here. Variables are in effect, however, in all regions, so that the alert CA will be able to relate these differences to his area and the chemicals he uses; matching this with his own experience, he will gain valuable insight into his profession.

Chemicals used for soil sterilization can be divided into two large categories: inorganic, those compounds not containing carbon; and organic, those with the element carbon in the molecule.

Inorganic: Arsenic

Arsenic trioxide, As_2O_3, is the natural compound, long known for its poisonous properties, by which toxicity of arsenic compounds is gauged; As_2O_3 is the active ingredient. Since this chemical is relatively insoluble in water, it can be applied only in granular form to weeded areas in regions of low rainfall, such as the West. It gives long-term vegetation control. At approximately 800 pounds active ingredient per acre, arsenic trioxide will give excellent control of annual weeds for several years. Arsenic trioxide is partly absorbed by stems and leaves; mainly it is leached by rainfall to root areas where it is absorbed by roots. When sufficient herbicide accumulates in the plant's tissues, it dies.

Sterilizing sandy soils with arsenic trioxide is most efficient because the chemical is more available to plants. Greater amounts of arsenic trioxide are needed for heavy soils with high humus or clay content. In regions of high rainfall the longevity of arsenic is decreased by microbial decomposition.

Sodium arsenite, Na_2AsO_3, is produced when arsenic trioxide is reacted with sodium hydroxide, NaOH(lye). Sodium arsenite is more water soluble than arsenic trioxide and can be applied in a spray form. It has had a wide use in both selective and nonselective terrestrial and aquatic weed control. Because of its mammalian toxicity, however, its usefulness is waning. Other herbicides will perform the same job more safely and efficiently.

Inorganic: Sodium Chlorate

Sodium chlorate, $NaClO_3$, is an effective soil sterilant with sufficient contact action to give foliage kill when applied as a spray. It is most useful for deep-rooted perennials, and is carried into the root zone by rain or leaching. If there is excess nitrate in the soil, killing action is reduced.

Therefore effective soil sterilization is dependent upon fertility of the soil. Excess nitrogen adversely affects the action and persistence of sodium chlorate in the soil, possibly because of the abundance of soil microorganisms.

Sodium chlorate is highly soluble in water which makes it possible to spray. A wetting agent or detergent increases its toxic action.

A drawback which makes this herbicide less desirable than others is that it is a powerful oxidizing agent and will ignite like a match if left to dry when on organic matter such as dry grass or clothing. It is said that the heat of the sun will ignite it. It is easy to extinguish with water but cannot be smothered because the chlorate carries with it its own oxygen in the molecule. There is no danger from pure or wet sodium chlorate. It will not burn or explode. Organic matter is necessary.

Compounds which absorb moisture, such as nonherbicidal calcium chlorate, are sometimes added to sodium chlorate to reduce this fire hazard. Borates are also combined with sodium chlorate for added protection against ignition. Sodium chlorate forms an essential part of such herbicide mixtures as "Chlorea," "Polyborchlorate," "Chlorax," and "Terratox."

Inorganic: Boron Compounds

Sodium borate, $Na_2B_4O_7$, is the anhydrous form (does not carry any H_2O with its molecule) of borax. It is a slowly leached, nonflammable, noncorrosive compound with low toxicity, which can be applied only in dry form. Three to 12 pounds per 100 sq. ft. will give sterility. Since borax is slowly leached and is not affected by soil microorganisms, it lasts about one year in moist warm soils, the most adverse conditions for a soil sterilant. Repeat applications the following year can be halved to maintain control.

To get a sprayable form of borax, hydrated forms are used. Sodium tetraborate, $Na_2B_4O_7 \cdot 10H_2O$, is more soluble than the anhydrous form. Disodium octaborate, tetrahydrate, and sodium metaborate are usually mixed 3 to 1 with sodium chlorate and eliminate the fire hazard of the latter chemical.

Solubility of borates is influenced by hydration. Hydrated forms of sodium pentaborate and sodium metaborate all have their uses in combination with other herbicides such as monuron, sodium chlorate, 2,4-D, and polychlorobenzoic acids.

Toxicity of borate to plants is related to clay content or texture of soils, whereas previously discussed herbicides depended upon nutrient content or fertility. The more clay in a soil, the more difficult it is to get satisfactory results.

As mentioned previously, borate persistence in the soil apparently stems from the chemical's inherent

Roadways inside industrial parks must be kept weed free. This sprayman uses a truck-mounted boom for accessible, level areas; a small sprayer for the hard-to-reach slopes.

This article was prepared by the technical staff of Weeds and Turf, *and reviewed by major suppliers and university researchers.*

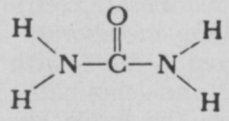
resistance to soil microorganisms which normally decompose or digest herbicides and make them nontoxic to plants. Additions of borates to other herbicides also increase their longevity in the soil, by inhibiting decomposition by soil organisms.

Organic: Substituted Ureas

There are four major substituted urea compounds, decreasing in solubility as follows: fenuron, monuron, diuron, and neburon. The two center compounds are selective herbicides commonly used at sufficiently high rates to act as nonselective chemicals and sterilize soils.

Fenuron, 3-phenyl-1,1-dimethylurea, is the most soluble of the four urea compounds. Its use is mainly for deep-rooted perennial and woody plant control. It is somewhat selective in this respect. We mention this compound because it illustrates how chemical researchers can work with a group of compounds and come up with several which appear to be similar, yet differ sufficiently to have slightly varied applications.

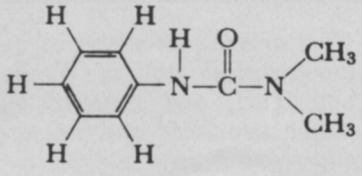
Urea is normally a nitrogen-furnishing fertilizer component. It looks like this:



urea

The C represents the element carbon; N, nitrogen; O, oxygen; and H, hydrogen. Lines between the atoms or elements represent the electrical bonds or links which hold the atoms together in a molecule.

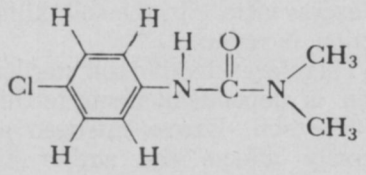
By a process known as substitution, chemists react urea, to which two methyl groups (CH_3) have already been substituted on the right end (1,1 position), with another chemical containing benzene, the hexagonal-shaped "phenyl" group. Researchers are thus able to produce a molecule where a phenyl group has replaced one atom of hydrogen. This is



fenuron

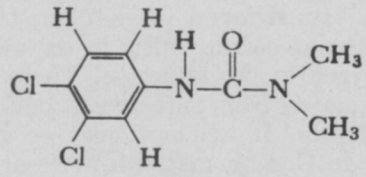
fenuron. The benzene ring which contains 1 carbon atom at each of the six corners and, normally 6 hydrogen atoms, is usually represented as an ordinary hexagon. The extra single lines also represent electrical bonds which hold the molecule together.

Monuron, 3-(4-chlorophenyl)-1,1-dimethylurea, is less soluble than fenuron. Ten to 50 pounds of active monuron per acre will control must vegetation. Monuron, like the rest of the substituted urea compounds, has a built-in resistance to decomposition under normal conditions. "Mono-" refers to the substitution of one chlorine atom on the phenyl group. The monuron molecule looks like this:



monuron

Diuron, 3-(3,4-dichlorophenyl)-1,1-dimethylurea, has the substitution of 2 atoms of chlorine; thus di-uron. It is even less water soluble than monuron. For this reason, it is preferred for soil sterilization at about 10 to 50 pounds active per acre in areas where there is more rainfall, and light sandy soils because it leaches less readily. Following the chemical substitution reaction, the original urea molecule has been transformed to:



diuron

Both monuron and diuron are absorbed by roots and are translocated to all parts of plants. Research indicates that the substituted ureas interfere with photosynthesis. Some workers feel that these herbicides prevent release of oxygen. This is a partial explanation of what causes death of weeds with substituted urea compounds.

Organic: 2,4-D Type Compounds

Fenac, 2,3,6-trichlorophenylacetic acid, is a growth regulator like 2,4-D, but is proving to be a longer lasting herbicide with special uses against perennial weeds.

Fenac is dependent upon rainfall for distribution throughout the soil where it has a contact effect on roots and germinating seedlings. Although it is one of the more persistent of the 2,4-D types, it requires repeated application for complete vegetation control. Rates of 15 to 30 pounds per acre will give soil sterilization.

Erbon, 2-(2,4,5-trichlorophenoxy)ethyl 2,2-dichloropropionate, is one example of organic synthesis where the molecules of two efficient weed killers, 2,4,5-T and dalapon, are combined into one large molecule with soil sterilant properties. Erbon is only slightly soluble in water and is available as an emulsion for use in water, or it can be applied in oil.

Applied as a spray at rates of 120 to 160 pounds of active ingredient per acre, it will eliminate all vegetation, and give extended control of germinating seeds.

Erbon does not move laterally on the soil as much as most herbicides and thus can be used with greater safety on smaller areas such as driveways around lawns where desirable vegetation is growing nearby.

Chlorobenzoic acids such as TBA, 2,3,6-trichlorobenzoic acid, and PBA, polychlorobenzoic acid, are effective soil sterilants at rates of 15 to 30 pounds per acre and 30 to 60 pounds per acre respectively.

They are especially effective against deep-rooted perennial weeds at these high rates.

TBA is the most potent of the possible chlorine-substituted benzoic acids. Depth of penetration depends upon rainfall and soil type, but the chlorobenzoics are persistent in the soil.

The same precautions must be taken when using these materials as with 2,4-D, namely avoidance of drift, and caution regarding the proximity to desirable species.

Tritac, 2,3,6-trichlorobenzyloxypropanol, is a new nonselective herbicide that will be available for the first time this season. Again the "2,3,6- trichlor" configuration should be noted. It is being recommended for deep-rooted perennials and will provide complete vegetation control at rates of 10 to

(*Continued on page W-30*)

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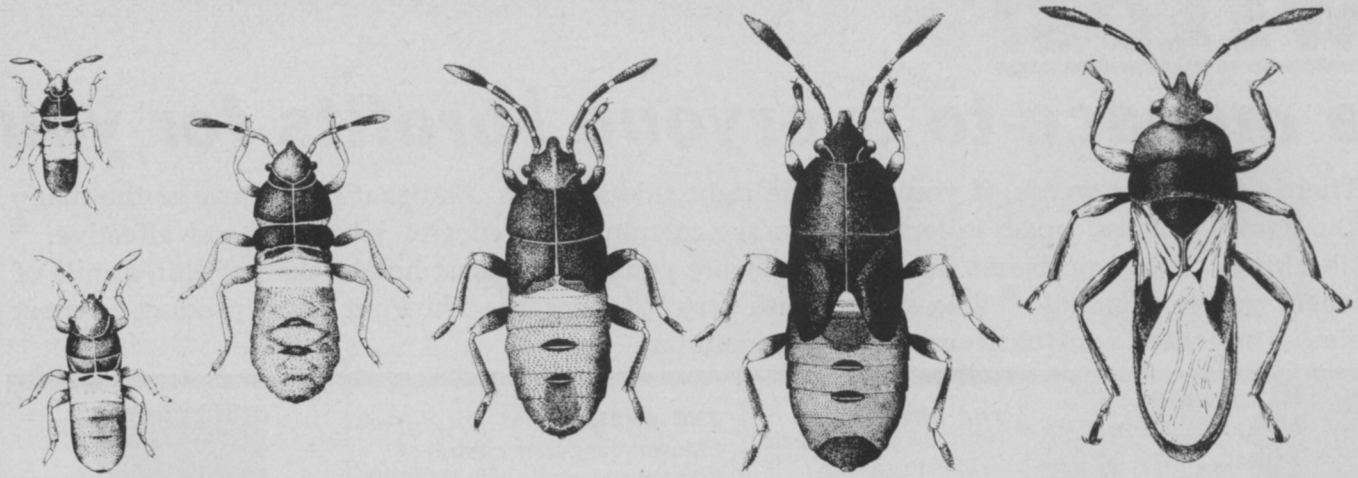


How the chinch bug develops. Note gradual loss of immature white band through growth of wing pads. Each stage gets darker, from original nymphal red to adult black. Nymphs are most damaging.

How to Identify and Control Insect Pests in Turf

Part 2

This is the conclusion of an original research article prepared by the technical staff of Weeds and Turf, *in cooperation with state experiment stations around the country. Part I, which appeared last month, discussed basic principles of insect control in turf, and dealt specifically with beetle grubs, miscellaneous beetles, and sod webworms. Ed.*

Other Moth Lawn Pests

Family Phalaenidae of the moth and butterfly order foster a number of agricultural and horticultural pests known collectively as cutworms.

Armyworms are very destructive and widespread larval moths of the cutworm family. Adults are pale brown to buff, night flying, nectar feeders, with one small white spot in the center of each front wing. The species designation *unipuncta*, meaning "one spot", is one way of remembering this pest, *Pseudaletia unipuncta* (Haworth).

Chinch bugs reveal themselves by floating to top of water in bottomless can which has been inserted into edge of infested area and filled

Wingspread is about 1½ inches. Females lay eggs, from 25 to 100, in folds and under grass leaves. One female may lay as many as 2,000 eggs a season. Small greenish larvae hatch in about 10 days. Maturation takes 3 to 4 weeks; greenish brown, longitudinally striped larvae, 1½ inches long, pupate and emerge as adults after 12 to 14 days pupation. There may be 3 broods a year in northern states; in the South, different life stages can be found in soil year around.

Larvae hide in litter on the soil and in crowns of plants during daytime. Night and evening (and cloudy day) feeding results in grasses being chewed off completely. When food supplies are exhausted in one area, armyworms band together and march off to greener pastures. From this habit they get their common name.

Recommended control chemicals are chlordane, dieldrin, heptachlor, toxaphene, DDT, and Sevin. Chlordane, dieldrin, and heptachlor follow sod webworm dosages (⅓ pound active ingredient dieldrin or heptachlor per 5000 square feet; 9 ounces active chlordane per 5000 square feet). Sevin is applied in both the North and South at 1 pound active per 5000 square feet.

Toxaphene and DDT are the main munitions against the fall armyworm, *Laphygma frugiperda* (Smith), in Florida. This species, often called the green grassworm, is more bothersome and more frequently encountered on cultivated turf.

Larvae of fall armyworms resemble true armyworms but have a prominent inverted white "Y" on the front of the head, and longer hairs arising from black tubercles on the back. On the true armyworm, these spots and hairs are less conspicuous. Adults have dark-gray mottled forewings and grayish-white hindwings. In habits and life cycle, the fall armyworm resembles the true armyworm. Toxaphene and DDT are applied at the same rates as prescribed for sod webworms.

A number of additional species in the family Phalaenidae are capable of doing extensive damage to turf. These are cutworms.

Professor Andrew S. Deal, of the University of California at Riverside, told *Weeds and Turf*: "Cutworms have been more prevalent in dichondra lawns (a favorite in southern California) during the past five years than they were previously. Many lawns have been damaged before the owners realized that cutworms were present."

Cutworms are similar in form and size to the moth species described previously; they differ mainly in coloration and pattern-

ing. Other members of the family are called loopers and underwings. Chemical control measures are the same as for armyworms. Control on dichondra lawns is best using DDT or toxaphene. The same pyrethrum test may be made for all Phalaenids, and chemicals should be applied in late afternoon, if possible, because insecticides will then have greatest effectiveness against these night feeders.

Chinch Bugs

The chinch bug is the greatest offender among those insects which suck plant juice. Nymphs, which account for greatest damage, are colored a bright red with a white band across the back. Infested areas show up as brown dead areas, sometimes just a foot or two in diameter. If left unchecked, a whole lawn may be destroyed. In the North, bentgrass is most susceptible; in the South, St. Augustine is damaged most heavily.

As nymphs mature they become darker in color; development takes 30 to 40 days. Adults are 1/6 to 1/5 inch long (not as long as some blades of grass are wide) and black. Each white wing cover is marked with a black triangle on its outer margin. Some of the immature red coloration is retained on the legs.

At least two forms of chinch bug are bothersome in United States. The hairy chinch bug, *Blissus leucopterus hirtus* (Montandon), a short-winged form, is a pest in the northeastern states, while *Blissus leucopterus insularis* (Smith), the lawn chinch bug, is prominent and damaging in the South. *B. leucopterus*, although distributed throughout the Mississippi Basin, is not listed as a turf pest by Indiana, Kansas, or Iowa, nor is its damage accounted in California and other states west of the Rocky Mountains.

"The lawn chinch bug is acknowledged by entomologists to be the major turf pest in all the Gulf States except Texas," reports Professor Kerr from Florida. He further states that the chinch bug is "evidently resistant to DDT in much of Florida and to parathion in some 'hot spots.' Other organic phosphorous insecticides and carbamates can control these populations."

When asked about insect resistance, Professor Milton G. Savos of the University of Connecticut at Storrs replied to *Weeds and Turf* that in his area controllers have encountered "no problem with resistance with the possible exception of the chinch bug to chlordane, dieldrin and DDT."

In Florida, in addition to chlordane, dieldrin is ineffective against *B. leucopterus insularis*, according to Professor Kerr.

Chemicals usually recommended in the Northeast for chinch bugs are chlordane at 1¼ pounds active, diazinon at 7½ ounces active, dieldrin at ⅓ pound active, and Sevin at 1 pound active, all per 5000 square feet,

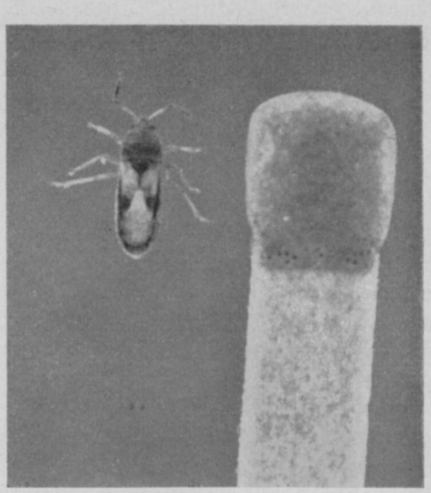
Munitions used against *B. l. insularis* in Florida's program are parathion, from 2 to 4 pounds active ingredient per acre; diazinon, from 4 to 8 pounds active per acre; V-C 13, maximum of 3 pounds active per 5000 square feet; Trithion, at 12 ounces active per 5000 square feet; and Ethion, at about 1 pound active chemical per 5000 square feet. The most recent addition to recommendations for Florida spraymen is ASP-51 (Stauffer), to be used at 10 pounds active ingredient per acre.

Although Zytron, the pre-emergence crabgrass killer, has not yet been registered for insect control, tests have shown it effective against chinch bugs in Alabama.

Easy Chinch Bug Test

In order to make a proper diagnosis of a lawn ailment, a test similar to that mentioned for webworms and cutworms should be made. To make this test, cut both ends out of a large can (a 2 pound shortening can will do). Force this can into the soil 2 to 3 inches deep at the edge of an area which appears to be damaged. Fill the can with water and wait about five minutes (you may have to add more water). If chinch bugs are there, they will float to the top of the water and can be positively identified. In addition to identifiable body characteristics, chinch bugs give off a vile odor when crushed.

As a postscript on chinch bugs, it should be mentioned that fertilization with soluble nitrogen may assist chinch bug development just as it assists grass development. Workers in Florida suggest that heavy nitrogen fertilization be held up until fall to discourage chinch bug population explosions.



Size of adult chinch bug as compared to paper match head. Adult chinch bug is 1/5 inch long.

Other Lawn Pests

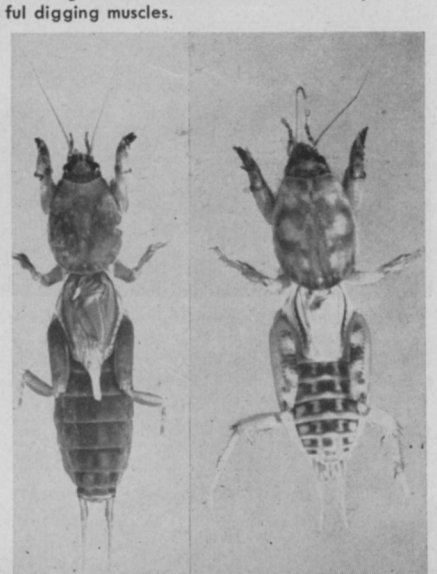
Clover mites (Tetranychidae) may inhabit lawns in some areas where there is plenty of moisture in the soil. Mites are usually noticed by homeowners when they move indoors during cooler weather. Someone reporting mites would probably describe them as "small, moving red spots." They are typically less than 1/30 inch long, and red.

According to a bulletin prepared by Dr. Harold Gunderson of Iowa State University: "On approach of cold weather . . . it is the search for protective sites for oviposition, molting, and hibernation that leads clover mites to accidently enter buildings and become a nuisance."

Removal of an 18-inch strip of grass around the foundation (if

(*Continued on page W-26*)

Immature mole crickets of the genus Scapteriscus do just as much damage as adults. Note reduced wings, naked abdomen, expanded front legs and broad thorax which houses powerful digging muscles.



"Record Attendance at 16th Southern Conference Proves Industry Growth," Holstun Tells Weedmen Gathered in Mobile, Jan. 16-18

"This all-time attendance record is an excellent example of the remarkable growth of the weed control industry," Dr. J. T. Holstun, president of the Southern Weed Conference, enthused at the group's 16th annual conference.

A precedent-setting 600 delegates flocked to the Admiral Semmes Hotel in Mobile, Ala., for the three-day convention, Jan. 16-18. Speakers from 26 states presented some 115 papers, covering research and developments in all phases of weed control. All sections of the nation and the industry were represented; Hawaii was the most distant state from which applicators traveled.

H. E. Rea, associate professor at the A & M College of Texas, College Station, reported Banvel D experiments on various broadleaf species, tested in the fall of 1961 and spring of 1962.

Analyzing results on a dense stand of second growth curly dock, treated at 3, 6, 9, and 12 lb., in 150 gallons of water per acre, Rea told the weedmen that top kill was complete in 10 days, except for a 2% survival following the 3 lb. treatment. Moderate resprouting and general reinfestation from seedlings occurred in less than 5 months on the 3 and 6 lb. plats. "No sprouts and only sparse seedling emergence occurred on the other plats," Rea revealed.

Noting the importance of climatic conditions, Rea told delegates that when collars of trumpet creepers were drenched with 8 lbs./100 gal. water of Banval D, treatment was not effective until a rainfall, several weeks later. "When the rains came, the tops of most of the trumpet creepers died," Rea reported. "However, considerable resprouting from surviving roots occurred before the end of the season."

Top of silverleaf nightshades were killed with a semibroadcast application of 16 lb./100 gal. Banval D, and within 6 weeks soil in the treated spots was bare.

Smutgrass, Mugwort Reviewed

Smutgrass has become a serious invader of improved pastures in peninsular Florida, scientists from that state's Agricultural Experiment Station warned weedmen at the conference.

In studies made in Ona, Fla., agmen found that dalapon, a water-soluble herbicide, will kill 85% or more of the unwelcome grass. An overall application of 5 lbs. per acre or 5 lbs. active/100 gallons of water for spot treatment were both found to be effective.

"Mugwort is a vulgar little plant that has incurred the displeasure of all of us," Dr. S. W. Bingham, Virginia Polytechnic Institute's plant pathology and physiology department member, said in introducing his subject.

Most promising controls, from tests of 25 chemicals and chemical solutions, are Fenac and Banval D, Bingham disclosed. "Used in the early stages of growth, a single treatment of either gave very good control not only of roots, but of underground stems as well," Bingham concluded.

2,4,5-T Control Effectiveness

"Newer chemicals have come along, but 2,4,5-T is still the standard control for woody plants," John P. Sterrett, of the Virginia Polytechnic Institute department of plant pathology and physiology, affirmed.

Two most common measures are the stem broadcast method, where all stems and branches are sprayed with a special effort made to cover the root collar, and broadcast basal method, covering the lower one-third of each main stem and root collar.

"Year-round spraying is thus possible," Sterrett claims, "and reduces cost of labor and equipment, although these methods cost about the same as summer foliage applications." Spraying in areas where susceptible crops are grown is feasible because spraying can be done before most crops are planted, Sterrett advises.

Although both methods are about equally effective, the lower chemical and labor cost of the broadcast basal method tend to make it more desirable in most operations, the researcher concludes.

"Oils alone, and the same oils in water emulsion, were practically equal in effectiveness as diluents for 2,4,5-T herbicide that was aerial-sprayed," Harry M. Elwell, research agronomist with the Oklahoma agricultural experiment station, revealed to the more than 600 weed and turf specialists.

"Although there was little measurable difference between oil alone and the same oil in emulsion form, there was a trend of greater defoliation with oil only," Elwell determined, and noted that the same trend has been reported by other researchers conducting brush control tests, under somewhat different conditions, in other states.

"Other sprayer components exist

Outgoing president of the Southern Weed Control Conference, Dr. John T. Holstun, extreme right, told newly elected officers of their responsibilities. Shown (l to r) are: president-elect R. F. Richards, Geigy Chemical Co., Orlando, Fla.; vice president R. E. Frans, University of Arkansas, Fayetteville; and secretary-treasurer Henry Andrews, University of Tennessee, Knoxville.

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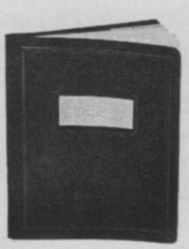

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First scholarship recipients, receiving awards from Dr. John Baker, Louisiana State University, chairman of the Conference Student Interest Committee, were (l to r): H. R. Bayless, University of Tennessee, third place winner; A. B. Rogerson, second place winner from Virginia Polytechnic Institute; and N. D. Camper, North Carolina State University student who received the $500 first place award in the essay contest.

only that the nozzles may be operated properly," Glenn C. Klingman, North Carolina State College, Raleigh, stated forcefully in his account of an "ideal" nozzle.

Many alleged *herbicide* failures are actually *equipment* failures, Klingman believes. In describing the "ideal" nozzle, he noted that it would apply the spray:

— uniformly under usual operating conditions;

— with little or no spray drift;

— at a low gallonage per acre when uniformity of application is the only need;

— with clogging reduced to a minimum;

— at low pressures to reduce spray drift, reduce pump wear, and cost of hoses required; and

— resist both chemical and abrasive corrosion, maintaining spray pattern and rate of discharge over extended periods of operation.

"These requirements can now be met with hollow cone, 'whirljet,' or 'nonclog' nozzles," Klingman concluded, "that have spray angles varying from 50° to 130°."

Recent observations of soil treated with herbicides and stored at various controlled temperatures revealed that effectiveness of the herbicides decreased with the warmer temperatures, Florida Agricultural Experiment Station scientists reported.

Under summer field conditions, researchers disclosed that herbicides tested were inactivated in less than seven weeks. This was not the case, however, in the winter or spring when temperatures were low.

Tennessee Valley Authority spokesmen D. C. Francisco and J. R. Aldred, Chattanooga, Tenn., confirmed this theory when they advised spraymen to apply soil sterilants in April or May.

Although various formulations of 2,4-D and related hormone-type herbicides have become the most generally accepted means of killing roadside vegetation, there are many factors which limit the use of these controls, U.S. Borax's V. W. Woestemeyer, research agronomist, informed the weedmen.

Handicaps include the several species that cannot be controlled with this type of herbicide, resprouting of many weeds and the susceptibility of adjacent crops and ornamental plants to damage from drift or volatility, Woestemeyer explained.

"The most promising material U.S. Borax is presently investigating is a product containing 8% trichlorobenzoic acid," Woestemeyer related.

Optimum range in application rates was 275 to 400 lbs. per acre. Initial symptoms of toxicity resulting from treatments consisted of damage to the foliage or complete defoliation, Woestemeyer claims. In some cases, defoliation was followed by the emergence of new foliage exhibiting severe toxicity symptoms.

"There is no doubt that chemicals provide the most desirable right-of-way control," James F. Jones, maintenance supervisor for First Electric Cooperative Corp., Jacksonville, Ark., told conference delegates.

In comparing chemical control methods with hand clearing and bulldozing operations, all of which First Electric utilizes to maintain its 3,100 miles of electric distribution lines, Jones concluded:

"Records and statistics to date show that chemical control, where applicable, is by far the most desirable method to use from both the economical and effective standpoint. But my experience indicates that no one method will meet all requirements. Methods should be adapted to local conditions."

"Original stump treatment in 1954 resulted in an 81% kill," R. A. Mann, from the TVA, disclosed in his discussion of stump treatment methods on rights-of-way for the Tennessee Valley Authority. "Cost then was $57 per acre, but in the last 5 years we've treated more than 12,500 acres, with an average cost of $65 per acre.

"So far, the lines we've treated have not needed any re-treatment for at least 3 years," Mann concluded.

"Air Blast" Sprayer Improves RR Right-of-Way Weed Control

A specially designed air blast sprayer, resembling an orchard mist blower, is being successfully used by the Illinois Central Railroad, D. H. Yazell told conference attendants.

F. E. Myers & Bro. Co. manufactured the machine for the Industrial Herbicides Corp., Memphis, Tenn. The device is powered by a fan driven at about 1,600 rpm by a 4-cylinder air-cooled engine, operating at close to 2,000 rpm.

"Initial air blast velocity is about 115 mph," Yazell pointed out, "but the force is almost completely dissipated within 80 to 90 ft."

Nozzles in front of the spray bonnet direct the mixture into the air blast at pressures up to 50 lbs. per sq. inch, Yazell disclosed. Solenoids, controlled by electrical switches, operate air-actuated valves which open and close material valves leading to the nozzles.

"Pressure is controlled by an air-motor control on the throttle, through an automatic pressure control device," Yazell revealed. Machine, installed on a regular Illinois Central brush spray car, is equipped with a speedometer, and speed is closely checked from both the engines and the spray car. Directions are relayed to the engines by radio.

"In one of our first test runs, we found that nearly all the leaves, stems, and branches in the sprayed swath were completely covered," Yazell reported. Moreover, experience confirms that the design

(*Continued on page 29*)

TURF:

One application of dieldrin controls major turf pests for an entire season

Dieldrin controls soil insects such as Japanese beetle grubs, white grubs, sod webworms and ants. These insects feed on grass roots, cut off nourishment and moisture and cause browning and bare spots.

Dieldrin also controls annoying, health endangering surface pests such as ticks, fleas and chiggers. Here are the details.

Now is the time to size up your turf insects problem and do something about it.

If you cannot start healthy, vigorous grass growing in certain areas, or if you have bare patches, soil insects could be the cause.

Turn up some sod in these trouble spots and sift through the dirt. See if you don't find grubs or some other evidence of soil insects.

Long-lasting dieldrin protection

If these soil insects are your problem, you can control them with dieldrin.

A single application lasts for a year or more. It protects roots—lets them utilize maximum nourishment and moisture.

Dieldrin can be applied in a number of ways. It can be sprayed on as a liquid or applied in granular form with a fertilizer spreader. Dieldrin is also available in fertilizer mixtures. This lets you combine the two operations and saves time and money.

Controls ticks, fleas and chiggers, too

Dieldrin also controls ticks, fleas and chiggers. These pests are not only annoying, but also are public health problems.

In addition to applying dieldrin to turf, to get maximum control of these above-ground pests, treat weeds, the ground around low-growing shrubs and buildings—anywhere these pests might take refuge.

Where to get dieldrin

Dieldrin is available from your local insecticide dealer under many well-known brand names. Accept no substitute. Check the label or the ingredient statement on the formulation you buy for the name *dieldrin*.

Shell Chemical Company, Agricultural Chemicals Division, 110 West 51st Street, New York 20, New York.

Control all these turf pests with dieldrin

European chafer grubs	Cutworms
Green June beetle grubs	Sod webworm
White grubs	Armyworms
Northern masked chafer grubs	Sowbugs
	Pillbugs
Asiatic garden beetle grubs	Snails
Oriental beetle grubs	Wireworms
Japanese beetle grubs	Root maggots
Earwigs	Slugs
Ants	Chiggers
Striped grassworm	Fleas
Mole crickets	Ticks

SHELL

dieldrin

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California Weedmen Focus on Application at 15th Annual Conference in Santa Barbara

By VINCENT H. SCHWEERS

Farm Advisor, University of California Agricultural Extension Service, Visalia

A welcome note of practicality which weedmen can put to work in the field highlighted the 15th Annual California Weed Conference, Santa Barbara, Calif., Jan. 22-24.

Sponsored by the University of California, the State Department of Agriculture, and participating chemical manufacturers, the conference drew 455 registrants. Many of these, both in the audience and on the podium, were contract applicators.

This "down-to-earth" character was proclaimed by conference president Charles C. Siebe, who said in his keynote address that he hoped the annual assembly would prompt delegates to new accomplishments in applied weed control.

A formidable array of talks followed, including sessions on vacant lot weed control, choice of spray equipment, new methods in brush control, and a special seminar on "What's new in weed control chemicals."

City Vacant Lot Program

Contract applicator Ron Burk, Chem-trol Company of Arlington, California, discussed the vacant lot program in his area.

One of the main problems, he said, is that city ordinances often prohibit the application of chemicals or sprays in the city. Sprays have advantages over discing or burning because they eliminate dust and smoke.

Contract applicators must contact the lot owner directly to sell the chemical treatment. The city burns or discs the weeds when they feel they are a hazard, and adds the cost to the taxes on the lot.

Combinations of chemicals are usually used on the lots sprayed. Usually chemicals are applied as a yearly maintenance treatment. Two pounds of atrazine and two gallons of trichlorobenzoic acid per acre has given good control, Burk said. When weeds are present, 2 lbs. of Amitrole is added as a knockdown treatment.

If weeds are established, after the usual rainy season is over, sprays of 7 to 8 lbs. dalapon plus 1 qt. of 2,4-D per acre are used with good results. Weed oil, or Amitrole, is used where 2,4-D is not safe and where the oil stains are not objectional, the Californian elaborated.

On lots, industrial sites, or open areas where longer control is desired, Burk said he uses 4 to 5 lbs. of Simazine and 2 gallons of Fenac per acre.

There is no one-shot weedkiller for ornamentals to do all the jobs desired, John Smith, State Division of Highways, Los Angeles, told the conference.

Procedures used today may be ineffective on the next time around and may need to be modified to maintain weed-free areas, Smith said. Often combinations have shown terrific results when applied at the correct time, but have been failures at other times.

Improper applications can result in destruction of desirable plant life, damage from erosion, and financial loss as well as loss of material, time, and man power. The continual use of one chemical often allows tolerant weeds to exist.

It is necessary to understand the basic idea of such plantings to consider weed control in ornamentals. Plants are in close proximity to shade the ground quickly, thereby reducing weed growth and moisture evaporation. Weed control problems predominate during the first few years of such plantings, hence the problem is primarily among young plants.

Spray shields are a must, but damage has resulted when some materials leach into the root zone of plants, or move on the surface in free water, causing concentration of the chemical in basins of new plants, resulting in damage to the plants.

Weed oil has been extensively used as a comparatively safe material, but young acacia plants and other related legumacea species have become chlorotic due to concentration of the oil in the basins. The discoloration of vegetation, painted surfaces, and fences has evoked complaints and criticism. The aromatics are a problem in heavily populated areas, Smith continued.

Dalapon applied to grasses, especially Bermuda and Johnsongrass, in the early growing season has shown less than 20% effective control, whereas when applied in late fall, prior to the first frosts, has been approximately 80% effective. Early applications are made to discourage growth of Bermuda and Johnsongrass without thought of eradication.

Amitrole has been used primarily as a knockdown in extremely wet areas and has been erratic in results, the highway official claimed.

Smith said the amine formulation of 2,4-D is the safest of the

Officers of the California Conference (left to right): Outgoing President Charles Siebe, State Department of Agriculture, with new officers Vice President Jim Dewlen, Amchem Products Co.; President William Hopkins, Best Fertilizer Co.; Secretary Norman Akesson, University of California, Engineer; Treasurer Cecil Pratt, State Department of Agriculture. The Robbins Memorial hoe passes as a trophy to each new President.