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Japanese beetle is spreading relentlessly westward despite strict quarantines. Adult stage, shown here in comparison with a millimeter rule, ruins flowers and foliage by its feeding.

Oriental Beetle, Masked Chafer, Rose Chafer, White-fringed Beetle, Green June Beetle, and the Rhinoceros Beetle. Turf grubs are a major problem in New England, Midwest, and Central Plains states. They range from the East Coast as far west as Kansas, and south into Florida, although their relative pest classification is lower in importance in the southern states.

Typically, eggs are laid about 5 inches deep in the soil at about 25 eggs per female. Eggs hatch in 2 to 3 weeks. Larvae feed on roots and underground plant parts, pruning them severely at infestation levels. Greatest damage is noticed when weather becomes hot and dry; grass withers from lack of water uptake. By autumn, larvae are about 1 inch long. One can readily recognize them by their characteristic "C" shaped body posture. Grubs have a dark head and three pairs of legs on the forepart of their body. Most of the species remain in the soil for 3 years; some spend only one year; while a few take 4 years to develop.

During warm months, grubs can be found 2 to 3 inches deep in soil; in winter they migrate below the frost line where they hibernate in a cell. Some species pupate in early summer and adults develop in late summer, but they do not emerge until the following spring when temperatures rise into the 70's again. This phenomenon of adults remaining in the soil is unexplained.

Test for Grubs

If grubs are suspected in a lawn, a test may be made to confirm this before treatment. With a knife, cut an area in the sod about 1 foot square and 2 to 3 inches deep, leaving one side attached

in hinge fashion. Roll back the sod and probe the dirt beneath and dirt clinging to the mat. Sifting may also help. Grubs may then be seen and counted. Repeat this test several times in other sections of the lawn. Average the number of grubs seen in all tests; if it figures 6 or more per square foot, an insecticide should be applied.

Standard chemicals for control of turf grubs include chlordane, aldrin, heptachlor, dieldrin, and in some areas Diazinon. Chlordane usually is applied at 1¼ pounds *active ingredient* per 5000 square feet, though the rate may vary in the South to 2 pounds *active* per 5000 square feet. Aldrin, dieldrin, and heptachlor generally range around ⅓ pound *active* per 5000 square feet.

In areas such as the South where some chlorinated hydrocarbons may not be effective, use of 1% parathion has given successful control of grubs. Care with this organic phosphate is stressed because of its hazard both to user and to children and pets who may use a lawn for a play area.

Insecticide labels should always be checked for proper application rate. Sufficient water should be used to insure washing insecticide into the soil. Fifteen gallons for 1000 square feet is generally recommended; somewhat more may be needed on heavy clay soils. Strive for even distribution of pesticide over turf. Beetle grub control may take 6 months to become completely effective. "Guarantees" of time periods for continued control vary from state to state. Some from Ohio claim 10 years effective control; Connecticut offers a conservative 3 to 5 years; and Indiana says grubs should be

controlled 4 years with one good application. Florida reports that control is not as long as northern states, but white grubs are not considered a major turf pest there.

On the eastern seaboard where the Japanese Beetle is a prominent pest, biological control has been used against the grub stage. Spores of the bacteria, *Bacillus popilliae*, or milky disease, are distributed over an area of turf. This disease is specific for the Japanese Beetle and will kill a large portion of grubs. Some will live to reproduce the disease and infect more grubs as the population grows from year to year. Milky disease does not kill all beetle grubs, but keeps their numbers at a tolerable level for turf. It is reported most effective along the central coastal states.

Miscellaneous Beetles

Wireworms (Elateridae) are larvae of what are called click beetles. Many species are distributed throughout North America. A common economic pest of agricultural crops, these beetles also thrive in cultivated turf where they attack grass roots and basal portions of stems. Damage results when they bore into plants causing them to wither.

Adults are those beetles which click and jump when turned on their backs. Clicking throws them into the air; the desired effect is for them to land on their feet.

Controls use the same chemicals as applied for white grubs with one exception: chlordane needs only



White grub is the name for larvae of scarab beetle. These widespread pests have voracious appetites and can ruin a lawn so that turf can be rolled up like a rug. Note strong mouthparts, curled position, legless hindparts.

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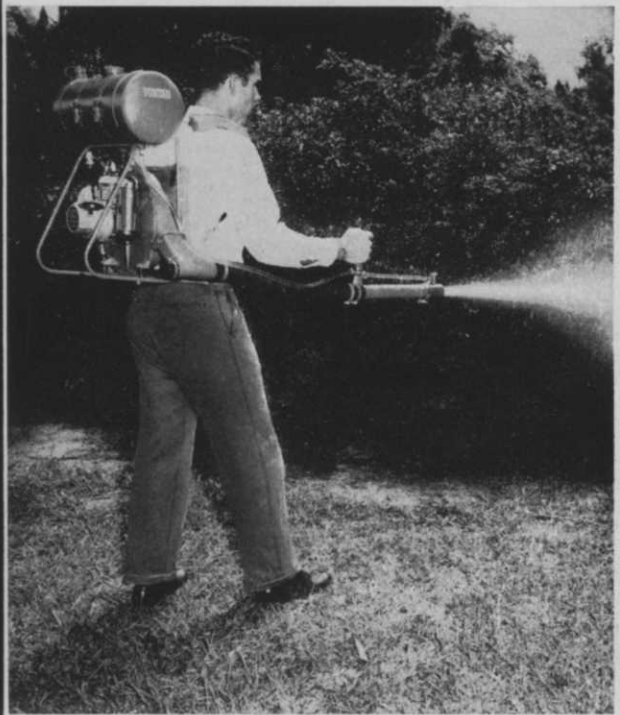


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By **HOUSTON B. COUCH**,
Assoc. Prof. of Plant Pathology
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May 1962. 6 x 9. 304 pages. \$10.00

HERE is a detailed, comprehensive treatment of the diseases of turfgrasses, including illustrated information essential for the identification and control of both fungus and nematode-incited diseases. This is the most complete, up-to-date work available on the subject of controlling turfgrass disease.



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½ the dosage for effective wire-
worm control.

Another family of beetles which is very damaging in some years, especially in the South, billbugs (Cucurionidae), are sometimes called snout beetles or weevils. Billbugs, as their name implies, have a long bill or snout in the adult stage. At the end of this snout are their powerful chewing mouthparts, which they use to chew into grass stems near the base. Adult billbug feeding causes stunting and deformities in plants.

Larvae damage root systems of turfgrasses, mostly bluegrass and redtop in general, Bermudagrass in the Southwest, and zoysia in the Southeast. Their burrowing into stems and roots causes lawns to bleach and wither.

Billbugs in their many species are distributed throughout the United States. They vary in color from clay yellow to reddish brown to jet black, and are generally about ¼ inch long. Control for most of the U.S. consists of using chlordane at twice other beetle grub dosage or, in other words, 40 fluid ounces of chlordane 75% (8 pounds per gallon) emulsifiable concentrate per 5000 square feet. Florida, although not much billbug damage was reported there last year, recommends 4 pounds active (maximum) of V-C 13 per 5000 square feet, or Trithion at 12 ounces active ingredient per 5000 square feet.

Depending upon whether the larval or adult stage is the target, applications should be soaked into the soil somewhat, or left on leaves respectively.

The fungus, *Beauveria bassiana*, originally introduced into United States to control the corn borer, also kills billbugs. This control, however, occurs naturally and is not commercially available.

A number of lepidopterous larvae cause extensive damage when present at infestation levels. They feed directly on stems and leaves of grasses.

Sod Webworm Control

Sod webworms (subfamily Crambidae) are pests which are damaging throughout the United States, as indicated by our survey. "They are most common in housing developments in California," according to Professor Andrew S.

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W-15

Deal of the University of California at Riverside. "Lawns are most certain to be damaged by sod webworms unless chemical treatments are applied," he adds.

"Sod webworm larvae are the most damaging species of caterpillar in Florida," reports Professor S. H. Kerr of the University of Florida at Gainesville. They are $\frac{1}{4}$ to $\frac{3}{4}$ inch long, chunky, and usually spotted and coarsely haired. Larvae construct tunnels of pieces of grass and excrement, and line them with silk which they spin. Tunnels are built close to the surface near bases of grass plants. Webworms hide in their tubes in daytime and forage for food at night. They chew off blades of grass and sometimes carry the pieces back to their burrows. Resultant damage resembles dollar spot fungus disease somewhat, being irregular circles of brown or bleached areas.

"We are currently having one of the heaviest sod webworm outbreaks in home lawns that has been reported. They were very destructive during late summer and early fall of 1962," Professor Dave Matthew of Purdue University, Lafayette, Ind., told us.

Sod webworms prefer new lawns, particularly of bluegrass, bentgrass, and fescues. Damage appears in late, hot summer months when home lawns and golf greens are well kept and watered, but other turf is brown and dormant. The moths prefer succulent growth for egg laying and tend to accumulate in well-kept turf.

Adults, $\frac{1}{2}$ to 1 inch long, are pale

Typical resting place of the sod webworm in turf is shown encircled in green. Note ravaged blades of grass around the insect.



Pencil point illustrates size of miller of tropical sod webworm. Larvae chew up expensive areas of turf annually. Adults will emerge from smooth, bulletlike pupae. Note chewed grass leaves and frass or excreta in culture. All three stages may be seen at once in southern United States.

or buff moths commonly called "millers." They are jerky fliers and have a projection on their heads formed from extending mouthparts. From this appearance they are also called snout moths. Millers can often be seen flying over a lawn in early evening during mid-summer. Females at this time drop eggs at random in the grass. There are normally 3 generations a season, but there may be 4 in California and Florida.

Pyrethrum Test

A test for species which hide in soil during daytime, such as the sod webworm, may be made by sprinkling the edge of an area suspect of infestation with 1 gallon of water containing 1 tablespoon of pyrethrum extract. This treatment will irritate the larvae and force older worms to the surface where they can be seen and positively identified.

Control measures are for a leaf-feeding type. Most widely used against sod webworms are DDT and toxaphene. From 6 to 9 ounces active toxaphene per 5000 square feet gives control in Florida. DDT, from 10 to 14 ounces active per 5000 square feet, gives control in the North at the lower rate and in the South at the higher one. Aldrin, dieldrin, and heptachlor also give control at $\frac{1}{3}$ pound active per 5000 square feet. Chlordane at 9 ounces active per 5000 square feet ($\frac{1}{2}$ the wireworm rate) is sometimes used in the North.

In addition to choosing a proper

insecticide for each area, there are other tricks to sod webworm control. Insecticides should be applied in the late afternoon when turf is relatively dry. Lawns should be mowed and watered prior to treatment and given a day or two to dry out. After spraying, turf should not be watered for at least another 24 hours, preferably 48 hours.

If a dry application is made, recommendations are to water lightly to wash insecticide down around the crowns of grasses. Irrigate after 2 or 3 days.

In Kansas, where sod webworms are the "principal problem," Professor D. E. Gates of Kansas State University at Manhattan summed up difficulties and offered controls for his region as follows: "Control problems appear to be in keeping the insecticide in the proper place rather than a failure of the material. The area of feeding of sod webworms at ground surface makes it difficult to hold the materials in the proper area. If left exposed to sunlight, the materials are destroyed rapidly. If they are soaked in, another flight of moths lays eggs for larvae above the treated zone. Apparently our best recommendation is to soak the soil and apply the insecticide to the surface with very little watering in. A treatment in June, July, and August seems to be needed under the heavy moth pressure we are experiencing this year (1962)."

Continued next month

184 9x12 Pages • 545 Illustrations • 109 Photographs • Hard Binding



UNIQUE PRONOUNCING INDEX

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**Scientific Guide to
PEST CONTROL
OPERATIONS**

"Scientific Guide to Pest Control Operations" preserves in durable book form, all 18 lessons for the widely-heralded Correspondence Course in Pest Control Technology offered by Purdue University and originally published a lesson a month in Pest Control magazine. Every page has been reviewed and brought up to date with latest use-information, and is now available in this beautifully printed, extensively illustrated, easy-to-read manual everyone interested in urban/industrial insect or rodent control should have.

PCO ORIENTED

"Scientific Guide to Pest Control Operations" (published by Pest Control magazine) was written by and for pest controllers. Author Dr. Lee C. Truman is a successful PCO in Indianapolis, Ind., and Professor William L. Butts is in charge of the four-year pest control curriculum of Purdue's entomology department. Working with them was an editorial committee representing important phases of the pest control industry: Dr. John V. Osmun, head of Purdue's entomology department; Dr. Howard O. Deay, Purdue professor of entomology; Dr. Philip J. Spear, technical director of the National Pest Control Association; Dr. Harry D. Pratt, in charge of insect and rodent control training for the Communicable Disease Center of the U.S. Public Health Service; George L. Hockenyos, PCO-researcher, owner of Sentinel Laboratories, Springfield, Ill.; and James A. Nelson, editor and publisher of Pest Control magazine.

By **DR. LEE C. TRUMAN** and
PROF. WILLIAM L. BUTTS



Published in cooperation with Purdue University

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Weeds around light standards are killed before they grow with Simazine pre-emergent herbicide.

Raceway Job Draws Harder to Weed Control

ARE you a pest control operator hoping to expand your business? The growth of Harder Tree Service, Inc., shows one way to do it.

Harder, located in Hempstead, Long Island, is an offshoot of Harder Extermination Service, Inc., also in Hempstead. It operates what is reported to be the largest custom weed control service in the metropolitan New York area. Headed by Bob Felix, vice president and general manager, Harder is a well-managed enterprise whose main problem has been to keep abreast of rapid growth and expansion.

Active primarily in New York's five boroughs, lower Westchester County, all of Long Island, and parts of New Jersey, Harder's principal operating area contains countless industries, many large government facilities, an assortment of petroleum installations, and numerous miscellaneous customers needing weed control.

Many of its customers use chemical weed control to achieve a neat appearance lasting all season at a cost lower than with older methods. Roosevelt Field Shopping Center, Sperry Rand, and race tracks, such as Aqueduct, Belmont Park, and Roosevelt

Raceway, use Harder's weed control services.

Some customers must prevent all weed growth to reduce fire hazards at tank farms, bulk plants, refineries, or around combustible dry materials such as lumber piles. It is not sufficient in such circumstances to kill weeds, because dead weeds are also a fire hazard. The strategy here is to prevent any weed growth from getting started in the first place. Harder accomplishes this with pre-emergence applications of chemicals before any weeds have emerged, early in the spring.

Government installations need weed control for several reasons: controlling fire hazards, improving visibility by eliminating interfering vegetation, and sprucing up appearance.

Treat Brooklyn Naval Yard

At the New York Naval Shipyard (Brooklyn Navy Yard), Harder used Simazine to control weeds growing close to some desirable ornamentals. "We prefer Simazine in such situations because it does not move sideways in soils to endanger cultivated plants," explained Bob Felix, adding that it has a long residual effect, keeping the area free of

most annual broadleaf and grassy weeds for an entire season.

Harder sprayed an extensive marsh area at the Naval Air Station, Floyd Bennett Field, with the chemical Radapon, to kill a rank growth of reeds 10 to 12 feet high that was obstructing the view and making air operations more difficult. At other locations, Harder has found the combination of 2,4-D and 2,4,5-T to be best for controlling brush.

Numerous municipalities and school districts in Nassau County, and the Long Island Park Commission, are all customers for Harder services.

An intimate knowledge of costs and a carefully worked out system of bidding on new business has permitted Harder to bid successfully on jobs as far away as Baltimore. This happened in competition with a contractor in the Baltimore area.

Harder's approach to estimating a job involves both on-the-site examination and a detailed examination of blueprints of the site. The total area to be treated is calculated by using a polar planimeter, an instrument that automatically measures the area of irregularly-shaped figures. The history of past weed control efforts

on the job is carefully considered. In examining the site, Bob Felix carefully notes any potential problems, with reference to wind direction, valuable cultivated plants, mechanical obstructions, and any operational difficulties.

The profitability of the operations and, equally important, the absence of claims for damage, testify to the careful evaluation Harder conducts. Freedom from claims also results from careful training for the foremen who are knowledgeable about their work.

Roosevelt Raceway Was First Job

The operations that are today known as Harder Tree Service began in 1954 as a modest diversification effort of the parent, Harder Extermination Service, Inc., a 40-year-old concern. In that year the organization began caring for Roosevelt Raceway's shade trees and the areas where weeds were troublesome. In 1957, Harder decided to go into industrial weed control in a big way. Two years later, in 1959, the shade tree and weed control work was formally organized as a separate corporate entity, Harder Tree Service, Inc.

The weed control clients are confined to industrial, commercial or governmental units. The shade tree work includes those, plus private residential clients, also.

Since 1957, growth has been steady. Later this year, Harder will add a \$25,000 extension on its main building at Hempstead for additional office and equipment area.

Harder uses three hydraulic sprayers to do its herbicide spraying. A small outfit, delivering 4 gallons per minute, is equipped with a spray boom, and is manufactured by H. D. Hudson. This tank holds 150 gallons. Two larger sprayers deliver 15 and 20 gallons

per minute, respectively. The latter is considered ideal for general purpose spraying. These two units, made by John Bean, hold 300 and 500 gallons. Inasmuch as many sites have areas inaccessible to vehicles, the sprayers are equipped with 1200-foot hoses to reach all parts of a job site.

All weed spray equipment is painted yellow to avoid using it to spray valuable plants. No weed control chemicals are ever used in equipment set aside for controlling insects and diseases. Equipment and chemicals are kept locked to avoid errors. Only two people have the keys.

Tree Work Goes on All Year

The equipment is used heavily from March 15 until September 1. Harder is able to retain good help by diverting men to shade tree work, which goes on all through the year. There is, consequently, no threat of seasonal layoffs for conscientious employees.

There are no special problems in weed control in public amusement areas, Felix says, but the public often reacts unpredictably to bare soil during midsummer, when it fully expects to see wisps of grass or weeds contributing green to the view.

Dead Weeds Look Odd in July

This reaction is even more evident if chemicals have been applied as a contact, instead of a pre-emergent, treatment. In this case, the dead, brown vegetation characteristic of late fall seems out of place in mid-July. While the overall effect is not one to cause any concern (especially when compared to the benefits that accrue), operators might want to give extra consideration to pre-



Herbicides must be selected with great care. Proper chemical in this application allows Harder to kill weeds but leave the tree unharmed.

emergent treatments which prevent this brownout.

Species of plants which are particularly troublesome in raceway jobs, Felix says, are quackgrass, crabgrass, plantain, dandelion, horsetail, and sorrel.

Touchup Jobs in June

Bob Felix believes in doing a complete job for Harder customers. After an initial spraying early in the spring, Bob visits the job to determine the control accomplished. If re-treatment or touchup sprays are needed, they are applied early in June.

Harder maintains a completely separate crew for weed control and tree work. To make sure everything is up-to-date, Bob puts his insatiable appetite for information to work for him. Constant references to the literature, including periodicals, attendance at weed control meetings, and close contact with the Nassau County Extension Service keep him technically qualified to guide this important Harder division.

Customers Vague about Weed Work

Because of the newness of chemical weed control, customer education is a very important task. Many potential customers are not yet aware of what chemical applications can do for them, and how low the cost is, compared with other methods. Harder's steady clients have discovered those facts.

The steady growth of Harder Tree Service activity indicates more clients are becoming aware and enlightened.



Mowing around parking lot poles and fire hydrants is time consuming and therefore expensive. Harder helps Roosevelt Raceway eliminate this expense by killing the weeds before they spring up.



Success of the 17th northeastern conference was due in large part to these '62-'63 officers and committee chairmen (l to r): Dr. Richard D. Ilnicki, Rutgers University, program; Dr. J. A. Meade, University of Maryland, secretary-treasurer; Dr. G. D. Hill, duPont, research coordinating; A. J. Tafuro, American Cyanamid, vice-president; Dr. C. R. Skogley, University of Rhode Island, public relations; Dr. Lawrence Southwick, Dow, awards; F. A. Ashbaugh, West Penn Power, sustaining membership; and Dr. D. A. Schallock, Rutgers University, president.

Science No Longer Divorced from Public, 17th Northeast Weed Conference Decides

Weed control leaders, both research men and applicators, are adopting a brave and dynamic new attitude towards their industry.

Over 700 delegates to the 17th Annual Northeastern Weed Control Conference agreed that the old concept of "pure science," which largely ignored public opinion, is now passing away, and responsible investigators recognize a new responsibility to tell their story to the public.

This public relations awareness was an underlying theme throughout the annual gathering of northeastern weed experts, held this year at the Hotel New Yorker, New York City, January 9-11.

Two keynoters sounded the prevailing theme in the early sessions of the conference. In a talk on pesticides and balanced environment, Dr. L. G. Merrill, Jr., Dean of Agriculture, Rutgers University, New Brunswick, N.J., reminded delegates that most pest control programs, whether insect or weed oriented, are aimed at the total physical environment, and take all aspects of this environment into consideration, despite what certain irresponsible popular writers may dream up to inflame the public.

"We must leave for future generations an environment favorable for procreation of desirable species, including, I hope, homo sapiens," Dean Merrill asserted.

"We are at the state that we must use pesticides to tip the balance of environment in our favor," he added. Otherwise, man would be forced to live on rootstocks and game, hardly diet

enough for today's teeming millions. But the scales are tipped, and Dean Merrill calls this favorable situation a genuine "chemical miracle."

Second in the impressive team of industry spokesmen was Parke C. Brinkley, President of the National Agricultural Chemicals Association, Washington, D. C.

Brinkley cited the extreme expense suppliers must face in the development and marketing of useful new chemicals. These pesticides undergo formidable testing to make sure there's no possibility of ill effects on anyone if the chemicals are used properly.

In return, Brinkley continued, chemical suppliers have the right to expect a profitable return on the millions they invest in research and development of new weedkillers and insecticides.

Herbicide Production Doubles

The Washington executive also gave delegates a breakdown on the growth of America's chemical pesticide industry, and weedmen were particularly interested to learn herbicides have advanced from 10% to 18% of the total of all pesticides produced, including insecticides, nematocides, fungicides, algaecides, etc.

Long noted for its technical excellence, the Northeastern Weed Control Conference once again demonstrated that its members are not ivory-tower-confined researchers with no direct communication with the practical aspects of weed control. Particularly noteworthy at this year's conclave was the increase in the number of contract applicators present.

Moreover, while much of the

program is given over to agricultural subjects, there was a wealth of urban/industrial seminars which are of utmost importance to progressive application companies.

Evidence that the NEWCC would get down to brass tacks was apparent from the beginning. Lead-off speaker on Wednesday



Hearty praise for our chemical world was voiced by keynoter Dr. L. G. Merrill, Jr., Dean of Agriculture, Rutgers University.

was A. T. Hanson of the Boston Edison Co., Boston, Mass., whose topic, "What a Utility Company Expects in Chemical Brush Control Work," was of vital interest to researchers and applicators alike, all of whom flocked to the Manhattan meeting to enlarge their knowledge of herbicides in all their varied phases.

Hanson outlined what is to be expected from chemical suppliers and the utility company, and discussed in detail what he wants from contract applicators who perform brush control work on his lines.

Utilities Want Careful CAs

The New Englander pointed out, for example, that the hazards of drift must be carefully avoided,



An ample staff helped the 700 delegates speed through registration.