

Effect of Cover Crops for Weed Management in Organic Vegetables – Neely-Kinyon Trial, 2005

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Introduction

Weeds constitute a major challenge for organic vegetable growers. Organic weed management options include tillage, mulches, flame burning, and allelopathic crops, such as rye (*Secale cereale*). In 2004 and 2005, we examined the effect of a rye cover crop on weed populations, crop stand and yield of organic green beans and peas at the Neely-Kinyon Research Farm in Greenfield, Iowa. In addition to the weed-suppressive effect of winter rye, the cover crop can be used to meet certified organic requirements for soil-building practices (USDA-AMS, 2005).

Materials and Methods

Main treatments in this experiment consisted of a winter rye cover before vegetables and no cover. Winter rye was no-till drilled into the rye treatment plots at a rate of 1.25 bushel/acre on November 24, 2004. Peas were seeded in rows in plots on May 16 and beans on May 17, 2005, at a spacing of 1 in. by 30 in. Four sub-plots of each pea and green bean cultivar were planted in each main treatment block. Plot size was 2.5 x 10 ft.

Sub-treatments include two cultivars of each crop: 'Contender' and 'Jade' green beans and 'Green Arrow' and 'Little Marvel' peas (Jordan Seeds, Inc., Woodbury, MN). A plastic mesh fence was erected on May 27 in order to keep

animals out of the plots, which caused problems in the 2004 season.

Weed populations were surveyed in green bean plots on June 7 and 23, and July 11, 2005, by counting the number of grass and broadleaf species in two random locations within each plot. Stand counts were taken in green bean plots on June 7 and 23, by counting the number of emerged seedlings and plants within a 1-meter length in two random locations within each plot. All green beans were harvested within each plot when beans were mature (≥ 4 in. in length) on July 11, 15, and 20-21, 2005. Weed counts in pea plots were taken on June 7 and 23, and July 11, 2005. Stand counts were taken in pea plots on June 7 and 23. Peas were harvested on July 13, 20, and 27, 2005.

Results and Discussion

In 2005, excellent organic green bean yields were obtained in both treatments. There were significantly higher plant stands on June 7 and 23 in green beans that were not planted with a rye cover crop (Table 1). Despite the significant differences in plant stand between treatments, yields were similar (Table 1). These results contrasted with second-year results where significantly higher plant stands on June 22, 2004, and yields were observed in plots with a rye cover crop. Producers must adequately kill the cover crop prior to vegetable planting, however, or crop stands and subsequent yields could be decreased (Delate et al., 2002). Competition from any remaining residue from the rye cover crop was not apparent in either year of the experiment but an

allelopathic effect on subsequent crops could have occurred.

There were trends toward lower populations of broadleaf weeds (pigweed, lamb's quarter and others) in the green bean plots with a rye cover compared with the control plots for all three sampling dates, and a significant difference between treatments was found on June 7, 2005 (Table 2). No significant differences were observed in grass weed populations between the two treatments (Table 3).

Unlike 2003 and 2004, 'Contender' exhibited a significantly higher yield and stand than 'Jade' (Table 4). There were no significant differences in either broadleaf or grass weed populations between cultivars, however (Tables 5-6).

When the effects of green bean cultivars and rye cover crop were analyzed together, yields differed significantly, and stand counts were significantly lower in the 'Jade' plots with a rye cover crop (Table 7). The 'Contender' cultivar with a rye cover crop showed a significantly higher yield than the other treatments, followed by the 'Contender' and 'Jade' plots with no cover crop, which had similar yields, and finally the 'Jade' cultivar with rye cover crop, which had a significantly lower yield than all other treatments (Table 7). The 'Contender' and 'Jade' control plots were equivalent in stand counts to the 'Contender' plots with a rye cover crop (Table 7). There were no significant differences between cultivar and rye cover on grass weed or broadleaf weed populations throughout the season (Tables 8-9).

In the organic pea plots no significant difference in yield was observed between

the control and cover crop plots (Table 10). Stand counts were significantly greater in the control plots, however (Table 10). Broadleaf weeds were significantly greater on the June 7 and July 11 sampling dates in control plots compared with rye-cover plots, which was similar to results from 2003 and 2004 (Table 11). Grass weeds were not affected by the cover crop, similar to 2003 and 2004, but populations were low overall (Table 12).

When specific pea cultivars were examined, there were no significant differences in stands, similar to 2003 and 2004 results (Table 13). Yields were significantly higher in 'Little Marvel' than 'Green Arrow' plots, however (Table 13). Cultivars were equally competitive with weeds, as demonstrated by similar grass and broadleaf populations in both cultivars (Tables 14-15). The lack of cultivar differences was also observed in 2003 and 2004 experiments.

When the effects of pea cultivars and rye cover crop were analyzed together, yields were significantly greater in the 'Little Marvel' control and rye cover crop plots (Table 16). Stands were significantly greater in both 'Little Marvel' and 'Green Arrow' control plots (Table 16). Broadleaf weed populations were greater in the control plots for both varieties on June 7 and July 11, with a significant difference observed on June 7 (Table 17). There was no significant difference in grass weed numbers when the effects of pea cultivars and rye cover crop were analyzed together (Table 18).

Results from these experiments were very encouraging for organic green bean and pea producers. With the exception of rabbits browsing on pea plants in 2004,

green bean and pea yields were excellent in 2003-2005, with no apparent nutritional, insect or disease problems. While there were no significant differences in yields and weed populations between treatments in 2003-2005, the overall benefit of planting a rye cover crop prior to green bean and pea planting can be related to weed management. Because weed management is recognized as one of the most pressing needs of organic farmers, a rye cover crop can assist in managing weed populations, particularly in years where weeds are plentiful due to high rainfall. Broadleaf weeds were effectively

managed in all years in both pea and green bean plots with the rye cover crop. Grass populations were not considered a problem in all year, and were not as affected by the rye cover crop. Any effort towards reducing weed seed densities will lead to an increase in yields in the long term.

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References

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Table 1. Organic green bean weed management trial: crop parameters, 2005.

Treatment	Yield (lb/acre)	Stand (plants m ⁻¹)	
		June 7, 2005	June 23, 2005
Rye Cover Crop	9,078.2	14.13b	13.69b
Control	9,097.8	21.44a	20.69a
LSD _{0.05}	NS	5.28	4.96

Table 2. Organic green bean weed management trial: broadleaf weed parameters, 2005.

Treatment	Broadleaf weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Rye Cover Crop	6.06a	2.63	2.81
Control	9.94b	3.81	3.63
LSD _{0.05}	3.37	NS	NS

Table 3. Organic green bean weed management trial: grass weed parameters, 2005.

Treatment	Grass weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Rye Cover Crop	2.25	0.69	0.81
Control	2.19	1.19	0.69
LSD _{0.05}	NS	NS	NS

Table 4. Organic green bean variety trial: crop parameters, 2005.

Treatment	Yield (lb/acre)	Stand (plants m ⁻¹)	
		June 7, 2005	June 23, 2005
Contender	11,861.6a	21.00b	20.19b
Jade	6,314.4b	14.56a	14.19a
LSD _{0.05}	3,263.2	5.43	5.14

Table 5. Organic green bean variety trial: broadleaf weed parameters, 2005.

Treatment	Broadleaf weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Contender	8.88	3.44	3.56
Jade	7.13	3.00	2.88
LSD _{0.05}	NS	NS	NS

Table 6. Organic green bean variety trial: grass weed parameters, 2005.

Treatment	Grass weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Contender	2.19	0.56	0.69
Jade	2.25	1.31	0.81
LSD _{0.05}	NS	NS	NS

Table 7. Organic green bean variety and weed management trials: crop parameters, 2005.

Treatment	Yield (lb/acre)	Stand (plants m ⁻¹)	
		June 7, 2005	June 23, 2005
Contender, Control	9,948.3b	19.50b	18.88a
Contender, Rye Cover Crop	13,774.9a	22.50b	21.50a
Jade, Control	8,247.3b	23.38b	22.50a
Jade, Rye Cover Crop	4,381.4c	5.75a	5.88b
LSD _{0.05}	3,733.0	3.96	3.80

Table 8. Organic green bean variety and weed management trials: broadleaf weed parameters, 2005.

Treatment	Broadleaf weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Contender, Control	11.88	4.88	4.50
Contender, Rye Cover Crop	5.88	2.00	2.63
Jade, Control	8.00	2.75	2.75
Jade, Rye Cover Crop	6.25	3.25	3.00
LSD _{0.05}	NS	NS	NS

Table 9. Organic green bean variety and weed management trials: grass weed parameters, 2005.

Treatment	Grass weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Contender, Control	2.13	0.63	0.63
Contender, Rye Cover Crop	2.25	0.50	0.75
Jade, Control	2.25	1.75	0.75
Jade, Rye Cover Crop	2.25	0.88	0.88
LSD _{0.05}	NS	NS	NS

Table 10. Organic pea weed management trial: crop parameters, 2005.

Treatment	Yield (lb/acre)	Stand (plants m ⁻¹)	
		June 7, 2005	June 23, 2005
Rye Cover Crop	3,128.0	11.63b	12.81b
Control	3,541.5	18.56a	23.25a
LSD _{0.05}	NS	3.46	4.28

Table 11. Organic pea weed management trial: broadleaf weed parameters, 2005.

Treatment	Broadleaf weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Rye Cover Crop	6.44a	3.19	2.25a
Control	12.25b	4.25	3.69b
LSD _{0.05}	2.97	NS	1.31

Table 12. Organic pea weed management trial: grass weed parameters, 2005.

Treatment	Grass weeds/m		
	June 7, 2005	June 23, 2005	July 11, 2005
Rye Cover Crop	3.25	1.06	0.63
Control	1.81	1.38	1.19
LSD _{0.05}	NS	NS	NS

Table 13. Organic pea variety trial: crop parameters, 2005.

Treatment	Yield (lb/acre)	Stand (plants m ⁻¹)	
		June 7, 2005	June 23, 2005
Green Arrow	2,508.4b	15.38	17.81
Little Marvel	4,161.0a	14.81	18.25
LSD _{0.05}	763.9	NS	NS

Table 14. Organic pea variety trial: broadleaf weed parameters, 2005.

Treatment	Broadleaf weeds/ m		
	June 7, 2005	June 23, 2005	July 11, 2005
Green Arrow	9.88	3.38	2.94
Little Marvel	8.81	4.06	3.00
LSD _{0.05}	NS	NS	NS

Table 15. Organic pea variety trial: grass weed parameters, 2005.

Treatment	Grass weeds/ m		
	June 7, 2005	June 23, 2005	July 11, 2005
Green Arrow	2.44	1.19	1.00
Little Marvel	2.63	1.25	0.81
LSD _{0.05}	NS	NS	NS

Table 16. Organic pea variety and weed management trials: crop parameters, 2005.

Treatment	Yield (lb/acre)	Stand (plants m ⁻¹)	
		June 7, 2005	June 23, 2005
Green Arrow, Control	2,631.6b	18.63a	23.13a
Green Arrow, Rye Cover Crop	2,385.3b	12.13b	12.50b
Little Marvel, Control	4,451.4a	18.50a	23.38a
Little Marvel, Rye Cover Crop	3,870.7a	11.13b	13.13b
LSD _{0.05}	1,116.9	5.07	6.28

Table 17. Organic pea variety and weed management trials: broadleaf weed parameters, 2005.

Treatment	Broadleaf weeds/ m		
	June 7, 2005	June 23, 2005	July 11, 2005
Green Arrow, Control	13.38b	3.75	4.25b
Green Arrow, Rye Cover Crop	6.38a	3.00	1.63a
Little Marvel, Control	11.13b	4.75	3.13ab
Little Marvel, Rye Cover Crop	6.50a	3.38	2.88ab
LSD _{0.05}	4.27	NS	1.81

Table 18. Organic pea variety and weed management trials: grass weed parameters, 2005.

Treatment	Grass weeds/ m		
	June 7, 2005	June 23, 2005	July 11, 2005
Green Arrow, Control	1.88	1.00	1.13
Green Arrow, Rye Cover Crop	3.00	1.38	0.88
Little Marvel, Control	1.75	1.75	1.25
Little Marvel, Rye Cover Crop	3.50	0.75	0.38
LSD _{0.05}	NS	NS	NS