CRUISER-TREATED SNAP BEANS FOR INSECT MANAGEMENT

Jeff Wyman[1] and Scott Chapman[2]

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 second 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 to 7 days before harvest. Pods are protected during this window wit a 2-4 spray program when crop maturity coincides with moth flights. A typical spray program in Wisconsin includes pyrethroid sprays (Capture, Warrior or Mustang Max) sometimes 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 with 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 insecticide Lorsban with most of the snap bean 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 Max), organophosphates (Dimethoate) or carbamates (Sevin, Lannate).

In the past 3-5 years, two additional pre-bloom insect pests have become prevalent and emphasized the need for an effective pre-bloom insect management program. The bean leaf beetle (BLB) which was primarily a problem in

---

[1]Professor, [2]Assistant Researcher, Department of Entomology, University of Wisconsin-Madison.

southern Midwestern production areas, has increased its range in recent years and is now established in parts of Wisconsin and Minnesota. 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.

The second newly introduced pest is the soybean aphid that was first noted in Wisconsin in 2000. Although not a direct pest of snap beans, the soybean aphid reproduces prolifically on soybean and the winged migrants have become significant vectors of virus diseases on late planted snap 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 snap beans 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 snap beans 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 neonicotinoid 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 and 2004.

In small plot replicated trials at the Arlington Agricultural Research Station, seed of Histyle variety snap beans was treated with insecticide and planted late (July 14 in 2003 and July 8 in 2004). Lorsban (62 g a.i./100 Kg seed), Gaucho (60 g a.i./100 Kg seed in 2003), Poncho (125 g. a.i./Ha in 2004) and Cruiser (30, 50 and 75 g a.i./100 Kg seed) were evaluated. The late planting was used to evaluate SCM, PLH, aphid and impact on virus spread.

SCM control was evaluated by carefully examining emerged seedlings for larval feeding at 2 weeks after planting. Final plant stands and percent damaged plants were recorded (Table 1 and 2). PLH control was evaluated with weekly sweep counts (20 sweeps/plot) and is presented as season totals since populations were low. Winged and wingless soybean aphids were counted weekly on 10 leaf samples and are also reported as season totals (Table 1). In 2003, prior to harvest, 2 x 10 leaf samples were taken and analyzed for cucumber mosaic virus using ELISA assays (Table 1). In 2004, aphid populations were very low and winged and wingless totals were combined (Table 2). Plots were mechanically harvested for yield both years (Tables 1 and 2).

In 2003, SCM damage was 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, which were very low in 2003 as a result of dry conditions, were significantly higher in all the nicotinoid 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.

In 2004, SCM injury was low but plant stand was significantly lower in the untreated control (Table 2) than in the seed treatment plots. Seed treatments did not differ in plant stand. The proportions of damaged plants were also higher in the control than in the seed treatment plots which did not differ significantly from each other.

Yields were much higher in 2004 and the seed treatment plots significantly out yielded the untreated control. Poncho treated plots had the highest yield but these were not significantly better than those in the Lorsban and higher rate Cruiser plots (Table 2).

In 2003, 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 peaked on 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 1. The nicotinoid seed treatments provided 30-40% reduction in alate aphid numbers that were occasionally significantly lower in weekly count analysis. However, none of the systemic nicotinoid treatments provided commercially acceptable control of winged aphids and all plots were infected 100% with cucumber mosaic virus.

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

Yields (Table 1) were significantly higher in the nicotinoid seed and foliar spray plots than in the control and reflected a combination of aphid control and SCM damage.

In 2004 potato leafhopper populations were extremely low throughout the season and no significant differences were seen among any of the treatments in PLH adults or nymphs (Table 2).

Soybean aphids were also extremely low in 2004 and table 2 represents the combined season totals of both winged and wingless aphids. No differences were detected between the plots in aphid numbers and since these were so low, no virus assays were conducted.

The impact of neonicotinoid seed treatments on prebloom insect control in commercial snap beans was also evaluated in 2004. In cooperation with Del Monte Foods seven commercial snap bean fields in Central Wisconsin, ranging in size from 50 to 160 acres with planting dates ranging from 5/27 through 7/20 were selected for study. Each field was split into approximate halves and seed in one half was pretreated with Lorsban (62 g a.i./100 Kg seed) and the other with Cruiser (50 g a.i./100 Kg seed). Agronomic practices, weed control, disease control and corn borer control were the same in both halves but prebloom insect control was dependent on weekly scouting. Fields were scouted weekly from emergence to pod formation using 25 sweeps and 25 leaf samples/sample site. There were 10 sample sites per field half. Potato leafhopper adults were counted in sweep samples and leafhopper nymphs and soybean aphids were counted on leaves. Capture 2E at 1.5 fl. oz/acre was applied to whole or half fields based on scouting data. Yields were taken at harvest.

Insect populations in the pre-bloom period during 2004 were extremely low throughout Central Wisconsin. No injury from seed corn maggot was seen I any fields and no differences in plant stand was detected. PLH populations were highest in the first 3 May/June plantings and in these both the Cruiser and Lorsban field halves each required a supplemental spray (Table 3). In the next 2 planting dates only the Lorsban halves required treatment and in the final 2 plantings no foliar sprays were applied.

Soybean aphids (Table 3) were essentially absent from all fields and no virus assays were conducted.

Yields ranged from 5.4 to 9.5 tons/acre (Table 3) and were not related to insect control. Overall, a slight yield advantage was gained from Cruiser use (0.23 tons/acre) but this was not significant.

These studies demonstrated that nicotinoid seed treatments have the potential to provide pre-bloom protection against the primary insect pests of snap bean. The systemic efficacy of the nicotinoids 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 insecticides.

The impact of systemic seed treatments was least against the soybean aphid where little reduction of either winged or wingless aphids were seen in 2003 when aphid populations were high and the systemic neonicotinoid seed treatments had no effect in reducing spread of CMV to snap beans in late season. The commercial field trials demonstrated that Cruiser was an effective seed treatment alternative to the organophosphate Lorsban for seed corn maggot which could also provide systemic control of bean leaf beetle and potato leafhopper.

Table 1. Control of foliage feeding insects on Hystyle variety snap beans treated with seed and foliar insecticides. Entomology Research Farm, Arlington, WI 2003.

Treatment	Rate (g. a.i./100 Kg)	Seed corn maggot damage		Season total PLH (20 sweeps)	Season total soybean aphids/10 leaves[3]		%CMV	Yield (tons/a)
		Final stand	% damaged plants		Winged	Wingless		
Untreated	---	211 b	9.3 a	5.8	91	180	100	1.1 b
Seed treatments[1]								
Lorsban	62	280 a	3.5 b	3.8	102	178	100	1.3 ab
Gaucho	60	263 a	2.3 b	9.6	72	147	100	1.4 a
Cruiser	30	264 a	2.5 b	3.8	63	109	100	1.4 a
Cruiser	50	279 a	4.3 ab	2.8	65	104	100	1.4 a
Cruiser	75	241 a	3.0 b	3.3	72	95	100	1.5 a
Foliar sprays[2]								
Dimethoate	16 oz./a	---	---	2.1	73	140	100	1.4 a
Warrior	3.2 oz./a	---	---	2.1	76	110	100	1.4 a

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

Table 2. Control of foliage feeding insects on Hystyle variety snap beans treated with seed and foliar insecticides. Entomology Research Farm, Arlington, WI 2004.

Treatment	Rate (g. a.i./100 Kg)	Seed corn maggot damage		Season total[2]			Yield (tons/a)
		Final stand	% damaged plants	PLH adults	PLH nymphs	Soybean aphids	
Untreated	---	102.25 b	6.11 a	3.75 a	1.25 a	24.00 a	7.06 c
Seed treatments[1]							
Lorsban	62	147.5 a	2.37 a	2.75 a	0.00 a	18.75 a	8.54 ab
Poncho	125 g. a.i./Ha	141.5 a	3.89 a	4.00 a	0.25 a	23.00 a	9.40 a
Cruiser	30	129.25 a	2.32 a	5.00 a	0.75 a	26.25 a	7.97 b
Cruiser	50	141.25 a	3.54 a	4.00 a	0.50 a	23.00 a	8.66 ab
Cruiser	75	142.75 a	3.33 a	2.75 a	0.00 a	23.75 a	8.69 ab

[1]Planted 7/8, [2]Weekly counts 7/16-8/24.

Table 3. Impact of Cruiser vs. Lorsban seed treatments on prebloom insect control in commercial snap bean production fields, Central WI 2004.

Field	Seed treatment[1/]	Acres	PLH adults[2] (25 sweeps)	PLH nymphs[2] (25 leaves)	SA[3] (25 leaves)	Prebloom sprays[3]	Yield (tons/a)	Yield difference (C-L) (tons/a)
1	L	73	12.7	6.0	5	1	8.33	+0.49
	C	70	18.1	24.6	3	1	8.82	
2	L	25	4.2	1.6	0	1	5.75	-1.25
	C	25	1.1	0	0	1	4.51	
3	L	75	2.3	0	0	1	9.47	-1.47
	C	75	2.5	1.8	1	1	8.00	
4	L	72	2.2	1.0	0	1	5.48	+1.85
	C	93	1.0	0.1	0	0	7.34	
5	L	80	1.6	0.2	0	1	5.86	+0.72
	C	65	0.6	0	0	0	6.59	
6	L	56	1.5	2.5	0	0	5.40	+1.76
	C	56	1.1	0.3	0	0	7.16	
7	L	74	0.2	0	1	0	6.57	-1.02
	C	74	0.4	0.3	1	0	5.55	
Average	L	---	3.5	1.6	0.8	0.7	6.58	+0.23
	C	---	3.5	3.8	0.7	0.4	6.81	

[1/]L=Lorsban @ 62g. a.i./100 Kg seed; C=Cruiser @ 50 g. a.i./100 Kg seed;
[2] Potato leafhopper (PLH) and Soybean aphid (SA) counts are season totals.
[3/]Capture 2EC @ 1.5 fl. oz./a.