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Livestock Research

Economic Impact of Grazing Cover Crops in Cow-Calf Operations

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In a Nutshell

- Grazing cover crops can provide economic returns to farming operations within the same year cover crops are planted.
- This study is in its third year and is being conducted by farmers in the North Raccoon watershed who are participating in a Water Quality Initiative project.
- Utilizing cover crops as forage represents a win-win for livestock producers and the Iowa Nutrient Reduction Strategy.

Key findings:

- Three cow-calf producers reported that over two years, cover crops provided up to 3.81 tons of dry matter per acre.
- Grazing cover crops offset winter feed expenses up to $40,192.
- Each farmer reaped economic benefits within the same year of planting the cover crops.
- Cost share was provided to each farmer, which contributed to profitability.

Project Timeline:
August 2015 – May 2017

Cattle grazing cereal rye in corn stalks, April 2017.

Background

Planting cover crops is a growing practice on Iowa farms - about 600,000 acres were planted in 2016 covering 2.6% of Iowa's cash crop acres (Rundquist and Carlson, 2016). Cover crops are known to reduce soil erosion and contribute to soil health. They are also proven to reduce agriculture runoff into waterways. Iowa's Nutrient Reduction Strategy lists cover crops as nitrogen and phosphorous reducing practices, with a potential impact of reducing runoff by 31% and 50%, respectively (IDALS, et al., 2016).

The environmental benefits of cover crops are evident, but one reason the adoption of this practice lacks is because of the expense. It is hard to justify paying for cover crops when their benefits are seen in the long-term, and cannot be directly reaped in the year of planting. One way to reap short-term benefits of cover crops is by utilizing them as livestock forage.

Extending the grazing season into the fall, winter and spring can be achieved through grazing cover crops. Cover crops can partially offset the winter feed needs of ruminant livestock, offer nutritionally adequate forage for maintenance and cut costs to producers (Dunn, 2013). The objective of this research project was to demonstrate the economic benefits from utilizing cover crops as forage on integrated crop and cattle farms. Over the past two years, farmers have recorded cover crop biomass growth and grazing moves through cover crop fields.

Methods

This research project is currently being conducted by three cow-calf producers in the North Raccoon watershed, in northwestern Iowa: Wesley Degner (Lytton), Bill Frederick (Jefferson) and Mark Schleisman (Lake City). Each operates an integrated cattle and crop farm. The project, funded by the Iowa Department of Agriculture and Land Stewardship (IDALS), began in 2015 and will continue through May 2018. In late summer and fall of 2015 and 2016, farmers seeded cover crops of their choosing with the intention of grazing the forage produced. Cattle grazed the cover crops in the fall, and some continued to graze into the winter and spring.

This study quantified the forage value of cover crops in two ways: 1) measuring cover crop biomass 2) estimating feed requirements of the herd while grazing cover crops.

Cover Crop Biomass

Aboveground cover crop biomass was measured the first day cattle were turned into fields to graze each fall, in order to estimate available forage for the cattle at that time. Farmers tossed 1-ft^2 quadrats at random into their cover crop fields, five times per field. All the forage within the quadrat was clipped to the ground, air dried and weighed. Biomass results are reported on a dry matter (DM) basis. This method provides an estimate of forage quantity available at one point in time, but does not account for subsequent cover crop growth. Therefore, these quantities underestimate total cover crop biomass production.

Livestock Feed Requirements

A more complex way of looking at the economics of grazing cover crops is to estimate the forage value of what was grazed based on the duration of each grazing period, number of cattle grazing, average cattle weight and DM requirements of each animal. Estimated daily DM intakes of 2.5% of bodyweight for dry cows and 2.7% of bodyweight for lactating cows were used in calculations (Radunz and Schriefer, 2011). Animal weights were not taken during this study and it was assumed that cows maintained weight while grazing cover crops.

> For example, a 1,000 lb dry cow requires 2.5% of her body weight in DM each day, or 25 lb. For a seven day grazing period, this cow would require 175 lb of DM (25 lb x 7 days = 125 lb of DM).

Forage Value

Forage value was estimated by determining the amount of feed saved by grazing cover crops and the value of the feed saved (Higgins, 2017). This study assumes hay would have been fed if cover crops were not available; at the cost of $80/ton (t) and 90% DM. In some cases, farmers supplemented cattle with other feed during cover crop grazing periods. The estimated percent of feed requirements provided by supplemental feed was taken into account.

Cow-days of grazing were calculated per 1,000 lb animal or animal unit (AU). Cow-days were figured based on the number of cows x average cow weight x number of days grazed ÷ 1,000 lb. The cost to feed each AU per day was then calculated by taking the total value of the cover crop forage ÷ by cow-days per AU.

> For example, (20 cows x 1,200 lb x 10 days) = 24,000 ÷ 1,000 lb = 240 cow-days per AU.
> $250 ÷ 240 cow-days per AU = $1.04 per AU per day.

Added costs for establishing and terminating the cover crop, machinery use, labor, fencing and watering were taken into account when figuring the total economic impact of the cover crops. In some cases, termination expenses were not included in the analysis because farmers would have applied herbicide regardless of the presence of cover crops, as a pre-plant burn down. In addition, labor costs were not included in all instances because the same amount of labor would have been spent if cattle grazed crop residue without cover crops. Iowa State University Ag Decision Maker files were used to determine the cost of herbicide application for termination, hourly labor wages and fencing costs (Plastina and Williams, 2016 and 2017). Data was entered into a budget spreadsheet titled, "Economic Analysis of Using Cover Crops for Forage Needs of Livestock" developed by Dr. William Edwards, Professor Emeritus, Iowa State University. The economic impact analysis does not take into account the potential cash crop yield increases or decreases, soil retention value, nutrient retention value, soil health value or the nutritional value of forage.

Each farmer was eligible for and received cost share; either from their county Natural Resources Conservation Service (NRCS) or from the Iowa Department of Agriculture and Land Stewardship (IDALS). The amount varied by field and by farm, but was included in each economic analysis.

Mark Schleisman holds a quadrat used for sampling cover crop biomass.

Results and Discussion

Part 1: Forage Value of Cover Crop Biomass

Cover crop biomass production at the different farms varied greatly, depending on species planted, planting date, cover crop growth and sampling date. Biomass DM produced per cover crop field in fall 2015 and 2016 is reported in **Table 1**. Biomass production at the three farms ranged from 0.07 to 3.81 t/ac. Fields with the greatest amount of biomass were seeded in August and grazed in November. Bill and Mark seeded in August due to small grain and popcorn production which afforded them earlier seeding opportunities. Waiting to graze until later in the fall increases the number of grazing days provided by cover crop forage.

Table 1

Farm location, year, field size, previous crop, cover crop species, seeding date, seeding method, biomass sampling dates and biomass production for each field.

Farmer, Location	Year	Field Size (ac)	Previous Crop Crop	Cover Crop Species	Seeding Dates & Method*	Sampling Date	Fall Cover Crop Biomass (t/ac)
Wesley Degner, Lytton	2015	67	Soybeans	Cereal Rye	08/31/15-A	10/09/15	0.47
		18	Corn	Cereal Rye	08/31/15-A	10/09/15	0.07
	2016	67	Corn	Cereal Rye	09/08/16-A	10/12/16	0.07
		18	Corn	Cereal Rye	09/08/16-A	10/20/16	0.12
Bill Frederick, Jefferson	2015	17	Rye	Oats, Turnips, Kale, Soybean	08/04/15-D	11/02/15	3.74
		40	Corn	Cereal Rye	09/06/15-D	11/02/15	0.21
		25	Soybeans	Cereal Rye, Turnips	09/19/15-A	10/16/15	0.09
		11	Soybeans	Winter Wheat	10/10/15-D	11/02/15	0.36
	2016	10	Wheat	Oats, Radish, Turnip, Kale	08/11/16-D	09/19/16	1.76
		11	Soybeans	Wheat	09/19/16-A	10/18/16	0.26
		40	Soybeans	Wheat	09/19/16-A	10/18/16	0.26
Mark Schleisman, Lake City	2015	83	Popcorn	Cereal Rye, Turnips	08/14/15-HC	10/15/15	1.82
		73	Corn	Cereal Rye, Rapeseed	08/14/15-HC	12/11/15	0.36
		64	Popcorn	Cereal Rye, Turnips	08/15/15-HC	11/10/15	1.15
		149	Popcorn	Cereal Rye, Radish	08/15/15-HC	12/24/15	1.84
		229	Popcorn	Cereal Rye, Radish	09/20/15-HC	02/04/16	0.19
	2016	150	Popcorn	Triticale	08/15/16-HC	11/01/16	3.81
		149	Popcorn	Triticale, Radish, Rapeseed	08/14/16-HC	12/02/16	3.00
		155	Popcorn	Cereal Rye	09/08/16 –A	12/02/16	0.31
		229	Popcorn	Triticale, Radish, Rapeseed	08/15/16-HC	12/02/16	1.51

*A=Aerial, HC=High Clearance, D=Drill

Table 2 demonstrates the estimated total amount of DM produced by the cover crops on each farm. To assign a value to the biomass produced, a value of $80/t and 90% DM was used.

For example: 33 t of cover crop biomass ÷ 0.90 (90% DM) = 36.67 t of hay needed to replace the amount of cover crop biomass produced. 33.67 t x $80/t = $2,933. $2,933 ÷ 85 acres = $34.51/acre.

These values do not take into account the cost cover crop establishment and termination, labor, fence or water and assume 100% of the biomass produced by the cover crop is harvested as forage. In actuality when grazing, some biomass is left ungrazed and some is trampled. Across the farms, estimated values per year ranged from $622 to $125,067 total, or $7.32 to $183.11 per acre. This is a simple way of showing how winter feed expenses can be offset by grazing cover crops, but is only a partial analysis.

Table 2

Total cover crop biomass dry matter (DM) produced and value of DM as hay.

Farmer, Location	Year	Total Acres Sampled	Total Fall Cover Crop Biomass DM (t)	Total Value of DM if Assigned Hay Value ($80/t, 90% DM)	Value of Cover Crop DM as Hay, Per Acre
Wesley Degner, Lytton	2015	85	33	$2,933	$34.51
	2016	85	7	$622	$7.32
Bill Frederick, Jefferson	2015	93	79	$7,022	$75.51
	2016	61	31	$2,667	$43.72
Mark Schleisman, Lake City	2015	598	570	$50,667	$88.89
	2016	683	1,407	$125,067	$183.11

Part 2: Feed Requirements & Forage Value

The following analysis does not incorporate cover crop biomass production listed in part 1. Feed requirements, forage value and economic impact are discussed by individual farm.

Wesley Degner, Lytton

In 2015, Wesley grazed 50 cows from Oct. 9 to Nov. 12, intermittently. The following spring, he grazed 24 cow-calf pairs from Mar. 25 to Apr. 11. During these grazing periods, his cattle required approximately 35 t of DM valued at $2,793 (**Table 3**). In 2016, Wesley grazed 40 cows between Oct. 12 and Nov. 25 and he did not graze in the spring. The herd required approximately 30 t of DM valued at $2,398 (**Table 3**).

Table 3

Tons of hay required, supplemental feed provided and value of cover crop during each cover crop grazing season at Wesley Degner's farm.

	Fall 2015	Spring 2016	Fall 2016	Spring 2017
Estimated DM as hay required for herd (t)	26.96	7.96	29.97	No grazing
Assumed cost of hay ($/t)	$80	$80	$80	$80
Estimated percent of feed requirements provided by supplemental feed (%)	0%	0%	0%	No grazing
Value of cover crop forage + crop residue[x] ($)	$2,157	$636	$2,398	$0
Total value of cover crop forage + crop residue ($)	**$2,793**		**$2,398**	

[x]Value of cover crop forage was calculated by assuming the herd's DM requirement was met by the cover crop forage + crop residue and assigning the cost of hay to that

During both years, the cattle were supplemented with minerals, but not any additional feed; only having access to the cover crop, corn stalks and soybean stubble present in the fields. The tons of DM required by Wesley's cattle far exceeded the amount of cover crop biomass measured in both fall 2015 (33 t) and fall 2016 (7 t) just before the cattle began grazing the cover crops (**Tables 1** and **2**). As the cereal rye continued to grow, cattle consumed it. This growth was not captured in the biomass measurements.

"When we grazed in the spring, the rye was double the growth than what it was in the fall. There wasn't much soybean stubble left in the fields, and what residue was left the cows didn't touch it since they had rye to eat," explained Wesley, "When cattle are out grazing covers, we don't feed cows their normal ration, which saves us money."

In 2015-2016, the cover crop and crop residue provided 2,471 cow-days of grazing per AU at $1.13 per AU per day. In 2016-2017, the cover crop and crop residue provided 2,158 cow-days of grazing per AU at $1.11 per AU per day.

Dennis and Wesley Degner inspect soil in a field of cereal rye that has been grazed for two years. Photo courtesy of Lynn Betts.

Bill Frederick, Jefferson

In 2015, Bill grazed 52 cow-calf pairs from Sept. 13 to Nov. 1, intermittently. Calves were weaned and cows went back to grazing cover from Nov. 2 to Dec. 15. During these grazing periods, his cattle required approximately 76 t of DM valued at $4,571 (**Table 4**). In 2016, Bill grazed 38 cow-calf pairs from Sept. 19–23, and then grazed 52 cows from Oct. 18 to Dec. 5. The following spring, he grazed 25 cow-calf pairs from Apr. 10 to May 2. Together these groups of cattle required approximately 57 t of DM and valued at $3,174 (**Table 4**).

Table 4

Tons of hay required, supplemental feed provided and value of cover crop during each cover crop grazing season at Bill Frederick's farm.

	Fall 2015	Spring 2016	Fall 2016	Spring 2017
Estimated DM as hay required for herd (t)	76.18	No grazing	45.29	11.43
Assumed cost of hay ($/t)	$80	$80	$80	$80
Estimated percent of feed requirements provided by supplemental feed (%)	25%	No grazing	25%	50%
Value of cover crop forage + crop residue[x] ($)	$4,571	$0	$2,717	$457
Total value of cover crop forage + crop residue ($)	**$4,571**		**$3,174**	

[x]Value of cover crop forage was calculated by assuming the herd's DM requirement was met by the cover crop forage + crop residue and assigning the cost of hay to that required amount.

During both years, cattle had access to permanent pastures along with the cover crops and crop residue, therefore Bill estimated his cattle received 75% of their feed requirements from the cover crop and crop residue. In spring 2017, Bill estimated his cows received half of their requirements from the cover crop and half from the pasture.

Bill produced a tremendous amount of biomass on the fields that were seeded after small grain harvest in 2015 (**Table 1**). Small grain production creates a larger window of opportunity for cover crops to grow, and Bill used this opportunity to produce forage. "If you raise small grains and plant cover crops, you potentially get another pasture, late in the season, that's highly nutritious for your cattle," stated Bill.

In 2015-2016, the cover crop and crop residue provided 5,335 cow-days of grazing per AU at $0.86 per AU per day. In 2016-2017, the cover crop and crop residue provided 4,016 cow-days of grazing per AU at $0.79 per AU per day.

Mark Schleisman, Lake City

In 2015, Mark grazed 309 cattle, split into several groups, starting Oct. 15 through Feb. 7. "Cattle were eating through light, fluffy snow for two weeks until we got ice on Feb. 7," explained Mark, who pulled cattle off the fields at that time because cattle could not graze through the ice. 309 cows were turned back on the cover crop fields on Mar. 10 through Mar. 26, to graze the residual cover crop that was covered with snow and ice. From Mar. 27 to Apr. 30, cow-calf pairs calved on fields of cereal rye, while grazing the rye growth and the rotten turnips left in the field. One of his fields was not grazed at all in the fall and only in the spring, "because I wanted to maximize spring growth for the calving pasture," explained Mark. During these grazing periods, his cattle required approximately 525 t of DM valued at $38,735 (**Table 5**).

In 2016, Mark grazed about 360 cattle, split into groups, throughout the fall and entire winter; from Oct. 12 to Mar. 18, 2017. 123 Cow-calf pairs were turned out from Apr. 1 to Apr. 26. During these grazing periods, his cattle required approximately 656 t of DM valued at $50,670 (**Table 5**).

Table 5

Tons of hay required, supplemental feed provided and value of cover crop during each cover crop grazing season at Mark Schleisman's farm.

	Fall 2015	Spring 2016	Fall 2016	Spring 2017
Estimated DM as hay required for herd (t)	367.60	157.78	610.67	45.41
Assumed cost of hay ($/t)	$80	$80	$80	$80
Estimated percent of feed requirements provided by supplemental feed (%)	0%	0% to 50%	0%	50%
Value of cover crop forage + crop residue[x] ($)	$29,408	$9,327	$48,853	$1,817
Total value of cover crop forage + crop residue ($)	**$38,735**		**$50,670**	

[x]Value of cover crop forage was calculated by assuming the herd's DM requirement was met by the cover crop forage + crop residue and assigning the cost of hay to that required amount.

"We grazed them pretty hard, and the cattle eat the cover crops to the ground when given a choice between that and normal crop residue," said Mark. . In March and April of both years, Mark supplemented some groups of cattle with 50% of their normal ration. "Generally in the spring, these fields are overstocked and cover crop growth or availability cannot satisfy their full needs so we add some feed to their diet," explained Mark, "but I still estimate they're getting most of the cover crop eaten as they prefer it and only eat from the bunk if enough cover crop isn't available."

In 2015-2016, the cover crop and crop residue provided 37,426 cow-days of grazing per AU at $1.03 per AU per day. In 2016-2017, the cover crop and crop residue provided 46,996 cow-days of grazing per AU at $1.08 per AU per day.

Table 6

Economic impact of grazing cover crops at each farm.

REVENUE	Wesley Degner		Bill Frederick		Mark Schleisman	
	2015-2016	2016-2017	2015-2016	2016-2017	2015-2016	2016-2017
Approximate tons of DM required (t)	35	30	76	57	525	656
Value of grazed forage + crop residue[x]	$2,793	$2,398	$4,571	$3,174	$38,735	$50,670
Value of cost share payment	$3,462	$3,462	$1,000	$1,000	$21,616	$17,034
Total added value	$6,255	$5,860	$5,571	$4,174	$60,351	$67,704
COSTS						
Costs for establishment & termination	$4,727	$3,275	$2,970	$3,310	$20,159	$27,705
Costs for grazing labor[y]	$156	$78	$520	$520	$0	$0
Costs for fences, waterers[y]	$1,017	$1,017	$247	$223	$0	$0
Total added costs	$5,900	$4,370	$3,737	$4,053	$20,159	$27,705
TOTALS						
Total net economic gain or loss	**$355**	**$1,490**	**$1,834**	**$121**	**$40,192**	**$39,998**
Net economic gain (loss) per acre	**$4.17**	**$17.53**	**$19.72**	**$1.56**	**$60.09**	**$47.78**
Net gain (loss) without cost share	$(3,107)	$(1,972)	$834	$(879)	$18,576	$22,965
Net gain (loss) without cost share per acre	$(36.55)	$(23.20)	$8.96	$(11.26)	$27.77	$27.43

[x]See Table 3 for Degner; Table 4 for Frederick; Table 5 for Schleisman.

[y]Mark Schleisman's labor, fence and waterer costs total $0 because equal costs would have been spent grazing crop residue alone, therefore no additional costs were incurred when grazing cover crops + crop residue.

Economic Impact

Wesley Degner, Lytton

Net economic gain amounted to $355 or $4.17 per acre in 2015-2016 and $1,490 or $17.53 per acre in 2016-2017 (**Table 6**).

Grazing for 17 days in the spring of 2016 was valued at $636 (**Table 3**), thus producing more value in 2015-2016 than in 2016-2017. However, Wesley spent money terminating the cereal rye with glyphosate in spring 2016, which lowered his net gain. In the spring of 2017, he terminated the rye by cultivating the field, which he would have done regardless of the growing cover crop. Therefore, the cost of cultivation was not included as a cover crop expense for the 2016-2017 period. The last two lines of **Table 6** show a net loss without cost share. As these were Wesley's first two years planting and grazing cover crops, he is still learning how best to utilize them. One way to increase grazing days, and value, would be to allow for more cover crop growing days before turning cattle out to graze.

Bill Frederick, Jefferson

Net economic gain amounted to $1,834 or $19.72 per acre in 2015-2016 and $121 or $1.56 per acre in 2016-2017 (**Table 6**).

Bill grazed more cattle for more days in the fall of 2015 than the fall of 2016, which is why forage value is greater in the 2015-2016, even with no spring grazing. Termination costs increased in 2016-2017, because Bill had used herbicide for termination in three of the four fields in spring 2017, as opposed to only one the year prior. The three fields that had to be terminated were planted with winter wheat, which was grazed for 22 days in spring 2017. The wheat was not grazed the fall prior because it was drilled on Oct. 15 and that did not result in enough growth for fall grazing. The spring forage was valued at $457 (**Table 4**) but termination cost $1,360 ($20/ac x 68 ac). For Bill, spring grazing provides several benefits. "Spring grazing young pairs and the health benefits of fresh pasture to calves is worth more than the value of the forage. Rye fields keep calves clean and dry in the spring," said Bill.

"For cattlemen, utilizing cover crops for forage is a no-brainer, especially on acres that get chopped for silage," expressed Bill, who also owns a business selling and custom seeding cover crops. "I don't understand why it's so hard to market cover crops to farmers who can recoup their costs in that same year." Bill thinks some farmers may be timid about having to kill a cover crop in the spring. In this case, farmers could plant winter-kill species and save money on termination costs. The only fields he plants with a cover that will over-winter, such as cereal rye or winter wheat, are those that will be used for calving.

The last two lines of **Table 6** show a net gain in 2015-2016 and a net loss in 2016-2017 when the value of cost share is removed from consideration.

Mark Schleisman, Lake City

As shown in **Table 6**, net economic gain amounted to $40,192 or $60.09 per acre in 2015-2016 and $39,998 or $47.78 per acre in 2016-2017.

His spring grazing was valued at $9,327 in 2016 and $1,817 in 2017 (**Table 5**). "We started planting cereal rye because it was easy to calve in. Now, most all of our covers are grazed as a way to justify the costs," stated Mark.

In both years, Mark estimated it took 56 hours to move cattle to and from each cover crop field, although he would have spent this time moving cows regardless of the cover crops. "We would normally graze the corn or soybean residue in most of the fields anyway; they just get to stay in one place longer with the added biomass of the cover crop being there."

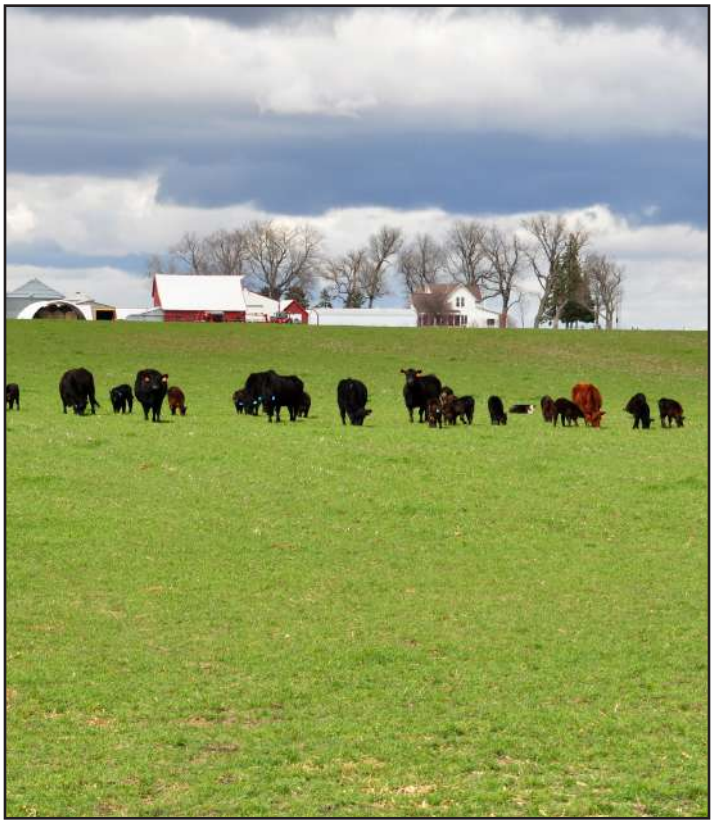
Conclusion

Total net economic gain ranged from $355 to $40,192 per year due to the grazing of cover crops and crop residue. This comprehensive economic analysis shows that utilizing cover crops as forage has short-term benefits that can be reaped within the same year of planting. Not only did these famers save money by offsetting winter feed expenses, they provided grazing opportunities to their cattle during seasons they wouldn't normally be eating fresh forage.

These farmers received cost share for planting cover crops on their farms, and in some cases, kept them profitable. In cases where farmers would have lost money if they did not receive cost share, farmers need to assess their cover crop planting and grazing strategies. Cost share is a way for farmers to experiment with practices they are not familiar with, hone their skills and buffer their mistakes in hopes that the lessons learned will result in future economic success.

The benefits of grazing cover crops excite famers. "Putting cows on cover crops makes the practice worth it and I probably wouldn't do much cover cropping if I didn't reap these benefits," said Wesley. Mark is most excited about the increased carrying capacity he has experienced, "My dad ran 200 cow-calf pairs on the same acres that we now run 360 pairs on," he said. "Because we can graze cover crops, we're producing more on the same amount of land."

In the future, Practical Farmers of Iowa will report on the cost per pound of gain when grazing cover crops in a beef feedlot system. For more information visit: http://practicalfarmers.org/member-priorities/cover-crops/



Wesley Degner's herd grazes cereal rye.

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