completely dry lawns. This may be because there was not enough moisture left in the drying grass crowns to support billbug or chinch bug feeding. The highest population and greatest injury was found on irrigated lawns or in areas of the state that received enough rain to keep home lawns alive.

Sod webworms, June beetle grubs (Phyllophaga spp.), Japanese beetle and European chafer continue to be a problem in localized areas. More home lawns are becoming infested with European chafer grubs around Detroit and Grand Rapids.

Chinch Bug Research

1988 was the third and final year of a project designed to determine what types of lawns are most likely to have chinch bug problems. The third year of study confirmed findings from the first two years: lawns at the highest risk of chinch bug infestations have a high proportion of fine fescue and a dense thatch layer. For a detailed report on this work see another paper in this proceeding report by Kortier and Smitley.

Biological Control of Japanese Beetle Larvae with Insect Parasitic Nematodes

On May 19, 1987, nine 1.0 ft^2 plots were each seeded with 26 Japanese beetle grubs. These plots plus an additional set of nine plots not receiving grubs were treated with insect parasitic nematodes (Neoaplectana carpocapsue + Heterorhabditis HP-88) on May 20. A final set of nine control plots did not receive grubs or insect parasitic nematodes. The plots were distributed equally among irrigation block replications at the Hancock Turfgrass Research Center at Michigan State University. Irrigation treatments were daily irrigation, irrigation to 80% PAN, and no irrigation. Three replications of nine treatments (Table 1) were analyzed for change in the number of grubs per plot and differences in the number of plant parasitic nematodes.

Conclusion

The number of grubs per square foot found in plots treated with insect parasitic nematodes was more reduced in irrigated blocks (6.7 or 2.7 per ft^2) than in the no irrigation blocks (12.0 per ft^2). Apparently the ability of the insect parasitic nematodes to locate the grubs, or their survival is considerably reduced in dry soil compared to moist soil. The results of this experiment suggest that the use of insect parasitic nematodes as a microbial insecticide for control of grubs in turfgrass is more practical for irrigated sites.

The number of plant parasitic stunt nematodes (Tylenchorhynchus) per plot was reduced in irrigated plots treated with insect parasitic nematodes (40-55 per 50 cc soil) compared to irrigated control plots (85-117 per 50 cc soil). The suppression of plant parasitic nematodes after application of insect parasitic nematodes has not been well researched. The results of this test should be confirmed by additional experiments.

Table 1. Survival of Japanese beetle grubs and plant parasitic nematodes in experimental plots four weeks after applying Heterorhabditis (HP-88) and Neoaplectana (NCA11) nematodes. Data in table are expressed as the mean of 3 replications per treatment.

Treatment	Initial number of grubs per ft^2	Final number of grubs per ft^2	Plant parasitic nematodes (stunt) per 50 cc soil
Daily irrigation + nematode treatment (HP88 + NCAII)	26	6.7	40
Daily irrigation + nematode treatment (HP88 + NCAII)	0	0	55
Daily irrigation control	0	0	117
80% PAN + nematode treatment (HP88 + NCAII)	26	2.7	47
80% PAN + nematode treatment (HP88 + NCAII)	0	0	38
80% PAN control	0	0	85
No irrigation + nematode treatment (HP88 + NCAII)	26	12.0	81
No irrigation + nematode treatment (HP88 + NCAII)	0	0	77
No irrigation control	0	0	39

Japanese beetle insecticide test

A grid of 3' x 3' plots separated by 1'-wide buffer strips was established in irrigated rough adjacent to a fairway at Rochester Golf Club in Rochester, Michigan. Six replications of 19 insecticide treatments were applied on September 15, 1988. Liquid products were applied with an R&D sprayer at 40 psi with an 80° LF3 nozzle. Insecticides were mixed in water and applied at a rate of 136 ml per 9.0 ft^2 (175 gal/A). Granular insecticides were applied with a hand shaker. Temperature at application time was 65°F with partly cloudy skies. The experiment was evaluated 22 days later (10-7-88) by digging 0.75 ft^2 sections from the center of each plot and examining thatch and soil for live grubs. This test was on Kentucky bluegrass with 1/4"-thick thatch layer and sandy loam soil.

All insecticide treatments except RH5849 at 0.5 and 1.0 lb ai/A, Diazinon Ag 500, and AC 299 486 at 7.0 and 5.0 lbs ai/A significantly reduced the number of grubs per plot compared to control plots. Diazinon Ag 500 was mistakenly applied at 4.0 oz/1000 ft^2, slightly lower than the recommended rate of 4.6 oz/1000 ft^2. Dylox 5 G and 80 SP, Sevin 4SC, Sevimol and Mocap 5G and 10G were highly effective against Japanese beetle grubs in this test. AC 290 713 and AC 290 230 showed a good rate response with the higher rates (7.0 lb ai/A) providing good control of grubs. RH 5849 worked better at higher application rates with the highest rate (2.0 lbs ai/A) also providing good control of grubs.