COVER CROPS AND CORN STOVER REMOVAL

Row crop producers have become increasingly interested in cover crops because of their contribution to sustainable agriculture through reducing soil erosion and improving soil quality and nutritive value. Cover crops are grown for these benefits rather than for harvest of seed or forage.

In a production system that includes corn, there is increased interest in the removal of corn stover for use as a feedstock for the production of cellulosic ethanol. However, this risks losing the positive benefits that corn residue contributes to soil conservation. Thus, while corn stover is a readily available resource for biofuel production, its removal should be limited so as not to reduce its positive effects on soil quality and resulting productivity if allowed to remain on the production site.

The Education Store–Purdue Univ. Extension has informative articles on the culture and management of cover crops. One such article is entitled "Synergies between cover crops and corn stover removal" authored by Michelle Pratt, Wallace Tyner, David Muth Jr., and Eileen Kladivko. The purpose of the analyses reported in this article is to show how cover crops can mitigate the potential adverse effects of corn stover removal, and even allow for increased sustainable removal.

- The authors use three methods to determine the costs and benefits of using cover crops in combination with corn stover removal. The methods are separate and use unique data sources.
- In their analyses, the authors considered two cover crop mixes (annual ryegrass/crimson clover and annual ryegrass/oilseed radish) and six single species cover crops (annual ryegrass, cereal rye, crimson clover, hairy vetch, oats, and oilseed radish).

- In the analyses, cover crop costs were broken into three components: 1) establishment costs, to include costs for seed and aerial seeding; 2) termination costs associated with using herbicides and their application; and 3) unexpected costs, which included possible multiple termination events, untimely termination of the cover crop, the cover crop becoming a weed in the following crop, and the need to disc the cover crop in the spring to aid termination. Data for these cost estimates were gleaned from several sources, including the Midwest Cover Crops Council–Cover Crop Decision Tool.
- The authors assumed four categories of agronomic benefits derived from cover crops: 1) increased soil nutrient content; 2) increased soil organic matter; 3) reduced soil compaction; and 4) reduced soil erosion. An economic value was placed on each benefit category, again using sources that included the Midwest Cover Crops Council Cover Crop Decision Tool.
- An economic benefit associated with corn stover removal assumed an existing market for corn stover.
- Specified management practices were cover crops, residue removal, crop rotations, and tillage.
- In the analyses, no additional benefits from cover crops were assumed when corn stover was harvested. Rather, the cover crop acted as a replacement for the removed stover and allowed for additional stover removal. Thus, the benefit of a cover crop when stover was removed is the profit made from the sale of the removed stover.

In the analysis, cover crop costs ranged from $35.78/acre for annual ryegrass to $69.81/acre for hairy vetch, which is a $24/acre difference.

Cover crop agronomic benefits ranged from $37.71/acre for oilseed radish to $77.73/acre for crimson clover. Benefits from the two legumes, crimson clover and hairy vetch ($67.95/acre), grown as single species greatly exceeded those from the non-legume single species cover crops. The two cover crop mixes provided lower benefits than the two legume species grown alone.

The higher benefit assigned to the two legumes in the analysis assumes that producers will apply the N credit from the legume cover crops. If producers do not take this N credit into account–i.e. assume it to be zero–then the above benefit from the legume cover crops will of course be lower. In a separate analysis that assumed the N credit to be zero, the economic benefits from growing the cereal rye ($51.20/acre) and crimson clover ($53.64/acre) crops as single species were the greatest and nearly equal to each other.

Net benefits derived from cover crops without considering stover removal was highest for crimson clover ($34.24/acre, 0 probability of loss) and lowest for oilseed radish ($-4.94/acre, 77% chance of loss). Using a mix of crimson clover and annual ryegrass provided the second highest net benefit of $17.58/acre and a near 0 probabilility of loss. Use of hairy vetch (59% probability of loss) and oilseed radish as single-species cover crops resulted in the greatest risk of a loss associated with their use.

Net benefits derived from a combination of cover crops (except hairy vetch) and stover removal (using $60/ton value for stover) was between $24.78/acre for crimson clover and $32.49/acre for annual ryegrass. Hairy vetch cover crop and stover removal resulted in a net benefit of $-1.53/acre and a probability of loss >58%. The probability of loss for all other cover crops/mixes with stover removal at the $60/ton value was essentially zero.

Use of a cover crop with stover removal provided a significant increase in the probability of a net benefit compared to use of most cover crops/mixes with no stover removal. Of course, the net benefits derived from using cover crops with stover removal will depend on the farm-gate value of the stover.

These analyses results provide the following important summary points about using cover crops in combination with corn stover removal.

- In most cases, cover crops alone provide positive agronomic and economic benefits to producers, but the benefits vary by cover crop species.
- Adding a cover crop to the production system allows for a sustainable increase in stover removal vs. the amount of stover removal with no subsequent cover crop.
- Cover crops used in combination with corn stover removal are estimated to provide greater farm profit potential compared to benefits from using cover crops with no stover removal.

Readers are encouraged to read the above-linked article to get further details about the components and procedures used in these analyses.

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