



# Corn Belt Assessment of Cover Crop Management and Preferences

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## ABSTRACT

Surveying end-users about their use of technologies and preferences provides information for researchers and educators to develop relevant research and educational programs. A mail survey was sent to Corn Belt farmers during 2006 to quantify cover crop management and preferences. Results indicated that the dominant cereal cover crops in Indiana and Illinois are winter wheat (*Triticum aestivum* L.) and cereal rye (*Secale cereale* L.), cereal rye and oat (*Avena sativa* L.) in Iowa, and oat in Minnesota. Legumes were used more frequently in Indiana and Illinois, and red clover (*Trifolium pratense* L.) was the dominant choice across the region. Farmers relied solely on herbicides 54% of the time to kill cover crops. Ninety-three percent of respondents indicated that they received no cost sharing for using cover crops and 14% indicated that they would plant cover crops on rented land. Corn Belt farmers prefer cover crops that overwinter (68%) and fix N (64%). The information provided in this survey supplements existing knowledge that can be used to develop relevant research and educational programs to address agronomic production systems that include cover crops.

**S**URVEYING END-USERS about their use of technologies and preferences provides information for researchers and educators to develop relevant research and educational programs. Singer et al. (2007) reported the results of cover crop use and factors affecting use of cover crops in the U.S. Corn Belt. Two primary goals of that article were to quantify cover crop use in the Corn Belt and identify the population of Corn Belt Farmers most likely to adopt and begin using cover crops in their operations. The second goal of that work was to quantify the amount of green payment or incentive farmers required to plant cover crops and how many would use cover crops if an adequate incentive was available. Information about farmer preference and management of cover crops was not included in that report. The information presented in this article provides the basis for understanding current cover crop management and preferences.

A mail survey was used to collect data from farmers in the four Corn Belt states (Illinois, Indiana, Iowa, and Minnesota) who were actively farming in 2006. The sampling frame used to select the sample was a list of individuals, addresses, and occupation codes (using the standard industrial classification system) maintained by Survey Sampling International.<sup>1</sup> For sampling purposes, farmers were defined to be any person whose occupation involves farming with wheat, corn (*Zea mays* L.), soybean [*Glycine max* (L.) Merr.], cash grains, or who operates a general farm that primarily grows crops. A stratified

random sample of 3500 farmers was selected by sampling 875 farmers from each state. The survey included questions about the respondent's farming operation, practices and government program participation, knowledge and attitudes about cover crops, and use of cover crops. Cover crops were defined as plants growing between regular grain crop production periods. A total of 1096 completed and useable surveys were received with response rates in Illinois, Indiana, Iowa, and Minnesota of 33.9, 33.6, 42.1, and 35.0%, respectively. To summarize the data, weighted estimates of means, percentages, and the number of farmers with a specific characteristic in the study region or in a specific state were calculated using stratified sample estimators.

## Cover Crop Preference

The survey found that cover crop use in the Corn Belt was low. Only 11% of Corn Belt farmers had planted cover crops in the period between 2001 and 2005. And only 8% had planted cover crops in the fall of 2005 (Singer et al., 2007). Plants used as cover crops varied somewhat among the four states (Table 1). In Indiana and Illinois, cereal rye, wheat, and red clover were the most popular choices. In Iowa, cereal rye and oat were the top two choices among farmers. In Minnesota, oat was the dominant choice. Minnesota farmers also listed other cover crops, not included in these choices, as a large percent (21%) of the cover crops they used. The results from these states indicate that farmers use multiple cover crops on the land they manage. Furthermore, the cover crops used follow from the major field crops planted in these states. For example, in 2006, Illinois and Indiana had 376,500 and 190,200 ha of winter wheat, compared with 10,121 and 20,243 ha in Iowa and Minnesota. Farmers in Illinois and Indiana are more familiar with winter wheat and may use some of the saved seed. Red clover use was also higher in these two states, which likely results from inter-seeding red clover in winter wheat.

<sup>1</sup>Mention of trade names or commercial products is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture

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Indiana farmers most frequently plant cereal rye (47.2%) and winter wheat (47.2%) after corn; and cereal rye (34.1%) and winter wheat (45.9%) after soybean. Illinois farmers most frequently plant cereal rye (59.3%), annual ryegrass (*Lolium multiflorum* L.) (15.6%), or winter wheat (15.6%) after corn; and winter wheat (44.1%) and cereal rye (26.4%) after soybean. Iowa farmers plant cereal rye (36.3%), oat (27.2%), and annual ryegrass (22.7%) after corn; and cereal rye (52.3%) and annual ryegrass (23.8%) after soybean. Minnesota farmers responded that cereal rye after corn was most common, but the sample size for cover crops planted after corn and soybean was small. After soybean, winter wheat (38.4%), oat (23.0%), and cereal rye (23.0%) were commonly used.

Differences in cover crop species selection were not detected for farmers who only planted crops versus farmers who raised livestock and crops. Only two farmers responded that they only raised livestock. The dominant livestock were beef cattle (*Bos taurus*) followed by dairy cattle. In Illinois, of the farmers that used cover crops during the past 5 yr, 16 only grew crops while 24 raised crops and livestock. Of these, four who only raised crops planted rye and 12 planted wheat cover crops. Of the farmers who raised both crops and livestock, 12 planted rye and 11 planted wheat cover crops. In Indiana, 16 farmers raised crops only, and 23 raised both crops and livestock. Of these, farmers that only planted crops five used rye and 12 used wheat compared with seven farmers who used rye and 12 who used wheat if they raised crops and livestock. Similar results were found in Iowa and Minnesota, although the cover crops were different. Singer et al. (2007) reported that farmers were more likely to use cover crops if they raised crops and livestock ( $P = 0.001$ ) versus only crops, but these results indicate that no clear selection preference was detected for farmers raising crops alone or crops and livestock.

### Cover Crop Management

About 33% of farmers responded that they use tillage to kill their cover crops compared with 54% that use chemicals (Table 2). About 34% farmers wait less than 5 d to plant their cash crop, 36% wait 6–10 d, and 19% wait 11–15 d. About 46% of farmers reported that cover crops increase their corn or soybean yield. In 25% of the cases where cover crops increase yield, the cover crop was red clover compared with 23% for rye. Farmers also responded that 18% of the time, cover crops lower corn or soybean yield. Of this 18%, annual ryegrass was reported to lower corn or soybean yield 38% of the time compared with 34% for winter wheat, 23% for winter rye, and 4% for red clover. Farmers reported that about 27% of the time they harvest the cover crop for animal feed, while 62% did not harvest their cover crops (Table 2). Corn Belt farmers reported receiving no cost sharing incentives (93%) for using cover crops and that cover crops fulfilled requirements for conservation plans on 40% of their farms.

Respondents also indicated that they plant cover crops in their fields (owned land), but only 14% indicated that they would plant cover crops on rented land (Table 2). The majority of farmers plant their own cover crops (88%) using a grain drill, broadcast spreader, or aerial seeding (Table 2). Seed sources included the cooperative (36%), seed dealer (45%), other farmers (18%), and saved seed (22%), indicating farmers used

**Table 1. Mean percent  $\pm$  standard error for cover crops used in Indiana ( $n = 39$ ), Illinois ( $n = 40$ ), Iowa ( $n = 20$ ), and Minnesota ( $n = 26$ ) from a survey of Corn Belt farmers during the summer of 2006 who had used cover crops during the period 2001–2005. Cover crops were defined as plants growing between regular grain crop seasons.**

| Species          | Indiana        | Illinois       | Iowa           | Minnesota      |
|------------------|----------------|----------------|----------------|----------------|
|                  | %              |                |                |                |
| Cereal rye       | 43.8 $\pm$ 6.2 | 49.9 $\pm$ 7.1 | 53.3 $\pm$ 9.2 | 18.4 $\pm$ 6.3 |
| Winter wheat     | 49.9 $\pm$ 6.3 | 40.0 $\pm$ 6.9 | 13.3 $\pm$ 6.3 | 26.3 $\pm$ 7.2 |
| Winter triticale | 3.1 $\pm$ 2.2  | 0              | 0              | 0              |
| Annual ryegrass  | 9.3 $\pm$ 3.6  | 15.6 $\pm$ 5.1 | 16.6 $\pm$ 6.9 | 15.7 $\pm$ 5.9 |
| Oat              | 14.0 $\pm$ 4.3 | 19.9 $\pm$ 5.7 | 43.3 $\pm$ 9.2 | 52.6 $\pm$ 8.2 |
| Red clover       | 28.0 $\pm$ 5.6 | 35.9 $\pm$ 6.8 | 13.3 $\pm$ 6.3 | 18.4 $\pm$ 6.3 |
| Hairy vetch      | 4.6 $\pm$ 2.6  | 11.9 $\pm$ 4.6 | 3.3 $\pm$ 3.3  | 2.6 $\pm$ 2.6  |
| Other            | 11.0 $\pm$ 3.9 | 7.8 $\pm$ 3.8  | 6.6 $\pm$ 4.6  | 21.0 $\pm$ 6.7 |

**Table 2. Mean percent  $\pm$  standard error for cover crop (CC) preference and management from a survey of Corn Belt farmers in Indiana, Illinois, Iowa, and Minnesota during the summer of 2006. Cover crops were defined as plants growing between regular grain crop seasons.**

| Question                                      | n   | CC preference  |
|---|-----|----------------|
|   |     | %              |
| Do you use CC on rented land                  | 22  | 14.1 $\pm$ 2.8 |
| Do you use CC on owned land                   | 75  | 45.1 $\pm$ 3.9 |
| Do you use CC on both                         | 69  | 40.7 $\pm$ 3.9 |
| Establish CC using a drill                    | 119 | 67.5 $\pm$ 3.6 |
| Establish CC using broadcast spreader         | 39  | 21.0 $\pm$ 1.8 |
| Establish CC by aerial seeding                | 14  | 7.8 $\pm$ 2.0  |
| Do you use tillage to kill overwintering CC   | 39  | 32.9 $\pm$ 4.3 |
| Do you use chemicals to kill overwintering CC | 65  | 53.9 $\pm$ 4.5 |
| Do you use both to kill overwintering CC      | 16  | 13.1 $\pm$ 3.1 |
| Do you harvest CC for feed                    | 49  | 27.2 $\pm$ 3.3 |
| Do you harvest CC for other uses              | 19  | 10.3 $\pm$ 2.3 |
| Do not harvest CC                             | 117 | 62.3 $\pm$ 3.6 |
| Prefer CC that does not winterkill            | 577 | 68.4 $\pm$ 1.6 |
| Prefer CC that fixes N                        | 539 | 64.3 $\pm$ 1.6 |

multiple sources to obtain cover crop seed. About 67% of farmers used past experience to determine their cover crop seeding rate, while 22% used the cooperative, 17% used extension, and 19% used information from other farmers to determine their seeding rates. The majority of Corn Belt farmers indicated that they obtained information about cover crops from other farmers (27%), university extension (28%), and soil and water conservation districts (28%). When asked about their preference for cover crop traits, 68% of Corn Belt farmers indicated that they preferred cover crops that did not winterkill and 64% preferred cover crops that fixed N.

### Synthesis

To develop effective educational programs that will increase cover crop use, researchers must first determine which cover crops and in which cropping systems they are most likely to be adopted. Cover crops are one of the most widely researched conservation practices, yet adoption in agronomic systems remains low. Approaches similar to Wilke and Snapp (2008) for hairy vetch (*Vicia villosa* Roth) are necessary to increase adoption. They propose breeding for primary cover crop function to increase farmer success with cover crops by improving the reliability and outcome. They acknowledge that tradeoffs likely exist for secondary functions when breeding for primary cover crop function. Targeting cover crop function to specific

cropping systems may influence behavior change and adoption. For example, if farmers are interested in using cover crops to fix atmospheric N, then they would select species whose primary function is to fix N. Farmers must also be willing to change their cropping systems to facilitate inclusion of a legume. This survey found that 64% of farmers prefer cover crops that fix N, but establishing legumes in a corn–soybean rotation is challenging because legume establishment in the fall after full-season summer annual crops are harvested is risky, particularly in the northern Corn Belt. Integrated approaches to achieve this include breeding legume cover crops for seedling vigor and fall growth, extending crop rotations with winter annual cereal grains, and using shorter-season corn hybrids and soybean varieties to increase the success and lower the risk of using legume cover crops in the U.S. Corn Belt.

Obtaining information from farmers about how cover crops fit into their cropping systems and their expectations is critical. Both Mallory et al. (1998) and Snapp et al. (2005) used informal interviews or focus group discussions to identify why farmers were using cover crops and impediments to their use. Researchers must also quantify short- and long-term cover crop benefits, including nutrient capture and release kinetics, soil C sequestration, N fixation, and scale-relevant erosion estimates, among others. Once these responses have been quantified, educators and researchers must work together to summarize data from the primary literature to develop educational materials that provide the information end-users require to make management decisions.

An example of this type of collaboration is the research and education effort focused on intercropping red clover in winter cereals in Iowa. Blaser et al. (2006 and 2007) quantified winter cereal species, cereal seeding rate, and red clover seeding rate and forage quality responses. Singer et al. (2006) quantified red clover cultivar performance in the presence or absence of winter wheat. This information was synthesized into an extension publication (Gibson et al., 2006) to help farmers select the best components of the system. Another example of a publication generated from research-based information is the third edition of *Managing Cover Crops Profitably* (Sustainable Agriculture Network, 2007). This publication contains an enormous

amount of practical information about cover crops adapted to all regions of the United States. Information should be synthesized for different end-users, who include not only farmers but also agencies like the Natural Resources Conservation Service, who recommends cover crops to landowners to remain in compliance with conservation plans. The information provided by Corn Belt farmers in this survey supplements existing information that can be used to develop relevant research and educational programs to address agronomic production systems that include cover crops.

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