Evaluating Rotational Vegetable Crop Sensitivity to Impact Herbicide
Final Report for 2011

Submitted to

Pennsylvania Vegetable Marketing and Research Program
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Justification:

Weed control in sweet corn is challenging for a number of reasons. Finding a balance between weed control, crop safety, and rotational flexibility is difficult. Many preemergence herbicides provide good weed control, but contain active ingredients that have long residual activity and they in turn limit rotational crop flexibility.

Most postemergence herbicides in sweet corn have a fairly limited spectrum of control or issues with sweet corn safety. Basagran and Option allow most vegetables to be planted within 2 months of application. However, Basagran has a fairly limited number of broadleaf weeds that it controls and provide no grass control. Option controls a number of broadleaf and grass species, but many corn hybrids show significant early season injury when treated with Option. Aim and Callisto can be used postemergence but the label does not allow vegetables to be replanted the same season and stipulates 10 to 18 months for many vegetables. Other herbicides are labeled but they have similar issues that limit their use (rotation or crop safety).

Impact can be applied postemergence and has excellent safety for sweet corn. Penn State University and University of Delaware field trials with Impact show consistent and effective control of most of the troublesome broadleaf and grass species in the region, including crabgrass. Some of Impact's competitors (Laudis or Callisto) do not control as many grass species. The Impact label was written to allow greater crop rotational flexibility than other herbicides. The Impact label provides "rotational crop guidelines" rather than "rotational restrictions". In fact the supplemental label for higher rates of Impact also states "**the . . . rotational crops may be planted after applying IMPACT herbicide at the recommended rate in corn. Planting earlier than the recommended interval may result in crop injury.**"

So the Impact label allows vegetable crops to be planted at shorter intervals, provided the grower is comfortable with the risk of injury. Preliminary data from University of

Delaware shows good crop safety for some common vegetables based on a single trial. Additional data is needed to determine the consistency of the data and provide better guidelines for vegetable rotations. Snap bean safety as a double-cropped vegetable will mean that there are no concerns with planting snap beans the year after application.

Study objective:
Evaluate the potential for carryover when sweet corn fields treated with Impact are double-cropped to snap bean. Furthermore, we will examine the influence of tillage on dissipating Impact and lessening its potential for carryover.

Methods:

This study was conducted at the PSU's Penn State Russell E. Larson Agricultural Research Farm in Centre County with silt loam, and the UD Research and Education Center in Georgetown, DE with loamy sand soils. These locations provided a range of soil types and environmental conditions to evaluate the safety of Impact to snap bean.

Experimental sites were conventionally tilled in late April to coincide with planting dates for early planted sweet corn. No sweet corn was planted to minimize influence of crop residue on establishment of snap bean. Impact was sprayed at 1X, 2X, and 4X the labeled rate. In addition 1X and 2X rate of Impact was applied in combination with low rates of atrazine as recommended by the manufactures label (treatments are listed in Table 1). Impact treatments were applied approximately four weeks after tillage, corresponding with typical timing for postemergence herbicides. Glyphosate was used to prevent weeds from establishing prior to planting rotational vegetables. Prior to planting, half of each plot was disked and the other half had no soil disturbance. On June 30 at UD and August 18 at PSU Three snap bean varieties, 'Caprice', 'Envy', and 'Slenderpack' were planted at PSU while Envy and Slenderpack were planted in DE. These varieties represent a range of snap bean sensitivity to Impact. Snap bean varieties are chosen based on other research funded by PAVGA.

All treatments were replicated three times and yields were recorded.

Results:

PSU (Table 1):
For most of the injury ratings, there was tillage by herbicide interaction, with less injury was observed at the highest rate of Impact when the plots were not tilled. This was unexpected. Overall, there was a very strong presence of herbicide rate on injury. Even at the lowest rate of Impact there was significant snap bean injury, and with increasing rates there was increasing injury. Envy appeared to be more sensitive to Impact than either Caprice or Slenderpack. Atrazine did not cause additional injury compared to Impact alone.

Yields at PSU were low due to lack of water early in the season and then need to harvest the plots prior to frost (Table 2). It is unclear why yields in the untreated check were less than the IX rate of Impact. But there was a consistent trend of reduced yield with increasing Impact rate.

UD-REC (Table 3):
Tillage had no impact on injury or yield. Impact at the recommended use rate, caused significant snap bean injury with both varieties. At both 2 and 8 weeks after planting, there was an increase in injury for increasing Impact rate, with even the 1X rate causing significant injury at both rating times. Overall, Envy was more sensitive to Impact than Slenderpack. Yields were low and variable due to the heat causing split sets of the beans, but there was a trend for Impact rates to reduce yield of Envy. The addition of atrazine did not seem to influence results compared to Impact alone.

Summary:

Even with tillage and more tolerant snap bean varieties, there is too much crop injury when snap beans are planted in the same season as Impact (snap bean double-cropped after sweet corn).

PSU Results:

Table 1. Snap bean injury at 4 and 8 weeks after planting (WAP). Values for each variety followed by the same letter are not significantly different from one another.

			% Injury 4WAP								% Injury 8 WAP							
			Envy		Slenderpack		Caprice		Envy		Slenderpack		Caprice	
Treatment	Rate		Till	NT	Till	NT	Till	NT	Till	NT	Till	NT	Till	NT
Untreated Check			0	0	0	0	0	0	0	0	0	0	0	0
Impact	1	fl oz/A	12 f	8 f	15 ef	8 f	15 ef	9 f	7 e	9 e	12 def	9 f	12 cd	9 d
Crop Oil Conc.	1	qt/A												
30% UAN	1	qt/A												
Impact	2	fl oz/A	30 cd	23 de	30 c	25 cd	30 c	25 cd	33 c	35 c	22 b-e	23 bcd	25 bc	23 bc
Crop Oil Conc.	1	qt/A												
30% UAN	1	qt/A												
Impact	4	fl oz/A	68 a	45 b	67 a	43 b	67 a	43 b	75 a	55 b	60 a	33 b	57 a	33 b
Crop Oil Conc.	1	qt/A												
30% UAN	1	qt/A												
Impact	1	fl oz/A	15 ef	15 ef	18 de	15 ef	18 de	15 ef	11 de	11 de	12 def	11 ef	12 cd	10 d
Atrazine 4L	1	pt/A												
Crop Oil Conc.	1	qt/A												
30% UAN	1	qt/A												
Impact	2	fl oz/A	40 bc	30 cd	43 b	30 c	43 b	32 c	33 c	27 cd	28 bc	20 c-f	30 b	22 bcd
Atrazine 4L	2	pt/A												
Crop Oil Conc.	1	qt/A												
30% UAN	1	qt/A												
Tillage			0.0020		0.0001		0.0001		ns		0.007		0.009	
Herbicide treatment*			0.0001		0.0001		0.0001		0.0001		0.0001		0.0001	
Till by Herbicide			0.0300		0.0030		0.0030		ns		0.01		0.07	
*lsd for herbicide treatment			7.2		5.5		5.4		10.8		7.8		8.2	

Table 2. Snap bean yield at PSU location.

Treatment	Rate	Yield (lb/A) Envy	Slenderpack	Caprice
Untreated Check		1861 bc	851 b	1701 b
Impact	1 fl oz/A	3074 a	1286 ab	2303 ab
Crop Oil Conc.	1 qt/A			
30% UAN	1 qt/A			
Impact	2 fl oz/A	1273 c	1580 a	2108 ab
Crop Oil Conc.	1 qt/A			
30% UAN	1 qt/A			
Impact	4 fl oz/A	179 d	723 b	1311 b
Crop Oil Conc.	1 qt/A			
30% UAN	1 qt/A			
Impact	1 fl oz/A	3224 a	1813 a	2782 a
Atrazine 4L	1 pt/A			
Crop Oil Conc.	1 qt/A			
30% UAN	1 qt/A			
Impact	2 fl oz/A	2085 b	1717 a	2392 ab
Atrazine 4L	2 pt/A			
Crop Oil Conc.	1 qt/A			
30% UAN	1 qt/A			
Tillage		ns	ns	0.009
Herbicide treatment*		0.0001	0.03	0.03
Till by Herbicide		ns	ns	ns
*lsd for herbicide treatment		983.0	769.0	888.0

Table 3. Results from UD Research and Education Center in Georgetown. Tillage did not influence results and data is averaged over tillage. Averages followed by the same letter for each parameter are not significantly different from one another. WAP= weeks after planting

			Injury 2 WAP				Injury 8 WAP				Yield (lbs/A)			
Herbicide(s)		Rate/A*	Envy		Slenderpack		Envy		Slenderpack		Envy		Slenderpack	
Untreated	-	-	0	a	0	a	0	a	0	a	1104	a	854	a
Impact	1X	1 fl oz	20	b	5	b	18	b	9	ab	786	ab	1034	a
Impact	2X	2 fl oz	36	c	18	c	62	c	22	b	160	c	755	a
Impact	4X	4 fl oz	65	d	46	d	89	d	65	c	7	c	270	b
Impact + atrazine	1X	1 fl oz 0.5 lbs ai	17	b	7	b	17	b	9	ab	868	a	846	a
Impact + atrazine	2X	2 fl oz 1.0 lbs ai	36	c	14	c	53	c	19	b	225	c	767	a