THE ECONOMICS OF COVER CROPS ON MINNESOTA FARMS

2022 data report

Environmental Defense Fund

Center for Farm Financial Management

Minnesota State
Southern Agricultural Center of Excellence

FBM 70 Years Est. 1952 Farm Business Management
Minnesota State

SW MN Farm Business Management Association
Add power to your farm management decisions

University of Minnesota Extension

About the authors

Pauline Van Nurden, Katherine Wilts Johnson, Devin Brand, Extension Economists with the Center for Farm Financial Management at the University of Minnesota.

The Center for Farm Financial Management (CFFM) develops applications and educational programs that provide educators, lenders, other professionals, and farmers resources to successfully manage farms and the financial activities related to farms and small businesses. Products and training focus on farm financial planning, financial analysis, business planning, commodity marketing, and credit analysis. CFFM products are widely used by farmers, agricultural and commercial lenders, and educators across the United States. FINPACK, CFFM's flagship software product, provides a suite of tools that guide producers, lenders, and educators to sound financial decisions. To learn more, visit **cffm.umn.edu**.

Vincent Gauthier
Environmental Defense Fund

Environmental Defense Fund, a leading international nonprofit organization, creates transformational solutions to the most serious environmental challenges. EDF links science, economics, law, and innovative private-sector partnerships. EDF's agricultural finance work includes farm financial analyses, collaborating with finance providers to develop solutions, and agricultural finance policy. To learn more, visit **business.edf.org/farm-finance**.

Acknowledgments

We would like to thank the following individuals and organizations for their contributions to this project and this report. Kevin Klair, Rann Loppnow and Dale Nordquist with the Center for Farm Financial Management. Keith Olander, Josh Tjosaas, Del Lecy, Judy Barka and all the MN State Farm Business Management instructors. Garen Paulson and the University of Minnesota's Southwest Minnesota Farm Business Management Association staff. Anna Cates and Marcelle Lewandowski at the Minnesota Office for Soil Health (MOSH) and Minnesota Natural Resources Conservation Service. Steven Rosenzweig at General Mills. Kim Melton at Wilkin County Soil and Water Conservation District. Samuel Porter at USDA NRCS.

This material is based upon work supported by USDA/ NIFA under Award Number 2021-70027-34694.

NORTH CENTRAL EXTENSION RISK MANAGEMENT EDUCATION

USDA National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

The project is supported by the Morgan Family Foundation.

MORGAN FAMILY FOUNDATION

DATA-DRIVEN INSIGHTS TO FARMERS' ECONOMIC QUESTIONS ON COVER CROPS

U.S. agriculture is making unprecedented investments in climate-smart agriculture. Farmers and ranchers, food and agriculture companies and the US Department of Agriculture are all contributing investments to address climate change, improve soil health, and protect the environment. The Inflation Reduction Act will invest $19.5 billion between 2022 and 2026 in USDA Natural Resources Conservation District cost-share programs,[i] and the Partnerships for Climate Smart Commodities grant program has invested $3.1 billion in developing markets for commodities grown with climate-smart practices.[ii]

Planting cover crops is a beneficial practice that can improve soil health, water quality, and provide climate adaptation benefits. In the U.S. Midwest, a winter cover crop is planted after (and sometimes before) harvesting the previous crop, with the general objective of maintaining soil cover and soil structure over the winter months. These cover crops winter-kill or are terminated before planting the next main feed or commodity crop the following spring. Cover crops can increase soil organic matter in the surface soil layers, improve soil structure, improve water retention and drainage, and reduce erosion.[iii] Improving soil health by planting cover crops and reducing tillage can reduce yield risk during extreme rain events.[iv]

Despite their positive agronomic potential, farmers continue to have questions about the economic impacts of cover crops on their farming operations. Sixty-nine percent (69%) of the farmers who do not use cover crops that were surveyed in the 2019-2020 National Cover Crop Survey identified 'no measurable economic return' as a concern to planting cover crops. Approximately two-thirds of that group emphasized this concern to be a *major* concern.[v]

Producers evaluate financial, environmental, and social factors when considering climate-smart practices to balance their environmental goals with their need to remain financially viable. Some farmers have hesitated to incorporate certain climate-smart practices, including cover crops, because they are unsure the practice will be financially viable. There needs to be more data consistently gathered from a large enough sample of farms to answer the financial questions producers have about cover crops.

In 2021, Environmental Defense Fund, the University of Minnesota's Center for Farm Financial Management, the Minnesota State Farm Business Management program, and the University of Minnesota Extension's Southwest Minnesota Farm Business Management Association began a collaborative effort to gather farm-level financial data on cover crops. The project is gathering detailed financial data on cover crops between 2022-2024 from corn, soybean, and other row crop farms across Minnesota. The project aims to inform producer decisions by analyzing actual farm financial data. The data and insights from this project may also provide value to federal and local cost-share programs, agricultural lending solutions, and other climate-smart initiatives.

This report provides preliminary project data on the financial impacts of cover crops on Minnesota farms during the 2022 growing season.

Many of the benefits from cover crops occur over the long term, so the data presented in the report should be considered preliminary with the goal of providing initial insights on the costs of adding cover crops to Minnesota crop rotations.

TABLE OF CONTENTS

ABOUT THE DATA

About the FINBIN database

FINBIN is one of the largest farm financial databases in the world, and it is the largest publicly available farm financial database in the U.S. There are approximately 3,500 farms that contribute data to FINBIN annually from roughly 12 different states within the U.S. The database can be used to run summary financial reports of specific management systems, crop and livestock enterprises, and regions. It can also benchmark a farm's financial performance against peers. Roughly 40,000 FINBIN reports are run every year by farmers, lenders, and other users.

FINBIN data is not survey data. Participating producers complete a comprehensive financial analysis of their operation at the end of each year, with the help of a farm business management educator. FINBIN data is gathered by instructors with farm business management programs that provide producers financial education, recordkeeping, analysis, and benchmarking support. The data is gathered by instructors in a consistent way using the FINPACK farm financial management software system. The Center for Farm Financial Management provides annual training and updates to FINPACK to promote consistent data gathering across the FINBIN database. The farm financial data is processed through several rounds of screening for accuracy and completeness. Farms that do not meet strict accuracy requirements are excluded. Every effort is made to verify the integrity of each set of farm financial data included in the database. Prior to aggregation, each producer's data is anonymized and secured to prevent any individual data identification.

FINBIN can be accessed at finbin.umn.edu, along with a helpful guide on how to query FINBIN for various cover crop financial reports.

Minnesota farm benchmarking data

Approximately 2,400 farms in FINBIN are Minnesota farms participating in the Minnesota State Colleges and Universities Farm Business Management program or the University of Minnesota Extension's Southwest Minnesota Farm Business Management Association. The FINBIN database includes a substantial share of Minnesota commercial farms. When comparing to USDA/NASS data, FINBIN includes 12% of Minnesota farms that grossed over $250,000 and a lower percentage of smaller Minnesota farms. It must be stressed, however, that this is not a random sample of Minnesota farms. These farms pay a fee to be part of these programs, and there are likely characteristics of participating farms that distinguish them from other farms in the state.

Gathering cover crop financial data

In 2021, the University of Minnesota's Center for Farm Financial Management, EDF and the Minnesota Farm Business Management program developed a new process for gathering cover crop financial data in FINPACK and presenting it in FINBIN. The new methodology treats cover crops as their own enterprise by gathering all revenue and costs specifically associated with the cover crop. The cover crop enterprise is then presented alongside and in combination with the main crop grown after the cover crop. The methodology assesses these enterprises in combination because the potential production and soil health impacts of the cover crop can influence the production of the crop that follows.

Grants from EDF, USDA Extension Risk Management Education, Minnesota Office for Soil Health, Minnesota Natural Resources Conservation Service, and the Morgan Family Foundation are funding producer scholarships for their Farm Business Management program tuition and fees. With the support of these scholarships, participating producers who plant cover crops will be contributing financial data for this project over the next three years.

DEMOGRAPHICS OF THE FARMS IN THIS REPORT

121 Minnesota farms are gathering cover crop financial data

The Minnesota cover crop group that will be evaluated over the project's three-year period includes 121 Minnesota farms. Eighty-three of these farms contributed cover crop financial data in 2022. The other 38 farms planted a cover crop in the fall of 2022 and have committed to contributing data for the 2023 production year. We will refer to these 121 farmers as the "cover crop group" throughout this and subsequent reports.

Farms using cover crops are similar to the average Minnesota farm

Table 1 compares the cover crop group to all Minnesota farms in the FINBIN database. The table demonstrates that the farms in the cover crop group are very similar to other Minnesota farms on average in 2022. This means the farms in the cover crop group can be considered representative of the average Minnesota farm. Analyzing a group of representative farms allows us to consider the potential impacts of cover crops on the 'typical' farm in Minnesota. A more detailed farm demographic comparison can be found in Table 9 in **Appendix A**.

The total crop acres in the cover crop group are slightly lower than the average Minnesota farm in FINBIN. The average operator age and average number of years the operators have farmed are the same between the two groups (47 years old and 23 years of experience, respectively).

Both groups have a similar percentage of crop farms, meaning over 70% of their gross revenue is generated from crop production. The rest of the farms in each group consist of similar splits between livestock farms, crop and livestock farms, and 'other' farms.

The average farm in the cover crop group is in a similar financial position to the average Minnesota farm in FINBIN in 2022. The cover crop group has a similar, but slightly lower, net income and a similar, but slightly lower, net worth. The cover crop group and all Minnesota farms in FINBIN have almost identical debt-to-asset ratios and operating expenses as a percentage of revenue.

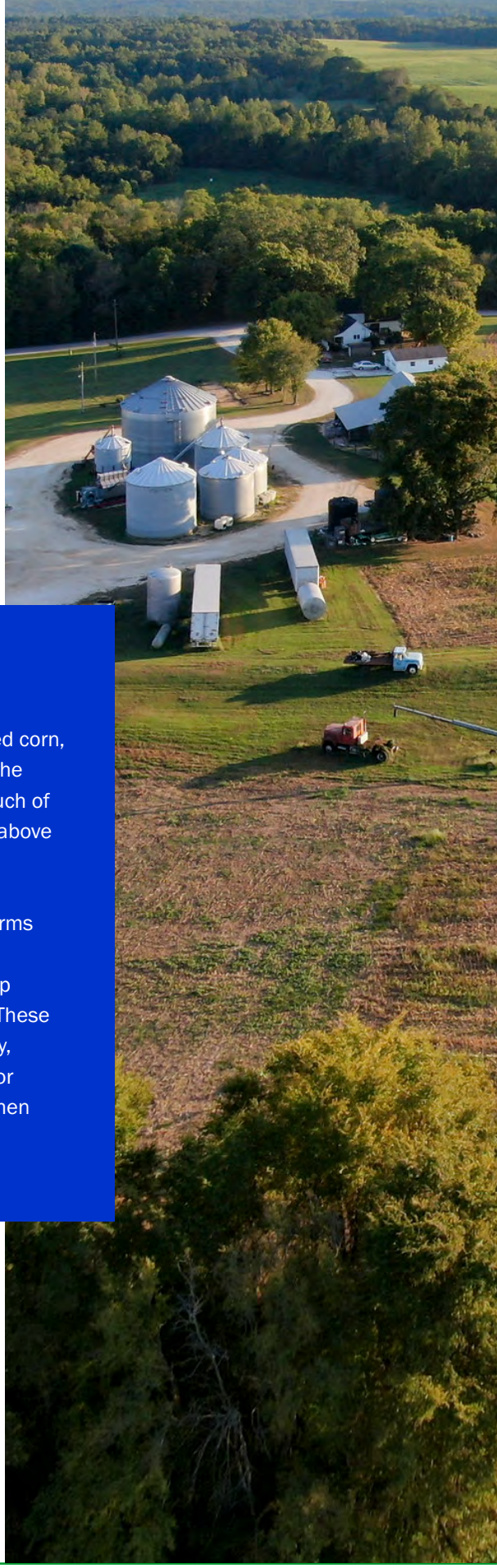
TABLE 1

Farm Demographics Comparison, 2022. This table displays averages unless otherwise noted.

	Cover crop group	All Minnesota farms in FINBIN
Number of farms (Total)	121	2,304
Total crop acres per farm	770	812
Operator age	47 years old	47 years old
Years farming	23 years	23 years
Percentage of farms that are beginning farmers	25%	28%
Average net farm income	$281,410	$317,495
Median net farm income	$171,681	$183,832
Net worth	$2,182,337	$2,333,228
Debt-to-asset ratio	43%	43%
Operating expense as % of gross revenue (Operating expense ratio)	67%	68%

COMPARISON ACROSS COVER CROP TYPES

The 83 farms that reported cover crop financial data from the 2022 growing season planted cover crops on 195 differentiated fields. The primary cover crop enterprises included rye, rye silage, cover crop forage, cover crop rye mix, and cover crop mix. The cover crop forage enterprise consists of any cover crop mix specifically grown to be used as forage or feed. The cover crop rye mix enterprise is a mix of 2-4 species, with a base species of cereal rye. The cover crop mix enterprise consists of 4-5 or more species.



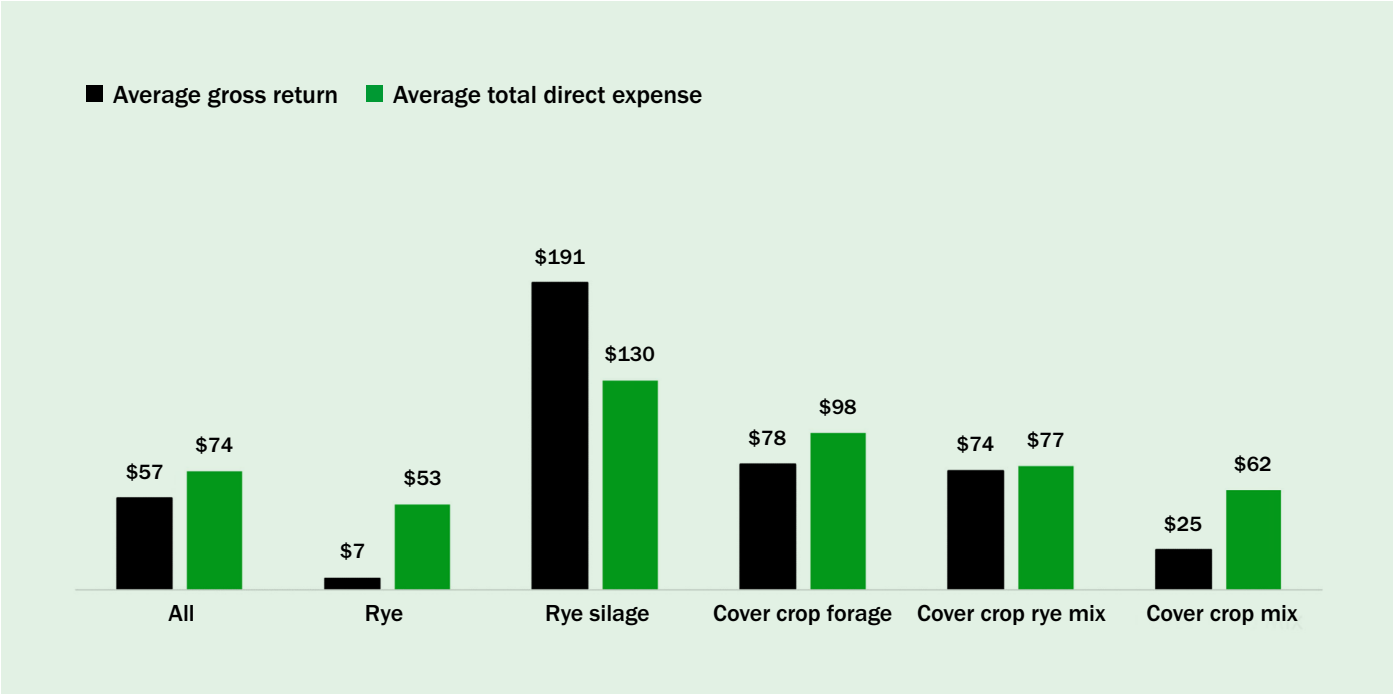
2022 crop and financial conditions

The spring of 2022 was cold and wet in Minnesota. These conditions delayed corn, soybean and wheat planting by several weeks compared to average years. The summer then turned drier, leading to lingering drought conditions across much of the state. Despite the drought conditions across the state, crop yields were above 10-year averages for corn, soybeans, and wheat.

Minnesota farms experienced continued financial improvement in 2022. Farms had the highest net farm income in the past 10 years. The primary reasons for high net returns were high prices for most crops sold in 2022, higher crop ending inventory values and mostly higher livestock prices overall in 2022. These profitability improvements were the result of strong yields, global uncertainty, and inflationary pressures. In fact, 2022 was the 2nd most profitable year for Minnesota farms in the FINBIN database. Only 2012 was more profitable when looking at the historical information found in FINBIN.

195 Cover crop fields were evaluated in 2022

FIGURE 1 | **Comparing returns and expenses of cover crops.**



Gross returns from cover crops

Figure 1 shows the average gross return and average total direct expense associated with the cover crop enterprise in FINBIN. It represents all Minnesota cover crop enterprises in FINBIN. Farmers growing a rye silage cover crop had the greatest gross returns at an average of $191 per acre. Farmers using the cover crop for forage purposes had the second-highest gross return, at an average of $78 per acre, then cover crop rye mix at $74 per acre. The other cover crop enterprises had much lower gross returns. Returns from cover crop enterprises are generated from crop production, grazing the cover crop, or from cost-share or other incentive program payments. Rye silage was the only cover crop enterprise with a higher average gross return than average total direct expense.

Cover crop direct expenses

Table 2 shows the expenses associated with the cover crop enterprises in FINBIN. The highest, lowest, average, and median per acre costs are presented for each expense category. The values are rounded to the nearest number to protect individual producer data. The median value represents the middle of the database, meaning 50% of the enterprises in that category are below the median, and 50% of the enterprises are above. A median is a helpful metric for comparison as it is not skewed by outliers in the same way averages can be. The total direct expenses across all cover crop enterprises in the 2022 database ranged from $14 to $310 per acre, with the average at $74. Total direct expense includes seed, chemical, fertilizer, fuel and oil, repairs, and custom hire cost categories. Table 2 presents a breakdown of each of these expense categories across the various cover crop species.

TABLE 2

Statewide cost comparison across cover crop enterprises.

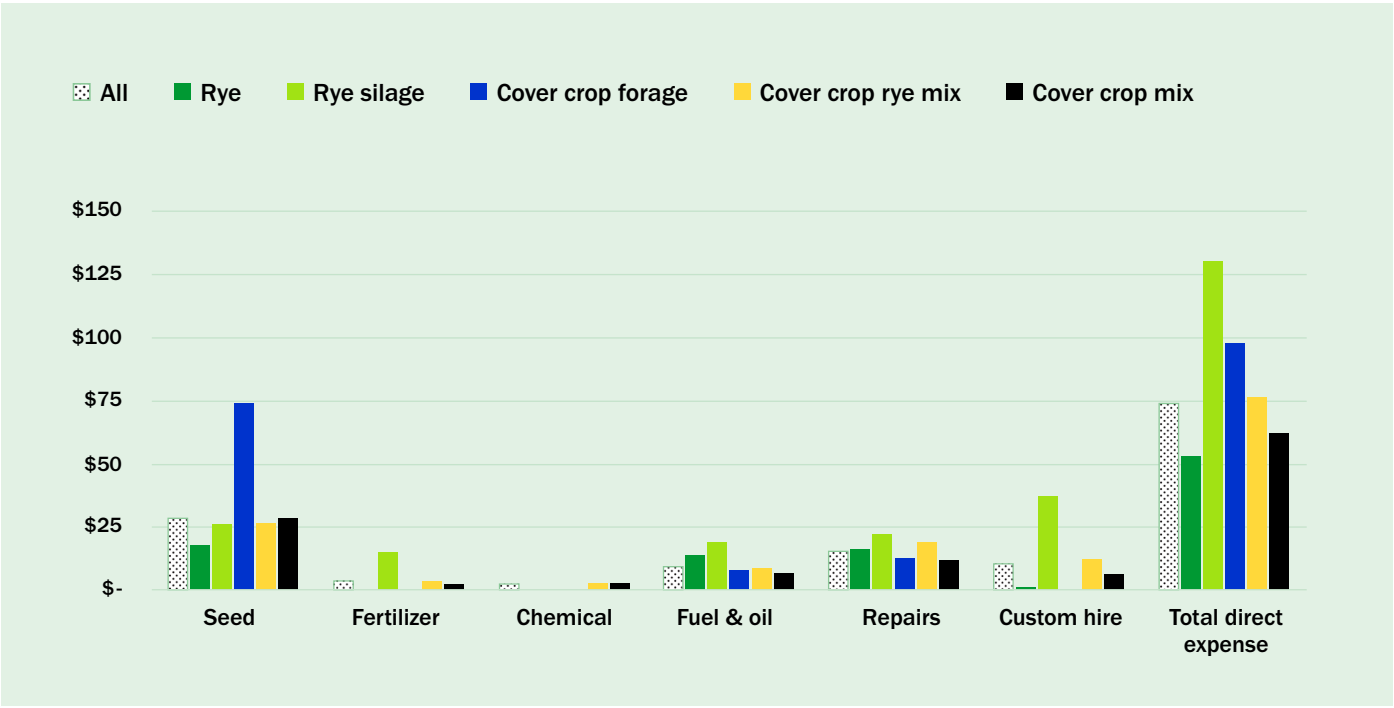
MINNESOTA FARM BUSINESS MANAGEMENT DATA						
Minnesota statewide cover crop enterprises						
	All	**Rye**	**Rye silage**	**Cover crop forage**	**Cover crop rye mix**	**Cover crop mix**
Number of enterprises	195	13	18	7	63	94
% of all enterprises	**100%**	**7%**	**9%**	**4%**	**32%**	**48%**
Seed						
Minimum	$5	$8	$12	$5	$6	$5
Maximum	$199	$25	$58	$199	$76	$199
Median	$22	$16	$22	$35	$28	$22
Average	$4	$18	$26	$74	$26	$28
Fertilizer						
Minimum	-	-	-	-	-	-
Maximum	$100	-	$100	-	$58	$99
Median	-	-	-	-	-	-
Average	$28	-	$14	-	$3	$2
Chemical						
Minimum	-	-	-	-	-	-
Maximum	$42	-	-	-	$37	$42
Median	-	-	-	-	-	-
Average	$2	-	-	-	$3	$3
Fuel & oil						
Minimum	-	$1	$4	$2	-	-
Maximum	$30	$25	$30	$10	$24	$25
Median	$7	$12	$19	$8	$8	$6
Average	$9	$14	$19	$8	$9	$7
Repairs						
Minimum	-	-	$6	$4	$2	-
Maximum	$50	$50	$48	$16	$42	$42
Median	$14	$13	$19	$14	$19	$12
Average	$15	$16	$22	$12	$19	$12
Custom hire						
Minimum	-	-	-	-	-	-
Maximum	$192	$17	$192	-	$147	$95
Median	-	-	-	-	-	-
Average	$10	$1	$37	-	$12	$6
Total direct expense						
Minimum	$14	$31	$47	$15	$29	$14
Maximum	$310	$97	$290	$248	$310	$248
Median	$52	$49	$95	$59	$51	$43
Average	$74	$53	$130	$98	$77	$62

The rye silage and cover crop forage enterprises that brought additional farm revenue as a feed source also had the highest average total direct expenses at $130 per acre and $98 per acre, respectively. The cover crop rye mix enterprise had an average total direct expense of $77 per acre, and the cover crop mix enterprise was $62 per acre. The least costly cover crop enterprise was rye at an average total direct expense of $53 per acre.

Seed, machinery repairs, and fuel and oil were the three greatest cost contributors to the cover crop enterprise. The average seed expense across all cover crop enterprises was $28 per acre, while the maximum seed expense was $199 per acre, and the minimum was $5 per acre. The average repair costs for all cover crop enterprises were $15 per acre with a maximum of $50 per acre and a minimum of $0 per acre. The cover crop enterprises had an average fuel and oil cost of $9 per acre. Additionally, custom hire was a large expense contributor to the rye silage enterprise, with an average of $37 per acre.

The 2022 cover crop data shows that cover crop direct expenses can vary significantly. One significant variation seems to be between cover crop enterprises meant for silage and forage, and those that contribute to soil health only. However, the 2022 data also shows significant variation of total direct expenses within cover crop types. This variation will continue to be evaluated in subsequent years.

FIGURE 2 | **Average expenses across cover crop types.**



COVER CROP IMPACTS ON CROP ENTERPRISES

In this section, we present enterprise-level financial data of Minnesota crop farms using cover crops, as compared to farms not using cover crops. Cover crops can impact the management and performance of the crop that follows via their effects on soil fertility, weeds and other pests, water availability, and planting effectiveness – the latter related to field accessibility by equipment or cover crop termination timing. It is, therefore, important to evaluate the financial impacts of cover crops in combination with the following crop. For this analysis, the cover crop enterprises are those planted in the fall of 2021. These cover crops were harvested or terminated in spring 2022 before planting the year's main crop.

The data comparing crops grown after a cover crop is also separated by Northern and Southern regions of Minnesota when possible. Minnesota is a large state, and growing conditions vary from north to south. Growing degree days for the two regions are different, as are the related management and input decisions. The corn silage and wheat data are not separated by region because there is not a sufficient sample size to do so.

Costs in this report reflect the average accrual adjusted expenses paid by producers, therefore timing, management, and vendor have an impact on the costs displayed. Likewise, the crop value reflects the marketing strategies of producers, therefore timing, methodology, and location impact the values displayed.

How to interpret the data tables

The corn, soybean, wheat and corn silage tables contain five columns to evaluate the financial impacts of cover crops.

Column 1 | Crop grown after cover crop
This represents the crop that was planted after a cover crop and is considered the primary crop. The acres of this field enterprise and the cover crop enterprise match exactly to ensure any long-term impacts of cover crops in the cropping system can be analyzed in future years.

Column 2 | Cover crop
This represents the revenue and expenses associated directly with the cover crop. It represents cover crops that were planted prior to a primary crop. In this column, no specific production information is listed, as there are various cover crop types planted. Any cost-share funding is included as other income. The gross return per acre includes any production returns along with cost-share and other cover crop program support payments.

Column 3 | Crop grown after cover crop and cover crop combined
This is the combined values from column 1 and column 2 and displays the total income and expense for the acre that was cover cropped and then planted to a primary crop in 2022. No production information is detailed here because two distinct types of crop enterprises are being combined. The gross revenue is the combined value of columns 1 and 2.

Column 4 | Cover crop group, fields with no cover crop
This column includes primary crop enterprises planted by growers in the cover crop group. These acres did not have cover cropping practices in 2022, but the farm operator uses cover cropping on other acres. This column provides an economic comparison to the combined acres shown in column 3. Column 4 is a subset of column 5.

Column 5 | Average crop grown without a cover crop in 2022
This column is the average of all fields for the crop in the region that were not grown following a cover crop.

CORN IN SOUTHERN MINNESOTA

TABLE 3 | **Southern Minnesota corn enterprise analysis.**

Corn enterprise analysis (owned & rented acres combined) Southern Minnesota Farm Business Management data	Southern Minnesota				
	Cover crop group				Average
	Corn grown after cover crop	Cover crop	Corn & cover crop combined	Corn fields w/ no cover crop	All corn fields w/ no cover crop
Number of enterprises	25	25	25	63	1,155
Yield (bushels per acre)	199.62	-	-	198.94	211.88
Value per bushel	$6.40	-	-	$6.37	$6.37
Product return per acre	$1,277.87	$2.02	$1,279.89	$1,267.90	$1,348.74
Other crop income per acre [vi]	$31.64	$26.31	$57.95	$24.51	$4.67
Gross return per acre	**$1,309.51**	**$28.33**	**$1,337.84**	**$1,292.41**	**$1,353.41**
Production expenses ($ per acre)					
Seed	110.84	23.09	133.93	110.79	114.85
Fertilizer	202.98	-	202.98	201.33	219.45
Chemicals	60.42	1.59	62.01	58.33	55.52
Crop insurance	33.86	0.33	34.19	36.30	36.11
Machinery cost [vii]	160.61	38.60	199.21	170.16	186.21
Land cost [viii]	197.48	1.28	198.76	219.60	224.40
Other expense [ix]	85.92	11.30	97.22	78.68	100.39
Total expense per acre	**$852.11**	**$76.19**	**$928.30**	**$875.19**	**$936.93**
Net return per acre	**$457.40**	**-$47.86**	**$409.54**	**$417.22**	**$416.48**
Labor and management charge	$70.19	$17.15	$87.34	$58.90	$68.50
Net return over labor & management per acre	**$387.21**	**-$65.01**	**$322.20**	**$358.32**	**$347.98**
Cost of production w/ labor & management per bushel	$4.46	-	$4.80	$4.57	$4.72
Net value per bushel	$6.40	-	$6.41	$6.37	$6.35

CORN IN SOUTHERN MINNESOTA

Key results

Gross return

- Gross return was similar (1% less) for the corn acres planted after a cover crop compared to the average corn acre grown in southern Minnesota last year.
- The yield was 12 bushels or 6% less for acres grown after a cover crop.

Total expenses

- Total expenses for the corn enterprise grown after a cover crop were $85 or 9% less than the average southern Minnesota acre of corn. Of significance were the cost savings for fertilizer, machinery cost, land cost, and other expenses on these farms.
- The total expenses of the corn enterprises were still less after adding the cover crop expenses than the average southern Minnesota corn field.
- The total combined expenses were $9 or 1% less than the average corn field. Seed, chemical, machinery costs, and other expenses drove the increased expense from the cover crop enterprise.

Net return

- The combined corn grown after a cover crop and the cover crop enterprise had a $7 lower (2%) net return compared to the average MN corn farm not using cover crops. However, the returns for all groups were strong in 2022.

CORN IN NORTHERN MINNESOTA

TABLE 4 | **Northern Minnesota corn enterprise analysis.**

Corn enterprise analysis (owned & rented acres combined) Northern Minnesota Farm Business Management data	Northern Minnesota				
	Cover crop group				Average
	Corn grown after cover crop	Cover crop	Corn & cover crop combined	Corn fields w/ no cover crop	All corn fields w/ no cover crop
Number of enterprises	10	10	10	25	364
Yield (bushels per acre)	168.15	-	-	158.49	170.53
Value per bushel	$6.16	-	-	$6.07	$6.11
Product return per acre	$1,036.62	$0.46	$1,037.07	$962.70	$1,042.57
Other crop income per acre[vi]	$15.23	$0.58	$15.82	$21.89	$9.09
Gross return per acre	**$1,051.84**	**$1.04**	**$1,052.89**	**$984.59**	**$1,051.66**
Production expenses ($ per acre)					
Seed	90.79	15.57	106.36	101.66	100.34
Fertilizer	189.24	-	189.24	177.62	192.62
Chemicals	44.19	-	44.19	41.36	39.36
Crop Insurance	30.61	-	30.61	32.01	29.51
Machinery cost[vii]	152.58	54.03	206.61	174.64	183.67
Land cost[viii]	102.36	1.34	103.70	126.11	136.65
Other expense[ix]	84.95	24.15	109.10	88.11	79.74
Total expense per acre	**$694.72**	**$95.09**	**$789.81**	**$741.51**	**$761.89**
Net return per acre	**$357.12**	**-$94.05**	**$263.08**	**$243.08**	**$289.77**
Labor and management charge	$54.79	$20.07	$74.86	$47.69	$59.76
Net return over labor & management per acre	**$302.33**	**-$114.12**	**$188.22**	**$195.39**	**$230.01**
Cost of production w/ labor & management per bushel	$4.37	-	$5.05	$4.84	$4.76
Net value per bushel	$6.16	-	$6.16	$6.07	$6.09

CORN IN NORTHERN MINNESOTA

Key results

Gross return

- Gross return was not significantly different for the corn acres planted after a cover crop compared to the average corn acre grown in northern Minnesota last year.
- Yield and price received were similar between the two groups.

Total expenses

- Total expenses for the corn enterprise grown after a cover crop were $67 or 9% less than the average northern Minnesota acre of corn. The savings for seed and machinery were significant on the farms in the cover crop group.
- When evaluating the corn enterprises grown after a cover crop combined with the cover crop enterprise, the total costs increased because of the cover crop enterprise.
- Total combined expenses were $28 or 4% more than the average corn field. Seed, machinery cost, and other expenses were the drivers of the increased expense.

Net return

- The net return of the combined corn grown after a cover crop and the cover crop enterprise was 9% lower than the comparison group, but the returns for all northern Minnesota corn fields were strong in 2022.

SOYBEANS IN SOUTHERN MINNESOTA

TABLE 5 | **Southern Minnesota soybean enterprise analysis.**

Soybean enterprise analysis (owned & rented acres combined) Southern Minnesota Farm Business Management data	Southern Minnesota				
	Cover crop group				Average
	Soybeans grown after cover crop	Cover crop	Soybeans & cover crop combined	Soybean fields w/ no cover crop	All soybean fields w/ no cover crop
Number of enterprises	36	36	36	49	1,059
Yield (bushels per acre)	53.45	-	-	57.74	59.23
Value per bushel	$13.95	-	-	$14.12	$14.21
Product return per acre	$745.56	$12.21	$757.77	$815.45	$841.70
Other crop income per acre[vi]	$11.93	$20.37	$32.30	$7.37	$5.76
Gross return per acre	**$757.49**	**$20.37**	**$790.07**	**$822.82**	**$847.46**
Production expenses ($ per acre)					
Seed	56.80	21.59	78.39	57.62	54.79
Fertilizer	61.13	0.94	62.07	48.15	36.89
Chemicals	73.36	2.66	76.02	76.20	69.72
Crop insurance	31.30	0.26	31.56	30.78	33.23
Machinery cost[vii]	104.92	40.82	145.74	126.51	125.08
Land cost[viii]	216.19	1.40	217.59	197.86	221.64
Other expense[ix]	41.72	10.91	52.63	45.74	54.14
Total expense per acre	**$585.42**	**$78.58**	**$664.00**	**$582.86**	**$595.49**
Net return per acre	**$172.07**	**-$46.00**	**$126.07**	**$239.96**	**$251.97**
Labor and management charge	$39.12	$14.35	$53.47	$46.80	$45.73
Net return over labor & management per acre	**$132.95**	**-$60.35**	**$72.60**	**$193.16**	**$206.24**
Cost of production w/ labor & management per bushel	$11.46	-	$12.61	$10.78	$10.73
Net value per bushel	$13.95	-	$13.95	$14.10	$14.20

SOYBEANS IN SOUTHERN MINNESOTA

Key results

Gross return

- Gross return was 11% lower for the soybean acres planted after a cover crop in southern Minnesota compared to the average soybean acre grown in the region last year.
- The yield was 6 bushels or 10% less for acres grown after a cover crop.
- For the combined soybean grown after cover crop and cover crop enterprise, gross revenue was 7% less than the average southern Minnesota soybean acre.

Total expenses

- Total expenses for the soybean enterprise grown after a cover crop were $10 or 2% less on average than the average southern Minnesota acre of soybeans. Of significance were the savings for machinery costs and other expenses on these farms. However, fertilizer expense was more for the soybean enterprises grown after a cover crop.
- The total expenses were $69 or 12% more for the soybean enterprise grown after a cover crop, combined with the cover crop enterprise, as compared to the average southern Minnesota soybean field. Seed, fertilizer, and machinery costs were the drivers of the increased total expense from the cover crop.

Net return

- The net return of the combined soybean grown after a cover crop and the cover crop enterprise was half (50% or $126 less) the net return of southern Minnesota soybean acres without cover crops.

SOYBEANS IN NORTHERN MINNESOTA

TABLE 6 | **Northern Minnesota soybean enterprise analysis.**

Soybean enterprise analysis (owned & rented acres combined) Northern Minnesota Farm Business Management data					
	Northern Minnesota				
	Cover crop group				Average
	Soybeans grown after cover crop	Cover crop	Soybeans & cover crop combined	Soybean fields w/ no cover crop	All soybean fields w/ no cover crop
Number of enterprises	10	10	10	21	375
Yield (bushels per acre)	43.71	-	-	38.44	41.01
Value per bushel	$14.29	-	-	$13.97	$13.91
Product return per acre	$624.48	$20.92	$645.41	$537.12	$570.34
Other crop income per acre[vi]	$25.69	$23.63	$28.39	$26.46	$16.06
Gross return per acre	**$650.17**	**$23.63**	**$673.80**	**$563.58**	**$586.40**
Production expenses ($ per acre)					
Seed	58.99	19.79	78.78	61.27	59.71
Fertilizer	48.13	14.50	62.63	26.66	31.87
Chemicals	52.27	-	52.27	45.01	48.04
Crop insurance	20.20	-	20.20	25.40	23.23
Machinery cost[vii]	90.19	44.90	135.08	86.25	101.59
Land cost[viii]	110.03	2.69	112.72	104.15	114.10
Other expense[ix]	35.80	14.39	50.20	56.63	38.15
Total expense per acre	**$415.61**	**$96.27**	**$511.88**	**$405.37**	**$416.69**
Net return per acre	**$234.56**	**-$72.64**	**$161.92**	**$158.21**	**$169.71**
Labor and management charge	$34.81	$16.55	$51.36	$34.87	$37.36
Net return over labor & management per acre	**$199.75**	**-$89.19**	**$110.56**	**$123.34**	**$132.35**
Cost of production w/ labor & management per bushel	$9.72	-	$12.08	$10.76	$10.68
Net value per bushel	$14.29	-	$14.57	$13.97	$13.89

SOYBEANS IN NORTHERN MINNESOTA

Key results

Gross return

- Gross return was $64 or 11% higher for soybean acres planted after a cover crop in 2022 in northern Minnesota compared to the average soybean acre grown in the region last year. This was a function of better yields coupled with more other income like crop insurance indemnity payments and other revenue sources.

Total expenses

- Total expenses were roughly the same for the average soybean enterprise grown after a cover crop and the average northern Minnesota acre of soybeans. These expenses were similar, but certain production expenses, like fertilizer, were more for the soybeans grown after a cover crop enterprise.
- The total combined expenses for the soybean enterprises grown after a cover crop, combined with the cover crop enterprise, were $95 or 23% more than the average soybean field in northern Minnesota.

Net return

- The net return of the combined soybean grown after a cover crop and the cover crop enterprise was 5% lower than the average soybean field in northern Minnesota. Again, returns for all northern Minnesota soybean fields were strong in 2022.

WHEAT IN MINNESOTA

TABLE 7 | **Minnesota statewide wheat enterprise analysis.**

Wheat enterprise analysis (owned & rented acres combined) Minnesota Farm Business Management Data	Minnesota statewide				
	Cover crop group				Average
	Wheat grown after cover crop	Cover crop	Wheat & cover crop combined	Wheat fields w/ no cover crop	All wheat fields w/ no cover crop
Number of enterprises	5	5	5	14	246
Yield (bushels per acre)	66.52	-	-	64.01	67.14
Value per bushel	$9.67	-	-	$9.06	$9.12
Product return per acre	$643.30	$0.26	$643.55	$579.92	$612.29
Other crop income per acre[vi]	$29.83	$55.98	$85.81	$10.55	$11.77
Gross return per acre	**$673.12**	**$56.24**	**$729.36**	**$590.47**	**$624.06**
Production expenses ($ per acre)					
Seed	41.97	30.42	72.39	36.39	30.64
Fertilizer	125.06	-	125.06	136.90	152.19
Chemicals	30.71	-	30.71	35.52	43.07
Crop insurance	7.79	-	7.79	15.50	19.96
Machinery cost[vii]	85.03	27.94	112.97	91.43	97.93
Land cost[viii]	99.84	0.49	100.33	106.66	104.53
Other expense[ix]	36.05	9.05	45.10	72.50	41.30
Total expense per acre	**$426.45**	**$67.90**	**$494.35**	**$494.90**	**$489.62**
Net return per acre	**$246.67**	**-$11.66**	**$235.01**	**$95.57**	**$134.44**
Labor and management charge	$24.82	$8.68	$33.51	$31.65	$38.26
Net return over labor & management per acre	**$221.85**	**-$20.34**	**$201.50**	**$63.92**	**$96.18**
Cost of production w/ labor & management per bushel	$6.34	-	$6.64	$8.06	$7.69
Net value per bushel	$9.67	-	$9.67	$9.06	$9.12

WHEAT IN MINNESOTA

Key results

Gross return

- Gross return was 8% more for the wheat acres planted after a cover crop as compared to the average wheat acre grown in Minnesota last year.
- When comparing wheat grown after a cover crop combined with the cover crop enterprise, gross return increased substantially and was $105 more than the average wheat acre in the state. This increased gross return was a factor of cost-share and other cover crop program payments from the cover crop enterprise.

Total expenses

- Total expenses for the wheat enterprise grown after a cover crop were $63 or 13% less on average than the average Minnesota acre of wheat. Fertilizer, chemical, crop insurance, machinery costs, and other expenses were all less on these farms.
- When evaluating the wheat enterprises grown after a cover crop, combined with the cover crop enterprise, the total costs increased because of the cover crop enterprise. When compared to the average wheat acre, these combined expenses were $5 (1%) more.
- When evaluating the combined enterprise, seed and machinery costs were greater than the average wheat enterprise grown without a cover crop. However, fertilizer, chemicals, and crop insurance were all lower than average on the wheat enterprises grown after a cover crop.

Net return

- The net return of the combined wheat grown after a cover crop and the cover crop enterprise was 75% or $101 per acre more than the average wheat field in Minnesota not using cover crops in 2022.

CORN SILAGE IN MINNESOTA

TABLE 8| **Minnesota statewide corn silage enterprise analysis.**

Corn silage enterprise analysis (owned & rented acres combined) Minnesota Farm Business Management data					
	Minnesota statewide				
	Cover crop group				Average
	Corn silage grown after cover crop	Cover crop	Corn silage & cover crop combined	Corn silage fields w/ no cover crop	All corn silage fields w/ no cover crop
Number of enterprises	16	16	16	30	359
Yield (tons per acre)	21.17	-	-	22.26	21.34
Value per ton	$51.72	-	-	$51.40	$50.36
Product return per acre	$1,094.87	$92.86	$1,187.73	$1,144.08	$1,074.78
Other crop income per acre[vi]	$7.47	$5.69	$13.16	$5.01	$7.25
Gross return per acre	**$1,102.34**	**$98.55**	**$1,200.89**	**$1,149.09**	**$1,082.03**
Production expenses ($ per acre)					
Seed	149.28	6.60	155.88	195.17	153.40
Fertilizer	60.67	0.16	60.83	50.26	53.74
Chemicals	27.21	-	27.21	27.99	25.33
Crop insurance	22.12	2.57	24.70	12.72	13.87
Machinery cost[vii]	350.07	59.28	409.35	218.66	256.71
Land cost[viii]	156.66	3.38	160.04	175.33	160.65
Other expense[ix]	152.73	34.62	187.34	151.70	175.04
Total expense per acre	**$918.74**	**$106.61**	**$1,025.35**	**$831.83**	**$838.74**
Net return per acre	**$183.60**	**-$8.06**	**$175.54**	**$317.26**	**$243.29**
Labor and management charge	$39.37	$9.90	$49.27	$49.04	$45.72
Net return over labor & management per acre	**$144.23**	**-$17.96**	**$126.67**	**$268.22**	**$197.57**
Cost of production w/ labor & management per ton	$44.90	-	$43.96	$39.35	$41.10
Net value per ton	$51.72	-	$49.19	$51.31	$50.35

CORN SILAGE IN MINNESOTA

Key Results

Gross Return

- Gross return was 2% more for the corn silage acres planted after a cover crop as compared to the average corn silage acre grown without a cover crop in Minnesota in 2022.
- When comparing the corn silage grown after a cover crop combined with the cover crop enterprise, gross return increased substantially and was almost $120 more per acre than the average corn silage acre in the state. This increased gross return was a factor of production value coming from the cover crop enterprise.
- Farms growing corn silage are presumably livestock operations; thus they are seeking feed benefit from both the corn silage and the cover crop.

Total Expenses

- Total expenses for the corn silage enterprise grown after a cover crop were $80 or 10% more on average than the average Minnesota acre of corn silage. Of significance were the increased costs for fertilizer, crop insurance, and machinery costs on these farms.
- When evaluating the corn silage enterprises grown after a cover crop, combined with the cover crop enterprise, the total costs increased because of the cover crop enterprise. When compared to the average corn silage acre, these combined expenses were $187 or 22% more.
- When evaluating the combined enterprise, all expenses were greater than the average corn silage enterprise not using cover crops.

Net Return

- The net return of the combined corn silage grown after a cover crop and the cover crop enterprise was 28% lower than the average corn silage acre in Minnesota not using cover crops, but the returns for all Minnesota corn silage fields were strong in 2022.

CONCLUSION

The 2022 cover crop financial data gathered from Minnesota farmers points to preliminary insights that will continue to be monitored over the next two years of the data-gathering effort. For a cover crop investment to break even, the gross revenue from the cover crop and any associated cost savings or yield increase to the main crop must exceed the expenses incurred in the production and use of the cover crop. Like any other farm enterprise, revenue generation and expense management are important for achieving positive net returns.

Only general observations can be made at this time since there is only one year of data. In this report, we observe that cover crop enterprises used for feed and livestock forage can provide additional revenue and financial benefits to the farm. Another additional revenue source for many of the operations in this report implementing cover crops are government payments, financial assistance, or environment-related program payments. In each scenario, the cover crop enterprise still needs to be well-managed to result in positive returns.

This collaborative effort to gather in-depth financial data on cover crops in Minnesota will continue in 2023 and 2024 with the aim to answer the questions farmers have about profitably implementing cover crops on their farms. This project in 2023 and 2024 will aim to explore whether crops preceded by a cover crop have higher yields. It will also explore if revenue associated with the cover crop offsets its costs if producers can reduce fertilizer, chemical and other direct expenses in their main crop enterprises, and other questions that can influence the decision of implementing cover cropping practices. The project also aims to track individual fields using cover cropping practices over time in FINBIN as this project advances. This project will also work to add more farm-level enterprise data to further inform the project findings.

This collaborative effort to gather in-depth financial data on cover crops in Minnesota will continue in 2023 and 2024.

Appendix A.

TABLE 9

Detailed farm demographic comparison.

Minnesota Farm Business Management data		
	Cover crop group	Minnesota statewide
Number of farms	121	2,304
Farm demographics		
Total crop acres per farm	770	812
Total crop acres	93,170	1,870,848
Average operator age	47 years	47 years
Average years farming	23 years	23 years
Beginning farmers[x] (#)	30	649
Share of farms that are beginning farmers	25%	28%
Farm type[xi]		
Number of crop farms	65	1,407
Share of farms that are crop farms	54%	61%
Number of livestock farms	21	336
Share of farms that are livestock farms	17%	15%
Number of crop & livestock farms	19	198
Share of farms that are crop & livestock farms	16%	9%
Number of farms in other farm type	16	360
Share of farms that are other farm type	13%	16%
Farm income		
Gross cash farm income	$1,003,464	$1,126,513
Gross crop income	$505,024	$618,687
Gross livestock income	$331,785	$356,558
Other income	$166,655	$150,770
Total cash farm expenses	$808,831	$919,786
Inventory change, depreciation, capital sales adjustments	$86,778	$110,768
Average net farm income	$281,410	$317,495
Median net farm income	$171,681	$183,832

Minnesota Farm Business Management data		
Farm balance sheet		
Total assets	$3,634,140	$3,908,848
Total liabilities	$1,451,802	$1,575620
Net worth	$2,182,337	$2,333,228
Financial metrics		
Working capital as a % of operating expense	76%	69%
Farm debt-to-asset ratio	43%	43%
Debt coverage ratio	3.26	3.39
Operating expense as a % of gross revenue (operating expense ratio)	67%	68%
Crop costs		
Seed cost per crop acre	$89.71	$87.55
Fertilizer cost per crop acre	$134.16	$145.12
Chemical cost per crop acre	$56.50	$64.03
Fuel and oil cost per crop acre	$49.23	$52.74

Endnotes

[i] USDA NRCS. Inflation Reduction Act. Accessed at: **https://www.nrcs.usda.gov/about/priorities/inflation-reduction-act**

[ii] USDA. Partnerships for Climate-Smart Commodities. Accessed at: **https://www.usda.gov/climate-solutions/climate-smart-commodities**

[iii] Daryanto, S., Fu, B., Wang, L., Jacinthe, P.A. and Zhao, W., 2018. Quantitative synthesis on the ecosystem services of cover crops. Earth-Science Reviews, 185, pp.357-373.

[iv] AGree. February 2023. Conservation and crop insurance research pilot. Accessed at: **https://foodandagpolicy.org/wp-content/uploads/sites/17/2023/03/Conservation-Crop-Insurance-Data-Pilot-Results-1.pdf**

[v] SARE, CTIC & ASTA. 2020. Annual report 2019-2020: National cover crop survey. Accessed at: **https://www.ctic.org/files/20192020-CoverCropSurvey(2).pdf**

[vi] Other crop income includes income from other crop products, hedging gains and losses, crop insurance income, and government payments.

[vii] Machinery cost includes fuel, repairs, custom hire, machinery lease expense, interest expense on intermediate term debts, and machinery depreciation.

[viii] Land cost includes land rent, real estate taxes, and long-term interest expense.

[ix] Other expense includes other direct and overhead expenses such as hired labor, utilities, farm insurance, and operating interest.

[x] A beginning farmer is a farmer with less than 10 years of farming experience.

[xi] Farm type is determined by which revenue category comprises at least 70% of gross revenue.