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PRESIDENTIAL ADDRESS

SUCCESS THROUGH INVOLVEMENT

Gary A. Lee[1]

A decade ago I addressed the Western Society of Weed Science in Albuquerque, New Mexico, in an entirely different capacity than today. I was a 22 year old graduate student, stripped of all confidence, and in a state of near mute shock. Individuals in the audience appeared to be fang-baring, red-eyed monsters ready to destroy an innocent nonsuspecting student of weed science. This group appeared to be a most powerful and awesome organization through the eyes of a graduate student. The realization that my first impression of this "awesome organization" was somewhat distorted, has been reassuring during my subsequent association with WSWS.

The opportunity to address this group today is as challenging as a decade ago. The privilege of serving as your president ascribes a certain amount of direction and responsibilities to the membership. I would like to convey some of my observations of the status of the Western Society of Weed Science at present in relation to the past and future. WSWS does not and probably never will have a large membership. This is not difficult to conceive, since our boundaries include the least populated portion of the United States. Yet, this does not mean that the Society cannot provide a vital service to Weed Science. Our membership list includes many internationally recognized weed scientists and many destined for such recognition. The key ingredient to the viability of the organization, however, is not the membership list. Service to members and in turn, member's service through participation and communication are essential items if the Western Society of Weed Science is to function as the founding fathers intended.

Internally, the Western Society of Weed Science has withstood numerous growing pains and is emerging as an organization which provides a media for the exchanges of research, education and regulatory information. The foresight of past leadership must be accredited with the present status of WSWS. A decade ago, this society was struggling to meet the financial obligations of printing the Research Report and Proceedings. Today we are concerned with a cash surplus and the problem of confrontations with the IRS.

In the not too distant past, the Research Section Chairman was burdened with the monumental task of editing, indexing and publishing the Research Progress Report. The quality of many papers submitted was subprofessional, to say the least, and required extensive revision or corrections to meet minimum standards. The formation of a Publication Standards Committee which has developed guidelines for contributors has alleviated much of the onerous task for one individual. The option of the Project Chairman to reject papers which do not meet the WSWS publication standards seems to be rather harsh, but it is apparent that the quality of the Research Report and Proceedings have improved immensely.

WSWS is making every effort to emulate services to weed science graduated for employment. The Job Placement Committee is to be commended for amassing a most complete inventory of employment opportunities. I encourage those of you in academics to urge your students to attend and participate in this Society. They can benefit from our services and we can gain from their youth and enthusiasm.

I feel the Western Society of Weed Science has a unique opportunity to take a leading role in expanding and strengthening the voice of weed science. The time has arrived for state, regional and the national weed science organizations to develop efficient communications so that cooperative efforts can be made to fortify our position at every level of decision-making in our government. I suggest that local and state weed organizations become involved with regional and national societies for several reasons. On the one hand, regional and national societies have sufficient scope and expertise to assist state and local organizations

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with legislative proposals, environmental problems and provide facts to refute emotional, special interest groups. On the other hand, local and state organizations can strengthen the regional and national societies by active participation. During the past year, a permanent Public Relations Committee has been initiated to publicize the attributes of and the need for weed science. I suggest that this committee distend to act as a liaison between state weed organizations and WSWS. Such a communication flow would augment all organizations involved.

A case-in-point is the Federal Noxious Weed Act which is a vital piece of legislation, which will allow the Secretary of Agriculture to carry out measures to control or eradicate any newly-introduced noxious weeds of foreign origin. Dr. Earl Rodgers, Past-President of WSSA, contacted me for any supportive information for this Act from the Western United States. I was able to provide only the resolution passed last year by the WSWS, but no information was available from state organizations. Dr. Rodgers' testimony would have carried greater impact had he been able to produce resolutions from each state organization as well as regional socities and the Act may have been in force today. Why was this not possible? Because communications have been lacking at the state and regional level. Hopefully, steps have been taken to correct this situation. In addition, through the endeavors of Dr. Arnold Applyby, the regional weed science organizations were able, for the first time this year, to meet and discuss various mutual problems and develop a communication system between the regions. These efforts will augment the long desired relations among the regions and permit a representative of regional weed societies to work more intimately with the WSSA Executive Committee. This may allow regions to prepare information in advance for use by WSSA in combating national confrontations.

Since the moment I was thrust into the position of President-elect, I have been perplexed by the thought of dealing with charges and allegations from irrational groups bent on "saving the world from pesticidal destruction." Refutiation of groups which view factual information as statements which induce cardiac arrest is a difficult task to say the least. Preparation for such an onslaught is virtually impossible. There was, however, no such attack on our honorable science this last year. The lack of cries in the past months has been encouraging in view of the fact that 2,4,5-T was restored for some agricultural uses. This makes one wonder at what front the inevitable attack will occur.

Is it possible that we are making inroads on public opinion at last? Could we dare to assume that people are realizing, since our agricultural commodities surplus are virtually non-existing, that herbicides are an essential tool for mazimum and efficient production? I am a born optimist or I probably would not be in this profession, but I am dubious about these questions. The consumer demands for lower food prices have been met with sympathy and reiteration from the Washington bureaucrats. Figures released recently indicate that the American housewife is uniquely fortunate in spending only 17.3% of the income on food items. High quality food is still in ample supply at a reasonable cost in the United States which makes pesticides a vulnerable target for future ridicule.

I would be remiss to lead you to believe that the "protectors of the environment" have not been active during the past year. I had occasion to visit the World's Fair in Spokane, Washington, this year. The theme of the fair was concerned with preservation of the world's environment. The United States Pavillion was an impressive open structure with the words "The Land Does Not Belong To You---You Belong To The Land" inscribed in large letters along one wall. Below this title was a display of huge insects with a narrative depicting pesticides as a man-made scourge. A short distance away was a mural stating that farming practices and the use of agricultural fertilizers are a major source of pollution for our nation's water supplies. The slanted view of these displays must have given the five million tourists a distorted prospective of the agricultural industry. The odds of combating such subtleties appear overwhelming at the present time. Consumers and bureaucratic lawyers in Washington have been away from agriculture too long to recognize that food is not manufactured in the back room of the supermarket or that agriculture commodities can be legislated into production. The vast majority of the electorate have been and will continue to enact laws which limit agricultural activities for they truely believe the land does not belong to the agricultural producer or that he has the ability to conserve the media of his livelihood.

EPA made a direct assault on experimental use pesticides in early 1974. The martyrous lawyers in Washington, D.C. are attempting to save us from ourselves by proposing regulations which severely restrict research activities with new pesticides. The Federal Register of March 27, 1974, states that FIFRA, as amended, is "legislatively silent" in regard to experimental use pesticides which was interpreted by EPA to mean they could promulgate any restrictions they deemed necessary. The reaction of many societies, including WSWS, was swift and deliberate in appealing such proposals. Although the war was not won, nor was it lost. Many of these regulations are being re-reviewed and hopefully disgarded by EPA.

When the occasion arises, weed science organizations have shown the ability to form a coalition which is influential. It is imperative that state, regional and national organizations be cognizant of mutual problems so that they can assist each other. This can only be accomplished through communication and member participation. I challenge you to give the weed science organizations in America the strength to be heard.

STATUS OF WEED SCIENCE IN MEXICO

Omar Agundis[1]

The weed problem in Mexico is quite variable due to the great differences in the ecological and edaphic conditions and the cultural practices prevailing in the farming areas of this country and to the wide diversity of crops which are grown on the different agricultural areas which range from tropical to semiarid regions.

The National Institute for Agricultural Research (INIA) has several experimental stations located on representative areas of Mexico. Thus for technical and administrative purposes the country has been divided in 8 Research Centers which control 42 Experimental Stations. CIANO and CIAS are located at the north-west part of the country where the agriculture mainly depends upon irrigation. CIANE is located at the north-central part and there, the agriculture is carried out under irrigation and rainfall. CIAT is located at the north-eastern part where the agriculture is mainly based on irrigation. CIAB, located at the central part, includes some tropical areas of the pacific coast; in general its agriculture is based on rainfall and irrigation. CIAMEC is located at the high plateau where the agriculture is based on rainfall. CIASE is located at the southern part of Mexico where the agriculture is mainly under rainfall and CIAPY is located at the Yucatan Peninsula where the agriculture is carried out under rainfall.

The weed Control Department of INIA has about 20 Agronomists, distributed on some of the 42 Experimental Stations of the 8 different Research Centers. There is no doubt that our personnel actually engaged in weed control research is quite limited in order to solve the great variety of weed control problems of the country.

The outlook of improving the methods of weed control in Mexico is bright, even when the economic level of most of the Mexican farmers is low which undoubtedly makes difficult the general acceptance of the use of chemicals for weed control. However, there has been a positive increase in the use of herbicides in the last ten years, especially on the irrigated areas, in crops such as rice, cotton, wheat and soybeans.

The research on weed control in Mexico is based in two general aspects: 1)- Botanical and Ecological Investigations which include; - a) Synecological surveys to determine the presence and dominance of weeds on the crops of the different ecological areas. b) Weed competition studies, to estimate the damage caused by weeds to the crops and the critical

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period of competition. c) Weed biology studies of the main weeds to find the interdependance with the use of herbicides and 2)- Weed Control; which includes the evaluation of herbicides on field and horticultural crops, brush control on pastures and grasslands, the combination of chemical and cultural practices for weed control and studies on residues of herbicides in soils. We consider that these lines of investigation establish the sequence of knowing the weeds, the damages caused and the periods during the growing cycle of the crops when they must be controlled. The information obtained will help to determine better methods of weed control.

Although these projects were established in 1961 and conducted through 1963, the lack of continuity for about 10 years delayed considerably the advanced in our work. In 1973 the above mentioned lines were reestablished and some of the results obtained will be presented in this talk.

The activities of the herbarium were reinitiated in order to identify and classify adequately about 3,000 stored specimens. About one third of this material has been arranged already and the technical name of the main weeds of the areas surrounding most of the experimental stations has been extablished.

The synecological surveys are being conducted on different areas. Some preliminary results obtained indicate that , in cotton, about 80 fields were required to be sampled in order to obtain the maximum number of weed species. Annual weeds were more abundant than perennials and the ones more frequently observed were: Echinochloa colonum (L.) Link, Solanum eleaegnifolium Cav., Xanthium strumarium L., Ipomea purpurea (L.) Roth, Amaranthus palmeri S. Wats., Helianthus ciliaris D.C., Sorghum halepense (L.) Pers. Flaveria trinervia (Spreng.) Mohr., Eragrostis pectinacea (Michx.) Nees, Cyperus esculentus L. and Setaria verticillata (L.) Beauv.

In the case of vineyards about 50 fields were required to be sampled in order to obtain the maximum number of weeds species (16). Here again annual weeds were more abundant than perennials and the ones more frequently observed were : Helianthus cilia ris D.C., Solanum eleaegnifolium Cav., Sorghum halepense (L.) Pers., Setaria verticillata (L.) Beauv., Ipomea purpurea (L.) Roth, Amaranthus palmeri S. Wats., Portulaca oleracea L., Flaveria trinervia (Spreng.) Mohr. and Cynodon dactylon L. The frequency of appearance seems to be related to the age of the vineyard. Most weeds, especially the perennial ones, tended to be more abundant on older vineyards, while most annuals remained about the same or decreased with the age of this crop.

Although the information obtained on these surveys was not correlated to the chemical and mechanical practices of weed control, the data regarding the distribution and abundance of weeds will help considerably in choosing the correct herbicides that must be tested in our programs.

Studies on competition are conducted in order to estimate the damage caused by weeds to the different crops. These studies are based on allowing the free competition of weeds for different periods of time during the growing cycle of the crop. By this method, it can be determined the time during the growing cycle of crop, at which the competition by weeds is more severe.

In the case of beans some plants were maintained on competition with weeds, while others without it, during 15, 30, 45, 60, and 75-day periods and all the growing cycle.

These results indicate that the critical period of competition in beans ranges from 30 to 45 days after emergence. It is during this time, when weeds must be eliminated in order to avoid the maximum yield reductions of the beans. The herbicides that selectively control weeds during this period will be the ones that can be recommended.

Regarding the weed biology studies and their relationship to the efficiency of the herbicides, the results on wild oat (Avena fatua L.) are presented: The germination tests indicate that the dormancy of the seeds do not last for more than 4 months after harvesting since most seeds, with palea and lemma or without them, shows a high germination capacity after this period, indicating that wild oat seeds are capable to germinate at the next planting season. Under field conditions, greater germination was observed when the wild oat seeds were placed at or near the soil surface; however, some germination was detected on seeds placed at depths of 20 and 25 cm. from the soil surface. The wild oat population that can be expected under field conditions indicate that a stand of 1.75 millions of plants per hectare can appear five days after wheat emergence, further increases were observed on the following 5-day periods, but most of the population of wild oat (3.2 millions/ ha) was detected 15 to 20 days after the emergence of wheat. More tillers and spikelets per plant were observed on wild oats that emerged during the first 10-day period, than on those that showed up later. In regard to the critical period of competition, greater yield reductions were observed when wild oats were allowed to compete with wheat during their jointing stage of growth, approximately 50 days after emergence. The results of this study can be related to the time of herbicide applications.

The best time for spraying Difenzoquat, WL-29761 and Suffix was at the stage of wheat tillering. Applications made at later stages, although effective on wild oat control, are not adequate because they are made close to the time of the critical period of competition, when the wheat has been already affected, which is reflected on the lower yields obtained. The maximum yield reduction was of about 45 percent on the weedy check. It must be recalled that most of the population of wild oats is obtained during the first days of wheat emergence, due in part to the short period of seed dormancy observed in this area, conditions that can be considered ideal to obtain the maximum benefits from a herbicide application.

In the case of corn and sorghum the use of Atrazine-50 at 2.0 to 2.5 kg./ha. controls efficiently the weeds Ipomoea spp. and Cucurbita foetidisima H.B.K. prevailing in the northeastern part of the country. The mixture of Atrazine-50 + 2,4-D amine + surfactant at 1 kg. + 1 lt. + 0.2% per hectarea controls most annual broadleaved and some grassy weeds prevailing in the north west part of Mexico and the mixture of Atrazine + Igram (25% each) at 3.5 kg./ ha.) controls efficiently the grassy weeds, resistant to the use of atrazine alone, which are found on the central part of the country, the Yucatan Peninsula and along the Gulf and Pacific coast. In dry farming areas of the north central part of Mexico, the use of 2,4-D and Atrazine, alone and in mixtures, solve the problems of the annual broadleaved weeds prevailing. Further north, at Chihuahua, the weed problem in corn starts at the layby stage. Here, the directed post-emergence applications of the herbicides mentioned and Karmex has given excellent results. The limitation to recommend Atrazine and Karmex on some of the areas mentioned is placed upon the residues of these herbicides that can damage susceptible crops which follows in rotation.

Different herbicides have been evaluated for weed control in beans. Basagran has given adequate control of annual broadleaves and Cyperaceaes while Dacthal and Treflan of grassy weeds. Basagran seems to be a very promising herbicide due to its good selectivity for most bean varities in overall post emergence applications which are less influenced by climatic conditions, as it is the case of the dry farming areas of the north central parts of Mexico. In regions where the rainfall is adequate and uniform tropical areas and the central part of the country- Lasso, metribuzin, linuron and Maloran offer quite promising results on the control of annual broadleaved and grassy weeds on beans.

The herbicides Karmex, Cotoran, Gesagard, at 2 kg./ha. and Treflan and Cobex at 1.5 to 2.0 lt./ha. of the commercial formulations have given adequate control of most annual weeds in cotton. However, none of these herbicides have controlled adequately Ipomoea purpurea(L.) Roth. which is found on most cotton fields, especially at the north west, northeast, and north central parts of the country. Other weeds not controlled by the above mentioned herbicides are : Cucurbita foetidisima H.B.K., Flaveria trinervia (Spreng.) Mohr., Solanum eleaegnifolium Cav., Cyperus esculentus L., Convolvulus arvensis L. Helianthus ciliaris D.C. Sorghum halepense (L.) Pers., among others. As an attempt to solve these problems, some herbicides were applied to the irrigations water to evaluate the effectiveness of this method. Preliminary results indicated a positive control of Ipomoea purpurea (L.) Roth. by means of 2 kg./ha. of Cotoran when applied at 1/4 or 1/2 of the time required to irrigate the plot. On the other hand Gesagard at the same rate did not move more than 25 meters. Similar results were obtained on 1974 trials on plots of 120 m. long, with an efficiency of control over 80 percent all over the plot, on most of the above mentioned weeds. In these trials, the efficiency of Cotoran was more positive when the applications were made during the whole time of irrigation than when made during 1/2 of the time only. It is considered that this method of application can solve the problems of weed control of those species annual and perennials, which are resistant to the normal applications of herbicides, besides, the cost and facility of application are greatly reduced.

On horticultural crops, the applications of Linuron + Gesagard at 1.0 + 0.5 kg./ha. and Linuron + 2,4-D at 1.) + 0.5 kg. and lt/ha. control most annual weeds on onions and garlic. The use of 2,4-D is in order to reduce the growth of Convolvulus arvensis L. on the lands infested by this weed. The applications are recommended to be made 15 to 20 days after transplanting these crops. Sencor-70 at 0.35 and 0.5 kg./ha., Linuron-50 at 2 kg./ha. and Gesagard-50 at 2 kg./ha. offer a good control of most annual weeds on carrots.

The mixture of propanil (LV-10) + 2,4-D amine + surfactant at rates from 3 + 0.5 lt./ha. + 0.2% to 5 + 1.0 lt./ha. + 0.2% is commonly used to control annual weeds in rice. However, the efficiency of this mixture is not always positive unless the applications are followed by irrigation to complete the control of weeds. Preliminary results of new herbicides (AC-92553, Ronstar, Bolero and Basagran) offer control of a broader spectrum of weeds and greater residuality.

Basagran has shown a positive control of most annual broadleaved weeds and Cyperaceas on wheat, oats and rice and might replace in the future the use of 2,4-D formulations, which causes severe damages to nearby susceptible crops and quite often to the cereal crops where it is applied.

Several herbicides have shown good efficiency on the control of weeds present on several crops: on sesame, Lasso and Linuron; on cantaloupe, Cobex and Treflan; on safflower, Lasso, Treflan and Eptam; on sunflower, Gesagard, Linuron, Metribuzin and Ronstar; on soya, Basagran, Sencor and Ac-92553.

In vineyards the recommended herbicides depend on the weeds prevailing and the period of appearance. For the broadleaved perennials (Solanum elaegnifolium Cav. and Helianthus ciliaris D.C.) , the applications of 2, 4-D amine (4 lb./gal.) at 2 lt./ha. offers a good control. Increasing the rate does not favor the percentage of control but on the contrary it is reduced. By the middle of April the annual weeds start to show-up. At this time the applications of 4 kg./ha. of Atrazine-50 or Simazine-50. 11 kg./ha. of Dacthal-50, 5 kg./ha. of Linuron-50 and 3 kg./ha. of Karmex-80 or Cotoran-80, effictively control most broadleaves and grasses. Johnsongrass (Sorghum halepense (L.) Pers.) shows-up during the spring and it can be controlled by applications of the mixture of Dalapon + NaTCA at rates from 100 + 400 to 150 + 500 grams of each in 10 lts. of water. The efficiency of this mixture is not only observed on the foliage but on the rhizomes and new shoots that develop as compared to that observed on the applications of higher rates of Dalapon of NaTCA alone. The efficiency of this mixture has also been proved on Johnsongrass which infest citrus orchards located on tropical areas.

Another method of weed control which is being evaluated on vineyards and orchards is the use of black polyethylene film. Here, an excellent efficiency of control has been observed on all weeds for more than one year, approximated duration of the film. Covering the film with a 5 cm. layer of soil seems to improve considerably its durations and the same efficiency of control is maintained. The use of black polyethylene film for weed control in vineyards and several fruit trees offers a method highly efficient for weed control, with the possibility of reducing time, labor, and in some cases the number of irrigations required The limiting factor to recommend this method is the reduced availability of this material at the present time.

In regard to brush control, most of our investigations have been conducted on the tropical areas along the Gulf coast of Mexico. Here, the estimated infestation of woody weeds on pasture lands ranges on the order of 25 to 45 percent, 6 months after these weeds were cut by hand or mechanical devices. Higher percentages of infestations can be expected after one year of the initial cuttings, if none of the brush control methods are applied. Most of the pasture lands are naturally infested with the native grass Bahia (Paspalum notatum Flugge.), although other grasses have been introduced as: Guinea-Panicum maximum Jacq., Estrella de Africa-Cynodon plectostachyum Pilger. y Pangola-Digitaria decumbens-Stent. among the more important ones.

A general survey made several years ago indicated the distribution of the main woody species found on the state of Veracruz. Some of these species are Puzgual (Croton ciliato-glanduloso Orteg.) Huizache (Acacia farnesiana (L.) Willd.) Olin (Croton sp.) Zarza (Mimosa pigra L.) and Palma Apachite (Sabal mexicana Mart.). Hand cutting is one of the practices followed for brush control and the dry material is burned, although this practice is not too common on this area. Shortly after the rainfall period starts, the reinfestation of woody species and weeds takes place on the land where the common practices of control were followed.

The control of most of the above mentioned species (Mimosa pigra L., Verbesina persicifolia D.C. Croton ciliato-glanduloso Orteg. and Acacia farneciana (L.) Willd.) can be obtained by the use of the ester formulations of 2,4-D, 2,4,5-T, alone or in mixtures and Tordon-101 at rates from 1 to 2 liters in 100 liters of water. The applications must be made when the new growth is from 50 to 100 cm. in length, after the rainfall period has been initiated. For the control of Sabal mexicana Mart. the use of furnace oil placed on the central top portion of the plan has given excellent results. The amount required depends on the size of the palm and ranges from 50 ml. for the smaller ones (50 cm. or less) to 300 ml. for those taller than 2 meters. The applications should be made prior to the rainfall period.

Gentlemen, I have presented a brief summary of what is being done in Mexico to control weeds in our main crops. It represents the efforts of a group of young Agronomists who have accepted the challenge of conducting weed investigations, with limitations of all kinds, but with the general aim of enhancing the production of most crops to their maximum level.

DEVELOPING REGISTERED PESTICIDES FOR MINOR USES

By

John B. Ritch, Jr.[2]

The delay in implementation of some very important sections of the amended FIFRA has created considerable uncertainty. Particularly is this true as regards state registrations

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and minor uses. I know that for many of you the question that needs answering is: What is being done to effectively promote registration or pesticide products for minor crop uses and what additional Federal action is required?

Let me say first off, that getting answers and actions for those questions is also important to those of us in the Evironmental Protection Agency. What I will tell you this morning will not provide these answers but I hope it will indicate that we are concerned and are working on the problem.

As a starting point, let's define what we mean by "minor crops" or "minor uses". I particularly want this understood because I don't want anyone to think there is an implication of minor importance. In our consideration of "minor uses", we think of "essential uses of pesticides for crops for which the cost of obtaining a tolerance and registration is not economically justifiable to the pesticide producer". It means these uses generally are not large enough from a volume standpoint to stimulate the interest of private pesticide producers but they are nevertheless certainly of substantial local economic significance. Such uses include needs in growing a small production crop- or on the other hand, it may be a minor pest on a very broad crop.

Obtaining data to support tolerances and registrations for such uses has been a problem for many years. The increasing costs of development of information, increasingly more stringent standards, longer development times, together with the low financial return in proportion to this cost and time, have prevented companies from registering pesticides for these uses.

To overcome the need in the past, agricultural advisors have suggested or recommended pesticide uses which have been effective- although not always- but which have been registered. Meeting the tolerance requirement also presented a barrier when food or feed crops were involved. In recognition of this problem, the USDA formed the IR-4 project in 1964 to evaluate and coordinate the assembly of current data, wherever available, and the needed research required to obtain tolerances for pesticide uses on minor crops.

Although this project has been helpful in obtaining clearances for tolerances for 40-45 minor uses on food crops each year, this does not meet the needs of the small growers in securing clearances. Their problem has been compounded over the past few years by a number of related actions:

For example, the phase-out of registrations based on no-residue or zero tolerance included the phase-out of a number of pesticides previously used on minor crops.

Also, actions cancelling some of the broad spectrum persistent pesticides, such as DDT and aldrin, took away registered pesticides used for many minor uses.

And, the lack of development of any acceptable residue grouping plan has continued to limit tolerances.

Despite these difficulties, the real magnification of problems in the minor use area came from the new requirements mandated by the enactment of the 1972 amendments to FIFRA:

For example, the requirement that all pesticide uses be registered at the Federal level with EPA, except those for special local needs within a state.

Also, the provision in the new law of civil and criminal penalties for shipment of misbranded products and for use inconsistent with the labeling.

Already the economic incentive for industry to spend the money to develop data needed for registration or tolerances on these uses of small market potential had been minimal. But the need to obtain a Federal registration makes it even less attractive. However, the largest deterrent of all is the disproportionate liability/profit ratio with minor crops--the cost of any liability problem could far exceed many years of sales on a minor crop. Even if someone else develops the registration data, the registrant who is responsible for the product must be convinced of the validity of the data--either Federally or at State levels--because of this liability problem.

So here we have the background of the problem:

-A high list of required minor uses-

-A decreasing availability of broad pesticides-

-A lack of incentive to get registration-

-A high liability/profit ratio outlook-

-A new law which is tending to further diminish the availability of recommended uses-.

This makes a pretty discouraging picture--but not a hopeless one.

When one looks hard at this picture, a couple of things become immediately apparent. First, the new law makes it essential that pesticides be registered either Federally or statewise--if they are to be used properly and legally. Therefore, steps must be taken to increase the activation of registration for minor uses.

Second, there has been NO central point with the government to actively support obtaining this registration--a focal point where priorities are established and from which needed research for data can be pushed to get the information both to support registration and to convince the producer of its validity.

The IR-4 program has been a start in this direction but it has essentially been a coordination point for development of residue data. It has performed this function quite successfully considering it has had only weak authority and financial support. It has attempted to achieve its objectives through contacts with land grant universities, state experiment stations, grower associations, and manufacturers. Although the project can stress specific needs to these institutions, their time and money is also critical and, therefore, their efforts tend to be directed toward major uses. The program itself has had no funding to conduct research and no specific control on funds assigned to universities or experiment stations.

Although EPA has continued to work closely with the IR-4 project to expedite registration by maintaining close liaison in developing specific informational needs and by handling tolerance petitions without fees in order to stimulate petitions, EPA has neither authority nor any kind of funding to actively direct the registration program. I point this out emphatically because so many persons turn to EPA to provide the solution to this complex situation, forgetting that EPA is a regulatory agency and not a program coordinator--and thus has few handles it can turn.

On the other hand, we in EPA don't want to be buck-passers and just wash our hands of this problem--we are concerned and we want to find a way to legally provide pesticides for minor uses. It is for this reason that we have taken positive action during the past year on key issues relating to minor use problems. Most of these actions have involved cooperative initiatives with counterpart personnel in USDA for we think that basic to the solution of this problem is proper assignment of responsibilities to the involved agencies.

The USDA is responsible for fostering and supporting agricultural production within the nation. This is not only for food and fiber but all other segments of the community which depend upon agricultural practice for livelihood. Until recently, their concern in minor crops has mostly been in the IR-4 program--the states agricultural groups pretty much handled this problem themselves. Although money was provided to universities and to the Cooperative State Research programs, it was not earmarked for work against specific pests or on specific crops. The divisions as to where funds and effort would be applied was left pretty much in the hands of experiment station directors. Even in the Agricultural Research Service whose mission is enhancing the production of food, emphasis has been on research in nonpesticidal control.

It appeared, however, that although emphasis was not put on minor crops, USDA had the arms and legs already built in to work at this problem if the emphasis were re-directed. It had the IR-4 program already operating, it has liaison with the agricultural community through the universities, the extension services, the CSRS and the ARS, and it has funding programs. It was for this reason that a number of us pushed vigorously for the establishment in USDA of the Office of National Coordinator of Pesticides for Minor Uses and this was set up in October 1974.

Mr. Kenneth Walker, who has been appointed as the first coordinator, was to have been here to talk of his role this afternoon. I did not intend to say too much here about it but in his absence I will state that I think he has four major responsibilities:

1) Establishing and maintaining a current priority of minor requirements.
2) Establishing and directing a network of communications among the supporting segments of USDA and industry to gather data in support of registrations for the priority needs.
3) Establishing and maintaining a focal point to assemble this data to submit applications for registrations.
4) Coordinating, directing, and supporting research on priority needs when data is not available from past work.

Although this Office has only been in existence a few months and is not yet fully staffed, action has been taken to get priority listing of needs and to initiate the network of supporting elements to go about getting data for these needs. I should add that I have assigned one man to help Mr. Walker in getting started and we intend to actively engage as many persons as needed to get this program moving. As present, EPA also has a man in the field assisting in expediting the collection of data for some of the higher priority needs.

As you are all aware, the amended FIFRA provides that all pesticides must be registered with adequate data to show that:

a) The product is effective for the intended purpose when used as directed.
b) That label warnings and cautions when followed are adequate to protect man, wildlife, and the environment.
c) That the directed use of the product will not result in illegal residues on food or feed.

The efficacy data to prove effectiveness and the application data to show resulting residues are the types of information that the network should develop or for which research must be done. It is our opinion that a large percentage of pesticides for minor uses will come from pesticides already registered for other uses- but the additional uses must be registered. It is a matter of getting this information to the label. This is what we think the National Coordinator's office can do.

Special arrangements will have to be made to capitalize on research already completed by state agencies to avoid unnecessary duplication of effort. Research requirements in support of national priorities have to be identified and funds made available to cooperating research agencies. It should be noted here that, though it is only a token, a quarter of a million dollars has been added to the program for fiscal 75 to get it started.

At the same time since EPA is responsible for establishing tolerances, we believe we can expedite this by development of residue grouping systems. This means providing systems to permit extrapolation or interpolation of a tolerance for a desired crop from known tolerance on similar crops or from similar applications. If such systems can be developed, much research to determine actual residue levels can be eliminated.

The basic concept of group tolerances is that it may be possible to make reliable judgments on expected residues for any commodity within a group of related commodities without eshaustive study of each commodity seperately. Thus, it is envisioned that a tolerance could be established for a given commodity within a group on the basis of less data than presently required as long as supporting data area adequate for the group as a whole.

In the past, the Food and Drug Administration established many small groups that were considered to be related, such as apples, pears, and quinces. In 1967, when tolerance for negligible residues were begun, somewhat more broad groups were established, such as seed and pod vegetables, root crop vegetables, and leafy vegetables. In 1973, Mr. Leo Duggan, under an EPA contract, studied this problem and proposed a system which divided food crops and foods of animal origin into ten major food classes containing 33 groups suitable for common pesticide residue tolerances.

Although the Duggan Report was intended to simplify existing tolerances by encompassing all foods, EPA has not been able to confirm the validity of the Duggan system except for a few groups. EPA currently has on-going studies evaluating new possibilities for residue grouping involving (1) pesticides of similar chemical structure, and (2) comparison of tolerances resulting from similar patterns of use. When the studies are completed all grouping schemes will be analyzed for their suitability as a viable individual plan and for key characteristics which could be useful in developing a new plan. After tolerance groups are derived from the two studies above, they will be compared with each other, the Duggan Report, the groups now in the tolerance regulations, and the IR-4 critical priority lists. Conclusions should be drawn as to what might be immediately useful and what would be long range improvement.

Within the next twelve months EPA will take positive action on a series of initiatives which should materially aid the Minor Crop Program.

The new residue grouping program should have the first phase studies complete by July. We will then make some test applications in cooperation with USDA. If the initial groupings can be made to work, a grouping plan will be available for case-by-case consideration of minor food uses. This will expedite clearance for minor uses of Federally registered pesticides from IR-4. This action alone should double the annual number of tolerances established for minor crops.

We are now working on a plan for the acceptance of state registrations or recommendations of three years or more duration as adequate evidence of efficacy and lack of phytotoxic. This could encompass the majority of all non-food uses not now Federally registered. Also, some additional pests on food crops would be covered whenever the Federally registered pattern of use provided control of such pests. This probably would be done by issuance of a series of Notices or Bulletins that a registration or recommendation of a use by a state for at least three years had been considered adequate evidence of efficacy and lack of phytotoxicity. Such Notices would have immediate, tremendous impact on all non-food uses. By requiring at least three years, EPA would avoid compensation problems from Section 3(c) (1) (D). It would save additional research by the states on uses they know are safe and efficacious. Registration Division would save manpower in reviewing many non-food uses. Additional pests on food crops that could be controlled by a registered use pattern might be added to labels. This matter is expected to be resolved by June 1975.

In another positive action, the Agency intends to come forth with some clear interpretations as to Section 12(a) (2) G of FIFRA on "use of any registered pesticide in a manner inconsistent with its labeling". In particular, Agency positions on (1) use of pesticides at less than label dosage, (2) use of registered pesticides for control of unnamed target pests, and (3) use of registered pesticides for control or unnamed target pests in related crops will greatly enhance use of registered pesticides on minor crops. The impact of clear Agency opinions on these topics is expected to be highly significant to the minor use program. If we can succeed in getting liberal interpretation by the Agency on these subjects, this should result in freeing approximately 50% of presently registered pesticide products for minor uses. In addition plans are underway to make labeling less restrictive as to specific sites and target pests. Modified labeling will broadan legal usage of registered products and free additional products for minor uses. In particular, this action will have a significant impact in non-food areas.

Under Section 24(c) a State may register for special local needs. EPA expects that, as future minor uses arise, they will be registered under 24(c). The draft regulations do not allow the States to register new chemicals; however, the States will register additional uses for those pesticides EPA already knows, which is exactly the situation with minor uses.

Under the provisions of Section 5(f) States may issue experimental use permits. When a State becomes certified to register special local needs under 24(c), it would also be certified under 5(f). These permits would be for minor uses in most instances.

While touching upon esperimental use permits, let me try to answer a couple of misconseptions that frequently appear about how we intend to handle these. It has been stated many times that our new regulations will strangle research in this area. We do not concur. The regulations will indicate that a researcher can do any kind of laboratory, greenhouse, or replicated small plot testing in order to determine pesticidal value. This can be done even on already registered pesticides if testing for additional uses. These tests can go on up to a total of ten (10) acres after which for larger more spread out tests an experimental permit should be obtained. It is our opinion- and we have obtained concurrence from industry- that research should proceed in an orderly manner without curtailment.

In the long range- that is, one year plus- EPA will work with the National Coordinator, with IR-4, the States, and with industry. The completion of the residue grouping study will require consultation with USDA and perhaps some field plots laid out by them with laboratory analyses by EPA. Eventually, as industry petitions for tolerances, EPA will simultaneously establish all possible tolerances for related crops. Then, when a State wants to register a special local need under 24(c), the necessary tolerance will already be in effect.

To get this whole program going is to demand the best efforts of grower organizations, state agricultural agencies, and industry. USDA and EPA are pledged to do their part. We hope this joint effort can make the picture a whole lot brighter.

EFFECTS OF INFLATION AND REGULATION ON WEED SCIENCE

University Administration Viewpoint

Dale W. Bohmont[1]

University administrators are faced with a continuing pressure of establishing priorities within an eroded purchase power of a tax supported budget. Continued inflation is a way of life in America and is acceptable to economic planners when held within the boundaries of two or three percent. Today, inflation in America exceeds twelve percent and on some specific energy demand items are above 300 percent.

Weed control, as a science, since it is heavily dependent upon technology, is a heavy user of energy especially in commodities and materials. Therefore, it is one area where inflationary effects are much more severe and quickly felt. The University is looked upon as a triumbirate where equal recognition must be given to teaching and extension as well as research. Yet, for progress to be made, discoveries must be made by the research components before the teaching can take place. The administrator must develop priorities not only within these areas, but also among related science disciplines where colleagues may not agree or where a willingness to make decisions is lacking. Conversely, when the administrator makes decisions, it is possible to be contrary to one or more viewpoints depending upon who has not succeeded in gaining a parity with inflationary pressures. Because of the insatiable demand of environmentally interested groups for an environment that cannot be stabilized as a continuing in-balance, it becomes obvious that certain fields will demand a greater effort and resource because the burden of proof lies on the user or developer and not on the regulator.

The demand for the establishment of priorities and making decisions with insufficient information or data is one of the greatest stumbling blocks for sound administration of any program.

Of equal pressure is the interest of the scientists who must be satisfied, salary-wise,

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before funds may be allotted for inflated purchases that are required but may have a lower priority in the scientists' minds. Also, there is a growing reluctance on the part of the money committees of the legislature and congress in providing a blank check. They are subject to pressures of divergent values that relate to such areas of change as weed science and are buffetted by demands that go beyond the University as a research, teaching and extension agency.

Accepting the principle that controlled inflation may be a way of life, that information upon which regulations are formed are not as complete as would be desirable, and accepting the fact that weed science is an example of problem areas associated with change, the best alternative for a university administrator is; (1) Be aware of available facts, (2) Recognize the limitations of information, and, (3) Identify political and vested interests and make judgements that are essential for the success of the University program.

There is no substitute for an able administrator who makes timely decisions based upon the principle of available facts. Programs in the years ahead will depend upon able staff, competent administrators, and an understanding and knowledgeable public.

EFFECTS OF INFLATION AND REGULATION ON WEED SCIENCE

PUBLIC AGENCY RESEARCH VIEWPOINT

Harold P. Alley[1]

It seems rather ambiguous that a person in my position elaborate on the effects of inflation on Weed Science. The task may seem simple until one attempts to direct his thoughts toward this assignment.

Not being an economist, but having just enough knowledge to know that inflation is simply, the supply of money increasing faster than the supply of goods until the price of goods goes up and the money is worthless, could be dangerous in drawing conclusions and including them in a published address. The inflation that we have become concerned about has not happened over night, but has been going on for over 30 years or more, or at least my tenure at the University of Wyoming and my research efforts in Weed Science and Technology.

I can very clearly remember when Dr. Dale Bohmont, a participant on this panel, and myself planted and harvested all the small grain veriety trials by hand when we were both undergraduate students attempting to finance our way through college. As I remember we were being paid somewhat less than $1.00 an hour, probably 65 cents. Now our operations are mechanical, there is a minimum wage law and even the number of hours a student assistant can work before overtime has to be paid. Inflation can only be caused by government, since no one else prints money and they are responsible for such regulations as was just cited. Can we then, as Weed Scientists, have any bearing in bringing a balance to the situation as it now exists?

Inflation has definitely had an effect upon Weed Science research activities. The cost of both basic and applied research has increased tremendously. Graduate assistantships have increased, laboratory equipment, technicians, supplies and travel are all in the same category. Even though graduate assistantships have increased almost yearly, we have not been able,or at least have not kept pace with other inflationary wages. Therefore capable young men, who are the backbone of our research programs and the future of our profession, are very scarce.

Until we realize that young men can make $4.50 to $6.00 per hour as a flagman on construction jobs during the summer months, whereby we expect them to count weeds on their hands and knees for $250 to $300 per month, we are not going to entice these young men into our programs. If I was singling out one area where inflation has really hampered our research programs, it would be here.

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We as Weed Science research people feel sorry for ourselves; there is not a single Weed Science department at any of the land grant universities in our society area that I am aware of. This being the case we do not build our own budgets, but feel we are at the mercy of the administrators. Rapport may be such that funding of some research programs are limited. However, I am of the opinion that in a majority of the cases the administrator will and does budget as to the productivity of the department, section, research group or individual under his juristiction.

As an individual who has been engaged in Weed Science research for twenty years, I cannot feel sorry for anyone that insinuates that inflation has curtailed or limited his research activities. Monies are available and in greater amounts than were before. This money can be secured if the effort is put forth.

The Weed research personnel at the University of Wyoming, one and one quarter men years, feels that in some respects, the inflationary pressures on industry have been an asset to our program. We may be in a unique situation as compared to other states in our society area. Due to the increase in research and development expenditures by the commercial concerns they are coming to us and offering research grants. These are not the $30,000.00 to $50,000.00 per year proposals you see highly publicized in University news releases, with the President of the University pictured with the grantee and grantor. Neither are these grants of which the University administration immediately ascounds over 50 percent of the grant. Our grants run from $500. to $6,000.00 per year. With several commercial grants, we accumulate $15,000.00 to $20,000.00 per year. This, to us, is as beneficial to our efforts as a $40,000.00 grant where over 50 percent is lost to the administration.

If we compare the public funds directly supporting weed research in the United States during the past 25 years, I think we would be inclined to draw the conclusion that we have fared quite well.

Using the information presented by Dr. E.G. Rodgers, in his presidential address to the 1974 Weed Science Society of America meetings, we note that total public funds including State and Federal monies, supporting weed research in the United States from 1950 to 1972 is as follows: Total public funds in 1950 was $804,283.00 as compared to $4,583,000.00 in 1962 and $15,352,000.00 in 1972. With this increase in specific expenditures in Federal and State monies between 1962 and 1972, one could be led to believe that Weed Science research is in an admirable position. This increase between 1962 and 1972 amounts to 353 percent in Federal and State monies.

In 1972 these values could be equated to approximately 53 scientific man years from Federal grants, 162 from non-Federal grants, and 72 scientific man years dedicated to weed control research in ARS of the USDA for a total or 290. This total reflects an increase of 199 scientific man years over 1962. We are not on parity with other disciplines, but we are making progress.

If we stopped here, most of us would assume that Weed Science research has no concern. However, how much money is available to each scientific man year in 1962 as compared to 1972? In 1962 we came up with a figure of $50,362.00 and 1972, $52,937.00 per scientific man year, or approximately a 2.0 percent increase. This minimum increase comes nowhere near the increased costs brought about by inflation.

The children of some of you in the audience today, and grandchildren of the rest of us may be taught that inflation caused the great depression of the 1970's and 80's. To them it will be little different than what the eighth graders of today are memorizing from their texts about the depression of the 1930's. If history shows us anything, it is that history repeats itself, and people never learn from it.

The effect of regulations on Weed Science research is becoming a factor which is very difficult to understand and live with.

The old FIFRA was changed from a labeling to a regulatory program. This remodeling was supposed to form a legal framework under which continued research could produce more knowledge about better ways to utilize existing perticides as well as developing alternate materials and methods of pest control. However, the proposals have not followed this general framework, but has the potential of limiting or even stopping all pesticide research in the United States.

Since it is impossible to cover all aspects of the new regulations in the short time alotted, let's look at a few proposals that have come forth in the last year or so.

Uses Inconsistent with the Labeling

The FEPCA amendments of 1972 to the 1947 FIFRA provided in Section 12 (A) (2) (K) that it shall be unlawful for any person to use any registered pesticide in a manner inconsistent with the labeling.

Upon questioning, the EPA immediately stated that application less than stated on the label was not consistent with the label. Who would have thought, especially those of us in pesticide research, who have taken quite a tongue lashing by ecologists, environmentalists, and other do-gooders, and when there is so much emphasis on integrated programs, pesticides in the environment, effect on human beings and animals, that the use of a rate lower than designated on the label would bring such a response.

Yes, we have again, after considerable effort and time expended, received an interpretation as of November 17, 1974, from the EPA concerning uses less than stated on the label.

In summary, the interpretation states "if dosage levels less than the level directed by the label would be used, it is essential that this usage be directed or authorized by a party having adequate expertise to provide this direction while maintaining proper efficacious pesticide usage. The office of Pesticide Programs is now of the opinion that expertise is maintained by Cooperative State Extension Service, State Agricultural Experimental Stations, etc. However, lower than label application rates may be permitted for agricultural use only:

1) where such use is part of an integrated pest management program and such use is:
   A) recommended in writing to the licensor agency by, and is supervised and/or carried out by a State licensed pest management consultant, or
   B) recommended and authorized in writing by an official state agency
2) where lesser dose is recommended in writing or in printed material by Extension or Experimental Station personnel."

This opinion sounds great if you stop here. But let's read further, and I quote, "it must be recognized also that the EPA has not assessed nor approved the efficacy of use less than label dose and the user applies them at his own risk with respect to effect upon crops, target pest, etc." This quote is one common when confronted for interpretations of the regulations.

Experimental Use Permits

When we become concerned with regulations and how they might effect Weed Science from the Public Agency standpoint, one has to be concerned with the proposed rules published in the Federal Register, Vol. 39, No. 60, November 27, 1974 (pp. 11,306 to 11,309) relative to experimental use permits for pesticides.

Basically, the proposals, with the regulations outlined, the permit requirements, and red tape necessary for field experiments and demonstrations with new pesticides would eliminate such programs. Not only by experimental stations, agricultural colleges, but private industry, USDA scientists, etc.

The rhetoric in this proposal makes it difficult to digest.

First, the proposal states "the development of an effective pesticide is a multiple-stage process often requiring substantial expenditures of time and finances. Typically, a commercial developer, college research department, or governmental agency initiates the process of applying test substances in its own laboratories or test fields. The objective at this point is to determine whether the substance has pesticidal potential to warrant further formulation and research developments. Also, it is at this stage that basic data on toxicity and environmental effects are obtained. The process then moves into a stage where the pesticide generally is tested on a large scale, primarily to determine the effects of factors such as climatic conditions, soil composition, severity of pest problems, and application rates, as they relate to efficacy."

Secondly, the proposal states "that under the 1947 FIFRA, any Federal or State agency authorized to conduct pesticide research did not need an experimental permit and was exempt from the provisions of the act. Thus, state agricultural colleges have conducted extensive pesticide research programs without being subject to FIFRA regulations. FIFRA, as amended, however, does not grant a blanket exemption to Federal or State agencies. While legislative history is silent on this question, it is EPA's position that no exemption such as granted by the 1947 FIFRA, was intended under the 1972 amendments and can be allowed."

Thirdly, the proposal carries this rhetoric further in implying that "the most important environmental consideration in the development of these proposed regulations is a necessity of striking a balance between facilitating or, as a minimum, not duly impeding-pesticide research and development and protecting against human and environmental injury. Experimental use and testing are essential to the development of new, less hazardous, more effective pesticides. After a broad outline of a pesticide's character has been developed, it becomes necessary to test the pesticide under field and different conditions."

Section 172.3 of this proposal under Exemptions explicitly states "no experimental permit is required for (A) a substance or mixture of substances being put through screening tests in which the only purpose is to determine if it has value for specific pesticide purposes and from which the user does not intend to receive any direct benefit from pest control from its use. Such tests will be limited to laboratory and/or small plot replicated field tests less than ten acres, conducted by Federal or State agencies, Colleges or Universities, on areas leased or owned by them and continually operated as an experimental farm on a long time basis."

As the EPA proposes, all new herbicides would be confined to the Agricultural Substations and Experimental Farms in the case of University or College research. These proposals, if enacted, would eliminate many research programs. The research stations with which I am familiar do not have the diversity of problems or infestation of weeds which are included and essential to a well-rounded research program.

I can assure you that there has been much concern over this proposal and that your President of the WSWS has done his part in representing you.

Recent correspondence on the revised regulations at least indicates that the agency has been responsive to many written comments made, concerning the proposed regulations and the intent explained. My concern is not the explanation of the intent, but the amount of time and effort expended by many research, regulatory and commercial concerns to bring about some logic by the EPA.

Pesticides For Minor Uses

Minor uses or "minor crop" is defined as any agricultural commodity where the expected pesticide usage is not adequate to warrant the development of the data needed to obtain Federal tolerances and registration without assistance from the public sector.

Increased regulations forced upon the pesticide industry by the EPA is a basic reason for decreasing registrations for minor uses. In essence the commercial people cannot economically meet the stringent requirements required to obtain the necessary information on residue and tolerances for each specific crop. The relatively low financial return in proportion to effort and expense has caused company abandonment of registration for minor crops. Many states have developed minor use labels, but as of October 1976, all uses must be registered at the Federal level with EPA.

To obtain the necessary data for registration, states probably could not generate the information even in a five to six year period, because of the limited staff and funds.

The IR-4 Project and Technical Committee (financed by USDA) were established to aid states, through land grant Universities and agricultural experiment stations, in registering pesticides needed which is not being fulfilled by industry. This project has surely helped and is being expanded. As Dr. Dewey of the New York State College recently stated "the problem is not with the IR-4 Project, but with the states who must develop the research information on efficacy of control, toxicity (when companies cannot supply it), analytical methods if necessary, and residues. It is often just as costly and time consuming to register a minor crop or minor crop use as it is a major one, and the cost is equally great."

Concern and pressure has brought about action with the appointment of a National Coordinator of Pesticides for Minor Uses to assist in obtaining EPA tolerances and registration where they are needed in the production of "minor crops."

The University-EPA-USDA Coordinating Committee for Environmental Quality Research Monitoring and Extension Education has recently (January 9, 1975) identified this area as a priority matter requiring early action. The requirement of FIFRA, as amended, that all state-registered pesticides must also be Federally registered by October, 1976, will intensify the need for additional activity in this area. This will bring about a necessity for more monies and research personnel. Which Universities and Colleges are well enough staffed to conduct this research?

There are several other regulations such as environmental impact statements, applicator certification, label requirements, etc., which will, and has had, a direct bearing and influence on the time and monies needed through public agencies to meet the requirements or bring some level of understanding among all agencies. We, as a society, have to be concerned and willing to put forth the effort necessary before we are put into a position of seeing what we have accomplished in a short span of 30 years, completely eroded away.

THE EFFECTS OF INFLATION AND REGULATION ON WEED SCIENCE

Cooperative Extension Viewpoint

Harry Agamalian[1]

Major emphasis of this discussion will be directed towards the county farm advisor staff and its operations, the grower and custom applicator.

Although there are only a few staff members with full time weed science responsibilities, those members working in plant science have some interest in weed control for their respective crop assignment.

Today, inflation is evident in all phases of one's assignment. It has fallen upon the county administrator to fight for increased funds for transportation, field assistants, and general office operating expenses, such as office machines, calculators, paper supplies, etc.

In the area of in-service training, which is most important so as to keep current greater restrictions, are placed on out-of-county travel expenses. The increase in transportation, lodging, and subsistance has necessitated greater selection in the type of meetings one may have the opportunity to attend.

Many county staffs have lost the privilege of taking county vehicles home. This restrictive use of cars has caused some inconvenience and loss of productive time, because of central housing. Eight to five operating times of many central facilities limits field research time where greater distances are a factor in many of California's counties.

From the statewide viewpoint, increased transportation cost has not been a major concern with Extension weed specialist. This continued availability of the weed specialist to the county farm advisor will greatly help those county staffs with restrictive budgets. Better use of the specialist's time with good planning and scheduling by the county personnel will be essential.

Another area closely related to budget restrictions is the implementation of the 40 hr. work week with time and a half payments being essential. The days of giving compensating time off are no longer in affect; thus prior budgeting of extra funds for these conditions are essential.

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[1]Extension Weed Science Advisor, University of California, Salinas, CA.

We are told to plan ahead for these situations. The value of grant-in-aids for technician type help is certainly most helpful under these conditions. Where extra-mural funds are not available, a given project must fit an eight hour day or extra days be allotted to complete the task. It is obvious, increased cost is evident because of decrease in efficient use of time. Again this problem exists in those counties where large travel distances are a factor.

The Affects of Regulations

In California, all pesticide applications must be supported by a recommendation. Although Extension personnel are exempt from pest control advisor licenses, University recommendations must be accountable in writing where they are made for a specific situation. In many situations the results of local tests in the form of "Progress Reports" have provided grower and applicators essential information for their decision making process in using herbicides.

Extension personnel have been involved in teaching pest control advisor short courses in cooperation with community colleges. In addition, considerable time has been involved in teaching "Worker Pesticide Safety" courses throughout the state. These classes have been a cooperative venture with the Department of Food and Agriculture and County Agricultural Commissioner's. The time demand has caused some reduction in field research programs.

The questions of tank mixtures and using less than recommended label rates are still difficult to define and are often described as "gray area" in making recommendations.

New safety standards, expecially with Class I and II, pesticides have increased cost in protective equipment for Extension personnel. Although the number of herbicides are currently limited in this category, the use of safety equipment is a prudent expenditure and will be added to the cost of maintaining Extension weed workers.

In the past where rubber gloves made up the main piece of safety equipment, overalls, rubber boots, face shields and hard hats, may become standard equipment to the field research demonstration program.

Field Experimentation

California's system of monitoring field research trials of the private sector has had some affect on the Extension worker. Utilizing grower space for experimental herbicides has been the principle method of aquiring efficacy and crop tolerance information. The practice of destroying these crops and/or preventing their being harvested is essential to this system. With greater cooperative efforts between state, federal and industry workers the Extension weed worker should continue to make his contributions in product evaluation. Consequently this information will be ultimately used in problem solving at the county level.

What Are The Affects of Inflation to The Grower?

The number one problem in weed control today is the herbicide shortage, which is most apparent with the farmer. Although he is vitally concerned with the affects of inflation on herbicide prices, this becomes secondary when compared to product availability.

In almost all crop production, herbicides have been accepted in some degree of utilization. When that component of the total crop production operations is lacking, a series of economic repercussions follows. A 10 to 15 percent increase in product prices is tolerated. But the critical shortage with some products has stimulated disagreeable activity in the market structure, causing a 100 percent increase in prices. Most growers find these set of conditions unacceptable and attempt to find replacement herbicides. Consequently this has caused a domino affect on other products as well.

A limited survey of 10 major to middle size farming organizations has supported the concept of inventory buying. This practice appears to be common to grower's whether they apply their own herbicides or use custom applicators. The tremendous importance of guarantee product availability and buying over a 12 month period has resulted in the establishment of this grower practice. Associated with good economic conditions, this practice appears to be on the increase, and with inflation will continue.

In this survey, pesticide inventories varied from $25,000 to a high of $350,000.

In general, existing herbicide programs are being maintained wherever possible with first and secondary choices depending on product availability. Supplemental physical weed control programs are being used, but where fixed budgets are in affect these practices are limited when compared to the cost of herbicides.

The Affects of Regulation is Also Causing Increases in the Cost of Production

The implementation of providing protective equipment to the applicator (drivers and loaders) requires considerable capital outlay.

Examples of this cost: Providing daily change of uniforms, masks, shields and/or goggles and hardhats, rubber boots and aprons.

Cost of renting and laundry of uniforms $1.00 per week/uniform. Hardhats and Shield $12.00 to $13.00. Respirator $10.00, gloves $3.00/pair. Apron $5.00 and rubber boots $10.00 to $15.00.

The additional services of supervising personnel is essential to enforce worker utilization of this equipment.

The Future of Closed Systems on the Commercial Applicator

At the present time, many experimental systems are being developed by individual organizations. In most cases prototypes are being built on a trial and error basis. The system must meet specific regulations for toxic pesticides, but must allow their compatible use of non toxic materials as well.

These closed systems may limit some of the former flexibility in ease of application, but appear to be workable systems with minor storage and loading modifications.

Again the applicator is witnessing a greater change in operating cost, involving protective equipment.

Some illustrated changes in the past three years from several sources are summarized as follows:

1973: 100 percent increase in safety equipment cost over 1972.

1974: 400% increase in safety equipment. In addition to equipment cost, additional personnel is assigned as safety supervisor.

1975: 500% increase in budgeted items.

What the future of federal regulations may have on safety practices is still to be determined.

In summary, the affects of inflation and increased regulations will result in the increased cost of herbicides and the production of food. One can be hopeful that these forces will assure us a continued good and wholesome supply of food and maintain our excellent safety record to those involved in herbicide use and/or its application.

THE EFFECT OF INFLATION AND REGULATION ON WEED SCIENCE

Pesticide Manufacturers Viewpoint

B. Wayne Arthur[1]

Introduction

Several centuries have elapsed since man first began the struggle to protect himself, his food, his property and his environment from the ravages of pests. One of the tools utilized from the earliest of times is the use of chemical pesticides for the elimination or control of disease , insects, and undesirable weed species. History tells us that Homer recommended sulfur, while the Greeks, Romans, and Chinese used arsenicals some 3,000 years ago. Ground tobacco (nicotine), kerosene, and turpentine have been used as insecticides since the 18th century, while inorganic compounds such as Paris green, lead arsenate and lime-sulfur combinations came into use in the 19th century and were in common use by the 1920's.

Modern pesticide use, however, began with the discovery of the insecticidal properties of DDT in 1939 and of the herbicidal value of 2,4-D in 1941. The introduction of these two compounds revolutionized the use of pesticides and gave rise to the birth of the agricultural chemicals industry. This industry experienced its greatest growth and development during the 1960's, and was then considered to be among the 100 fastest growing industries in the U.S.

Table 1. U.S. Production and Sales of Pesticide Chemicals, 1962-1971

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Production (millions of lbs.)	730	763	783	877	1013	1050	1192	1104	1034	1136	1158	1289
Sales (millions of lbs.)	634	651	692	764	822	897	960	929	881	946	1022	1199
Volume of sales ($'s million)	346	369	427	447	584	787	849	851	870	979	1092	1344

Source: Report of the President's Science Advisory Committee entitled, "Chemicals and Health." Science and Technology Policy Office--National Science Foundation.

For example, the data in Table 1 indicate that between 1962 and 1968, U.S. manufacturer's sales of unformulated chemical pesticides showed an annual average increase of 73% on a volume basis and 18.6% on a value basis, reaching a level of 960 million pounds of active ingredients valued at $849 million. Between 1968 and 1970, however, volume sales declined 3.7% a year while dollar sales increased only slightly more than 1% annually. This decline in volume was due in part to reduction in inventories and in part to lesser pest infestations. In 1971, chemical pesticide sales recovered almost the 1968 level in pounds, with a value of approximately $979 million. Sales of pesticides formulation are currently valued at about $1.4 billion annually at the manufacturers level of almost $1.7 billion at the user level.

Despite these impressive figures, however, there is a feeling among pesticide manufacturers that the industry will never again achieve the position of rapid growth and expansion which characterized the 1950's and early 60's. Thus, after a decade of soaring production and sales, it is now evident that a number of factors have combined to halt the rapid growth and expansion in the pesticide industry.

Inflation and regulation have been identified as two of the most important factors contributing to many of the present problems besetting the pesticide industry. I will attempt to discuss some of these problems and the effect they are having on our present operations, and will also try to project their impact on future developments in the industry.

Of the many economic factors stemming from inflation, none has had a more adverse effect on the pesticide business than the resultant shortage and cost of raw materials. Coupled with raw material shortages and cost, is the increased demand by farmers for pesticidal products. Let's take a look at these prevailing conditions- firstly, the availability and cost of raw materials, and secondly, product demand versus availability, and let's examine the constraints that they have imposed on the industry.

In the first place, we all recognize that the key to the continued existence and growth of any chemical company is the availability of raw materials. Yet, some of the basic oil and gas derivatives from which pesticides are made of are becoming a lot less plentiful. To aggravate matters, most of our natural gas supplies originate from overseas. Our dependence on these external sources and the recent exploitation by these countries in terms of higher prices and unfair embargos are still fresh in our minds. These developments more than any other, are responsible for the current shortage of pesticide products and the higher prices being paid by farmers. Unfortunately, I do not believe that some of us have learned our lesson or benefited from this experience. For example, in the fertilizer industry, a recent survey indicated that one of the leading engineering and construction companies that has built 75% of the world's ammonia plants, presently has 40 new plants under construction ot close to it. Yet, of that 40, only 2 are being built in the U.S. Thus, we find that the action is in places where natural gas is cheaper and more plentiful. According to one observer,"the U.S. is on its way to becoming a major importer of ammonia based fertilizer to the extent that 10 years from now we could easily end up importing 1/3 to 1/2 of our nitrogen fertilizers". Fortunately, we do not believe that a similar situation exists in the pesticide industry, but let us look at the cost and availability of raw materials.

After many years without any significant price increases, CIBA-GEIGY was forced to announce modest price increases on most of the Division's products in July 1, 1973. A second upward adjustment went into effect on September 30, 1974, as a result of continuing increases in the cost of raw materials. Up until this time, our leading product, AAtrex , had not experienced a significant price increase in more than 10 years. These increased prices were essential if we were to avoid losses due to increased raw material and labor costs. Actually, as our President explained recently, "the two price increases have only helped us stay about even; our profit has actually decreased."

Production efficiencies have helped us to hold the line on prices, but the price and availability of raw materials is really hurting us. Among those chemical raw materials in short supplies are benzene, toluene, and xylene. Also in short supply are alcohols and amines.

An indication of the spiralling cost of raw materials is shown in Table 2.

Table 2 - Raw Material Prices - 1969-1975

	(cents per pound)						
	1969	1970	1971	1972	1973	1974	1975
Hydrogen Cyanide	.0838	.0811	.0843	.0871	.0879	.1332	.1640
Isopropyl Amine	.1340	.1388	.1275	.1217	.1217	.2786	.3564
Methylethyl Amine	.1402	.1198	.1150	.1150	.1150	.2600	.4264
Chlorine	.0200	.0200	.0200	.0215	.0215	.0292	.0310
Toluene	.0320	.0304	.0304	.0304	.0288	.0950	.0794
Benzene	.0310	.0350	.0323	.0317	.0376	.1393	.1500
Dichlorobenzil	.5718	.6050	.7210	.7013	.7120	1.0050	1.2275
Sodium Cyanate	--------	--------	--------	--------	.1900	.4300	.4500

The data in this table show a list of the more important raw materials and price changes and their cost per pound since 1969. Two trends are evident- firstly, there are only slight changes in price situation during the five year period, 1969-1973. Secondly, we see dramatic price changes between 1973 and 1975 in which costs have just about doubled in most cases.

As we continue to analyze our financial position, it has become abundantly clear that the price adjustments of last year are insufficient even to cover the increased cost of raw materials, let alone other inflation-related cost such as salaries, the ever increasing electricity rate, packaging, transportation, construction and taxes.

With respect to increases in construction costs, I would like to show you some data on current business indicators. (Refer to Table 3.)

Table 3 - Annual Index of Equipment Costs

1968 = 113.7
1969 = 119.0
1970 = 125.7
1971 = 132.2
1972 = 137.2
1973 = 141.1

These data refer to the plant cost index for plant construction items for the period 1968-1973. Here we can see a steady increase in plant construction costs over the 6-year period. These increases are further reflected in the itemized breakdown of construction equipment costs for August, 1973 versus the same period in 1974. As shown in Table 4, most of the items are simply reflecting the current high cost of steel and other structural support components.

Table 4 - Construction Equipment Plant Cost Item (1957-59 = 100)

	1974	1973
CE Plant Cost Index	172.0	145.0
Equipment, machinery, supports	181.5	142.0
Construction labor	163.8	156.3
Buildings	168.5	150.4
Engineering and supervision	134.3	130.1
Fabricated equipment	181.3	143.0
Process Machinery	167.9	138.5
Pipe, valves, & fittings	206.7	151.8
Process instruments	168.2	147.4
Pumps & compressors	186.8	140.9
Electrical equipment	133.5	105.1
Structural supports & misc.	180.8	141.2

The spiralling cost of raw materials and products stem from the petro-chemical shortage and the tremendous boom in agricultural production. The farm boom has resulted in a phenomenally increased demand for agricultural input items, such as fertilizer, tractors and equipment, tires, bailing wire, pesticides and gas.

The increased demand by farmers for pesticides is triggered by higher prices for farm products and increased crop acreages. For example, the price of all farm commodoties was 16% higher in April, 1974, than they were in April, 1973, with cotton prices 55% higher and grains ahead by 63%. Also, according to figures published in 1974, 18% more land was planted in cotton, 20% more in wheat, and 10% more in corn, than was planted in 1973. According to the Federal Energy Administration (FEA), the growth trend for pesticides is expected to continue over the next five years at approximately a 6% rate, largely due to increased use of herbicides. There is still about 50% of the planted crop land that is not currently being treated for weeds. With the need for high yields per acre, increased labor cost, and higher farm prices, the FEA believes that there will be considerable more incentives for the grower to use more herbicides. The FEA report concludes by projecting that in view of the economic advantages that can be achieved from using pesticides, growers will be willing to absorb price increases that are reasonable as long as farm commodity prices remain high. We share this optimism and hope that their forecasts are correct.

Another impact of this inflationary spiral is the effect on product availability. To say there were product shortages in 1973 and 1974 is somewhat misleading since we produced and sold more materials than ever ever before; but demand for agricultural products exceeded forecasts, and there wasn't enough products to go around. Because of these shortages, most of the raw materials we need are on allocation. Consequently, pesticide manufacturers in turn are forced to allocate finished products. According to the National Agricultural Chemicals Association, a poll of its member companies which produce the bulk of U.S. pesticides, revealed that about 80% had allocated products to their customers in 1974. Significantly, a majority of the companies also felt that Agricultural Chemicals supplies probably would continue to be tight in 1975 because of continued raw material shortages and increased crop acreages. In our own case, we have already advised our customers as to our allocation schedule. We at CIBA-GEIGY have been very fortunate in this respect and have already advised our sales staff that we will be able to supply at least 100% of past season's purchases in most cases to our established customers. Unfortunately, we see the situation of the so-called shortage of chemicals continuing in 1975, because manufacturer and distributor inventories were depleted last spring and last summer. Many firms have entered the 1975 season with a less than normal amount of inventory of finished goods. The pipelines are as near empty as they can get. Thus, even if we get a reasonable amount of raw materials, the 1974-1975 season is going to appear as another so-called shortage year, simply because demand is going to remain high. Fortunately, we believe that there is some relief on the horizon. Recent plans revealed by a number of pesticide manufacturers including ourselves, Shell, Stauffer, Chemagro, Kerr-McGee, Mobile, and Dow show that there are at least 6 new pesticide plants currently under construction in the U.S. and many of these will be on-stream by early 1976.

In addition, several companies have decided to expand or construct basic raw material facilities to ensure themselves a constant and reliable source in the years ahead. These developments auger very well for the future and indicate that current pesticide shortages may be alleviated within the next 2 years.

So far, we have seen what inflation has done in terms of raw material supply and cost to the manufacturer, and in terms of product availability and cost to the consumer. I think it will also be of interest to you to see how both inflation and regulation have affected our R&D operations over the past five years.

In 1971, the National Agricultural Chemicals Association undertook a sample survey of 33 U.S. producers of pesticides which represented a total aggregate share of 81% of the total pesticide sales. This survey was repeated in 1974. I will show you some data from these surveys to help dramatize the impact of increased R&D costs with respect to a) maintaining existing products on the market and b) developing new compounds for existing and new markets.

Table 5 - Relationship Between Pesticide Sales and R&D Expenditures

	1967	1970	(1967-1970) % Increase
Pesticide Sales ($ Millions)	639	722	13%
R&D Expenditures ($ Millions)	52.4	69.9	33%
R&D Expenditures as a Percent of Sales	8.2%	9.7%	

Source: Ernst & Ernst Trade Association, Pesticide Industry Survey. (A study prepared for the National Agricultural Chemicals Association.)

One of the more meaningful findings of the survey is that between 1967 and 1970 while sales were increasing 13 percent, research and development expenditures increased 33 percent. The feeling is that despite the possibility of some inflation effect on both figures, the relationship that shows R&D Expenditures increasing at a more rapid rate than sales, probably reflects the increasingly strong commitment of the industry to exhaustive testing of new products and the careful monitoring of existing products. In both cases, these actions are designed to ensure that the public will have pesticide products that are safe, effective, and economical.

This sentiment was recently expressed by Mr. James Agee the Assistant Administrator in charge of pesticide registrations at the EPA. Mr. Agee said that all EPA decisions concerning pesticides have always been guided by the rule that a pesticide cannot exert unreasonable adverse risks to man of the environment, taking into account the economics, social, and environmental costs and benefits of the pesticide's use. Further, he said that the burden of proof is on the registrants i.e., industry, who must show through test data that their products will perform intended functions without unreasonable adverse effects on the environment. Consequently, Mr. Agee said, under the propsed regulations of the new FEPCA, such data will have to include the acute, chronic, and delayed effects (i.e., teratogenicity and mutagenicity) of the pesticide on fish, wildlife, and mammals, and the propensities of the pesticide to dissipate in the environment and accumulate in animal tissues. The data must also include several parameters describing the chemical and physical properties of the formulation.

We in industry must live with these requirements and must either take the necessary steps to obtain the required information or decide to go out of business. That we have accepted the challenge is further reflected in the 1974 industry survey, which showed that since 1971, the percent of R&D costs for regulatory maintenance of existing products alone has approximated 17 percent. Also, with respect to new products, the survey showed (Table 6) that there was significant increase of 26% in pesticide research and development expenditures for the period 1971 through 1973.

Table 6 - Pesticide Research and Development Expenditures

(Composite Analysis of 36 Pesticide Companies)

	1971	1972($000)	1973
Synthesis and Screening	25,145	27,010	28,152
Field Testing & Development	28,850	33,045	37,579
Toxicology and Metabolism	10,684	12,707	15,566
Formulation & Chemical Development (Includes process development)	15,789	17,222	19,338
Environmental Testing	3,115	3,591	4,727
Registration & Other	4,125	4,880	5,358
Total	87,708	98,455	110,720

Source: Ernst & Ernst Trade Association, Pesticide Industry Survey. (A Study prepared for the National Agricultural Chemicals Association.)

While registration and other related activities per se appear to account for only a relatively small part of the R&D expenditures, increases in the expenditures of other categories are also directly related to new and more stringent government regulations and requirements. Thus, field testing and development, toxicology aid metabolism, and increases in formulation and chemical development expenditures are attributed to increased government requirements. Let me inform you also, that five years ago the separate category referred to as environmental testing was non-existent.

In 1962, the Department of Agriculture estimated that it required an investment of $1 million to $1.5 million to achieve a successfull and marketable pesticide product. (According to industry sources, a commercialized product is one with a market lasting at least 9 years at an annual sales level of $10 to $20 million per year and a return on investment of 40% before taxes). Also, according to the 1974 industry survey, for each compound that is presently commercialized, approximately 10,000 are screened, the total cost from discovery to commercialization is about $6.5 million, and this effort requires approximately 6 1/2 years. Let me emphasize that this $6.5 million does not include manufacturing plant construction costs, and does not include the cost of losers or unsuccessful candidates.

Another area of cost that I must refer to is that having to do with pollution control provisions which are now being required at the pesticide laboratories and manufacturing plants. The data in the next Table show how these costs have skyrocketed since 1971.

Table 7 - Expenditures For Pollution Control Related to Production of Pesticides

	1971	1972(000)	1973
Capital Pollution Control Expenses	$4,861	$7,025	15,997
Other Related Expenditures	4,294	6,768	8,868
	$9,155	$13,793	$24,865
% Increase		51.66	80.43
% Increase 1971 vs. 1973			173.63

Source: Ernst & Ernst Trade Association, Pesticide Industry Survey. (A study prepared for the National Agricultural Chemicals Association.)

Thus, according to more than thirty of the leading pesticide companies, since 1971, pollution control related costs have increased by 51.6% in 1972 and by 80.43% in 1973. Phenomenally, there has been an increase of 173.43% in 1973 expenses vs. 1971. Thus, these types of expensive pollution safeguards will limit chemical expansion and will force pesticide manufacturers into large capacity integrated complexes. Only in such conplexes will it be possible to make the necessary expenditures for environmental control while maintaining product prices at a level that can bring the required return on capital employed, and permit long-term market growth.

Another factor of some importance is the continuous clamour by the public and also by many scientific groups for the development and use of fewer broad spectrum products. They are demanding compounds that are non-persistent and more selective. This insistence will in all probability lead to the creation of smaller market segments with potentially reduced market volumes. This will force industry to take a more critical look at projected business analysis. Thus, ROI considerations and market dollar volume will become more crucial. If ROI calculations do not project a potential market that is attractive enough to permit recovery of its research investment, companies presumably will not develop compounds for such markets.

It is for these reasons that there is a general consensus among pesticide manufacturers that inflation and regulation have had a definite depressing effect on the economic climate in the pesticide industry. This belief is further supported by the fact that some firms have been forced to discontinue at least part of their activities, some have merged with other larger companies, while several others have discontinued operation entirely. What this means is that smaller firms are finding it increasingly more difficult to meet the rising costs of doing business due to inflation and pollution related costs, and also the cost of supporting the size and sophistication of an R&D staff necessary to conduct laboratory and field testing programs essential for obtaining and maintaining the registration of existing and new products.

HERBICIDE LIABILITY AND REGISTRATIONS

Stuart W. Turner[1]

In considering the question of liability pertaining to the application and use of herbicides, we must remember that the name of the registrant on the label governs no matter who might be the actual manufacturer.

The greatest hazard with which we are faced at the present time is the increasing application of the doctrine of strict liability on matters pertaining to alleged injury resultant from the use of herbicides.

Formerly it was necessary for a Plaintiff to show negligence, breach of implied warranty, or breach of expressed warranty in order to prevail. Contributory negligence afforded an excellent defense. Under the doctrine of strict liability the contributory negligence defense is no longer available as a defense unless it can be shown that the Plaintiff had knowledge of the hazard that would or could result from the use of the product and continued with that use notwithstanding the question of knowledge.

We must keep in mind that lack of privity of contract does not estoppel direct action against a manufacturer in the majority of jurisdictions in this country today.

The test as to whether or not a product was inherently dangerous has been replaced by the question as to whether or not the product is unreasonably dangerous in order that strict liability may prevail. Under the inherently dangerous doctrine, the question as to whether or not the product had the capability of causing harm, irrespective of the degree of care associated with its use was accepted as the test. Under the unreasonably dangerous theory we have a situation where the question is raised as to the capability of the product causing harm beyond contemplation of the buyer or user of the product, which gets into the question of what is in a man's mind at any given point in time and is much more difficult to overcome.

In one such case which turned upon the question of the application of strict liability the Court said:

> "One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer or to his property if (1) the seller is engaged in selling such a product; (2) it is expected to and does reach the consumer without substantial change in the condition in which it is sold; (3) this rule applies even though (a) the seller has exercised all possible care in the preparation and sale of his product and (b) the user or consumer has not bought the product or entered into any contractual relation with the seller."

Contributory negligence will not afford a defense if the Plaintiff fails to discover the defect and an example of this might well be the adverse results brought about by applying a herbicide at two or three times the maximum recommended rate. We must keep in mind,

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however, that contributory negligence is a defense under assumption of risk if the Plaintiff is aware of the defect and proceeds anyhow.

The question in regards application of herbicide and the adequacy of label warning from the standpoint of the manufacturer's liability has been passed upon by the Appellate Court of the State of California in the case of Nomellini and Crudelli v. Haley Flying Service, et al. In this case, tried before a jury, the aerial applicator was exonerated of liability and the manufacturer held to be totally liable. On appeal, the Appellate Court sustained the verdict of a trial court and held that the manufacturer had, indeed, failed to adequately warn on the label as to the hazards of the compound from the standpoint of drift.

It is possible, however, on drift cases, that a defense verdict can be achieved if the Plaintiff is unable to establish negligence. Such was the verdict in the recent case of Bateman vs. Ken Spray in Idaho where the defendant aerial applicator admitted to carrying out the aerial application of 2, 4-D to a wheat field which bordered the Plaintiff's sugar beet field. Defendant testified, however, as to the unsprayed safety zone he left, that he personally flagged the field, that he utilized all possible precautions to avoid drift.

In the case of Gilbert vs. Clark the State of Washington Appellate Court held that contributory negligence was, indeed, an effective defense to the action.

In the case of Wilson v. Reeder Flying Service the trial court found for the defendant aerial applicator on the grounds that the injury complained of could not be held solely the result of the defendant's actions, but that other proximate causes more likely were responsible.

The value of expert testimony was clearly demonstrated in the case of Henderson and Olson vs. Comico American, Inc., et al wherein it was alleged that the use of herbicide had resulted in destruction of a peppermint crop.

The Supreme Court of Idaho, in reversing the judgement of the trial court, held that Plaintiffs could not rely upon circumstantial evidence to prove the herbicide was the actual cause of their loss, and thus sustained the underlying principle that a verdict cannot rest upon conjecture.

The question of the relationship of a manufacturer and a distributor in a case involving alleged herbicide damage to a squash crop was tested in Wilson v. E-Z Flo Chemical Company v. Uniroyal. In this particular case the Plaintiff attended upon the defendant distributor and asked for a herbicide (not specifying brand name) for control of weeds in his squash crop. The distributor recommended a particular herbicide and further recommended immediate use. Plaintiff made the application on March 20 to the total crop with the exception of four (4) rows in the center, and the crop was destroyed except for the four (4) untreated rows.

Plaintiff brought his action against the distributor, who responded and brought a cross complaint against manufacturer Uniroyal.

Evidence showed a label warning which stated:

"Do not use Aplanap on vine crops of any kind when growing conditions are very adverse, namely in early spring when weather is cold and wet."

Uniroyal urged that earlier seperate warnings had been given to the distributor and that the proximate cause of the problem was a recommendation and sale for use at the wrong time of the year contrary to said warnings.

The Plaintiff contended that he had relied upon defendant distributor for years, and that he did not order Alanap by name, but only a herbicide.

The Court found for the Plaintiff against the distributor and for the distributor against the manufacturer who appealed.

On appeal, the Supreme Court reversed as to the manufacturer and held that adequate warnings had been given both in literature and on the label and that said warnings had been imparted to the defendant distributor prior to the sale of the product to the Plaintiff. The court further held that the distributor had failed to pass these warnings on to the ultimate consumer.

The question of liability in regards the affects of unexpected weather conditions was tested in the midwest when the United States Court of Appeals for the Eighth Circuit held that a manufacturer of herbicides had a duty to warn users of one of its products that, under certain conditions, the plants to which the herbicide was applied would become brittle and subject to extensive breakage. They further held that warnings should also have been made on the minimum amount of water in which the herbicide should be mixed to avoid such results.

In essence, in reversing the trial court, the Appellate Court held that certain weather conditions when coupled with the use of the herbicide in question could cause severe damage and discounted the argument that the Plaintiff had or should have had prior knowledge of this fact in the absence of an adequate warning on the label.

The value of the manufacturer entering into a contractual arrangement with the ultimate purchaser insofar as the question of performance is concerned was upheld in the case of Veretto v. Eli Lilly & Company in a recent Texas decision.

The Appellate Court held that in Texas there was no privity between the purchaser and the manufacturer of the product insofar as failure to control weed growth was concerned, and that the Plaintiff was not allowed to recover the purchase price of the product because he had failed to use the product in the prescribed manner.

Touching upon the question of the contract, however, the court held that lack of privity of contract would not bar recovery by the Plaintiff for the purchase money of the herbicide under the express warranty or guaranty made by defendant manufacturer on labels and pamphlets accompanying each can of the herbicide, and also under the guaranties made by Defendant in their advertising program. The court held that the pamphlets, labels and guaranties were relied upon by th ePlaintiff and that he would be entitled to recover provided he could demonstrate compliance with the terms of the guaranty, but this he was unable to do.

The question as to the adequacy of prior testing was touched upon in the Washington case of Dobias v. Western Farmers, et al, a case involving alleged Eptam damage to corn.

The trial court held for the Plaintiff against Defendant Western Farmers, and against the manufacturer Stauffer Chemical Company, but denied a retailers' claim against the manufacturer.

On appeal, the Appellate Court affirmed the trial court decision, but held that manufacturer was liable to the dealer on the grounds that the primary duty to test lies with the manufacturer. The question of disclaimer of warranty was touched upon and the court held that this must be negotiated between the buyer and the seller.

The question of liability in regards the combination of products in the same spray tank was passed upon in the case of Udall v. Rohm and Hass, et al, by the Washington Supreme Court when two seperate compounds manufactured by two different companies were combined in the spray tank and allegedly caused substantial damage to the crop to which the material was applied.

In reversing the trial court's non-suit, the Supreme Court held that the action was not based upon any warranty arising from the sale of the product or any defect or negligence concerning the product itself, but rather was based upon the specific advise and direction of the manufacturer's agents beyond the scope of contemplation of the disclaimer provision. The court stated that if the products had been combined in the absence of the knowledge and direction of the field representatives of the manufacturer, no disclaimer provision would have to be considered to find the manufacturers free from liability. As the disclaimer would there be irrelevant, in this case the court held so it is here.

Turning to the question of registration for minor crop uses, we must consider, of course, the law under which such registrations are governed, namely PL 92-516.

While Section 5F recited the procedure whereby experimental use permits may be obtained, from a practical standpoint this will do little to solve local state and area needs.

We must, therefore, turn to Section 74 which recites the authorities of the states.

While this purports to offer a procedure whereby an individual state may regulate the use of any pesticide in the state, said state may do so on ly if the use does not differ from the federal requirements.

This, in essence, is the nut of the problem.

If, as set forth on Section 24(c) a state may provide registration for pesticides formulated for distributuion and use within that State to meet special local needs, if that State is certified by the Administrator it is capable of exercising adequate control to assure that such registration will be within the purposes of the act, and if said registration for such use has not previously been denied, disapproved or cancelled by the Administrator, such registration shall be deemed registration under Section 3 for all purposes of the act but shall authorize distribution and use only within such State and shall not be effective for more than ninety (90) days if disapproved by the Administrator within that period.

At first reading this may appear to be a procedure that will save minor crop use of herbicides and other pesticides, but one must refer back to Section 24 (a) which recites that a State may regulate the sale or use of any pesticide or device in the State but only if and to the extent the regulation does not prevent any sale or use prohibited by the act.

Since the act requires federal registration, unless this is waived by deviation any individual state will find considerable difficulty in obtaining an individual state registration for use not in accord with federal dictum.

You are all familiar with the DDT application for Tussock Moth Control in the Pacific Northwest in 1974, and the great amount of effort that was required to obtain permission to save these valuable forest lands.

An individual grower of ten (10) acres of radishes who finds one given herbicide will control his weeds without harm to the crop is less likely to receive a dispensation if the herbicide in question does not carry federal registration for radishes.

The value of the IR-4 Technical Committee has been recently demonstrated with the registration of Paraquat for use on Guar beans and the establishment of a livable tolerance.

But this procedure, helpful though it may be, is not the answer.

There is no question but that individual state agencies and individual state universities are much closer to the individual problems and the solutions to those problems lie within their state. There is no question but that these entities have far greater experience in comparison with the E.P.A. and we would cite as an example the State of Washington which promulgated the first law governing commercial aerial application of pesticide in the United States in the year 1948.

Twenty-seven years later, the State of Washington is still governing commercial aerial application of pesticides, and along with other states in the west, such as Idaho, California and Oregon, the expertise and experience that has been developed through research, and enforcement of state regulations, has given these entities more knowledge as to how pesticide may be safely used then can be found throughout the whole of E.P.A.

I see no way in which the E.P.A.can effectively establish a workable competent operating program by the target date proposed, and in my view the best action that coule be taken by E.P.A. would be to extend the date when this act shall become effective thus allowing time for appropriate review and basic changes which are sorely needed.

We need a common sense compendium wherein crops may be classified by groups rather than individually insofar as pesticide use and residue is concerned. We cannot have national limitation standards in a country as large and as diversified in climate and soils as the United States. We need a timely registration procedure for additional uses once the original toxicology studies on a product have been accepted. We need to return the authority to the individual states where such states have clearly demonstrated their ability to regulate the manufacture, application and use of pesticides long before E.P.A. came into existence.

DIFENZOQUAT FOR WILD OAT CONTROL IN WHEAT AND BARLEY–WESTERN STATES

D. R. Colbert, R. S. Nielsen, C. L. Amen, and C. C. Papke[1]

ABSTRACT

Difenzoquat (Avenge) is the recently approved (WSSA) common name for the wild oat herbicide, 1, 2-dimethyl 1-3, 5-diphenyl pyrazolium methyl sulfate.

A number of field trials were conducted in the West from 1972 - 74 to evaluate the effectiveness of difenzoquat for controlling wild oats selectively in spring or winter wheat and barley.

Results showed that postemergence applications of difenzoquat at .62-1.0 lb. a. i./A gave commercially acceptable wild oat control with good crop tolerance. For best results, the herbicide should be applied to wild oats in the three to five leaf stage of development.

Also, these field studies showed that if a broadleaf problem occurs, difenzoquat can be tank-mixed with either; 2, 4-D, MCPA, or bromoxynil without effecting it's herbicidal activity on wild oats.

[1]American Cyanamid Company, Lodi, California.

USE OF DIFENZOQUAT UNDER TEMPORARY PERMIT FOR CONTROL OF WILD OATS IN BARLEY

Tom O'Hare, Don Colbert and Clark Amen[1]

Abstract: In 1974 an experimental permit was issued to evaluate Difenzoquat (1,2-dimethyl - 3,5-diphenylpyrazolium methyl sulfate) for postmergence control of wild oats (Avena fatua) in spring planted barley. When applied at the 3 to 5 leaf stage (wild oat) Difenzoquat has shown excellent control in numerous research trials.

Through the aid of an EPA permit, Difenzoquat was, for the first time, evaluated by the grower in field trials. Cooperators in the program included not only farmers and ranchers but custom applicators as well. Both ground and air methods of application were employed. This enabled an examination of a wide variety of use patterns with a limited amount of product.

Participants of the program were asked to complete data reports regarding application technique, injury level and wild oat control. Results obtained firmly indicate that Difenzoquat has excellent potential as a postmergence wild oat herbicide. Rates of 5/8, 3/4 and 1 lb/A were applied in accordance with recommendations based on wild oat density. More than 85% of the sites evaluated reported wild oat control effectiveness in the excellent range (85-95%). Growers were receptive to Difenzoquat because of its application timing and weed control performance.

American Cyanamid plans in 1975 to further examine Difenzoquat under experimental permit. This would involve a larger number of sites and hopefully combinations with the phenoxy herbicides. Additionally, it is planned that the use permit be expanded to include winter wheat as a portion of the acreage. Enlargement of the program will allow more extensive testing through grower participation, and further verify the potential of Avenge Wild Oat Herbicide.

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2 - ETHOXY - 2, 3 - DIHYDRO - 3, 3 - DIMETHYL - 5 - BENZOFURANYL METHANESULPHONATE (NC 8438), A NEW HERBICIDE FOR SUGARBEET AND GRASS SEED CROPS

Ekins, W.L. and J.M. Bennett[1]

2 - ethoxy - 2, 3 - dihydro - 3, 3 - dimethyl - 5 - benzofuranyl methanesulphonate (NC 8438) shows promise as a preemergence and postemergence herbicide for the control of many annual weeds in sugarbeet, grass grown for seed and other crops.

NC 8438 is formulated as an emulsifiable concentrate containing 1.5 lb ai/gal. NC 8438 is relatively non-volatile and has a water solubility of 110 ppm at 25°C. Toxicological studies have shown that the acute oral and dermal LD_{50} values for the rat, expressed as total formulation, are 5.65 ml/kg and 4.0 ml/kg, respectively.

Nc 84 38 is taken into plants mainly by the emerging shoot growing through the treated soil; however, uptake through the roots and foliage is important in some broadleaved species.

NC 8438 has been extensively tested in sugarbeet in the United States and in other countries. Preemergence applications are effective where rainfall or overhead irrigation activates the herbicide after application. Under dry conditions and under furrow irrigation, NC 8438 performs best if shallowly incorporated into the soil. Recommended rates for soil applications range from 1.12 to 4.48 kg ai/ha. NC 8438 controls most common weed species infesting sugarbeet fields, including redroot pigweed, smartweed, foxtails, volunteer small grains and hard-to-kill weeds, such as kochia and Russian thistle. Control of susceptible weed species is obtained for up to 10 weeks following application.

NC 8438 applied in combination with pyrazon or TCA has proven promising for the control of specific weed problems in some geographic regions.

NC 8438 in combination with phenmedipham or desmedipham is a promising post-emergence treatment.

Recent studies in grass seed crops indicate NC 8438 to be selective in ryegrass when applied preemergence or postemergence. There also appears to be a satisfactory margin of selectivity in established stands of Kentucky bluegrass. Excellent control of annual bluegrass, downy brome, chickweed, wild oats, volunteer small grains and rattail fescue has been achieved at rates of 1.0 to 2.0 kg/ha.

Other crops showing selectivity include field beans, tobacco, peas, onions, carrots and sunflowers.

METHODS OF APPLYING ACTIVATED CHARCOAL

K. E. Clapp[2]

Introduction

During the past several years, extensive work has been done to establish the effectiveness of activated charcoal as a plant protection agent. Tests show that activated charcoal effectively reduces unwanted herbicidal activity caused by over-application, mis-applications, accidental spills, and even normal application. Research covered a wide variety of fruit, vegetable and grass crops. During this period, different methods of application have been suggested and tested.

This presentation describes a variety of application techniques such as root dip, broadcast, band spray, coating, and dry. Typical results are also given.

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It is desirable to remember that one of the most convenient ways of working with activated charcoal is in the water slurry form. Agricultural grade activated charcoal wets readily and requires no additional wetting agent. (Any wetting agent added would be absorbed by the charcoal using up valuable surface area.)

Root Dip Application With Activated Charcoal

One of the earliest researchers to work with activated charcoal in the United States was John Ahrens of Connecticut. He dipped various plants in one and two pound per gallon slurries of activated charcoal prior to transplant to protect them from various herbicides. The successful results are outlined in his numerous publications.

An additional way to incorporate activated charcoal into a transplant system is adding it to the transplant water.

Fred Warren of Purdue recently ran tests using 1/8 and 1/4 pound per gallon activated charcoal in the transplant water for tomatoes. This system provided protection against higher rates of preplant-incorporated Treflan.

In Canada, a field of transplanted cauliflower produced a spotty stand because of a residue of 2,4-D and Atrazine from a previous corn crop. By root dipping the transplants in a one-pound gallon slurry of activated charcoal, and adding enough activated charcoal to the transplant water to produce a dosage of 50 pounds per acre, an excellent, uniform stand was obtained. In California, experiments were run with container grown Texas Privet and Pyracantha. Test plants were root dipped in a two pound per gallon slurry of activated charcoal and the control plants were not. All containers were then treated with eight pound per acre rate of Simazine. The plants treated with the activated charcoal were protected and had a much better growth.

Broadcast Spray Application of Activated Charcoal

A broadcast application of activated charcoal can be made using equipment as simple as the normal sprinkling can. A home garden sprayer is also a convenient piece of equipment for this method of application. Before spraying from a garden sprayer, however, the activated charcoal should be slurried in a seperate bucket and poured through a screen into the sprayer. This is necessitated by the low amount of agitation available in the normal home sprayer. Power equipment with conventional nozzles is another convenient way to make broadcast applications with activated charcoal. A spray gun can also be conveniently used.

Incorporation of Activated Charcoal

After a broadcast application of activated charcoal, it should be incorporated into the area in which it is excepted to tie-up the herbicide or other organic compounds. This can be done by simply using a rake, rotor tiller, hoe, disc, plow, aeroblade, etc. When working with established turf, the only practical means of incorporating activated charcoal without seriously damaging the turf is with a thorough watering.

Experiments at the University of Rhode Island proved watering can be an effective means of incorporating the activated charcoal. A simulated spill was applied by spraying a three pound per acre rate of Simazine on established turf. One part of the turf was treated 24 hours later with a 500 pound per acre rate of activated charcoal. No precipitation or watering was allowed in the area in the intervening time. After the application of the activated charcoal, both areas were thoroughly watered. One month later the non-charcoal treated portion was completely dead, while the part treated with activated charcoal was growing vigorously.

At the University of Deleware, an experimental herbicide produced areas in their turf that were sterile to the establishment of grass seed. These barren areas were sprayed with a 300 pound per acre rate of activated charcoal, followed by incorporation and reseeding. Six weeks later, an excellent stand of grass had been established on this previous barren and sterile area.

Banded Spray Technique of Applying Activated Charcoal

The banded spray technique is a convenient method for limiting the amount of activated charcoal needed for a particular application. It provides specific protection for newly emerging seedlings while allowing a herbicide to give the necessary weed control. Orvid Lee of Oregon was one of the earliest researchers who experimented with the banded spray technique. He applied a narrow band of activated charcoal as a water slurry directly over the seed row of newly planted perennial rye grass grown for seed. Immediately following the planting, the entire area was oversprayed with the desired herbicide. As a result of his research, between 10,000 and 20,000 acres of perennial rye grass is raised for seed each year using this planting method. A one-inch band is sprayed over the seed row with 300 pounds per acre activated charcoal in the one-inch band. This requires 20 pounds per acre in grass grown on 15 inch centers. The area is then oversprayed with a 3 pound per acre rate of diuron. Without the use of the activated charcoal, little survival of the desired grass would be achieved. With the use of the charcoal, excellent survivals are achieved while still maintaining excellent weed control.

When spraying activated charcoal, it should be handled in much the same manner as a concentrated wettable powder mixture. The sprayer should be filled approximately 1/2 full with water and the agitator started. The activated charcoal and the balance of the water should be added simultaneously. Choice of pump is very important since the abrasive nature of activated charcoal will cause premature failure of a paddle or roller pump. The best pump to use is either a centrifugal or piston pump with ceramic cylinders. Nozzles with large orifices should be used to prevent plugging and screens should be removed. If foreign matter is present in the spraying system and screens are required, slotted screens should be employed. Mechanical agitation is preferable, but an efficient by-pass agitator is sufficient. Nozzles should be located close to the ground to limit spray drift.

A spray rig used to put out plots as large as 20 acres consisted of a 75 gallon tank mounted horizontally with a pipe across the bottom with holes drilled in it to provide for by-pass agitation. The pump was a three-horse power centrifugal pump which supplied sufficient pressure and flow for four spray nozzles and the by-pass agitation. In conjunction with this spray unit, a 300 gallon nurse tank was employed with mechanical agitation and a centrifugal transfer pump that also doubled as a by-pass agitator. Pouring activated charcoal into the unit through a wide opening, created a minimal amount of dusting. As with any spray unit, calibration is important to assure proper application.

The spray equipment to apply test plots of several acres or more can be extremely simple. In Guatemala, this consisted of a five-gallon pail for the mix tank and a 15-gallon plastic carboy as the spray tank. The pump was a three-horse power centrifugal pump which supplied sufficient pressure and flow for the by-pass and agitation and six spray nozzles.

Standard commercial literature can be used to choose the proper nozzle and conditions for applying a band spray of activated charcoal. For example, if you desire to spray a 300 pound per acre rate in a one-inch band, you could make a one pound per gallon slurry and spray a 300-gallon rate in the one-inch band. If the tractor was traveling at 3 miles per hour, this would require a .15 GPM flow from each nozzle. Continuing to consult the literature you will find this flow could be achieved by using a 10 pound per square inch pressure from a choice of nozzles such as a cone nozzle using a D4 disc and a 25 core or a 6503 flat spray nozzle. A one pound per gallon slurry of activated charcoal does not redically alter the viscosity of water. Normal spray data can therefore be used without substituting a conversion factor for changes in viscosity.

Coated Seeds, Potting Soild and Seed Wafers

Seeds containing coatings with activated charcoal are currently commercially sold. In addition, several researchers have experimented with seeds which they have coated with activated charcoal. One such test was run by Harry Meyers in Florida in which he was over-seeding Bermuda Grass which had been freshly treated with a 1 lb/Acre rate of Kerb for Poa Annua Control. Without the use of activated charcoal, a successful over-seeding was not achieved. By coating the annual rye grass with 10% activated charcoal by weight, an excellent over-seeding was achieved. It is interesting to note that in Harry Meyer's greenhouse and field studies, the presence of the charcoal coating in no way interfered with the action of a Koban seed treatment.

Potting soil is commercially sold which contains activated charcoal. In addition, several researchers have incorporated it into the bottom layer or potting mixes to protect container grown nursery stock from herbicides. Bill DeTar has published several articles on his use of 10 grams of activated charcoal per liter of Vermiculite to make seed containing wafers. The charcoal enhances germination and protects from herbicides.

Dry Application of Powdered Activated Charcoal

The final type of application to be discussed is the direct use of the powdered activated charcoal. Activated charcoal should not be dispensed in the powdered form from equipment designed for dispensing granular material. This is because of the bridging tendency of powders. However, direct use of powdered charcoal has achieved acceptance on golf courses where it is applied to herbicide and hydraulic oil spills followed by a thorough watering. An additional area where powdered charcoal is being tested is with citrus trees affected with young tree decline. Young tree decline is affecting orange trees grafted onto rough lemon rootstock in the Florida area. It is a fatal malady of unknown cause. In the Winter Haven Research Station, three trees were similarly affected with the young tree decline. One of the three trees was treated last April with five pounds of dry activated charcoal sprinkled on the ground underneath it. The charcoal was then watered in with 100 gallons of water. Core samples showed it was carried as deep as 18 inches into the sandy soil. By August, the other two trees were virtually dead, but the treated tree had a good flush of new growth. Additional tests are being run to determine if this is a practical method to treat for young tree decline.

Conclusions

Activated charcoal is an ideal plant protection agent. It is easy to work with, effective, and since it is classified as a soil amendment, it can be applied without EPA approval. However, it should not be used to violate a herbicide label.

The various application techniques discussed should be sufficient to cover crop situations. If you desire additional information, consult available literature, ICI United States Inc. publications, or the author.

VARIETAL SENSITIVITY OF POSTEMERGENCE APPLICATIONS OF METRIBUZIN ON POTATOES

J.K. Alldredge, and A.D. Cohick[1]

Metribuzin (SENCOR) has been tested extensively for weed control in potatoes from 1969 through 1974 in the United States and Canada. Results of this testing show that metribuzin is an excellent herbicide with a broad spectrum of activity especially for control of broadleaf weeds and some grasses. This activity is achieved with both preemergence and postemergence applications. The application of metribuzin to potatoes generally shows excellent crop tolerance with both preemergence and postemergence treatment. However, some verietal differences have been noted. This varietal difference is most obvious from

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postemergence application and is dependent, to a certain extent, upon several factors including crop height, weather conditions, and soil texture and type.

Introduction

Wide-scale testing of a new herbicide designated BAY 94337 was initiated in potatoes and soybeans during 1969 in the U.S. and Canada. This herbicide, now known as SENCOR and having the common name, metribuzin, is a novel triazinon compound which shows an uncommonly broad spectrum of weed control. In addition, a good level of crop tolerance was noted with preemergence application to potatoes and soybeans and with postemergence application to potatoes.

My presentation this morning is the third in a series of 3 dealing with crop tolerance and follows the papers given at the NCWSS meeting in December 1974 in St. Paul, Minnesota and the National meeting in Washington, D.C.

Although the emphasis of my presentation today is directed to postemergence application of metribuzin to potatoes, I will review briefly the major points presented in the first two papers.

Preemergence Application

Although metribuzin has a broad herbicidal spectrum that encompasses both broadleaf and grass weeds, rates of application of metribuzin needed for grass control are higher than for broadleaf weeds. Thus, proper rate of application is influenced to a degree by weed population.

Activity of metribuzin is also influenced to a degree by soil texture and organic matter content. Preemergence application of metribuzin on heavy textured soils such as clay or clay loam require higher rates for weed control than on light textured loamy sand or silt soils.

Crop tolerance of preemergence applications of metribuzin to potatoes is generally excellent. In a survey of more than 100 experimental trials in the U.S. and Canada during the years 1969 through 1972, the data show that even the rate of 1.75 lb AI/A could be applied in almost all cases without significant crop injury. The few test results with significant injury can be attributed to excessive moisture, extremely low organic matter content, or a combination of these factors. Crop tolerance margins in these tests generally ranged from 2 to three-fold depending on soil texture and weed population.

In order to determine the influence of crop variety in these reports of crop tolerance, we have now surveyed the results of nearly 500 experimental trials with 43 potato varieties conducted in the U.S. and Canada from 1969 through 1974. When we summarize the total observations for all varities from tests at rates of 4 to 32 oz AI/A, the following table can be presented.

Metribuzin

Preemergence Application to Potatoes

	Total Tests (4 to 32 oz AI/A)	% of Tests Showing: No Phyto	Slight Phyto (<15%)	Significant Phyto (>15%)
43 Varieties	475	65%	28%	8%

In considering these data, it must be pointed out that the proposed use rates of metribuzin preemergence application to potatoes, under our Temporary Permit registrations and in our currently pending petition to EPA, are 8 to 16 oz AI/A. Of the 8% of tests for which significant crop injury is reported, several comments and contributing factors may be cited: (1) high rates of application (i.e., greater than 16 oz AI/A) can cause damage under some conditions, (2) preemergence application to potatoes grown in extremely light-textured soils can result in injury, (3) crop injury from preemergence applications may be reported as significant in early observations and become insignificant as the growing season progresses, (4) certain varieties do appear less tolerant to preemergence applications of metribuzin under these stress conditions.

A comparison of the overall average with selected varieties is shown in the next table. Several varieties correspond closely to this average figure - Kennebec, Russet Burbank, and Norgold. One variety, Katahdin, shows a considerably greater percentage of tests (89%) with no phytotoxicity than the overall average. Three other varities, Sebago, Superior and especially Pontiac, show a significantly smaller percentage of tests with no phyto.

Two varieties especially show a lower incidence of significant damage- Kennebec and Sebago. Three others - Katahdin, Russet Burbank and Norgold also show lower figures. Pontiac and especially Superior show a much higher percentage of tests with significant crop damage.

These results show that crop tolerance to preemergence application is good for a wide spectrum of varieties but that certain varieties may exhibit more crop tolerance than others. Again, it is important to note that this information is based on results from application of metribuzin up to two times the proposed recommended rate for preemergence application.

Metribuzin Preemergence Application to Potatoes

		% of Tests Showing		
Variety	Total Tests (4 to 32 oz AI/A)	No Phyto	Slight Phyto (<15%)	Significant Phyto (>15%)
All Varieties	476	64	28	8
Katahdin	64	89	5	6
Kennebec	67	67	30	3
Sebago	30	43	53	3
Russet Burbank	54	67	28	6
Norgold	22	68	27	5
Superior	11	45	36	18
Pontiac	9	11	77	11

When results for several varieties with postemergence application of SENCOR are compared, the following table can be presented.

SENCOR Postemergence Application to Potatoes

Variety	Total Tests (4 to 32 oz AI/A)	No Phyto	% of Tests Showing: Slight Phyto (< 15%)	Significant Phyto (> 15%)
All Varieties	475	43	32	25
Katahdin	64	57	31	11
Russet Burbank	87	70	11	18
Superior	12	50	30	20
Warba	14	21	0	79
Pontiac	20	15	40	45
La Soda	14	0	64	36

You will note that no crop injury is reported in 43% (204 of 475 total tests) of the tests shown here. Two varieties listed here performed some better than the average. Katahdin with no phyto in 57% of the tests and Russet Burbank with no crop injury in 70% of these tests at 4 to 32 oz AI/A appear considerably more tolerant than Pontiac, Warba, or La Soda varieties. In fact, significant injury appears commonly in tests with these latter varieties especially at rates of 12 oz AI or more.

To more fully consider the effect of dosage rate the following tables show varietal results on a rate by rate basis.

When the Katahdin variety is considered we can see that at rates of 4 to 8 oz AI/A only 2 of 23 tests showed significant injury.

SENCOR Postemergence Application to Potatoes

Variety Katahdin

Number of Tests

Rate AI/A	No Phyto	Slight Phyto < 15%	Significant Phyto > 15%	Total Tests
4 oz	10	3	0	13
8 oz	3	5	2	10
12 oz	10	1	0	11
16 oz	11	9	3	23
24 oz	2	1	1	4
32 oz	1	1	1	3

Even at rates of 12 to 16 oz AI/A only 3 of 34 tests showed unacceptable damage. In these tests all postemergence applications showing significant crop injury were applied as early postemergence treatments, i.e., when potatoes were 2 to 3 inches tall.

A far fewer number of test results are available at rates of 24 to 32 oz AI/A. These results show that 2 of 7 tests showed significant crop injury. But, again, this application was early postemergence.

A similar factor is seen for the Russet Burbank variety. At rates of 4 to 8 oz only 1 of 37 tests showed significant injury. At 12 ro 16 oz only 3 of 35 tests showed significant injury. Afain these applications were early postemergence.

SENCOR Postemergence Application to Potatoes

Variety Russet Burbank

Number of Tests

Rate AI/A	No Phyto	Slight Phyto < 15%	Significant Phyto > 15%	Total Tests
4 oz	8	0	0	8
8 oz	27	1	1	29
12 oz	15	1	3	19
16 oz	10	6	0	16
24 oz	1	0	5	6
32 oz	0	2	7	9

The higher rates of application at 24 to 32 oz AI/A appear to show a definite rate response for this variety. Twelve of fifteen total tests show significant injury with both early and late postemergence application on this variety.

DYERS WOAD AND ALFALFA INTERACTION

A DOUBLE TAKE OF A COMPETITION STUDY

Varga, William A. and John O. Evans [1]

Dyers woad (Isatis tinctoria), a relatively new weed, was first observed in Utah in the early twentieth century. The weed has become an economic problem only in the last twenty years as it spread rapidly and infested large tracts of rangeland, alfalfa fields, and in some instances dryland wheat.

Woad is a persistent weed, and its rosette is thought to inhibit the growth of other plants. Young and Evans have found a germination depressant in the fruits of woad which in some instances inhubuts germination of related mustard and other plants.

We designed a competition study to observe interaction between dyers woad and alfalfa. Alfalfa emerged two days prior to dyers woad emergence, and the depressant discussed by Young and Evans did not appear to inhibit germination and emergence of alfalfa. Statistics

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obtained from comparisons of varying densities of dyers woad on nine alfalfa plants showed little or no competition between alfalfa and high densities of dyers woad. In all cases evidence prevailed that alfalfa filler plants used in the study when dyers woad densities were low, competed to a greater extent with the nine standard alfalfa plants than did dyers woad. Our study involved seedlings and immature rosettes which may not compete as vigorously as does the mature dyers woad rosette. Further study is necessary to study dyers woad's competitive ability in the field.

NITRO POISONING IN LIVESTOCK FROM RED-STEMMED PEAVINE AND SICKLEPOD MILKVETCH

M. C. Williams, L. F. James and A. T. Bleak[1]

Abstract: Red-stemmed peavine, Astragalus emoryanus (Rydb.) Cory, and sicklepod milkvetch, Astragalus falcatus Lam., contain organic nitro compounds which are toxic to domestic livestock. Peavine is an indigenous species found principally in Texas and New Mexico. Sicklepod milkvetch is a native of Russia which has been introduced into the United States.

Peavine was collected near Fort Stanton, Lincoln Co., New Mexico in 1972. The plant contained 8 mg. NO_2/g when first analyzed in 1973 and 5.6 mg NO_2/g when fed to a sheep in the fall of 1974. Peavine contains the nitro compounds miserotoxin, cibarian, karakin, hiptagin, and 3-nitro-1-propanol (3-NPOH). Miserotoxin catabolizes to 3-NPOH and cibarian, karakin, and hiptagin catabolize to 3-nitropropanoic acid (3-NPA). A sheep was fatally poisoned when fed peavine at 400 grams (37.6 mg NO_2/kg of body weight) per day for seven days. The clinical syndrome was identical to that produced by 3-NPA infused intravenously in sheep at 20 mg NO_2/kg. The toxic signs associated with peavine poisoning are similar to those produced by other nitro-bearing Astragalus.

Sicklepod milkvetch leaves collected near Logan, Utah contained 40 to 80 mg NO_2/g of plant from June to September. Analyses indicated that the majority of the nitro compounds were cibarian, karakin, and hiptagin. A sheep and cow were killed when fed one dose of sicklepod milkvetch at 500 and 350 mg NO_2/kg, respectively. Sicklepod milkvetch fed to cattle at 300 mg NO_2/kg produced the loco syndrome.

COMPARISON OF TWO REGIMES OF HERBICIDE APPLICATION ON WESTERN BRACKEN

W. C. Robocker[2]

Abstract: Picloram (4-amino-3,5,6-trichloropicolinic acid) and dicamba (3,6-dichloro-o-anisic acid), applied in granular formulations in autumn at 2- to 4-year intervals with a total of 6.0 lb/A of picloram and 16.0 or 18.0 lb/A of dicamba, did not entirely eliminate western bracken (Pteridium aquilinum (L.) Kuhn var. pubescens Underw.) when evaluated 6 years after the initial treatment (6 months after the final treatment). Grass yield showed a significant increase in plots treated twice with 8.0 lb/A of dicamba.

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Picloram at 1.0 or 2.0 lb/A or dicamba at 3.0, 4.5, or 6.0 lb/A were each applied yearly in the same granular formulations and season for three consecutive years, for a total of 3.0 or 6.0 lb/A of picloram or 9.0, 13.5, or 18.0 lb/A of dicamba. With these treatments, bracken was reduced to near zero coverage by picloram and to approximately 2% coverage by the highest rate of dicamba 6 months after final application of herbicides. No significant increase or decrease of grass resulted from the yearly applications of herbicides, apparently reflecting a counterbalancing of residual herbicide effects and release from competition with bracken.

Western thimbleberry (Rubus parviflorus Nutt.) was injured, but not eliminated, in both treatment regimes. Common snowberry (Symphoricarpos albus (L.) Blake) showed morphological effects on the leaves, particularly from dicamba, but survived all treatments in both trials.

IMPROVING FORAGE PRODUCTION

AND BIG GAME WINTER RANGE WITH PHENOXY HERBICIDES

Roy R. Johnson[1]

Abstract: Butoxyethanol esters of dichlorprop [2-(2,4-dichlorophenoxy) propionic acid], silvex [2-(2,4,5-trichlorophenoxy) propionic acid], 2,4,5-T (2,4,5-trichlorophenoxyacetic acid), and a 1:1 mixture of 2,4-D (2,4-dichlorophenoxyacetic acid) or 2,4,5-T and dichlorprop were aerially applied at rates of 2.24 to 3.36 kg/ha to 2.8 ha plots near Rifle and Crawford, Colorado. Initial applications were made in 1969 in early July at Rifle and in early July and late August at Crawford. Repeat applications were made three years later at Rifle and two years later at Crawford. Evaluations in 1974 indicated that July application was superior to August application and that repeat sprays after two years were better than after three years. All herbicides gave similar control of Gambel oak, but silvex and dichlorprop were less effective on Saskatoon serviceberry (Amelanchier alnifolia), roundleaf snowberry (Symphoricarpos rotundifolius) and squaw-apple (Peraphyllum ramosissimum) than 2,4,5-T or a mixture of 2,4-D and dichlorprop.

Introduction

Forage production for domestic livestock and winter range for big game animals of Colorado's western slope is limited by mature stands of Gambel oak. Reduction of the Canopy density of oak increases forage production of the understory of native grasses and forbs. Browse produced on mature Gambel oak is out of reach of most cattle and big game animals. Other browse species such as serviceberry, snowberry and squaw-apple, which make up the shrub community, are more desirable winter range for elk and other wildlife (3,4).

Repeat applications of phenoxy herbicides one or two years after an initial application have increased defoliation and total stem kill of other oaks (Quercus spp.) in Oklahoma (1). Effects of repeat applications on Gambel oak in field scale aerial applications have not been reported. Marquiss reported that time of application during the spring or summer had little effect on results (2). Little attention has been paid to the response of associated species when stands of Gambel oak are treated with phenoxy herbicides.

In this paper, the results of aerial applications of several phenoxy herbicides to Gambel oak and associated species are reported. The effects of initial treatment time and intervals before retreatment on canopy reduction are discussed. Visual observation of forage and browse response and of the effect of intensity of grazing on brush response are reported.

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Materials and Methods

Plot areas comprising 2.8 ha were selected and established on the Gordon Meeks ranch south of Crawford, Colorado in 1968. Plot boundaries were marked by a bulldozed strip at the edge of each plot with a 50 foot buffer area between plots. Initial herbicide application was scheduled in 1968, but a frost in early July injured much of the oak foliage, so applications were delayed until 1969. On July 9, the following treatments were applied, all as butoxyethanol esters: 2,4,5-T at 2.24 kg/ha, silvex at 2.24 kg/ha, a 1:1 mixture of 2,4,5-T and dichlorprop 2.24 kg/ha and dichlorprop at 3.36 kg/ha. All treatments were applied by fixing-wing aircraft at a volume of 5.5 liters/ha using #2 diesel fuel as diluent. A second application was made six weeks later on August 23.

On the Pitman ranch near Rifle, Colorado, the following treatments were applied to 2.8 ha plots by fixed-wing aircraft on July 8, 1969, all as butixyethanol esters: 2,4,5-T at 2.24 kg/ha, silvex at 2.24 kg/ha, dichlorprop at 3.36 kf/ha and a 1:1 mixture of 2,4-D and dichlorprop at 3.36 kg/ha.

All treatments were applied at a total volume of 5.5 liters/ha using #2 diesel oil as a diluent. Plot boundaries were delineated by bulldozing a strip the year following application.

Major species on the Meeks site were Gambel oak, Saskatoon serviceberry, roundleaf snowberry and squaw-apple. Some big sagebrush (Artemesia tridentata) was present. Height of the dominant brush was 8-10 feet, with occasional oak trees up to 16 feet in height. Major species on the Pitman ranch were Gambel oak, Saskatoon serviceberry, roundleaf snowberry and big sagebrush. Several eastern redcedar (Juniperus virginiana) and Douglasfir (Pseudotsuga menziesii) were scattered through the plot area. Height of the dominant brush was six to eight feet.

Visual evaluation of canopy reduction was made on both sites on July 20, 1971.

Repeat applications were made to the Meeks site on July 14, 1971, two years after the initial application. Both early and late treatment plots from the 1969 applications were treated at this time. The 1969 treatments were repeated, except that treatment #3(2,4,5-T +dichlorprop) was replaced with a 1:1 mixture of 2,4-D and dichlorprop at 3.36 kg/ha. Treatments on the Pitman site were retreated on July 20, 1972, three years after the initial application. Canopy reduction was evaluated on both sites on July 19, 1972 and on August 13 and 14, 1974.

Results & Discussion

Timing. Evaluation of the 1969 timing trial at the Maaks ranch in 1970 and 1971 showed the following canopy reduction in Gambel oak (Table 1) and Saskatoon serviceberry (Table 2):

Table 1. Canopy reduction of Gambel oak following July and August - 1969 application of phenoxy herbicides.

Treatment	Rate kg/ha	Percent canopy reduction of Gambel oak			
		July 9 application		August 23 application	
		8/4/70	7/13/71	8/4/70	7/13/71
Silvex	2.2	85	80	70	75
2,4,5-T	2.2	60	40	50	35
2,4,5-T + dichlorprop	1.1+ 1.1	80	50	55	25
dichlorprop	3.4	75	75	70	35
Average		75	61	61	42

Table 2. Canopy reduction of Saskatoon serviceberry following July and August 1969 application of phenoxy herbicides.

Treatment	Rate kg/ha	Percent canopy reduction of serviceberry			
		July 9 Application		August 23 Application	
		8/4/70	7/13/71	8/4/70	7/13/71
Silvex	2.2	30	35	20	15
2,4,5-T	2.2	85	45	30	35
2,4,5-T + dichlorprop	1.1+ 1.1	85	65	20	20
dichlorprop	3.4	80	65	46	30
Average		70	52	29	25

July 9 application gave substantially better initial canopy reduction of oak and serviceberry than application on August 23. Evaluation of the July 9 application in both 1970 and 1971 indicated that silvex was more effective on oak than 2,4,5-T, dichlorprop or the 1:1 mixture of 2,4,5-T plus dichlorprop, while serviceberry was most effectively controlled by dichlorprop or the 2,4,5-T dichlorprop mixture. 2,4,5-T was slightly less effective for serviceberry control, while silvex was much less effective.

Brush Control and Selectivity. Results of evaluation of canopy reduction by species on August 13, 1974 are given for the Meeks ranch (Table 3) and the Pitman ranch (Table 4).

Table 3. Percent canopy reduction by species following 1969 and 1971 application of phenoxy herbicides; Meeks ranch.

Treatment	Rate kg/ha	Applications	Canopy reduction[1]			
			Oak	Serv.	Snowb.	Squaw.
Silvex	2.2	1969 & 1971	82	25	25	30
2,4,5-T	2.2	1969 & 1971	92	35	30	60
2,4,5-T + dichlorprop	1.1+ 1.1	1969	80	75	40	25
2,4-D + dichlorprop	1.7 + 1.7	1971				
dichlorprop	3.4	1969 & 1971	70	65	40	55

[1]Evaluated August 13, 1974.

Table 4. Percent canopy reducation by species following 1969 and 1972 application of phenoxy herbicides; Pitman ranch.

Treatment	Rate kg/ha	Applications	Canopy reduction[1]			
			Oak	Serv.	Snowb.	Sage
Silvex	2.2	1969 & 1972	60	30	20	20
2,4,5-T	2.2	1969 & 1972	50	70	20	20
2,4-D + dichlorprop	1.7 + 1.7	1969 & 1972	40	75	30	40
dichlorprop	3.4	1969 & 1972	40	80	35	60

[1]Evaluated August 14, 1974.

The most effective phenoxy herbicide for Gambel oak control on the Meeks ranch after applications in 1969 and 1971 was 2,4,5-T. A repeat treatment of silvex in alternate years or 2,4,5-T + dichlorprop followed by 2,4-D + dichlorprop gave essentially equal of oak, while dichlorprop alone was slightly less effective. Silvex was much less effective on the associated brush species than on oak. Treatments containing 2,4-D or dichlorprop increased control of these species.

While similar relationships between herbicides and species response were observed on the Pitman ranch, overall control of oak was less. This reduction in oak control can be attributed to three factors. The Pitman site is considerably drier than the Meeks site, it is grazed more heavily so competition is reduced, and the three year interval between treatments allowed more oak recovery.

Based on the results of this study, any of the phenoxy herbicide treatments used can be expected to substantially reduce Gambel oak canopy and increase herbaceous forage production. Choices can be made among the treatments based on herbicidal effects on the associated species and the objectives of the management plan for the area. If winter range for big game is a goal of the plan, silvex or 2,4,5-T will favor the wildlife browse-providing shrubs, while treatments containing 2,4-D or dichlorprop will give more uniform brush control. For optimum canopy reduction of oak, treatments should be applied in early July after most frost danger is past, and treatment should be repeated in alternate years.

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RELEASE AND DISPERSAL OF *RHINOCYLLUS CONICUS* IN MONTANA FOR BIOCONTROL OF MUSK THISTLE

J. M. Hodgson and N. Rees[1]

Abstract

Musk thistle (*Carduus nutans* L.) is a serious problem of overgrazed pastures and waste areas of Montana. In 1969 a seed-eating weevil host-specific to *Carduus*, *Cirsium*, *Silybum* and *Onopordum* genera was introduced into the United States by Dr. L. A. Andres, et al. of

[1]Agr. Res. Ser., U.S. Dept. of Agriculture and the Montana Agric. Exp. Sta., Bozeman, MT.

the Biological Weed Control Laboratory, Agricultural Research Service of the U. S. Department of Agriculture, Albany, California. Over a 4 year period we have received from them about 3,000 adult beetles for release on musk thistle in Montana. During the growing seasons of 1969, 1971, 1972 and 1973 we received and released 3,000 adult R. conicus beetles on existing infestations of Musk thistle in the Gallatin Valley.

Surveys of thistle flowers at the release sites one year after release and in succeeding years proved that the insect was successfully parasitizing the seeds of the musk thistle. Monitoring of the thistles in the release sites each year apparently did not indicate the increase of the beetle population as they were apparently dispersing away from the release sites. In 1974 an extensive survey revealed that R. conicus had spread over a 500 square mile area in Gallatin county.

The degree of infection of musk thistle varied greatly from almost complete infection of all primary flowers in one location to only a few infected flowers at other sites. Only 20% of the musk thistle sites examined throughout the county lacked beetles.

At this time there is no indication that the musk thistle population has been decreased because of seed destruction caused by the beetles. These studies will be continued to evaluate the influence of the beetle on musk thistle stands.

3,5,6-TRICHLORO-2-PYRIDYLOXYACETIC ACID, A NEW HERBICIDE

L. E. Warren[1]

Abstract

Laboratory and field trials have indicated that 3,5,6-trichloro-2-pyridyloxyacetic acid is a highly effective herbicide for the control of many woody plants and broadleaf weeds. Formulated as a water soluble triethylamine salt formulation, 3,5,6-trichloro-2-pyridyloxyacetic acid at equivalent rates has been more effective than 2,4,5-T on certain resprouting species such as sassafras, black locust, ash and maple. Good control has also been obtained for Ponderosa pine, Douglas fir, hemlock, poison oak, black oak, vine and bigleaf maples, manzanita, ceanothus, blackberry, salmonberry, cherry, willow, rose and mesquite.

3,5,6-trichloro-2-pyridyloxyacetic acid degrades under field conditions somewhat more slowly than 2,4,5-T, but considerably faster than picloram.

Preliminary toxicological information indicates that the chemical has a moderate acute oral toxicity to mammals and should pose no problem for ingestion incidental to handling and spraying. The chemical also has a very low toxicity to fish and birds.

[1]Ag-Organics R&D, Dow Chemical U.S.A., Davis, CA.

VEGETATION CONTROL WITH DOWCO® 233 HERBICIDE

B. C. Byrd, W. G. Wright and L. E. Warren[1]

INTRODUCTION

The search continues for new herbicides which are more effective, safer or less costly than the materials presently available. Use of phenoxy herbicides on species such as locust, salmonberry, cherries, maple, oaks, ash and hickory usually results in crown or root sprouting. Picloram alone or in combination with phenoxy herbicides has proven to be more effective

[1]Herbicide Specialist, DOW CHEMICAL U.S.A., Charlotte, NC, Midland, MI, Davis, CA.

for control of resprouting hardwoods as well as being efficacious on confiers. However, ash (*Fraxinus* spp.) and certain other species are still not being adequately controlled.

Research trials with DOWCO 233 Herbicide [(3,5,6-trichloro-2-pyridinyl) oxy] acetic acid, have shown excellent activity on woody plants. The data summarizes field trials established in cooperation with several university, USDA, and USFS personnel.

MATERIALS AND METHODS

Woody plants 4 to 8 feet tall were sprayed with high or low volume sprays containing varying amounts of formulation M-3724 containing 3 pounds acid equivalent per gallon of DOWCO 233 as the triethylamine salt. The objective of these trials was to determine the effective dosage, by species, needed for adequate control at several locations and under different growing conditions across the U.S.

High volume treatments were made at rates of 1 to 4 pounds DOWCO 233 in sufficient water to give 100 gallons spray mixture and applied at 100 to 450 gallons per acre depending on vegetation size and density.

Low volume broadcast treatments were applied using rates of 1 to 8 pounds DOWCO 233 per acre in sufficient water to provide 25 to 30 gallons per acre of spray mixture. Individual stems of each species to be evaluated were identified and tagged with aluminum tags indicating treatment, species and stem number. Colored flagging tape was used to help locate the tagged stems for spraying and to relocate the same stems for evaluation throughout the trial period. Periodic evaluations were made during two full growing seasons after application, except that only one growing season was used for those applications made in October, 1973.

RESULTS AND DISCUSSION

Thirty-one woody or bramble species were present in trials in Western states; and 25 species in Eastern states.

Vegetation control by species response with high volume spray applications containing 1 to 4 pounds per 100 gallons of DOWCO 233 herbicide at four locations in the western United States is presented in Table 1. This data indicates high volume sprays containing 1 pound acid equivalent of DOWCO 233 per 100 gallons spray mixture provided 90 to 100 percent control of the major root and collar sprouting hardwood species in the western states. A notable exception was salal where 4 pounds acid equivalent per 100 gallons was needed for good control. The conifers, Sitka spruce and hemlock, were more tolerant as 3 pounds acid equivalent of DOWCO 233 effected only 50 percent control of Sitka spruce and 1 pound acid equivalent effected 80 percent control of hemlock.

The data in Table 2 from four locations in western states indicates that DOWCO 233 is also effective when applied broadcast in low volume sprays of 25 to 30 gallons per acre. In general 2 to 3 pounds acid equivalent per acre effected 70 to 90 percent control. The conifers, Douglas fir, Monterey pine, redwood and Sitka spruce, were again exceptions as 2 to 6 pounds acid equivalent per acre did not consistently control these species.

SUMMARY

A new chemical, DOWCO herbicide, [(3,5,6-trichloro-2-pyridinyl)oxy]-acetic acid, was evaluated as an herbicide for industrial vegetation control on 51 brush species under a wide range of geographic and climatic conditions at 16 locations across the United States.

Application of high volume sprays containing 1 to 2 pounds acid equivalent per 100 gallons of spray at 12 locations controlled most hardwood species regardless of location. Of particular importance was the high degree and consistency of ash control. The western conifers appeared to be more tolerant to this chemical than the eastern conifers.

Low volume sprays containing 2 to 3 pounds of DOWCO 233, applied in 25 to 30 gallons per acre spray volume also effected acceptable control of these species at four locations in the United States.

Table 1. Vegetation Control by Species with DOWCO 233 Herbicide Applied as a High Volume Spray in Western States

Common Name	Botanical Name	Location/Application Date		Mean Percent Control at Lb. Acid Equivalent Per 100 Gallons			
				1	2	3	4
Alder	*Alnus spp.*	Ore.,	6/72	100	100	0	100
		Wash.	7/73				
Blackberry	*Rubus spp.*	Ore.	6/72, 7/73	93	98	100	100
Cascara	*Rhamnus purshiana*	Wash.	7/73	100	100	100	
Cherry	*Prunus spp.*	Wash.	7/73	90	100	100	
Elderberry	*Sambucus spp.*	Wash.	6/72, 7/73	100	100	100	100
Douglas Fir	*Psuedotsuga menziessi*	Ore.,	6/72	80	88	88	86
		Wash.	7/73	100	100	100	100
Hemlock	*Tsuga heterphylla*	Ore.	7/73	80	-	-	
Bigleaf Maple	*Acer macrophyllum*	Ore.,	7/73	96	91	93	
		Wash.	6/72	95	100		100
Vine Maple	*Acer circinatum*	Ore.	6/72	73	89	93	96
		Wash.	7/73	95	100	97	100
Wild Rose	*Rosa spp.*	Ore.	6/72	98	100		100
Salal	*Gaultheria shallon*	Ore.	6/72	42	57		91
Salmonberry	*Rubus spectabilis*	Ore.,	7/73	93	98	95	
		Wash.	6/72	98	98		100
Squawbush	*Holodiscus discolor*	Ore.	6/72	100	100		100
Sitka Spruce	*Picea sitchensis*	Ore.	7/73	35	58	50	
Thimbleberry	*Rubus parviflorus*	Ore.	6/72, 7/73	98	100	95	100
Willow	*Salix spp.*	Ore.,	6/72,	93	100		99
		Wash.	7/73	100	-	-	-

Table 2. Vegetation Control by Species with DOWCO 233 Herbicide Applied as Broadcast Low Volume Sprays (25-30 gal/A) in Western States

Common Name	Botanical Name	Location	Application Date	Mean Percent Control at Lb. Acid Equivalent Per Acre 1	2	3	4	6	8
Alder	*Alnus spp.*	Ore.	7/73	100	100			100	
Blackberry	*Rubus spp.*	Ore.	7/73		70	95	90	99	
Ceanothus	*Ceanothus spp.*	Calif.	7/72, 7/73		82,95	86	94	-	
		Calif.	10/73*		79		67,100	76	
Chamise	*Adenostoma fasciculatum*	Calif.	7/73		79	83	80		
Douglas Fir	*Psuedotsuga menziessii*	Calif	10/73*		68		63	60	
Hemlock	*Tsuga heterophylla*	Ore.	7/73		10	70	20	-	
Huckleberry	*Vaccinum parviflorum* *V. ovatum*	Calif.	10/73*		69		69	65	
Madrone	*Arbutus menzesii*	Calif.	10/73		59		81	71	
Manzanita	*Arctostaphylos spp.*	Calif.	10/73		67		67	63	
		Calif.	7/73		74,95	81	75,95		
Black Oak	*Quercus kellogii*	Calif.	7/72	91	97	92			98
Interior Live Oak	*Quercus agrifolia*	Calif.	7/73		75	78	79		
		Calif.	10/73*		70		86		
Scrub Oak	*Quercus spp.*	Calif.	7/73		81	85	88		
		Calif.	10/73*		88		89		
Tan Oak	*Lithocarpus densiflora*	Calif.	10/73*		69		66	65	
	Rhus diversiloba	Calif.	7/72	89	92		88		89
Monterey Pine	*Pinus radiata*	Calif.	10/73*		76		69	68	
Ponderosa Pine	*Pinus ponderosa*	Calif.	7/72	87	96		100		100
Redwood	*Sequoiadendron sempervirens*	Calif.	10/73*		60		60	65	
Sitka Spruce	*Picea sitchensis*	Ore.	7/73		19	37	30	64	
Thimbleberry	*Rubus parviflorus*	Ore.	7/73		35	83	90	88	

*Applications were made late in the season under adverse growing conditions.

Foresty and rangeland trials are currently under investigation. Grass residue and watershed runoff studies are presently being conducted. Other studies concerning the impact on non-target organisms are underway.

Preliminary toxicological information indicates that DOWCO 233 has a moderate actue oral toxicity to mammals and should pose no problem from ingestion incidental to handling and spraying. The chemical also has a very low order of toxicity to fish and birds.

The results reported here suggest that DOWCO 233 is effective at low rates on a broad range of woody species, and causes no permanent injury to established grasses. These data suggest that DOWCO 233 shows excellent promise as an herbicide for use on rights-of-way, and forestry sties for woody vegetation control. The addition of this herbicide for use in woody vegetation control programs would be complementary to, but not a replacement for, the established phenoxy and picloram herbicides.

WATER INCORPORATION OF PREEMERGENCE ORCHARD HERBICIDES

A. H. Lange and J. Schlesselman[1]

Abstract

The time between application of preemergence herbicides and their incorporation by sprinkler irrigation was found to be important with most of the new selective herbicides being studied in orchards and vineyards. Some of the variables in the incorporation of herbicides by overhead sprinkler such as surface soil moisture, amount of initial irrigation, ground cover, and characteristics of soil have been studied by means of controlled irrigation systems.

The initial activity of herbicides with volatility characteristics similar to EPTC and trifluralin were affected by soil moisture at the time of application more than herbicides with volatility characteristics closer to simazine.

Relatively small amounts of initial sprinkle irrigation were necessary in order to incorporate most of the preemergence herbicides being studied.

Ground covers of plant material both live and dead reduced the activity of some herbicides.

The water accepting characteristics of soil can influence the activity of preemergence herbicides. Large initial applications appeared detrimental to subsequent weed and crop growth and, therefore, increased the apparent initial activity of herbicides.

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CONVERTING A CITRUS WEED CONTROL PROGRAM
FROM TILLAGE TO NON-TILLAGE

Stanley Heathman[1]

Abstract

Where tillage is used to control annual weeds in citrus orchards, growers mechanically remove weed growth three or more times per year. Weed density is very high in these orchards because weeds are allowed to go to seed before they are removed. Increased costs for fuel, labor and equipment have made this weed control method expensive. Weed control costs are not reduced where tillage is used, until the trees are of sufficient size to shade the area between

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tree rows. Soil applied herbicides can reduce weed control costs but will they be adequate for conversion to non-tillage programs? A three year study was made in Arizona to determine the effectiveness of the soil applied herbicides available for non-tillage weed control.

Herbicides were applied to the soil each spring and fall. Twice yearly treatments beginning in the fall of 1971 were made of diuron plus trifluralin, simazine plus trifluralin, diuron and a mixture of bromacil plus diuron. Alternate treatments of bromacil plus duiron followed by simazine; or princep plus trifluralin followed by bromacil plus diuron were also made.

No injury to citrus trees or fruit were observed. Mechanical incorporation of the herbicides was required because of the use of cross checks and high borders for irrigation control. The principal weed species present were Amaranthus sp., red sprangletop, barnyardgrass, London rocket, and silversheath knotweed. Treatments which included trifluralin resulted in the best weed control after two or more years of use. Weed control was 97% or better in treatments which included trifluralin, by the 1974 summer evaluation. Where princep, diuron and bromacil plus diuron were used exclusively, hyssop spurge and horse purslane became the predominant weed species. Conversion to non-tillage was possible in all treatments following two or three years of intensive use of soil applied herbicides. Weed density had been reduced to a low level. Weeds could now be economically controlled using foliar applied herbicides.

TREE AND VINE RESPONSES TO GLYPHOSATE

A. H. Lange and J. Schlesselman[1]

Abstract

Perennial weed control with glyphosate has been outstanding. While it's non-selective characteristic has merit in non-crop weed control problems, glyphosate will require special attention when used selectively in crops. A series of field and greenhouse studies aimed at evaluating the hazard of glyphosate in trees and vines has been conducted for the past two years. The general conclusions from the work are that glyphosate caused less immediate symptomology, but more damage from drift than the oil soluble amine of 2,4-D, commercial formulations of MSMA, amitrole, cacodylic acid, paraquat and dalapon. Glyphosate moved further into the unsprayed portions of trees and vines than the other translocated herbicides, based of foliar response.

Applications of glyphosate to basal suckers has not resulted in visible movement into the tree. The basal application of glyphosate to the well barked tree trunks has not caused visible damage. However, application to young green, and in some cases, light brown tree branches has caused severe burn, splitting and exudations.

The response of trees and vines to sub-lethal doses appeared to center in the mechanisms controlling bud growth. There is an apparent release of adventitious and lateral buds suggesting an initial low level of growth regulator followed by extreme stunting in the subsequent surviving shoots. A few weeks after the beginning of bud growth, at which time normal untreated growth is well along, i.e., several inches to a foot long, a few affected shoots on treated branches of the large number starting initially grew and developed quite normally. Most of the initially released buds remained distorted and stunted. Some turned brown and died. Some treated trees and vines have recovered normal foliage from a sub-lethal dose in 1 to 2 years. However, the total growth has been greatly reduced. Very few observations have been made on the effects of glyphosate on flowering or fruiting.

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THE EFFECT OF SEVERAL DINITRO ANILINE HERBICIDES ON ROOT DEVELOPMENT OF COTTON AND SOYBEAN SEEDLINGS

H. Fred Arle[1]

ABSTRACT. Possible differences in the relative phytoxicities of nine substituted dinitro aniline herbicides on root development of cotton and soybeans were compared under greenhouse conditions. Glass-front boxes were filled with untreated soil to within 2 inches of the top. Each of the herbicides was then applied at the rate of .75 lb/A to the surface. An additional 2 inches of untreated soil was added to fill the boxes. This simulates a condition encountered under field conditions when these herbicides are used to control weeds. Soybean and cotton were planted (5 seeds of each) at a depth of .75 inch. After seed germination the primary root must penetrate the band of herbicide at the 2-inch depth before again reaching untreated soil. The following herbicides were included in the study:

trifluralin (a,a,a trifluoro-2,6 dinitro-N,N-dipropyl-p-toluidine)
nitralin [4-methylsulfonyl) 2,6 dinitro-N,N-dipropyl aniline]
An 56477[N,N,bis (2 chloroethyl)-2,6 dinitro-p-toluidine]
Penoxalin [N-(ethylpropyl-2,5 dinitro-3,4-xylidine]
fluchloralin [N-(2-chloroethyl)-2,6 dinitro-N-propyl-4 trifluoromethyl) aniline]
profluralin [N-(cyclopropylmethyl)a,a,a trifluoro-2,6 dinitro-N-propyl-p-toluidine]
butralin[(1,1-dimethyl)-N-(1-methyl propyl) 2,5 dinitrobenzamine]
dinitramine (N^4,N^4 diethyl-a,a,a trifluoro-3,5-dinitrotoluene-2,4 diamine)
USB-3153

There are generally less effect of these materials on primary root development of cotton seedlings as compared to soybeans. Profluralin, butralin, fluchcloralin and USB-3153 had least effect on the initial development of soybean roots. Early development of primary roots by cotton seedlings was temporarily retarded by dinitramine and notralin. After penetrating the zone of treated soil, subsequent growth of plants appeared normal. Three weeks after planting there was little difference in top growth of cotton plants regardless of treatment. Top growth of soybean seedlings was near normal with butralin, fluchloralin and USB-3153.

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DINITROANILINE HERBICIDES IN IRRIGATED COTTON

K. C. Hamilton and H. F. Arle[1]

ABSTRACT. Eight dinitroaniline herbicides were applied preplanting and incorporated by (a) disking before furrowing or (b) only by furrowing for the preplanting irrigation for cotton in 3 years. Cotton treated with AC-92553 [N - (1-ethylpropyl)-2,6-dinitro-3,4-xylidine] had the best stands and nitralin caused the greatest stand reductions. In 2 years cotton stands were better where herbicides were not incorporated by disking. There was no difference in broadleaf weed control at harvest when the eight herbicides were combined with postemergence applications of diuron. An-56477 [2,6-dinitro-N,N-di-(2-dichloroethyl)-p-toluidine] gave less grass control than the other herbicides. The lowest yield of cotton was from cotton treated with An-56477 and butralin. There was no significant difference in yield of cotton treated with dinitramine, AC-92553, fluchloralin, nitralin, profluralin, and trifluralin.

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CONTROL OF WEEDS IN CONTAINER GROWN ORNAMENTAL PLANTS

C. Elmore, D. Maire, D. Farnham and W. Humphrey[1]

ABSTRACT. Herbicide studies in container grown ornamental plants indicate new herbicides or herbicide combinations capable of controlling a broad spectrum of weedy plants. The principal species that remain as a problem in ornamentals are lesser-seeded bittercress, *Cardamine oligosperma;* spotted spurge, *Euphorbia maculata;* creeping woodsorrel, *Oxalis corniculatus* and common groundsel, *Senecio vulgaris.* Grass weeds have been controlled with DCPA, trifluralin or nitralin. Tests evaluating oxadiazon, oryzalin, napropamide, dinitramine, perfluidone, norflurazon, and alachlor or combinations of these herbicides were conducted to determine potential control of these problem weeds in container grown ornamentals. These herbicides were compared to the standard herbicides DCPA and trifluralin. Oxadiazon was the only herbicide that gave excellent control of *Cardamine oligosperma.* Oxadiazon at 4 lb/A or in combination at 2 lb/A with napropamide at 4 lb/A reduced common groundsel over 70 percent for 4 months. Oxadiazon also gave 96 percent control of spotted spurge for 4 months at 4 lb/A. Dinitramine at 4 and 8 lb/A gave 86 to 92 percent control of spotted spurge at 4 months. Other herbicides gave lesser control ranging from 12 percent to 82 percent at 4 months. Creeping woodsorrel was best controlled with oryzalin at rates of 2 to 4 lb/A.

Common groundsel, although suppressed, was not satisfactorily controlled in these tests. No one herbicide controlled all the weeds present in these container grown ornamental tests. The ornamental test plants were tolerant to these herbicides in these studies.

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RESEARCH RESULTS ON POST-EMERGENCE HERBICIDES IN ONIONS

H. M. Kempen[1]

ABSTRACT. Studies to evaluate several herbicides on two major weed problems in onions—broadleafed weeds and yellow nutsedge—were conducted during 1973 and 1974. Most trials were on sandy loams with low organic matter where onions were sprinkler irrigated.

The studies indicated that of post-emergence herbicides tried, tolerance was greatest to nitrofen, then oxadiazon, chloroxurun and finally methazole. Three sequential treatments of low rates of methazole, oxadiazon or nitrofen at 5-7 day intervals caused no appreciable damage to onions, but chloroxurun plus 1% oil containing adjuvant did.

Another trial compared nine surfactants and nonphytotoxic oil (UR rating of 93) with chloroxurun at 2 or 4 lb/A. Results showed most surfactants were more toxic to onions and caused yeild depression. The most effective surfactant was Colloidal's Tronic® at ½% v/v. Increasing the percentage of nonphytotoxic oil used with chloroxurun increased phytotoxicity. A comparison of herbicides applied to wet vs. dry soil indicated that chloroxurun and methazole were somewhat more effective applied to dry soil whereas the reverse was true with oxadiazon. Rainfall occurred two days after treatment.

On yellow nutsedge, trials at two dates of application indicated MSMA and S-21634 were effective but marginal in safety. Bentazon, with or without Citowett® surfactant, was not sufficiently effective. Nitrofen provided partial control. A shielded spray into furrow areas seemed a logical approcah to control.

[1]Coop. Extension, Univ. of Calif., Bakersfield.

General Procedure: Several post-emergence trials were conducted on onion crops in Kern County, California, between 1970 and 1974. These trials were established to determine the edaphic and climatic limits under which use rates of herbicides might be "safe" for grower application.

Soil organic matter in most Kern County soils is characteristically low, probably averaging 0.3%, but often being less than 0.1%. Many soils are coarse textured sandy loams but clay contents usually are over 12%. Though temperatures are usually between 50 and 70F, late spring applications on late plantings may occur when temperatures approach 90F.

All test plots were 40 to 60 inches wide by 15 to 20 feet long, arranged in a randomized block design with four to six replications. All ratings were made on a 0 to 10 scale with 0 = no effect and 10 = kill. Primary emphasis was on the herbicide chloroxuron but other compounds were included in various tests to evaluate their potential for control of broadleafed weeds in beets. All trials were sprinkler irrigated.

TRIAL 1. Winter application of herbicides to Early Hybrid onions.

Procedure:

This field of October planted fresh market onions was treated with DCPA pre-emergence which controlled all weeds but shepherdspurse (Capsella brusapastoris). A dense stand 4 to 6" across occurred when the first application was made to 2-leaf onions on January 5, 1973, to 6 replications. Temperatures ranged from 30 to 60F. Soil was sandy loam.

Following treatment, frost occurred for extended periods of the evening of January 6 and 7; then 0.25" of rain occurred on January 8th.

The grower treated the field and the test area on January 24, 1973, with chloroxurun at 2.5 lb/A plus 1% nonphytotoxic oil in 75 gpa. Results were not adequate because shepherdspurse was 8" across and 6" tall by that date. Onions were 6 to 8" tall pushing a 3rd leaf 1 to 6". The second leaf was frozen off. A second application, again over the test area, was made on February 21, at 1.5 lb/A with 1% nonphytotoxic oil.

Results:

Because the shepherdspurse was larger in this October planting than it normally is when onions are planted in December or January, weed control was not adequate. Chloroxuron and methazole, which normally show a temperature response, were not sufficiently effective at the lower rates, but approached commercial control at the 2X rates tested. (Table 1.) Dinoseb (NH_4+) and RP 2929 both killed weed foliage rapidly but weeds were not completely killed and new growth developed quickly.

Glyphosate acted on weeds very slowly; it stopped further growth, caused yellowing and then about 2 months later (along with the chloroxuron over-treatment) effected the weed's demise.

Onion tolerance to chloroxuron, methazole and RP 2929 was excellent. Some evidence of increased toxicity from Colloidal X-77[1] vs. nonphytotoxic oil was evident on the 1/22/73 date. No differences between chloroxuron or methazole with or without surfactants, were apparent by mid-February or later, despite the two field applications over these plots. Thus the highest rate applied was 9 lb/A of chloroxuron. Oxadiazon caused moderate retardation of onions which persisted into early March. Dinoseb reduced stand at the high rate and killed enough plant tissue to reduce vigor. Recovery was rapid. Hlyphosate showed no selectivity, killing onions completely at 1/2 lb/A and reducing stand 90% or more at 1/4 lb/A after two months.

TRIAL II. The effect of herbicides applied post-emergence during high temperatures on loamy sand under sprinklers.

Procedure:

Because of high spring prices, a late planting of Fiesta onions was planted in May. The soil was a loamy sand soil with low organic matter under solid-set sprinklers. No DCPA was applied pre-emergence but a post-emergence treatment was made in early June after hand removal of weeds at a cost of over $100/A. Onions at the 5-leaf stage were treated on June 7, 1973, using 3 replications.

[1]Trade names of adjuvants are used for clarity.

Table 1. Results of winter application of herbicides to Early Hybrid onions. Weedpatch, California.[1]

Treatment	lb/A	Phytotoxicity ratings (0 to 10) Onions 1/12	1/22	2/8	Shepherdspurse 1/12	1/22	2/8
Untreated	--	0	0.7	1	0	0	5
"	--	0	0.8	1	0	0	5
Chloroxuron 50 WP plus oil	2	0	1.0	3	2	5.7	9.8
Chloroxuron 50 WP plus oil	4	0	1.8	1	2	8.5	10
Chloroxuron 50 WP plus X-77	2	0	1.2	2	2	6.0	9.5
Chloroxuron 50 WP plus X-77	4	0	2.5	3	2	7.8	10
Methazole 75 WP	1	0	1.0	2	0	4.5	9.0
"	2	0	1.3	2	0	7.0	9.5
Methazole + X-77	1	0	1.0	2	1	5.7	9.0
"	2	0	1.5	2	1	8.1	10
Oxadiazon 2 EC	1/2	0	1.8	4	4	3.7	7
"	1	0	3.2	6	4	4.2	9
RP 2929 1.25 EC	2	2	0.8	2	6	4.3	7
"	4	3	1.5	2	8	6.7	9
RP 2929 3 flowable	2	1	0.8	2	5	3.8	6
"	4	1	1.3	2	8	6.2	9
Dinoseb (NH_4+)	1	3	2.0	2	6	5.7	8
"	2	5	3.5	3	9	8.3	9.5
Glyphosate 3S	1/4	0	1.8	4	2	4.7	8
"	1/2	0	3.7	6	4	7.0	9.5
LSD .05			0.8			1.03	

[1]Treated 1/5/73. Onions planted in October were in 2 leaf stage; shepherdspurse was 4-6" across. All plots were treated with chloroxuron at 2.5 lb/A on 1/24/73 and 1.5 lb/A on 2/21/73, each with 1% nonphytotoxic oil.

Results:

Table 1 shows results of treatments included in the test. Under the extreme conditions of this test too much damage occurred from several herbicides.

Chloroxuron showed more injury in one replication where onions were smaller and less vigorous. The adjuvant, Colloidal X-77, appeared to enhance toxicity more than nonphytotoxic oil (NPO) or Colloidal Tronic. Methazole was more toxic than chloroxuron.

Two other experimental compounds, cyperquat and EMD 70610H were included. The former indicated some effectiveness on yellow nutsedge (*Cyperus esculentus*) and selectivity. The latter was toxic to onions, potatoes and nutsedge for about one month.

TRIAL III. Chloroxuron tolerance trial on onions at two temperatures and two nonphytotoxic oil variables.

Procedure:

White Globe onions were treated 10 days apart before and after temperatures suddenly increased. The first application was made to onions nearly at the 2-true-leaf stage (1 to 3"); the second when plants were reaching the 3rd leaf stage. Temperature ranged 50 to 70F on 3/23/73 but jumped to 50 to 85F when the 2nd application was made 4/6/73. Plots were replicated 3 times.

Table 2. Post-emergence herbicides applied to onions during high temperatures on loamy sand under sprinklers. Lamont, Ca.[1]

Treatment	lb/A	Phytotoxicity ratings (7/2/75) Onions 12-18"	Volunteer potatoes 12"
Untreated	--	0.7	0
Chloroxuron	1/2	1.0	0
"	1	2.3	0.5
"	2	1.7	1.0
"	4	4.7	1.0
Chloroxuron + Tronic	2	1.7	0.0
"	4	4.3	3.0
Chloroxuron + X-77	2	4.3	0.7
"	4	5.7	1.0
Methazole	1	5.7	4.3
"	2	7.7	5.0
Cyperquat 3S	1.5	0.7	0.0
"	3	0.0	1.3
EMD 70610 H 80WP	4	6.3	4.3
"	8	8.7	6.7
LSD .05		1.75	

[1]Treated 6/7/73 Fiesta onions at 5-leaf stage. Temperature 90F.
NPO - Puregro PG93 nonphytotoxic oil at 1% added as indicated.
Colloidal Tronic + X-77 added as indicated at 1/4%.

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Table 3. A chloroxuron tolerance trial on onions at two temperature and nonphytotoxic oil variables. Lamont, Ca.[1]

Treatment[3]	lb/A	gpa	Early-cool[1] 4/3/73	5/4/73	Later-warm[2] 4/13/73	5/4/73
Chloroxuron + 1% NPO	2	35	1.3	1.0	2.3	1.3
"	4	70	2.7	2.7	3.3	2.7
Chloroxuron + 3% NPO	2	35	2.7	1.0	2.7	2.0
"	4	70	3.3	3.7	5.0	4.7
Methazole + 1/2% X-77	1	35	1.0	1.7	3.0	4.0
"	2	70	1.7	5.0	4.0	7.0
Untreated	--	--	0	0.3	0	0.7
Average			2.1	2.5	3.4	3.6

[1]Applied 3/23/73 to onions 1-3" tall; temperature range was 50-70F.

[2]Applied 4/6/73 to onions in 3rd leaf stage 6-8" tall; temperature range was 50 to 85F. Onion injury was rated 0 to 10: 0 = no effect; 10 = kill; an average of 3 replications.

[3]Oil was Puregro PG93 1% nonphytotoxic oil with UR rating of 93%.

Soil was a low-organic matter loamy sand and the field was sprinkler irrigated at 4 day intervals beginning in May. DCPA was applied pre-emergence at 10 lb/A in December, 1972, and a supplemental application of 4 lb/A was made in mid-February. Harvest was not made because bermudagrass (Cynodon dactylon) overwhelmed the onions soon after these data were taken.

Results:

Results showed some retardation occurred from all herbicides at the rates tested under these soil conditions. At the early date of application, only retardation occurred and recovery ultimately occurred when observed after May 21, 1973. Injury from the later application was somewhat greater initially, manifested as grey lesions on the onion leaf, and lasted longer where injury was pronounced initially.

Increasing the nonphytotoxic oil from 1% to 3% increased toxicity somewhat, indicating it would be prudent not to exceed 1% when under adverse soil and temperature conditions such as these.

TRIAL IV. Post-emergence herbicides on loamy sand under sprinklers.

Procedure:

Herbicides were applied March 25, 1970, over Granada onions at the 1-true-leaf stage when temperatures ranged from 50 to 80F daily. Weeds present were Russian thistle (Salsola iberica) 1-2", volunteer grain sorghum 1-2" and red brome (Bromus rubens) 2-3". DCPA at 8 lb/A was applied pre-emergence.

Results:

Table 4 shows that rates of Chloroxuron tested were too high for onions at the 1-true-leaf stage. Even the lowest rate caused unacceptable injury though little stand loss was evident a month later. Oxadiazon showed considerable promise.

Excellent control of Russian thistle and grain sorghum was obtained, but no treatments provided red brome control.

TRIAL V. Post-emergence herbicides on a silty clay loam under sprinklers.

Procedure:

Application was mady March 3, 1970, when White Globe dehydrator onions were at the 2-leaf stage, on 4 replications. Diurnal temperatures were from 45 to 75F. DCPA was applied pre-emergence at 10 lb/A. Some weeds were rather large when treated. London rocket (Sisymbrium irio) was to 8" across; hedge mustard (Sisymbrium officinale) to 2" and sweetclover (Melilotus indica) had 8 to 15 leaves.

Results:

Table 5 shows acceptable weed control results with chloroxuron and oxadiazon with acceptable injury levels on the onions. Weeds competed with untreated onions before being weeded May 5, and thus reduced vigor and later, yield. Neither herbicide provided adequate clover control.

TRIAL VI. Effects of adjuvants on chloroxuron performance in onions.

Procedure:

Chloroxuron was applied to second leaf White Globe onions infested with hedge mustard 4 to 10 inches tall March 13, 1974, on 6 replications. The soil type was San Emigdio sandy loam. The temperature was 70 F. The field was sprinkler irrigated. Two rates of chloroxuron (2 and 4 lb/A) were combined with 1/2% v/v of 9 locally distributed wetting agents in comparison to chloroxuron alone or with 1% v/v of nonphytotoxic oil using 6 replications.

Results:

Onion injury evaluations (Table 6) showed that chloroxuron alone caused no damage; nonphytotoxic oil, Colloidal's Tronic and Helena Chemical's Agridex (a blend of nonphytotoxic oil and wetting agent) were slightly injurious but all other wetting agents caused more injury. Yet little visible evidence of injury was present after two months.

Yield measurements indicated most wetting agents and nonphytotoxic oil reduced yields somewhat. Exceptions were Colloidal's X-77, Colloidal's Tronic or chloroxuron alone at either rate.

Table 4. Post-emergence herbicides on loamy sand under sprinklers. McKittrick, Ca.[1]

		Onions			Weeds Ratings (0 to 10)	
			4/8/70	4/9/70	4/8/70	4/23/70
Treatment[2]	lb/A	Yield lb/plot	Onion injury	No. plants in 10 ft.	Russian thistle	Milo
Check	--	21.0	0	17.3	0	1.7
Chloroxuron 50 WP	4	0	6.0	9.7	7.3	8.0
Chloroxuron + NPO	2	0	7.3	14.6	9.3	9.3
"	4	0	8.3	3.7	10.0	7.3
"	6	9	7.7	9.0	9.7	9.0
Chloroxuron + ½% X-77	4	0	4.7	13.5	8.3	9.3
Chloroxuron + 1% X-77	4	0	7.0	6.7	9.7	9.3
"	6	0	7.0	6.0	7.3	7.7
Oxadiazon 3.3 EC	1	17.5	4.3	19.0	9.7	9.0
"	2	31.0	4.0	17.0	10.0	10.0

[1]Applied 3/25/70 when temperatures were 50 to 80F. Granada variety; 1 true leaf.
[2]Adjuvants used: NPO - Gulf crop oil at 1½ gpa. Colloidal X-77. Applied at 35 gpa.

Table 5. Post-emergence herbicides on a silty clay loam under splinklers. Mettler, Ca.[1]

		Onions				Weed control (0 to 10)	
Treatment	lb/A	3/24/70 injury	5/5/70 injury	3/31/70 plants/ 5 ft.	7/14/70 yield/ plot lbs.	3/24/70 London rocket	3/24/70 Sweet clover
Untreated	--	0	4.5	44.0	14.9	0	0
Oxadiazon	1/2	0	1.8	47.3	18.2	8.6	2.0
"	1	1.5	0.8	41.3	18.7	9.8	9.8
"	2	1.8	1.4	49.0	17.3	9.8	9.2
Chloroxuron	4	2.5	2.0	34.0	17.6	8.5	1.3
Chloroxuron + X-77	4 + ½%	3.0	2.3	39.5	16.2	9.8	4.0

[1]Applied 3/3/70 to White Globe onions at the 2-leaf stage when temperatures were 45 to 75F.

Table 6. Chloroxuron at 2 and 4 .b/A plus adjuvants. Mettler, Ca.[1]

	Onion injury		Tons/acre		Weeds (gm/plot)	
Adjuvant[2]	2 lb	4 lb	2 lb	4 lb	2 lb	4 lb
Untreated	0.0	0.0	35.5	33.8	55.3	35.9
No adjuvant	0.2	0.5	35.1	33.4	10.0	10.6
+ nonphyto oil	0.2	1.7	30.4	28.6	6.3	2.3
+ Tronic	1.3	2.0	34.0	33.0	3.0	1.2
+ X-77	1.8	3.3	34.9	32.2	7.2	4.1
+ Helena Spret	2.8	3.8	33.4	30.5	5.4	3.4
+ Kerntox B99	2.0	2.8	31.5	31.5	6.4	3.1
+ BB Spreader	1.3	3.2	29.1	25.4	7.3	1.4
+BAC Spred-Stick	1.7	3.3	32.3	24.4	2.7	1.9
+ CP Brand	1.5	2.7	30.2	27.6	3.9	3.9
+ Niagra Nutrient Aid	0.2	1.8	31.5	29.9	4.2	1.6
+ TOK 50 WP	0.2	0.5	32.4	30.4	16.3	3.5
LSD .05			2.3		4.3	
LSD .01			3.0		5.7	

[1]Applied 3/13/74 to Southport White Globe at 2 leaf stage on San Emigdio silty clay loam under sprinklers. Temperature 70F.

[2]Adjuvant added at 1/2% except nonphytotoxic oil at 1%, and TOK 50 WP at 3 or 6 lb/A. Low rate of chloroxuron applied in 35 gpa; high rate at 70 gpa.

Measurements of weed weights showed all treatments reduced plant growth from 80 to 93% with higher rates of chloroxuron giving better control. The three best adjuvants against weeds were Colloidal's Tronic, Helena Chemical's Agridex and Bakersfield Ag-Chem's Spred-Stick.

TRIAL VII. Sequential vs. single applications of herbicides on onions.

Procedure:

Table 7 lists treatments included in this test on a Hesperia loamy sand under sprinklers. Southport White Globe onions were treated one or three times, beginning at tha 2½-true-leaf stage on March 14, 1974, on 3 replications. Subsequent treatments were made on March 18 and March 25. High yellow nutsedge population may have effected yield results.

Results:

The onion injury results and yields in Table 7 indicated that repeated applications of chloroxuron plus 1% adjuvant were more damaging to onions than an equal amount of chloroxuron (1½ lb/A) applied once. The results suggest that repeated applications result in additive uptake by foliage and increase toxicity. The limits of the test and variable temperature conditions prevent absolute conclusion of this hypothesis but the lack of additive toxicity from sequential treatments of methazole without adjuvant reaffirms the hypothesis.

SUMMARY:

Research tests over a 4-year period in Kern County showed that onions will tolerate topical applications of chloroxuron under most climatic and soil conditions. The results indicated that onions should be past their 1-true-leaf stage. The choice of adjuvants seemed important, with nonphytotoxic oil at no more than 1%, or Colloidal's Tronic at 1/4% most acceptable. Excess plant damage and/or yield depression occurred where onions on loamy sands are sprinkled, or where temperatures were high. Sequential treatments appeared to be hazardous, but more research is necessary on this aspect of application.

Other herbicides which showed safety were oxadiazon and nitrofen.

Table 7. Sequential treatment of onions with herbicides. Lamont, Ca.[1]

		Weed rating (0 to 10)		Onions	
Treatments	lb/a	Mustards	Nutsedge	injury	tons/A
Untreated	--	0.0	0.0	1.0	25.6
Nitrofen 50 WP	3	2.3	2.7	0.0	25.7
"	3 + 3 + 3	5.0	5.3	0.3	30.1
Chloroxuron 50 WP + oil	1/2	7.3	0.0	2.7	21.5
Chloroxuron 50 WP + oil	½ + ½ + ½	10.0	3.3	5.3	13.1
Chloroxuron 50 WP + oil	1 1/2	10.0	1.0	2.3	19.7
Methazole 75 WP	¼ + ¼ + ¼	10.0	0.3	1.3	28.1
"	3/4	8.7	0.7	1.3	23.0
Oxadiazon 2 EC	¼ + ¼ + ¼	8.3	2.3	2.3	25.1
"	3/4	7.5	1.0	1.0	31.7
LSD .05					4.5

[1]Mustard species (shepherdspurse and London rocket) were 6 to 8" tall when treated on 3/14/74. Yellow nutsedge 0 to 4" and onions at the 2 ½ leaf stage. Repeat treatments were made 3/18/74 and 3/25&74. Sprinkler irrigation was on a 4-day cycle. Temperature was 70F. Soil type was Hesperia loamy sand. Oil used was at 1% Puregro PG 93 on 3/14/74 and 3/25/74.

HEAD LETTUCE-2,4-D EFFECTS AND SYMPTOMS

P. E. Heikes, Frank D. Moore, and James G. Walker[1]

This experiment was designed to observe symptoms on head lettuce following light applications of 2,4-D and 2,4-D/dicamba combinations at low rates at two growth stages.

A small area of lettuce was planted on the San Luis Valley Research Center at Center, Colorado, June 5. The area was approximately 130 x 35 ft. Benefin was applied to the soil as a preplant herbicide, over half of the plot area; the other half of the plot had no preplant herbicide. Benefin was soil incorporated with a Lilliston-rolling-cultivator immediately after application. The lettuce (Mesa 659 variety) was planted in 40 inch beds. It was thinned June 28.

Four postemergence applications of 2,4-D amine were applied across the beds, crossing the area with and without benefin. Each plot was 10 ft. wide, with a 3 ft. buffer between treatments. The first application was made June 8—approximately 10 days after thinning. The second application (over a different area) was made July 22—two weeks after the first. At this time, the lettuce was beginning to head.

2,4-D amine was applied at three rates each of the two times—1/16. 1/8 and 1/4 lbs a.i. per acre, and 2,4-D/dicamba @ 1/16 + 1/64 lbs a.i. per acre. These low rates were intended to simulate 2,4-D drift and the amount of 2,4-D a lettuce field might receive from an aerial application. All postemergence herbicides were applied in 40 gallons of spray solution per acre, applied with a plot sprayer and a 10 ft. boom.

First observations were made July 22, prior to the second 2,4-D application and again August 22, when the untreated lettuce was mostly headed. The first observation was of the July 8 applications.

OBSERVATIONS—July 22: At the 1/16 lb rate there was approximately 25% stand loss and 15% less vegetation (stunting). At the 1/8 lb. rate, there was almost complete stand loss, and at 1/4 lb. all lettuce was killed. 2,4-D/dicamba caused about 50% stand loss; the addition of dicamba significantly increased phytotoxicity.

OBSERVATIONS—August 22: At the 1/16 lb. rate applied July 8, some of the lettuce recovered and there was approximately 10% marketable heads. The same rate of 2,4-D applied July 22 caused severe stunting and deformed heads, but no stand loss. However, there was no marketable lettuce in the 1/16 lb. late application plots, applied when the heads were beginning to form.

At the 1/8 rate, there was more than 20% stand loss with the early application and more than 30% stunting; there was no marketable lettuce. When applied at the later date, this rate of 2,4-D did not cause significant stand loss, but the stunting was severe and all plants were badly deformed and no marketable heads.

At the 1/4 lb. rate, there was more than 90% stand loss with the early application and the stand was reduced 100% with the later application.

2,4-D/dicamba caused more stunting than the same rate of 2,4-D alone and there was no marketable lettuce with either time of application. Applied at the early date, the combination caused about the same stand loss as 1 oz. of 2,4-D alone, but the stunting was more severe. When applied at the later date, the lettuce made almost no growth after the herbicides were applied; it was chlorotic and generally unthrifty.

SYMPTOMS: The most noticeable effects of low rates of 2,4-D or dicamba on lettuce can be described as follows:

1. When applied at the early growth stage, stand loss was evident with severe stunting. When applied near the time the lettuce was heading, stand loss was less evident, but small amounts of 2,4-D caused the leaves, making up the head to be deformed resulting in a non-marketable head. These heads were small, soft, made up of loosely rolled leaves, rolled from the mid-rub.
2. A much enlarged root at the base of the crown with enlarged secondary root

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[1]Extension Service, Colorado State University, Fort Collins, and Superintendent San Luis Valley Research Center, Center, CO'

development and a very rough warty-like tap root. This is contrast to the lesser swelling at the crown with benefin and a smooth root though slightly enlarged but not warty-like and not the mass of secondary roots.

A 2,4-D ester formulation was applied at 1 lb. a.i. per care with the second application of herbicides—July 22. This form of 2,4-D was much more phytotoxic at the same rate, as compared with the amine form. The ester form was almost as phytotoxic at 1/16 lb. as 1/4 lb. in the amine form.

From this experiment, it was evident that very small amounts of 2,4-D will affect head lettuce and that it is sensitive to 2,4-D at almost all growth stages, with possibly more sensitivity soon after thinning. It was evident that very small amounts of 2,4-D that might occur by drift, could affect lettuce significantly. Also, the visible injury may not follow in direct relation to the rate of 2,4-D application. There was little difference in effect of 2,4-D or 2,4-D/dicamba when applied over benefin treated area as compared with no preplant herbicide. There was a difference in root development where benefin was used, causing the root to be enlarged, but the enlarging was much less than where 1/16 lb. of 2,4-D was applied and the root was smooth. There did not appear to be any adverse effect on the lettuce, either appearance of heading, where the benefin was used.

PERSISTENCE OF 2,4-D AND 2,4,5-T IN SOUTHERN CALIFORNIA SOIL AND CHAMISE VEGETATION

T. R. Plumb and L. A. Norris[1]

ABSTRACT. A test was conducted on the Cleveland National Forest to determine the persistence of 2,4-D and 2,4,5-T in soil and in sprouting chamise vegetation on a typical chaparral site in arid southern California. A 50-50 mixture of low volatile esters of 3-lb acid equivalent each of 2,4-D and 2,4,5-T in 20 gal. of water per acre was applied as a broadcast spray in early May 1972. Plant samples consisting of the terminal 6 inches of sprout material were collected at the time of spraying and 14, 29, 69, 146, and 379 days later. Soil samples from depths of 0 to 4, 4 to 8, and 8 to 12 inches were collected 14 days after applications and then on the same schedule as the sprout material. Herbicide analysis was done by means of gas chromatography.

Immediately after spraying, chamise vegetation contained 90 ppmw each of 2,4-D and 2,4,5-T. Residue levels declined rapidly in chamise, with a 50 percent decrease in 2,4,5-T and 2,4-D at 17 and 37 days, respectively. One year after application, the vegetation contained about 3 ppmw of each herbicide. The concentration of 2,4-D and 2,4,5-T was 1.2 and 0.9 ppmw, respectively, in the top 4 inches of soil 2 weeks after spraying. During the first 35 days, 2,4,5-T disappeared at a faster rate than 2,4-D; however, 50 days after treatment, the concentration of 2,4-D was lower than 2,4,5-T. The concentration of 2,4-D and 2,4,5-T was 0.04 and 0.05 ppmw, respectively, 1 year after application. Low levels of residues were found in the two lower soil profiles, and the decrease in herbicide concentration with time was similar to that in the surface soil.

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UPTAKE, METABOLISM, AND ACCUMULATION OF BENTAZON IN CHANNEL CATFISH (Ectalurus punctatus)

Gary M. Booth and R. Ward Rhees[1]

ABSTRACT. The primary objective of this study was to determine the uptake, accumulation and metabolism of 351 in channel catfish, Ectalurus punctatus from previously treated and aged soil. Two levels of concentration were used throughout the study: These were 0.01 and 1.0 ppm incorporated into 4 lb. soil samples. The treated soil samples were allowed to age under 2 gallons of spring water.

The 351 was found to partition rapidly (within 7 days) from the soil into the water at both concentrations. The 0.01 ppm tanks had about equal amounts of activity in soil and water, while in the 1.0 ppm tanks about 73% of the total activity ends up in the water and 27% remains in the soil.

The concentration of bentazon in the catfish viscera plateaued off after approximately 7 days in both concentrations. The concentration of 351 in the catfish meat in the 1.0 ppm tanks also leveled off after 7 days. In the 0.01 ppm tanks, the activity in the meat leveled off after 21 days. In general, the 1.0 ppm tanks gave more consistent data.

The viscera always contained more activity than the meat (0.99 to 8.87X for the 0.01 ppm tanks and 2.82-5.88X for the 1.0 ppm tanks). The total concentration in the meat was extremely low, being 5-15 ppb for both tanks. Because of the low activity, extractions were largely ineffectual.

The ratio of the fish ppm/water ppm showed values of 1-11X for the 0.01 ppm group and 0.05 to 0.28X for the 1.0 ppm group. Hence, 351 does not bioconcentrate in channel catfish.

[1]Department of Zoology, 697 WIDB, Brigham Young University, Provo, UT 84601.

SPECIES DIFFERENCES IN THE ULTRASTRUCTURE OF MESQUITE LEAF SURFACES

H. M. Hull, H. L. Morton and C. A. Bleckmann[1]

ABSTRACT. Ultrastructure of the epicuticular waxes on leaves and cotyledons of several species and varieties of mesquite from North and South America were studied by electron microscopy. Certain interspecific differences were detected in epidermal wax structure, and species-related differences in size and distribution of wax crystals on guard cells as compared to those on epidermal cells were also noted. These differences may partially explain some of the variations in wetting characteristics and herbicidal response which have been observed.

[1]H. M. Hull, H. L. Morton, and C. A. Bleckman, ARS, USDA, Tucson, AZ 85719.

Mesquite continues to encroach on millions of acres of increasingly valueable rangeland in the southwestern United States. Although the control of this woody plant by aerial application of herbicides has improved to some extent in recent years, control by foliar spray is still difficult and tends to be erratic from year to year. Past research has suggested that variable development of the waxy leaf cuticle may be partially responsible for variations in foliar wetting characteristics and subsequent herbicidal absorption. For example, Hodgson (1973) has demonstrated a variation in quantity of lipid present on the leaf surfaces of different ecotypes of Canada thistle, and has observed a distinct negative correlation between lipid quantity and susceptibility to 2,4-D.

In the case of mesquite, besides the year to year variation of cuticular development that occurs, there also exists the possibility of variations in cuticular structure and development between different varieties or species. For instance, are there any consistent differences in this respect between the honey mesquite of western Texas and the velvet mesquite of Arizona? Could any observed differences in cuticular sturucture of these two varieties, for example, partially account for the known fact that velvet mesquite is somewhat more difficult to control by chemical means than is honey mesquite? Climatologic factors or edaphic factors could, of course, also be involved in such differential susceptibility.

Materials and Methods

To evaluate possible differences in cuticular ultrastructure, we collected seeds from five different species and varieties of Prosopis, native to various parts of the western hemisphere. These included velvet mesquite (P. juliflora var. velutina (Wooton) Sarg.), honey mesquite (P. juliflora (Swartz) DC. var. glandulosa (Torr.) Cockerell), and three South American species--P. alba Griseb. from northern Argentina, P. juliflora (Swartz) DC. from the Galápagos Islands, and P. tamarugo Phil. from northern Chile.

All seedlings were grown together in the greenhouse at Tucson, AZ, and were harvested for electron microscopy at an age of 25 days. Carbon replications of the upper surfaces of leaflets and cotyledons were prepared, all leaflets being selected from near the midpoint of one rachis of the first leaf above the primary leaf. Replications were prepared according to the technique of Juniper et al. (1970), with certain modifications. On the foliar surfaces, carbon evaporation was accomplished with the shortest possible pump-down time, to minimize desiccation and consequent destruction of the tiny leaflets. Evaporation was carried out as rapidly as possible to minimize possible thermal damage.

After carbon deposition, a 4% solution of Formvar[2] in chloroform was applied to the leflet surface, followed by a 200-mesh grid that had been dipped in the Formvar solution. When dry, the plastic film was gently peeled from the leaflet, together with the grid and carbon replication. To remove the Formvar, we placed the grids on filter paper and repeatedly flooded them with ethylene dichloride for 24 hours. The grids were finally placed replica side down in the evaporator and the carbon film shadowed with 80/20 platinum/palladium at an angle of 34^{o}. Replicas were photographed at various magnifications with a Hitachi HS-7S electron microscope.

Results and Discussion

Epicuticular wax structures on the stomatal guard cells of the leaflets varied in both size and distribution from those on adjacent epidermal cells, depending on the species. However, epicuticular wax on the cotyledon surfaces tended to be more homogeneous among species. Shown herewith are micrographs only of the upper leaflet surfaces of honey mesquite (Figs. 1, 2) and of P. tamarugo (Figs. 3, 4).

Leaflet wax in all species, except P. tamarugo, varied mainly by the extent of development of the flat dendritic-shaped platelets lying on the cuticular surface. This type of structure on honey mesquite is easily seen in the upper portion of Fig. 1. Wax structures on the guard cells of honey mesquite leaflets are considerably smaller than those on adjacent epidermal cells (Fig. 2).

The wax of P. tamarugo leaflets (Figs. 3, 4) was unique in consisting partly of large, thin plates that were apparently situated loosely on top of the more basic type structures common to all of the other species. The presence and structure of these plates has now been

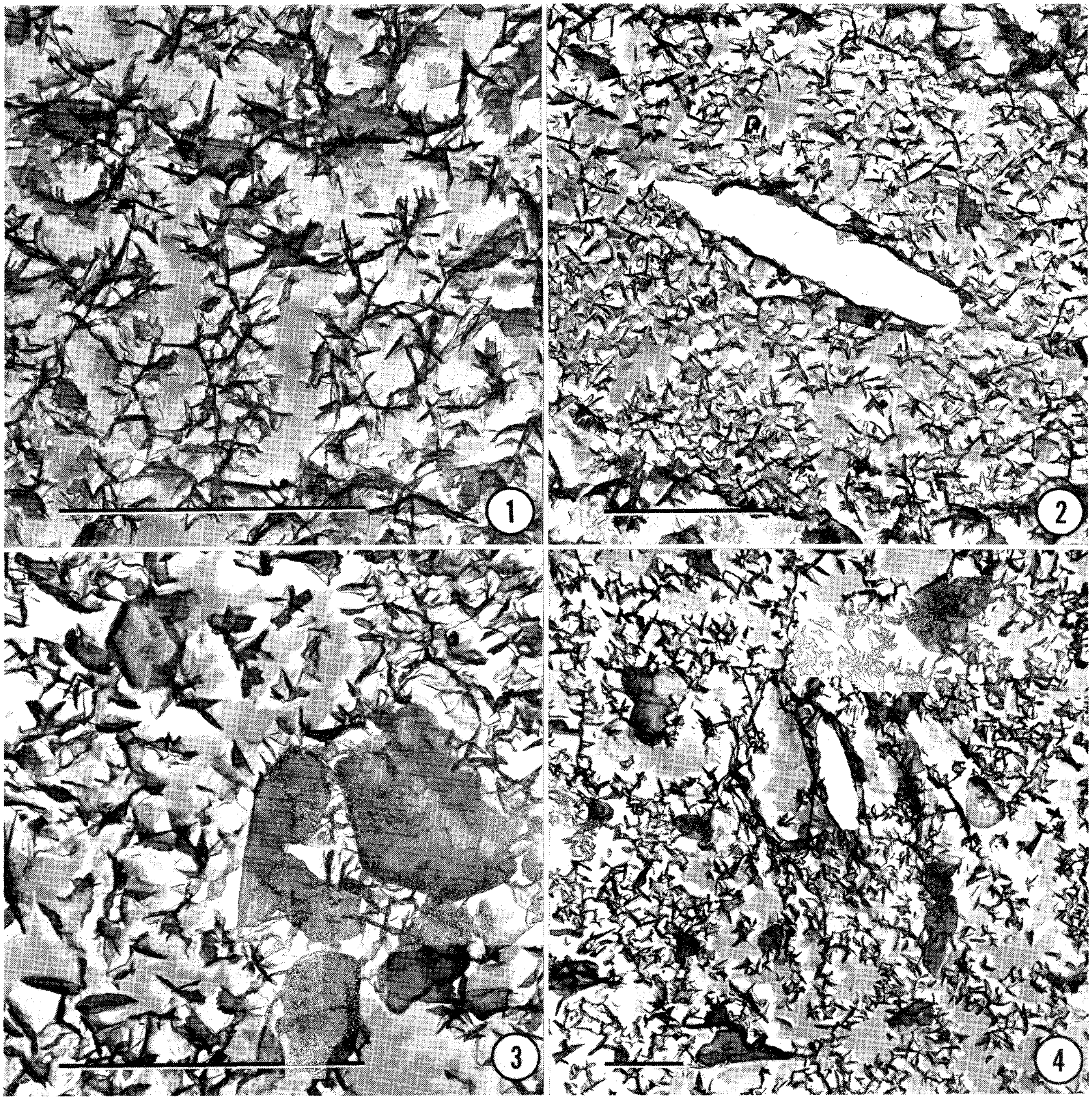
[2]Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or imply its approval to the exclusion of other products that may be suitable.

Figure 1. Epicuticular wax on epidermal cell of Prosopis juliflora var. Glandulosa. Rod-shaped structures and dendritic plates are mostly in upper part of picture. X10,000.

Figure 2. Stoma on leaflet shown in Fig. 1. Note relatively small wax structures on guard cells and larger structures on adjacent epidermal cells, visible in upper right and lower left corners. X5,500.

Figure 3. Wax on epidermal cell of Prosopis tamarugo. Large, thin plates sit loosely on top of other epicuticular structures. X10,000.

Figure 4. Low magnification of stoma on Prosopis tamarugo. Wax structures on guard cells are relatively few, but of about the same size and shape as those on adjacent epidermal cells. Several of the large plates are visible also. X2,300.



Figures 1-4. Transmission electron micrographs of leaflet upper surface replications of two species of Prosopis. Scale lines in all micrographs represent 5 um.

verified by scanning electron microscopy, and their mode of deposition is under study. Such structures might significantly influence the wetting and absorptive characteristics of the leaf surface and perhaps also the ability of leaves of P. tamarugo to absorb atmospheric moisture in a land of almost no rain, as discovered by Sudzuki (1960). On the other hand, it seems questionable whether the epicuticular waxes of the other four species and varieties would vary enough to significantly influence foliar wetting and absorptive characteristics.

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TRIALLATE ACCUMULATION IN WILD OAT AND BARLEY

G. H. Thiele and R. L. Zimdahl[1]

ABSTRACT. A technique to recover triallate [S-(2,3,3-trichloroallyl)-diisopropylthiocarbamate] from wild oat (Avena fatua L.) and barley (Hordeum vulgare) and detect it via gas liquid chromatography was developed with recovery percentages of 81.5 for wild oat and 85.0 for barley. Exposing barley seedlings to triallate vapor in a germinator resulted in a linear accumulation of triallate with time while in wild oats triallate accumulated for ½ to 2 days and remained constant thereafter. Similar accumulation patterns were shown for the same exposure periods when barley and wild oats were planted ½ inch below a triallate treated soil layer in the greenhouse. More triallate accumulated in wild oats and barley when they were planted in a triallate treated soil layer than below. Differential uptake of triallate by barley and wild oat coleoptiles growing into the treated layer was not the reason for selectivity. Although selectivity may be related to differential emergence of the coleoptile node, these studies indicate that selectivity is also a function of the total amount of triallate accumulated since planting in the treated layer resulted in greater accumulation of triallate.

[1]Graduate Research Assistant and Associate Professor, Department of Botany and Plant Pathology, Colorado State University, Fort Collins, CO, 80523.

EDUCATION AND REGULATORY SECTION

Two major topics were discussed pertaining to minor uses of herbicides in crops.

A. Responsibilities of the National Coordinator position for minor uses.

Four major responsibilities:

1. Determine need and priorities for minor use registration.
2. Encourage and develop lines of communication between USDA, EPA and University personnel.
3. Focal point for assembly of materials needed for registration. (working with IR-4 and states).
4. Support research to accumulate data (toxicological, metabolism, efficacy and tolerance, etc.) for registration.

The need and present status of groupings for registrations was discussed:

1. The Duggan crop grouping method.
2. Chemical structure and use patterns.

B. Presentation of the California State Department's role in state registration was presented indicating regulation, testing and licensing procedures.

There was additional discussion on the implementation of section 24c and the states role in registration of special local needs.

Ninety-five persons were in attendance.

THE EFFECTS OF CONTROLLING WOODY PLANT GROWTH ON WILDLIFE ABUNDANCE AND VARIETY

by

Lewis Nelson Jr.[1]

It is a rare and rewarding privilege to be able to address this distinguished group of scientists at the annual meeting of the Western Society of Weed Science. The basic objectives of our professions--weed science and wildlife science--have sometimes resulted in conflicts during past years. This is understandable because much of your efforts have been directed toward controlling weeds whereas much of our efforts have been in retaining weeds, which serve as food and cover for many wildlife species. Even the term "weed" is subject to disagreement because we do not consider all weeds undesirable plants.

I've emphasized a difference between our professions, and a comment about our similarity is needed. That bond would most definitely have to be people. It has been stated that Wildlife Management is 90 percent people management and 10 percent biology. This is evident by the amount of public concern and involvement in wildlife management decisions. Management through "common sense" by the public has resulted in less-than-desirable programs in a variety of cases. We in the wildlife profession had better get used to public involvement, though, because it's going to be here a long time and the intensity of that involvement is going to increase considerably. This same public concern and involvement is evident in your profession also. If you could talk to Mister Average Citizen and ask him his opinion of using a herbicide to control undesirable woody plants, chances are that he would be strongly opposed to it. The term "chemical" is a dirty word in today's society. People may not understand chemicals, their use, or the reliance of agriculture on them, but people are strongly opposed to chemicals. And I'm sure that public concern and involvement has resulted in less-than-desirable weed control programs in many cases. Weed scientists also had better get braced because this public concern and involvement is going to be here a long time and the intensity of that involvement is going to increase.

It is because of this public aversion to the use of chemicals that I am here today. The use of herbicides to control undesirable woody plant growth is controversial (as far as the general public is concerned), and many of you probably spend a significant portion of your time defending the use of herbicides for such purposes. Not long ago a meeting was held between the University of California weed scientists and the California Department of Fish and Game biologists to discuss herbicides and their use in suppressing undesirable woody plant growth. Surprisingly, there was little opposition to the wise use of selective herbicides as a technique. Rather, the biologists were primarily concerned with the effects on wildlife habitat of all brush removal programs, regardless of the techniques used. In other words, how will a brush control program affect wildlife habitat and, consequently, wildlife abundance and variety? That's a legitimate question and one that needs to be answered by weed scientists who are involved in brush control programs.

My objective is to discuss the effects of brush control programs on wildlife abundance and variety and to establish guidelines which can be followed in brush control programs so that wildlife are not adversely affected. My comments will be most applicable to the chaparral brushlands of California, but I know that several of the western states have similar problems. Before going directly into the subject of weed control and its effect on wildlife, it is necessary to lay down a few principles regarding wildlife and their needs.

Wildlife Habitat

Habitat is the environment that supplies everything wildlife species need for life--food, cover, water, and space. When these habitat factors are all in good supply, they contribute to

[1]Wildlife Specialist, University of California Cooperative Extension.

the well-being of wildlife. If any of the habitat factors is in short supply, it limits the numbers and variety of wildlife.

Each wildlife species has a preference for specific foods, regardless of other foods that may be abailable in an area. Large amounts of vegetation in an area does not necessarily mean that there is an abundance of food for all wildlife species. Plants also need to be nutritious to benefit wildlife. Some plants have more nutritional value than others and this varies according to the time of year and consequent growth stage of the plants. Some types of vegetation may be unavailable for some species, such as that which grows out of reach or is located in inaccessible or hard to reach spots. Wildlife also have need of a variety of foods in their diets. For most species, this variety depends on the preference, nutritive value, and availability of the various foods. Thus, the quantity, quality, availability, and variety of food are all important factors to wildlife.

Wildlife need cover to protect them while feeding, hiding, breeding, nesting, sleeping, playing, roosting, and traveling. Cover can take many forms, such as different types of vegetation, burrows, rocks, or other natural features. Open space with little relief can also be considered a type of cover for some species. The presence of large amounts of vegetation does not necessarily mean that cover is sufficient.

All wildlife species need water. Sources of water are surface or free water, dew, snow, and succulent vegetation. Some animals can also produce metabolic water.

Wildlife need space if they are to survive. Overcrowding leads to severe competition for all the habitat factors essential to life and, in some cases, results in the destruction of habitat. Animals in nutritionally poor condition are often the result of overcrowding. To maintain healthy populations, only a specific number of animals can live in an area.

The arrangement of food, cover, and water in an area determines wildlife abundance and variety. If these habitat factors are in large blocks that are located far apart, then animals must travel long distances to obtain them. While traveling, they are more vulnerable to climatic factors, predation, and other forms of mortality. Therefore, wildlife prefer not to travel far from protective cover unless absolutely necessary. Thus, the centers of large blocks of food and cover may not be used by wildlife. The best arrangement of habitat factors occurs when combinations of small blocks are close together, somewhat resembling a checkerboard pattern. A good arrangement of habitat factors insures that wildlife can obtain food, cover, and water within a relatively small area. Such an arrangement can support many more wildlife number of species, although the total acreage of the different habitat factors remains the same.

Wildlife are often described as edge species because they commonly live along the edges--not in the centers--of the different types of vegetation growing in an area. This tendency to concentrate between two or more types of vegetation is called the edge effect. If there is a good arrangement of food, cover, and water, it creates more edge area for wildlife to live in. Irregular shapes are also desirable because they have more edge than regular shapes.

Carrying Capacity

Carrying capacity is the number of each wildlife species the habitat can support throughout the year without damage to either the animals or the habitat. Carrying capacity is often compared to a 1-gallon bucket of water. Regardless of how much water you pour into the bucket, it only holds 1 gallon.

When wildlife numbers exceed the carrying capacity of the habitat, the excess animals die from starvation or other causes. When animals are over-crowded, they must compete for food, sometimes destroying the vegetation that serves as a source of food and cover. This extreme competition can affect the quantity, quality, availability, and variety of foods that wildlife utilize. It habitat is damaged or eliminated, it decreases the carrying capacity of the area for all species.

The only way to increase wildlife abundance and variety in an area is to increase the carrying capacity. That can be done by improving existing habitat or by creating new habitat.

Plant and Animal Succession

Each wildlife species lives in the biotic community (all the plants and animals in an area) that best meets its needs. Some species may live in several community types; others may spend their entire life in one type.

Each biotic community is subject to gradual change due to the effects of weather, soil development, plant growth, and other factors. This change is called succession. During each stage of succession, the plants and animals change, gradually being replaced by other species of plants and animals that are better able to survive in the type of habitat that has developed. In other words, succession is the orderly replacement of one biotic community by another. The final stage in succession is called the climax stage. Some wildlife species live only in the earlier (intermediate) stages of succession and are called intermediate species. Other species live only in the later (climax) stage and are known as climax species.

Succession can be set back to earlier stages by disturbance, such as controlled burning, bulldozing (and other mechanical methods), or through the use of chemicals. This process also changes the wildlife species to those that are better able to survive in the new type of habitat that has developed. These species which prefer the early or intermediate stages of succession are often called disturbance species.

There is no single stage of succession that will benefit all wildlife, although a much greater abundance and variety usually occur in the intermediate stages of succession than in the climax stage. However, a variety of plant communities and stages of succession from young to old provide a varied habitat where a greater variety and abundance of wildlife can live.

Status of Mature Brushlands

Many of the brushlands in the western United States are covered with large, dense, decadent stands of mature brush. This old and decadent brush, which represents the late stages of succession, is not preferred food for most wildlife,is out of reach or inaccessible to some species, is not nutritious, and offers very little variety. Because the brush is so tall and dense, it shuts out the sunlight and prevents the smaller and more desirable nutritious forbs, grasses, and shrubs from growing. Similarly, there is a poor arrangement of the habitat factors and the edge effect is minimal. These factors combined make the brushlands biological deserts or organic garbage dumps because there is relatively little wildlife abundance and variety.

Habitat Management of Mature Brushlands

Mature brushlands can be managed to benefit most wildlife species through the use of prescribed burning, bulldozing (and other mechanical methods), or chemical treatments. Removing small areas of decadent brush results in a reduction in brush density, a decrease in the competition between shrub species, and an alteration of the vegetative species composition and diversity. The subsequent regrowth of the brush species is higher in nutritive value and is more available to wildlife. There is also growth of a variety of nutritious grass and herbaceous species because of the increased sunlight penetration and decrease in plant competition. If fire is used to open stands of brush, many of the brush species will sprout readily from the root crowns or develop from seeds that have been dormant in the soil. The primary benefits to wildlife that occur when mature brushlands are treated are a better arrangement of the habitat factors, increased edge, more abundant and nutritious food, more available food, and a greater variety of food. This results in a greater variety of wildlife species, increased numbers of animals, and healthier populations. The increased health can also lead to other benefits, including a higher reproductive rate, greater weight, and so on. The benefits to sportsmen must be considered because much of the habitat management of mature brushlands is instigated for and financed by sportsmen. Benefits to non-consumptive wildlife users (which primarily involves aesthetics) must also be considered because of their desire to see wildlife in its natural habitat.

To optimize wildlife abundance and variety, there are certain guidelines which need to be followed in managing mature brushlands. These guidelines will vary according to several factors, including objectives of the brush control program, location, topography, and so on. These guidelines include:

(1) Determine the specific management objectives—Is the management being undertaken to increase livestock forage, improve watershed values, or for some other purpose? Could management of the area be done to fulfill the primary objectives and, at the same time, enhance wildlife populations?

(2) Determine the wildlife species that you want to enhance—The techniques followed in encouraging deer would be different than those used to encourage songbirds and small mammals. If the objective is to enhance as many species as possible, then the appropriate action would be to manage for deer. Although this would not be optimum for all the smaller species, most would still be benefited considerably by the brush manipulation which creates a better arrangement of the habitat factors and increased edge.

(3) Good soils should be developed first—Wildlife can be considered a renewable natural resource that is a product of the land. The better soils produce the most nutritious and vigorous plants upon which animals depend. Therefore, good soils can produce large healthy populations whereas poor soils produce small unhealthy populations.

(4) Openings in the brush should be established in accordance with the needs of the particular wildlife species for which you want to enhance habitat—As mentioned earlier, the techniques followed in encouraging deer would be different than those used to encourage songbirds and small mammals. Deer usually utilize openings that are within approximately 300 feet of protective cover. These areas should be small enough so that the deer, hopefully, can keep the plants from growing out of reach and becoming unavailable again. The size of the openings for songbirds and small mammals vary according to the wildlife species, location, etc. but are generally smaller than openings for deer.

(5) Dense brush cover should not be reduced below 30 percent of the managed area—If the primary purpose of the brush control program is to enhance wildlife, this is an appropriate recommendation. If the primary purpose is to enhance livestock production, then this figure would have to be lower. Retention of only 10 percent of the brush as islands well distributed over the managed area can mean the difference between an extremely low wildlife population and a significant population.

(6) Patches of cover should be large and dense enough so that wildlife species are not exposed to excessive predation—For deer in areas that are heavily hunted, a patch of cover that is approximately square in shape and covering 10 to 15 acres is the usual recommendation. For birds and smaller mammals, a patch of cover that is approximately square and covering at least 1 acre is recommended.

(7) A variety of plant communities and stages of succession from young to old should be encouraged—This can be accomplished through treatment of different parts of an area over a period of several years and seeding of the cleared area with a variety of grasses and herbaceous vegetation. This encouragement of a variety of plant communities and stages of succession will encourage a variety of wildlife species.

(8) The edges of cleared areas should be "feathered" or thinned out (removal of about 50 percent of the vegetation) to create a transition between managed and unmanaged brush and enhance the forage value of this transition zone.

(9) Herbicides should be used to remove selected, undesirable woody plant species or individual plants to control density—The broadcast use of chemicals to control woody vegetation usually results in the reduction or elimination of many of the desirable plant species for wildlife. The selected removal of undesirable woody plant species, however, can benefit wildlife.

These guidelines are general in nature. Their use depends on several factors, including objectives of the brush control program, location, topography, and so on. Professional help is needed to survey an area, design an appropriate habitat management program, and aid in its implementation. This technical assistance is available through the fish and game departments in the western United States. I encourage anyone who is undertaking a brush control program to consider the effects of such a program on wildlife abundance and variety and take advantage of this professional service.

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MINUTES OF THE BUSINESS MEETING

March 20, 1975

President Lee called the meeting to order at 10:15 a.m. with seventy-six members present. Minutes of the 1974 WSWS business meeting were accepted as printed in the Proceeding of WSWS, Vol. 27, by unanimous vote.

NOMINATION COMMITTEE REPORT

K. W. Dunster, Dave Bayer, J. Wayne Whitworth

The nominations committee reported that 131 members cast ballots with the following results:

President-elect--Clyde L. Elmore
Secretary--Richard D. Comes
Chairman-Elect, Research Section---Larry C. Burrill
Chairman-Elect, Education Section--Alvin F. Gale

TREASURER-BUSINESS MANAGER REPORT

The following financial statement was presented by the WSWS Treasurer-Business Manager covering the period 1 March 1974 to 1 March 1975.

Income	
Registration, Hawaii Meeting (146)	$ 730.00
Dues, members not attending Hawaii meeting (118)	236.00
1974 Research Progress Report Sales	1,275.02
1974 Proceedings Sales	1,381.80
Sales of Old Publications	94.00
Payment of Outstanding Accounts	20.00
Industry Contributions for Coffee Breaks	325.00
Advance Order Payments	30.00
Interest on Savings	285.11
Total Income	4,376.93
Assets, March 1, 1974	4,339.70
	8,716.63
Expenditures	
Annual Meeting Incidental Expenses	638.39
1974 Research Progress Report	942.60
1974 Proceedings	1,500.00
Office Supplies	119.40
Business Manager Honorarium	250.00
Postage	365.23
Plaques	91.12
1975 Research Progress Report	114.00
	4,020.74
Liquid Assets	
Savings ($2,800.00)	
Checking ($1,855.89)	
Cash on Hand ($40.00)	4,695.89
Accounts Receivable	44.00
Potential Net Worth	$4,739.89

FINANCE COMMITTEE REPORT

L. Jordon, G. Massey, A. F. Gale

Chairman Lowell Jordon reported that an audit of the books and financial report indicated they were in order and the committee report was accepted unanimously by the members present.

SITE SELECTION COMMITTEE REPORT

The 1976 WSWS meetings will be held in Portland, the 1977 meetings in Sacramento, California, and the site selection committee with some input of the Executive Committee announced the 1978 meeting site to be Reno, Nevada.

LOCAL ARRANGEMENTS COMMITTEE, 1976 SITE

J. R. McKinley, Chairman, reported arrangement had been made with the Sheraton Hotel in the Lloyd Shopping Center, Portland for the 1976 meetings. Meeting dates are March 16, 17, and 18, 1976. Motion made and carried to accept the Local Arrangements Committee report.

RESOLUTIONS COMMITTEE REPORT

D. H. Hall, S. Radosevich and H. M. Kempen

One resolution was presented to the membership present for consideration and action, it reads as follows:

Resolution:

Whereas the registration and use status of herbicides is in a continuous state of change and revision and;

Whereas current, accurate information must be made available to weed researchers, teachers, and Extension personnel and;

Whereas EPA Compendiums were quickly prepared and are presently available for reference concerning other pesticides;

Now therefore be it resolved that the Western Society of Weed Science stresses the immediate need for the Herbicide Compendium and ages the EPA to expedite completion and publication of the compendium without further delay.

The resolution was adopted unanimously by the membership present and sent to the Environmental Protection Agency.

WSSA REPRESENTATIVE REPORT

Representative D. E. Bayer reported on the activities and programs of WSSA of interest to the WSWS membership. The following six points were outlined from the WSSA Executive Meeting held in conjunction with the annual meeting of the national society meeting in the Statler-Hilton Hotel in Washington.

1. It was suggested that each regional society poll their membership as to the possibility of a summer meeting of the Weed Science Soc. of America.
2. Each region select an EPA relations committee to coordinate the weed related activities within their region.
3. That all regions consider adoption of a uniform rating system for weed control to be used nationwide.
4. An International Society of Weed Science is currently being established and membership to the society is encouraged. Neil Schaeffer of American Cyanamide is Chairman of the Steering Committee. He would appreciate any comments from WSWS members.
5. It was suggested that we consider the use of the WSSA Executive Secretary as Business Manager of WSWS. He is available and the details and extent of his services could be obtained.
6. An advertizing service can be made available through the national organization to list and describe publications of the WSWS members.

Representative Bayer's report was unanimously approved.

EDUCATION AND REGULATORY SECTION REPORT

Chairman Clyde Elmore reported a lively discussion of several extension and regulatory aspects of weed control including guidelines for registration of minor use herbicides which is currently being detailed in most states and by the EPA. The section was attended by 95 persons. Ron Burr will be the next chairman and Alvin Gale was elected chairman-elect.

RESEARCH SECTION REPORT

Results of the elections of new Project Chairmen were as follows:

Project 1. Perennial Herbaceous Weeds–1976–Chairman, Dean Swan; Chairman-elect, Larry Evetts.

Project 2. Herbaceous Weeds of Range and Forest–1976–Chairman, A. Wayne Cooley, Chairman-elect, Howard Morton.

Project 3. Undesirable Woody Plants–1976–Chairman, Ron Stewart; Chairman-elect, Tom Johnsen.

Project 4. Weeds in Horticultural Crops–1976–Chairman, Larry Senior; Chariman-elect, Robert Callihan.

Project 5. Weeds in Agronomic Crops–1976–Chairman, Jack Orr, Chairman-elect, Don Colbert.

Project 6. Aquatic and Ditchbank Weeds–1976–Chairman, V. Bruns; Chairman-elect, Jim McHenry.

Project 7. Chemical and Physiological Studies–1976–Chairman, G. Booth; Chairman-elect, Dr. Floyd Colbert.

PROJECT 1 REPORT–PERENNIAL HERBACEOUS WEEDS–Alvin F. Gale

The project met for two hours with 95 persons participating. Discussions followed in four areas of common interest.

Perennial broadleaf control centered on Canada Thistle control, was discussed by Dr. Robert Zimdall. Importance of application rates and timing with glyphosate.

Dr. K. C. Hamilton discussed perennial grass control with emphasis on Johnsongrass, Bermudagrass and nutsedge control. Fall treatments of glyphosate provided good control, but not complete control. Stage of growth and timing of application with glyphosate was discussed for Reed Canarygrass.

Subsurface placement of herbicides for perennial weed control was discussed by Don Baldridge. Layering and injections results are quite successful. Uses of fumigants DD, telone, and methyl bromide are entering the scene for weed control purposes.

Registration status of new herbicides for perennial weed control were discussed by Dean Brown and Paul Ritty.

Incoming Chairman for 1976–Dean Swan of Washington State University; Chairman-elect, Larry Evetts of Monsanto Products.

PROJECT 2 REPORT–HERBACEOUS WEEDS ON RANGE AND FOREST

Herbaceous Weeds on Range and Forest, Section 2 met with over 30 participants. A. Wayne Cooley is the chairman for 1976, with Howard Morton as chairman-elect.

The general area of registration status for various herbicides used or showing promise for use in forestry and grazing lands was reviewed by company representatives. Up-date on the evaluation of several new compounds was also included.

Discussion on the implementation of multi-discipline or multi-agency research efforts toward range and forestry problems disclosed that this has only been done to a limited extent. The need for improved communication to the general public through things such as "Blue Ribbon Tours" of research programs was emphasized.

The compiling of an index of species-herbicide response for herbaceous range and forest weeds was felt desirable but thought to be beyond the scope of this group.

An illustrated review of Arizona herbaceous weed problems was presented by Howard Morton with emphasis on poisonous plants.

PROJECT 3 REPORT—UNDESIRABLE WOODY PLANTS—Steve Radosevich

Ron Stewart—Chairman—1976

Tom Johnsen—Chairman—1977

Twenty-two people attended. Two topics were discussed:

(1) Ron Stewart (Subcommittee chairman) presented a progress report on a proposed publication to describe control of woody species by various herbicides. Information for this publication is hoped to be compiled by December 1975.

(2) Dr. Lew Nelson, Wildlife Specialist (University of California, Davis) presented information about wildlife needs in managed wildland areas. He presented eight principles of wildlife management and indicated how wildland managers could benefit wildlife. His paper is published in the Proceedings.

PROJECT 4—WEEDS IN HORTICULTURAL CROPS

Harold M. Kempen, Chairman met with seventy-five weed scientists and regulatory personnel participated in the workshop on Wednesday, March 19, 1975. A summary of salient points of the four discussion topics follows. Larry Senior, Stauffer Chemical Co., was elected chairman in 1976; Robert Callihan, chairman elect for 1977.

Subject 1. Update on Glyphosate—Dr. A. H. Lange, University of California, Parlier

No residual soil activity has been generally noted on subsequent crops where preplant or pre-emergence applications have been made at high rates (over 8 lb/A). However occasional soil activity on weeds has been noted in perennial crop trials. No toxicity has been noted in many tree and vine trials if only woody bark is sprayed. Where foliage or buds are sprayed, fall applications cause more injury than spring applications. Drift is a potential problem but of a lesser hazard than 2,4-D by a factor of about 10. Use of drift control reduction systems such as drift control agents, nozzle improvements and/or hooded sprayer systems, should limit hazards to crops and non-target vegetation to acceptable levels. Control of perennial weeds in crops with glyphosate is generally better than in non-crop areas.

Subject 2. Herbicides on minor crops—Dr. J. W. McKenzie—EPA—Region IX, San Francisco, Ca.

Because of earlier discussions on this topic, discussion was limited. Dr. McKenzie related the many pressures from the "unknowing" public, industry, researchers and politicians as well as occasional distorted media releases which play on emotion. Despite such pressures, progress continues to be made in coping with problems of gaining registrations on minor crops under the guidelines of the FEPCA amendment to FIFRA. Industry representatives expressed concern over liability with registrations on minor, high-value crops and expressed the need for thorough research as well as their being the final authority on whether to register. It was concluded that effort be directed toward a system which limits the liability of manufacturers and retailers. Also a better coordinated system for collection of registration information where registration is through the IR-4 committee, is needed.

Subject 3. Promising new herbicides and herbicide programming techniques on vegetable crops—Harold M. Kempen, University of California, Bakersfield.

Discussions centered on weed control programs in several western states and the need for "field practitioners" or consultants in the field who can keep track of weed problems and prevent increases in problem "escape" weeds. Rotation was considered an essential element but small changes in cultural practices can greatly increase weed problems. Herbicides tend to increase weed monocultures, examples being nightshade in tomatoes and cotton. Weed management is a new need in agriculture.

Subject 4. Methods for evaluating herbicide effects on plants—Dr. L. C. Burrill, IPPC, Corvallis, Oregon.

Many techniques are used to evaluate crop and weed response to herbicides; some systems are difficult for the reader to understand. Regulatory people often have difficulty understanding some evaluation techniques. Since such systems must communicate the actual results obtained in the trial, they must be standardized. Efforts at the WSSA level and by the ASTM (American Society of Testing Materials) are under way to accomplish standardization.

PROJECT 5 REPORT—WEEDS IN AGRONOMIC CROPS

Approximately 75 persons attended agronomic crops meeting. Three short, informal presentations were made to introduce main topics which generated good exchange of questions and comments from group.

1. Dr. Robert Zimdahl introduced and narrated topic on wild oat research. Several new promising post-emergence compounds were discussed from standpoint of control, crop tolerance and label status. Wild oat severity appears to be increasing and several persons indicated sequential herbicide treatment might have utility.

2. Dr. Roland Shirman lead discussion on reduced tillage systems is growing. Numerous herbicides show utility but considerable research in this area is required before wide grower acceptance can occur.

3. Dr. Alex Ogg introduced a topic on herbicide residues in waste irrigation water. Discussion on how pesticides get into irrigation water, severity of problem and how various areas are handling waste water resulted. In PNW growers are injecting herbicides into center pivot irrigation systems while in California and Arizona considerable use of herbicide application in water runs is being made. With either use, if handled properly, hazard of contamination of waste water does not appear great.

During meeting Jack Orr, Farm Advisor, University of California was introduced as 1976 project chairman and Don Colbert, American Cyanamid Co., was elected chairman-elect.

PROJECT 6 REPORT—AQUATIC AND DITCHBANK WEEDS

Chairman (1975-1976) Mr. V. F. Bruns
U.S.D.A. A.R.S. P.O. Box 30, Prosser, WA 99350
Chairman-Elect (1976-1977) Mr. Jim McHenry
Department of Botany, University of California, Davis, CA 95616

Neither the Chairman, Mr. Floyd Oliver, nor the Chairman-Elect were able to attend the meeting because of federal travel restrictions. Richard Comes acted as Chairman of the session. Moreover, none of the lead-off speakers whose names were printed in the program were able to attend the meeting for the reason given above. Nevertheless, four short informal presentations were used to stimulate a lively discussion and exchange of ideas between the 25 people in attendance.

Fred Corbus discussed some of the problems of delivering multiple use water on the Salt River Project. Weed oils used in the past to control ditchbank vegetation can no longer be used because they contaminate potable water supplies. Pramitol applied to light soils on the banks of dry canals killed all vegetation which resulted in severe erosion problems. On heavy spils, only annual weeds were controlled and perennial weeds became a severe problem. To control submersed weeds without killing fish in the multiple use canals, the project applied low concentrations of copper sulfate on a continuous basis. Results were very satisfactory, but the cost for an 11-month period was $942 per mile of channel. The need for tolerances in water of herbicides required the control aquatic and ditchbank vegetation was discussed. Later in the session it was brought out that a tolerance of 0.1 ppm of the dimethylamine salt of 2,4-D has been established in portable water. Also, an interim tolerance of 0.2 ppm has been established for endothal and its derivatives in potable water.

Jim McHenry reported on the need for an herbicide to replace the low volatile esters of 2,4-D for the control of hardstem bulrush in areas adjacent to 2,4-D susceptible crops. He reported excellent results with glyphosate at 1 lb/A when applied in October in Califormia. A discussion ensued concerning drift reducing agents and the use of high volume-low pressure nozzles to reduce the movement of herbicides to non-target areas.

Dick Comes discussed the dissipation of glyphosate in irrigation water. When glyphosate was injected directly into the water, approximately 30 percent of the glyphosate could not be accounted for 1 mile downstream. Thereafter, the rate of apparent loss was only 2 to 4 percent per mile. When glyphosate was applied to the banks of dry canals in the fall, no residues were found in the first water that flowed through the canals the following spring.

Soil samples taken below the waterline in the spring contained appreciable quantities of glyphosate and its soil metabolite.

The last discussion topic concerned the biological control of aquatic weeds with the White Amur. Jim McHenry showed and narrated a movie filmed by Dr. R. R. Yeo at the University of California depicting the eating habits and some anatomy of the White Amur, silver dollar fish, and Tilapia. Considerable discussion followed concerning the pros and cons of using the White Amur for aquatic weed control.

PROJECT 7–CHEMICAL AND PHYSIOLOGICAL STUDIES

Project 7 had 59 registered participants. Short, informal presentations were used to introduce two main topics, with a free flow of questions and comments during and after the presentations.

Subject 1: Differential Response Within A Species to Herbicides

Dr. Tom Muzik reviewed this topic and discussed four main points.

(a) Kinds of plants likely to exhibit differential responses. Response of this type is widespread and appears to be prevalent in both annuals and perennials. Some examples cited were barnyardgrass-dalapon, common groundsel--atrazine, field bindweed--2,4-D, reed canarygrass--amitrole, redroot pigweed--atrazine. Many other examples of both weeds and crops were cited by participants of the meeting. It was noted that there are two types of resistance. That is, in one case there are sensitive and resistant plants with no gradation between and in the other cases there are plants that have various levels of resistance.

(b) Kinds of herbicides likely to cause the appearance of differential response. Many examples were cited including soil applied and foliar applied herbicides. Dr. Muzik stated that herbicides with a narrow weed spectrum are more likely to cause appearance of resistant plants. No examples of contact herbicides were cited.

(c) Mechanism of response. Evidence is overwhelming the resistance exists within the plant population and is not caused by a mutation as a result of exposure to a herbicide. Dr. Muzik stated that the resistance was not related to differential absorption, translocation, or metabolism, but may be caused by differential binding of the herbicide to cell membranes. Considerable discussion ensued on these points.

(d) Practical economic importance of the differential response. Several points were brought out. (1) Build-up of resistant weed populations. (2) Introduction of new crop varieties that are sensitive to herbicides that have been proven safe on the established varieties.

Dr. Muzik urged the establishment of a descriptive name for plants within a species that exhibit a differential response to a herbicide. He suggested "Chemotype." It was suggested that our representative to WSSA bring this matter to the attention of the terminology committee.

Subject 2: Methodology in Herbicide Leaching Studies

Dr. Robert Zimdahl introduced the subject and reviewed some of the methods currently being used. He also described EPA's required method of herbicide leaching and stated that the method results in very wet soils and anaerobic conditions within the column. He concluded his comments by stating that laboratory leaching studies cannot be related to field studies. Laboratory studies are useful mainly in comparing the relative movement of herbicides. Dr. Paul Santlemann presented detailed descriptions of thin-layer, thick-layer, and soil column methods of studying herbicide leaching in the laboratory.

Dr. Gary Lee presented data that demonstrated root uptake of glyphosate from nutrient solutions.

The session ended in a short business meeting. Dr. Gary Booth was introduced as the Chairman for the 1976 meeting and Dr. Floyd Colbert was elected as Chairman for the 1977 meeting.

PUBLIC RELATIONS COMMITTEE

D. L. Bohmont, D. L. Burgoyne and I. Shelton

Foremost among the recommendations from the committee was a press room to be available at the meetings in Portland next year.

The Public Relations Committee has considered the various options and procedures available to enhance the image of weed science and get the general public acquainted with WSWS and its role in weed control and food and fiber production. The following recommendations are submitted for consideration by the WSWS members:

1. It is critical that we get information into non-agriculture oriented news media. Examples might be Playboy Magazine with titles such as: "What the Well Informed He-Man Should Know About Pesticides" or "A Study Manages His Environment." Another could be Ladies Home Journal with "Good Family Health Through Proper Pesticide Use" or "Are They Trying to Starve Your Family Through Banning of Pesticides?" Other magazines might include Harper's and Saturday Evening Post.

2. We might need to draft some editorial help. We need a person with the ability to write articles for non-agricultural minded people. He would also need to have the ability to plant articles in the "other" kind of news media than what we are used to writing articles for. An example of the "traditional" article is attached as evidence of effort by the committee to date, but it is also an example of "talking to ourselves" because it is an agriculture publication.

3. Establish a circulation list of people we can send articles to that we know will be able to get them into print in the various magazines, newspapers and other news media.

4. Recognize outstanding contributions by weed control individuals and publicize the fact in the media and regional and national newspapers with appropriate accompanying "ballyhoo" for WSWS.

5. Closer contact between the various state organizations and WSWS is desirable and should be established. A flow of information in both directions would be helpful.

6. Establish and publish a list of individuals who would be willing to speak before civic organizations, schools, women's groups, etc. The key to success of this operation would be publicity of the lists on a state or even local basis so that the various organizations would know who is available. The contact and cooperation as described in recommendation number 5 would be vital to the success of this recommendation.

7. Consider the possible use of mailers or envelope stuffers that could be published in quantity and sent along with certain mailings, public utility bills or other mailings where the originators would permit us to "piggyback" our information.

8. Consider production of 1-minute radio spots that can be circulated to radio stations.

9. Public education T.V. stations (and others) are always looking for "fillers" in the range of 2 to 10 minute spots. Good color T.V. spots can be produced for $250 or less if the speaker and graphics are well prepared. Some chemical companies already have T.V. takes and/or materials that could be adapted to this use.

10. Consider educational displays at certain non-agricultural sites and conventions. Hotel lobbies where numerous kinds of meetings and conventions are held would be a likely spot for this kind of exposure.

11. Consider sponsoring essays or poster contests and give cash prizes for the winners and then use the materials for publicity.

12. Consider special tours for non-agricultural people and/or encourage their attendance at regularly scheduled events through issuance of special invitation to organization leaders and officers.

This committee recognizes that one of the original reasons for its existence was to get information to legislators, both State and Federal, through the use of a position letter or other information to establish our stand on certain issues. We feel that the Executive Committee should establish an Editorial Policy to guide the membership and to provide for approval and clearance of news articles, publicity endeavors, and other public relations efforts.

The committee also feels that it should be clarified as to who is responsible for writing news articles, letters to legislators, etc. Is it the PR Committee's responsibility or can anyone submit material?

NOMINATIONS OF FELLOWS AND HONORARY MEMBERS

D. L. Bayer, A. P. Appleby and D. L. Burgoyne

No Honorary Members nominated. Two Fellows were elected into the Society, they were R. A. Fosse and C. I. Seely. Report accepted as reported to the membership.

RICHARD A. FOSSE

Richard A. Fosse was born on a farm near Webster, South Dakota, on July 10, 1924. His first entry into the field of weed science came in 1949 and 1950 when he served as County Weed Supervisor in Day County, South Dakota. After receiving his B.S. degree from South Dakota State University in 1951 he joined Monsanto Chemical Company. During his employment with Monsanto he was instrumental in setting up the primary herbicide screening program at Dayton, Ohio, and in the transfer of that screening operation to the location near St. Louis, Missouri.

In 1954 he joined Amchem Products, Inc., then known as the American Chemical Paint Company, as a research representative in the Western United States working out of Denver, Colorado. He is presently Senior Research Manager in charge of Research and Development for Amchem Products, Inc., in the Western District.

Mr. Fosse has served Weed Science in many capacities including activity as committeeman and committee chairman for the North Central Weed Control Conference, Western Weed Control Conference, California Weed Control Conference, and the Weed Science Society of America.

He has handled all of the offices of the California Weed Conference as well as the Western Society of Weed Science. He served as President of the Western Society Weed Science from 1958 through 1960 and was this organization's representative to the Weed Science Society of America. He has just completed his year as President of the California Weed Conference in January of 1975.

CLARENCE I. SEELY

Clarence I. Seely was born October 19, 1912, at Woodburn, Oregon, and was raised on a wheat farm near Dayton, Washington. He was graduated with honors from Washington State University in 1933, and granted his MS degree in 1935. He served as superintendent at the Lind, Washington Branch Experiment Station for one year before joining the USDA as Assistant Agronomist in Weed Investigations in 1936.

Clarence was one of the original four "Weed Investigators" employed by USDA as a result of the historic Bindweed Investigations Appropriations Bill of 1936. He served as Associate Agronomist and director of the Genesee, Idaho Bindweed Research Station until 1947 when he joined the Agronomy Department as Associate Agronomist and Associate Weed Scientist, University of Idaho. In 1955, he was promoted to Agronomist and Professor of Agronomy and Weed Science.

He is a charter member of WSSA; member of the Executive Committee 1951-52; president of WSWS 1951-53; member Board of Directors, Idaho Weed Control Assn. 1968 to present; president of latter 1973. Memberships in other societies include: ASA; Northwest Science; Idaho Academy of Science; Western Society of Crop Science. Since joining the University of Idaho staff he has taught the following courses: Weed Control, Advanced Studies in Weed Control, Properties and Functions of Herbicides, Crop Ecology, and Advanced Crop Production.

He has been elected to membership in the following honorary societies: Phi Kappa Phi, Sigma Xi, Phi Sigma, Alpha Zeta, Gamma Sigma Delta. His civic and service activities include: Lions Club International, 1947-present; Moscow Lions Club President, 1957; Boy Scouts: Cubmaster, Scoutmaster, District Commissioner and he is the recipient of the Silver Beaver Award.

He has over thirty publications in the weed science field. These cover the broad spectrum of: a fungus disease of field bindweed, cultural control, selective and nonselective use of 2,4-D, diuron in winter wheat, translocation of C^{14}-amitrole, and values of total weed control.

Clarence's greatest contribution to weed science, however, have been his depth and breadth of insight of the whole field including: the applied, the basics, their combinations, and the financial and social consequences.

REPORT OF AD HOC CONSTITUTIONAL AMENDMENT COMMITTEE

A. P. Appleby, D. Burgoyne and G. Lee

Several constitutional amendments were suggested by the Constitutional Amendment Committee and enacted by the membership present. A revised printing of the Constitution and By-Laws including the changes enacted during the 1975 Business session of the Western Soc. Weed Science meeting in Phoenix is included in this Proceedings. The changes made were discussed and voted upon individually by Article and Section and all changes passed unanimously. Article and Section changes made to the Constitution and to the By-Laws are listed below in their presently approved wording.

Constituion, Article IV, Section 5. The Society Representative to the Weed Science of America shall serve three years beginning at the Weed Science Society of American Business Meeting in the year following the WSWS meeting in which his election is announced.

Constitution, Article VI, Section 1. The Nominating Committee shall be appointed by the President, with the advice and consent of the Executive Committee. They shall present their nominations for each office to be filled at the annual meeting. No members names shall be placed in nominations by the Nominating Committee without his prior consent. All candidates for office shall be selected from the Society membership and shall be elected by the majority of the members voting. In case of a tie vote, the winner shall be determined by flip of a coin in the presence of both nominees or their representatives at a meeting of the Executive Committee.

Constitution, Article VI, Section 4. If any elected officer cannot serve the full term, the vacancy shall be filled for the interim by appointment by the President with the advice and consent of the Executive Committee, unless otherwise provided for in this constitution. The President-elect shall serve as President if the President becomes unable to serve. This service shall not constitute his term as President. In case both the President and President-Elect are unable to serve, the most immediate Past-President who is willing to serve shall serve as interim President until new officers are elected by the members.

Constitution, Article VII, Section 4. The Resolutions Committee shall consist of a Chairman and two additional members. Term of office of this committee shall be three years, established to expire alternately so that at least two members continue over each year. The member serving his second year of the term shall serve as Chairman.

Constitution, Article VII, Section 6. The Nominating Committee shall consist of a Chairman and two members. Terms of this committee shall be as in Section 4 above.

Constitution, Article VII, Section 7. The Public Relations Committee shall consist of a Chairman and others as needed. Terms of office of this committee shall be at the discretion of the President.

Constitution, Article VII, Section 8. The Placement Committee shall consist of a Chairman and two additional members. Terms of this committee shall be as in Section 4 above.

By-Laws, Article I, Section 1. The President shall be the executive officer of the Society. He shall act as Chairman of the Executive Committee, carry out the spirit of the constitution and the decisions of the Executive Committee, prepare agenda and preside at all meetings of the Scoiety and Executive Committee, appoint designated officers and committees and perform other usual duties of that office. He may confer, if in his opinion a member of the Society has demonstrated distinguished service, the Presidential Award of Merit. This Award will be presented solely at the discretion of the President.

By-Laws, Article II, Section 6. The Public Relations Committee shall take every feasible opportunity to inform the scientific community and the general public of the activities and benefits of the Society and of weed science in general. Any statement which may be construed as reflecting policy of the Society should be approved by the President before release.

Society approved and accepted the Constitutional Amendment Committee report.

A feeling of great debt toward Dr. Gary Lee outgoing president of the society was expressed from many individuals present at the business meeting and during the general conduct of the annual meetings. Dr. Lee in turn expressed his deep appreciation to those who worked immeasurably to insure the success of the organization. He then turned the meeting over to the new President, Bill Anliker who called for the adjournment of the 1975 Business Meeting.

WESTERN SOCIETY OF WEED SCIENCE

CONSTITUTION AND BY-LAWS

With revisions and additions as adopted by the membership on March 20, 1975

CONSTITUTION

ARTICLE I–Name

Section 1. The name of this organization shall be the "Western Society of Weed Science," hereinafter called the "Society." It shall include the states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming, and persons of the western provinces of Canada and of other states and nations as may wish to become members.

ARTICLE II–Objectives

The objectives of the Society shall be:

Section 1. To foster cooperation among state, federal and private agencies in matters of weed science in the Society area.

Section 2. To support the Weed Science Society of America and foster state and regional organizations of persons and agencies interested in weed control.

Section 3. To aid and support commercial, private and public agencies in the solution of weed problems.

Section 4. To foster and encourage education and research in weed science.

Section 5. To support legislation governing weed control programs and weed research and education programs.

Section 6. To assist in the development of uniform weed control and eradication legislation and weed seed quarantine legislation and regulations.

ARTICLE III–Membership

Section 1. Membership shall be open to anyone interested in the objectives of the society. Two types of membership are provided (1) active and (2) honorary.

Section 2. Active members are individuals who are interested in weeds or their control and who have paid their annual dues to the treasurer. Active members may attend all Society meetings, vote on Society matters, hold office and receive official notices of all meetings.

Section 3. Honorary members are members selected from outside the Society who have significantly contributed to the field of weed science, and who are elected by two-thirds majority of the Executive Committee. Honorary members shall receive all publications and announcements of the Society but will not be eligible to vote or hold office.

ARTICLE IV–Officers and Executive Committee

Section 1. The officers of the Society shall be:

(1) President
(2) President-elect who serves as Program Chairman
(3) Secretary

Section 2. The Executive Committee shall be composed of:

The President
President-elect
Secretary
Immediate Past-President
The Representative to WSSA
Chairman of the Research Section
Chairman of the Education and Regulatory Section
One member chosen at large by the President with the consent of other members of the Executive Committee.

Section 3. The President, President-elect, and Secretary shall begin their duties at the close of the regular business meeting at which they are installed and shall remain in office until the close of the next regular Society business meeting. Other members of the Executive Committee shall begin their term at the close of the meeting at which they are installed, except the Representative to WSSA whose term is described in ARTICLE IV, Section 5 of the Constitution.

Section 4. The Chairman of the Research Section and the Chairman of the Education and Regulatory Section shall serve a one year term beginning at the close of the business meeting at which they become chairmen.

Section 5. The Society Representative to the Weed Science Society of America shall serve three years beginning at the Weed Science Society of America Business Meeting in the year following the WSWS meeting at which his election is announced.

Section 6. The Executive Committee may elect a Treasurer-Business Manager to serve as they may direct.

ARTICLE V–Society Sections

Section 1. In promoting a full exchange of ideas and information on weed science and to facilitate programming of meetings, there shall be two general sections as follows:

(1) The Research Section, and
(2) The Education and Regulatory Section.

Section 2. These two sections may have sectional programs, project meetings and informal discussions of research reports and other pertinent information. Such meetings shall be at the regular meeting at a time designated by the Program Committee.

Section 3. The chairman of each of these sections shall be a member of the Society Executive Committee and shall be elected as stated in Article VI, Section 3.

ARTICLE VI–Election of Officers

Section 1. The Nominating Committee shall be appointed by the President, with the advice and consent of the Executive Committee. They shall present their nominations for each office to be filled at the annual meeting. No members name shall be placed in nomination by the Nominating Committee without his prior consent. All candidates for office shall be selected from the Society membership and shall be elected by the majority of the members voting. In case of a tie vote, the winner shall be determined by flip of a coin in the presence of both nominees or their representatives at a meeting of the Executive Committee.

Section 2. The terms of office shall be as follows: The officer moving through the office of president-elect, president and past president shall be a member of the Executive Committee for a three-year term, the Secretary shall serve a one-year term but shall be eligible for renomination as secretary or as any other officer.

Section 3. The Chairman-elect of each of the two sections shall be elected by the Society and serve a one-year term. Following this, they shall succeed as Chairman of their section for an additional one-year term. The Chairman-elect shall serve as Chairman if the Chairman is unable to serve his term.

Section 4. If an elected officer cannot serve the full term, the vacancy shall be filled for the interim by appointment by the President with the advice and consent of the Executive Committee, unless otherwise provided for in this constitution. The President-elect shall serve as President if the President becomes unable to serve. This service shall not constitute his term as President. In case both the President and President-Elect are unable to serve, the most immediate Past-President who is willing to serve shall serve as interim President until new officers are elected by the members.

ARTICLE VII—Standing Committees

Section 1. There shall be eight standing committees: Program, Finance, Resolutions, Local Arrangements, Nominations, Public Relations, Placement and Nominations of Fellows and Honorary Members, appointed by the President with the advice and consent of the Executive Committee.

Section 2. The Program Committee shall consist of the President-elect as Chairman, the two Section Chairmen and such other members appointed by the Program Committee Chairman as required to give all phases of weed science adequate representation.

Section 3. The Finance Committee shall consist of a Chairman and two members. Terms of these committee members shall be established to expire alternately so that at least two members continue over each year.

Section 4. The Resolutions Committee shall consist of a Chairman and two additional members. Term of office of this committee shall be three years, established to expire alternatively so that at least two members continue over each year. The member serving his second year of the term shall serve as Chairman.

Section 5. The Local Arrangements Committee shall consist of a Chairman and others as needed. They shall be appointed from coming meeting site area.

Section 6. The Nominating Committee shall consist of a Chairman and two members. Terms of this committee shall be as in Section 4 above.

Section 7. The Public Relations Committee shall consist of a Chairman and others as needed. Terms of office of this committee shall be at the discretion of the President.

Section 8. The Placement Committee shall consist of a Chairman and two additional members. Terms of this committee shall be as in Section 4 above.

Section 9. The Committee for Nominations of Fellows and Honorary Members shall consist of the three most immediate Past-Presidents of the Society. The member who is service his second year on the committee shall serve as Chairman.

ARTICLE VIII—Dues

Section 1. The amount of dues and the method of collecting such dues shall be determined by the Executive Committee.

Section 2. In the event of the dissolution of the Western Society of Weed Science, the physical assets shall be sold and after payment of all debts, moneys possessed by the Society shall be given without let or hindrance to agricultural education institutes in the states listed in ARTICLE I, Section 1, by the Executive Committee holding office at the time of dissolution.

ARTICLE IX—Meetings

Section 1. Meetings shall be held at such times and places as may be determined by the President in consultation with the Executive Committee.

ARTICLE X—By-Laws

Section 1. The Conference may adopt By-Laws.

ARTICLE XI—Amendments

Section 1. The constitution and By-Laws may be amended by majority vote of the members present at any regular meeting.

BY-LAWS

ARTICLE I—Duties of Officers

Section 1. The President shall be the executive officer of the Society. He shall act as Chairman of the Executive Committee, carry out the spirit of the constitution and the decisions of the Executive Committee, prepare agenda and preside at all meetings of the Society and Executive committee, appoint designated officers and committees and perform other usual duties of that office. He may confer, if in his opinion, a member of the Society has demonstrated distinguished service, the Presidential Award of Merit. This Award will be presented solely at the discretion of the President.

Section 2. The President-elect shall perform the duties of President if he cannot serve, serve as Chairman of Program Committee, develop program outlines of the Society meetings, assign responsibilities to Program Committees to prepare the programs, issue calls for papers and advise Executive Committee of program status one month before the meeting and present a copy of the program to the Business Manager for publication.

Section 3. The Secretary shall prepare minutes of Society and Executive Committee meetings, prepare and maintain an up-to-date list of officers including Executive Committee, all standing committees and special committees, perform other duties when designated by the President.

Section 4. The Treasurer-Business Manager will receive and dsiperse monies of the Society in accordance with prescribed policies, maintain financial records and records of property, prepare records for annual audit and meet with designated auditors, maintain supplies of Proceedings and Research Progress Reports, receive and fill orders for above publications and collect payments for same, maintain standing orders and mailing lists for distribution of publications, arrange for and consumate publications for the Society.

ARTICLE II—Duties of Standing Committees

Section 1. The Program Committee shall develop the program for the meetings of the Society. The President-elect who is Chairman, shall delegate duties to members as he deems advisable (see duties of President-elect).

Section 2. The Finance Committee shall analyze the financial condition of the Society and recommend, if needed, immediate and long-range plans for sound growth of the Society, recommend budget policies, recommend policies regarding registration fees and prices of publications, audit the financial accounts at least annually and make a report to the Society.

Section 3. The Resolutions Committee shall develop resolutions and recommendations regarding the general field of weed science within the Society area and put into writing important recommendations that the Society should promote and encourage; they shall report to the annual meeting.

Section 4. The Local Arrangements committee shall make all arrangements in all matters pertaining to the meeting place. They shall contact Chambers of Commerce or Convention Boards of the city chosen for the conference, choose an adequate hotel, make recommendations to Executive Committee, get agreement of hotel to sponsor no other conventions or competing activities during meetings, reserve meeting rooms, estimate costs, arrange for registration at meetings, name tags, typewriters, receipts, cash box, etc.

Section 5. The Nominations Committee shall nominate at the annual meeting candidates for the offices of President-elect, Secretary, Chairman-elect of the Research Section, Chairman-elect of the Education and Regulatory Section and WSSA Representative when necessary. Such candidates shall be contacted and cleared as set forth in Article VI of the Constitution.

Section 6. The Public Relations Committee shall take every feasible opportunity to inform the scientific community and the general public of the activities and benefits of the Society and of weed science in general. Any statement which may be construed as reflecting policy of the Society should be approved by the President before release.

Section 7. The Placement Committee shall provide at each annual meeting of the Society a registration service to make information available to potential employers and employees in cooperation with the Weed Science Society of America.

Section 8. The Committee for Nominations of Fellows and Honorary Members shall prepare nominations for these awards under the provisions of Article III, Section 3 of the Constitution, and Article V, Sections 1 and 2 of the By-Laws. They shall prepare biographical data for publication in the Proceedings and shall work with the Public Relations Committee in preparation of news releases concerning the award recipients.

ARTICLE III—Duties of the Section Chairmen

Section 1. The Chairman of the Research Section shall organize sectional and project meetings of those engaged in research in the Society to exchange information and ideas and for improvement of research in weed science. He shall solicit and assemble abstracts of Research Progress Reports from research workers for publication by the Society each year. The Chairman may delegate to the Chairman-elect part of his duties as may be wise.

Section 2. The Chairman of the Education and Regulatory Section shall organize sectional meetings of those engaged in this phase of weed science in the Society for exchange of information and improvement of the work. He shall solicit program reports of education and regulatory work in weed science for publication in the Society Proceedings. The Chairman may delegate part of these duties to the Chairman-elect.

Section 3. The Chairman-elect of each of these Sections may attend Executive Committee meetings but cannot vote.

ARTICLE IV—Publications

Section 1. Proceedings and Progress Reports will be published for each annual meeting. Publications will consist of reports and papers to be given at the meetings, reports of the Standing Committees and special committees, minutes of the business meeting and Progress Reports from the two Sections. Research Progress Reports shall be available at the annual meeting. Other publications may be authorized from time to time by the Executive Committee.

ARTICLE V—Fellows and Honorary Members

Section 1. Fellows of the Society are members who have given meritorious service in Weed Science, and who are elected by two-thirds majority of the Executive Committee. Not more than two Fellows shall be selected each year. A cumulative list of Fellows shall be published each year in the Program and in the Proceedings.

Section 2. Honorary Members shall be selected as set forth in ARTICLE III, Section 3 of the Constitution. A cumulative list of Honorary Members shall be published each year in the Program and in the Proceedings.

Section 3. Persons selected as Honorary Members prior to 1974 shall continue to receive publications of the Society. They shall be listed annually in the Program and in the Proceedings under the heading, Fellows (formerly Honorary Members).

ARTICLE VI—Rules of Order

Section 1. Business at all regular meetings of the Society shall be conducted according to Robert's Rules of Order.

ARTICLE VII—Quorum

Section 1. All members of the Society in good standing who are present at any regular meeting shall constitute a quorum.

ARTICLE VIII—Authorization

Section 1. The adoption of this Constitution and By-Laws shall render null and void all previous rules and regulations of this society.

FELLOWS OF THE WESTERN SOCIETY OF WEED SCIENCE

Fellows (formerly Honorary Members)

Robert B. Balcom, 1968

Walter S. Ball, 1968

A. S. Crafts, 1968

F. L. Timmons, 1968

D. C. Tingey, 1968

Lambert C. Erickson, 1969

*Jesse M. Hodgsen, 1969

Lee Burge, 1970

Bruce Thornton, 1970

Virgil H. Freed, 1971

W. A. Harvey, 1971

H. Fred Arle, 1972

Boysie E. Day, 1972

Harold P. Alley, 1973

K. C. Hamilton, 1973

Fellows

William R. Furtick, 1974

Oliver A. Leonard, 1974

Richard A. Fosse, 1975

Clarence I. Seely, 1975

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*Deceased

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