2012 – 2013 Cover Crop Survey

June 2013 Survey Analysis

CTIC
CONSERVATION TECHNOLOGY INFORMATION CENTER

NORTH CENTRAL
SARE
Sustainable Agriculture
Research & Education

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Acknowledgement

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Preface

This survey was conducted over the winter of 2012 – 2013 and concluded in the spring of 2013. It was conducted both online and using paper copies distributed at meetings where cover crop users would be present.

There were a total of 759 individuals who started this survey and answered at least one question using either the paper copies or the online version of the survey. Of the 759 who started the survey, 718 (94.6%) advanced through the entire survey to the last question. These numbers may be a bit misleading when you look at the charts within this document. Even though a respondent did not complete the survey by advancing to the last question, they may have provided responses to some questions within the survey that are included in this analysis. Also, because an individual did complete the survey does not mean that they provided a response to every question. For these reasons, there is an "n" value shown on the charts in this document which indicates the number of responses that were analyzed for each individual question.

In charts contained in this document, percentages listed represent the percent of responses to that individual question ("n" value), not the percentage of the 759 total respondents.

It is also worth noting that some questions gave respondents the opportunity to choose multiple responses from a list, up to a maximum number of responses. However, it is not safe to assume that all respondents provided the maximum number of responses in all cases.

Introduction

Though they have been grown for generations, cover crops are among today's exciting frontiers in conservation. Seasonal crops planted to cover, protect, or build the soil, cover crops are employed for a wide variety of uses. Investing money, time and management in a crop that grows during the period between cash crops is a bold, but often highly productive strategy for a farming system that is healthy over the long term – both economically and ecologically.

With a wide range of grasses, legumes, brassicas and other plants to choose from and vast numbers of possible combinations, cover crops can be managed to accomplish a variety of objectives from improving soil structure to choking out weeds.

However, there are many barriers to adopting cover crops, and many challenges in cover crop management. Understanding the barriers – as well as the attractions – can help increase adoption and better ensure success among producers new to cover cropping.

Figure 1. Annual ryegrass and radish on a farm in Ohio.

In late 2012 and early 2013, the North Central Sustainable Agriculture Research and Education (SARE) program and the Conservation Technology Information Center (CTIC) conducted a survey of farmers who grow cover crops. More than 750 farmers from across the U.S. completed the survey, representing hundreds of thousands of acres of cover crops and drawing on cover cropping experience that goes back as far as 1948.

The 2012 crop year was a challenging one in which to study yield impacts – much of the U.S. was impacted by drought, which pushed national per-acre corn production estimates down by 43.7 bushels, or 26.3%, and reduced soybean production by 8.1%, or 4.0 bushels per acre, based on early-season predictions from the U.S. Department of Agriculture Economic Research Service[1]. However, even in those conditions – or perhaps because of them – the survey revealed a positive impact of cover crops on yields.

This report summarizes the findings of that survey and interprets the results. Further details may be found online at http://www.northcentralsare.org/CoverCropsSurvey

Figure 2. Planting into cover crops on a farm in Michigan

[1] http://www.ers.usda.gov/topics/in-the-news/us-drought-2012-farm-and-food-impacts.aspx

Method

The purpose of the survey was to gather insight from conservation-oriented producers who have had one or more years of experience with cover crops.

To find large groups of farmers using cover crops, representatives of SARE and CTIC distributed a 13-question survey at various conservation conferences and conducted an email campaign to invite growers to complete the survey online via www.surveymonkey.com.

The team distributed the survey at the following meetings:

- No-Till on the Plains, Salina, Kan., January 2013
- Soil and Water Conservation Society Cover Crops Meetings:
    - Altoona, IA, December 2012
    - Decatur, IL, January 2013
- National No-Tillage Conference, Indianapolis, Ind., January 2013
- Conservation Tillage and Technology Conference, Ada, Ohio, March 2013

The meetings accounted for 43% of the completed surveys, and the balance, 57%, were completed online.

In all, 759 growers responded to the survey. Of those, 718 (94.6%) of those who started the survey completed it.

Respondents

Geography

A significant majority of the respondents (71%) farm in the Mississippi River Basin.

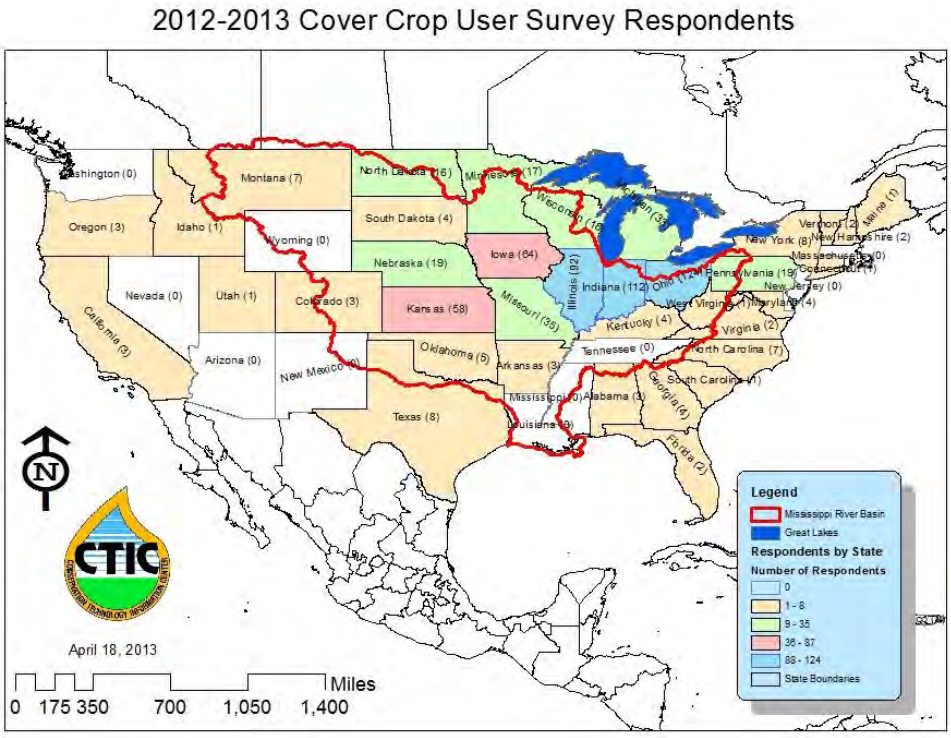

Figure 3. Distribution of cover crop user survey respondents by state.

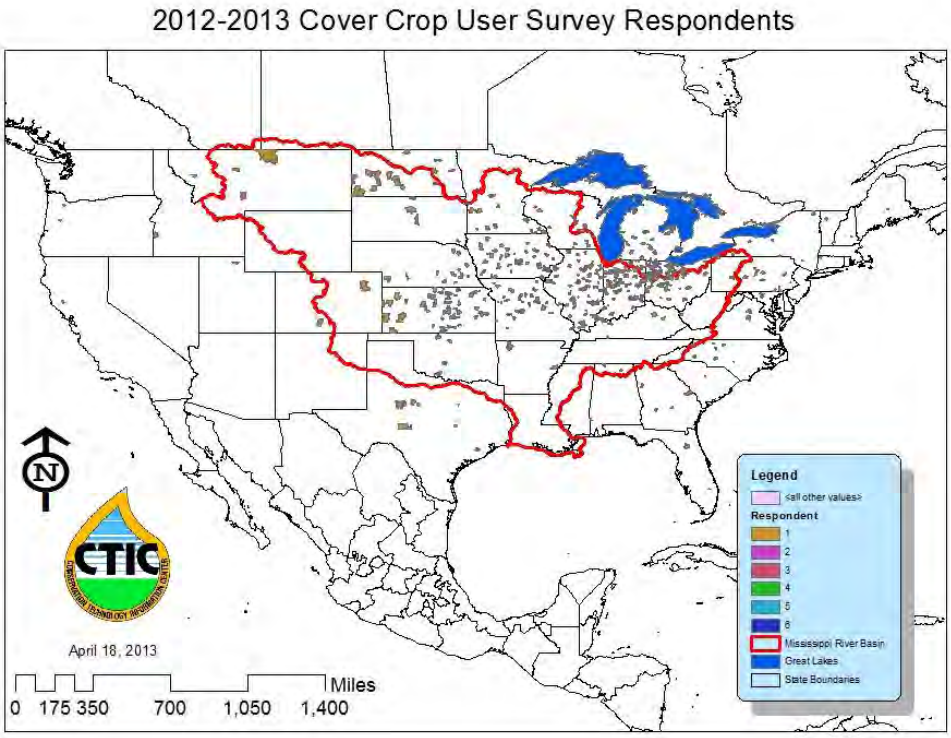

Figure 4. Distribution of cover crop user survey respondents by zip code.

Acreage

The respondents who reported on their acreage represent an estimated 218,608 acres of cover crops for the 2012-2013 season in 36 states. In 2012, respondents planted an average of 303 acres to cover crops, and predicted they would plant an average of 421 acres of cover crops in 2013.

In total, respondents reported that they plan to plant 301,100 acres of cover crops in the summer or fall of 2013.

On average, respondents planted cover crops on 42% of their acreage.

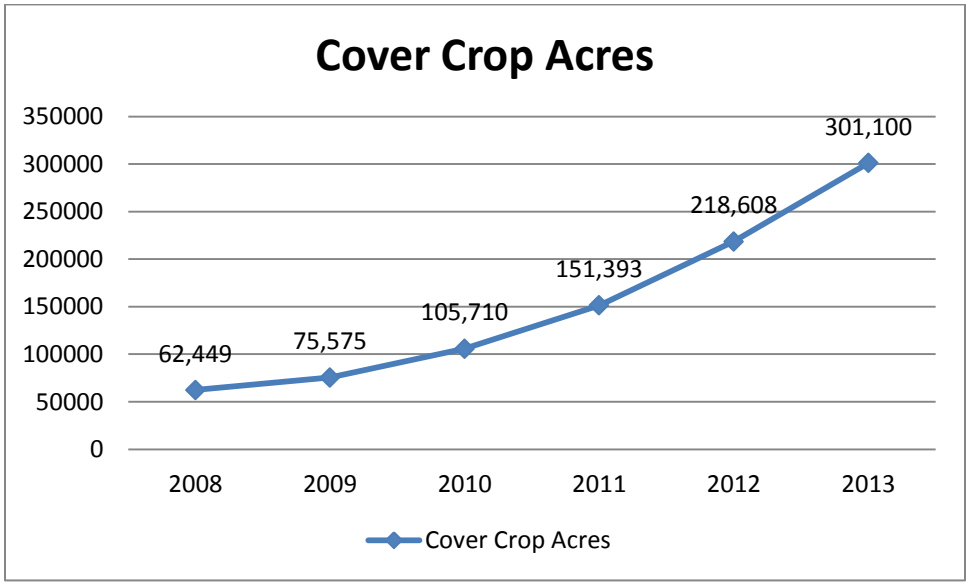

Figure 5. Total cover crop acres by year for all cover crop user survey respondents.

Year	2008	2009	2010	2011	2012	2013
Total Acres	*62,449*	*75,575*	*105,710*	*151,393*	*218,608*	*301,100*
Average Acreage per Respondent	*116*	*133*	*169*	*228*	*303*	*421*
Number of Responses	*537*	*567*	*623*	*664*	*720*	*714*

Figure 6. Total and average cover crop acreage by year with respondent numbers.

Experience

Half of the respondents had more than three years of experience with cover crops, a strong reflection of the dramatic and steady increase in cover crop adoption since 2001.

In total, the respondent pool represented more than 2,500 years of cover crop experience, with the most experienced respondent planting his first cover crops in 1948.

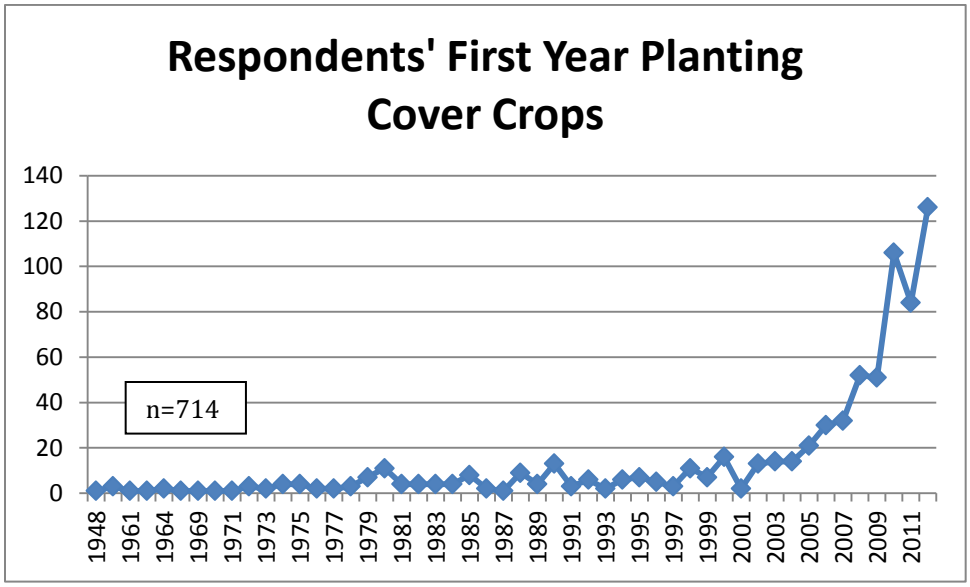

Figure 7. First year cover crop user survey respondents planted cover crops.

Results

Cover Crop Choices

A wide variety of plant species and varieties are available to growers as cover crops. The most popular cover crops among the 721 respondents to this question – who were allowed to give multiple answers – were winter cereal grains (planted by 72% of the respondents), followed by brassicas (62%), legumes (58%) and annual grasses (56%).

Two-species and multi-species mixes were moderately popular among respondents, at 29% and 34%, respectively. Many cover crop experts recommend mixes of grasses, legumes and brassicas to garner multiple benefits, combining nitrogen fixation, nutrient scavenging and the hardpan-breaking activity of deep, strong root systems.

The "Other" category on the chart below includes specific species mentioned by respondents in their surveys, including sunflowers, radishes, clover, buckwheat, flax and others, as well as more general categories such as native grasses or forages.

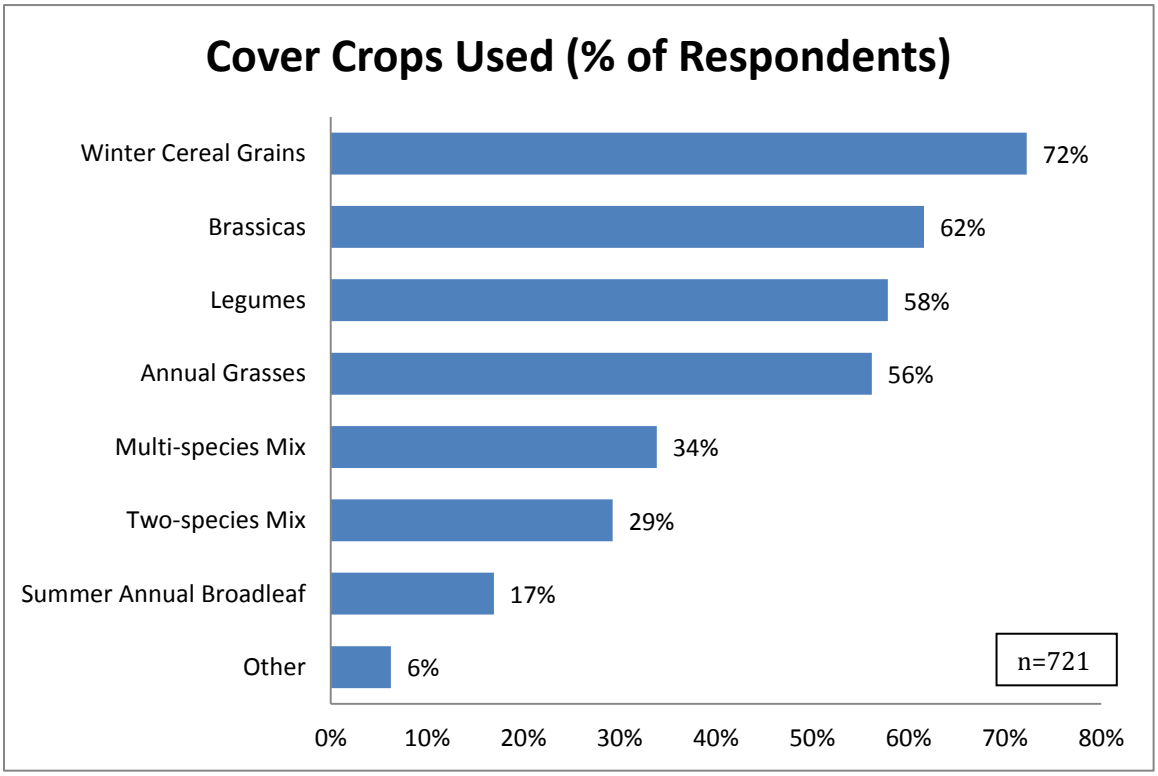

Figure 8. Cover crop species used by survey - percentage of respondents

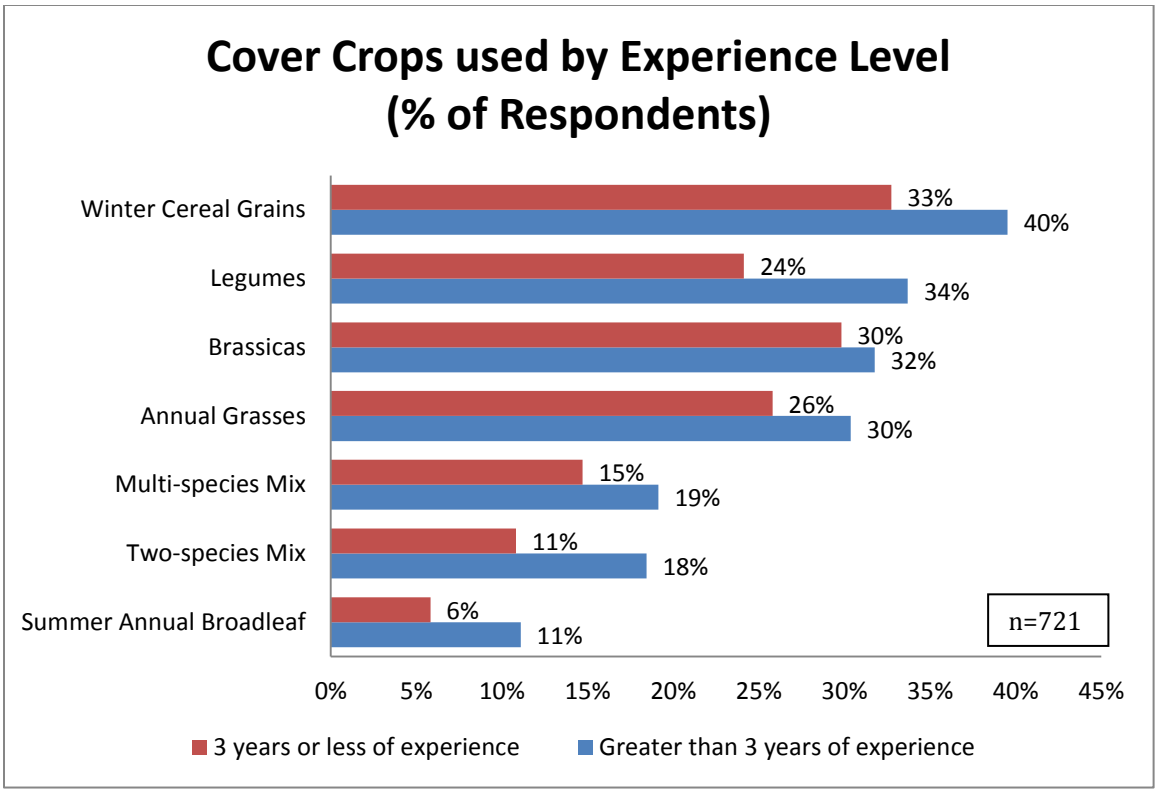

Figure 9. Survey respondents' cover crop choices broken down by experience level (percentage of respondents).

Figure 10. Annual rye grass cover crop.

Cover crops play a role in a wide variety of rotations. Among respondents, cover crops were most often used following corn and before soybeans (57% of the 691 respondents who answered this question). Other common use of cover crops in rotation included: following soybeans and before corn (54%), following small grains (43%), and in a continuous corn rotation (18%). (Respondents could choose multiple answers to this question.)

The "Other" category in the chart below (14%) includes cover crops in rotation with less-common crops such as sugar beets, potatoes, seed wheat and alfalfa, as covers for annual forages or alfalfa, or as full-season cover crops.

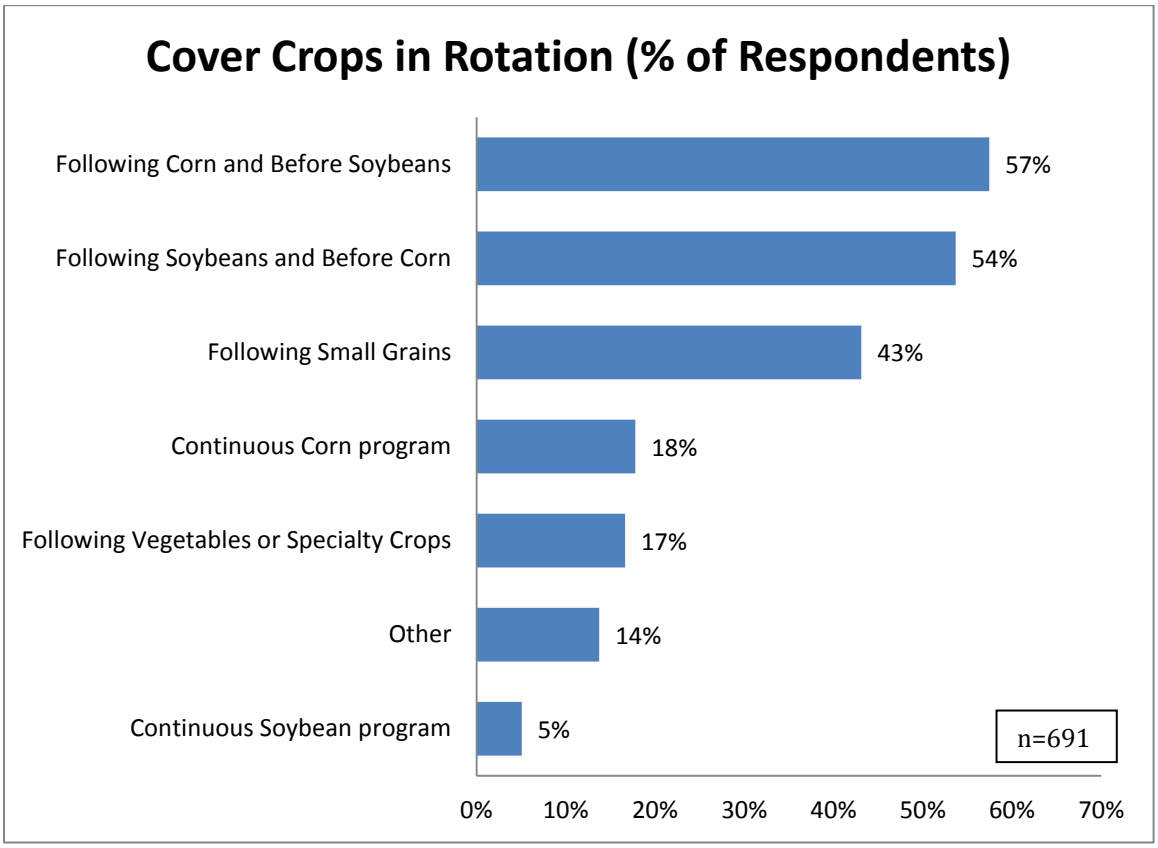

Figure 11. Crop rotations used by cover crop survey respondents with cover crops in their rotations (percentage of respondents).

Management Practices

Cover crops complement a variety of conservation farming practices and often appeal to producers engaged in other soil-building and erosion prevention activities.

A majority (55%) of the 696 respondents who reported on other management tactics practiced continuous no-till – in other words, no soil disturbance by tillage equipment at any point in the rotation – with their cover crops, versus 19% who reported practicing rotational no-till and 19% who practiced reduced tillage. Manure applications were reported by 28% respondents. Farmers could report multiple management practices.

Of 696 respondents who provided a response to this question, 7% reported that they did not plant cover crops in 2012.

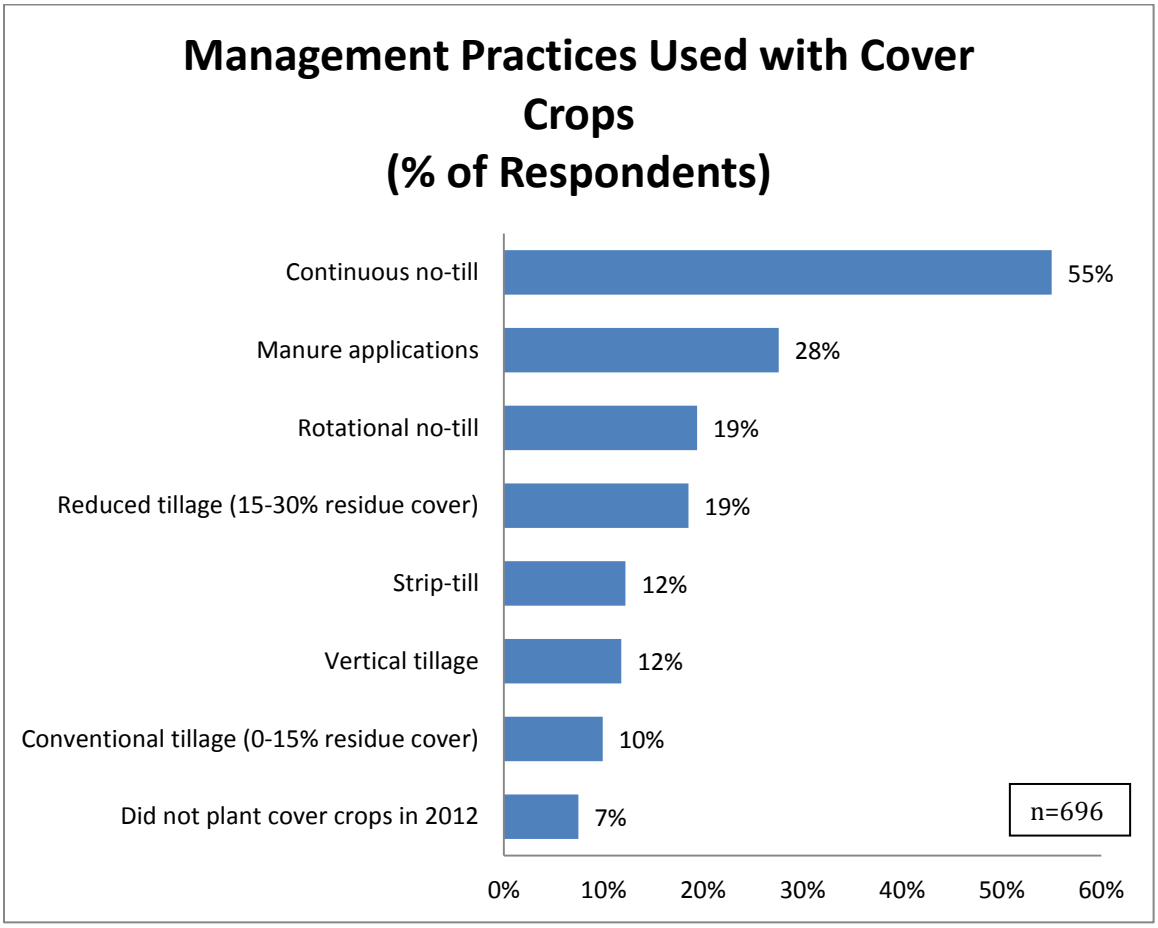

Figure 12. Management practices used by survey respondents (percentage of respondents).

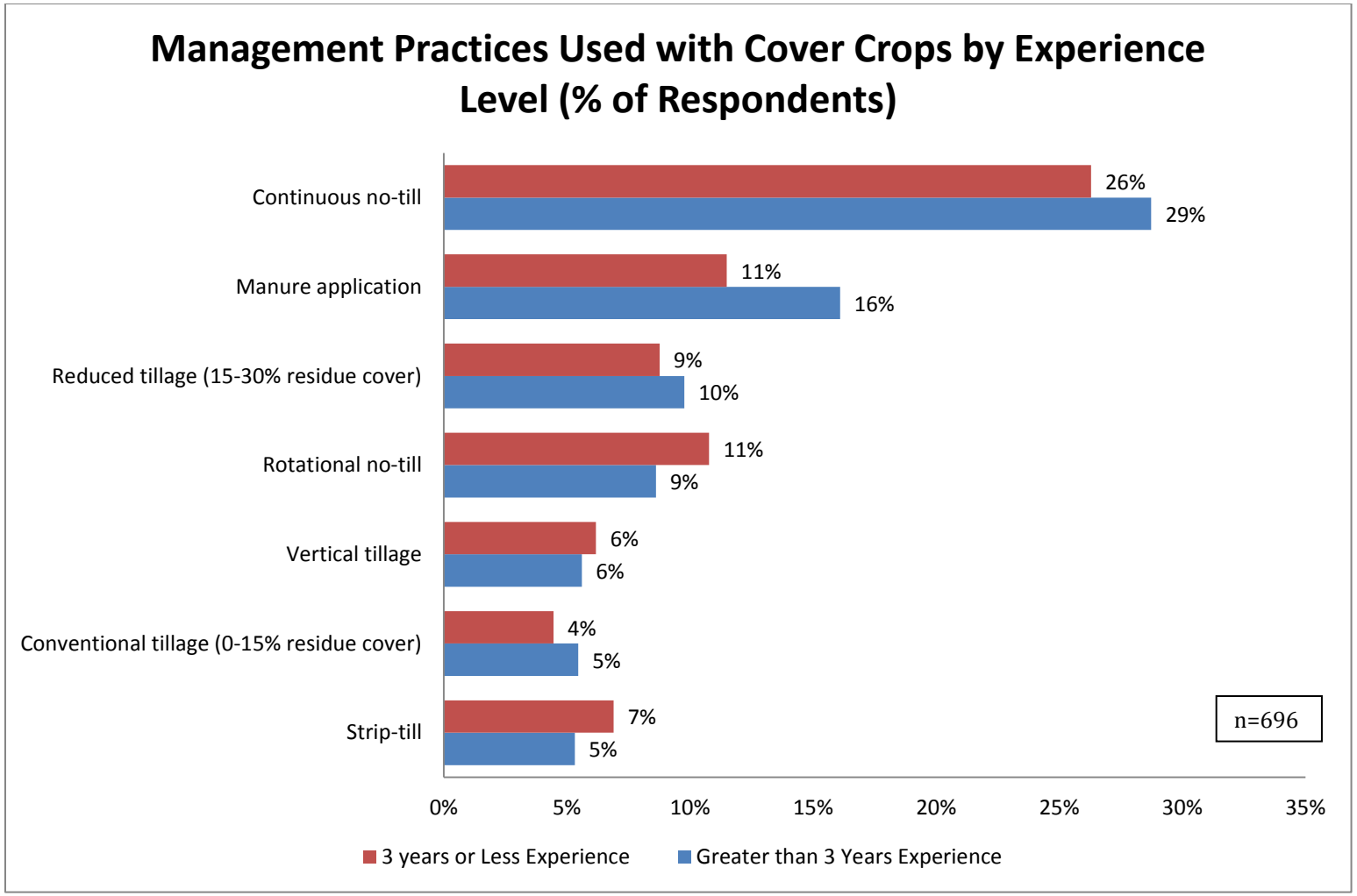

Figure 13. Management practices used by survey respondents broken down by experience level (percentage of respondents).

Challenges and Benefits

Cover crops are by no means a quick solution to production challenges or a one-size-fits-all proposition. Some of the greatest insight from the SARE/CTIC survey involves the challenges growers encounter in utilizing them and the benefits they desire from cover crops.

Nearly half the respondents (46% of those who answered the question) reported challenges with the establishment of their cover crops, making establishment the number-one challenge. Time, labor and increased management was noted by 44% of respondents, putting it firmly in second place on the list of challenges.

Species selection was cited third, by 43% respondents. Costs – of cover crop seed (33%) and planting/management costs (27%) – followed on the list. Cover crop potentially using too much soil moisture was sixth on the list, applying to 23% of respondents.

Presumably due to the growing popularity of cover crops, a lack of available seed was identified as a challenge by 18% of the farmers in the survey.

Concerns that cover crops could become weeds the following year were cited by 15% of the participants. Other production concerns, including insects, reducing disease, yield reduction, and overall risk, each garnered numbers in the double digits.

Write-in concerns included weather, planting times, slugs and voles, crop termination, managing seed rates, and others. Uncertainty surrounding USDA Risk Management Agency (RMA) regulations on cover crops was mentioned by several respondents.

Breaking the data on challenges down by years of experience – 378 respondents with more than three years of cover crop experience versus 375 with three years of experience or less – shows that experienced growers reported fewer problems with selection, establishment and having the cover crop become a weed the following year. However, experienced users were more likely to identify management, nitrogen immobilization, and increased insect potential as challenges.

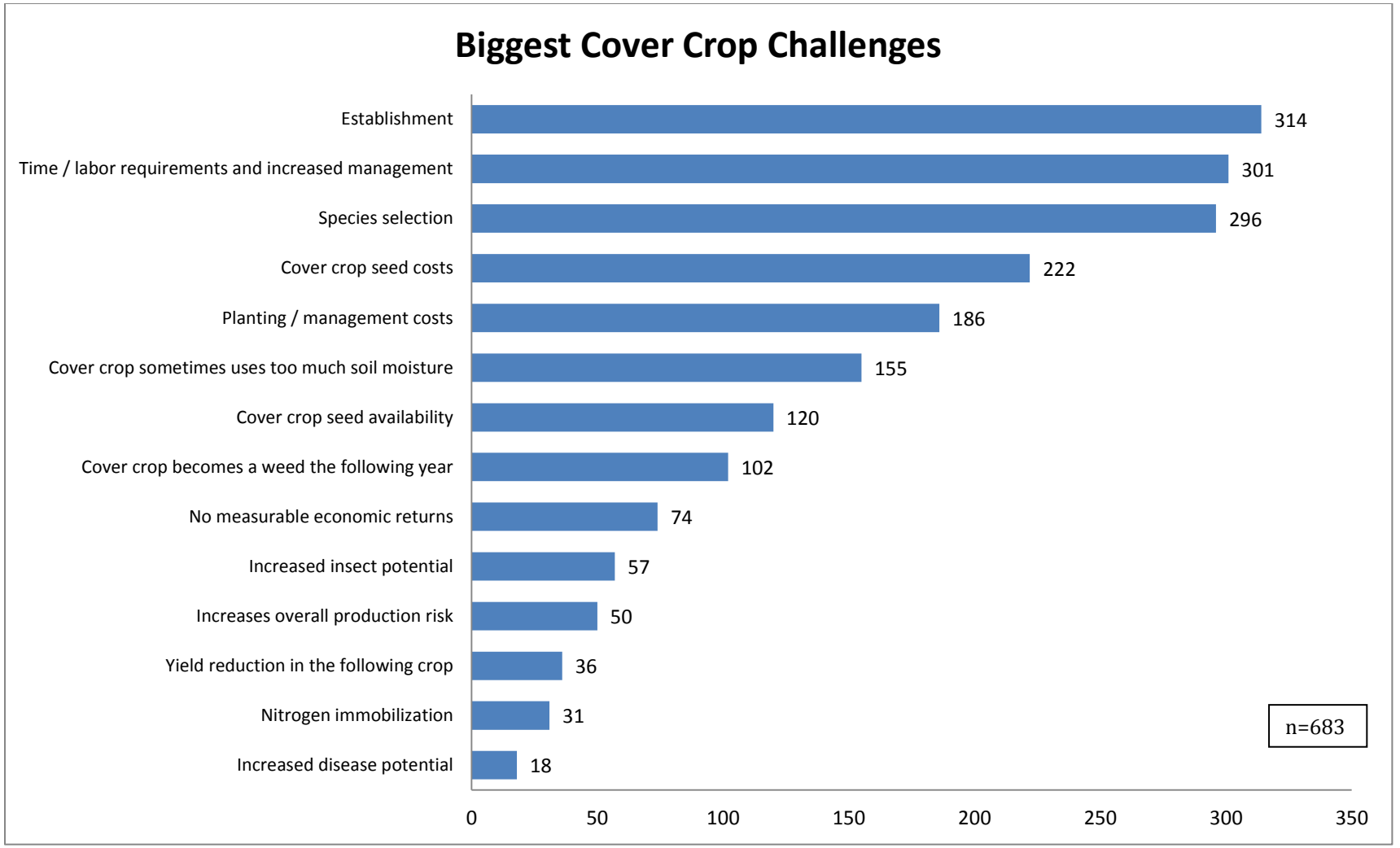

Figure 14. Challenges faced using cover crops by cover crop survey respondents (number of responses).

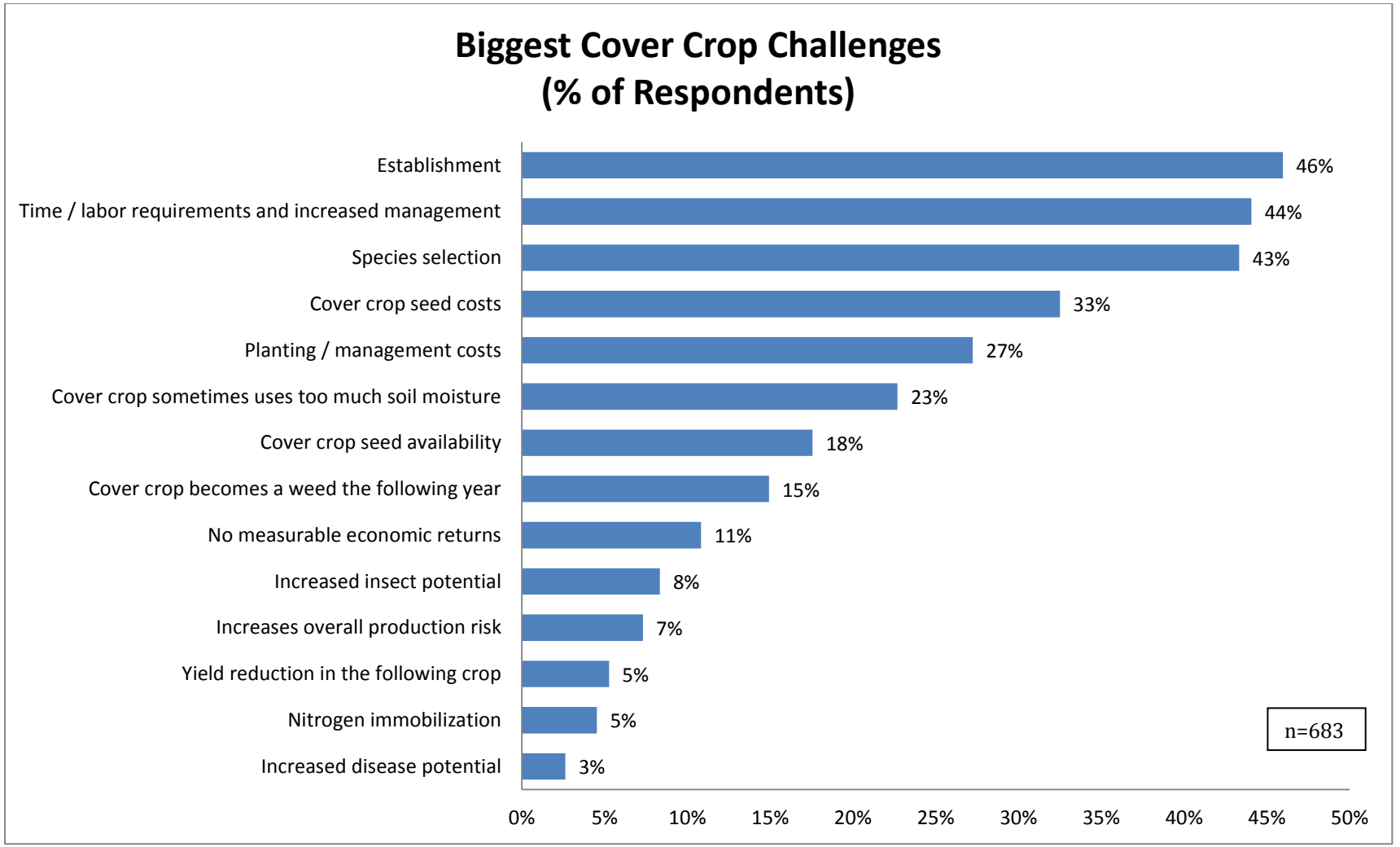

Figure 15. Challenges faced using cover crops by survey respondents (percentage of respondents).

However, farmers' thoughts on cover crops do not revolve solely around the challenges they present. Growers utilize cover crops because they deliver specific benefits.

When asked which characteristics they look for in cover crops – a question with no limit on the number of options they could choose – 700 gave at least one response. Respondents listed "reduces soil compaction" and "reduces soil erosion" most often by far, with 58% and 56% of the responses, respectively.

Nitrogen scavenging (41%) and weed control (40%) were nearly tied for third place, while 251 respondents – about 36% of the people who answered this question – believe cover crops increase yields for future crops.

Figure 16. Corn planted into an annual rye grass cover crop in Michigan.

Other notable benefits included economic return from haying and grazing (17%), disease reduction (7%), and production-related traits including "winter kills easily" (9%) and the opposite, yet almost equally attractive, "winter hardiness" (8%).

Given a write-in "Other" category, increasing soil matter was most often suggested. Improving water quality, increasing biological activity, building water holding capacity, and benefitting insects such as pollinators also were among the write-ins.

Comparing the desired benefits of growers with more than three years of cover crop experience with those of farmers who had three years' experience or less revealed some interesting differences. Newer cover crop users were more interested than their more experienced counterparts in reducing soil compaction. Growers with more than three years of experience in cover crops were more likely to cite goals such as reducing soil erosion, controlling weeds, providing a source of nitrogen, and decreasing future production costs.

A table depicting data on desired benefits by experience level is available in the Appendix.

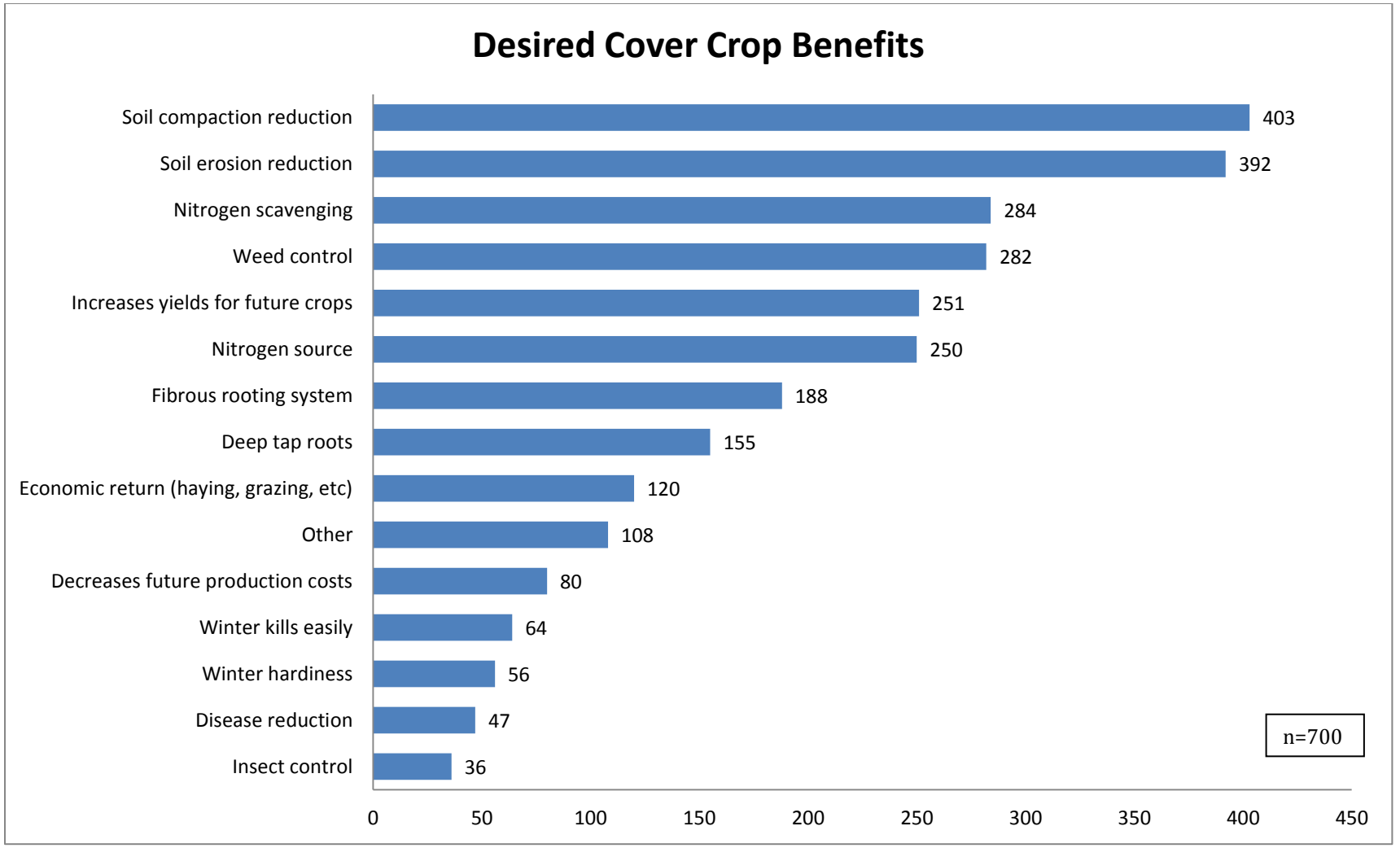

Figure 17. Cover crop benefits desired by cover crop survey respondents (number of responses).

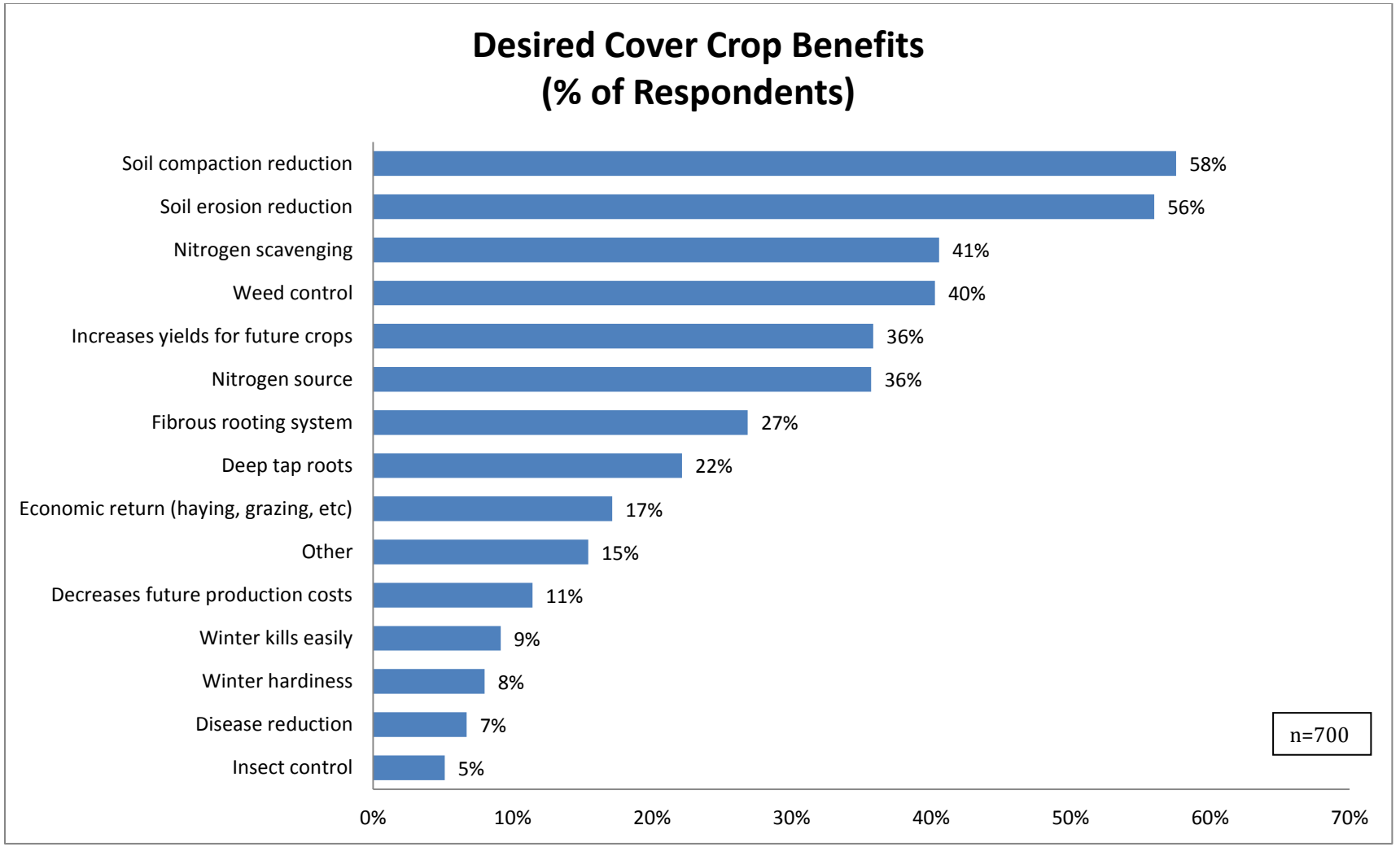

Figure 18. Cover crop benefits desired by cover crop survey respondents (percentage of respondents).

Costs of Seed and Establishment

The producers who participated in the survey clearly don't expect the benefits of cover crops to come free of charge.

Analyzing data from questions about the amount of money respondents were willing to spend per acre on cover crop seed and establishment is challenging. Some states had so few respondents and/or such dramatic outliers that the information could be significantly skewed and potentially misleading if taken out of context.

Sample size and outliers dictated the use of median, rather than mean, analysis.[2]

Median seed cost that farmers were willing to pay was $25.00 and the median value respondents were willing to pay for establishment was $15.00.

Growers in Kansas and Nebraska fell on the high end of the scale, growers reporting that they were willing to pay a median seed cost of $30.00. Producers from five states – Illinois, Iowa, Missouri, Ohio and Wisconsin – were willing to pay a median cost of $25.00. Response on seed price farmers are willing to pay was lowest in Michigan, at $18.50 an acre.

The median cost growers reported they were willing to pay for establishment of cover crops grouped strongly at $15.00 per acre, the median cost in six of the 12 states for which data were analyzed for this question. Growers in Indiana and Minnesota reported a median low of $10.00, while Wisconsin growers offered the high median value of $15.50.

[2] See Appendix for a discussion of the difference between mean and median values.

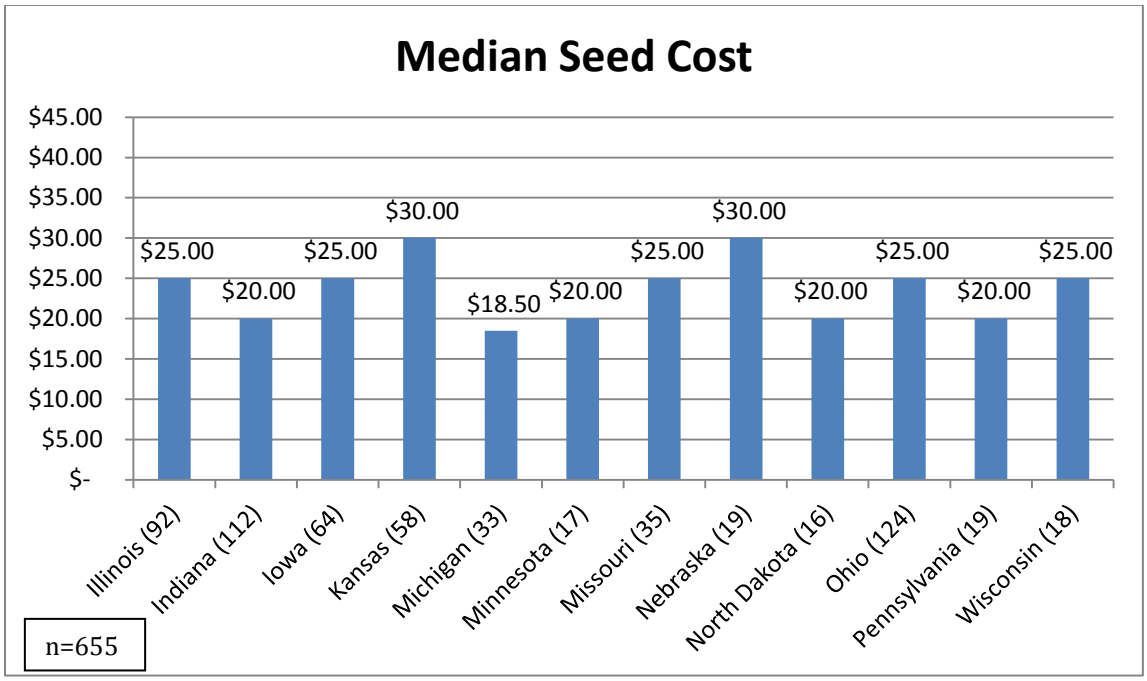

Figure 19. State breakdown of the median amount cover crop survey respondents are willing to pay for cover crop seed.

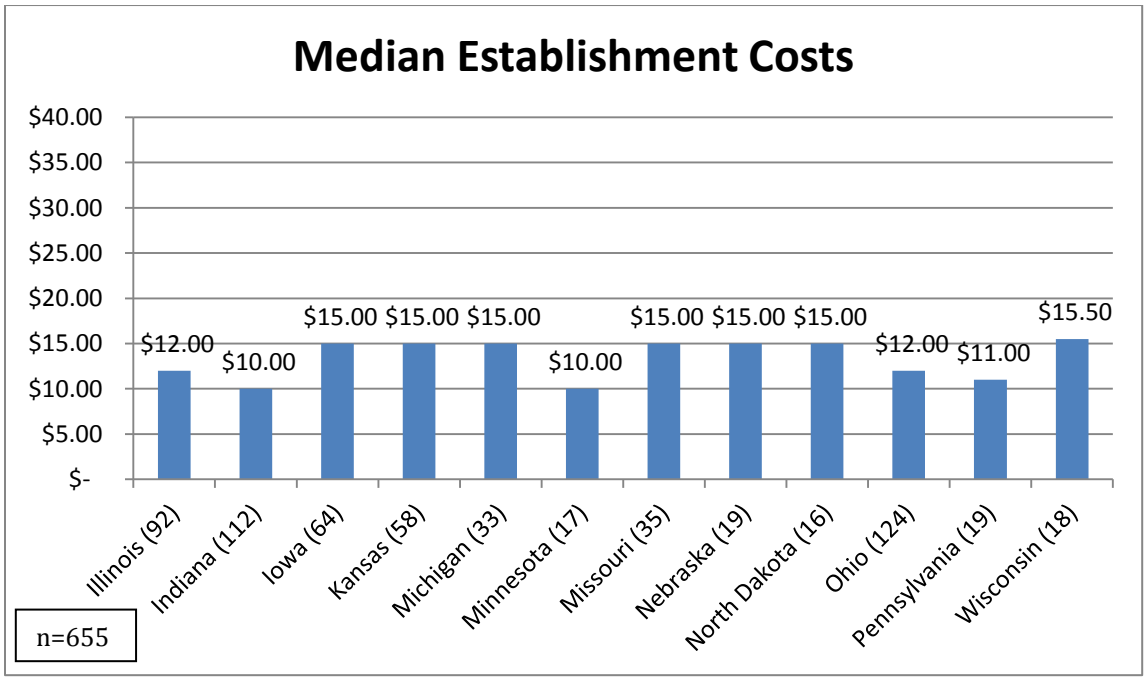

Figure 20. State breakdown of the median amount cover crop survey respondents are willing to pay to establish cover crops.

Yield Impacts

Respondents reported increases in 2012 cash crop yields in fields where they used cover crops – an average corn yield of 126.2 bushels per acre after cover crops vs. 115.1 bushels per acre without cover crops.

(It is important to note that the 2012 drought had a profound impact on corn yields across much of the country, reducing production to a nationwide estimated average yield of 122.3 bushels per acre. Proponents of cover crops point out that water held in the soil by the shading action of cover crops, and the additional moisture-holding capacity of soils in which long-term cover cropping and other conservation practices have increased soil organic matter, likely accounted for much of the yield gain where cover crops were planted.)

National soybean yield estimates fell to 39.6 bushels per acre due to the drought. However, growers in the survey report that their soybean yields averaged 47.1 bushels per acre after cover crops, compared to 42.2 bushels per acre without the use of cover crops.

That is an average increase of 11.1 bushels of corn per acre (calculated from 234 responses) and an average bump of 4.9 bushels of soybeans per acre (from 196 responses). Those growers reported yield information from comparable fields that were similar in nature – one field planted to cover crops and the other in similar conditions and rotation not planted to cover crops.

In percentage terms, those extra bushels represent an average 9.6% greater corn yield after cover crops and an 11.6% increase in soybeans.

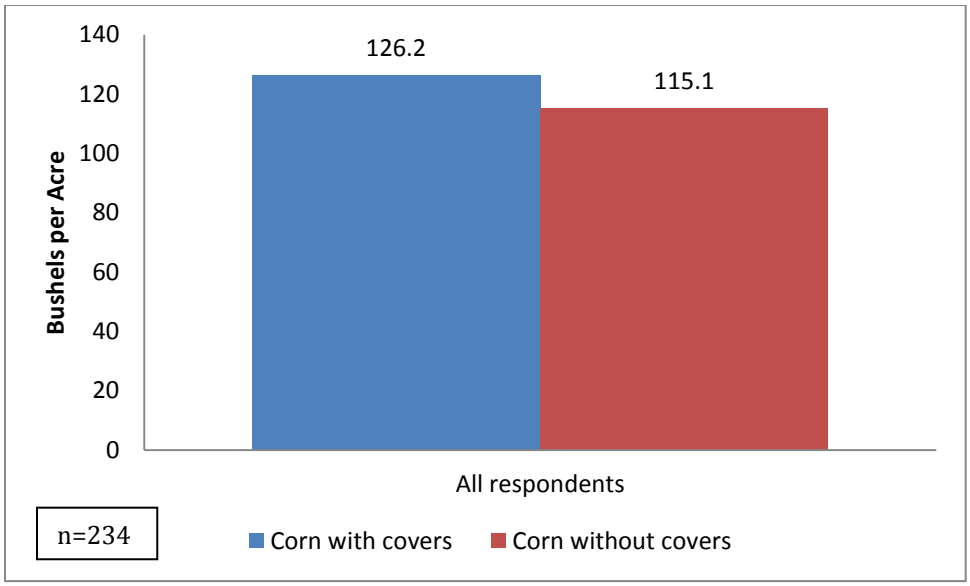

Figure 21. Average corn yields from cover crop survey respondents.

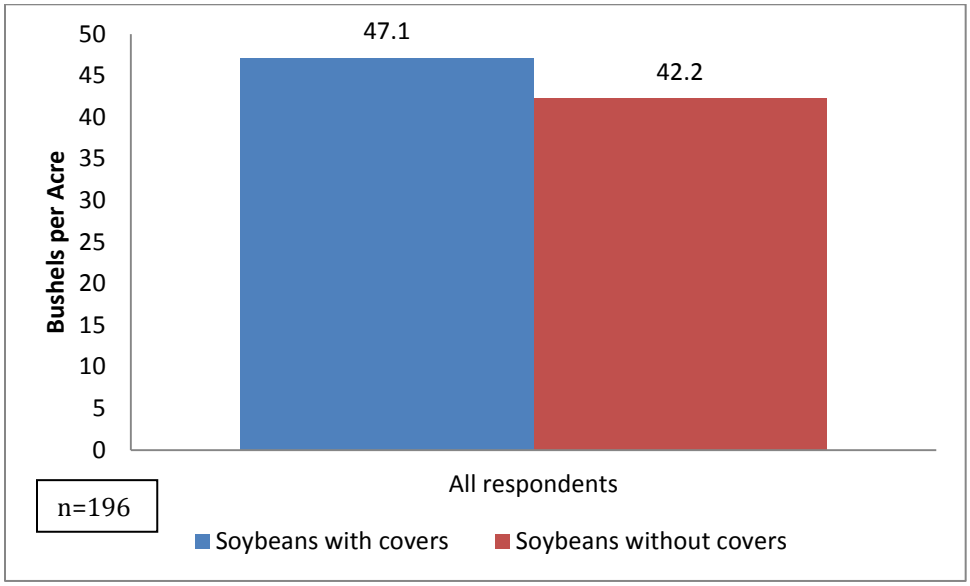

Figure 22. Average soybean yields from cover crop survey respondents.

The survey organizers explored the data to determine if the yield differences were higher for farmers who had longer experience with cover crops.

In corn, experience did correlate with success – growers more than three years working with cover crops saw a 9.6% increase in their corn yields, while growers with one to three years of experience reported a 6.1% boost in corn.

In soybeans, yield increased more than 11% for growers in both of the experience categories.

Experience Level with Cover Crops	Corn	Soybeans
All respondents	9.6% Yield Increase	11.6% Yield Increase
More than 3 years of experience	10.5% Yield Increase	11.6% Yield Increase
3 years or less of experience	6.1% Yield Increase	11.4% Yield Increase

Figure 23. Crop yield response to cover crops based on experience levels

Figure 24. Aerial cover crop seeding demonstration on a farm in Ohio.

Another interesting breakout of the data isolated the yield impact of cover crops on corn and soybeans in the states most affected by the 2012 drought: Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska and South Dakota.

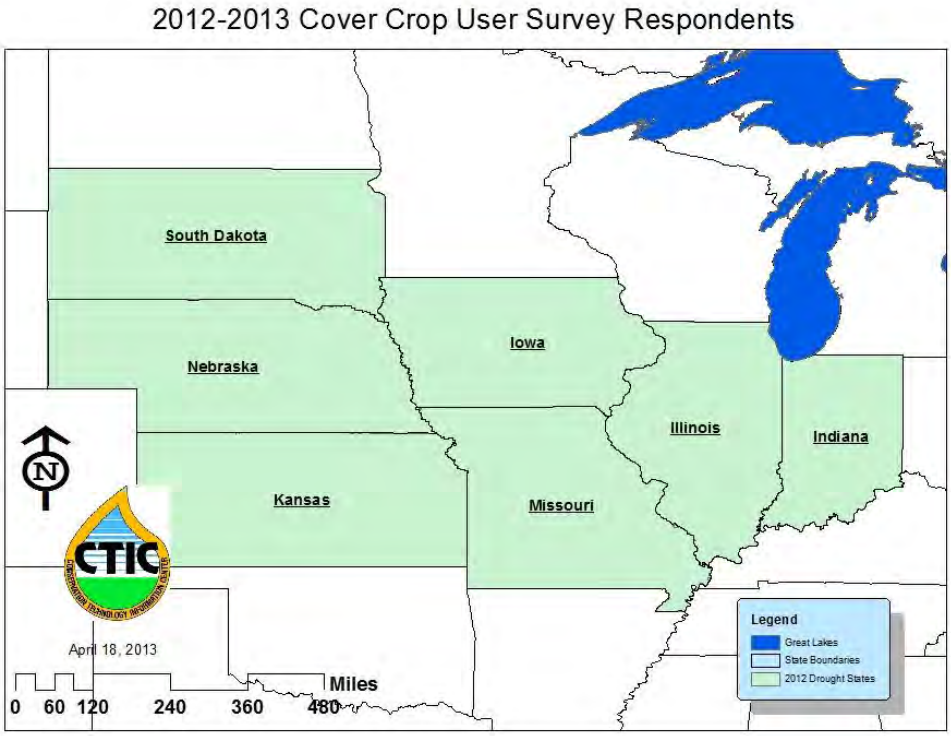

Figure 25. States most impacted by 2012 drought.

Among the 141 respondents from those states who reported their corn yields, the average yield benefit from cover crops was 11.3 bushels per acre, which represented an 11% increase.

The 118 respondents from drought-affected states who reported their soybean yields averaged an increase of 5.7 bushels per acre, or 14.3% higher yields after cover crops than without cover crops.

Within the sample of drought-affected growers, experience correlated with greater yield benefits. Growers in those seven states with three or more years of experience with cover crops saw an average increase of 11% in corn yields and 13% in soybeans, while respondents with less than three years of experience achieved a 6% increase in corn and an 11% increase in soybean yields after cover crops.

The chart below illustrates the differences in yield advantage – and the differences in the number of respondents, indicated by the green line – on a state-by-state basis.

Corn yield increases in 2012 following cover crops ranged from highs of 41 bushels per acre in Wisconsin, 28.1 bushels in Kansas and 22.5 bushels in Illinois to a yield disadvantage of 20 bushels per acre in Minnesota. However, it is important to note that Minnesota's figure is an average of only two reports – one of which reported substantially worse yields after cover crops, substantial enough to be considered an outlier in the context of the entire study – and Wisconsin's data reflects the mean of five respondents' answers.

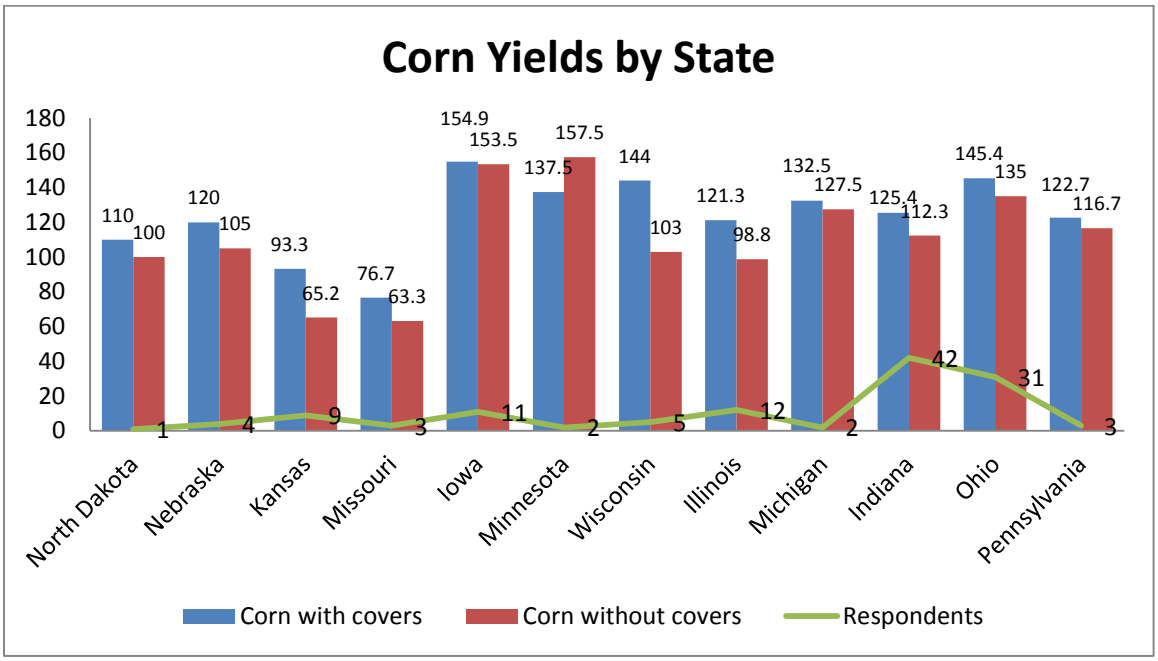

Figure 26. Average corn yields by state with and without cover crops.

In all, while there was significant farm-to-farm variability in the yield impacts of cover crops, the clear trend is that growers enjoyed better corn yields after cover crops in all but one of the states hit hardest by the drought.

The soybean yield advantage after cover crops in 2012 can be similarly broken down by state.

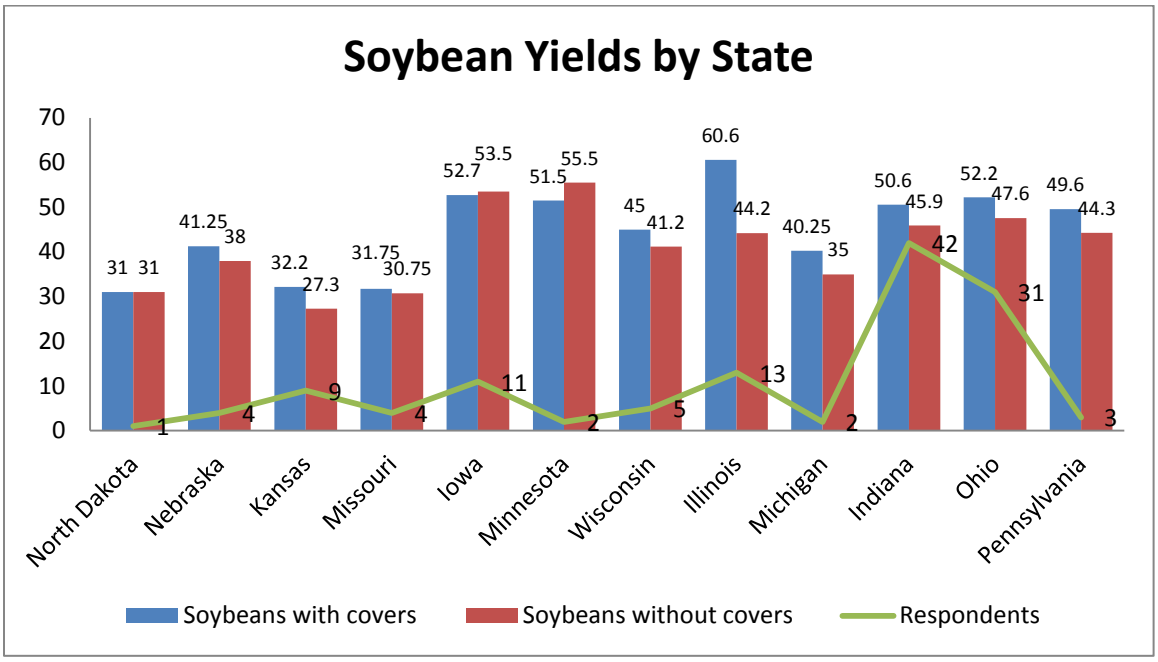

Figure 27. Average soybean yields by state with and without cover crops.

Comments About Cover Crops

At the end of the survey, respondents were asked for a comment they would share with a neighbor who didn't use cover crops. Statements reflected a wide variety of insight and approaches, from humorous ("Don't change, I want more land for myself") to contemplative ("The benefits of having the ground covered is hard to see at times, but believe in it").

In an informal analysis of the words or themes addressed in respondents' comments at the end of the survey, "Soil health" was by far the most often-used phrase or theme (other than "Cover crops" and "Benefits," which were filtered out of the analysis because they were generally an echo of the question, rather than a reflection of respondents' interests, expectation or opinions). "Erosion" was next in line. Many answers included two or more key words or themes.

The tally is charted below.

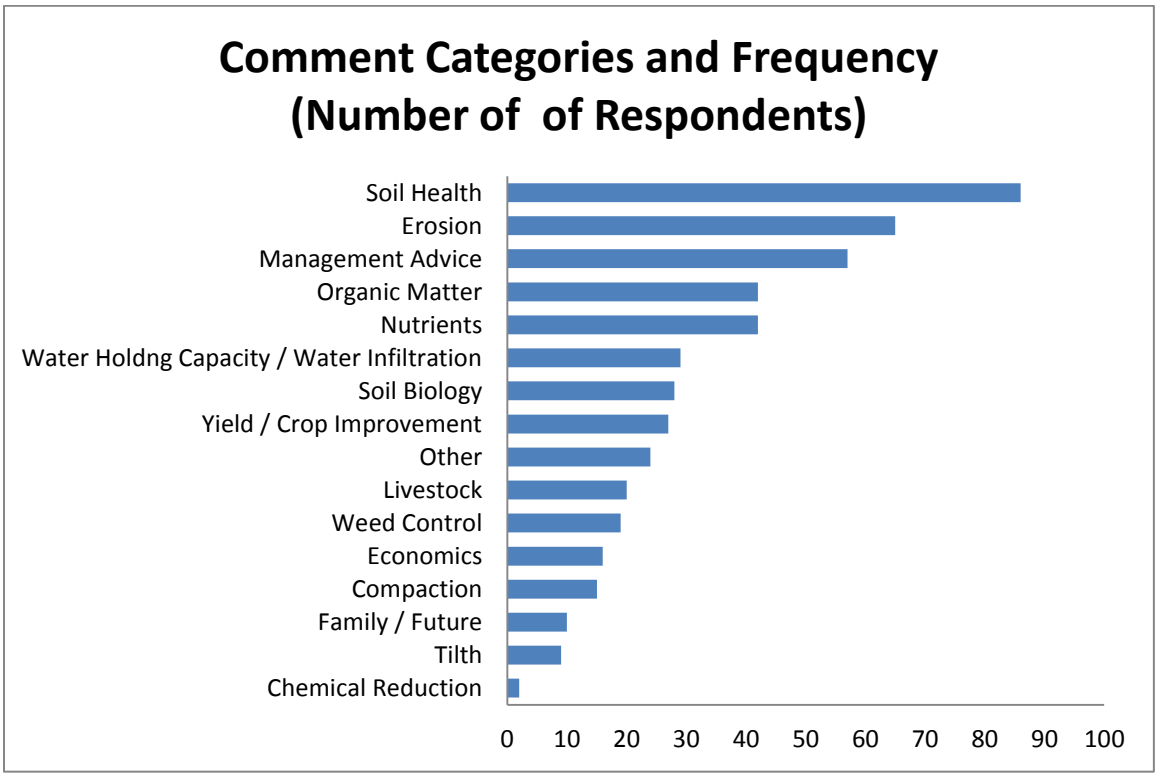

Figure 28. Number of cover crop survey respondents whose responses fit into each category.

Another way to visualize the relative importance of words, phrases or themes is through a word cloud, in which the relative number of appearances of a word is reflected in its size. A word cloud generated by the survey software appears below.

Figure 29. Word map showing relative word usage from the statements.

Among other notable statements were:

- "Cover crops will save and even rebuild your soil. There is a place for a cover crop in every operation, and the benefits will accumulate over time."
- "Cover crops hold more moisture in the soil than they use."
- "Through use of cover crops, we are able to better meet the biological needs of our soil. Once our soil is in balance, nutrient uptake is easier for the plant and we are able to reduce disease in our crop. Ag is not only about managing our crop health, but also soil health."
- "Cover crops are just part of a systems approach that builds a healthy soil, higher yields, and cleaner water."
- "Every day without live roots in the ground is a day wasted. The soil is alive and we must feed and protect it!"
- "Soil health is key. Cover crops are better than steel."
- "The use of cover crops can reduce compaction without doing deep tillage."
- "If you pick the right cover crop you won't have to use your ripper in the fall, then complain about all the topsoil you lost over the winter."
- "Cover crops are a long-term investment in improving your soil biology."
- "Building soil stability is key, regardless of economic returns. Think of it as an investment."
- "You have to think longer term about your rotations, not just look year to year. That is when you realize cover crops are integral to your crop rotations."
- "Our system captures carbon, increasing organic matter. We will produce more yield with less inputs. Your kids won't be able to compete. ;-)"

Figure 30. Planting into an annual ryegrass cover crop in Michigan.

Conclusion

The 2012-2013 Cover Crop Survey provided SARE and CTIC with great insight from more than 750 farmers from 35 states about their cover crop experience, their expectations, their hopes, and their concerns.

The data reflect the large number of discussions and questions surrounding the benefits of cover crops among farmers – both the value cover crop growers feel they receive from the practice, and the concerns about how they fit into commercial rotations.

The survey demonstrates conclusively that users saw yield benefits from their cover crops. There is a strong possibility that moisture management benefits – reducing evaporation by shading the soil surface, and building up water-holding soil organic matter over time – contributed to an especially dramatic yield difference in the drought-plagued 2012 season.

Analyzing and understanding the results of the survey can help guide communications about cover crop strategies and choices, help producers set realistic expectations for their cover crop systems, and help marketers and advisors anticipate the level of interest in investing in cover crops.

For more details on cover crops, visit www.sare.org/Learning-Center/Topic-Rooms/Cover-Crop-Topic-Room or www.ctic.org/Cover%20Crops/.

Appendix

Mean vs. Median Analysis

To offer the most extensive data set possible and explore the impact of outlier figures, the research team analyzed the answers to the cost questions in two ways:

1. As an arithmetic mean, adding up all the values and dividing them by the number of responses in the state. This method can be skewed by outliers, which carry the same weight as every other figure in the group. (For instance, if six growers report a value of $20 and one reports he would pay $200, the mean is $45.71.)

2. As a median, which is the value that is midway between the highest and lowest answer in the group – the number that separates the higher half of the sample from the lower half. Using a median is considered more "robust" by statisticians, especially when extremely high or low values could otherwise skew the data set. (In the example of six answers of $20 and one of $200 – 20, 20, 20, 20, 20, 20, 200 – the median is the fourth number in the set: $20.)

The mean amount respondents reported being willing to pay for cover crop seed was $35.07 per acre (based on 653 complete responses), and mean establishment cost they were willing to invest was $26.97 per acre, based on 620 responses.

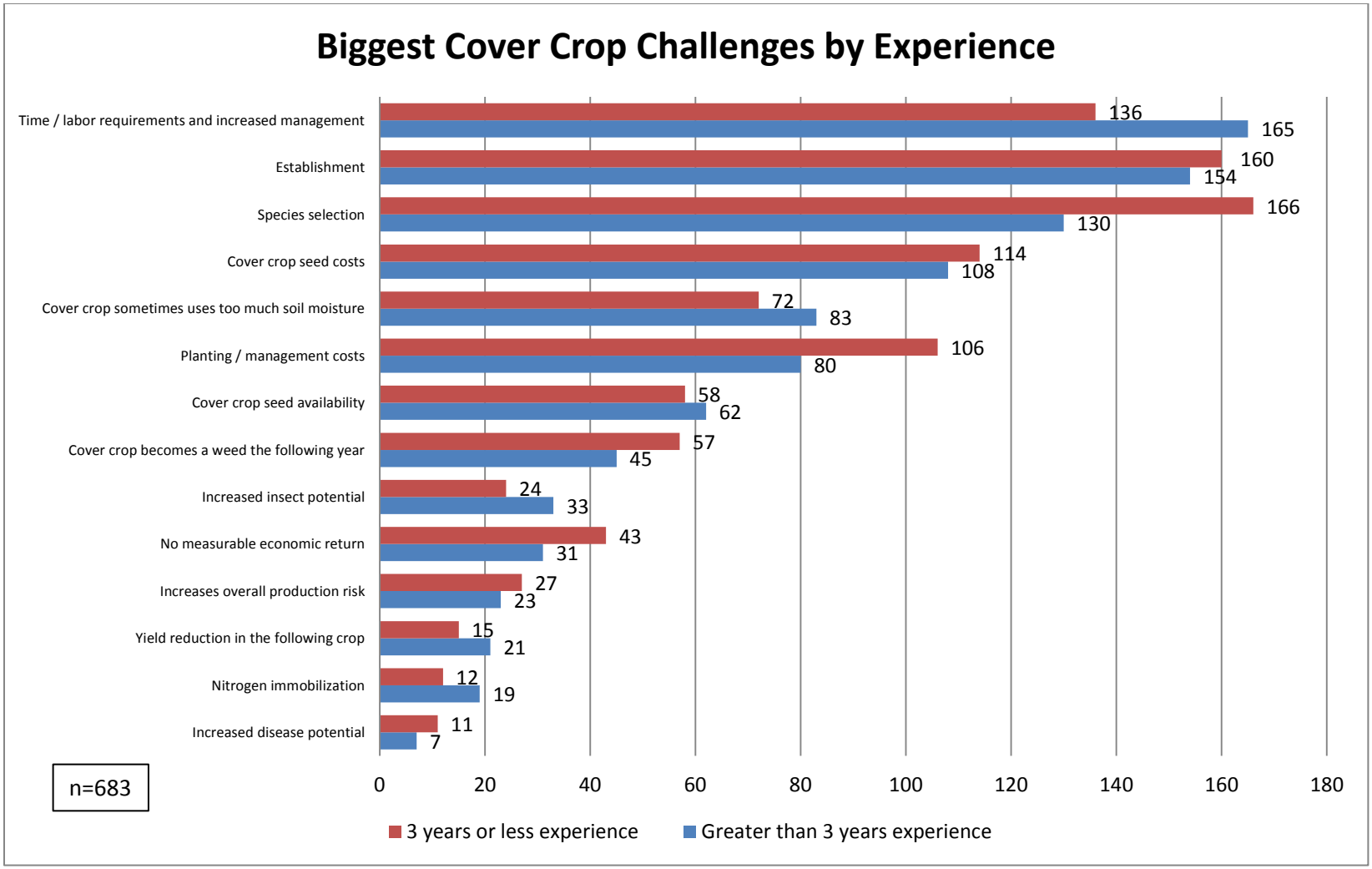

Figure 31. Cover crop challenges faced by cover crop survey respondents broken down by experience level.

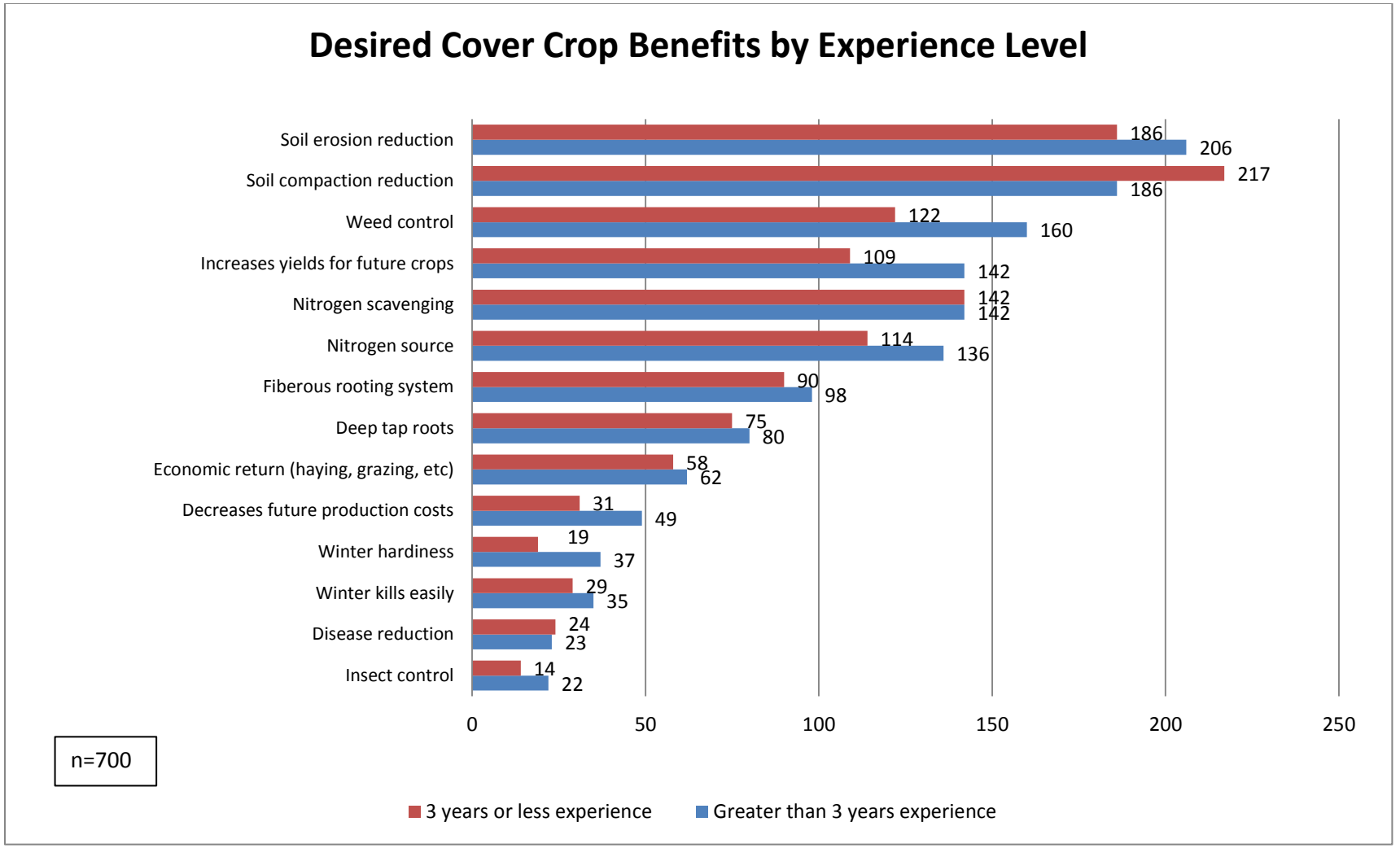

Figure 32. Cover crop benefits desired by cover crop survey respondents broken down by experience level.

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Figure 33. Annual ryegrass cover crop terminated for planting corn in Indiana.

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