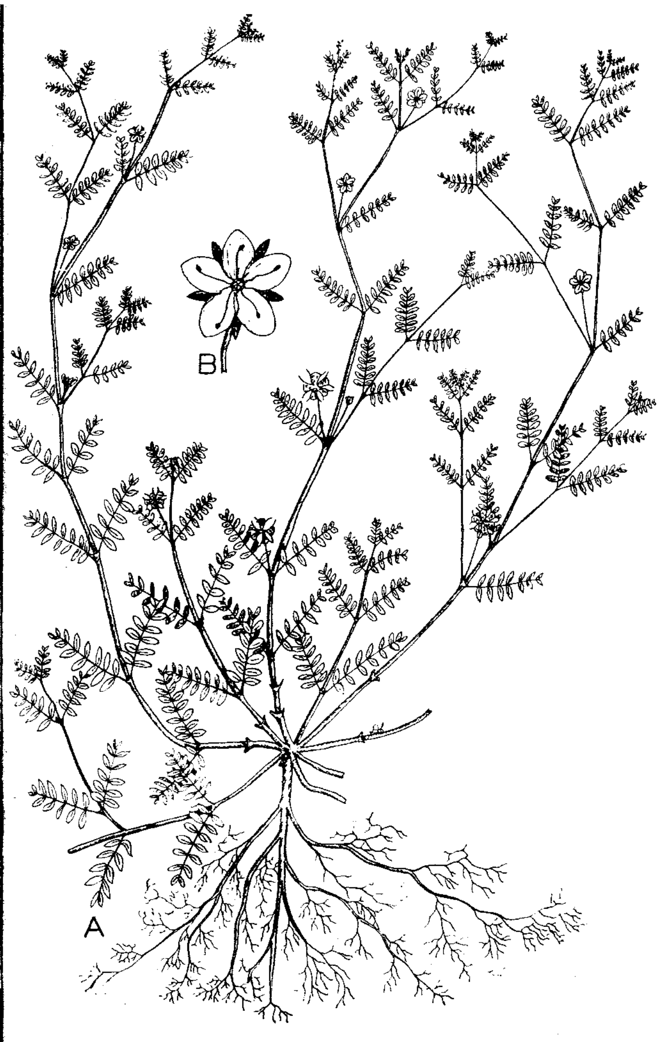

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PROGRAM AND TABLE OF CONTENTS

Tuesday Morning, March 19, 1968

EDUCATION AND REGULATORY SECTION

Chairman: Bert L. Bohmont

Page

Presidential Address, Stan W. Strew 1

Some Thoughts on a University Training Program in Weed Science. Arnold P. Appleby 2

Cost-Effect Syndromes in Weed Research. Lambert C. Erickson 4

Training the Pesticide Inspector. Everett W. Spackman 5

Oregon Pesticide Application Law. W. H. Kosesan 6

Montana County Weed District. William O. Gibson 7

Leafy Spurge in Montana (Education Film). L. W. Sonder .... *

Thin Layer Chromatography of Artemesia spp. J. R. Brunner 9

Vapor Pressure of Low-Volatile Esters of 2,4-D. G. W. Flint, J. J. Alexander, O. P. Funderburk 9

Tuesday Afternoon, March 19, 1968

RESEARCH SECTION

Chairman: Harold P. Alley

Soil Moisture and Prior Herbicide Treatments as Factors Influencing the Activity of Diphenamid. T. Tisdell and F. M. Ashton 9

Physiological Response of Douglas-Fir to Atrazine in Sand Culture and Clay Loam Soil. C. A. Peterson and Michael Newton 9

The Decomposition of Triazine Herbicides in Soil. R. L. Zimdahl and V. H. Freed 10

Page

Charcoal, a Means of Protecting Crops in Oregon. R. G. Brenchley 10

Symposium on "Herbicide Mixtures"

1. Responsibilities of Research in Testing Herbicide Combinations. Gary A. Lee 11
2. Herbicide Mixtures—Extension Viewpoint. Stanley Heathman 14
3. Herbicide Mixtures—Industry's Views. Kenneth W. Dunster 15

Wednesday Morning, March 20, 1968

RESEARCH SECTION

Chairman: Dick Fosse

Siduron, a Selective Herbicide to Aid in the Establishment of Perennial Grasses. James A. Young, Raymond A. Evans, and Richard E. Eckert, Jr. 17

Effects of Nopalmate on Pricklypear (*Opuntia* spp.) and Other Vegetation on the Rio Grande Plains. P. E. Buckley, J. D. Dodd, and W. H. Culver 17

The Influence of Dormant Brush Sprays in Western Oregon on Forest Succession. Tharon O'Dell and Michael Newton 19

Some Herbicide—Carrier Interrelationships in the Control of Velvet Mesquite. Herbert M. Hull and Samuel J. Shellhorn 19

Hatchett-Injection of Phenoxys, Picloram and Arsenicals for Control of Some Hardwoods and Conifers. Michael Newton and Harvey A. Holt.... 20

Effects of Tillage Operations on Dispersion of Downy Brome Caryopses in the Soil. James A. Young, Raymond A. Evans, and Richard E. Eckert, Jr. 22

Page

Chemical Treatment of Freshly Cut Big Leaf Maple (*Acer macrophyllum Pursh.*) Stumps to Prevent Sprouting. J. M. Finnis 22

Crop Response and Tolerance to Picloram Residue in Soil. H. P. Alley and G. A. Lee 23

Response of Cotton Seedlings to Combinations of Soil-Incorporated Systemic Insecticides and Trifluralin. H. Fred Arle 25

Suppression of Annual Grasses on Roadsides, Levees, Railroads and Other Non-Crop Areas With Dowpon. L. E. Warren 25

Evaluation of Complementary Preplant and Post-emergence Treatments for Weed Control in Sugar Beets. G. A. Lee and H. P. Alley 26

Wednesday Afternoon, March 20, 1968
RESEARCH SECTION
Chairman: H. Fred Arle

Equipment for Field Plot Work. D. W. Swan and T. J. Muzik 28

Amitrole in Irrigation Water After Ditchbank Treatment. R. J. Demnt and P. A. Frank — See page 95 of Research Progress Report

Page

Behavior, Reactions, and Effects of Acrolein and Copper Sulfate in Irrigation Water. V. F. Bruns, J. L. Nelson, and C. C. Coutant — See pages 94-95 of Research Progress Report

Control of Annual and Perennial Broadleaved Weeds on Noncrop Areas With a Mixture of Tordon and 2,4-D Herbicides. L. E. Warren........ 28

"Weeds" Need New Definition. Lambert C. Erickson 31

Herbicide Residues in Blacktail Deer From Forests Treated With 2,4,5-T and Atrazine. Michael Newton and Logan A. Norris 32

Thursday Morning, March 21, 1968
GENERAL SESSION

Industry Panel:
What's New in Herbicides? .... *
Chairman: D. L. Burgoyne

Minutes of Business Meeting 34

Financial Report 38

Financial Committee Audit 38

Registration List 40

---

*No Paper

PRESIDENTIAL ADDRESS

S. W. Strew[1]

"In the course of five years, a diligent botany professor at an Eastern State College pulled and counted 37,639 weeds from a plot of ground only ten feet square."

Since this research was reported, considerable progress has been made in the weed research programs throughout the country. The number of compounds researched, produced and marketed has grown rapidly to the point where we now have one or more products that can effectively control a specific weed in any given circumstance. Why then, the proliferation of screening programs?

The chemical industry is now faced with the moment of truth—

Research costs continue to skyrocket
Marketing costs constantly increase
Risk of success—extremely hazardous

The increasing costs of marketing compound represents an economic factor of concern—if the chemical is effective, can the grower afford it? Will a competitor enter the market with a more effective and cheaper compound before we can realize a profit on our investment? These aspects of our current dilemma are not new — they have always been a part of industry.

The risk of success — unnerving! Several years ago we were bombarded by such protagonists of the evils of chemicals as Rachel Carson — now we are faced with a far more potent group — the consumers. Ross Fitzsimmons recently spoke to the chemical industry on the subject "Shall Technology or Consumerism Prevail". He pointed out the farmer has virtually lost his political voice while the so-called protectors of the consumer are being proclaimed the White Knights in the legislative halls. The consumer of agricultural products must be protected not only by government but by industry—he is industry's ultimate consumer. However, it would hardly seem wise to see him legislated into starvation.

Starvation? Insecticides poison food — fertilizers pollute our waters — herbicides poison our land. The public is being constantly exposed to these blatant falsehoods. There is no way under today's conditions for any agricultural group to effectively combat this propaganda as long as our legislators are unaware or unwilling to recognize that without the intelligent use of insecticides, fertilizers, and herbicides — starvation!

What can we do now? It is important that every segment of agriculture re-evaluate its position — research, industry, production. Due to disappearing profits, the grower has become acutely aware of some of the deficiencies. Just recently a regional group of farmers proposed the establishment of an independent research organization to give them answers *Now* for the control of a pest that could wipe out a crop. They accused research of taking too long to come up with recommendations and industry of failing to develop new and less expensive chemicals. These accusations may be valid, but the growers must take a more aggressive approach to legislation that affects them either directly or indirectly — aid research in securing funds for problems of immediate concern — support industry in their fight against unwarranted restrictive legislation.

The Western Society of Weed Science may well find itself a bell wether in the cooperative approach to immediate problems by research, industry, and production. This organization was conceived as a forum for all weed problems of the Western States. Recognizing the value and strength of State conferences, this Society played a major role in coordinating problem priorities, exchange of information and the necessity and character of basic research.

Not too long ago, we found ourselves drifting away from the original concepts — splitting ourselves into two groups, a conference and a research group. Based on the advice of many and the hard work on the part of a few, a gradual reorganization began to take place. We believe that now we have a solidly knit group with an organizational set-up to accomplish with unity and efficiency any goal that we set for ourselves.

Drawing on the comments and suggestions of many, we would like to outline a proposed course of action. First, establish ourselves as a WORKSHOP for the handling of current problems whether in research, regulation, industry, extension, education or any other phase of activity relating to weed science.

Research Section could undertake a number of projects of immediate concern or long range projection through a series of task forces. The effectiveness of relatively small groups in attacking problems is well known. The best qualified personnel for a field of activity could be readily available for example for a coordinated handling of an eradication program.

Industry Section would be responsible for supplying up-to-date information to all research personnel in the region to assure uniformity of tests and methods of reporting.

Regulatory officials presently have an excellent cooperative program in most states. As regulations seemingly multiply geometrically, their contributions to the WORKSHOP could be invaluable in attempting to secure uniformity of necessary regulation.

Education Section could be valuable in implementing our program to secure weed scientists we so desperately need, not only for the future, but right now. Their activity might include the editing and dissemination of WORKSHOP reports. The curricula of various

[1]Colloidal Products Corporation, Sausalito, California.

institutions could be studied and proposals made for more effective courses pertinent to weed science.

Extension Specialists are finding the going rougher all the time. Some universities allow recommendations to be made only by extension personnel based on that particular state's research and/or in strict accordance with the manufacturer's label. In some cases, extension personnel are regarded as field screening units for research. In many cases, the original concept of Extension has been mislaid. Originally the Extension Specialist was to give the grower the best information and advice available to enable that grower to produce clean, wholesome food, economically in quantity to provide him a profit and to help provide the highest standard of living in the world to the consumer — the ultimate consumer of research, extension, regulation, industry and farmer.

We can visualize a WORKSHOP Task Force for Extension composed of Specialists from states or areas having similar problems becoming a vital necessity in the near future. To illustrate, residue restrictions have caused some chemicals to be taken off the market or used in such small quantities as to be ineffective. One answer to this has been mixtures of two or more chemicals to reduce residue of one or both and in many cases to provide better control. Currently, in most places these mixtures cannot be recommended unless such recommendation appears on both labels. A Tast Force for Extension could conceivably help this situation by appraising their individual Directors of such problems and their advice based on their collective approach to the problem.

CONFERENCE — SOCIETY — WORKSHOP!

The Western States are unique in having strong State Conferences — something that does not exist elsewhere, with a few isolated cases. These Conferences provide their states with a program unique to that state and its crops. The applied approach is ideally suited to this environment.

The national Society provides the more desirable media for publication, according to most authors. True, it would be impossible for every paper to be published that might be submitted, but we suspect if the subject were of interest and the presentation was acceptable — publication would take place.

WORKSHOP — A place for work with Task Force efficiency. An annual WORKSHOP would be held but Task Forces would meet any time a need developed. The annual WORKSHOP would be devoted mainly to Sectional Meetings and their satellite Task Force groups. Part of the program would include the condensed report of each Section to the entire group with the possibility of invitational or selected submitted papers of content consistent with the best interest of the WORKSHOP.

Not the least of the considerations are the travel restrictions being placed on all of us. Meetings of one type or another seem to be increasing and managements are hard pressed to determine who attends what. With as many conferences, societies, and just plain meetin's, an efficient WORKSHOP might conceivably be more acceptable to administrators — that is — a WORKSHOP with specific programs of accomplishment directed by dedicated workers.

I'm sure that the botany professor we spoke of in the beginning made an important research contribution — it is from these small isolated instances we often gain much. However, as times change the demand for service from research, industry, and producer becomes increasingly louder and a more sophisticated program must be developed by us to satisfy this clamor. We believe the cooperative effort of all segments of agriculture NOW is the only ANSWER.

SOME THOUGHTS ON A UNIVERSITY TRAINING PROGRAM IN WEED SCIENCE

Arnold P. Appleby[1]

At meetings of this conference, emphasis has always been placed on research, extension, and regulatory phases of Weed Science. We have never really paid much attention to undergraduate and graduate training programs. It is time this subject received attention and I would like to offer some thoughts on the subject in hopes that other comments and ideas will be forthcoming at future meetings.

I don't need to belabor the point that training programs are vital to our field. Demand for well-trained graduates is very high at the present time. There are few companies without at least one vacancy and, in some cases, entire programs are restricted or curtailed because manpower is not available. Companies have resorted to hiring valuable men away from other companies. Employers are forced to pay higher salaries to new employees than they are paying old employees, leading to morale problems among the staff.

Simply more people in the field is not enough. These new graduates must be better trained than ever before. They should have a strong background in the fundamentals so that they can understand new concepts and adjust to changing times. But they also need some practical experience *during* their training program to help make the classroom experiences more meaningful. I know of several cases in which new Ph.D's in Agronomy or Horticulture have been hired with the primary responsibility of evaluating research conducted by others. Yet these new Ph.D's have never had any experience in conducting field experiments. To me that is as ridiculous as hiring a new Ph.D. in Biochemistry who has never had any experience in a Biochemistry lab. In either case,

[1]Oregon State University, Corvallis, Oregon.

it is not simply learning techniques that is important. It is *seeing* and *working with* concepts and principles that are studied in the classroom which makes the difference between a weed scientist who *thinks* and one who just *remembers.*

I would like to briefly discuss the graduate training program in the Farm Crops Department, Oregon State University, not with the arrogance that we think everything we do is right. We know we have room for improvement. But some phases of our program seem to have been successful and if I can pass along an idea or two to someone else working in this area, my purpose will have been accomplished.

We try to provide a broad range of research experiences to all of our graduate students. All graduate students are expected to have experience in laboratory, greenhouse, and field work experimentation. Each graduate student in weed control is given responsibility for some phase of our research program. For example, a student may be given responsibility for the corn project. He helps with the planning, makes arrangements for the plot area and field preparation, establishes the trial, evaluates the results, and writes the report. Of course all of this is conducted with help and supervision, the extent of which depends on the experience and capabilities of the student. This project work is a requirement for a degree. It is not a formal requirement and it is not written in any catalog. It is not a part of the thesis and it is not given for credit. It is simply part of our training program. We have found it very effective in helping to teach our students the fundamentals of weed science.

Seminars are held whenever possible. These can be formal presentations of data or can be informal discussion on any topic of interest. We strongly encourage discussion and debate among the group. Reading a paragraph in a book can sometimes be dull but defending a point of view against critical colleagues can help eliminate misconceptions and help a student to understand those facts that he has gathered and stored away.

Industry work-study programs have been helpful to certain students. This is accomplished by a chemical company supplying an assistantship to a graduate student. The student studies full time during the fall and winter quarters; then works full time for the company during the spring and summer quarters. Thus the student gains experience in agriculture and weed control, he learns a great deal about how a company operates, and he receives financial help for his schooling. The chemical company receives good help during the peak work period of the year at a cost less than half of what it would cost to hire a full time person. They also gain satisfaction in knowing that they have helped in providing the field of agriculture chemicals with another potential employee.

Programs are being planned to provide students with the opportunity of working outside the state of Oregon during their training program. We have hopes of arranging a cooperative program with the University of Hawaii. Under this program, students may spend a term in Hawaii taking short courses in tropical agriculture and studying weed control under tropical conditions. Also, plans are being made to provide opportunities for advanced graduate students to complete their thesis research while working in various countries throughout the world. This will be made possible by an AID/Oregon State University contract for weed control in less developed countries.

To summarize our philosophy, we believe in a strong program of study with emphasis on fundamentals but at the same time we believe the old adage that "a student's schooling should not interfere with his education." It is the responsibility of the universities to help provide these educational opportunities in every way possible.

Now let's talk about industry's responsibilities. There is no question that industry has benefited greatly from these training programs. What can the agri-chemical business do to help? That is a difficult question and there may be no answers or there may be many. Here are a few ideas:

More could be done in stimulating bright young fellows to become interested in agriculture and in weed science in particular. Help can be given *during* the training of these people by making persons available to give seminars and lectures to students or by making staff and facilities available to help students with short-term projects that cannot be easily carried out at the university. In general, the chemical industry has been very helpful in these aspects already.

One of our most critical problems in training programs, at least at Oregon State University, is lack of sufficient staff to work with graduate students. We regularly turn away many more students than we accept each year. Our legislature, like other legislatures, is bombarded with many justifiable requests for funds. They are also warned not to raise taxes nor to spend more money. I am not optimistic about receiving funds from our state legislature to add more staff for training weed control students. I don't know the solution to this problem but I think that the representatives from industry should give it some thought. One possibility has occurred to me. You can decide if it is practical or desirable. If each major company actively engaged in the herbicide business would put funds into a pool, these funds could be used to support one or more staff members who would spend full time advising graduate students in weed control. These funds could also be used to support some of the students and to cover costs of supplies. This could be set up in a number of ways. A foundation or commission could act as an advisory board. This board could help recruit and to screen candidates for these fellowships or assistantships. Of course, there would need to be some permanence about this arrangement. Any new staff member would want some assurance that the position would not be closed after one year. This is a new role for industry. Companies have not been involved in these activities in the past. My opinion is that the companies are going to have to get involved if the manpower problem is to be solved.

COST — EFFECT SYNDROMES IN WEED RESEARCH

Lambert C. Erickson[1]

The first question you will ask is, where did the speaker get the word "syndrome" and what does it have to do with weed research? One definition, as used in psychology, is simply "concurrence", or "concurrent interrelated thoughts". In medicine "syndrome" is defined as "a group of concurrent symptoms characterizing a disease".

Today we have the obvious social diseases recognized as: the Hippie syndrome; the Flower Children syndrome, the Beatnick syndrome, the White and Black Power syndrome, and neither last nor least, we have the "quote" the Super-Science Syndrome. A super science disease? A social disease among scientists? How impossible, how repulsive, to even suggest a social disease among ourselves — biological scientists.

What are the concurrent symptoms within the super science syndrome? I am not going to categorize or identify, enumerate, or elucidate on them. Instead, I will leave it to you to identify and characterize them as we review the weed problem and the field of weed science.

When we speak of the syndrome, we, of course, speak of a sub-culture. And so within every group, or industry or profession, we have recognizable syndromes. Agriculture versus mining, medicine versus theology, the radical and inconsistent social sciences versus the conservative agricultural sciences. I think you are beginning to get the point. Every group or subgroup has its own peculiarities, diseases, syndromes.

The assembled group here today we might best classify broadly as biological scientists. But within this group we have numerous sub-groups and sub-cultures each with their special syndromes. The Hippies have attracted great attention and concern because the majority of people are convinced that they represent a destructive, decadent culture.

As knowledgeable persons, we must then be sensitive of the minimal or less productive aspects within groups, professions and disciplines that are on the whole highly productive. To do a proper job of such analyses we must ask not just, "What is it? What is this?" but we must ask "*What goes on here*?" Sometimes man has asked himself this question and arrived at some highly erroneous answers. Sigmund Freud, or at least too many of his successors, came up with the conclusion that the only motivating force in man was sex! Dr. Spaak and too many of his successors came up with the conclusion that children must not be disciplined! By combining these two "profound" conclusions you synthesize a system that equates and relegates man to a non-disciplined sexual entity. Somehow, as I observe all of us here today and listen to the performance, I see symptoms that prove that both of the preceding conclusions were vast fallacies. But we still have so called intellectuals subscribing to the former.

At this point you could very well ask "What do Freud and Spaak have to do with weed research?" Well - - - -

One hundred and six years ago the Morrell Act was passed by the United States Congress to provide for "the teaching of branches of learning related to agriculture and the Mechanic Arts." This, of course, established the College of Agriculture. Fifty years later our forefathers recognized that a vacuum existed between the researcher and the producer. This resulted in the passage of the Smith-Lever Act, establishing the Agricultural Extension Service.

What were the results? You know them; I am merely reiterating them for you. The World Encyclopedia says, "The results have been priceless." This system, this syndrome of applied science — with all its faults — has effected results that have been the envy of the world for three quarters of a century.

The result was production. But what were the spin-offs, the residues?

1. At long last a Nation could produce enough food to feed itself.
2. It created wealth both material and mental whereby industry could develop and come into its own.
3. It provided leisure time whereby man could formulate and test his ingenuity.
4. It released trained manpower to man the industrial giant.
5. It provided time for recreation and, consequently, the vast recreation industry.
6. It created our affluent society.

But somehow in the minds of some men this is wrong. We must totally cease in our applied research efforts and do something that is called "Basic Research". The term has many meanings — one definition is that its "sumthin which does nothin for nobody". Personally I don't think that there is such a thing as basic research, and the sooner we rid ourselves of the term, the better.

[1]Professor of Agronomy and Weed Scientist, University of Idaho, Moscow, Idaho.

Imagine someone digging a hole, watching a test tube or putting digets into a computer for no reason whatever.

There has developed in recent years syndromes within agricultural research groups that they no longer have the obligation to communicate to and with extension aspects. Perhaps that is basic research: "that research which no one ever learns about."

The National Science Foundation estimated that 24 billion dollars were spent for research in 1967. I humorously note that NSF statement that "only 9 to 12% of research funds is spent for basic research." Yet, most everybody I know tells me that *he* is doing basic research. Somewhere there is a credibility gap!

Let's turn to problems nearer to home. There is a public document titled: *A National Program of Research for Agriculture*. This is dated October 1966. Hundreds of persons worked on compiling this document. To a very high degree it dictates what kind of research we will do and where the inputs will be for the next 10 years.

I want to call your attention to just these few facts. Whatever I say hereafter does not mean that I am opposed to any other discipline, or the increase allocated to them, maybe they are still too small. The significant fact that we must be aware of is the *WEEDS,* weed science, weed technology, weed control, *(WEEDS period) is getting the short end of the stick.*

I know of no one anywhere who is knowledgeable of our natural resources who does not agree that weeds comprise the highest cost factor in our greatest national industry — agriculture. And agriculture means food. And food is the first essential of life.

How, then, could the following come about? How could such future national planning reach such results. For purposes of illustration:

We now have about 875 entomologists. By 1977 the plan requests 1530, an increase of 655 Science Man Years, or 74%.

We now have about 1150 plant pathologists. By 1977 the plan requests 1850 plant pathologists or an increase of 700 SMY or 63%.

We now have 325 weed scientists. By 1977 the plan requests 550 weed scientists or an increase of 225 SMY or an increase of 70%. If forecasts are reliable there will be more herbicides sold in 1977 than all other pesticides combined.

It all amounts to this. If we are going to meet our future obligations we must work on weeds under some other disciplinary title. Lets look around. What terms are popular?

Pollution is popular! Conservation is popular! I am convinced that weeds — weed science — weedology, is a victim of phonetics, euphonisms, and semantics. We do not get the word's significance portrayed in the public's mind.

Pollution! We of course are concerned about pollution. We are concerned about pollution and so is everybody else. The possibility prevails that in the future our total 350 million agricultural acres may be intermittantly or annually treated with herbicides. Then what shall we turn to to meet the obvious obligations before us?

We now have 70 SMY involved in pollution. By 1977 the plan suggests 430 SMY devoted to pollution. The question then is, which would you rather be:

Professor of Weeds, or

Professor of Pollution. Or would we prefer to call ourselves pollutionists?

We'll talk about that tomorrow!

TRAINING THE PESTICIDE INSPECTOR

Everett W. Spackman[1]

First all, perhaps we should discuss what some of the duties are of the pesticide inspector: he is the "field" contact man for the enforcing agency, which in my case happens to be the Wyoming Department of Agriculture. His responsibilities are to check every known pesticide dealer to determine whether the products being distributed or offered for sale are properly registered in the State and to also properly collect samples for chemical analysis. The inspector carries a dealer handbook which lists all known persons selling pesticides..

In training the pesticide inspector, we first assign him to work with an experienced inspector. We supply him with a copy of all the necessary equipment and other supplies. We have him read and study the law, and after he works with it for a while he is requested to make a written outline of the law. This helps one dig things out of the law that may be over-looked by just reading the legal language. He must be able to determine whether the product is subject to the pesticide law. He must continually add to his knowledge.

An inspector must have a pleasant personality, good judgment, initiative, integrity, firmness, willingness to work, tact in dealing with people, as well as a lot of ability and tact in being "snoopy."

We in Wyoming furnish each inspector with a current list of pesticides registered by each company. As each registration is processed, the inspector is furnished with a copy. In doing this the inspector is kept up to

[1]Wyoming Department of Agriculture, Cheyenne, Wyoming.

date on products registered. He checks these products in the place of business against his listing on a company basis. If the product is not registered, then a NOTICE OF VIOLATION is issued. The dealer is subject to prosecution if he does sell it. The inspector checks the labels of such products as dieldrin and heptachlor to see whether there are any instructions or directions for use which are not approved — for example, on alfalfa. Minor violations are called to the attention of the dealers so as to be a helpful hint and not a criminal offense. He should not try to impress the public with authority without sufficient knowledge to support his actions; if he does, it will be more detrimental than helpful. He must be able to discharge responsibilities fairly and firmly. He must remember as a public servant that the law is for the public's protection. He is a public relations ambassador, not just a public relations man; public relations is continuous. Education and cooperation are the backbone of enforcement work.

Samples are collected by purchasing small (quart or pint) containers. Five-gallon containers and larger are sampled by collecting 4 oz. of the product. Unless the label directions call for shaking or agitation, none is given. The inspector is instructed to use care in completing each form accurately, because if he does not then it may be a worthless sample.

At our staff meetings, about twice each year, the procedures of an inspection are reviewed and the inspector has an opportunity to ask questions and express his ideas and suggestions. We also prepare little exams to keep the individual alert on some points of inspection and law.

Things To Remember

1. Personal appearance should be such as not to detract from your position.
2. Greet people properly when entering their establishment.
3. Make your presence known to the owner or manager of the business.
4. Request assistance of dealers in your inspection work when it is most convenient.
5. Waste no time visiting at length with employees.
6. Have an identification card to prove authority to sample pesticides, inspect records, etc.
7. Thank people who freely cooperate and assist the work.
8. Answer questions on the Pesticide Law raised by the dealer or find the answer for them as soon as possible.
9. Comply as soon as possible with all requests for special assistance on urgent problems received from dealers directly or through the office.
10. Keep informed on new developments in the pesticide industry and know the reasons for new regulations.
11. Seek advice from better informed persons.
12. Follow up on actions requested of dealers to see that they are completed.
13. Comply to the letter with instructions received from your supervisor and suggest means of improvement in your work.
14. Conduct yourself properly in your off-duty hours so as not to reflect upon your position.

OREGON PESTICIDE APPLICATION LAW

W. H. Kosesan[1]

The 1967 Session of the Oregon Legislature passed a revised bill covering application of pesticides in the state. The new law became effective January 1, 1968.

Many persons and groups were involved in preparation of the bill and in getting it approved by the legislature. The Assistant Attorney General assigned to our Department, our Chief Chemist, our Chemical Applicator Supervisor, staff members from Oregon State University, and pesticide applicators themselves through an advisory committee and their industry associations all contributed to preparation and passage of the bill.

Oregon's new law provides for the licensing of all persons applying or who are engaged in the business of applying pesticides in the state. It defines pesticide operator, pesticide applicator and pesticide trainee. Pesticide operator is a person or persons who own or operate a pesticide application business. Pesticide applicator is a person who is employed by an operator and actually applies or supervises the application of pesticides. A pesticide trainee is a person who is employed by a pesticide operator and is going through a training period to qualify as a pesticide applicator. "Special applicator" and "Special trainee" are two additional classifications provided for under the new law and are those persons who are employees of the State of Oregon, other governmental agencies, counties, school districts, irrigation districts, public utilities, etc, qualified to apply pesticides or who are going through a training period.

Regulations promulgated under the law authorize licensing based upon the type or types of pesticides applied or business engaged in. Four separate categories were established upon which licensing is based: (1) Herbicide, (2) Insecticide, fungicide, (3) Structural Pest and Rodenticide, and (4) Fumigation.

[1]Oregon Department of Agriculture, Salem, Oregon.

Certain exemptions from licensing are permitted. These include: (1) manufacturers of pesticides engaged in research work, (2) state and federal agencies, except employees must obtain a Special Applicator or Special Trainee license, (3) farmers and landowners applying pesticides on their own or leased land or crops, (4) farmers who apply pesticides occasionally for their neighbor provided the pesticides are furnished by the neighbor, (5) landscape gardners provided their pesticides are applied with hand-operated equipment and such pesticides are not on the list of highly-toxic materials, (6) railroads provided non-volatile chemicals and no power equipment are used in the applications, (7) counties, cities, and other public agencies, except employees must obtain a "Special" license, and (8) chemical and equipment salesmen.

Persons doing structural pest control work are now required to be licensed.

The new law requires each applicant for an applicator's license to be examined and to meet certain minimum qualifications of age, experience, or education before a license is issued. It also permits persons who were actively working as licensed pesticide applicators during four months of 1967 to be issued an applicators license without examination.

The new law requires all operators or owners of pesticide application businesses to provide evidence of insurance before a license will be issued. The insurance must be in amounts not less than $25,000 each for bodily injury and property damage to one person and not less than $50,000 to more than one person or occurrence or in the aggregate during the license period. Deductible clauses in amounts not to exceed $1,000 are permitted.

All operators also are required to keep records of their applications. The records must include the date of each application, person for whom the pesticide was applied, the pesticide used and the concentration, rate of application, the crop treated, location of the field treated, equipment used, and the name of the applicator.

We have encountered a few problems during this first year under the new law. Structural pest operators had some difficulty in the start in getting insurance to cover their operations. We had some difficulties in informing people of the new law and requirements and in scheduling and holding training sessions.

Our problems are slowly being ironed out. Oregon's new law appears workable and we hope will result in upgrading the knowledge and standards of person applying pesticides in our state.

MONTANA COUNTY WEED DISTRICTS

William O. Gibson[1]

The Montana Weed Law authorized the creation of a County Weed Control District, provides the legal means of management and sets a broad policy of operation. It states specific provisions to enable the Weed Districts to operate independently from other divisions of the County Government that must operate under the limitations of the State Budget Law.

These provisions would give the impression that most problems that would arise related to organizing and operating a weed district in an efficient and business-like manner are sufficiently covered. Financing the establishment of a county-wide weed district requires considerable investments in machinery and equipment and the law makes no provision for this large initial investment. It doesn't provide sufficient funds to cover necessary operating expenses in many counties even if they were fully equipped and organized. After working four years with such a weed district and conferring with other Montana counties attempting to operate under both the Montana Budget Law and the Montana Weed Law; and the Montana Weed Control Association, we have come to the conclusion that we must have a Universal Weed Law. The Montana Budget Law does not allow for unforseen needs or the reuse of funds that are returned to the weed district within the fiscal year. The Montana Weed Law does allow the reuse of funds but is restrictive in the amount of funds available.

The problems are many and vary from county to county with the result being counties with no organized Weed District and weed control, to those with a token program and on to a very few with a meaningful, progressive, effective weed district and weed control program. We in Montana like most western states have vast, sparsely populated areas. Noxious weeds grow profusely and uncontrolled along rivers and spread from headwaters to their merging with larger streams in the watersheds. These weeds cover areas where the rough terrain makes control extremely expensive and cost per acre of control is far more than the land value would be with no weed infestation. We need to progress with weed control now and need a weed law that will insure that it is accomplished.

The Montana Weed Law provides for the legal creation of a County Weed District, but it is left to the counties discretion. The creation of weed control districts state-wide are needed and a new law should make this mandatory under a Control Agency responsible for and with authority to direct the state-wide program of weed control.

Under the present law funds for the operation of a weed district may either come from the County General Fund or a maximum of 2 mills tax levied on property

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within the county. The most usual method is the use of the mill levy set at 2 mills maximum in the Montana Weed Law. Some Counties set the mill tax levy to support the program and operate under the budget law, while still others operate under the weed law. These methods work fairly well in those counties with relative high population and properly valuation. (i.e. 2 mills in one county may equal $50,000.00 while in another only $9,000.00) The county with the high population and property valuation can form a weed district and advance over a period of time to provide the services needed. Now consider forming a weed district with $9,000.00 annually to purchase machinery, chemicals for roads and road right-of-ways, pay machinery operators, clerical, office and transportation mileage expenses, awareness and educational program, Weed District Supervisors and the expense of a weed board. The counties with low population and valuation are in a terrible dilemma. They can't afford not to have an efficient weed district but it is impossible because they don't have the funds and cannot get funds under the present Weed Law. A few counties have tried contracting the weed control work to buy as much weed control as possible with their limited funds, but this in most cases has amounted to a token effort. It has not been satisfactory because the contractors were usually farmers and the road spraying contract was accomplished after all of his busy season farm work was done. It was proven to be too late and too little. They need assistance. A universal weed law for Montana is a real need. The law must provide the means as well as the requirement for county or area weed districts throughout the state.

Under the Montana Law there is no provision to require accurate, meaningful records for a weed district operation, but simply a record of where the money was spent. The law should include placing responsibility for establishing records of objectives clearly stated and policy set to accomplish the goals toward these objectives. Objectives should include an accurate weed survey of the state to enable a weed control program state-wide coordinated by a well qualified and properly staffed state authority. An educational and awareness program on weed control should be part of the state-wide weed program.

The educational program should cover the phases of organization and operation of the Weed Control Districts for employees, and supervisors to insure efficient and completely safe operation. It should also include an intensive educational program for the public in order to gain support and cooperation with a state official having authority over a state-wide weed control program. Purchasing of machinery, supplies and chemical could be done by volume giving a cost advantage. Full time personnel could be employed and justified with a well planned program.

Under present conditions many counties cannot retain full time employees and may not have a single man on the job of weed control that was there last season. Most counties cannot afford the expense of just one full-time employee as weed supervisor who is qualified for his responsibilities under the law. I know of no county who has been able to find one on a seasonal basis.

Counties become entangled in complaints of damage from chemical sprays because there is no accurate records of the operation. With our present condition of inefficiency and poor or no meaningful records, we can expect little or no cooperation from other large landholders such as the railroads, state and federal agencies. With 56 counties in the State we could expect possibly five or more agreements between each county and other large landholders within the county. If we assume five agreements per county and all counties within the state participated we would necessarily have two hundred eighty agreements under the present weed law. Now compare one State Weed Control Agency administration agreement necessitating ten agreements with other large landholders and the savings in man hours to both weed control districts and the large landholders. We are not presently getting satisfactory weed control on vast areas within the state. This condition gives the individual landowner a defeatist attitude especially when so many individual landowners are bordered on one or more sides by weed infested public and semi-public lands. We aren't putting enough dollars in weed control and we aren't getting nearly enough weed control for the dollars we do spend.

At the present time Montana has 28 of her 56 counties with active weed control districts. Of these 28 with active weed control districts, only 12 are county-wide and of these 12 there are 12 that need to be improved beyond the necessary limitations under our present Montana Weed Law.

At the present time my home county, Gallatin County Montana, County Seat, Bozeman, we are completely surrounded by counties with either no weed control program or else a very ineffective program. It is not altogether their fault, because most are doing the best they know how. They are simply hog-tied by their dilemma.

I believe Gallatin County and several other counties in the State of Montana will make good progress in the next few years on weed control. There really isn't any reason why we shouldn't because we are the fortunate few who have the taxable value of property in our counties to support such a program under the present Weed Law.

I predict that we in Montana are not going to have a state-wide, meaningful, efficient weed control program until our legislature enacts a uniform Weed Law to correct the shortcomings of our present Weed Law. I believe that we all should take a hard look at our present weed control programs and work toward the adoption of the Universal Weed Law.

THIN LAYER CHROMATOGRAPHY OF ARTEMESIA SPP.

J. R. Brunner[1]

(*Abstract*) Thin-layer chromatography can be used as a chemical means of plant identification by isolating chemical compounds (poly-phenols). The various compounds produce various colors. The colors adjacent to the chlorophyll spot identify the plant.

Color slides of the chromatograms, taken under ultra-violet light, illustrate that *Artemesia tridentata* subsp *tridentata* f. *parishii* is not closely related to ARTR "blackbark" or to ARTR "whitebark", but that blackbark and whitebark are closely related. ARTRTR parishii has two different physical forms, shown by slides of the plants and of the chromatograms.

The very different chromatograms of *A. arbuscula* and *A. nova* were shown. A hybred "dwarf tripartita", shows primary colors of both *A. nova* and *A. arbuscula.* It may be possible to show which sagebrush species are primary genetic material and which are hybreds thru the colors of a chromatogram. The primary colors of *A. tridentata* subsp. *tridentata* were illustrated. Chromatograms of *A. tripartita,* made some 6 months apart, show that this method is reproducible.

ARTR "delicious", a highly palatable sagebrush, was illustrated.

Persons interested in methodology are invited to contact the author.

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VAPOR PRESSURE OF LOW-VOLATILE ESTERS OF 2,4-D

G. W. Flint[1], **J. J. Alexander**[1], **O. P. Funderburk**[2]

(*Abstract*) The vapor pressures of the four most common commercial low-volatile esters and a reference high-volatile ester of 2,4-D were determined by the new gas-liquid chromatographic method of Jensen and Schall. The order of increasing volatility and the vapor pressures in mm. of Hg at 187 C are as follows: iso-octyl - 2.7; 2-ethyl hexyl - 3.0; butoxy ethanol - 3.9; propylene glycol butyl ether - 3.9; and the reference, isopropyl - 16.7. Extrapolations to 25 C confirm this ranking at working temperatures. The AOAC biological technique, Method 4.149, also shows that the commercial 2,4-D esters derived from long-chain hydrocarbon alcohols are in the same volatility range as the commercial esters containing an ether linkage.

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SOIL MOISTURE AND PRIOR HERBICIDE TREATMENTS AS FACTORS INFLUENCING THE ACTIVITY OF DIPHENAMID

T. Tisdell and F. M. Ashton[1]

(*Abstract*) The erratic performance of diphenamid in tomato fields during the last two seasons led to the initiation of this investigation. Kanota variety oats were used to measure diphenamid activity in all greenhouse trials. No effect due to soil moisture at the time of incorporation was found. When sub-irrigation was used, soil incorporation increased the activity. There was very little difference in activity with or without incorporation, when surface irrigation was employed. The incorporation of the diphenamid into the top 1 inch of soil showed increased activity as compared with surface applications with high irrigation rates. The surface applied diphenamid showed higher activity with low levels of irrigation than with the high irrigation treatments. When diphenamid was applied to soil which had been previously treated with diphenamid, there was no activity or very low activity with the second application. This was also observed with field soil that was treated with diphenamid 5 months prior to being brought into the greenhouse and re-treated with diphenamid. Soil that had been treated with diphenamid, and showed no activity from a second diphenamid application, was steam sterilized. When this soil was re-treated, the normal response to diphenamid was observed. This indicates that the treatment of a soil with diphenamid results in the formation of a heat labile factor capable of causing the rapid destruction of a second diphenamid application. Further research should show whether or not this occurs under field conditions, and if so, how important a consideration it is in tomato weed control.

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PHYSIOLOGICAL RESPONSE OF DOUGLAS-FIR TO ATRAZINE IN SAND CULTURE AND CLAY LOAM SOIL

C. A. Peterson and Michael Newton[1]

(*Abstract*) A two-part study was undertaken to determine some of the physiological effects atrazine has on Douglas-fir seedlings, as measured by photosynthesis and respiration, and to separate, in field plots, the biochemical effect of the herbicide from environmental changes caused by reduced vegetative competition.

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Seedlings grown in washed quartz sand were treated with atrazine at rates of ¼ and ½ pound per acre when 90 days old. Photosynthesis was measured under saturated light conditions; respiration was determined in the dark.

Douglas-fir does not appear to be biochemically resistant to atrazine. Initial screening rates over ½ pound per acre were lethal to seedlings grown in sand. Lower rates depressed the photosynthetic rate, in proportion to concentration, with ½ pound per acre reducing photosynthesis by 65 per cent after seven days. One fourth pound per acre caused a 25 percent reduction after five days.

Surviving seedlings, however, regained photosynthetic efficiency, and in the case of ¼ pound per acre, eventually exceeded the control. Those treated with ½ pound per acre were just slightly below the control after the same period. Dark respiration was not affected by atrazine.

Seedlings grown in a clayey forest soil were not killed by concentrations of atrazine as high as 8 pounds per acre, suggesting surface activity of the soil may retard the plant's uptake of the chemical.

The field study plots on a clayey forest soil were treated with atrazine at rates of 0, 1 ⅓, and 4 pounds per acre prior to planting two-year-old Douglas-fir. All plots were kept weed free by hoeing. Survival was excellent in all treatments, with no mortality attributable to atrazine. Total dry weight, terminal elongation and number of growing root tips were all adversely affected by atrazine during the first year following treatment. Four pounds per acre, reduced each by about 10 per cent, while the lower rate was less severe. Moreover, a setback of this magnitude is an attractive alternative to the setback caused by competition.

THE DECOMPOSITION OF TRIAZINE HERBICIDES IN SOIL

R. L. Zimdahl and V. H. Freed[1]

(*Abstract*) Experiments were designed to test the hypothesis that the breakdown of some of the more persistent herbicides follows a first order rate law, in the soil. It was assumed that the initial breakdown occurred by a bio-chemical process in the soil and that the rate varied for different groups of compounds, and that the variation could be correlated with molecular structure.

The triazines were selected as one group of persistent herbicides. The rate of breakdown of atrazine, simazine, ametryne and atratone was measured in a silt loam soil, at 15 and 30 degrees centigrade. The rate constants obtained followed a consistent pattern of variation with temperature. The Arrehenius equation was applied to the data and the activation energies obtained showed substantial differences, supporting the hypothesis of the involvment of bond energies. The premise for this hypothesis was that the energy residing in the bond at the point of attack varied and therefore more or less energy would be required to initiate the reaction. The activation energies for these triazines do differ. It is thus postulated that the mechanism of degradation is not through dealkylation but rather, via attack at the two position of the triazine ring. This postulate is supported by the relation between the energy of activation and the bond energy at the two position.

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CHARCOAL, A MEANS OF PROTECTING CROPS IN OREGON

R. G. Brenchley[1]

(*Abstract*) Research was conducted in the greenhouse to evaluate three brands of activated charcoal and one source of non-activated charcoal. Atrazine at rates of 3 and 6 lbs. active/A was applied to soils containing 200, 400, and 600 pounds of activated charcoal per acre and 400, 800, and 1600 pounds of non-activated charcoal per acre. The harvested dry weight of oat plants indicated that pound for pound, Aqua Nuchar A was slightly more active in adsorbing atrazine than Atlas Dacro S51 which was two times more effective than Atlas Darco DM which, in turn, was about three times more effective than non-activated charcoal. Cost-wise it appears that non-activated charcoal would be most preferred.

Three persistent herbicides (atrazine, bromacil, and diuron) were applied to plots at rates of 1.6 and 4.8 lbs. active/A every 15 days starting August 15, 1966 and continuing through March 15, 1967. On June 2, 1967 200 lbs./A of charcoal (Aqua Nuchar A) was applied to one-half of each plot. Following charcoal application the entire plot was rototilled to a depth of four inches. Oats were then drilled across both the charcoal-treated and untreated areas. Evaluation of oat growth indicated that 200 pounds of charcoal was sufficient to overcome 1.6 lbs. of atrazine residue. From 10-60% injury was observed on oats seeded in plot containing 4.8 lbs./A atrazine + 200 pounds charcoal, depending on when atrazine was applied. Ten to eighty percent injury was observed on oats in plots containing 1.6 lb./A bromacil + 200 lbs./A charcoal, again depending on when the herbicide was applied. Approximately 20% injury was observed on oats containing 4.8 lbs./A diuron + 200

[1]Oregon State University, Corvallis, Oregon.

pounds charcoal. The injury ratings on oat plants where no charcoal was added are as follows: 1.6 lb./A atrazine, 45%; 4.8 lbs./A atrazine, 97%; 1.6 lb./A bromacil, 100%; and 4.8 lbs./A diuron, 72%.

Sugar beets were seeded with 190 lbs./A of charcoal applied in the furrow over the seed compared with a one-inch band of charcoal applied on the surface directly over the seed. Pre-emergence herbicides (pyrazon, 6.0 and 12 lbs./A; R-11913, 3 and 6 lbs./A; bromacil, 1.5 and 3.0 lbs./A; and propachlor, 4 and 8 lbs./A) were applied the day after seeding. Results of visual injury ratings and plant count indicates that there was little preference between the two methods of applying the charcoal. Charcoal was extremely effective in reducing R-11913 injury to sugar beets. Charcoal also reduced injury from the 12 pound rate of pyrazon and 8 pound rate of propachlor. Bromacil at 1.5 lb./A was much too toxic to beets but charcoal deactivation was noted. Weed counts indicated that weed control within the row with activated charcoal was just as good as that found between the rows where no charcoal was applied.

RESPONSIBILITIES OF RESEARCH IN TESTING HERBICIDE COMBINATIONS

Gary A. Lee[1]

I am sure that those of you who are engaged in research dealing with phytotoxic chemicals are presently working or have worked with herbicide combinations. The subject of herbicide mixtures has been discussed at national, regional and state weed meetings which makes the task of adding any new information a difficult one. Therefore, I would like to deviate slightly and expound upon the responsibilities of research personnel in testing herbicide combinations. Although I represent the university facet of research, other agencies such as USDA, ARS, industry and private research institutes share in the responsibility of obtaining basic and applied information in this area which is of paramount importance to chemical weed control.

The establishment of parameters for use and determination of limitations of herbicide combinations should be of utmost concern. People involved in research must consider several factors when evaluating herbicide mixtures.

(A.) Survey of The Weed Complex

Knowing the target species which are to be controlled is probably the most basic rule in controlling weeds. Nonetheless, without this knowledge it would be impossible to determine which chemicals might be included in a mixture. We have at our disposal a large arsenal of selective herbicides which are specific toward a single species or group of species of weeds. We must choose the proper chemicals which will fulfill the requirements for commercial control. This problem can be compared to a medical doctor who must know the disease which is causing an illness before he can prescribe the proper drugs for cure.

(B.) Selection of Herbicides For Components of a Mixture.

Many factors must be considered when selecting components for a herbicide combination. First, one must consider the specificity of the herbicieds to be used so that a broad spectrum of control can be obtained. Herbicide mixtures used for weed control in sugar beets clearly illustrates this point. Pyrazon will control many of the broadleafed weeds common to sugar beet fields but the addition of some type of grass killer is required in order to obtain satisfactory control of the total weed population (12). Should kochia (*Kochia scoparia* L. Schrad.) be present in the weed population, yet another herbicide must be added to the mixture to control this species as shown in Table I.

Table 1. Postemergence weed control in sugar beets.

Treatment	Rate lb/A	Percent Control		
		Pigweed	Kochia	Grass
Pyrazon + Dalapon + W.A.	4 + 2 + ½%	93	53	73
Pyrazon + Dalapon + Daxtron + W.A.	3 + 2 + .5 oz. + ½%	99	91	77

Second, mode of action of the herbicides in combination must be compatible. For example, the delatorious effect which could occur should a systemic and contact herbicide be mixed. The specific design of a contact is to rapidly burn or cause injury to tissue, whereas, the systemic must be translocated in the conductive tissue throughout the plant. Crafts (6) reported that Amitrol and MH restricted the normal movement of 2,4-D when applied at a 24-hour interval. Transversely, a herbicide may compliment the other by acting as a "transporting agent" to increase translocation throughout the plant as demonstrated by the autographs of radioactive tagged picloram and 2,4-D alone and in combination (11). Picloram was found throughout the leaves and roots 12 hours after treatment. 2,4-D moved directly from the treated leaves to the roots without lateral movement into the lower leaves. However, the autograph of the plant treated with the combination of picloram plus tagged 2,4-D shows the radioactive material translocated in the same pattern as picloram alone.

Third, if surfactants and other addatives are classified or qualified as phytotoxic chemicals, the inclusion of such a material with a herbicide can justifiably form a mixture. Freed (8) showed that percent of herbicide

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concentration in a plant increased when varying amounts of surfactants was included (Table II).

Table II. Effect of surfactant concentration on absorption of 2,4-D.

Percent surfactant	Percent 2,4-D absorbed
0.0	10.1
0.1	36.5
1.0	38.8

(C.) Methods of Evaluating Efficiency of Herbicide Mixtures.

Basically, three possible responses occur when two or more phytotoxic chemicals are applied together (6). They are (1) an *additive effect* in which the plant injury is *equal to* the sum of the injuries produced by each component used alone, (2) an antagonistic effect in which the plant injury is *less than* the sum of the injuries produced by each component used alone, and (3) a *synergistic effect* in which the plant injury is *greater than* the sum of the injuries produced by each component used alone.

Gowing (9) and Colby (5) have devised mathematical equations by which the type of response of herbicide combinations can be calculated based upon expected toxicities. Herbicides must be applied at the same rates alone and in combination in order for calculations to be made.

A distinct problem arises when one analyzes the methods of obtaining data. When an entomologist applies an insecticide, the end product is either a live or dead insect, in most instances, which makes the task of obtaining toxicity values relatively simple. However, this is not the case with plants. A herbicide may surpress root or stem elongation, reduce dry weight, or kill the species. The difficulty would then appear to be which type of reaction should be measured in order to obtain data that reflects the true phytotoxic response of the herbicide combination.

(D.) Objectives For Use of Herbicide Mixtures.

In discussing the responsibilites for researching herbicide combinations, several objectives should be outlined as directives for consideration.

1. Control a greater spectrum of weeds. This is perhaps the primary objective of applied research. To reiterate briefly, individual herbicides most often exhibit low phytotoxic activity toward either broadleaf or grass weeds. The addition of a grass killer to a selective broadleaf weed herbicide may be complementary in terms of overall weed control. Studies conducted at the University of Wyoming showed that pyrazon alone did not result in the control desired of either broadleaf or grass weeds common to sugar beet fields (1). However, the combination of pyrazon plus Ro-Neet resulted in good control of broadleaf weeds and substantially increased grass control (Table III).

Table III. Preemergence weed control in sugar beets.

Treatment	Rate lb/A	Percent Weed Control Broadleaf	Grass
Pyrazon	3	71.6	36.8
Pyrazon + Ro-Neet	3 + 2	81.0	68.4

2. Potential for reduction in rates of the herbicides required for effective weed control. If the mixture of herbicides results in an additive or synergestic response, it may be possible to reduce the chemical dosage and obtain effective weed control. For example, Alley and co-workers (2) demonstrated that picloram + 2,4,5-TP at 0.37 + 1.5 lb/A eliminated plains larkspur, whereas, the individual components at higher rates gave unsatisfactory control (Table IV).

Table IV. Effect of plicoram and 2,4,5-TP, alone and in combination, on plains larkspur.

Treatment	Rate lb/A	% control of Plains larkspur
Picloram	.125	34.5
Picloram	.25	54.6
2,4,5-TP	2.0	00.0
Picloram + 2,4,5-TP	.25 + 1	92.9
Picloram + 2,4,5-TP	.37 + 1.5	100.0

3. Minimize or eliminate crop injury. Many undesirable plant species and crops may have a very narrow range of tolerance to a herbicide. In such instances, the chemical dosage required for weed control may also result in crop injury. Preliminary investigations conducted by Baldridge (3) showed that sugar beet injury was reduced with the mixture of pyrazon + Ramrod and total weed control was increased (Table V).

Table V. Results of herbicide treatments for weed control in sugar beets.

Treatments	Rate lb/A	Percent beet stand	Percent Weed Control Kochia	Lambs-quarters
CP-31393	3	63.0	87.3	83.3
CP-31393	5	70.4	87.3	85.7
Pyrazon	4	100.0	33.3	45.2
Pyrazon	6	100.0	23.8	61.9
Pyrazon + CP-31393	4 + 2	92.6	93.7	97.6

4. Reduce soil residual. Because of the number of species of crops grown within rotation systems in the

west, herbicides with short-term residues are required so that injury to subsequent crops is eliminated. Residues from atrazine use have caused considerable damage to crops grown in the arid west. However, Bush (4) has demonstrated that satisfactory weed control can be obtained with reduced rates of atrazine when applied in combination with Amiben, thus, reducing the potential of hazardous residues (Table VI).

Table VI. Effect of Atrazine plus Amiben combinations for weed control in corn.

Treatment	Rate lb/A	Weed Control Rating
Ambien	1	Fair
Ambien	2	Fair
Atrazine	1	Fair
Atrazine	2	Fair to Good
Atrazine	3	Very Good
Atrazine + Amiben	1 + 1	Very Good
Atrazine + Amiben	1 + 2	Very Good to Excellent

5. Increase the effective period of weed control. Physiological and morphological differences, depth of placement, soil moisture and temperature and other factors may attribute to variations in weed seed emergence. Many annual weeds have the ability to germinate early in the spring while others do not appear until later in the growing seaason. Several of the selective herbicides result in initial weed control but fail to affect later infestations. As an illustration, when Amiben and DNBP at 1.5 lb/A were used alone, the percent weed control diminished approximately 50 percent within three weeks (10). However, the combination of the two herbicides resulted in excellent weed control and increased the effective control period (Table VII).

Table VII. Effect of herbicide combinations in increasing weed control period in peanuts.

Treatment	Rate lb/A	Percent Weed Control		Peanut Inj. Rating	
		May	June	May	June
		26	16	26	16
Amiben	1.5	30	15	0.0	0.0
DNBP	1.5	53	25	0.0	0.0
Amiben + DNBP	1.5 + 1.5	97	97	0.5	0.0

A second major area of concern for research personnel is the limitations encountered in testing herbicide combinations.

(A.) The Time Element

When a promising herbicide combination is discovered, time necessary to evaluate the mixtures under various climatic conditons, cultural practices, weed complexes, soil types and et cetera may require three to five years. Also, many universities have adapted policies which require a minimum of two to three years of evaluation before a herbicide is recommended. This emphasizes the delay which occurs between the time a combination is found and when it can be released to farmers. However, it is imperative that herbicide mixtures be thoroughly evaluated to protect everyone involved in the production and consumption of agricultural commodities.

(B.) Limited Facilities and Personnel.

Because of the infinite number of combinations which are possible with the selective herbicides that are available today, it would be an impossible task to evaluate the phytotoxic potential of all the herbicidal mixtures. Limited funds from federal, state and private source as well as a scarcity of qualified personnel compliment the problem. Therefore, it is necessary to select only a fraction of the possible combinations for evaluation.

(C.) What Needs to Be Done?

Refined field techniques of chemical application and data sampling could aid in a more efficient evaluation program. Develop methods of correlating results obtained under laboratory and greenhouse conditions with field conditions so that time necessary to evaluate a combination would be reduced.

An increase in funds and facilities are necessary in order to support research programs dealing with herbicide mixtures.

Perhaps the greatest need is for responsible qualified personnel to work in the field of herbicide research. It is the ingenuity and imagination of such people which will develop the full potential of herbicide combinations.

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HERBICIDE MIXTURES — EXTENSION VIEWPOINT

Stanley Heathman[1]

Mixtures or combinations of herbicides have gained increasing exceptance. Some of the more important advantages advanced for the use of herbicide combinations are: lower application rates and reduced herbicide carryover, improve the control of a particular weed species, increase the spectrum of weed control, and lower costs.

A common concept of herbicide combinations is for their use in controlling a specific weed species. A synergistic effect is hoped for but it is usually additive.. A combination of picloram + 2,4-D has given evidence of synergistic effect for the control of field bindweed. A foliar application of dalapon, pyrazon and surfactant under certain conditions, will control annual broadleaved weeds in sugar beets more effectively than will the individual herbicide applied alone.

Combinations have not always been successful. In most instances a specific herbicide for a specific weed problem is the most effective.

The use of combinations of herbicides has offered the potential for obtaining an appropriate length of activity and control for a broad spectrum of weed species. While some combinations have not been successful others have worked well under a wide range of soil and climatic conditions. In some instances herbicides with diifferent characteristics are needed before appropriate combinations are possible.

A more thorough delineation of herbicide characteristics and weed susceptibility will be helpful in gaining acceptance for combinations. It is here that the Extension Service can make a significant contribution. This information is not readily available for most herbicides on a state or regional basis. It would also be helpful if the efficacy of promising herbicide combinations could be observed and recorded for local areas.

In Arizona, cotton growers have searched for a single herbicide for controlling all annual weeds. Research has shown that the herbicides used in cotton for preemergence annual weed control should be divided into two groups: those that control annual grassy or annual broadleaved weeds.

The preemergence herbicides recommended in Arizona are as follows: DCPA, trifluralin, bensulide, and nitralin will control annual grassy weeds. Diuron, monuron and prometryne will control annual broadleaved weeds. While these boundaries are flexible they are real. A combination of a herbicide from each group, applied in an appropriate manner, will usually control the annual weed species occurring in Arizona cotton fields. The application rate, herbicide combination and time and method of application will vary with each growers conditions.

Experience has shown that continuous use of a single herbicide in cotton fields will often result in the replacement of the weeds susceptible to the original herbicide by resistant weeds species. Herbicide combinations will help avoid this problem.

The legal questions involved in the use of herbicide combinations are not clearly answered. Even though each component herbicide may be registered separately they may not have specific federal clearance for use in combinations. It has been said that the "chemical relationship" of two herbicides are not any greater than that of an insecticide and a herbicide applied to the same field. Some operate under the assumption that the use of herbicide combinations mixed on the farm is legal as long as no illegal residue occurs in the crop or damages succeeding crops. If a violation occurs then the grower is responsible.

Commercial firms are reluctant to become involved with the presentation of residue data and obtainance of clearance for herbicide combinations. This is particularly true when these combinations involve herbicide other than their own. When research has demonstrated a potential for specific combinations, an expeditious procedure for necessary clearance is needed. However, it will never be possible to obtain clearance for all of the infinite combinations used in the field. Also, the need for and the use of particular combinations will change rapidly with time.

The Extension Service is called upon to make recommendations based on effective methods of weed control with adequate crop safety. If a combination of herbicides is more effective than an individual herbicide, in a specific situation, can this be ignored until a combination registration is secured?

If Extension and Research make recommendations for specific combinations, and if these combinations are not registered for use, then Extension and Research would be responsible for an educational program in their proper use. They would also be responsible in some degree for performance, crop safety, residues and other

[1]University of Arizona, Cooperative Extension Service, Tucson, Arizona..

factors usually assumed by the manufacturers. It is doubtful that Extension and Research will be able or willing to assume this obligation.

I believe a more logical approach to this problem would be an educational program designed to help the growers make individual decisions regarding the possible use of combinations of herbicides. The grower must select the herbicides and the correct method of application on the basis of particular situations. While this may require the grower to hold the major responsibility for the use of herbicide combinations there appears to be no other legal solution to the problem.

HERBICIDE MIXTURES — INDUSTRY'S VIEWS

Kenneth W. Dunster[1]

Chemical weed control, now a standard practice in efficient crop production, is constantly being refined. As the skills of farmers have increased, so have their discrimination and specific requirements. Mixtures of herbicides are now solving some weed problems and offer promise of solving others. The concept of herbicide mixtures raises a number of questions with which manufacturers must be concerned. Therefore, a questionnaire was sent to research or development representatives of 24 companies active in the herbicide field. That 20 of them completed and returned the questionnaire is an index to the industry's keen interest in herbicide combinations.

All the firms responding are currently investigating herbicide mixtures, and most (80%) are recommending or suggesting such usage. The 1967 WSWS Research Progress Report provides further evidence of interest and increasing emphasis on herbicide combination evaluation (Table 1).

Table 1. Herbicide combination trials reported, 1967 WSWS Research Report

Category	Research reports	Combinations tested
Perennial weeds	7	5
Herbaceous range weeds	2	2
Undesirable woody plants	4	3
Horticultural crops	9	22
Agronomic crops	12	33

Many benefits have been cited to justify herbicide mixtures. The primary reasons prompting investigation vary, and depend largely on the contemplated end use. Controlling a wider range of weed species was the only purpose common to all survey cooperators. Other beneficial factors are listed in Table 2 in the order of reported importance.

Table 2. Motives for investigating herbicide combinations.

	Number responding
Control of a wider range of weed species	20
Improved crop tolerance	13
Reduced crop and/or soil residues	12
Improved performance reliability with environmental change	10
Economic advantage	7
Increased soil residual activity	4

It is reasonable to expect problems as herbicide mixtures are investigated and developed. The survey showed that increased registration problems are of primary concern to industry when mixtures are contemplated. However, this is not insurmountable where biological performance or the economics warrant effort. Other factors are reported in Table 3.

Table 3. Factors influencing industry's interest in herbicide mixtures

	Number responding
Registration requirements	16
Product liability	9
Marketing problems	9
Interest or cooperation from other companies	9
Formulation problems	6
Facilities or methods for evaluation	3
Performance of currently available herbicides	2
Interest or cooperation from experiment stations	2

Registration problems

The responsibility for presenting residue data and obtaining label registration for promising herbicide combinations rests primarily with industry. Direct control of combination components or close cooperation with other manufacturers are essential for developing successful one-package combinations. Among the responsibilities in such a venture, package compatibility of the components must be assured.

Regulations for combinations to be tank-mixed in the field have not yet been defined clearly. This often makes it difficult for extension and sales personnel to advise farmers about the best chemical procedure available.

Survey cooperators were asked how adequate they thought current state and federal guidelines are for registering herbicide mixtures. Seven thought present understandings are adequate, but 10 desired better-

[1]Amchem Products, Inc., Ambler, Pa.

defined procedures. The remaining three were undecided or did not offer an opinion. It is probably significant that 14, or 70%, of those responding felt that labeling procedures would become more exacting in the future.

Product liability

Responsibility for the performance of herbicide combinations is generally assumed to rest with the company initiating the registration procedure and promoting sale of the product. This, of course, would not necessarily extend to farmers who purchase separate chemicals and mix them in the field without benefit of official recommendations.

Marketing problems

There are fewest merchandising problems if a combination is offered as a single-package product. Before it is marketed, the relative responsibilities of registration and product liability have already been determined.

There are also fewer merchandising problems if cooperation between manufacturers and other investigators has been in effect through the development period. Rates and methods of application, and even the merit of combination, must be worked out. Obviously, cooperation between industry, state and federal weed workers, and registration officials is essential to the successful development and marketing of a herbicide mixture.

Cooperation between herbicide companies

Of the 16 companies reporting mixture recommendations or suggestions, only one had complete control of all constituent active ingredients. Despite this fact, only eight responses credited cooperation with other companies for their investigation and development. A number of factors may account for this discrepancy, including the need to apportion available research resources.

Formulation problems

Herbicide combinations can take the form of one-package products, field mixtures, or separate or split treatments.

Single package mixes are the easiest for farmers to use. Chemicals are present in the proper proportion, which tends to minimize potential error in measuring and weighing the components. Selecting proper emulsifiers, suspending agents, etc., to provide satisfactory shelf life and spray tank compatibility, is seldom an easy task and is performed most knowledgeably by a formulation chemist. Different ratios of ingredients may be required for each area or crop, making several similar products desirable or necessary. It is probably for these and similar reasons that eleven companies responding to the questionnaire currently recommend mixtures in single-package form.

When herbicides are tank-mixed in the field, incompatibilities are often encountered. Physical compatibility and complementary biological activity do not always go hand in hand. Wettable powders often do not mix well with emulsifiable concentrates. Oily particles of the emulsifiable product tend to attract powder particles which may result in the formulation of a globule with the consistency of mud. If emulsifiable concentrates are to be combined, it must be remembered that not all such concentrates are compatible. The two systems may even completely inactivate each other so that no emulsion is obtained. In less critical cases the two emulsifiables may produce a very weak and rapidly-breaking emulsion and require constant vigorous agitation. If such mixes are allowed to stand long in the spray tank without agitation, agitation might not reconstitute the emulsion. Vigorous tank agitation is often required and may be critical in the successful application of tank mix combinations. Tank or field mix recommendations are reported by 14, or 70%, of the companies cooperating in the survey.

The future of herbicide mixtures

As the goals of higher crop yields and reduced production costs are pursued, there is emphasis on narrow-row plantings, minimum tillage, increased mechanization, and subsequent elimination of hand labor. Realizing some of these concepts will depend to a large extent on achieving adequate weed control. Past experience has proved that no herbicide can be expected to control all weeds on all soil types and under all weather conditions.

Rapidly-expanding population and urbanization requires better vegetation management in non-cropped areas. Here, again, no single chemical can be expected to control all weed or brush species and have the desired residual characteristics under all conditions.

Undoubtedly new and possibly better herbicides will be discovered and developed. However, with the increasing expense and time required to bring such compounds to the point of registration, it may be more difficult for industry to maintain the pace of introducing them. To answer needs, there is increasing evidence that using herbicide mixtures may improve weed control under a wider range of environmental conditions. The wealth of biological, biochemical, and physiological information being accumulated on plant response to herbicides will aid in the logical selection of suitable combination candidates.

Mixture registration procedures will become more rigorous, but increasing attention and accumulation experience will help establish definitive registration guidelines. The cost of labeling herbicide combinations will probably increase, but is not expected to approach that of developing totally new chemicals. Development of single-package mixtures will receive increased emphasis. They offer advantages such as minimized problems of registration, chemical compatibility, errors in mixing, product liability, and marketing, encountered when components are purchased separately and mixed in the field.

With healthy competition between industries devoted to producing better and thus more readily saleable products, it seems like that the emphasis on investigating, developing, and ultimately marketing herbicide combinations will be continued and increased.

SIDURON, A SELECTIVE HERBICIDE TO AID IN THE ESTABLISHMENT OF PERENNIAL GRASSES

James A. Young, Raymond A. Evans, and Richard E. Eckert, Jr.[1]

(*Abstract*) Siduron (1- (2-methylcyclohexyl)-3-penylurea) is the only herbicide available for selective control of the annual grasses medusahead (*Taeniatherum asperum* (Simonkai) Nevski) and downy brome (*Bromus tectorum* L.) in seedling stands of perennial wheatgrasses (*Agropyron* spp.). Four years of field trials in northern Nevada and northeastern California have shown the weed control obtained from application of this herbicide to be quite variable. Siduron has effectively reduced annual grass population when applied at 0.75 lb/A during seasons with below normal precipitation. Six lb/A of siduron have not adequately controlled annual grasses during seasons with above-average precipitation. Fall application before annual grass germination has been most successful. Applications of siduron to freshly furrowed seedbeds have enhanced weed control and perennial grass establishment. Incorporation of siduron by disk harrowing has not resulted in better weed control than furrowed and sprayed treatments. Siduron has been effective even when sprayed on dry soil which did not receive any precipitation for 30 days following application of the herbicide.

Numerous field trials have shown siduron to lack phytotoxicity for the broadleaf species in annual grass communities. The application of small amounts of picloram (4-amino-3,5,6-trichloropicolinic acid) in conjunction with the siduron treatment has successfully controlled broadleaf species without injury to seedling perennial grasses.

Wheatgrass plants established in siduron treatments appear less vigorous than plants established with other techniques. The chronic effect of siduron on wheatgrass seedlings is being investigated.

[1]Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Reno, Nevada.

EFFECTS OF NOPALMATE ON PRICKLYPEAR (OPUNTIA SPP.) AND OTHER VEGITATION OF THE RIO GRANDE PLAINS

P. E. Buckley,[1] J. D. Dodd,[1] and W. H. Culver[2]

The effects of the experimental chemical, Nopalmate (potassium hexafluoroarsenate), on pricklypear and other vegitation of the Rio Grande Plains of Texas have been investigated. Of the approximately 17 million acres of rangeland in this region, 15.8 million acres (93%) support a 20% or greater canopy of brush cover. Effective control of brush and the associated cacti species is not only desirable but imperative.

The three areas for this study were leased by Texas A&M University. Each of the areas represent one of the major soil types of the Rio Grande Plains. All had been rootplowed for brush control prior to the start of the investigation and supported a dense stand of pricklypear. Rootplowing had effectively removed most woody species but resulted in a rather uniformly distributed stand of pricklypear. Rootplowing scattered the cladophylls (pads) of pricklypear favoring vegitative reproduction.

The soil types represented in this investigation were Red Sandy Loam, Rolling Hardlands and Saline Clay. Plots ranging from 2 to 3 acres in size were laid out in each of these areas with 30 foot buffer zones between plots. Plots were treated at 3-month intervals with 1,2, and 4 lbs of Nopalmate in 30 gals of water/A applied with ground equipment using the Spraying Systems Company Boomjet spray nozzle (#5880-¾-2TOC20). Monthly treatments were made with fixed-wing aircraft (Pawnee) at 2 lbs Nopalmate in 5 gallons total spray per acre with no surfactant added. For comparison purposes, 2,4,5-T was applied at 2 lb chemical in 8 gal diesel and 22 gal water mixture per acre. All ground applications were with double coverage. Treatments and dates of application were allocated to plots by use of a random numbers table. Five plots were designated as untreated controls in each of the three study areas. Data from the untreated plots are the arithmetic means of the five plots in each area.

Pricklypear density data were collected from plots 7, 12 and 15 months following treatment and the five untreated plots in each area. The sampling technique consisted of locating five equa-distant, ten-foot diameter circular quadrats along a diagonal transect in each plot. Every pricklypear plant rooted within the quadrats and each living cladophyll on these plants was counted.

Green color, the visible indication of chlorophyll, on any part of the pad was accepted as evidence of a "living cladophyll". Since vegetative reproduction of pricklypear usually is by a cladophyll rooting at an aerole, the percent control data presented here are based

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on cladophyll numbers, not plant numbers. Many of the treated cladophylls counted as living were 90% or more disintegrated.

Mean density of pricklypear on the untreated plots was taken on the same date as treated plot densities. Concurrently established densities provide the most accurate basis for comparison. Mean density of pricklypear on the untreated Red Sandy Loam plots was 3086 plants/A, 62,937 cladophylls/A or 21.6 cladophylls per plant. The Rolling Hardlands had a stand of 2375 plants/A, 116,650 cladophylls/A or 52.3 cladophylls per plant. Pricklypear density on the Saline Clay was 2286 plants/A, 37,450 cladophylls/A or 20.6 cladophylls per plant. Average height of plants ranged from 18 inches on the Saline Clay to 4 feet on the Rolling Hardlands. Untreated plot data were used as the zero effect basis for all percent cladophyll kill calculations (Table 1).

Table 1. Percent cladophyll kill by treatment, treatment date and soil type. Data collected February 1968, 15, 12 and 7 months following treatment.

Treatment	Treatment Date	Percent Cladophyll Kill		
		Red Sandy Loam	Rolling Hardlands	Saline Clay
Nopalmate—				
1 lb/A ground	10/66	84	88	43
	2/67	65	83	50
	6/67	67	82	26
Nopalmate—				
2 lb/A ground	10/66	99	97	84
	2/67	93	93	8
	6/67	94	77	70
Nopalmate—				
2 lb/A aerial	10/66	90	81	91
	2/67	79	92	43
	6/67	65	78	90
Nopalmate—				
4 lb/A ground	10/66	97	99	91
	2/67	96	94	94
	6/67	99	95	69
2,4,5-T—				
2 lb/A ground	10/66	82	75	58
	2/67	56	87	22
	6/67	30	95	51

The mean percent of cladophyll kill on the three areas (Table 2) indicated some clear trends. The percentage of control was found to increase with age of the treatment, regardless of the type of chemical or rate of application. Nopalmate at 4 lb/A gave the most rapid control. After 15 months, however, there was not a measurable difference between the 2 and 4 lb/A rates, ground applied. The effects of the 1 lb/A Nopalmate although less than the 2 or 4 lb/A rates, approximately equaled the 2 lb/A of 2,4,5-T. Although not indicated in Tables 1 or 2, the pricklypear plots treated 15 months previously with 2,4,5-T had initiated regrowth of cladophylls. Differences in cladophyll kill appeared to be associated primarily with duration of treatment. If there was a treatment date effect it favored fall application. In general, complete deterioration was widespread on the 15 month old 4 lb/ Nopalmate plots, indicating that time was probably the determining factor.

Table 2. Comparison of percentage cladophyll kill by age and treatment

Age	Percent Cladophyll Kill by Treatment				
	Nopalmate				2,4,5-T
	1 lb/A grd.	2 lb/A grd.	2 lb/A Air	4 lb/A grd.	2 lb/A grd.
15 mos.	71	96	87	96	72
12 mos.	66	85	71	95	55
7 mos.	58	80	77	88	59

All treated and untreated (control) plots were sampled to determine litter, composition and production of the vegetation, and pricklypear density at approximately 3-month intervals. A continuance of cladophyll necrosis was apparent on all Nopalmate treated plots at each observtaion. There was no indication of cessation of herbicidal effect. It was observed that Nopalmate treated cladophylls did not root and grow as frequently when in contact with the soil as the untreated cladophylls. When they did survive, a vigorous root ssytem was not developed. Pricklypear treated with 2,4,5-T showed some new growth of cladophylls within 9 months following treatment.

In summary, the quantitative and qualitative observations made during this investigation established a clear pattern. The most rapid rate of pricklypear deterioration following treatment with Nopalmate occurred at the 4 lb/A rate and the slowest at the 1 lb/A rate. After one year the 2 lb/A rate, although intermediate to the 1 and 4 lb/A rates, very closely approximated the 4 lb/A rate. The 1 lb/A rate may, in time, produce the same results. Little difference was found in control with the application of 2 lb/A by ground equipment and the same rate applied by air. Aerial application does appear to provide a more uniform coverage and also would be more practical on a large scale basis.

Nopalmate shows promise of giving excellent pricklypear control. In the present investigation, applications of 2,4,5-T resulted in a more rapid initial burn and growth retardation than Nopalmate but overall control by Nopalmate was superior. It showed a more rapid reaction and generally better control on the Red Sandy Loam and Rolling Hardland Sites than on the Saline

Clay site. No indication of a depressant effect on the grass cover, composition, production or grass seedling establishment was observed or measured on any of the treated plots. An actual increase in grass production was obtained on the 4 lb/A Nopalmate treated plots on the Red Sandy Loam. Herbicidal injury to certain annual weed species and other woody species was observed but quantitative investigation of these effects was not made.

THE INFLUENCE OF DORMANT BRUSH SPRAYS IN WESTERN OREGON ON FOREST SUCCESSION

Tharon O'Dell and Michael Newton[1]

(*Abstract*) This study was designed to learn the effect of chemical silvicultural tools on communities.

Data were obtained from brushfields that had been aerially sprayed with 2,4-D (2,4 dichlorophenoxyacetic acid) and/or 2,4,5-T (2,4,5 trichlorophenoxyacetic acid). Observations involved species composition, density, height, response to herbicide and site description. These data were analyzed to determine the influence of dormant treatments with these herbicides on the distribution and vegetational pattern of the forbs and herbs, as well as woody plants.

The developmental stage of the vegetation determined its response to the applied chemical. That is, an increase in density and height of the brush cover was accompanied by increased interception of the herbicide by the taller brush species and, generally, a decrease in the effect of the herbicide on low-growing vegetation. Therefore, the time elapsed between clearcutting and chemical treatment was the dominant factor in the effect of the herbicide on the various vegetative strata.

The data assembled imply that the seral development of an area such as that sampled can, in part, be controlled by the aerial application of herbicides. Certain seres can be extended and/or various resistant species may fill environmental niches which might otherwise be occupied by species sensitive to herbicidal treatments.

A slope comparison study was incorporated into the basic plan of the research problem, but from the data collected and analyzed it was impossible to determine conclusively whether reaction of vegetation on southeast slopes to chemical treatment differed from that of vegetation on the northwest slopes. Substantial differences beween the flora on the two slopes prevail, but evidence was not conclusive that herbicides were responsible for this difference.

[1]Oregon State University, Corvallis, Oregon.

SOME HERBICIDE-CARRIER INTERRELATIONSHIPS IN THE CONTROL OF VELVET MESQUITE

Herbert M. Hull and Samuel J. Shellhorn[1]

(*Abstract*) In previous experiments with greenhouse-grown velvet mesquite, a number of surfactants and other types of adjuvants have been used, in an attempt to enhance foliar absorption of 2,4,5-T. One of the more promising compounds, and one that demonstrated a significant synergism when used in combination with 2,4,5-T, was dimethylsulfoxide (DMSO). The markedly increased absorption of 2,4,5-T obtained by relatively high concentrations of DMSO (40 to 50 percent v/v) has previously been reported at this conference. The synergistic activity of DMSO was more marked with 2,4,5-T than with other herbicides, and was apparent at DMSO concentrations of 40 percent or over. In the persent work an attempt was made to further enhance the herbicidal activity of DMSO-2,4,5-T combinations, and also to test the activity of other herbicides in combination with 2,4,5-T. Greenhouse-grown seedlings were treated at an age of 10 to 28 days, when at the 2 to 10-leaf stage. Equal-aged plants were used for every experiment, 20 being selected for each individual treatment. Herbicidal applications of 0.01 to 0.06 ml per plant (depending on size) were made with a micrometer-driven syringe to the upper surface of the basal 1, 2, or 3 leaves of each plant.

The interaction of pH and surfactant concentration in an aqueous solution of 40 percent DMSO, as a carrier for 1000 ppmw of the triethylamine salt of 2,4,5-T was investigated in the first experiment. The various herbicidal responses that we measured indicated no significant differences among pH levels of 2.0, 4.0, and 6.0. However, there were some marked effects of surfactant (Tween 20[2]). Herbicidal activity was directly correlated with surfactant concentrations between 0.0 and 0.5 percent (v/v), but fell off significantly at the 2.5 percent concentration.

The second experiment was designed to test the effect of diesel oil, nontoxic oil, xylene, and gycerol, each used in a 50-50 mixture with DMSO as a carrier for the butoxyethanol ester of 2,4,5-T. The formulations were emulsified with several concentrations of Span 20[2], a relatively lipophilic surfactant. Growth repression and other herbicidal responses showed that the most effective compounds used in 50-50 admixture with DMSO were diesel oil and nontoxic oil. Nontoxic oil in combination with 0.03 percent Span 20 gave particularly good results; however, a higher concentration (0.5 percent) is preferable for holding a more stable emulsion.

[1]Crop Research Division, Agricultural Research Service, U.S. Department of Agriculture, Tucson, Arizona.

[2]Trade names are used in this publication solely for the purpose of providing specific information. Mention of such a name does not constitute a guarantee or warranty of the product, or an endorsement over others not mentioned.

One experiment was carried out to determine whether herbicidal activity from the butoxyethanol ester of 2,4,5-T carried in a 1:9 inverted emulsion of nontoxic oil and water, could be further enhanced by addition of certain water-soluble herbicides to the aqueous phase of the emulsion. Various concentrations and combinations of 2,4,5-T with amitrole, MSMA, and picloram (potassium salt) were used. The most effective combination was 1000 ppmw of 2,4,5-T in combination with 1000 ppmw of picloram. Additional experiments have demonstrated that a ratio of picloram to 2,4,5-T of approximately 1:4 is as effective as a 1:1 mixture.

A final experiment tested the relative effectiveness of the butoxyethanol ester of 2,4,5-T, as compared to the triethylamine salt when used at 800 ppmw in combination with 200 ppmw of picloram, all in a 1:9 emulsion of nontoxic oil in water. The 2,4,5-T amine salt and picloram combinations were also evaluated in a plain water carrier and in a 50 percent DMSO carrier. Of the various physiological responses which occurred from 3 to 7 weeks after treatment, the picloram-2,4,5-T ester combination in a nontoxic oil emulsion was least effective, followed by the picloram-2,4,5-T amine in the same type emulsion. When the latter herbicidal combination was in an aqueous carrier, it was more effective, and in a 50 percent DMSO carrier it was far more effective than any of the above combinations.

HATCHETT-INJECTION OF PHENOXYS, PICLORAM AND ARSENICALS FOR CONTROL OF SOME HARDWOODS AND CONIFERS

Michael Newton and Harvey A. Holt[1]

Chemical silviculture is asserting its place in the forest management program. It has proven effective in regeneration, release, thinning, and control of undesirable species. This paper presents a general picture of species response as influenced by chemical, season, dosage, and locale, and operational implications.

Species treated include several coniferous and deciduous species in eastern and western U.S. Chemicals include organic arsenicals, picloram dilutions, phenoxy formulations, and endothal salts. Injection was done with an automatic injector hatchet, with intervals between the injections regulating dosage.

Undiluted picloram is very effective for controlling undesired species, regardless of the season. Persistant residue is an undesired side-effect. Dilution with water reduces the residue problem more than it reduces the chemical's effectiveness.

Cacodylic acid has not proven effective on bigleaf maple, whereas Ansul's L-2505 (MSMA) is quite efficient, particularly in the spring and summer months. Oregon white oak, conversely, is very susceptible to cacodylic acid, regardless of the season, and is not greatly affected by MSMA.

In general, results from the herbicides are more readily apparent during the time of active growth, varying somewhat by species and chemical. Coniferous species appear to be controlled effectively by the organic arsenicals regardless of season, with treatments during the winter months requiring a longer time lapse before results are apparent.

Silvex, postassium salt, and 2,4-D amine react more slowly than picloram and the organic arsenicals, but are effective on some species at certain seasons. Silvex works well on maple and 2,4-D amine controls oak satisfactorily; both provided good kill of Douglas-fir in spring (March).

The time required for treating, hence cost, varies with stand density. Chemical injection has proven to be less expensive than conventional thinning with power saws and can be conducted as a year-round operation. The injection of herbicides generally means inexpensive equipment and efficient utilization of manpower.

Chemical injection is not only more economical than cutting, but also is more aesthetic and less of a fire hazard. Use of cacodylic acid, and possibly other fast-acting herbicides, may prevent serious infestations of insects.

[1]Oregon State University, Corvallis, Oregon.

Herbicides, dosages and seasons of treatment that provide 80 percent or better kill of several species. Hatchet Injection.

SPECIES	Diameter range-index	Herbicide	Dosage/cut Milliliters	Cut spacing inches	Season
Conifers:					
Douglas-fir	8	MSMA	1.0—1.5	6	All
	8-12	MSMA	1.5	4	All
	8	Cacodylic acid	1.0—1.5	6	All
	8-12	Cacodylic acid	1.5	3	All
	12	Picloram*	1.0	6	All
Ponderosa Pine	8	Cacodylic acid	1.0	6	All; insect activity least fall and early winter . . .
	8	MSMA	1.0	6	" " " "
Lodgepole Pine	All	Cacodylic acid	1.0	4	All
Eastern White Pine	10	Cacodylic acid	1.0	6	Summer
	10	Endothall, Di-Na	1.0	6	Summer
	10	2,4-D amine*	1.0	6	Summer
Hardwoods:					
Bigleaf maple	8	MSMA	1.5	4	Spring—Fall
	8	MSMA	1.5	3	" "
	All	Picloram	1.0	3	All
	All	K-Silvex	1.0	3	All
Oregon White Oak	8	Cacodylic acid	1.0	3	All
	8	Picloram	1.0	6	All
	8	2,4-D amine	1.5	3	Spring—Summer
	8	Endothall	1.0	3	Summer
	8	K-Silvex	1.0	3	Spring—Summer
Red alder	All	Cacodylic acid	1.5	3	Summer
	All	Picloram	1.0	3	All
	All	2,4-D amine	1.5	3	Summer
Red maple	All	Cacodylic acid	1.0	3	Summer
	All	Picloram	1.0	9	Summer
	All	Endothall	1.0	6	Summer
	All	2,4,5-T amine	1.0	3	Summer
Beech	All	Cacodylic acid	1.0	3	Summer (reduces scale insects)

* Root graft

EFFECTS OF TILLAGE OPERATIONS ON DISPERSION OF DOWNY BROME CARYOPSES IN THE SOIL.

James A. Young, Raymond A. Evans, and Richard E. Eckert, Jr.[1]

(*Abstract*) The dispersion in the soil of downy brome (*Bromus tectorum* L.) caryopses by moldboard and disk plowing, disk harrowing, and furrowing was investigated at two locations in northern Nevada.

Tillage treatments were made in April as fallow treatments and in October as fall tillage treatments. One-half of each treatment was furrowed and seeded in October to Amur intermediate wheatgrass (*Agropyron inermedium* (Host.) Beauv.). The remainder of each treatment was seeded without furrowing.

Dispersion of downy brome caryopses was measured by sampling the soil surface and by 2-inch increments in the soil to a depth of 8 inches. Samples were obtained after each date of treatment and in April of the year after treatment. The density and yield of downy brome and other weeds were determined in July of the year after initial treatment.

Moldboard plowing was the most effective treatment in burying downy brome caryopses to a depth from which they could not emerge. Disk plowing was intermediate and disk harrowing was least effective. Furrowing, which creates a favorable microenvironment for seedlings of perennial grasses on semi-arid rangelands, exposed the buried downy brome caryopses and reversed the effectiveness of the tillage treatments.

[1]Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Reno, Nevada.

CHEMICAL TREATMENT OF FRESHLY CUT BIG LEAF MAPLE Acer macrophyllum PURSH. STUMPS TO PREVENT SPROUTING

by J. M. Finnis[1]

Growth of trees and shrubs is rapid in the Northwest and since many of you gentlemen are from more arid regions, it is necessary to point this out in order that you grasp the practical significance of this work.

Big leaf maple is a problem in that it is seldom merchantable and so has little commercial value. It is hard to kill with chemicals—let me correct that and say it can be controlled if you know the right chemical and correct method of application—and it is not controlled by any aerially applied chemical spray currently in general use. If you cut it, it resprouts and the first slide illustrates this situation: (1) This tree was cut in the late forties about 20 years ago. It is now 50 feet tall with 25 stems and a crown diameter of 43 feet. It is still young so you can imagine the size it will reach on maturity. It does not take many of these trees to cover an acre and instead of a yield of 60M b.f., you have little or no merchantable volume at rotation age. This tree in the first slide resprouted after cutting when the old growth was logged 20 years ago and it is obviously poor business to allow this process to be repeated.

Fairly recently, we started using a clause in certain timber sales that any non-merchantable stem over 4" in diameter must be cut. This was a good step in the right direction, but it does not go far enough in the case of a sprouting species such as big leaf maple.

Therefore, we started a study in January, 1966, to determine if we could prevent resprouting by treating the cut stump immediately after falling. Since this technique, if successful, would be used in both Timber Sales and Rehabilitation work at all times of the year, it was essential to run the tests throughout the year.

The following six treatments and a control were tested each month of 1966 on freshly cut maple stumps:

1. Picloram (Tordon 22K).
2. Picloram (Tordon 101).
3. 2,4,5-T amine.
4. Ammate X.
5. Gasoline.
6. Diesel.
7. Control.

Treatments 1, 2 and 3 were applied, undiluted, in a band around the cambium of the cut stump using a plastic squeeze bottle. Ammate X was applied in the same manner using a solution made up of one pound of Ammate X crystals in one pint of water. The gasoline and diesel treatments were applied by pouring the material over the cut stump. Five stumps were treated per treatment per month and these were examined and treated in August, 1967, using the following rating system:

Rating 1 — No effect of treatment. Vigorous resprouting.

Rating 2 — Little effect of treatment. Vigorous resprouting.

Rating 3 — Considerable effect of treatment. Very little resprouting.

Rating 4 — Stump dead. No resprouting.

The results of this examination are shown in Table 1.

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Table 1. Average Rating of Stump Treatments.

Month of Treatment	Tordon 22K	Tordon 101	2,4,5-T amine	Ammate X	Gas	Diesel	Control
January	4.0	4.0	3.8	2.2	....	....	1.0
February	4.0	4.0	4.0	2.4	1.6	1.2	1.0
March	4.0	3.8	2.4	1.8	1.2	3.25	1.0
April	4.0	4.0	4.0	1.25	2.0	2.6	2.8
May	4.0	4.0	4.0	2.0	1.8	2.2	1.4
June	4.0	4.0	4.0	3.6	2.8	3.4	3.0
July	4.0	3.8	4.0	2.4	3.4	3.4	1.8
August	4.0	4.0	4.0	3.4	2.4	2.8	2.2
September	4.0	4.0	3.4	1.8	2.6	2.4	1.8
October	4.0	4.0	4.0	3.4	2.4	2.8	2.0
November	4.0	4.0	3.6	2.2	2.2	1.8	2.0
December	4.0	4.0	4.0	3.0	2.6	2.0	2.0

These results separate very nicely into two groups. Tordon 22K, Tordon 101 and 2,4,5-T amine gave satisfactory control and the other treatments did not. We have not used Tordon 22K because of its high cost, $31.00, when the cheaper Tordon 101 at $11.05 a gallon will do the job. We are also somewhat concerned about the residual effect of Tordon.

We have incorporated a maple stump treatment clause into timber sales, where applicable and started using Tordon 101. When that became unavailable, because of Vietnam, we changed to 2,4,5-T amine. Then 2,4,5-T amine became unavailable but fortunately Tordon 101 came back and so we were able to make a switch. The effectiveness of these stump treatments when promptly and properly applied are shown in the following slides. However, conscientious application is necessary to make this treatment effective and we will not know how this is working out in the field on timber sales, until we make an examination this coming summer.

CROP RESPONSE AND TOLERANCE TO PICLORAM RESIDUE IN SOIL

H. P. Alley and G. A. Lee[1]

Considerable research has been conducted and reported since the introduction of picloram in 1963. The herbicidal activity of this compound on broadleaf plants has been well researched, however, response of crops to residues in the soil may not be as well understood or as well correlated as the spectrum of activity toward undesirable plant species.

Herr et al. (2) reported the relative tolerance of the agronomic crops tested to the residues of picloram herbicides were corn > oats > barley > alfalfa > soybeans. Two ounces/A applied 9 months prior to planting had no visible effect on any of the crops. The rate of 32 ounces/A applied 9 months previously had no effect on corn or oats, while stand reductions of 40 to 50 percent occurred in barley and reached 100 percent with alfalfa and soybeans. In another experiment an application of 32 ounces ae/A 20 months prior to soybean planting had no effect on yield or stand of soybeans.

The picloram herbicide was originally cleared for spot treatment in cropland. A considerable amount was used for such purposes. Its use in cropland has presented problems as to how long the chemical may remain in the soil, in magnitudes high enough to prevent economical establishment of crops.

Percent organic matter, moisture as a percent of water holding capacity, and temperature all influence the rate of decomposition. Rate of decomposition increased with increasing organic matter and temperature. Rate of decomposition also increased with increasing moisture in the low moisture range for soils, but the reverse was true in the high moisture range (3).

Disappearance from soil studies of soils collected from California, Kansas, South Dakota, and Minnesota indicated that losses of picloram ranged from 58 to 96 percent within 1 year after application, and from 78 to 100 percent within 2 years after application (1). Half-lives at the various locations ranged from 1 to 13 months.

To better understand the problems encountered, a picloram soil residual and crop tolerance study was established in 1964, soon after the chemical was introduced for research purposes. Permanent plots were established and treated with ½, 1, 1½, 2 and 3 lb/A of picloram (4-amino-3,5,6-trichloropicolinic acid). The treated areas have been cross-seeded to crops common to Wyoming for the past three growing seasons.

[1]University of Wyoming, Laramie, Wyoming.
Presented with approval of the Director, Wyoming Agricultural Experiment Station as Scientific Report 89.

The soil, on which the plots were established, is of the Hill series which is a sandy clay loam. Climatological data show 113 days between 32° F in the spring and 32° F in the fall, and the area receives an average of 11 inches annual precipitation.

Readings obtained from the crops planted in the treated areas are presented in the following table. Three years after the treatments were applied (1967) there was a limited amount of establishment of alfalfa, soybeans and pinto fieldbeans. Germination and emergence of soybeans and fieldbeans was prevalent in the ½ and 1 lb/A rates, however, the soybeans developed only one trifoliate leaf and the fieldbeans did not develope past the cotyledon stage of growth. Alfalfa was established in all rates of picloram application, ½ lb. to 3 lb/A. However, the alfalfa stand was thinned and damage was progressively severe above the ½ lb. to the 3 lb/A rate. A good stand was prevalent in the ½ lb/A treatment but the leaves of the alfalfa seedlings exhibited cupping and elongation of the midrib.

Of the grass crops, corn, sorghum, oats, wheat and barley showed tolerance to picloram in the order listed above. There was no indication of phytotoxicity to corn at any rates of picloram application, whereas, the high rate of application, 3 lb/A, delayed emergence of the oat panicle from the leaf sheath. A good stand of barley and wheat was common on all plots. The emergence of the wheat head was restricted at rates above 1½ lb/A and the height was reduced at rates higher than 1 lb/A. Barley plants, growing in plots treated with rates higher than ½ lb/A, showed prostrate growth and head emergence was delayed and restricted.

Under cool, dry climatic conditions, similar to those common to the Laramie, Wyoming area, it could be assumed that alfalfa, soybeans and fieldbeans could not be economically grown, within three years after application, on areas treated with as low as ½ lb/A of picloram. Small grains, corn and sorghum could be grown with the order of selection, from a tolerance standpoint, being corn, sorghum, oats, wheat and barley.

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The response of selected crops to picloram residue in the soil three years after application of rates of ½, 1,1½,2 and 3 lb/A.

Chemical	Rate lb/A	Betzes Barley	Cody II Oats	Thatcher Wheat	Corn	DeKalb SX-6 Forage Sorghum	Alfalfa	Amsoy Soybeans	Pinto Fieldbeans
picloram picloram picloram picloram	½ 1 1½ 2 3	Good healthy barley in ½ lb/A rate. Barley prostrate and emergence of head delayed at all higher rates.	Good stand in all rates. High rate of 3 lb/A delayed emergence of panicle from the sheath.	in all rates. Emergence of head restricted from 1½ lb/A to 3 lb/A. Height ½ lb - 18" 1 lb - 18" 1½ lb - 14" 2 lb - 12" 3 lb - 8"	Good stand no indications of injury at any rate.	Good stand at all rates. Slight variation in height of sorghum plants between the ½ lb and 3 lb/A rates.	Good stand in ½ lb/A rate but showed cupping and elongation of midrib. Thinned stand in 1 lb/A and damage progressively more severe up to 3 lb/A where stand was very light.	Germination and emergence at ½ and 1 lb/A rates. One set of trifoliate leaves, soybeans dying.	Germination and emergence in the ½ lb/A rate, beans did not develop past cotyledon stage of growth. No growth at rates higher than ½ lb/A.

RESPONSE OF COTTON SEEDLINGS TO COMBINATIONS OF SOIL-INCORPORATED SYSTEMIC INSECTICIDES AND TRIFLURALIN

H. Fred Arle[1]

(*Abstract*) The effects on cotton seedlings of soil-incorporated combinations of *a,a,a,* trifluoro-2,6-dinitro-*N, N*-dipropyl-p-toluidine (*trifluralin*) and granular O,O-diethyl S-(ethylthio) methyl phosphorodithioate (phorate) or O,O-diethyl S-[2-(ethylthio) ethyl] phosphorodithioate (disulfoton) were studied in greenhouse experiments.

Trifluralin at 1 lb/A. was applied alone and in combination with phorate or disulfoton at broadcast rates of 10, 20 and 40 lb/A. Ten, 20 and 40 lb/A. of phorate and disulfoton without trifluralin, and untreated checks were included. The various treatments were incorporated in two inches of soil containing 47% sand, 28% silt, 24% clay and 1% organic matter. This soil was used in filling the top 2 inches of clay pots. Each treatment was replicated 4 times.

Two weeks after planting, soil was washed from the root systems of the cotton seedlings. Secondary root development in the zone of chemical incorporation, the top 2 inches of soil, was less inhibited by various combinations of phorate with trifluralin and disulfoton with trifluralin than with trifluralin alone. No significant dfferences in numbers of secondary roots, as compared with the untreated check, were observed when phorate or disulfoton was used at 40 lb/A. in combination with trifluralin. Although disulfoton in combination with trifluralin increased secondary root development, increases were significantly less than from each corresponding rate of phorate with trifluralin.

[1]Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Phoenix, Arizona.

SUPPRESSION OF ANNUAL GRASSES ON ROADSIDES, LEVEES, RAILROADS AND OTHER NON-CROP AREAS WITH DOWPON

L. E. Warren[1]

Introduction

Annual weed growth along roadsides, fence rows, levees, and other non-crop areas in the Western States with dry summers is unsightly and may present a fire hazard. Soil sterilization, leaving bare soil, except for a few feet off the edge of the pavement, encourages erosion and blowing dust, and also is not considered appealing to tourists. Sprays with 2,4-D have been used to control annual broadleaves; a new treatment using Tordon 101 Mixture[2] at low rates is even more effective as reported by Byrd and Nyman (1).

The control of broadleaved weeds releases the annual grasses which then produce good growth by the end of the rainy season. This growth matures and dries in early summer and can be a fire hazard for the rest of the summer. Along roadsides, mowing can reduce the growth if repeated several times before maturity, but this is expensive and labor often is not available. Mowing after maturity produces a fire hazard from the excess straw on the ground. Little can be done with herbicides to reduce the growth after the boot stage, although heavy amounts of contact weed killers will cause early drying. Fire is used in some situations after the growth dries, but this practice is meeting stronger objections from the public. A systemic grass killer in early growth could be effective in reducing growth at low cost, would reduce maintenance costs and also reduce the fire hazard.

Previous work with Dowpon Grass Killer (2) has shown that rates of 2 to 4 lbs. per acre applied during the early growth stage will reduce the annual grass growth in proportion to the dosage. January applications in the Sacramento Valley have reduced growth, and no additional emergence occurred later that season even with later rains. This report presents the results of studies to determine the efficacy of Dowpon at rates of 1 to 4 lbs. per acre alone and with Tordon herbicide and 2,4-D, which could be used with Dowpon.

Experiments and Results

On February 16, 1966, an experiment was established on a roadside at Stockton, California, using Dowpon alone and with Tordon 22K[3] and Tordon 101 Mixture, the latter two to determine the effect, if any, on the action of Dowpon. Colloidal X-77 surfactant at 8oz. plus 1 qt. diesel oil per acre were added to mixes. Sprays were applied to 8 by 30 ft. triplicated plots with a hand wand using two OC-04 nozzles (off-center) at 30 psi to give 25 gals. per acre. Norbak Particulating Agent (3) for drift control was added to some mixes to determine the effect on efficacy. Grasses included *Avena fatua, Festuca myuros, Poa annua,* and *Bromus mollis,* which were 4 to 8 inches high and growing well. On May 12, 1966, the plots were rated for growth on a scale of 0 to 100 compared to the adjacent untreated strips. These were converted to percent control based on the growth in the untreated plots.

The treatments and results are shown in the table.

Dowpon at 2 lbs. per acre left a fair stand of grasses, but their growth was greatly reduced. Broad-

[1]Plant Science Research and Development, The Dow Chemical Company, Davis, California.

[2]Tordon 101 Mixture contains 0.54 lb. Tordon herbicide plus 2 lbs, 2,4-D per gallon as the triisopropanolamine salts.

[3]Tordon 22K contains 2 lbs. Tordon acid equivalent per gallon as the potassium salt.

leaved weed control with both Tordon products was excellent, and without the Dowpon, grass growth was excellent. It is interesting that Tordon 22K apparently enhanced the activity of Dowpon grass killer in this experiment. Tordon 101 Mixture does not appear to exert a consistent effect on the activity of Dowpon.

Table
Reduction of Annual Grass Growth With Dowpon

Dowpon Herbicide per acre[1]	Tordon Herbicide per Acre[1]		% Annual Grass Control
	22K	101 Mix.	
1 lb.	....	....	45
2 lbs.	....	....	88
1 lb.	½ pt.	....	87
2 lbs.	½ pt. + Norbak	....	88
1 lb.	....	1 qt.	48
2 lbs.	....	1 qt.	60
Untreated	....	....	0

Treated February 16, 1966 Rated May 12, 1966
[1]Amount of product.

In January and February 1967, several applications were made for the control of roadside broadleaved and grassy weeds using 1 to 4 lbs. of Dowpon alone and with Tordon 101 Mixture at 1 to 2 qts. per acre. Some treatments were particulated with Norbak. Treatments were applied with two DOC-32 nozzles mounted on a trailer power sprayer. The spray was pressurized at 30 psi to give 25 gals. per acre on plots 20 ft. wide and 100 to 200 ft. long. Spray coverage of the weeds was good. Grass growth at the time of application was a few inches high and vigorous.

With the 4 lb. rate of Dowpon herbicide, grass growth was nearly completely controlled. The 1 lb. rate was not adequately effective, but the 2 lb. rate gave a growth reduction of 40 to 80% compared to the adjacent untreated areas. There was no further germination or regrowth through the summer despite exceptionally late spring rains into June. Grass suppression with Dowpon was equally good when Tordon 101 Mixture was added at 1 or 2 qts. per acre.

Discussion

Previous work by Torrell (4) and Warren (2) has shown that the efficacy of Dowpon herbicide is affected little by volume rate in the range of 5 to 100 gals. per acre, if the coverage is good; as the volume rate is decreased, the nozzles must be reduced in size to produce finer sprays. Treating when the grasses are growing well and *not* after tillering stage is also essential for good control. The addition of a good polyglycol type surfactant at 8 to 12 oz. per acre is also desirable, but the need for diesel oil has not been found critical if the surfactant is sufficient to obtain maximum action of the Dowpon.

Simultaneous applications of Dowpon and 2,4-D herbicides are used commonly for over-all weed control, and it is likely that Dowpon will not reduce broadleaved weed control. The addition of Tordon 101 Mixture did not appear to reduce the grass control in these tests. In some areas, timing for the best grass control will probably be earlier than for the broadleaves; separate applications may give better results in both objectives.

The practice of suppressing annual grasses with Dowpon has the advantages of low cost, retention of some ground cover, reduced need for mowing, reduced fire hazard, and very low mammalian toxicity of sprays.

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EVALUATION OF COMPLEMENTARY PREPLANT AND POSTEMERGENCE TREATMENTS FOR WEED CONTROL IN SUGAR BEETS

G. A. Lee and H. P. Alley[1]

Field studies were conducted on sandy loam and clay loam soil to determine the effect of complementary preplant and postemergence herbicidal treatments on percent weed control, stand and vigor of sugar beets, percent sucrose in sugar beet roots and tonnage yields. The preplant treatments consisted of pyrazon + Ro-Neet (3 + 2 lb/A), pyrazon + Ramrod (3 + 3 lb/A), Ro-Neet + PEBC (2 + 2 lb/A) and Ro-Neet (3 lb/A). The postemergence treatments were Topcide (2 lb/A), pyrazon + dalapon + wetting agent (4 + 2.2 + 2 lb/A), pyrazon + dalapon + Dax-

[1]University of Wyoming, Laramie, Wyoming.

tron (4 + 2.2 lb. + 1 oz/A), and pyrazon + dalapon + H-273 (5 + 2.4 lb. + 4 pt.). The preplant herbicides were applied in 32.5 gpa of carrier on a seven in. band and incorporated to a depth of 1 to 1½ in. of soil. The postemergence treatments was applied in 40 gpa of carrier and sprayed full coverage laterally across the preplant plots.

The experiments were arranged in a split block design for statistical analysis. Whole plots and split plots were replicated three times.

Sugar beet stand and weed species counts were taken from an area 10 feet in length and three in. in width, 1½ in. on either side of the beet row. Species were compared to a nontreated check plot to determine percent sugar beet stand and percent weed control. Two rows were counted to make a total of 20 linear feet per subplot. Counts were taken in seven predetermined and permanently marked locations in each preplant plot so that a record of plant population was available before and after postemergence treatments. Postemergence valuations were made approximately 2 weeks after treatment.

Rough pigweed (*Amaranthus retroflexus* L.), lambsquarters (*Chenopodium album* L.), Kochia (*Kochia scoparia* (L) Roth.), nightshade (*Solanum sp.*) and green foxtail (*Setaria viridis* L.) were present at the sandy loam location. The major weed population at the clay loam location consisted of wild mustard (*Brassica kaber* (DC) Wheeler), lambsquarters, rough pigweed, green foxtail, and volunteer oats (*Avena sativa* L.). Secondary species were sunflower (*Helianthus annuus* L.), wild buckwheat (*Polygonum convolvulus* L.) and nightshade which were grouped together for percent weed control evaluation.

Because mechanical thinners were not available on the experimental substations, hand labor was used for the blocking and thinning operation. Both locations received one weeding with long-handled hoes during the growing season.

Harvesting consisted of the removal of sugar beet roots from exactly the same area from which the sugar beet stand and weed counts were taken. Percent sucrose and sample weights were determined by the Great Western Sugar Company factory at Lovell, Wyoming and Holly Sugar Company factory at Torrington, Wyoming.

Percent weed control for the complementary treatments is expressed as total control resulting from the preplant and postemergence treatments combined.

Pyrazon + Ro-Neet (3 + 2 lb/A) and Ro-Neet + PEBC (2 + 2 lb/A) resulted in the greatest overall weed control of the preplant treatments at the sandy loam and clay loam locations, respectively.

Pyrazon + Ro-Neet (3 + 2 lb/A) with pyrazon + dalapon + wetting agent, pyrazon + dalapon + Daxtron and pyrazon + dalapon + H-273 gave 92 percent or better control of all weed species present at the sandy loam location. The addition of the above mentioned postemergence treatments significantly increased percent weed control over the preplant treatment. Comparisons of the effect of the combined treatments on percent stand of sugar beets showed that significant reductions occurred when the postemergence treatments were applied. Pyrazon + dalapon + Daxtron as a complementary treatment gave 96 percent or better control of the weed population present at the clay loam site. Yield from the plots receiving pyrazon + Ro-Neet (3 + 2 lb/A) and pyrazon + dalapon + wetting agent were significantly higher than the nontreated check.

Pyrazon + Ramrod (3 + 3 lb/A) followed by pyrazon + dalapon + wetting agent and pyrazon + dalapon + Daxtron resulted in 92 percent or better control of all species present at the sandy loam location. However, total weed control obtained with the preplant and complementary treatments was not satisfactory at the clay loam site. The sugar beet stand showed a greater reduction with all treatments at the sandy loam site when comparing both locations.

Ro-Neet + PEBC (2 + 2 lb/A) with pyrazon + dalapon + Daxtron gave better than 93 percent control of all weed species at the sandy loam location. However, pyrazon + dalapon + wetting agent and pyrazon + dalapon + H-73 as complementary treatments resulted in over 93 percent control of lambsquarters, nightshade and setaria. Pyrazon + dalapon + Daxtron was the only complementary treatment which resulted in better than 90 percent control of all weed species present at the clay loam site. Yields from plots treated with Ro-Neet + PEBC followed with pyrazon + dalapon + wetting agent and pyrazon + dalapon + H-273 were significantly higher than the nontreated check.

The combined effects of Ro-Neet (3 lb/A) as a preplant treatment plus the various complementary treatments did not give satisfactory control of the complete weed population at either location. Sugar beet stands were reduced more on the sandy loam site when comparing both locations. However, the reduction was not below commercial acceptance. Yields from plots which received complementary treatments of Topcide and pyrazon + dalapon + wetting agent were significantly higher than the nontreated check plot at both locations.

From the data obtained in this study, we can conclude that:

1. Pyrazon + Ro--Neet (3 + 2 lb/A) as a preplant treatment resulted in the highest percent control of all species of weeds present at the sandy loam location. No preplant treatment gave satisfactory weed control at the clay loam site which indicates that increased rates may

be necessary for commercially acceptable results.

2. The poor control of setaria at the sandy loam site, due to late emergence, substantially lowered the overall weed control obtained by all preplant treatments. However, this same factor was complementary to several of the postemergence treatments in giving higher overall control than the preplant treatments.

3. Although pyrazon + dalapon + Daxtron caused temporary toxicity to the sugar beet plants, this postemergence and complementary treatment gave the highest percent control of the weed population at both locations.

4. Yields from plots treated with pyrazon + dalapon + wetting agent (complementary treatments) were consistently significantly higher than the nontreated check plots.

5. Results from this experiment indicates that certain postemergence treatments were as effective in reducing the weed population as preplant treatments. However, to obtain the level of weed control desired, both preplant and postemergence treatments were necessary.

EQUIPMENT FOR FIELD PLOT WORK

D. W. Swan and T. J. Muzik[1]

(*Abstract*) A new weed research project was initiated at Washington State University in the fall of 1966. This provided an opportunity to purchase or build new spray equipment. Several new innovations were used. Many ideas for these innovations were gained from observing other weed research worker's equipment and techniques.

The main piece of spray equipment is an aluminum framed single wheeled bicycle plot sprayer built by Mater Machine Works, Corvallis, Oregon. Air supply is provided by two approximately 24″ x 10″ surplus oxygen cylinders. The four quart capacity spray tank is a cut-down Hudson stainless steel sprayer with a funnel shaped bottom outlet. Tygon tubing carries the spray solution to the 10-foot spray pattern boom. The boom, made from ¼″ stainless steel tubing, has welded stainless steel couplers for the snap-in TeeJet spray tips. Boom extensions can be added for spraying 13- or 16-foot plots.

The second piece of equipment is a back-pack sprayer. The frame is built of conduit with shoulder padding. The air supply is provided by two surplus A-6 oxygen cylinders mounted on the back of the frame. The 10-foot spray pattern boom is built from ¼″ hard drawn brass (stainless steel tubing would be satisfactory). Other features of the boom are the same as the boom on the bicycle wheeled sprayer. Two handles attach to the boom for better operator balance. The left handle contains the air guage, air valve, and regulator. Pressure hose delivers the air to the two-quart capacity spray tank (built the same as the spray tank on the bicycle wheeled sprayer). The right boom handle has the liquid valve and carries the spray solution to the boom. A strap from the boom to the back-pack frame supports most of the boom weight. The left handle detaches when a single nozzle is used on the right handle.

The water supply for field work is carried in a 27-gallon glass-lined pressure tank. Air from the compressor is regulated into the tank. Water is delivered for mixing and washing by a hose with a service station type water valve.

An equipment box mounted on the side of the pick-up bed provides organized storage for small items.

[1]Washington State University, Pullman, Washington.

CONTROL OF ANNUAL AND PERENNIAL BROADLEAVED WEEDS ON NONCROP AREAS WITH A MIXTURE OF TORDON AND 2,4-D HERBICIDES

L. E. Warren[1]

Annual and perennial broadleaved weeds are serious problems on roadsides and other noncrop areas in many sections of the Western States which are characterized by winter rainfall and long dry periods in the summer. The weeds include an abundance of winter annuals along with such troublesome summer annuals as Russian, yellow star and milk thistles, and perennials such as Canada thistle, Russian knapweed, dock, and chicory. Under the dry summer conditions, these weeds mature in early summer. Elimination of these weeds from roadsides and other noncrop areas and encouragement of a low growing grass cover is usually desired to improve appearance, reduce sources of infestation to adjacent farm lands and reduce fire hazards.

Recent reports by Byrd and Nyman (1) showed good control of annual and perennial broadleaved weeds on roadsides in Eastern United States with single or repeat treatments of Tordon 101 Mixture at 2 qts. per 20 gals. of spray per acre. Tordon 101 Mixture contains 0.54 lb. Tordon herbicide and 2 lbs. 2,4-D per gallon as water soluble salts. Norbak Particulating Agent (2) was added to reduce drift and enhance placement of the spray.

[1]Plant Science Research and Development, The Dow Chemical Company, Davis, California.

This report presents the results of studies in California, Oregon and Washington in 1966 and 1967 to determine the effectiveness of treatments with Tordon 101 Mixture at low rates for control of annual and perennial broadleaved weeds.

Experiments and Results

On February 21, 1966, an experiment was established on a roadside near Stockton, California, using Tordon as 22K (contains 2 lbs. Tordon herbicide per gal. as the potassium salt) and Tordon 101 Mixture at a volume rate of 25 gals. per acre. Norbak at recommended amounts was added to some mixes. The weeds, which are indicated with the results below, were mostly a few inches high except that some *Malva parviflora* plants were 12 to 16 in. high. All were growing well from recent rain. Plots were 8 ft. x 30 ft. triplicated. Application was made with a hand wand using two OC-04 nozzles and two passes per plot.

After the weeds had matured, ratings of plant growth were made on a scale of 0 - 100 compared to adjacent untreated strips, and the averages were converted to percent control based on the untreated areas. The dosages and results with each treatment are shown for annuals and perennials in Table 1.

Table 1
Control of Annual and Perennial Broadleaved Weeds on a Roadside, California, 1966

	Amount per Acre[1]	% Control - Broadleaves	
		Annuals[2]	Perennials[3]
Tordon 22K	½ pt.	85[4]	----
" "	1 pt.	95	96
" "	½ pt.+Norbak	84[4]	100
+Dowpon	2 lbs.		
Tordon 101	1 qt.	98	98
" "	2 qts.	100	100
" "	2 qts.+Norbak	96	98
+Dowpon	2 lbs.		
Untreated	----	0	0

[1]Applied February 21, 1966; Readings, May, 1966.
[2]**Lactuca scariola, Amaranthus** spp., **Erodium** spp., **Stellaria media, Raphanus sativus, Brassica** spp.
[3]**Rumex crispus, Plantago** spp., **Cichorum intybus, Taraxacum vulgare, Malva parviflora** (biennial).
[4]Escapes nearly all crucifers—radish and mustard.

The control of all broadleaved weeds, both annual and the tap-rooted perennials listed in Table 1 was excellent with 1 to 2 qts. of Tordon 101 Mixture per acre. It was generally good also with Tordon 22K; a very few crucifers escaped although their growth was retarded. Control was not affected by the addition of Norbak nor of Dowpon added separately.

Another replicated test established at Davis, California, on May 4, 1966, provided similar good control of these weeds. Morning glory at this location was suppressed with 2 to 3 qts. of Tordon 101 Mixture per acre.

Tests were established with a power sprayer with two ¾ OC-80 nozzles at 20 psi mounted on the edge of the sprayer and projected outward to cover a maximum 20 ft. swath. At a speed of 10 mph, the volume rate was 25 gals. per acre. Tordon 101 Mixture was used at 1, 2 and 3 qts. per acre, with the addition of Norbak particulating agent to give the viscosity recommended for drift control. These tests were applied at locations on roadsides from Merced, California, to eastern Washington during the period from March 23 at Merced to April 30, 1966, in Washington. After application, light rains fell on most of these sites, except those at Merced, California, and Pasco, Washington. Some applications at 2 and 3 qts. of Tordon 101 herbicide per acre were made also in western Oregon and Washington in late May.

The control of Russian and yellow star thistles and nearly all other annual broadleaves as well as the tap-rooted perennial broadleaved weeds listed earlier was excellent with the 1 and 2 qt. rates of Tordon 101 Mixture generally. Where morning glory was present, it was suppressed with the 2 qt. rate of Tordon 101. At two locations in western Oregon and Washington, Canada thistle and tansy ragwort were partially controlled with 3 qts. per acre in late May. In Washington, the 2 qt. rate in late May controlled buttercup (*Ranunculus* sp.) and common mullein (*Verbascum Thapsus L.*) was suppressed greatly with the 2 and 3 qt. rates when treated early.

Observations of some of these plots in 1967 indicated a definite residual effect of the Tordon herbicide through the second season especially on Russian and yellow star thistles. In some cases, the second season control of all species, including the tap-rooted perennials, was excellent. The degree appeared to be related to the amount of rainfall within a few weeks after treatment.

The spring of 1966 was extremely dry after Tordon 101 Mixture was applied in February, in most of the areas except western Oregon and Washington. Rainfall was generally less than a total of 1 inch in small increments, and in some cases there were only traces. Further tests using similar equipment and techniques were established in Central California during late January and February 1967 to evaluate the effect of several inches of rainfall on efficacy. Tordon 101 Mixture at 1 and 2 qts. per acre particulated with Norbak was applied with two ¾ DOC-32 nozzles at 30 psi mounted on a sprayer traveling at 5.4 mph to give 25 gals. per acre. The plots were 20 ft. wide by 200 to 700 ft. and replicated at several locations near Davis, Zamora and Sunnyvale. Some treatments included Dowpon for annual grass control. The broadleaved weeds included *Lactuca scariola* (wild lettuce), *Erodium* spp. (filaree), *Brassica* sp. (mustard), *Amsinkia douglasiana* (fiddleneck), *Erigeron* sp. (horseweed), *Solsala kali* (Russian thistle), *Centauria solstitialis* (yellow star thistle), *Amaranthus* spp. (pigweed), *Helianthus annua* (sunflower), and *Silybum marianum* (milk thistle). *Rumex crispus* (curly dock), *Cichorum intybus* (chicory), *Plantago* spp. (plantain), *Taraxacum vulgare* (dandelion), *Convolvulus arvensis* (morning glory), and *Eremocarpus setigerus* (doveweed) were present in all or most areas. Rainfall during the rest of the rainy season (to June) amounted to 10-13 inches. Plots were rated in the fall on the same basis as in 1966. The results in three typical situations are shown in Table 2.

Control of annual broadleaves was generally excellent. A very few mustard and pigweed plants were observed at the Davis location where the application was made on January 23. The long wet spring probably allowed some more germination of these weeds on which Tordon herbicide is less effective. Also, the very small seeded pigweed probably germinated very close to the soil surface above a lethal concentration of the herbicide. At some locations, control of hardwoods and conifers a few inches high was good with 2 qts. of Tordon 101 Mixture during the late spring. Doveweed (*Eremocarpus setigerus*) appeared to be unaffected by the 2 qt. rate of Tordon 101 Mixture.

Effects on plants off the target areas from drift, run-off water or blowing dust have not been observed in any situation with these low dosages of Tordon 101 Mixture and Norbak particulating agent.

TABLE 2

CONTROL OF ANNUAL AND PERENNIAL BROADLEAVED WEEDS WITH FIELD SCALE APPLICATIONS OF TORDON 101 MIXTURE AND NORBAK PARTICULATING AGENT

		Percent Control								
	Amount per Acre[1]	Davis			Zamora			Winters		
		AW[2]	AS[2]	PB[2]	AW	AS	PB	AW	AS	PB
Tordon 101	1 qt.	92	94	94	98	....	....	98	98	97
" "	2 qts.	95	95	97[3]	99	....	....[3]	99	99	100[3]
Tordon 101 + Dowpon	2 qts. 2 lbs.	95	96	95[3]	99	....	....[3]	99	99	100[3]
Untreated	....	0	0	0	0	0	0	0	0	0

[1]Amounts of products
[2]AW is annual winter broadleaves,
AS is annual summer broadleaves,
PB is tap-rooted perennial broadleaves.
[3]The creeping perennial species, morning glory and ragweed **(Ambrosia psilostachya)** were noticeably suppressed.

Discussion

The method of applying weed sprays on roadsides at volume rates of 15 to 25 gals. per acre and speeds of 10 to 15 mph with 1 or 2 large nozzles located on the vehicle has certain logistical advantages over boom applications conventionally made at 1 to 3 mph. There would be less water requirement, less treatment time, less hazard from exposure to traffic, more time for other work, more timely application in relation to growth stage and conditions, and no concern about obstructions off the edge of the road surface. The Norbak agent imparts a particulated nature to the spray, and in addition to reducing drift greatly, the ability to project sprays up to 25 or 30 ft. accurately under varying low wind speeds allows mounting a flat-fan and 1 or 2 large off-center nozzles inboard or only slightly outboard of the vehicle.

Previous studies (3) have indicated that the volume rates in the range of 15 to 25 gals. per acre give about equal results. Amounts of 5 to 10 gals. per acre sometimes gave reduced weed control. The equipment and procedures for mixing are simple, but important; the details and specifications are outlined in appropriate instruction manuals.

Tordon 101 Mixture has been cleared for this use with Norbak particulating agent at rates up to 2 qts. per acre. Some rainfall after application is necessary to provide the desired residual effect on emerging seedlings of most broadleaved weeds. Even then, crucifers may escape. Since 2,4-D has good foliar effect on many weed species but is weak through the soil, treatments after most of the winter broadleaves have emerged will give maximum efficiency of the spray.

Since Tordon herbicide is effective through the soil, care should be taken to not apply this spray where roots of desirable and susceptible species may contact the residues. Since small amounts can be picked up in the first flush of water over the treated surface, care should be observed to prevent run-off water from the first rains after treatment reaching irrigation systems or areas where susceptible plants may be located.

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"WEEDS" NEED NEW DEFINITION

Lambert C. Erickson[1]

We are agreed that the word "weeds" does not portray an adequate mental image on the public, nor on administrators, at the highest levels. It is, of course, our duty to scrutinize ourselves. Are we delivering the message? Even in this group today I'm concerned that too many would define a weed as "a plant out of place." Our own organization, The Weed Society of America, after some deliberation, settled for "a plant growing where it is not wanted." Immediately, it is obvious that neither of these definitions do much for describing the problem. Surely these definitions are not adequate justification for our assembling here in the 22nd meeting of this conference.

A few days ago I listened to a speech by our vice-president for academic affairs. This man advanced through the ranks and was recognized as a very outstanding teacher. Knowing his record as a teacher, I was most impressed by his statement, "To know a subject well you must know it from the beginning." In determining what we are talking about, perhaps we need to review the subject back to the beginning.

Where is the beginning of weeds? Who first recognized that weeds were a problem? What were the involved species? It appears that neither the problem nor the word was recognized literarily by the magnificant Greeks. Again, neither the word nor the problem existed with the glorious Romans. Now why should they since the duty of their subjugated colonies was to supply Rome with food, or more specifically the cereal grains.

Literarily, then, we must turn to the Judean culture and review the Bibical references. A synonym for weed does not exist. However, we find the English translation to contain the words; thorn 9 times, thistle 4 times and tares twice. The references to thistles and thorns usually emphasize discomfort rather than competition. The parallels of the tares, however, were another matter. We shall return to that word.

Then came the dark ages—almost 15 centuries. Apparently, population pressures never became very intense because microorganisms suppressed the human macroorganism. Scarlet fever, diphtheria, bubonic plague, influenza, tuberculosis, you name it. They had it.

Food was certainly in short supply. Certainly, they did not question the quality nor, perhaps even the kind of cereal grain, so long as it was edible. Remember that within 200 years ago wheat was not wheat. Oats was not oats. Barley was not barley. They were mixed cereal grains varying in composition but being primarily either wheat, oats, barley or rye. There is an old English word "succotash" denoting mixed grains. It is also interesting that modern dictionaries do not contain this definition.

Rye, the sturdy winter-hardy grain of Northern Europe, prevailed on large acreages due in larger part to its competitive ability and secondly by early shattering and, thereby, re-seeding itself each fall. Rye bread became a staple food. It also influenced the population problem because it was so ergotized that certainly numerous, if not the majority of human conceptions, were aborted.

How often do we reflect on the fact that any form of a reputable seed industry is less than a hundred years old. It is almost exactly 100 years ago that the Gardeners Chronicle, published in London, revealed the fact that seeds sold in "the trade" germinated only 10 to 30 percent and that a purity of 50% was excellent. Likewise, it's 100 years ago (99 to be exact) that Dr. Nobbe started the world's first fundamental studies in seed quality and physiology.

In passing, let us also note that the seed merchants were not without ingenuity. Diluants for seeds had become a refined specialty. Clay, sand and gravel were seized and colored to imperceptably mix with the specific crop seed.

And so our forefathers moved to America. Why worry about weeds? There's another fresh, clean million acres over yonder hill. And at the fore of the movements, just over yonder hill, was the seed industry. The seed industry obviously searched for clean land. For many years this was synonymous with new land. Idaho was very much the last of that frontier. Now, the duty is ours to protect and maintain that last frontier. Wherever you (man) are now, you are, landwise, on that last frontier. That environment, that biosystem, that made it possible for agriculture to flourish, that is what must be maintained.

We know it. We know it too well, that the greatest, single, continuing, almost unalterable cost in crop production is the weed factor. What is this annual cost?

[1]University of Idaho, Moscow, Idaho.

Is it 5 billion dollars or 10 billion dollars? Is it \$5.00 per acre or \$50.00 per acre?

Weed—defined as "a plant out of place," or "growing where it is not wanted," somehow leaves too much to be desired. It does not imply the significance of the problem and, consequently, we do not communicate the vast problem.

Let's attempt some parallels. The rubble, the glut, the devestation before you as you drive through the Mesabi Range—the old open pit mining area of northeastern Minnesota—can hardly be described as a steam shovel out of place; although steam shovels did it. As I stood on the bank of the 20-foot-wide open sewer in Cleveland, Ohio, and observed the slime, the goo, the industrial wastes and the vast quantity of raw human excrement floating by, making a cesspool of Lake Erie, I could hardly describe this situation as some excrement out of place. It was instead, "the wanton destruction of a natural resource."

When farmers abandoned their weedy farms in the depression thirties, because only the very best could survive on clean land; when the mortgage holders would happily sell weedy farms at severe financial loss, the situation could hardly be called a plant out of place. When tenants, production loans, and grower contracts could not be obtained for weedy farms, when "Gone with the Weeds," was as common an expression in some rural communities as "Gone With the Wind" was in Hollywood; the situation could not be described as a plant out of place.

I need not review for this group the ten or twenty cardinal characteristics that make a plant a weed. Although an oak tree in a wheatfield and a Peace rose in an asparagus bed may seem out of place to us; the species appear to be quite contented. It is quite certain that field bindweed in quite "in place" in Kansas, and Johnsongrass in Texas and Canada thistle in the Pacific Northwest.

Weeds—what are we talking about? What do we need to define?

We must define that weeds are plants that compete for possession and too frequently take full possession of a natural resource, be it land, or water, or air.

"Gone with the weeds." That phrase denotes possession. In the book *Vegetation of Wisconsin,* J. T. Curtis says, "weeds are plants that compete with man for possession of the soil." That definition is adequate until we encounter plants that interfere with water systems, either by obstruction or transpiration, and, thereby, jeopardize crop production throughout the irrigated world. It omits plants which contaminate or alergize the air, making it unfit for human consumption.

Can we, then say, that weeds are plants which compete with man for possession of the soil, air or water? No, we still have some notable omissions: the poisonous plants, the phreatophytes, the ruderals, the unaesthetics. Let's contemplate this definition. "Weeds are plants that compete with man for possession of his natural resources."

Earlier we mentioned the Bibical "tares." Remembering that the presentation is in parables, can we extrapolate this reference to cover the field of weed science? If so, how would you like the term "Tareology" for the discipline? Its apparent equivalent in Greek would be Zizaniology. This name deal is, of course, "old hat" to most of us. However, it is obviously true that definitions, terms and titles do create mental images, and mental imagery is communication. Did Erick the Red have black hair?

HERBICIDE RESIDUES IN BLACKTAIL DEER FROM FORESTS TREATED WITH 2,4,5-T AND ATRAZINE

Michael Newton and Logan A. Norris[1]

(*Abstract*) This report summarizes an exploratory study designed to gain some order-of-magnitude estimates of herbicide residues in various organs of blacktail deer whose habitat was entirely treated either with 2,4,5-T or atrazine.

Areas treated were in the Oregon Coast Range; both supported large populations of deer. Food supplies for deer were generally good, and it is likely the proportion of migrant animals was minimal. Two atrazine units were 200 and 300 acres in size, largely open grassy cover with numerous brush clumps. The 2,4,5-T unit was about 90 acres in size, and was dominated by extremely heavy brush cover. The latter unit had been treated two years previously with 2,4-D, and substantial coppice browse had developed. Atrazine was applied at four pounds per acre in water in early April by helicopter; 2,4,5-T was applied at the same time at the rate of two pounds per acre acid equivalent as the isooctyl ester, with a small amount of 2,4-D in mixture, in ten gallons fuel oil. Essentially no rain fell during the sampling period.

Several deer were killed in each area at irregular intervals after treatment in hopes of obtaining an estimate of cumulative effects, elimination patterns and reduction of intake with time after treatment. From each deer were taken samples of tissue from brain, thyroid, mesentery lymph nodes, spleen, heart, lung, liver, kidneys, blood, muscle, urine, feces and stomach contents. Mammary glands were sampled on pregnant does. Most of the deer were not fat enough to provide samples of adipose tissue. Some deer were not sampled competely because of confounding from wound damage. The accompanying table illustrates amounts of herbicide found by tissue and length of time following treatment.

[1]Oregon State University, Corvallis, Oregon.

Herbicide found in several organs of deer at various intervals after continuous exposure to herbicide treatment.

Atrazine detected parts per billion

	Time of exposure — Days				
Organ	10	17	26	26	44
Blood	167.1	77.2	142.2		0
Brain	....	....	0	0	....
Fat	....	....	688.3	....	0
Feces	197.7	0	0	0	244.7
Heart	....	76.0	0	15.2	0
Kidney	0	30.0	0	13.3	0
Liver	0	24.6	0	75.2	0
Lung	0	0	0	....	....
Lymph nodes	498.2	....	0	76.4	Lost
Mammary gland	190.7	....	....	30.1	0
Muscle	Trace	Lost	21.4	35.9	0
Spleen	51.5	23.6	12.2	0	0
Stomach Contents	5,762.0	3,453.0	442.9	177.9	428.0
Thyroid	325.7	....	....	T	....
Urine	....	0	....	....	....

2, 4-D and 2, 4, 5-T detected — parts per billion

	Herbicide and Time of exposure — Days							
	No exposure		15		31		43	
Organ	2,4-D	2,4,5-T	2,4-D	2,4,5-T	2,4-D	2,4,5-T	2,4-D	2,4,5-T
Blood	....	....	....	....	14.8	57.9	<6.0	<6.0
Brain	....	....	<6.0	<6.0	....	....	....	....
Feces	32.7	8.0	126.7	79.5	71.7	162.3	14.8	39.2
Heart	< 6.0	< 6.0	<6.0	<6.0	....	....	<6.0	< 6.0
Kidney	....	....	< 6.0	<6.0	<6.0	16.8	8.4	< 6.0
Liver	< 6.0	< 6.0	<6.0	<6.0	12.8	6.0	11.1	20.9
Lung	....	....	....	....	<6.0	17.8	<6.0	19.7
Lymph-nodes	....	....	<30.0	<30.0	6.9	9.4	< 20.0	< 20.0
Muscle	24.6	6.0	< 6.0	< 6.0	<10.0	<10.0	<6.0	<6.0
Spleen	....	....	< 6.0	<6.0	9.2	< 6.0	<6.0	6.8
Stomach contents	24.5	22.3	< 6.0	<6.0	<6.0	<6.0	88.0	358.2
Thyroid	....	....	< 60.0	<60.0	54.4	149.6	<15.0	< 15.0
Urine	....	....	28.1	191.6	42.1	< 30.0	....	....

It is clear that deer do not accumulate large amounts of either herbicide when exposed to maximum dosages throughout their habitats. Intestinal contents provide abundant evidence of present or past exposure, but low levels of herbicides in most body tissues is evidence of breakdown within the animal, perhaps within some endocrine glands, or passage through the digestive system.

These results are definitely not conclusive. They provide fragmentary evidence that (1) deer do not leave areas thus treated, (2) safe limits for wildlife were apparently observed in these operations, (3) deer do not accumulate 2,4,5-T and atrazine to an appreciably degree, (4) that concentrations in flesh rarely reach detectable levels, particularly in the case of 2,4,5-T, and (5) this ruminant is able to degrade these herbicides almost completely soon after ingestion.

Acknowledgment

This investigation was supported by research grant WP-00477 from the Federal Water Pollution Control Administration. Cooperation from the Oregon State Game Commission is gratefully acknowledged.

MINUTES OF THE BUSINESS MEETING OF THE WESTERN SOCIETY OF WEED SCIENCE HELD AT THE OWYHEE HOTEL, BOISE. IDAHO

MARCH 21, 1968

President Strew suggested dispensing of the readings of the minutes of the Business Meeting of March 19, 1967. Gary Lee moved dispensing of reading of the minutes. Seconded from the floor. Passed unanimously.

Treasurer's Report by J. La Mar Anderson reported that the Society was in good financial condition and that the Society was striving for a balance of one-year's operating expense. The finance committee report presented by Ken Dunster found the books in good order and expenses well documented. The finance committee (D. Ragsdale, K. Dunster, Jack May—acting) questioned the purchasing of the $1200.00 savings certificate and the reporting to Internal Revenue on interest accumulated. Dan Ragsdale is pursuing the situation with the Internal Revenue and will have directions for the Society in the near future. R. Schieferstein moved to accept Treasurer's and Finance Report. Seconded from the floor. Passed unanimously.

Resolutions Committee Report — W. Dean Boyle, Chairman, Jess L. Fults, L. E. Warren.

The Committee has carefully reviewed all resolutions received from members of the Society and offers the following resolutions for consideration and possible adoption by the Society:

The Committee moves the adoption of the following resolutions and further moves that the Society Secretary send copies to each of the appropriate agencies and/or individuals concerned.

RESOLUTION NO. 1

Whereas, our Society officers during the past two years, President S. W. Strew; Vice-President K. C. Hamilton; Secretary H. P. Alley; Representative to the Weed Science Society of America J. M. Hodgson; Director at Large R. H. Schieferstein; Chairman of the Research Section H. P. Alley; Chairman of Education and Regulatory Section B. L. Bohmont; Treasurer-Business Manager J. L. Anderson, have conducted this Society in an effective and pleasing manner,

Now, therefore, be it resolved that we express to them our appreciation and thanks for their services.

RESOLUTION NO. 2

Whereas, the Western Society of Weed Science assembled in Boise, Idaho, on March 19, 20 and 21, 1968, appreciates the opportunity to meet in Boise, and

Whereas, the Local Arrangements Committee, Robert E. Higgins, Chairman, H. Fred Arle and Dudley Zoller have done an outstanding job,

Now, therefore, be it resolved that we express to them our appreciation and thanks for their service.

RESOLUTION NO. 3

Whereas, this Society appreciates the leadership and assistance of the standing committees:

Program Committtee—
K. C. Hamilton, Chairman
H. P. Alley
B. L. Bohmont
D. L. Burgoyne
J. W. Koehler

Finance Committee—
Dan W. Ragsdale, Chairman
Ken Dunster
E. E. Schweizer (Jack May—Acting)

Resolutions Committee—
W. Dean Boyle, Chairman
Jess L. Fults
L. E. Warren

Now, therefore, be it resolved that we express to them our appreciation and thanks for their services.

RESOLUTION NO. 4

Whereas, we owe a debt of gratitude to those persons who dedicate their lives to the service of man and our country including those who had the foresight and initiative to organize and hold the first meeting of this Society in Denver, Colorado, June 16 and 17, 1938, and

Whereas, Mr. Robert B. Balcom, Chief Agronomist, Bureau of Reclamation, Washington, D. C., a charter member and energetic supporter of this organization, is retiring at the end of 1968 from Federal service,

Now, therefore, be it resolved that we express to Bob our appreciation of his valued contribution to the progress of weed science in the Western States and thanks for his long and faithful service.

RESOLUTION NO. 5

Whereas, recognition of specific weedy plants by name and appearance is essential in order for those not trained in weed identification to know existing weed infestations and to know potentially dangerous weeds as well as to select proper control methods, and

Whereas, extension workers, public and private agencies and others have need for recognition aids such as single sheet fliers with colored pictures of specific weeds,

Now, therefore, be it resolved that the President of the Western Society of Weed Science appoint an active committee of three to study the need for, the mechanics of obtaining and the possible methods of handling such a program and report to the Western Society of Weed Science at the 1969 meeting.

Proposed Committee—
Robert E. Higgins, Chairman
P. E. Heikes
W. B. McHenry

RESOLUTION NO. 6

Whereas, noxious weeds are a problem in all states of the United States and it is difficult for states individually to control noxious weeds without inter-state cooperation, and

Whereas, a large part of the land in many states is controlled by the Federal Government and therefore Federal cooperation is essential to effective weed control, and

Whreas, noxious weeds do invade the states from other states and foreign countries, and

Whereas, the United States Department of Agriculture is limited in its authority of noxious weed control to the protection and improvement of future productivity of range lands, and

Whereas, a Plant Pest Control Contingency Fund has been established by U.S.D.A. to provide inter-state cooperation in attacking pest infestations that cross state lines and threaten large areas, and

Whereas, weeds have not been included as "pests" in allowing funds for emergency control measures under the above Contingency Fund,

Now, therefore, be it resolved that a committee be appointed by the Western Society of Weed Science to determine:

a. Whether weeds can come under the provisions of the existing Pest Contingency Fund program and what arrangements are necessary, and
b. How much additional funds should be requested to support weed control projects in addition to those for other pests, and
c. If weeds are not "pests" under the present Contingency Fund, determine procedures for inducing U.S.D.A. to establish a Weed Control Contingency Fund, and administration of such a fund together with an estimate of amounts of money to be requested.

Proposed Committee—
J. W. Koehler, Chairman
L. C. Erickson
Lyal Taylor
S. W. Strew

RESOLUTION NO. 7

Whereas, there are tremendously increased demands for food in the world and the number of people in this country who are actually engaged in the mechanics of food production is rapidly decreasing, it appears that those who actually do the work of food production will become key people in our future complex civilization. This means that these people must have unusual skills and abilities in the area of *applied* scientific agriculture.

With the present image of agriculture in the minds of the general public there are far too few top flight young men entering the professions of *applied* agriculture. One of the key areas is that of Weed Science since the greatest limiting factor in the efficient modern mechanization of food production is the adequate control of weeds.

Now, therefore, be it resolved that the presidents and other administrative oiffcers of our land grant colleges as well as our top administrators in the U.S.D.A. and in industry be urged to devise means of encouraging young men to enter various aspects of *applied scientific agriculture* so that the skills so vitally necessary to our continuing prosperity will not only be maintained but vastly expanded to meet the increased needs of world food production tomorrow.

Be it further resolved that we urge foundations and governments to allocate more realistic financial support to the integration of scientific knowledge into production practices, particularly in the area of Weed Science.

Representative to WSSA Report by J. Hodson.

REPORT TO WSWS EXECUTIVE COMMITTEE OF 1968 WSSA MEETING IN NEW ORLEANS, LOUISIANA.

A very intensive conference was held by WSSA February 6, 7, and 8, 1968. Excellent coverage of the conference theme, "Weed Control and the World Food

Problem," was accomplished by the general session speakers. A registration of over 700 was reported. Dr. G. F. Warren of Purdue University was elected a fellow of the Society.

Dr. Boysie Day, President-elect, was program chairman. A large group of representatives from the Latin American countries were present, giving papers in a Latin American section, and the usual sections were conducted.

New officers elected were as follows:

Glen C. Klingman—President-elect
L. L. Danielson—Secretary
Phillip Upchurch—Exec. Comm.
Paul W. Santleman—Exec. Comm.

The Executive Committee of WSSA met February 5, 1968, at the Jung Hotel, New Orleans, one day prior to the meetings of the entire Society. The following items are reported for your information.

1. Financial Report from F. W. Slife, Business Manager, to December 1, 1967.

		Bank balance	
Income	$40,354.01	12-1-67	$10,466.01
Expense	41,470.37	Investments	26,634.25
Net	$ 1,116.36	Net Worth	$35,983.90

Although expenses were greater than income, there was an $8,084.46 investment in the herbicide handbook and returns on the handbook at the time of the statement were $3,767.00. Many copies are still available for sale.

Dr. Slife pointed out that printing costs continue to increase and suggested that some action will be needed before too long to provide for this. He suggested a page charge as preferable to an increase in subscription rates. The Executive Committee discussed the matter and indicated that the business manager should watch the situation quite closely so that proper action could be initiated when needed. Purchase of a new typewriter was authorized for the business manager.

2. Editor's Report—There has been an increasing number of manuscripts and more pages per issue in the Weeds Journal.

Time for publication of manuscripts after receipt, usually 9-10 months. This is partly due to the publication coming out only quarterly. It is possible in 6 months if author and reviewers take less than 1 month for their reviews.

INTERNATIONAL WEED SCIENCE
CONFERENCE COMMITTEE

Dr. W. B. Ennis, Chairman, reported that FAO had agreed to sponsor such a conference but that many details were unresolved and that budget cuts to the State Department were seriously interferring. The original date of the summer 1969 may yet be changed. An alternate date of June 1970 was also proposed. In other words, the conference is not yet definitely scheduled. WSSA has agreed to help with the conference as they may be able if it becomes a reality.

Education Commitee was quite active during the past year. Dr. Paul Santleman reported this committee had prepared an exhibit which was shown at the National FFA Meetings. The exhibit explained opportunities in Weed Science. A Weed Science Career Leaflet was also made available at the exhibit by the education committee. About 2,000 copies were picked up by the FFA boys.

A subcommittee is working on a revised Weed Science Career brochure. The Executive Committee authorized the printing of 25,000 copies of this brochure. When it is finished it is to be made available to industry, schools, etc. A permanent exhibit is also to be built and will be available for fairs, or meetings, etc. and can be obtained by writing to WSSA and paying shipping costs. The costs will be quite nominal because of the knockdown type of construction of the exhibit.

This committee is also preparing a booklet of science fair projects in Weed Science. This will also be published by WSSA when completed.

Constitution and Operating Procedures Committee have developed several suggestions for bringing operation of the Society up to date. Several sample ballots will soon be forthcoming as follows: 1) To provide for the election of one new member of the Executive Committee each year rather than two members every other year; 2) To provide for an additional officer of the Society, the Vice President, who will succeed to the office of President-elect; 3) To revise the names of member conferences in line with the new names, i.e., Western Society of Weed Sicence.

The committee suggested that members of the WSSA who are to be so honored be called fellows rather than honorary members and that outstanding persons in Weed Science, not members of WSSA, might be extended honorary membership. The suggestion was accepted by the Executive Committee.

Local Arrangements Committees report plans are well along for the 1969 meeting in Las Vegas at Caesar's Palace Hotel, February 10, 11, 12 and 13, 1969.

The WSWS Executive Committee had instructed the representative to clear the day previous to these meetings for a short business meeting of WSWS and for meetings of the research project committees and presentation (sale) of the Research Progress Report. The representative received approval as follows:

"All replies received favored allowing the WSWS meet for a one-half day meeting in Las Vegas provided that it does not interfere with the WSSA committee meetings. Publicity and registration should be handled separately. In no way should this be considered a joint meeting. Several expressed concern for possible conflicts with WSSA committee meetings if WSWS holds its meetings just prior to the WSSA meeting. The possibility of WSWS meeting immediately atfer WSSA was suggested as an alternative."

The representative was advised to request the WSWS to coordinate closely with WSSA so that there would not be interference with their meeting.

The WSSA meeting for 1970 will be held at the Queen Elizabeth Hotel, Montreal, Canada.

Above report submitted to the WSWS Executive Committee by the Representative to WSSA.

Research Committee Report—H. P. Alley, Chairman. Alley commended D. Bayer for editing and indexing the Research Reports. Gary Lee was given a vote of thanks for his untiring efforts in getting the Research Reports published. Seven project meetings were held at Boise.

Project 1. *Perennial Herbaceous Weeds.* The meeting was conducted by Al Fechtig. Louis Jensen is the new Chairman. Clyde Elmore is the Chairman-elect.

Project 2. *Herbaceous Range Weeds.* The meeting was conducted by Jim Young. Roger Scott is the new Chairman. Gene Cronin is Chairman-elect.

Project 3. *Undesirable Woody Plants.* The meeting was conducted by H. Hull. Jack Warren is the new Chairman. Lyle Green is Chairman-elect.

Project 4. *Weeds In Horticultural Crops.* The meeting was conducted by H. Agamalian. Bill Anliker is the new Chairman. Alvin Hamson is the Chairman-elect.

Project 5. *Weeds In Agronomic Crops.* The meeting was conducted by D. Peabody. Gene Chamberlain is the new Chairman. Gary Lee is the Chairman-elect.

Project 6. *Aquatic and Ditchbank Weeds.* The meeting was conducted by E. Bowles. V. Bruns is the new Chairman. Dean Boyle is Chairman-elect.

Project 7. *Chemical and Physiological Studies.* The meeting was conducted by H. Hull. Roland Schirman is the new Chairman. Bob Schieferstein is Chairman-elect.

Nominations Committee Report—W. A. Harvey, Chairman; Arnold Appleby, Richard Fosse. A. Appleby presented the report in the absence of W. A. Harvey.

President Strew explained the method and reasons for balloting for the new officers to the group.

Dean Swan moved, seconded from the floor that officers of the Society be elected by mail ballots and that the by-laws be changed to permit the use of mail ballots. After considerable discussion a show of hands showed a large majority in favor of the mail ballots. Passed unanimously.

The officers elected for the next year are:

President-elect—H. P. Alley, University of Wyoming

Secretary—K. W. Dunster, Amchem Products, Inc.

Chairman-elect — Research Section — J. H. Dawson, U.S.D.A., Prosser, Washington

Chairman-elect—Education and Regulatory Section — Rex Warren, Oregon State University

L. Erickson moved, A. Gale seconded approval of the slate of officers as presented. Passed unanimously.

New Business—D. Burgoyne stated that we need clarification on nomenclature of what constitutes a mixture in herbicide work. We seriously need guidelines. President Strew instructed D. Burgoyne to contact the other weed conference and to present the thoughts in an outline and give to Jess Hodgson the WSWS represenative to the WSSA. This is to be done in time for the WSSA meetings in Las Vegas, Nevada, February, 1969.

L. Erickson moved, seconded from the floor that the Executive Committee be commended for their efforts if they would admit their errors. Passed unanimously.

President Strew commended R. Higgins and the Arrangements Committee for the local arrangements.

Dave Bayer expressed the need for clarification and directions on research papers and reports at the annual meeting. Dave felt that the papers or reports should not necessarily represent completed research.

Meeting adjourned 12:10 p.m.

H. P. Alley, Secretary, WSWS

FINANCIAL STATEMENT OF WESTERN SOCIETY OF WEED SCIENCE MARCH 10, 1967 — MARCH 10, 1968

Income

On hand, March 10, 1967	$1,249.49
Registration, Phoenix meeting (257 @ $2.00)	514.00
Banquet tickets (123 @ $5.00)	615.00
1967 Research Progress Report	884.98
1967 Proceedings	891.00
Sale of old publications	165.00
Payment of outstanding accounts	45.99
Dues, persons not attending meetings	59.00
Interest on savings	30.00
	$4,454.46

Expenditures

Phoenix meeting incidental expenses	$ 156.25
Banquet—Phoenix	571.20
Printing costs, 1967 Research Progress Report	484.84
Printing costs, 1967 Proceedings	750.00
Office supplies	125.92
Postage	263.10
Mailings to membership ($108.00)	
Boise meeting expenses	132.90
Gratis publications (29)	
	$2,484.21

Liquid Assets	
checking ($747.25)	
saving ($1,200.00)	
cash on hand ($23.00)	
Total	$1,970.25
Accounts Receivable	48.50
Publications on hand (418 no assigned value)	
Net worth	2,018.75
Potential net worth (418 @ $3.00)	1,254.00
	$3,272.75

OFFICERS WESTERN SOCIETY OF WEED SCIENCE 1969

President—K. C. Hamilton

President-Elect—H. P. Alley

Secretary—K. W. Dunster

Chairman Research Section—Dave Bayer

Chairman-Elect—Research Section—J. H. Dawson

Chairman Education and Regulatory Section—Phil Martinelli

Chairman-Elect—Education and Regulatory Section—Rex Warren

Immediate Past President—Stan Strew

Member-at-Large—To be selected

Representative to WSSA—Jess Hodgson

Treasurer—Business Manager—J. LaMar Anderson

Standing Committees

Finance Committee—E. E. Schweizer, Chairman; D. Ragsdale, one to be appointed.

Resolutions Committee—Jess L. Fults, Chairman; W. Dean Boyle, L. E. Warren

Nominating Committee—Richard Fosse, Chairman; W. A. Harvey, one to be appointed.

Local Arrangements Committee—Dudley Zoller, Chairman; R. E. Higgins

Program Committee—H. P. Alley, Chairman; Dave Bayer, Phil Martinelli

Chairman and Chairman-Elect of Projects 1 through 7

Project 1. *Perennial Herbaceous Weeds*
Chairman—Louis Jensen
Chairman-Elect—Clyde Elmore

Project 2. *Herbaceous Range Weeds*
Chairman—Roger Scott
Chairman-Elect—Gene Cronin

Project 3. *Undesirable Woody Plants*
Chairman—Jack Warren
Chairman-Elect—Lyle Green

Project 4. *Weeds in Horticultural Crops*
Chairman—Bill Anliker
Chairman-Elect—Alvin Hamson

Project 5. *Weeds in Agronomic Crops*
Chairman—Gene Chamberlain
Chairman-Elect—Gary Lee

Project 6. *Aquatic and Ditchbank Weeds*
Chairman—Vic Bruns
Chairman-Elect—Dean Boyle

Project 7. *Chemical and Physiological Studies*
Chairman—Roland Schirman
Chairman-Elect—Bob Schieferstein

AUDIT OF THE FINANCIAL STATUS OF THE WESTERN SOCIETY OF WEED SCIENCE

The financial records of the WSWS for the period covering the 11th of March, 1967, to the 10th of March, 1968, were reviewed by the Finance Committee on 20 March, 1968. A financial statement was prepared and submitted by LaMar Anderson, Society Business Manager. It was found to be properly documented and in good order.

INCOME: Four major items in this section accounted for the bulk of this portion and dealt primarily with the 1967 meeting.

EXPENSES: Appeared to be in line with the operation of the society. Dr. Anderson is to be commended for the extra efforts expanded in the detailed accounting requested by the 1967 Auditing Committee.

LIQUID ASSETS: Savings certificates were purchased by Anderson as directed by Mr. S. Strew, President. This was done to avoid having an excess in the regular checking account. It is the feeling of the Committee that before additional such action is taken there should be a careful study made into the benefits and detriments of such purchases. Also inquiry into how others in this field handle their surplus funds.

ASSETS	
Checking	$ 747.25
Savings	1,200.00
Cash on Hand	23.00
	1,970.25
Accounts Receivable	48.50
Old Publications 418 $3.00 ea.	1,254.00
Potential Net Worth	$3,272.75

It should be noted that the WSWS Finances in this audit period showed a net profit of $540.76.

Therefore the Committee recommends that the financial report be accepted as submitted by the Business Manager.

Dan W. Ragsdale, Chairman
John W. May
Ken W. Dunster

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