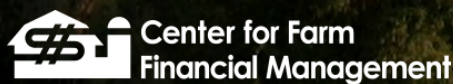


THE ECONOMICS OF COVER CROPS ON MINNESOTA FARMS

2022 data report



About the authors

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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.

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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.



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.

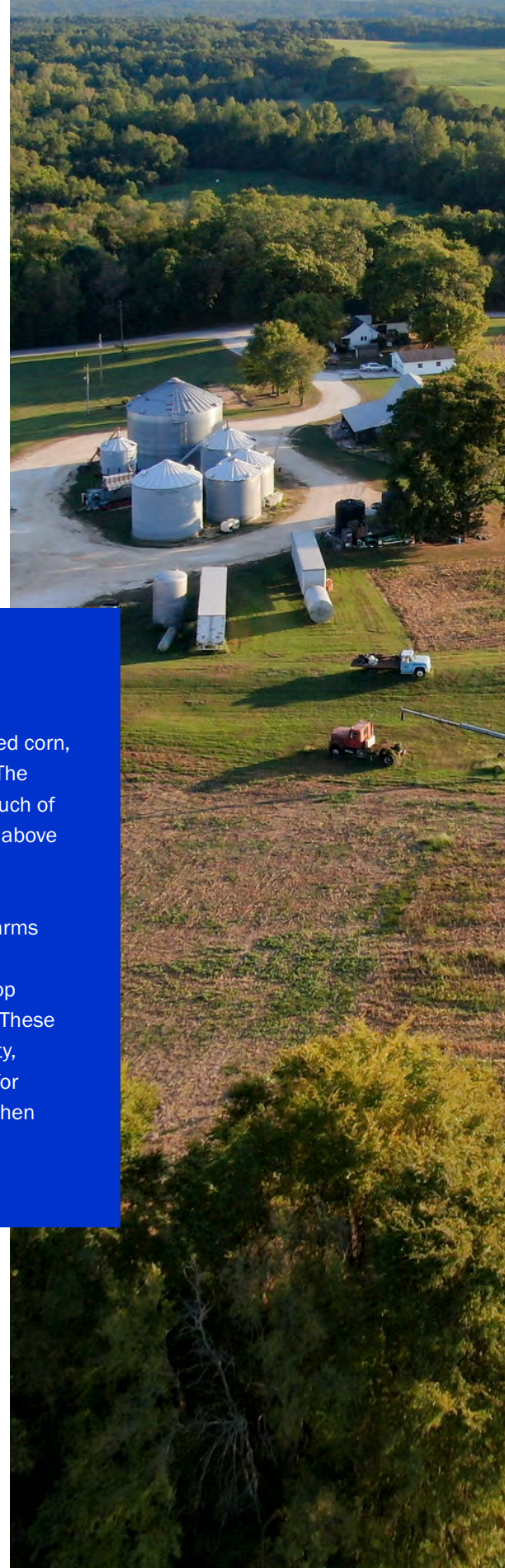
2022 crop and financial conditions

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



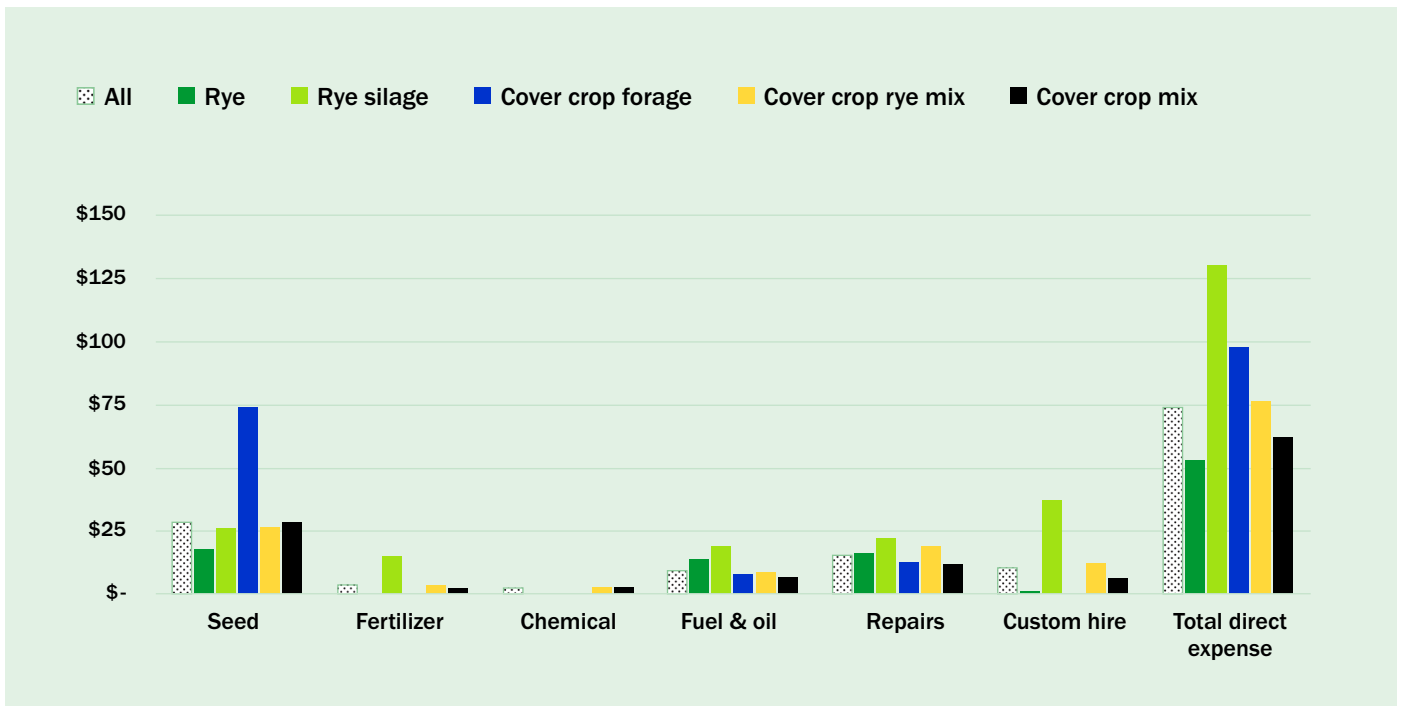
The rye silage and cover crop forage enterprises that brought additional farm revenue as a feed source also had the highest average total direct expenses at \$130 per acre and \$98 per acre, respectively. The cover crop rye mix enterprise had an average total direct expense of \$77 per acre, and the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





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

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				Average
	Cover crop group				
	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 ⁱ	\$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				Average
	Cover crop group			Wheat fields w/ no cover crop	
	Wheat grown after cover crop	Cover crop	Wheat & cover crop combined		
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 ⁱ	\$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				Average
	Cover crop group				
	Corn silage grown after cover crop	Cover crop	Corn silage & cover crop combined	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 ⁱ	\$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	\$1,575,620
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>
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- ^{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](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.