ECONOMICS OF HIGH-INPUT CEREAL COVER CROP

In production agriculture, there is a monetary cost associated with each and every input, regardless of the crop or production system. So it follows that there is a cost associated with establishing a cover crop. Unlike most inputs that producers apply to their crops, there is not or should not be an expectation of a monetary return that equals or exceeds the cost associated with inserting a cover crop into any production system. It has always been touted that benefits from cover crops will or should come from enhanced control of herbicide-resistant weeds or an intangible environmental benefit that may take years to be realized.

Results from a study by Balkcom et al. titled "Fertilizer Management for a Rye Cover Crop to Enhance Biomass Production" (Agron. J., Vol. 110, No. 4, 2018) add a new twist to the above assumed scenario by exploring the agronomic and economic ramifications of adding N fertilizer to a cereal cover crop to enhance its biomass production. The study was conducted for 3 years (2005-2008) using a cereal rye cover crop followed by strip-till cotton. The premise supporting this research is that winter cereal cover crops are a necessary component for achieving maximum benefits from conservation tillage in the southeastern US, and that these benefits generally are enhanced as cover crop biomass increases.

The experiment was initiated in fall 2005, and all treatments remained in the same location for the duration of the experiment. Treatments in the experiment consisted of fall and spring application of N fertilizer applied at three rates of either commercial fertilizer or poultry litter (Table 1). Mineral N supplied by the poultry litter was not consistent across years and application times, but was estimated to be reasonably close to rates of mineral fertilizer N at each application time each year. Results from soil tests each year indicated that P, K, and lime levels at the site were considered "high" according to Alabama Experiment Station recommendations for cotton. Cover crop termination occurred on 20 Apr. 2006, 16 Apr. 2007, and 21 Apr. 2008, and corresponded to approximately 3 weeks before anticipated cotton planting.

Total cost for cover crop seed, planting, and termination was estimated at $40/acre across the years of the study. Estimated costs associated with the N fertilizer treatments in the study are shown in Table 1.

Pertinent results from the study follow.

- Cereal rye biomass production was increased by the addition of N fertilizer regardless of source.
- Commercial fertilizer resulted in 13% more cereal rye biomass than poultry litter.
- Fall- vs. spring-applied N produced more biomass at the medium and high fertilizer rates. At the low N application rate, both fall- and spring-applied N were equally effective at increasing biomass.
- N content of the cereal rye biomass responded linearly to N rates, and ranged from about 19 to 53 lb N/acre.
- N content of rye biomass was greater from fertilizer vs. poultry litter.
- N content of rye biomass was greater for spring- vs. fall-applied fertilizer regardless of N source. Thus, the C:N ratio in rye biomass following spring N application was lower. However, all C:N ratios were above the 25:1 to 30:1 threshold established to promote mineralization and/or rapid decomposition of cover crop biomass.
- N fertilizer recovery efficiency across all effects in the study averaged 37%.
- N recovery for spring-applied fertilizer was 145% greater than that for spring-applied poultry litter.
- As expected, adding N fertilizer to the cereal rye cover crop in this study added considerable additional expense beyond that required (~$40/acre) for establishment and termination of the cover crop (Table 1).
- Commercial N fertilizer increased biomass for less money compared to poultry litter (Table 1).
- Lower biomass production and higher costs for poultry litter reduced the feasibility of poultry litter vs. commercial fertilizer as an N source for increased biomass production from the cereal rye.

There are several take-away points gleaned from the results of this study.

- If the sole purpose of a cereal cover crop is to reap the perceived benefits from maximum biomass production, then N fertilizer addition to the cover crop will increase biomass production.
- The increased expense from using poultry litter to increase cover crop biomass production may be somewhat offset by the fact that poultry litter contains other nutrients, which may benefit the cover crop and subsequent cash crop (click here for example nutrient

contents of poultry litter). However, it is not likely that producers will be willing to incur this large additional expense just to benefit a cover crop.

- It is accepted that many of the benefits assumed from using cover crops will not be realized in the short-term. Also, the preponderance of evidence indicates that there will be no short-term yield gain for the cash crop that follows a cereal cover crop. Thus, the additional expense from applying N fertilizer in any form to a cereal cover crop will likely be prohibitive since there will not likely be any short-term return to the additional expense.

Finally, the results reported in the above-linked article provide valuable insight into the cost of not only inserting a cereal cover crop into a production system, but also how using applied N fertilizer to increase biomass production from that cover crop will drastically increase costs. Crop producers in the southeastern US are likely to forego the added expense of the fertilizer and use other methods such as earlier planting of the cover crop or properly timed termination to ensure maximum biomass production from an unfertilized cereal cover crop. Future research may show added benefits/returns from fertilizing a cover crop, but for now, the expense of an unfertilized cover crop is likely all producers are willing to incur in commodity crop production systems.

Table 1. Rates of fertilizer N and estimated rates of poultry litter N at time of application (TOA) in fall and spring of 2005-2008, and their cost (all costs include application costs).

		Fertilizer N*					
Year	**TOA****	**Rate**	**Cost**	**Rate**	**Cost**	**Rate**	**Cost**
		lb/acre	*$/acre*	*lb/acre*	*$/acre*	*lb/acre*	*$/acre*
All years	Fall	Low–30	22.06	Med.–60	37.64	High–90	53.70
	Spring	Low–30	22.06	Med.–60	37.64	High–90	53.70
		Poultry Litter N***					
2005-2006	Fall	Low–38	44	Med.–76	88	High–115	132
	Spring	Low–37	44	Med.–73	88	High–110	132
2006-2007	Fall	Low–27	44	Med.–53	88	High–80	132
	Spring	Low–35	44	Med.–69	88	High–104	132
2007-2008	Fall	Low–32	44	Med.–64	88	High–96	132
	Spring	Low–33	44	Med.–66	88	High–100	132

*N from ammonium nitrate.
**Fall application on 12 Dec. 2005, 4 Dec. 2006, and 19 Nov. 2007 after cover crop establishment; spring application on Feb. 2006, 7 Feb. 2007, and 14 Feb. 2008.
***Low, medium, and high rates of poultry litter are 1, 2, and 3 tons/acre. Available N based on 50% mineralization of total N becoming available the first year of application compared to commercial fertilizer rates.
Caveat: Current prices may change magnitude of effects, but likely will not change relationship among treatments.

Composed by Larry G. Heatherly, May 2018, larryheatherly@bellsouth.net