

The Economic Value of Cover Crops to Shenandoah Valley Producers

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Cover crops serve multiple beneficial roles in Virginia cropping systems, and serve an especially vital role in the Shenandoah Valley. The Virginia Department of Conservation and Recreation offer incentive programs for producers interested in planting cover crops. While quite popular with many producers, cover crop seed costs in 2009 were greater than ever before (Table 1). Nitrogen fertilizer costs have dropped considerably in the last year, but the market is still somewhat volatile. Many producers wonder what the actual nitrogen value of legume cover crops are. Likewise, many producers have expressed interest in growing cereal grains with legumes to achieve the benefits from both species. Unfortunately, very little research has been conducted in the Valley to answer many of these questions.

This paper highlights the results of the first year of a cover crop research and demonstration project that is on-going in Rockingham County, Virginia. Seven different cover crop treatments were planted in the fall of 2006 in a randomized complete block design with three replications. Cover crops consisted of cereal rye, crimson clover, hairy vetch, forage radish, and combinations of cereal rye and legumes. Main effect treatments consisted of cover crop termination date. Cover crops were terminated by applying herbicide and mechanically rolling the residue on 10 May, 1 June and 15 June. Corn to be harvested for silage was planted immediately following cover crop termination. Biomass, plant available nitrogen, and carbon:nitrogen ratios of the cover crop species were determined at termination. At maturity, the corn silage in each plot was harvested with field-scale harvesting equipment and weighed.

The following tables outline the findings from the first year of this project. Table 2 shows the significant yield advantage that was observed from corn silage planted into killed legume cover crops over corn silage planted into either rye alone, or no cover crop. Furthermore, this table presents the value of that corn silage yield advantage when considering the seed and establishment costs. Table 3 illustrates the results from extensive plant and soil testing. Calculations of plant available nitrogen were made from the cover crop residue and the soil nitrogen sources, and estimates of the total plant available nitrogen as well as the economic value of that nitrogen were determined. Finally, Table 4 combines the short term economic benefits of increased corn silage yield and plant available nitrogen into a dollar value that producers may use to help plan their cover crop decisions.

Table 1. Expected seed and establishment costs for cover crop seedings in the Shenandoah Valley in 2009.

Cover Crop	Variety	Average Price ¹	Seeding Rate ²	Seeding Cost ³	Establishment Costs	Cost Share		Producer Costs for Cover Crop Establishment	
						Before Oct 5	After Oct 5	Before Oct 5	After Oct 5
Wheat	VNS ⁴	\$ 19.00 bu	2 bu/ac	\$ 15.86 ac	\$ 53.86 ac	\$ 50.00 ac	\$ 25.00 ac	\$ (3.86) ac	\$ (28.86) ac
Rye	Graze Master	\$ 16.00 bu	2 bu/ac	\$ 15.86 ac	\$ 47.86 ac	\$ 60.00 ac	\$ 35.00 ac	\$ 12.14 ac	\$ (12.86) ac
	Wheeler	\$ 17.75 bu	2 bu/ac	\$ 15.86 ac	\$ 51.36 ac	\$ 60.00 ac	\$ 35.00 ac	\$ 8.64 ac	\$ (16.36) ac
	Huron	\$ 18.50 bu	2 bu/ac	\$ 15.86 ac	\$ 52.86 ac	\$ 50.00 ac	\$ 25.00 ac	\$ (2.86) ac	\$ (27.86) ac
	Abruzzi	\$ 16.25 bu	2 bu/ac	\$ 15.86 ac	\$ 48.36 ac	\$ 60.00 ac	\$ 35.00 ac	\$ 11.64 ac	\$ (13.36) ac
Barley	Nomini	\$ 10.88 bu	2 bu/ac	\$ 15.86 ac	\$ 37.62 ac	\$ 50.00 ac	\$ 25.00 ac	\$ 12.38 ac	\$ (12.62) ac
	Thoroughbred	\$ 11.25 bu	2 bu/ac	\$ 15.86 ac	\$ 38.36 ac	\$ 50.00 ac	\$ 25.00 ac	\$ 11.64 ac	\$ (13.36) ac
Triticale	Trical 815	\$ 24.25 bu	2 bu/ac	\$ 15.86 ac	\$ 64.36 ac	\$ 50.00 ac	\$ 25.00 ac	\$ (14.36) ac	\$ (39.36) ac
Crimson	VNS	\$ 0.80 lb	20 lb/ac	\$ 15.86 ac	\$ 31.86 ac	\$ 35.00 ac	\$ - ac	\$ 3.14 ac	\$ (31.86) ac
Vetch	Hairy	\$ 1.98 lb	20 lb/ac	\$ 15.86 ac	\$ 55.46 ac	\$ 35.00 ac	\$ - ac	\$ (20.46) ac	\$ (55.46) ac
	Common	\$ 1.08 lb	20 lb/ac	\$ 15.86 ac	\$ 37.46 ac	\$ 35.00 ac	\$ - ac	\$ (2.46) ac	\$ (37.46) ac
Radish	Tillage	\$ 2.92 lb	10 lb/ac	\$ 15.86 ac	\$ 45.06 ac	\$ - ac	\$ - ac	\$ (45.06) ac	\$ (45.06) ac

Notes

1. Average price taken from a seed dealer survey Fall 2009
2. Seeding rates based on requirements in the 2009 BMP manual
3. Seeding cost based on the 2008 Shenandoah Valley Farm Custom-Work Rate Guide
4. VNS = variety not stated.

Table 2. Effect on corn silage yield and dollar returns from cover crops killed on 10 May, 2007.

Cover Crop ¹	Variety ²	Seeding	Seed	Establishment	Corn Silage Yield @ 35 DM	Value of Corn	Return over
		Rate	Cost ³	Cost ⁴		Silage ⁵	Establishment Costs
		lb ac ⁻¹	\$ ac ⁻¹		tons ac ⁻¹	\$ ac ⁻¹	
Rye	Wheeler	120	\$ 35.50	\$ 51.36	8.98	\$ 269.52	\$ 218.16
Crimson Clover	VNS	20	\$ 16.00	\$ 31.86	13.79 *	\$ 413.82	\$ 381.96
Hairy Vetch	Early	20	\$ 39.60	\$ 55.46	13.79 *	\$ 413.82	\$ 358.36
Rye/Vetch	Wheeler/Early	90/20	\$ 66.23	\$ 82.09	10.62	\$ 318.53	\$ 236.44
Rye/Vetch/Clover	Wheeler/Early/VNS	60/10/10	\$ 45.55	\$ 61.41	14.52 *	\$ 435.60	\$ 374.19
Rye/Radish	Wheeler/Tillage	90/15	\$ 70.45	\$ 86.31	12.98 *	\$ 389.32	\$ 303.01
No Cover		0	\$ -	\$ -	5.99	\$ 179.69	\$ 179.69

Notes:

1. Crimson clover, hairy vetch, rye/vetch, rye/vetch/clover and rye/radish planted on 8 September, 2006
Rye planted on 15 November, 2006
2. VNS = Variety not stated
3. Seed cost estimated at \$17/bu for Wheeler rye, \$.80 /lb for crimson clover, \$1.08/lb for vetch, and \$2.95/lb for radish
4. Establishment cost calculated by multiplying the seed cost by \$15.86 ac⁻¹. This rate was determined from the 2008 Shenandoah Valley Farm Custom-Work Rate Guide
5. Value of corn silage calculated from an average 2007 price of \$30.00 per ton

* Indicates that values within a column are not significantly different at $P < 0.05$

Table 3. Amount and dollar value of plant available N returned to corn silage from cover crops killed on 10 May, 2007.

Cover Crop ¹	Variety ²	Total PAN Available from Residue ³	Adjusted PAN Available from Residue ⁴	PAN from Soil NO ³ and Soil NH ³	Estimated PAN for Corn Silage Crop ⁵	Value of N Returned (@ 0.46 N)
		-----lb ac ⁻¹ -----				\$ ac ⁻¹
Rye	Wheeler	87.48	0.00	32.45 *	32.45	\$ 14.93
Crimson Clover	VNS	<i>170.55</i> *	<i>85.27</i>	23.31 *	108.58	\$ 49.95
Hairy Vetch	Early	<i>126.22</i>	<i>63.11</i>	23.94 *	87.05	\$ 40.04
Rye/Vetch	Wheeler/Early	<i>215.06</i> *	<i>107.53</i>	45.36 *	152.89	\$ 70.33
Rye/Vetch/Clover	Wheeler/Early/VNS	<i>172.53</i> *	<i>86.26</i>	43.88 *	130.15	\$ 59.87
Rye/Radish	Wheeler/Tillage	136.14	0.00	39.96 *	39.96	\$ 18.38
No Cover		0.00	0.00	16.29	16.29	\$ 7.49

Notes:

1. Crimson clover, hairy vetch, rye/vetch, rye/vetch/clover and rye/radish planted on 8 September, 2006
Rye planted on 15 November, 2006
2. VNS = Variety not stated
3. Total N calculated by multiplying the cover crop biomass by the percent N in the biomass.
Numbers in the column that are italicized indicate C:N ratios of < 25.
4. Adjusted N rates are calculated by assuming 1) approximately 50% of PAN will be lost to volatilization because cover crops are killed and left on the surface; and 2) PAN in cover crop residue with a C:N of >25 will undergo net immobilization.
5. Total estimated PAN determined by summing adjusted PAN from residue and soil mineralization.

* Indicates that values within a column are not significantly different at $P < 0.05$

Table 4. Short-term economic advantage of cover crops in a Shenandoah Valley corn silage rotation in 2007.

Cover Crop ¹	Variety ²	Corn Silage Value after Establishment		Value of N Returned (@ 0.46 N)	Total Short-Term Dollar Value ³		
		Costs					
-----\$ ac ⁻¹ -----							
Rye	Wheeler	\$	218.16	\$	14.93	\$	233.09
Crimson Clover	VNS	\$	381.96	\$	49.95	\$	431.91
Hairy Vetch	Early	\$	358.36	\$	40.04	\$	398.40
Rye/Vetch	Wheeler/Early	\$	236.44	\$	70.33	\$	306.77
Rye/Vetch/Clover	Wheeler/Early/VNS	\$	374.19	\$	59.87	\$	434.06
Rye/Radish	Wheeler/Tillage	\$	303.01	\$	18.38	\$	321.39
No Cover		\$	179.69	\$	7.49	\$	187.18

Notes:

1. Crimson clover, hairy vetch, rye/vetch, rye/vetch/clover and rye/radish planted on 8 September, 2006
Rye planted on 15 November, 2006
2. VNS = Variety not stated
3. Short-term return does not include the additional benefits of cover crop residue, including increased water holding capacity, increased CEC, increased OM, and reduced erosion.