize state boundaries. The Department of Agriculture is in a favorable position to assume the responsibilities for some of the broader problems particularly where those problems are regional in nature. It might be well, at this point, to make a distinction between proper replication of an experiment and unnecessary duplication. Until weed research technics achieve a greater degree of standardization than they possess at the present time the human element will continue to be a major variable in any experiment. The magnitude of this variable can be reduced by better training and improved methods of plot technic, but at the moment considerable duplication of experiments should be encouraged among the several states. The Department of Agriculture has no desire to dictate policy nor to umpire disputes, instead we would be pleased to have the states represented here individually or collectively, preferably the latter, tell us what functions you want us to assume in a weed program for the South.

DISCUSSION

Led by R. W. Cummings, North Carolina

Dr. Cummings: The Southern Experiment Station Directors, in a meeting about a year ago last March, recognized that weed control was a problem of regional significance which should be considered among the lines of activity that needed to be attacked on a coordinated basis under the Research and Marketing Act. At that time the administrative advisors were appointed for the various projects. Upon request all the Experiment Station Directors designated one man from his particular station who would be the contact man for his station concerning weed investigations. In working up this program, those men from the experiment stations in the Southern region, in Puerto Rico, and members of the appropriate bureaus of the U. S. Department of Agriculture, were contacted for suggestions as to the program. As a result of the suggestions that came in from those groups, the program was tentatively formulated and circulated and eventually the program which we have had today was developed. Now we recognize, of course, that there were a lot of people outside of this group who were interested in, and very much concerned about the weed control problem. We realized that by such an approach we would not be able to bring together all the pertinent information on the subject which was available here in the region. But we knew we could provide the mechanism for starting such a movement, and I feel that our coming together here and exchanging ideas today has been a most valuable thing. Those of you whom I have talked to feel that it will be wise to make arrangements for periodically renewing this sort of a meeting. I do not know the best procedure but unless you have a better suggestion, I am going to let the group which the Southern Experiment Station Directors have appointed as the official representatives of their respective stations on this program, together with the representatives from the U. S. Department of Agriculture, and who have been designated for this purpose, serve as a committee to formulate plans for setting up an organization. I will be glad to have your comments on this. Is that procedure a reasonable one or do you have a better one?

Question: "How does that compare with the western and other regional weed conferences?" Dr. Quisenberry, can you give us a little information on that. I believe you have had some experience with those other conferences."

Dr. Quisenberry: "I am not quite sure of the question you ask; how was it started or how does it run after it is going? Well, I think, as Dr. Cummings has pointed out, it has to be started some place. In general, a group of research workers get together and perfect their organization and draw up their by-laws and so on. That does not mean that after they get going they necessarily are limited to workers designated or only to advisory committees."

Dr. Cummings: "It was my understanding that this was approximately the procedure that had been followed by the other regions. It seems to me that it is the only practical solution to the problem now.

Now, since we must come to some conclusion in regards to forming a committee, we might put this motion before the group, that we go ahead and form our committee as suggested."

Dr. Young: "I second that motion."

Dr. Cummings: "All those in favor of the motion will let it be known by saying "Aye" --- Now that the motion is carried, we will proceed on that basis. In addition to doing that job, there is the other job of coordinating research. We should have a more definitely coordinated research program, which will be region wide in nature. So I am going to ask, if there is no objection to it, that this group of research workers of the states and various workers in the Department of

Agriculture meet here tonight at 8:00 P. M. and begin the consideration of those problems. If there is any objection to that, just let me know, otherwise we ask you to be back at that time so we can begin to get the organization underway. There are a lot of you who have had considerable experience and observations along the lines that have been discussed today, perhaps along some other line; perhaps some of you have had experiences that go beyond what has been discussed today, or obsêrvations of a different character or maybe observations which are in conflict with some of the things that have been discussed today. We do not have very much time, but I wouldn't like to close the meeting without giving an opportunity of at least a few minutes for general discussion of some of the things that we haven't thought of quite as much or need to add additional comments on. Don't everyone speak at once now but I would like to hear a few comments."

(I didn't quite get the name of the person asking this question or making this comment).

Dr. Sell: "Before we go into this discussion of our comments, I would like to bring up one thing Dr. Dallavalle and I discussed this morning. I think some of us may have gotten the impression that in order to get kill with some of these 2,4-D compounds it is necessary to have a relatively fine sized particle. Most of the evidence, I think, indicates that you get the best kill with the larger size particles. He did not intend to leave the impression that it was necessary to have a fine particle, and I thought maybe he might wish to comment further with the group."

Dr. Cummings: "Do you wish to comment further on that point, Dr. Dallavalle?"

Dr. Dallavalle: "Yes, if I may. This morning I only spoke generally. I had no intention of being very specific on that point and stand to be corrected. He is quite right. So far as we know the larger particles do seem to be more effective than very fine ones."

Dr. Sell: "I didn't mean that you gave us the wrong information, Dr. Dallavalle, but I just thought some of us might have gotten the wrong impression of that point."

Dr. Young: "That brings a question up in my mind, would you infer from that that you would get a better kill with high gallonage than with low?"

Dr. Dallavalle: "No. I think that my impression has been that with low gallonage you do get an equally effective kill as with larger gallons."

Mr. Klingman: "Has anything been done on chemical analysis of 2,4-D in plants. I mean is there any way of telling how much 2,4-D is in a plant, or is there some method of tracing it?"

Dr. Cummings: "Can anyone enlighten Mr. Klingman a little on that."

Dr. Loustalot: "I think that Dr. King of Cornell has or is doing some work along that line down in Cuba, where he is studying translocation as affected by the anatomy of the plant."

Dr. Albert: "There is one comment that I would like to make regards 2,4-D in nutgrass. When you spray nutgrass with 2,4-D you kill the virile portion of the plant and sometimes the little bulbs beneath. When you do that, you further destroy the apical dominance and some of the dormant bulbs, by some biological mechanism two or three germinate at once. There is one thing we noticed, though I can't speak for sure, if it was nutgrass, but sometimes when we start using too high a concentration we kill conductive tissue, whereas if we had used low concentration, we would not kill conductive tissue. So it is wise to make an attempt to define the concentration you have been using. There is reasonable data to show that you can get 2,4-D which may kill the second and third tuber. I believe that was done in Florida."

Dr. Cummings: "You say that the translocation of 2,4-D is more likely to be accomplished in low concentration than high concentration?"

Dr. Albert: "Yes. Dr. Mitchell gave a very good paper last season in which he showed pictures where they had used radioactive materials. Those pictures showed very definitely the points of application and the movement of the material in the plants. I think, probably his papers that he has published so far have a good deal of information of that nature, if anyone is interested in that phase of the problem."

Dr. Cummings: "Any other comments on this?"

Dr. Young: "I would like to offer just one suggestion. I am just afraid that we are all so anxious to get results so quickly. I feel that in the next three years, probably in the next five, with all general information that we have, we should begin to do a lot of detailed quantitative work. I would like to see in one section especially good work in one particular trial of weed control and in another section, another. We are all dabbling here and dabbling there, and I am afraid we will not make the proper progress that we should. I think we should settle down with a little guidance and attack some of these various important problems in groups, say one or two groups, in every State, in every Experiment Station. I think that is what we need."

Dr. Cummings: "I hope that we will get some further ideas of that phase of it, Dr. Young. The hour is getting late and I think we could have considerable more discussion, but there is one other very interesting part of our program here which we want to give plenty of time to. I am now going to ask Mr. Klingman of the North Carolina Station to introduce the next portion of the program."

Mr. Klingman: "We originally planned for the evening program the motion picture, "New Conquests in Agriculture", sponsored by the Sherwin-Williams Company. It is a very fine film and a large part of the group have never seen it. Mr. W.H. O'Kane of Greenville and Mr. Paul Slade of Jackson, both of the Sherwin Williams Chemical Division are here to show the picture. If there are no further announcements, we will go on with the picture."

Dr. Cummings: "Before going into the showing of the film, let me say again that I feel we have accomplished much by our getting together today here at the Delta Branch Experiment Station, and we hope to see many of you later on in the evening at our concluding meeting. Thank you."

FIELD TRIP OBSERVING WEED CONTROL INVESTIGATIONS ON THE DELTA BRANCH EXPERIMENT STATION

Charles R. Sayre and Staff of Delta Branch
Experiment Station, and O. A. Leonard
Mississippi Agricultural Experiment Station

Chemical Weed Control in Alfalfa

An area seeded to Oklahoma Common alfalfa on September 26, 1947, was divided into three parts for tests on the effectiveness of herbicides on the control of weeds in seedling alfalfa. Test A consisted of 25 plots each 12 feet x 20 feet and the following treatments were made on December 1, 1947, when the alfalfa was in the three-leaf stage: Sinox W, 6 pints per acre; Sinox W, 8 pints per acre; Dow Selective, 3 pints per acre; Dow Selective, 6 pints per acre; and a non-treated check. The treatments were replicated five times and the herbicides were diluted with water and all applied at the rate of 100 gallons per acre. Sinox W contained 13 percent of toxicant while Dow Selective contained 27 percent, hence the differences in the amounts used. All the herbicides gave good control of henbit and chickweed and fair control of cruciferous weeds (rock cress and shepherd's purse) but failed to control wild winter barley (Hordeum pusilum). The latter weed occurs abundantly in the Delta and is undoubtedly a factor in getting seedling alfalfa established.

Test C consisted of 15 plots, each 10 feet x 12 feet, and the following treatments were applied on December 2, 1947. I.P.C. in sand, 16 pounds per acre; I.P.C. in sand, 4 pounds per acre; Sinox General, 2 pints per acre; Dow General, 2 pints per acre; and a non-treated check. The treatments were replicated three times and the two general herbicides were diluted with water and applied at the rate of 100 gallons per acre. The I.P.C. in sand was applied dry and was broadcast by hand. The general herbicides controlled broad-leaved weeds as reported above for the selective herbicides, but had no effect on the wild barley. The I.P.C. on the other hand gave practically complete control of the wild winter barley when applied at this time in the dry state and carried into the soil in solution by the winter rains. Broad-leaved weeds developed, however, in the I.P.C. treated plots. It would appear, therefore, that a combination of a selective herbicide and I.P.C. applied in December to fall-seeded alfalfa might give an almost weed-free stand and aid materially in getting the alfalfa seedlings off to a vigorous start. Tests of this type are planned for 1948.

Test B a duplicate of Test A as far as plot lay-out was concerned, but treatment was delayed until March 10, 1948 and the general herbicides were used with a small amount of diesel oil (8 pints to each pint of herbicide) to aid in getting the herbicides dispersed in the water. All applications were again at the rate of 100 gallons per acre. The alfalfa at this time was about 8 inches in height and it was severely burned by the spray application but subsequently recovered.

Since the applications made in December injured the alfalfa very slightly and it had fully recovered by the time of the first cutting in the spring, it was concluded that treatment when the alfalfa seedlings are in the three-leaf stage is much superior to treatment delayed until spring when the alfalfa seedlings have become fully established.

Chemical Weed Control on Annual Cultivated Field and Horticultural Crops at Stoneville

L. R. Farish and O. A. Leonard

On April 29, 1948 a chemical weed control test was applied on the surface of the soil immediately after planting the crops at Stoneville, Mississippi. Two rows were planted of each crop and the rows were 24 inches apart. Half of the area was freshly disked and smoothed just before planting the crops and half of it had had a rain after disking and the grass and weeds were germinating at the time of treatment. The two rows of each crop were planted across both areas in a like manner, with the seeds being covered approximately 3/4 inch. The treatments were made in duplicates, one of each on the freshly prepared soil and the other on the area where the weeds were germinating. Each treatment was applied in 10-foot strips across the rows of crops in each of the two areas. Water was used to make up each of the chemical treatments to the same volume and applied with a hand pressure sprayer at the rate of 40 gallons of solution per acre.

The following crops were planted in the test: Sweet corn, field corn, milo, barley, wheat, oats, soybeans, lima beans, snap beans, mung beans, cowpeas, garden (English) peas, cotton, okra, cantaloupes, watermelons, cucumbers, spinach, beets, carrots, lettuce, turnips, mustard, broccoli, radish, tomatoes, pepper, and peanuts.

The treatments were as follows:

1. Sodium 2,4-D (2 lbs. per acre)
2. " " (4 " " ")
3. Amine 2,4-D (2 " " ")
4. " " (4 " " ")
5. Sinox W (3 gal. per acre)
6. " " (6 gal. " ")
7. Dow Selective (3 " " ")
8. " " (6 " " ")
9. Sodium Pentachlorophenate (10 lbs. per acre)
10. " " (20 " " ")
11. " " (40 " " ")
12. Sodium Trichloroacetate (5 " " ")
13. " " (10 " " ")
14. Sinox General .78 gal. + 15 gal. diesel oil per acre
15. Dow General 1.13 gal. + 15 " " " " "
16. Sodium pentachlorophenate 10 lbs. + Dow Selective 1 gal. per acre
17. " " 10 " + " " 2 " " "
18. Check (no treatment)

Sinox W, Sinox General, Dow Selective, and Dow General did not injure any of the large-seeded crops such as corn, beans, cotton, okra or the cucurbits, but injured germination of the small-seeded crops such as lettuce, spinach, carrots, tomatoes and the cruficers. However, these materials did not give satisfactory grass control. They did give satisfactory control of the broad-leaf weeds such as Amaranthus.

Sodium pentachlorophenate also injured the small-seeded vegetable crops and did not injure the large-seeded crops except in the high rate of 40 pounds per acre. This high rate injured practically all the crops, and the high rate was the only rate of this material that was effective in controlling grass and weeds, and it was not too satisfactory in controlling some of the grasses.

Trichloroacetate injured all the bean crops, including cowpeas, and it also injured the grain crops of the grass family. It did not injure cotton, okra, the cucurbits or the small-seeded vegetable crops. It was the only material used that did not injure these small-seeded vegetable crops. However, it was not effective in controlling the broadleaf weeds, but was more effective in controlling the grasses than some of the above materials.

Both the sodium and amine forms of 2,4-D were more effective in controlling annual grasses and weeds than the other materials used. However, the 2,4-D injured all the crops, even corn, in this test. None of the small-seeded vegetable crops came through without serious injury in any of the 2,4-D plots. Four pounds per acre gave practically 100 percent control of crab grass, crowfoot and the broadleaf weeds. A few bunches of Brachiaria grass came through the 2,4-D plots, but they had severe injury to the root system.

Of the various materials tested for pre-emergence weed control at this location 2,4-D has given best results so far as control is concerned. However, under certain conditions it has given injury to practically all the crops when applied after the crops are planted. Under certain conditions corn planted one inch deep or deeper has escaped serious injury by this material.

When 2,4-D was applied on the surface of the soil several weeks before the crops were planted a number of crops, including some very susceptible ones, were grown without serious injury under certain field conditions.

Weed count in the 2,4-D plots are given in Table 1, and it is shown in this table that only one grass (Brachiaria) survived the treatment and it was greatly reduced in number of plants per 100 square feet. The plants that did survive were badly stunted from root injury.

Table 1. Weed count per 100 square feet in the 2,4-D plots.

Treatment	Crab grass	Crowfoot	Brachiaria	Amaranthus
Na 2,4-D (2 lbs.)	0	0	25	0
Na 2,4-D (4 lbs.)	0	0	21	0
Amine 2,4-D (2 lbs.)	1	0	25	0
Amine 2,4-D (4 lbs.)	0	1	18	0
Check*	35	300	150	40

*The grass plants in the check plot were estimated, because of the difficulty in counting them.

MINUTES OF BUSINESS MEETING OF SOUTHERN WEED CONTROL CONFERENCE

DELTA BRANCH EXPERIMENT STATION, STONEVILLE, MISSISSIPPI

JUNE 10, 1948

Meeting opened by Dr. Ralph W. Cummings. Dr. Cummings is Administrative Adviser on Weeds for the Directors of the Southern Experiment Stations.

Skold (Tenn.) moved that a President, Vice-president and Secretary-treasurer be elected by the group to constitute the Executive Council of the organization. After the first year the Past-President will be added as a fourth member of the Executive Council.
Rea (Texas) seconded motion.
Motion passed.

Nominated for President:

Clair A. Brown
O. A. Leonard
Clair A. Brown elected President

Nominated for Vice-president:

O. A. Leonard
V. A. Young
G. C. Klingman
O. A. Leonard elected Vice-president

Nominated for Secretary-treasurer:

G. C. Klingman
Nominations closed. Unanimous ballot cast.

Rea (Texas) moved that five advisory members be elected at large in addition to the three officers plus the past-president.
Motion seconded.
Discussion
Motion lost

Shear (Virginia) moved that the Board of Directors consist of one member from each Experiment Station plus one member from the U. S. Department of Agriculture.

Skold (Tenn.) amended the motion to increase the one U. S. D. A. member to three U. S. D. A. members.
Discussion
Amendment withdrawn by Skold
Motion withdrawn by Shear.

Rea (Texas) moved that President, Vice-president and Secretary-treasurer appoint a committee on Constitution and By-Laws.
Seconded by Wooten (Miss.)
Motion carried.

Discussion as to whether Weed Control Conference should meet with or separate from Southern Agricultural Workers meetings.
18 voted for having separate meeting.
2 voted for meeting with Southern Agricultural Workers.

V. A. Young (Texas) moved that time and place of meeting be determined by the Executive Committee.
Seconded by Sell (Ga.)
Motion carried (later nullified by appointment of a committee on time, place, and arrangements for meeting).

General Discussion of Plans for Regional Weeds Research

Prior to the meeting, a suggested outline for weed control investigations in the South had been circulated among the State and U. S. D. A. representatives. As a preliminary step in discussing possibilities of regional cooperation in weed research, each state representative was asked to list some of the major weed problems in his state.

Skold (Tenn.) pastures, particularly wild garlic and bitterweed.
Shear (Virginia) pastures, coralberry, garlic, etc.
Danielson (Virginia) vegetable crops.
Klingman (N. C.) pastures, row crops, cereal crops, vegetables
Albert (S. C.) row crops, pastures, Johnson grass, Bermuda grass, nutgrass, woody shrubs.
Sell (Ga.) pastures, woody shrubs, certified seed.
Leonard (Miss.) nutgrass, Johnson grass, Bermuda grass, wild garlic, brush eradication, truck crops, row crops, cereal crops.
McMurray (Tenn.) Those problems listed by Leonard. Probably No. 1 problem is pasture weed control.
Rea (Texas) 1. brush species
2. weeds in rice
3. row crops
(a) annual grasses
(b) Johnson grass
(c) nutgrass
Tullis (Texas) aquatics
Young (Texas) same as Rea.
Garman (Arkansas) pastures.
Brown (Louisiana) 1. rice, 2. cotton, 3. corn
Elder (Okla.) bindweed in wheat, Johnson grass, Bermuda gras
Davis (Texas) protection of susceptible crops from damage by weed control chemicals
Loustalot (Puerto Rico) unintentionally omitted. Later stated that most of their problems had been covered.
V. A. Young (Texas) moved that we adjourn until 8:30 the next morning. Seconded. Carried.

Meeting resumed Friday morning
President Brown opened the discussion for the regional weeds research program.
After considerable group discussion, V. A. Young (Texas) moved that the Executive Council revise the outline of plans for Weeds research and circulate to the representatives designated by the respective Experiment Station Directors for suggested changes.
Seconded by Anderwald (Texas)
Motion carried.

Committees appointed
Constitution and By-Laws
O. E. Sell, Chairman
E. C. Tullis
L. L. Danielson
Place, time, and arrangements for next meeting
W. H. Garman, Chairman
V. A. Young
E. P. Carter

Program committee
- G. M. Shear, Chairman
- W. B. Albert
- S. F. McMurray
- A. J. Loustalot

Research Committee
- O. A. Leonard, Chairman
- A. J. Loustalot
- H. E. Rea
- E. N. Scarborough

Orue Hedden (Ohio) suggested that the C. A. A. be invited to an active part in the over-all program.

R. W. Cummings and Dr. C. A. Brown expressed appreciation to Dr. C. R. Sayre and his staff at the Stoneville Station for the cooperation, planning, and cordial hospitality shown the group.

Moved that meeting be adjourned

Seconded. Carried.

Meeting adjourned at 10:45 - Friday, June 11, 1948.

Glenn C. Klingman
Secretary-Treasurer