Timing Crucial With Neonicotinoids

By David J. Shetlar

When using the insecticides in the neonicotinoid family, a key to success is timing the application of materials correctly.

Early data, based primarily on imidacloprid, indicates neonicotinoids have excellent activity against sucking insects (primarily *Hemiptera*), *Coleoptera*, and hymenopterous (e.g., sawflies) pests, but poor activity against lepidopterous pests. Because caterpillars can be significant pests of turfgrasses and ornamental plants, neonicotinoids have been combined with pyrethroids. Pyrethroid combinations also appear to improve control of other surface-feeding pests, especially chinch bugs.

In our field evaluation studies, imidacloprid controlled the turfgrass ant, *Lasius neoniger*, only when applied in April or early May when the mound building was first noticed (Tables 2 and 3, p. 54). However, this control (usually 80 percent or better) did not occur until about six to eight weeks after the application. We have three separate studies that demonstrated this phenomenon. But when thiamethoxam was applied at the same time, control was nearly immediate .

In a subsequent study, applying thiamethoxam in July also resulted in control of the ants within two weeks. More recent studies have shown that clothianidin has this same rapid ant control action.

Concerning hairy chinch bug control (Table 1), we have evaluated imidacloprid, clothianidin, thiamethoxam and acetamiprid and all produce excellent results in applications applied in June, July or August. However, when compared to the standard, bifenthrin, which can knock out the chinch bugs in three to five days, these neonicotinoids often take 10 to 14 days to achieve their maximum effect. In one study, we counted the different nymphal instars and adults, and imidacloprid took out the first through third instar nymphs in two to four days, but the larger nymphs took about a week to eliminate and the adults were the ones that took 10 to 14 days to control.

TABLE 1

Efficacy of Arena 50WP, Arena 0.5G and Talstar for Control of Hairy Chinch Bugs in a Home Lawn, Pickerington, Ohio, 2004.

Treatment[a]	Rate	Ave. number of insects/ft^2 (% Control)b		
	lb. AI/acre*	7DAT	14DAT	28DAT
Arena 50WP	0.2	6.4(95)b	0(100)b	0.9(100)b
Arena 50WP	0.3	0(100)b	7.3(97)b	0(100)b
Arena 0.5G	0.2	7.3(94)b	4.6(98)b	0(100)b
Arena 0.5G	0.3	5.5(96)b	0.9(100)b	0.0(100)b
Talstar F	0.2	2.8(98)b	5.5(98)b	0.9(100)b
Check	-	132.9a	260.4a	263.1a

*a Treatments applied 25 August, 2004 to plots 5 x 5 ft, replicated 4X. * Pounds of active ingredient per acre.*

b Data taken 1, 10 & 21 September based on the number of chinch bugs recovered from two 5-inch diameter cylinders per plot (water flotation). ANOVA and LSD based on plot totals. % Controls followed by the same letter are not significantly different (numbers per ft2 calculated). ANOVA = $p<0.001$ for all dates; LSD @ 0.05 = 8.206, 22.075, and 28.301, respectively.

Control of mole crickets with neonicotinoids has been inconsistent unless you carefully look at the timing of applications. When applied at egg lay to egg hatch, imidacloprid and thiamethoxam have produced very good results. This suggests that the mode of action is to cause the first instar nymphs to stop feeding or stop normal behavior. Of course, this is lethal for such small instars.

While imidacloprid controls the bluegrass billbug very well, it has generally produced poor control of the annual bluegrass weevil. But recent studies with clothianidin have demonstrated that it has excellent activity against this weevil. This again illustrates that each of these neonicotinoids can affect different spectra of pests.

In our sod webworm control studies, imidacloprid has always resulted in poor control, but applications of clothianidin, thiamethoxam and acetamiprid have been quite effective. Again, this control commonly takes seven to 10 days to be maximized compared to the pyrethroids that achieve maximum control in three to five days.

In future studies, fellow entomologists and chemical companies should be encouraged to fully evaluate all of the neonicotinoids for expansion of their target spectra — especially mole crickets, chinch bug species, weevil species, caterpillar species, crane flies and scales (e.g., bermudagrass scale).

Application timing issues

Because most discovery companies first targeted turfgrass insecticides for control of white grubs, and our IPM training recommends that these controls be optimized for egg hatch, many new insecticides are not initially evaluated for early or late applications. With the

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TABLE 2

Efficacy of insecticides for suppressing ant mounds from *Lasius neoniger* on golf course fairway No. 11, Crockett's Green Hills Golf Course, Clyde, Ohio, 1999.

Treatment/ Formulation[a]	Rate lb.AI/acre	Active mounds/yd² and (% reduction)[b] 13DAT	30DAT	79DAT	128DAT	169DAT
Scimitar 0.88GC	0.06	0.1(97) de	3.1(57)cdefg	4.4(31)a	3.9(34)abcd	3.0(40)bc
Scimitar 0.88GC+	0.06+					
Merit 75WP	0.3	0.0(100)e	5.3(28)abc	5.1(20)a	2.5(57)e	1.3(75)cd
Merit 0.5G	0.4	3.4(29)b	6.3(14)ab	2.8(57)a	1.4(77)abc	0.9(83)d
MACH2 2LTI	1.5	1.8(63)b	3.8(48)bcdef	6.6(43)a	3.1(47)abc	3.1(38)b
Fipronil 0.05G	0.025	1.8(63)b	4.1(43)bcde	3.3(49)a	0.1(98)de	0.1(98)d
Talstar 0.66F	0.1	0.1(97)de	3.4(53)cdef	5.5(14)a	5.0(15)e	2.8(45)bc
Talstar 0.66F	0.2	0.0(100)e	1.4(81)fg	4.8(25)a	4.6(21)e	3.1(38)b
Check	-.-	4.8(--)a	7.3(--)a	6.4(--)a	5.9(--)ab	5.0(--)a

a Treatments applied 27 April 1999; plots 10x15ft replicated 4x, spray volume 1.5 gal/1,000ft2; no posttreatment irrigation.

b Data taken 10 May, 27 May, 15 July, 2 September & 13 October based on two 1 yd2 observations from each plot. Mound count sums analyzed by ANOVA and LSD @ " = 0.05. Means followed by the same letter are not significantly different (P < 0.001, < 0.001, = 0.193ns, <0.001, and <0.001 for 13, 30, 79, 128, and 169 DAT periods, respectively).

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long soil residual half-lives of neonicotinoids, more and more tests are being performed with April, May and early June applications (well before white grub egg lay). These generally result in excellent control of the new white grub generation that arrives in July and August.

However, one might think that these early applications might miss some of the surface active insects, especially chinch bugs and sod webworms that normally appear in damaging populations in mid-summer. In our studies, May applications of most of the neonicotinoids result in excellent bluegrass billbug control.

Because it appears that the foliar and stem systemic residues of most of these neonicotinoids are at effective levels for only 20 to 30 days, these May applications should take out overwintered adult chinch bugs and any new nymphs as well as the first generation of sod webworm larvae that begin in late May and early June. May applications will achieve control of these secondary targets and still control the white grubs that arrive later in the season.

On the other end of the season, neonicotinoids generally have been considered to be poor as curative insecticides. Again, we have long known that imidacloprid will kill third instar white grubs, but death can take 14 to 20 days after exposure. In fact, these third instar grubs appear to die not from the insecticide but from secondary infections of bacteria, fungi and nematodes.

In more recent studies, we have found that thiamethoxam takes about seven to 10 days to kill third instar masked chafers but clothianidin achieves control in five to seven days. While these shorter rapidity-of-kill actions are still longer than achieved by trichlorfon, they are certainly within the acceptability range, especially if digging animals are not an issue.

Entomologists should continue to investigate earlier preventive and later curative timings to better define the affects of these chemicals on primary and secondary pests.

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TABLE 3

Season-long efficacy of insecticides for controlling the ant mounds of *Lasius neoniger* on a golf course fairway at Crockett's Green Hills Golf Course, Clyde, Ohio, 2000.

Treatment[a]	Rate lb.ai./A*	Active mounds/yd2 and (% reduction)[b] 7 DAT	14 DAT	28 DAT	8 WAT	12 WAT	21WAT
Talstar 0.2G	0.20	2.4ef(87)	7.3cd(46)	10.5a(26)	10.1ab(0)	10.8a(0)	5.9a(2)
Fipronil 0.0143G	0.025	10.6bc(37)	11.0abc(18)	11.1a(22)	6.4c(20)	2.3cd(63)	0.8b(88)
Merit 75WP	0.40	11.1abc(11)	8.9bc(34)	5.8b(60)	0.3d(97)	0.1d(98)	2.4b(60)
Meridian 25WG	0.26	5.6de(60)	3.0de(78)	0.8c(95)	0.1d(98)	0.1d(98)	2.0b(67)
Meridian 25WG +	0.26						
Scimitar 0.88GC	0.06	0.4f(98)	0.0e(100)	1.4bc(90)	0.5d(94)	0.6d(90)	1.3b(79)
Check	-.--	14.8 a	13.4ab	14.3a	8.0bc	6.4b	6.0a
	ANOVA	<0.001	<0.001	<0.001	<0.001	<0.001	=0.001
	LSD@0.1	3.998	5.396	4.622	3.290	3.571	2.639

*a Treatments applied May 17, 2000, to plots 10 x 15 ft replicated 4x. No post-treatment irrigation. *Pound of Active Ingredient per Acre.*

b Data taken 25 May, 1 June, 15 June, 13 July, 10 August and 12 October based on the same central 2 yd² area observed each time within each plot. ANOVA and LSD on plot totals. Means followed by the same letter are not significantly different at " = 0.05 (NOTE: confidential products removed).