Chlordane Rates High in Insect Control Tests

By JOHN C. SCHREAD

(Entomologist, Connecticut Agricultural Experiment Station.)

Turf is subject to many insect, fungus and systemic ills. Sometimes these ailments are confused and incorrectly treated resulting in much loss of time and money. In the following paragraphs a few of the entomological problems of turf will be discussed and practical and economical control measures suggested.

Virtually 32 years ago in the summer of 1916 a small number of green and brown beetles were collected at Riverton, N. J. They were sent to the United States National Museum in Washington where taxonomic experts identified them as the Japanese beetle. It was believed the insect made its accidental introduction into this country a year or two earlier as grubs in soil around the roots of exotic plants shipped from Japan. There was no previous record of the insect occurring anywhere but on the main Islands of Japan and this was the first reported instance of its occurrence in the United States.

Since that time the beetle has multiplied and spread until by the end of 1947 the pest is known to occur in 24 states. In some of these states there is only an occasional isolated colony whereas in other states such as New Jersey, Delaware and Maryland the insect occurs everywhere.

To what extent the Japanese beetle will spread beyond the states of Iowa and Missouri, areas farther west in which it has been found up to the present time, or how far north into Canada or south beyond the confines of the United States it may successfully migrate is not known. In any case, however, this insect constitutes today one of the major pests of the western hemisphere and in its immature or grub stage a constant threat to the maintenance of beautiful and valuable turf.

Weather conditions in northeastern United States favoring a rapid increase in population during the past two years (1946-1947) resulted in extensive grub injury to turf where it was believed certain biological agencies had sufficiently mastered the beetle situation to prevent serious trouble henceforth. As a direct result of this unexpected turn of events the Connecticut Agricultural Experiment Station directed its beetle control efforts towards the investigation of recently developed toxicants in an effort to determine their value and adaptability for suppression of both Japanese beetle grub and adult populations. Fortunately the insecticides in question—DDT, Chlordane, Benzene hexachloride, Toxaphene and Parathion were so well formulated as dusts and wettable powders as to lend themselves to comparative ease of manipulation.

Test DDT on Jap Beetle

In the spring of 1946 a one-quarter acre plot was staked out in the center of a golf course fairway at Wepawaug CC, Milford, Conn. On May 20 the over-wintering Japanese beetle grub population was calculated to be 65 per sq. ft. average. On the same date a ten per cent DDT dust at the rate of 250 lbs. to the acre, a dosage level established by the United States Department of Agriculture, was applied to the plot by a 3-foot hand operated fertilizer distributor. Fourteen days later a grub count revealed the fact that the average sq. ft. population was down to 44. On the 25th day after treatment it was down to 24.5 and on June 26 or 36 days from the date of treatment the population was 16 per sq. ft., a 75 per cent reduction in five weeks.

During the summer months of 1946 a heavy Japanese beetle grub population developed over most of the golf course. A close check was kept on egg laying in the DDT plot and in adjoining untreated turf. On July 22 the egg plus grub count in the experimental plot was 72.6 per sq. ft., all but 5 per cent of which were eggs. At this time the count in untreated areas nearby was 78 (eggs plus grubs) per sq. ft. of turf. By September 18th, 11.4 weeks from the start of the generation the grub population in the DDT treated plot averaged 2 per sq. ft., whereas in the untreated plots there was an average of 79. Control in the order of 97.4 per cent of the second grub population following use of the insecticide was attained. Turf in the DDT treated plot was in perfect condition throughout the season; on the other hand, however, where the toxicant had not been used the turf was completely ruined.

In the autumn of the following year (1947) the turf in the experimental plot

was still in excellent condition whereas the balance of the fairway which had not been treated in 1946 was virtually void of living grass and revealed a devastating grub population of 110 per sq. ft. A grub count in an adjoining untreated fairway disclosed a high grub population of 206, a low of 85 and an average of 145 per sq. ft.

Toxaphene Results Shown

Rapid development of new insecticides subsequent to the popularization of DDT provided a material chemically known as Toxaphene. It is a chlorinated camphene having insecticidal properties and the approximate empirical formula $C_{10}H_{10}Cl_8$. Using a ten per cent dust the insecticide was applied to five one-eighth acre plots at the rate of 8, 12, 16, 20 and 24 lbs. of actual Toxaphene per acre in 80, 120, 160, 200 and 240 lbs. of dust respectively. At the time of treatment, May 12, 1947, the Japanese beetle grub populations in the plots ranged from an average of 111 per sq. ft. in the 8 lb. treatment plot down to 92 in the 24 lb. plot. Between the fourth and the fifth week following the treatments the per cent reduction in grub populations in the five plots was respectively 67.5, 76.5, 80.4, 75.9 and 79.1 per sq. ft. By September 25 the average number of grubs per square foot of turf in the Toxaphene plots were 0.4, none, 1.8, 0.6 and 0.1 respectively at the same time it was 81.5 in the untreated plots. Egg deposition in all of the treated plots suggested the insecticide was not an inhibiting factor to reproduction.

Benzene Hexachloride

Benzene hexachloride containing 6 per cent of the gamma insomer was applied as a 50 per cent wettable powder at five dosage levels of .96, 1.92, 2.88, 3.84 and 4.80 lbs. of actual gamma isomer per acre. The one-eighth acre experimental plots were treated on May 15, 1947 using 150 gals. of water with the toxicant per plot. An 18 nozzle spray boom with the nozzles in pairs at 16 in. intervals was carried back and forth over the plots at a height of 18 in. from the turf. Pressure of 400 lbs. was maintained by a hydraulic spray rig. Grub populations averaged from 92 to 124.5 per square foot in the various plots. By June 17, one month following treatments the per cent reduction in the plots was 70.1, 67.2, 70.0, 73.8 and 83.2 respectively. On September 25 the average number of grubs per square foot in the experiments was 0.4, 1.8, 0.4, 5.0 and 0.2 whereas in the untreated plots it was 81.5. The presence of Japanese beetle eggs in the Benzene hexachloride plots throughout the season gave no indication of inhibition to egg laying.

Parathion On Test Plots

Parathion (Parathion, O, O-diethyl O-p-nitrophenyl thiophosphate) formulations 0.25, 1 and 2 per cent were first applied to turf on August 22, 1947 for Japanese beetle grub control, at the rate of 1, 4 and 8 pounds respectively of the actual toxicant per acre, in 400 lbs. of dust. Because of the extreme toxicity of the material each experimental plot was sprayed with clear water at the rate of 1600 gals. to the acre to wash the Parathion from the grass foliage into the soil. Two weeks following the treatment the per cent reduction in grub population at the three insecticide dosage levels was 69.7, 91.8 and 95.2 respectively whereas in the untreated plots the grubs averaged 85 per sq. ft. Four weeks later the per cent reductions per plot was in the order of 97.1, 100 and 100 respectively while in the untreated plots the grubs averaged 88.3 per square foot.

The experiments were repeated on September 17. It was seen that at higher air and soil temperatures prevailing during the summer months the degree of grub mortality was not as rapid as during the autumn when air and soil temperatures were lower. The insecticide is volatile and in consequence when exposed to air at high temperatures loses its toxic action rapidly. At the end of 14 days subsequent to September 17 the reduction in grub population in the 0.25, 1 and 2 per cent plots was in the order of 96.4, 99.3 and 99.7 percent. Parathion is a quick killing insecticide, however extremely poisonous and consequently should be treated with great respect.

Chlordane Shows Results

Chlordane, a chlorinated hydrocarbon insect toxicant with the empirical formula $C_{10}H_6Cl_8$, was first reported in literature in 1945 as "1068." This toxicant is highly toxic to a wide order of insects and other invertebrates. It kills by insecticidal vapor, contact and as a stomach poison. It is reported to be mild in action to warm-blooded animals and consequently it may be used to kill destructive insects of all kinds under many conditions.

Chlordane was first used to combat Japanese beetle grub infestations. In May, 1947, three ⅛ acre plots were laid out at Wepawaug CC. Dosage levels of 8, 16 and 24 pounds of actual toxicant per acre were used, employing a 2 per cent dust for the purpose at 400, 800 and 1200 lbs. of dust to the acre. At the time of treatment on May 20 the over-wintering grub population per experimental plot was 97.3, 76.0 and 102.6 per square foot respectively. Four weeks later the average grub count per square foot was down to 22.0, 13.8 and 4.8 per plot providing control in the order of 88.0, 93.6 and 98.7 per cent. On August 19 the Japanese beetle grub infestation which had developed during the summer months subsequent to the destruction by chlordane of the over-wintering brood displayed an average of 48 grubs per square foot in the untreated plot whereas in the treated plots the population was in the

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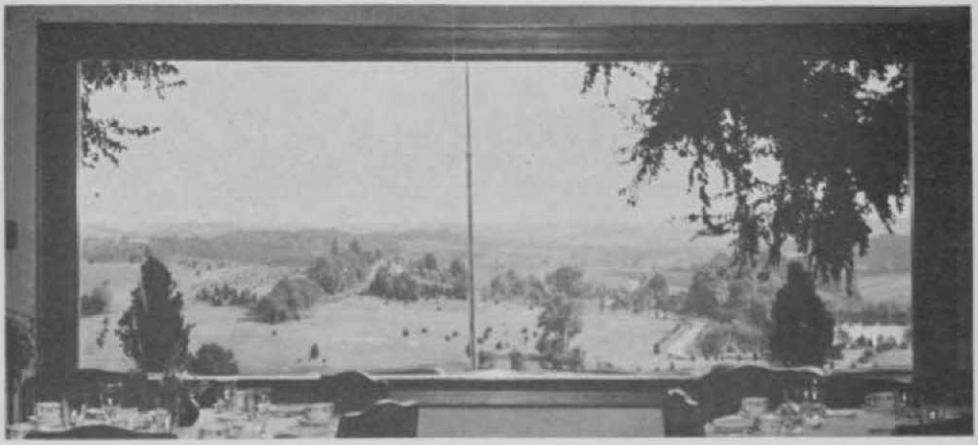

A picture window in the Belmont Hills CC, St. Clairsville, O., clubhouse shows what can be done in remodeling an old clubhouse and using glass to get the value of charming vistas often shut out by the old style "baronial castle" clubhouse architecture. Newer clubhouses all are taking advantage of best possible site locations and a lot of big windows.

order of 0.5, 0.0 and 0.5 per square foot of turf. On September 25 there were no grubs in the chlordane treated plots and 117 average per sq. ft. in the untreated.

Egg deposition in the experimental plots did not indicate inhibition to reproduction by the insecticide. Large numbers of dead adult beetles were seen on the turf in the treated plots indicating high mortality as they attempted to enter the soil for egg laying.

On August 13 a one acre plot in the center of a fairway having an average Japanese beetle grub population of 30 per square foot was treated with 100 lbs. of 10 per cent dust, thus providing actually 10 lbs. of technical chlordane. Fourteen days later the grub count was down to 2.2 per sq. ft. or a reduction of 93.2 per cent in two weeks. On September 14 or four weeks from date of treatment there were 0.7 per sq. ft. in the experimental plot and 87.2 in the untreated. The 0.7 grubs per square foot in the chlordane plot represented mature grubs of the over-wintering 1946 generation. They were at a depth of 3 to 4 inches below the surface of the ground and not in immediate danger from the toxicant. At a later date it was seen that the chlordane had penetrated the soil to a depth great enough to seriously affect these individuals.

The municipal football stadium at New Haven, Conn. was found to be heavily infested with Japanese beetle grubs on September 16, 1947. A population count disclosed the fact that the insects were in the order of 80 per sq. ft. At the time the better color has been seen. It is not known at present what residual toxic action chlor- examination was made the grass displayed some discoloration resulting from grub feeding. Chlordane treatment was made the following day, September 17, using the insecticide as a 5 per cent dust and at the rate of 200 lbs. to the acre. Eight large turf sprinklers were spaced in each of the twelve 10-yard zones at hourly intervals for a period of 48 hours thus providing four hours of actual drenching for each 10-yard zone. The turf was then firmed by a tractor drawn water roller. Heavy rain fell two days after the treatment was applied.

The watering and rolling treatment was designed to provide maximum penetration of the insecticide in minimum time and to assist the turf in recovering before the injured root system dried out completely. Remarkable results were obtained. The grub population was inactivated by chlordane in about 24 hours and reduced to 3 grubs per sq. ft. in 7 days or about 96 per cent control. Although considerable damage was done to the already injured turf by the cleats of football players shoes complete destruction of the playing field was prevented through the timely use of chlordane.

Not only will chlordane act much faster than DDT for control of Japanese beetle grubs but it is also more thorough in ridding turf of its injurious tenants. No injury to grass has been observed where chlordane has been used at stated dosage levels, in fact stimulation of growth and

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Milarsenite in 1947. Following a once over with an aerifier Wilfong used an alfalfa disc drill to sow bent seed on all of the fairways. Result—a dense turf in eight weeks.

Leonard Strong of Saucon Valley used a spike disc in producing a proper seed bed before sowing 55 lbs. of bent seed per acre, emphasizing the importance of using a mulch on new seedings to get quick results.

Dr. Fred V. Grau and Marvin Ferguson of the USGA Green Section and J. O. Pepper and A. E. Cooper of the Ext. Service were present to answer questions.

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better color has been seen. It is not known at present what residual toxic action chlordane may have after one year. In any case, it is the most desirable insecticide for suppression of dangerous grub populations.

Chinch Bug Control

Chinch bug injury to turf during hot dry seasons is frequently of a serious nature. This piercing-sucking insect occurs throughout the United States, southern Canada and Mexico. It has two forms, one most frequently found in corn and small grain growing areas of the country and the second in the east, northeast and southern Canada especially at higher elevations. The latter variety of chinch bug restricts its activities to the destruction of grass.

Chlordane has been demonstrated as sensationally effective in control of chinch bug. Used at the rate of 5, 6½, 8 and 10 lbs. of 5 per cent dust to 1000 sq. ft. of turf the insecticide gave immediate and reasonably long lasting relief from this insect. All dosage levels tried provided 100 per cent kill in less than 24 hours. Consequently 5 pounds of 5 per cent dust to 1000 sq. ft. of turf has been established as practical and economical for control of chinch bugs. The insecticide can be applied as taken from the package or it may be diluted with Milorganite or finely sifted sand in ratio one-to-one to facilitate distribution. The former diluent gave best results.

Following distribution it is advisable to assist settling of the toxicant around the crowns of the plants by mowing the turf or employing other mechanical means such as the back of a wooden rake drawn back and forth over the turf for this purpose. A very light sprinkling of water has also given excellent results.

Ant Control in Turf

Lasius niger Linn. var. americanus Emery, frequently a serious nuisance in well-kept turf, especially golf course greens, is encountered more often than all other species and hence is the most abundant of all species in numbers of individuals and colonies. It is a miniature brown ant that builds small single or clustered craters on the surface of the ground directly above its nest in turf and in open soil. Chlordane, an organic toxicant recently developed as an aid in suppression of destructive insect life, has been shown to be specific as an ant control. Not alone is Lasius niger effectively destroyed by chlordane but other species as well, including carpenter ants, mound building ants, soil infesting and house ants.

For control of ants in turf of golf course greens and lawns the following methods of treatment are suggested:

1. Spot treatment of individual ant nests.
2. Complete turf treatment method.

The principle of the first method is to treat each individual ant nest separately and is applicable to turf areas where nests occur infrequently or at least not in great abundance. One-eighth of a teaspoon of chlordane, 50 per cent wettable powder, should be placed in the center of each ant-hill and thoroughly watered into the galleries of the ant nest. Watering may be accomplished through the use of a 4-gal. pressure sprayer by removing the spreader from the nozzle, thus obtaining a thin stream of water rather than a cone shaped spray. Water slowly poured from a watering can, with sprinkler removed, may also be used. A supplementary method of treatment may be followed by adding one ounce of chlordane to each gallon of water in a small pressure sprayer and with the spreader removed from the nozzle direct the suspension into each ant nest.

The principle of the second method of treatment is to apply the toxicant (50 per cent wettable powder) in solution to every square foot of golf course green, or other turf to be protected. Add 4 ounces of chlordane to 75-100 gallons of water and apply to 1000 sq. ft. of turf with a hose and garden nozzle, the latter open as wide as possible, at 100 lbs. pressure. Following treatment, water turf with 50-60 gals. of clear water per 1000 sq. ft. Not only will the insecticide eliminate all ant colonies present at time of treatment, but protection from reinfestation should last four to six weeks. Treatment may be repeated if necessary at the end of this time.