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FACTSHEET

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Economic Benefits of Grazing Cover Crops: Results From the Field

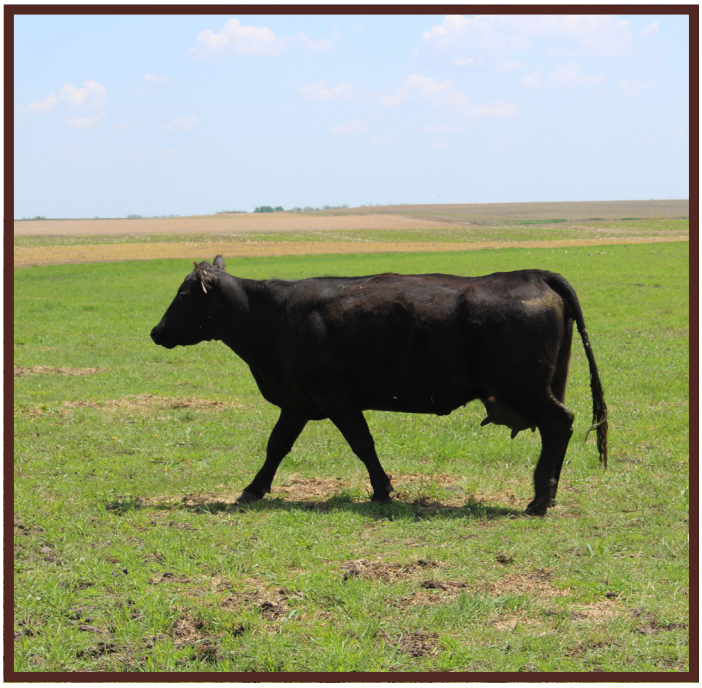
By Margaret Chamas

Cover cropping is a soil health practice that keeps living roots in the soil and cover on the ground during the time of year when traditional crops have been harvested and fields would typically be fallow. The practice supports soil health and conservation, meeting three of the four soil health principles established by the Natural Resources Conservation Service (NRCS): maximize soil cover, maximize presence of living roots, and maximize diversity. Because of this, governments and private and corporate funders offer incentives and cost-share programs to encourage farmers to integrate cover crops into their farming systems.

Livestock are an often-overlooked component of the "maximize diversity" soil health principle, leading some to adopt it as a semi-official fifth principle. Grazing animals recycle nutrients into more bioavailable forms. This, in turn, helps provide food and nutrients for soil microorganisms and growing plants. Because of this key ecological role, livestock are vital to soil health.

Adding livestock to land used for crop production is also a way for farmers to stack enterprises. For instance, grazing cattle on cornstalks or soybean stubble over the winter is not an uncommon practice in the Upper Midwest, as cows are capable of digesting the crop residues. Since feeding hay or other forages during the winter is the single largest expense for most livestock producers, grazing these residues can considerably cut costs.

Adding cover crops to these cropping systems provides even more forage and better-quality nutrition. These benefits are usually realized immediately. Compared with the soil health benefits of cover crops, which may take years to emerge, farmers who graze cover crops see a more direct economic benefit.



Grazing livestock on crop residues, with or without cover crops, can be a financially smart choice if labor and fencing can be managed efficiently.

Despite the benefits, cover crop grazing can be challenging to put into practice. Many crop fields have no fence or water infrastructure, which represents a huge investment in time, fuel and money. Cover crop seeding rates are generally higher (and more expensive) when grazing is a goal. This has led farmers and funders interested in supporting regenerative, soil-health-supporting practices to ask if grazing cover crops is worth the cost needed to get started with the practice.

Through PFI's grazing cost-share pilot program in 2022, and through a multistate survey of crop farmers using cover crops in the 2020-2021 cropping years, it is possible to gain some insights on the costs and returns of cover cropping for forage. This helps inform the sorts of incentives that may be needed for grazing cover crops to become a more accepted practice.

Twenty-nine farmers in Iowa, Nebraska and Minnesota grazed on crop acreage and reported information such as animal number and weight, days of grazing, supplemental feed, and time and funds spent constructing fence. This data was used to calculate the feeding value of crop residue and cover crops.

Cost of Infrastructure

Fence is a prerequisite for grazing, though it may be a one-time expense (permanent fencing such as woven wire, multistrand barbwire or multistrand high-tensile) or a recurrent expense (temporary fencing such as single-strand electric wire). Rotational or temporary grazing may be supported through cost-share assistance offered by the Natural Resources Conservation Service's Environmental Quality Incentives Program. But there are limitations – especially when grazing cropland or land that is not owned. Thus, the cost often falls to individual farmers to install fence and water.

Survey respondents were asked whether they had to install fencing around grazed crop fields, and if so, about the costs and time required. Sixteen farmers reported building fence; 13 of these were temporary and three were permanent or semi-permanent. Of the permanent fences, two did not include any materials cost, so were not included in the analysis.

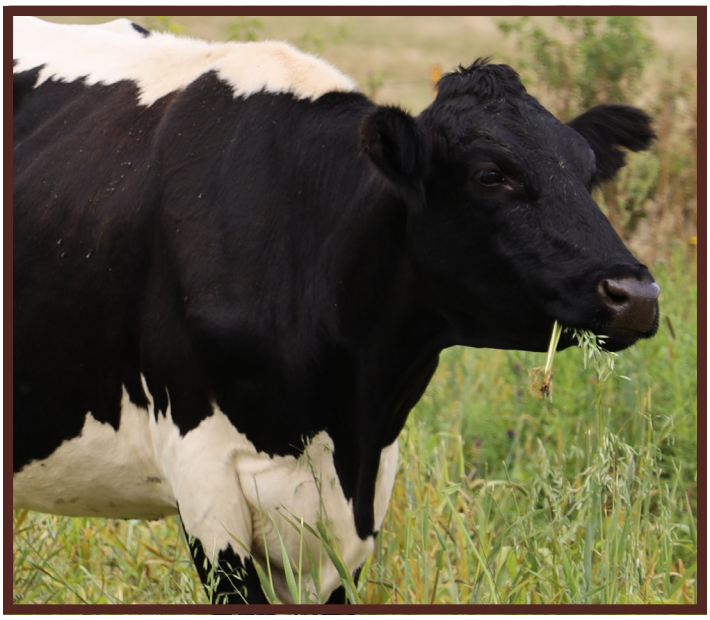
Water is another essential for grazing livestock, and one that can be difficult to provide if there are not facilities available. Only one survey respondent provided expenses for getting water to the animals.
A summary of costs is in **Table 1**. Labor was valued at $15 per hour. Fence costs are provided on a per-foot and per-acre basis. Water costs are noted per-acre and per-animal unit day (AUD, or per requirements for a 1,000-pound animal unit per day).

Table 1. Costs of grazing infrastructure

	Responses	Average
Fence, $/ft	14	$0.08
Temporary fence	13	$0.08
Permanent fence	1	$0.12
Fence, $/ft	14	$14.26
Temporary fence	13	$10.96
Permanent fence	1	$57.14
Water, $/ac	1	$17.14
Water, $/AUD	1	$0.83

As expected, temporary fence is less expensive than permanent fence. It's important to note, however, that while permanent fence might need some ongoing maintenance, it is generally a one-time cost. Temporary fence is less costly but generally needs to be reinstalled annually. This means that while the *materials* cost is generally one-time only, there will be labor costs each year.

The cost of fence on a per-foot basis is relevant for those considering fencing in fields of known dimensions. The cost on a per-acre basis varies considerably with the acreage involved and the shape and orientation of that acreage. However, for some of our later calculations, it is useful to determine.



With the relatively high digestibility of many cover crops, cattle can consume a significant portion of the plant and demonstrate high harvest efficiency.

Table 2. Costs of cover crops (CC) seed and seeding						
	All field types		CC before soybeans		CC before corn	
	Responses	Average	Responses	Average	Responses	Average
Cover crop cost, $/ac	26	$31.65	18	$31.83	8	$31.25
Single species	15	$31.10	8	$30.56	7	$31.71
Multispecies	11	$32.40	10	$32.84	1	$28.00

Cost of Cover Crops: Seed and Seeding

Another cost to consider is that of the covers themselves. Survey respondents were asked to provide the costs of seed and seeding, if known, of the covers they planted. They were also asked whether they seeded a single species or a multispecies mix. Respondents who did not know the costs (often, those who raised their own cover crop seed) were told to input "0" as the cost; these were excluded from analysis

The results were not surprising. Multispecies cover crops were generally more costly than single-species cover crops, which are often cereal grains and are relatively inexpensive. The respondents who grazed livestock spent more per acre on cover crops than the average of the entire dataset ($27.66 per acre before soybeans and $26.39 per acre before corn, data not shown). Cover crop seeding rate recommendations are higher when forage production is a goal.

Determining Value of Cover Crops for Grazing

Survey respondents provided information on their grazing practices: the number, species, class and average weight of grazing animals; and the number of days the animals were grazing (and the number of times the animals grazed a given field). They also provided information on any supplemental feed offered, reported as cost per head per day.

The number and weight of grazing livestock and the duration of grazing were used to calculate the demand for feed, expressed as AUD (animal-unit days, or the number of 1,000-pound animal units (AU) multiplied by the number of days the animals are being fed). To figure out the feed value of the crop residues and cover crops, the total feed requirements of the livestock needs to be determined. The value of the supplemental feed is then subtracted from that number. Because supplemental feed was reported in dollars per head of livestock per day ($/hd/d), AUD needs to be converted to a dollar value.

Historical data from the U.S. Department of Agriculture's National Agricultural Statistics Service on Iowa grass hay prices ($94 per ton in 2020) was used to calculate the daily cost of hay needed for an animal unit. A 1,000-pound animal unit will consume (and/or waste) approximately 3% of its bodyweight per day, as dry matter. Assuming 85% dry matter in hay, this is a bit over 35 pounds per animal unit per day (lb/AU/d), for a cost of $1.66 per AUD.

The total AUD for each field grazed was multiplied by $1.66 to represent the total dollar value of livestock feed demands during the time they were on that field. The value of any supplemental feed was subtracted from that total demand, to generate a net grazing value: the value of forage (whether cover crop or crop residue) harvested by grazing animals. Dividing the net grazing value by the number of acres in the field produces a value that can be compared across fields.

Table 3 shows the AUD demand per acre (AUD for each field divided by the acres in that field), average per-head-per-day value of supplemental feeds and net grazing values of different field types. As expected, the net grazing value of fields with cover crops was greater than those without cover crops, where the animals were only harvesting crop residues. Also not surprising is that supplemental feed costs were higher for fields without cover crops compared to fields that had been cover cropped.

Table 3. Animal Unit Days (AUD) required, supplemental feed supplied, and net grazing value of fields with and without cover crops (CC)										
	All field types		No CC before soybeans		CC before soybeans		No CC before corn		CC before corn	
	Responses	Average	Responses	Average	Responses	Average	Responses	Average	Responses	Average
AUD demand, $/ac	40	$94.57	6	$52.22	20	$129.41	6	$49.47	8	$73.05
Supplemental feed provided, $/hd/d	19	$0.97	1	$1.00	14	$0.95	2	$1.13	7	$0.89
Net grazing value, $/ac	40	$68.47	6	$45.53	20	$89.18	6	$40.18	8	$55.13

However, it's important to note that the quantity and quality of forage available are not the only factors driving supplemental feed costs. A farmer could remove animals as soon as the available forage was depleted or could keep them on the field and supplement hay for weeks or months past the end of effective grazing. Thus, while the higher daily value of supplemental feed supports the assumption that there is less grazeable feed without cover crops, the amount of supplemental feed is not necessarily a consequence of the lower forage availability.

While cover cropped fields provided more grazing value, was this value more than the cost of getting the cover crops established in the first place?

To estimate the portion of grazed forage that came from cover crops alone, the net grazing value of the non-cover cropped field is subtracted from the net grazing value of the cover cropped field to generate a net grazing value of cover crops. **Table 4** shows the total grazing values again, along with a few other calculated metrics:

- **Net grazing value of cover crops:** net grazing value of the cover cropped field (corn or soybeans) minus the net grazing value of non-cover cropped field (corn or soybeans)
- **Return on investment (ROI):** net grazing value of cover crops divided by the cost of cover crops

Table 4. Net grazing value and return on investment (ROI) of fields with and without cover crops (CC)					
	All field types	No CC before soybeans	CC before soybeans	No CC before corn	CC before corn
Net grazing value, $/ac	$68.47	$45.53	$89.18	$40.18	$55.13
CC cost, $/ac	$31.65	-	$31.83	-	$31.25
Net grazing value of cover crops, $/ac	$31.56	-	$43.65	-	$14.95
ROI: net grazing value of CC / cost of CC	1.00	-	1.37	-	0.48

While cover crops increased the amount of available feed for livestock, it was only in the fields going into soybeans that the grazing value exceeded the cost of establishing cover crops. In fact, the high net grazing value of the non-cover cropped fields makes them attractive as feed sources as well.

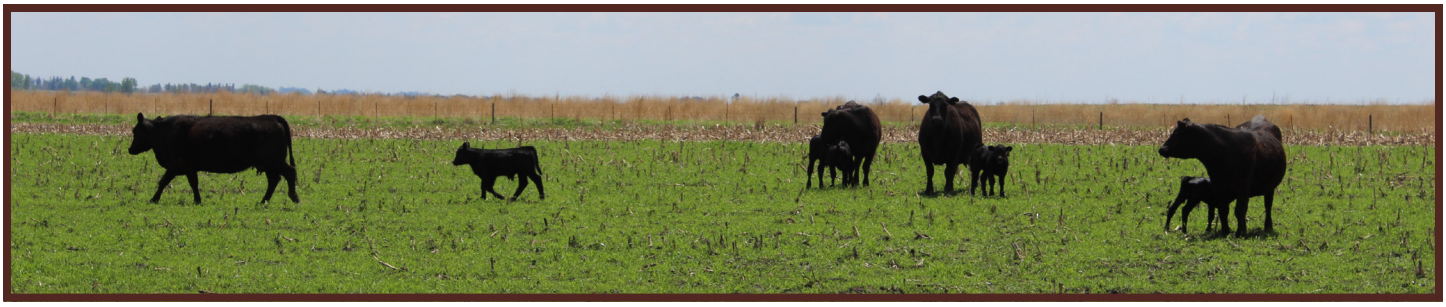
Table 5 digs further into the costs of grazing crop fields by accounting for the cost of fencing. In this instance, the values for temporary fence are used, as most farmers trying this for the first time are unlikely to invest in full permanent perimeter fencing. Note that because of only having one data point for water costs, this was not included in cost analysis but was presented above for information only. The data in Table 5 shows:

- Net grazing value over the cost of fence: net grazing value minus the cost of fence
- ROI of fence: net grazing value divided by the cost of fence
- Net grazing value over fence and cover crops (only for cover crop fields): net grazing value of cover crops minus the cost of fence
- ROI of fence and cover crops: net grazing value over fence and cover crop divided by the cost of fence and cover crop

This analysis suggests a few things. First, fencing crop fields to graze was financially worthwhile, with or without cover crops present. In fact, the highest ROI was in non-cover crop fields, particularly those going into soybeans. Most fields going into soybeans are coming out of corn, which leaves a lot more stubble for livestock to eat.

Table 5. Return on investment (ROI) of fence and cover crops (CC) on grazed fields

	All field types	No CC before soybeans	CC before soybeans	No CC before corn	CC before corn
Net grazing value, $/ac	$68.47	$45.53	$89.18	$40.18	$55.13
Net grazing value over fence, $/ac	$57.51	$34.57	$78.22	$29.22	$44.17
ROI of fence	5.25	3.15	7.14	2.67	4.03
Net grazing value of cover crops, $/ac	$31.56	-	$43.65	-	$14.95
Net grazing value of CC over fence & CC, $/ac	$20.60	-	$32.69	-	$3.99
ROI of fence & CC	0.48	-	0.76	-	0.09



Cover crops provide a clean space and fresh forage for cows in early lactation.

Somewhat depressingly, cover crops were not a huge financial 'win.' While the ROI was positive – this was not money lost – less than a dollar of grazing value was realized for each dollar spent on cover crops and fence.

While the results presented are interesting and meaningful, it is important to remember that this is data from a relatively small number of farms from a single year. Weather and field conditions may have resulted in lower-than-average cover crop growth, and a different year might have resulted in more grazing.

The analysis also required us to make assumptions with the conversion of AUD to dollars. These assumptions are defensible but are simplifications. For instance, it is well-established that the forage quality of cover crops is greater than that of cornstalks or soybean stubble. Thus, it's not entirely accurate to consider all grazing days to be worth a single dollar value. However, integrating these assumptions into our conversion formula for AUD to dollars was the best option to make use of the available data.

Conclusions and Takeaways

The survey results provide information that should inform farmers (both row crop farmers and livestock farmers), as well as funders and supporters who wish to see more soil health practices on the land. Here are some key takeaways:

- **Investing in fence had a positive ROI:** This is a noteworthy point for farmers. The time and materials required to implement grazing were rewarded with significant feed savings. Of course, each individual growing season, logistics, available human and material infrastructure and many other factors may influence whether it's a wise choice for any given farm in any given year. But in general, getting the animals grazing was a net positive on the financial side.

- **The best returns from grazing cover crops were before soybeans:** This is an important point for farmers thinking of starting to graze cover crops. It's likely farmers saw the best returns from cover crops planted before soybeans because cereal rye doesn't have the same potential negative effects in soybeans that it does when planted before corn.

  For instance, ahead of corn there are more concerns about how cereal rye might tie up nutrients, reduce water available for the corn plans and have an allelopathic effect on the corn. Before soybeans, however, cereal rye can be safely planted. Rye is also considered an "entry-level" cover crop because it's easy to establish and has good biomass production.

- **Cover cropping for forage production is costly and does not guarantee a similar return in grazing value:** For those who support soil health practices, this result illuminates why continuing and expanding risk-reducing programs is helpful. For instance, providing cost-share to help establish cover crops reduces the out-of-pocket expense for whoever is paying to seed them.

  When cover crops are being used for grazing, it's often the livestock farmer who is expected to pay for the cover crops – a risky venture, as weather conditions may limit growth or might prevent grazing, if the cropland owner doesn't want pugging to occur. Shifting that financial burden from the livestock farmer will encourage more farmers to adopt the practice of grazing covers.

Diverse cover crops keep soil in place, help recycle nutrients, and provide livestock with high-quality feed.

While only one respondent reported the cost of providing water for livestock, conversations with graziers suggest that it's a major barrier to grazing fields located away from the livestock farmer's home base. This is especially true during winter when water needs to be transported (either by truck or trailer, or with hoses or pumps) and freezing is an issue. Sheep are capable of consuming enough snow to meet their daily water needs, but cattle generally are not.

The logistical challenges of water access have been expressed through responses to PFI's grazing infrastructure cost-share program. Out of the 18 farmers provided funds in the pilot program, 14 used the funds for watering equipment as well as fencing. One recipient wrote:

> With this new fencing and waterline in place, we will now be able to fall/winter graze our cattle on more acres of stockpiled organic cover crops. With our 2-year organic rotation (oats & corn) we will be able to graze corn stalks after corn and cool-season cover crops after oats.

Through PFI's work with on-farm research, farmer-to-farmer education and networking – and now in reducing the barriers to farm viability – we have repeatedly heard how farmers want to make changes that benefit their farm land, farm finances and broader communities.

They also express frustration when financial or technical barriers impede their adoption of these practices. Cost-share support of cover cropping and grazing infrastructure are two ways to make it easier for farmers to implement these practices.