INSECTICIDE SEED TREATMENTS FOR SNAP BEANS

Jeff Wyman and Scott Chapman [1/]

In the Midwestern United States, snap beans are grown primarily for processing with production areas in Wisconsin, Illinois, Minnesota, and Michigan. Wisconsin ranks first nationally with 35% of national production on over 80,000 acres valued at $36 million annually.

The most damaging insect pests are those that attack the pods and result in either damage or contamination of the processed product. The European corn borer (ECB) and to a lesser extent the corn earworm (CEW) are the major pod feeding pests with damage primarily from 2nd generation ECB and late flights of CEW in August/September. Damage from both species occurs from flowering to harvest, creating a treatment window of 30-7 days before harvest. Pods are protected during this window with a 2-4 spray program when crop maturity coincides with moth flights. A typical spray program in Wisconsin includes a pyrethroid (Capture, Warrior or Mustang) frequently used in rotation with an organophosphate (Orthene).

Although much of the insecticide used on snap beans is targeted at bloom/pod pests, there is never the less a complex of insects which frequently attacks snap beans prior to bloom. These insect pests in Wisconsin have traditionally been the seed corn maggot (SCM) and potato leafhopper (PLH). SCM adults lay eggs in the soil over freshly planted bean seed and larvae (maggots) tunnel in germinating seeds and plants causing seedling distortion and stand loss. Control of SCM has been achieved with a seed treatment using the organophosphate (OP) insecticide Lorsban with most of the snapbean acreage being treated. PLH adults migrate into emerged beans and feed by extracting sap and causing leaf chlorosis, necrosis and yield loss. Control of PLH is achieved with foliar sprays at threshold using low rates of pyrethroids (Capture, Warrior, Asana, and Mustang), organophosphates (Dimethoate) or carbamates (Sevin, Lannate).

In the past 3-5 years two additional pre-bloom insect pests have become prevelant and emphasized the need for a pre-bloom insect management program. The bean leaf beetle (BLB) which was only a problem in southern production areas, has increased its range in recent years and is now established in Wisconsin. Foliage feeding by first generation adults must be controlled early to avoid pod feeding by the second generation and foliar sprays used for PLH are equally effective against BLB.

[1/] Professor and Research Assistant, Dept. of Entomology, Univ. of Wisconsin-Madison.

The second newly introduced pest is the soybean aphidthat was first noted in Wisconsin in 2000. Although not a direct pest of snapbeans, the soybean aphid reproduces prolifically on soybean and the winged migrants have become significant vectors of virus diseases on late planted beans. Cucumber mosaic virus (CMV) and alfalfa mosaic virus (AMV) are present in all Wisconsin production areas and have caused significant yield and quality losses annually since 2001. Additionally, feeding by the large flights of winged soybean aphids occurring from July through August have been associated with phytotoxicity symptoms on snapbeans which are also thought to reduce yield. Virus transmission cannot be prevented by foliar insecticide sprays since viruses are transmitted in seconds and large influxes of winged aphids occur daily. However, the potential for reductions of secondary virus spread within fields and the reduction of phytotoxic injury on plants has resulted in the use of both pyrethroid (Capture, Warrior, and Asana) and organophosphate (Dimethoate and Orthene) foliar sprays during the pre-bloom period.

Pre-bloom insect protection in snapbeans is often required for only the first 30 days of the crop since the pod protection program for ECB effectively controls all insects for the remainder of the season. Seed treatments which are incorporated on the seed in small amounts prior to planting represent a potential new delivery system for insecticides with systemic activity which could provide effective early season protection during the pre-bloom period. Two nicotinyl insecticides, imidacloprid (Gaucho, registered in 2003) and thiamethoxam (Cruiser, registered in 2004) are now available to the industry and these were evaluated for efficacy against pre-bloom insect pests in 2003.

In small plot replicated trials at the Arlington Agricultural Research Station, seed of Histyle variety snapbeans was treated with insecticide and planted using two planting dates. Lorsban (62 g. a.i./100 kg. seed), Gaucho (60 g. a.i./100 kg. seed) and Cruiser (30, 50, and 75 g. a.i./100 kg seed) were evaluated. An early planting (May 29) was used to evaluated SCM control and a late planting (July 14) was used to evaluate SCM, PLH, and aphid control. In the late planting two foliar spray programs were also used to compare weekly sprays of dimethoate (1 pt./a) and Warrior (3.2 fl. oz./a) for aphid control against the seed treatments. The foliar spray treatments used untreated seed and received 4 applications (7/29, 8/8, 8/13, 8/21).

SCM control was evaluated by carefully examining emerged seedlings for larval feeding at 2 weeks after planting. Final plant stands (with an initial seeding rate of 360 seeds/30' row) and % damaged plants were recorded (Table 1). PLH control was evaluated with weekly sweep counts (20 sweeps/plot) and is presented as season totals since populations were low (Table 2). Winged and wingless soybean aphids were counted weekly on 10 leaf samples and are also reported as season totals (Table 2). Prior to harvest, 2 x 10 leaf samples were taken and analyzed for cucumber mosaic virus using ELISA assays (Table 2). Plots were machine harvested for yield (Table 2).

SCM populations were high during emergence of the 1st planting but stands were not significantly impacted (Table 1). Damage to seedlings was extensive, however, with 16.8% damage on the untreated plants. All seed treatments provided effective SCM control with the nicotinyl treatments having slightly (but not statistically) less damage than the Lorsban standard (Table 1). In the later planting SCM damage was also moderate and stands in the untreated control were significantly reduced (Table 1) compared to all seed treatments. Damaged seedlings were also significantly higher in the untreated control than the seed treatments that did not differ significantly.

Yields were significantly higher in all the nicotinyl seed treatment plots (Table 1) than in the untreated controls. The Lorsban treatment was intermediate and since SCM control in this plot was similar to that in the nicotinyl treatments it is assumed that the higher yields in the nicotinyl plots resulted from superior control of foliar feeding aphids.

Foliar feeding insects were evaluated on the later planting only (Table 2). Potato leafhopper populations were low throughout sampling and although fewer leafhoppers were generally found in the seed and foliar treated plots these did not differ significantly from the control. Soybean aphids were counted weekly with winged and wingless forms counted on leaf samples. Winged aphids were insignificant prior to July 29 when a sudden influx was noted. Populations declined equally rapidly and since over 90% of winged aphids were present on 7/29, season totals only are presented in Table 2. The nicotinyl seed treatments provided 30-40% reduction in alate aphid numbers that were occasionally significantly lower in weekly count analysis. However, none of the systemic nicotinyl treatments provided commercially acceptable control of winged aphids and all plots were infected 100% with cucumber mosaic virus. The sprayed treatments also did not provide effective winged aphid control even though 4 sprays were applied. Winged aphids in the Warrior and Dimethoate plots were similar to those in the nicotinyl-treated plots.

Control of wingless aphids was slightly more effective with the Cruiser treatments being better than the Gaucho treatment. However, none of the treatments, seed or foliar, provided acceptable wingless aphid reduction.

Yields (Table 2) were significantly higher in the nicotinyl seed and foliar spray plots than in the control and reflected a combination of aphid control and SCM damage.

The impact of nicotinyl seed treatments on pre-bloom insect control was also evaluated in commercial fields in 2003. Since Cruiser was not registered in 2003, 100’ x 100’ plots were treated with Cruiser, planted by hand, and compared with equal sized plots of the commercial field which was treated with Lorsban. An untreated control was also included. Plots were located in Portage and Adams counties and were late planted (July 5-8) to evaluate potato leafhopper and soybean aphid control. No SCM injury was present at either location.

Plots were scouted weekly from emergence to bloom using sweep nets for PLH and leaf counts for aphids. Data are presented as seasonal totals since populations were low at both locations (Table 3). Pre-bloom foliar insecticidal applications were made by the processor if populations were considered damaging.

PLH populations were generally low in this trial but supplemental foliar sprays (Mustang) were required at both locations in the Lorsban-treated plots. In Portage County the Cruiser seed treatment was more effective in PLH control than the Mustang foliar spray that was needed in the conventional Lorsban seed treatment plot and significantly lower than the control. Aphids (winged and wingless) were reduced by over 50% in the Cruiser plot compared to the Lorsban/Mustang plot but populations were low and no significant differences were detected. At Adams County there were no differences between the cruiser seed treatment and Lorsban/Mustang plots areas.

These studies demonstrated that nicotinyl seed treatments have the potential to provide pre-bloom protection against the primary insect pests of snap bean. The systemic efficacy of the nicotinyls provides growers with an organophosphate alternative to Lorsban seed treatment and dimethoate foliar spray, which could be an added value as the Food Quality Protection Act proceeds with its review of organophosphate and carbamate insecticides.

Table 1. Seed corn maggot control on Histyle variety snap beans treated with seed insecticide. Arlington 2003.

Seed treatment	Rate (g ai/100kg)	Early planting (5/29)		Late planting (7/14)		Yield (tons/A)
		Final stand	%damaged	Final stand	%damaged	
Untreated	---	310 a	16.8 a	211 b	9.3 a	21.2 b
Lorsban	62	305 a	5.0 b	280 a	3.5 b	25.2 ab
Gaucho	60	301 a	4.5 b	263 a	2.3 b	27.1 a
Cruiser	30	316 a	3.3 b	264 a	2.5 b	27.8 a
Cruiser	50	307 a	3.3 b	279 a	4.3 ab	27.4 a
Cruiser	75	306 a	4.5 b	241 a	3.0 b	29.0 a

Table 2. Control of foliage feeding insects on Histyle variety snap beans treated with seed and foliar insecticides. Arlington 2003.

Treatment	Rate (g. a.i./100 kg or oz./a)	Season total PLH (20 sweeps)	Season total Soybean aphids/10 leaves[3]		%CMV	Yield (tons/A)
			winged	wingless		
Seed treatments[1]						
Untreated	---	5.8	91	180	100	21.2 b
Lorsban	62	3.8	102	178	100	25.2 ab
Gaucho	60	9.6	72	147	100	27.1 a
Cruiser	30	3.8	63	109	100	27.8 a
Cruiser	50	2.8	65	104	100	27.4 a
Cruiser	75	3.3	72	95	100	29.0 a
Foliar sprays[2]						
Dimethoate	1 pint	2.1	73	140	100	26.9 a
Warrior	3.2 oz.	2.1	76	110	100	26.1 ab

[1]Planted 7/14, [2]Sprayed 7/29, 8/8, 8/13, 8/21, [3]Weekly counts 7/29-8/28.

Table 3. Control of foliage feeding insects on Histyle variety snap beans treated with seed and foliar insecticides. Arlington 2003.

Seed treatment	Pre-bloom foliar spray	Season total insects	
		PLH (per 25 sweeps)	Soybean aphid (per 25 leaves)
Portage County			
Lorsban	Mustang	14.5 ab	9.9 a
Cruiser	None	11.2 b	4.0 a
Untreated	None	22.5 a	4.7 a
Adams County			
Lorsban	Mustang	6.2 a	3.0 a
Cruiser	None	7.7 a	1.4 a
Untreated	None	9.7 a	1.4 a