FACTORS AFFECTING JAPANESE BEETLE GRUB CONTROL WITH OFTANOL* AND TRIUMPH*

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White grubs in general, and Japanese beetle grubs in particular, cause substantial damage to turfgrass roots under a variety of maintenance regimes. During the past four years I have conducted many field studies in Massachusetts to identify the most effective insecticides and the most efficient way to use those insecticides.

The Japanese beetle normally completes one generation each year. Adults emerge in July and lay eggs. Young larvae (grubs) hatch out in late July or August and feed on turf roots throughout August and September, molting twice before the end of September. As the soil cools in the fall, the now large grubs migrate downward, staying below the frost line through the winter. In the spring the soil warms again and the grubs return to the root zone to feed in late April and May. By mid June most grubs begin to pupate in the soil. While the insect is in the pupa ("resting") stage, it transforms from the grub stage to an adult beetle, with wings, a new digestive system, and a reproductive system. The beetles emerge in July to repeat the cycle. There are two times of year when grub feeding damage is most severe--September when grubs are near their full size and still feeding actively, and again in April, when full grown grubs return to the root zone to feed.

Many people do not notice grub populations until they reach damaging proportions. Unfortunately, large grubs are much more difficult to control chemically ("the bigger they are, the harder they fall"). Usually the most effective time to apply soil insecticides to control Japanese beetle grubs is early August, as the tiny grubs emerge from eggs. Most soil insecticides have an adequate residual activity (at least two to four weeks) to kill subsequently emerging grubs. A second alternative which sometimes is considered is a spring (April) application. The grub is large at this time, but the normal heavy spring rains generally ensure good penetration of the insecticide into the soil, where the grubs are active.

One recent field study looked at the effect of application date on the effectiveness of two new soil insecticides. Oftanol* (isofenphos) recently received federal registration for use on turf, and has been of interest because early screening tests indicated that it remained active in the soil for several months. Triumph* (isazophos) is another organophosphate insecticide, apparently relatively close to receiving federal registration, which does not appear to have the residual activity of Oftanol* but does have the ability to kill grubs, even larger ones, quickly.

Our field trial looked at five spring and six summer application dates. We included Oftanol* 5 G and 2 I, each at 2 pounds ai/A, Triumph* 1 G and 1 E, each at 2 pounds ai/A, and diazinon 5 G at 6 pounds ai/A. All plots

watered in with 3/4 inch using an automatic watering system 12 hours after application. We sampled each plot weekly for four weeks and bi-weekly thereafter until at least 95% mortality was observed compared with the untreated check. We also sampled all of the spring plots in September to look at residual activity (spring applications had been directed toward overwintering grubs, while the September sample involved grubs produced from the recently emerged adults). We sampled all plots again in June of the following year to see whether there was any residual activity carried through the winter.

The spring application dates in 1983 were 1 April, 21 April, 5 May, 20 May and 2 June. The most effective dates in terms of speed and overall effectiveness appeared to be 21 April and 5 May. The results of these two dates are summarized in Tables 1 and 2. All of the materials used on these two treatment dates performed very well, eventually providing 95% control. There was no significant difference in the performance of the two formulations of the same material on any of the five spring applications, but the Oftanol* and Triumph* liquid formulations consistently provided excellent (95%) control at least a week sooner than their granular counterparts.

The summer application dates were 14 and 29 July, 10 and 24 August, and 8 and 21 September. Tables 3 and 4 summarize the results of the 10 August and 8 September applications, respectively, which are representative of the summer applications. Diazinon and the granular formulation of Oftanol* failed to provide acceptable levels of control throughout the test period. The two liquid formulations (Oftanol* and Triumph*) performed quite well, providing 95% control three to six weeks after application. Again there was usually no statistically significant difference between formulations of the same insecticide, but the liquid formulation generally seemed to be slightly quicker than the granular counterpart.

The early spring applications (1 of 21 April or 5 May) all provided excellent grub control, in spite of the belief that spring applications tend to be less satisfactory than late summer applications because the grubs are at their maximum size. Apparently heavy spring rains (8 inches in April, 6 inches in May, 3 inches in June) were sufficient to drive all of the early spring applications through the thatch and into the soil, where the insecticide was ingested by the grub. In contrast, the summer rains (less than an inch in July and August) were not sufficient to drive the insecticide into the soil, so some of the active ingredient may have been tied up in the thatch. It appears that the liquid formulations may have penetrated the thatch slightly more readily than their granular counterparts.

The spring applications were sampled again in early September of the same year to identify any possible residual activity. The results are summarized in Table 5. All of the Oftanol* applications, regardless of date of application or formulation, reduced the grub population significantly compared to the untreated check. On all but one of the application dates, either Triumph* formulation also reduced the grub population significantly, but almost always the reduction was less than the Oftanol* counterpart. On four of the five dates, diazinon did not reduce the grub population significantly. This, of course, was not unexpected, since diazinon has never been noted for an extended capability for residual activity.

The following summer we sampled all plots one more time to determine whether there was an over-winter residual activity. The results are summarized in Tables 6 and 7. None of the five spring 1983 applications provided a significant grub reduction in the subsequent June 1984 sampling, so it appears that Oftanol* residual activity is something less than 12 months. In contrast, all of the summer plots which involved Oftanol* 2 I, Triumph* 1 G, or Triumph* 1 E, regardless of date of application, did reduce grub populations significantly. This reduction ranged from 67 to 98%, though in some cases (less than 80%) might not be sufficient to maintain high quality turf, but nevertheless the insecticidal activity did persist. Oftanol* 5 G also reduced populations significantly on four of the six summer applications, but in each case the reduction was less than the liquid counterpart or either Triumph* formulation.

The bottom line seems to be that both Oftanol* and Triumph* can provide excellent Japanese beetle grub control if used properly. The liquid formulations of both insecticides appear to have at least slight advantages in speed of efficacy. Triumph* provided an unexpectedly good level of residual activity in these tests, but the design of our test did not permit us to differentiate residual control of overwintering grubs as opposed to a fall reduction of population and subsequent low spring population because of the earlier fall mortality. Nevertheless, it appears that both materials provide at least some residual activity.

Finally, we looked at the possible effect of lime applications on subsequent Oftanol* applications. In this test we applied ground dolomitic limestone at 2 tons per acre followed two to eight weeks later by an application of Oftanol* 5 G, 1.5 G, or 2 I at 2 pounds ai per acre. The test was conducted in the spring and again in the summer. Each test involved the following applications: early lime only, late lime only, early lime plus early Oftanol*, early lime plus late Oftanol*, late lime plus early Oftanol*, late lime plus late Oftanol*, early Oftanol* only, and late Oftanol* only. The spring application dates were: lime 26 March or 13 April, Oftanol* 26 April or 15 May. The summer application dates were: lime 14 June or 18 July, Oftanol* 2 August or 17 August.

If lime did interfere with a subsequent Oftanol* application, we would expect to see a significant reduction of grub populations from the Oftanol* plots which were preceded by lime to those which were not. The trend should be most apparent when the interval betwen lime and Oftanol* applications was shortest, for example late lime and early Oftanol*. In fact, there was never any significant difference between any of the Oftanol*-treated plots involving the same formulation, regardless of any preceding lime applications. Thus, it appears that applications of ground dolomitic limestone do not interfere with subsequent Oftanol* applications.

Our field studies have revealed some interesting information concerning the efficacy of Oftanol* and Triumph* on Japanese beetle grubs, but have also raised new questions. In particular, the role of water- and proper watering procedures for soil insecticide application - is obviously critical. Also, each white grub species reponds differently to insecticides, so there is no way to predict how another species might react to similar Oftanol* or Triumph* applications. However, these studies do provide a start - gradually we can fine tune the proper timing to maximize insecticide efficiency.

Table 1. Japanese beetle control with Oftanol* and Triumph*
Treated 21 April 1983.

Insecticide	Per cent mortality Weeks after application 1	2	4	6	8
diazinon 5 G	36	78	85	91	96
Oftanol* 5 G	43	72	95	X	X
Oftanol* 2 1	5	94	98	X	X
Triumph* 1 G	29	85	97	X	X
Triumph* 1 E	50	83	100	X	X

Check population ranged from 9.6 to 21.2 grubs per square foot.

Table 2. Japanese beetle control with Oftanol* and Triumph*
Treated 5 May 1983

Insecticide	Per cent mortality Weeks after application 1	2	3	4	6	8
diazinon	3	78	81	94	85	94
Oftanol* 5 G	49	76	84	86	65	96
Oftanol* 2 1	78	90	97	X	X	X
Triumph* 1 G	54	87	90	99	X	X
Triumph* 1 E	54	92	94	92	100	X

Check population ranged from 4.2 to 11.0 grubs per square foot

Table 3. Japanese beetle control with Oftanol* and Triumph*
Treated 10 August 1983.

Insecticide	Per cent mortality Weeks after application 1	2	3	4	6	8	10
diazinon 5 G	86	51	0	47	44	45	59
Oftanol* 5 G	55	49	23	15	44	67	94
Oftanol* 2 1	59	72	91	89	99	X	X
Triumph* 1 G	93	92	74	82	92	92	90
Triumph* 1 E	79	97	X	X	X	X	X

Check population ranged from 5.8 to 19.2 grubs per square foot

Table 4. Japanese beetle control with Oftanol* and Triumph*
Treated 8 September 1983.

Insecticide	Per cent mortality Weeks after application 1	2	3	4	6	8
Oftanol* 5 G	61	49	68	47	58	42
Oftanol* 2 1	77	71	77	93	95	X
Triumph* 1 G	62	55	77	82	89	97
Triumph* 1 E	81	83	96	X	X	X

Check population ranged from 15.4 to 38.6 grubs per square foot

Table 5. Residual insecticide activity on Japanese beetle grubs. Sampled 1 September 1983

Insecticide	Per cent mortality Date of application (1983) 1 April	21 April	5 May	20 May	2 June
diazinon 5 G	80 #	7	9	48	67
Oftanol* 5 G	79 #	95 #	70 #	54 #	59 #
Oftanol* 2 1	83 #	83 #	77 #	75 #	81 #
Triumph* 1 G	68 #	60 #	48	57 #	60 #
Triumph* 1 E	-	79 #	52	48 #	57 #

Check population was 20.6 grubs per square foot (1 April, 21 April, 5 May) or 39.8 grubs per square foot (20 May, 2 June).

Numbers followed by pound sign were significantly different from the untreated check.

Table 6. Residual insecticide activity on Japanese beetle grubs. Treated Spring 1983, sampled 12 June 1984

Insecticide	Per cent mortality Date of application (1983) 1 April	21 April	5 May	20 May	2 June
diazinon 5 G	31	0	0	0	0
Oftanol* 5 G	0	51	18	79	50
Oftanol* 2 1	26	23	23	19	64
Triumph* 1 G	0	28	21	60	40
Triumph* 1 E	-	0	3	50	17

Check population was 7.8 grubs per square foot (1 April, 21 April, 5 May) or 11.6 grubs per square foot (20 May, 2 June)

None of the treatments was significantly different from the untreated check

Table 7. Residual insecticide activity on Japanese beetle grubs. Treated summer or fall 1983, sampled 14 June 1984

Insecticide	Per cent mortality Date of application (1983) 14 July	29 July	10 Aug	24 Aug	8 Sept	21 Sept
diazinon	50	-	45	85#	-	89#
Oftanol* 5G	26	12	79#	83#	83#	69#
Oftanol* 2 I	71#	98#	91#	93#	95#	93#
Triumph* 1 G	69#	81#	81#	98#	97#	93#
Triumph 1 E	67#	67#	81#	95#	86#	86#

Check populations were 8.4 grubs per square foot (14 and 29 July, 10 August) or 13.0 grubs per square foot (24 August, 8 and 21 September).

Numbers followed by pound sign were significantly different from untreated check.