ECONOMIC ANALYSIS

Rotational Grazing with Cover Crops

Four Sauk County, Wisconsin Case Studies

Cover crops are promoted as a soil health management practice because of their potential to protect the soil surface from erosion, increase organic matter, reduce compaction, and enhance soil biology [1]. Though Wisconsin's short growing season does not provide an ideal window of opportunity to incorporate cover crops, there are cropping systems conducive to seeding and proper establishment [2-6]. For example, fields harvested earlier than conventional row crops, such as those planted to canning crops, winter wheat, hay, corn silage, or older alfalfa, are optimal for cover crops – especially if they have been or are being used for livestock grazing. Although corn silage harvest dates vary, the residue is removed from the field with harvest, leaving several months of bare soil, often with a manure application. When well established, cover crops can armor the soil to reduce winter and spring erosion and nutrient loss, while potentially improving soil health by maintaining living roots longer throughout the year [7].

Grazing cover crops has been promoted in the Midwest to extend the grazing season through late-fall and offset hay feeding in early spring by providing high-quality forage that can reduce supplemental feed expenses [8]. When properly managed, and with cooperative weather, rotational grazing cover crop fields may further enhance soil conditions and water quality as vegetation becomes denser and the nutrients are cycled [9, 10 & 11].

Since rotational grazing of cover crops is not a common practice, to address some of the current questions from farmers of the upper Midwest, Sand County Foundation partnered with the Sauk Soil and Water Improvement Group (SSWIG; a farmer-led group) and the University of Wisconsin-Madison to explore short-term agronomic and environmental costs and benefits of managed grazing of cover crops.

SSWIG SAUK SOIL & WATER IMPROVEMENT GROUP
NORTH CENTRAL SARE Sustainable Agriculture Research & Education
USDA United States Department of Agriculture National Institute of Food and Agriculture
Grassland Ecology COLLEGE OF AGRICULTURAL & LIFE SCIENCES UNIVERSITY OF WISCONSIN-MADISON

Agronomics

Partial budgeting is a planning tool that can help a farm manager understand how a decision will affect the profitability of the farm enterprise. It compares the whole-farm costs and benefits of implementing alternative management compared to a farm's "business as usual" or normal operations. Some examples of alternative management include raising your own replacement heifers, making capital improvements, or purchasing equipment.

Partial budgets consider:

1. Increased returns/revenues
2. Eliminated or reduced costs
3. Additional or increased costs
4. Eliminated or reduced returns/revenues

We created a partial budget to compare rotational grazing of cover crops to raising livestock in a feedlot using 2023 costs from Sauk County, Wisconsin. Using average field size and "typical" management of the region, we estimated costs associated with grazing 50 head of beef cattle in a 26-acre row crop field on cover crop forage for 26 days in the fall. We assumed that a farmer would normally plant a cereal rye cover crop when not grazing and a diverse cover crop mixture when grazing. Feedlot costs included hay feed, straw bedding, manure management, and vet bills, while grazing costs included temporary electric fencing supplies (annualized over 20 years).

Table 1. Partial budget comparison of fall livestock rearing in a feedlot vs. rotationally grazing on cover crops.

Business as Usual: Feedlot					Rotational Grazing Cover Crops				
	$/unit	unit	#units	$		$/unit	unit	#units	$
Hay feeding	$ 2.51	AUD	1300	$3,265.29	Fencing	$ 0.18	linear foot	7003	$ 1,294.26
Bedding	$ 0.19	AUD	1300	$ 251.33	Daily watering	$ 9.46	day	26	$ 245.96
Manure management	$ 0.12	AUD	1300	$ 151.02	Multi-species cover crop mix	$ 47.93	acre	26	$ 1,247.64
Cereal rye cover crop	$18.89	acre	26	$ 491.70					
Vet bills	$ 0.60	AU	50	$ 29.29					
Feedlot Costs				$ 4,189.34	Cover Crop Grazing Costs				$ 2,787.86
								Cost Difference:	$1,401.48

Animal Unit Days (AUD) detail the product cost for one animal unit for one day. Animal units standardize values across different types of livestock. One "Animal Unit" (AU) is equal to one 1,000-pound animal, therefore, a 1,200-pound bull is 1.2 AU.

If cover crops establish well with sufficient biomass, rotational grazing for 26 days in the fall can reduce costs by ~$1,400 compared to feedlot rearing during that time (Table 1).

Table 2. Cost differences resulting from insufficient cover crop biomass for grazing.

Business as Usual: Feedlot					Rotational Grazing Cover Crops				
	$/unit	unit	#units	$		$ /unit	unit	#units	$
Cereal rye cover crop	$18.89	acre	26	$ 491.70	Multi-species cover crop mix	$ 47.93	acre	26	$ 1,247.64
Feedlot Costs				$ 491.70	Grazing Costs				$ 1,247.64
								Cost Difference:	$ -755.94

Diverse cover crop mixtures for grazing typically cost more than double the price of a cereal rye cover crop. When cover crops do not establish well, leaving insufficient biomass for grazing, farmers bear the expense of a more costly cover crop mix and their normal feeding costs (Table 2).

The following case studies compare the grazing systems managed by four SSWIG farmers.

Ron Schoepp

In fall 2021, Ron Schoepp and his family grazed two dairy herds, 106 dry cows/springing heifers and 60 breeding age heifers, on a 17-acre row crop field planted to a 15-species cover crop mix after wheat harvest. Occasionally, the two groups grazed at the same time, but in different paddocks, leading to 21 grazing sessions across 15 days. If the Schoepp's were not grazing cover crops, the cattle would be fed baleage, and Ron would move the bale feeder daily to reduce compaction and ensure nutrients from cattle manure are properly dispersed around the field. The Schoepp's found no difference in the time spent on daily chores between normal baleage feeding and rotational grazing of cover crops. If fields are not grazed, the Schoepp's usually plant a legume cover crop mixture to fix nitrogen after wheat (before corn) and the following year, interseed a 3-species cover crop mix into corn when side-dressing nitrogen. The field used for this demonstration has permanent electric fencing along two edges, which saved them almost $400 annually in fencing costs. In 2022, Ron planted corn, but did not interseed cover crops like usual. Instead, he allowed volunteer cover crops to grow from the prior year's multi-species mix. These volunteer cover crops (mostly buckwheat) grew chin-high but did not affect the corn yield. Due to cold, wet weather, he was unable to harvest the corn until late November and chose not to graze cattle that fall because the ground was wet and not frozen. In spring 2023, the cattle grazed corn stalks and buckwheat residue for four days (7 grazing sessions across 166 cattle) with supplemental baleage feed and additional minerals.

Year 1:

Business as Usual: Baleage Bale Grazing					Rotational Grazing Cover Crops				
	$/unit	unit	#units	$		$/unit	unit	#units	$
Baleage feeding	$ 2.00	AUD	1968	$3,946.37	Fencing	$ 0.01	linear foot	1380	$ 7.98
Legume cover crop mix	$63.73	acre	17	$ 1,111.45	15-species cover crop mix	$65.16	acre	17	$ 1,136.45
Baleage Bale Grazing Costs				$ 5,057.81	Cover Crop Grazing Costs				$ 1,144.43
								Cost Difference:	$3,913.38

Year 2:

Business as Usual: Baleage Bale Grazing					Rotational Grazing Cover Crops				
	$/unit	unit	#units	$		$/unit	unit	#units	$
Baleage feeding	$ 2.00	AUD	580	$ 1,163.62	Fencing	$ 0.01	linear foot	1380	$ 7.98
3-species cover crop mix	$22.52	acre	17	$ 392.81	Supplemental baleage & minerals	$ 0.81	AUD	580	$ 468.42
Baleage Bale Grazing Costs				$ 1,556.43	Cover Crop Grazing Costs				$ 476.41
								Cost Difference:	$1,080.02

Grazing cover crops reduced the Schoepp's costs by ~$4,000 compared to baleage grazing for 15 days (21 grazing sessions across 166 cattle) in the fall. The following year, they could not graze until the spring due to weather, resulting in a shortened grazing season and a need for supplemental bales. However, they still saved ~$1,000 by grazing for four days (7 grazing sessions across 166 cattle) because they did not plant a cover crop.

Roger Bindl

After harvesting wheat in summer 2021, Roger Bindl planted a 12-species cover crop mixture on three fields totaling 13 acres. During 24 days in the fall, Roger grazed 2 bulls, 4 cow/calf pairs, 8 Holstein heifers, and 11 beef cattle. Before Roger started grazing cover crops, his cattle would graze corn stalks and supplemental hay for two weeks before going into the feedlot. Since the project started in 2021, Roger has added more grazing opportunities for his cattle, so now they are rotationally grazed in a pasture when not grazing cover crops. His daily chores take about the same amount of time if the cattle are grazing corn stalks or cover crops. Roger had not grazed these crop fields before, so he needed to purchase additional fencing supplies, which cost $0.08 per foot when spread over 20 years. Roger's cover crop mixture for cattle grazing is less expensive than the nitrate-fixing cover crop mixture that he would typically plant. In 2022, Roger interseeded a 5-species cover crop mix into his corn crop but found that the wet spring and heavy rainfall led to issues with cover crop establishment. He was able to graze 28 cattle for 44 days following corn harvest, but had to provide additional hay bales. Due to blizzard conditions, grazing finished sooner than anticipated.

Year 1:

Business as Usual: Corn Stalk Grazing & Feedlot					Rotational Grazing Cover Crops				
	$/unit	unit	#units	$		$/unit	unit	#units	$
Stalk Grazing - Supplemental hay	$ 60.00	bale	7	$ 420.00	Fencing	$ 0.08	linear foot	6425	$ 529.90
Feedlot - Hay feeding	$ 2.88	AUD	242	$ 697.26	12-species cover crop mix	$ 39.71	acre	13	$ 500.69
Feedlot - Bedding	$ 0.19	AUD	242	$ 46.75					
Feedlot - Manure mgmt	$ 0.12	AUD	242	$ 28.09					
Feedlot - Vet bills	$ 0.02	AUD	242	$ 6.00					
Nitrate-fixing cover crop	$ 63.73	acre	13	$ 803.63					
Feedlot Costs				$ 2,001.72	Grazing Costs				$ 1,030.59
								Cost Difference:	$ 971.13

Year 2:

Business as Usual: Corn Stalk Grazing & Feedlot					Rotational Grazing Cover Crops				
	$/unit	unit	#units	$		$/unit	unit	#units	$
Stalk Grazing - Supplemental hay	$ 60.00	bale	7	$ 420.00	Fencing	$ 0.08	linear foot	6425	$ 529.90
Feedlot - Hay feeding	$ 2.88	AUD	725	$2,091.77	5-species cover crop mix	$ 17.39	acre	13	$ 219.35
Feedlot - Bedding	$ 0.19	AUD	725	$ 140.24	Supplemental hay	$ 60.00	day	44	$ 2,640.00
Feedlot - Manure mgmt	$ 0.12	AUD	725	$ 84.27					
Feedlot - Vet bills	$ 0.02	AUD	725	$ 17.99					
Nitrate-fixing cover crop	$ 63.73	acre	13	$ 803.63					
Feedlot Costs				$ 3,557.91	Grazing Costs				$ 3,389.25
								Cost Difference:	$ 168.66

Roger's costs were reduced by ~$970 by grazing his 25 cattle on cover crops for 24 days, when cover crop forage was well established. The following year, he still had a cost difference of ~$170, even though the cover crops were not well established.

Darren Yanke

Darren Yanke of Echo-Y Farms grazed 70 beef cattle on a 50-acre row crop field that was three miles from his cattle barn. The field was planted to an 11-species cover crop mix (that Darren concocted) after wheat harvest. The cattle were hauled at the beginning of the grazing season, where they grazed for 40 days before being hauled back to the cattle barn. Each day, Darren hauled water to the field using a liquid storage tank in his truck bed to fill a stock tank that he moved with the cattle. The costs of daily watering and transportation include the extra time and labor it took to care for the animals when grazing cover crops. If Darren was not grazing cover crops, he would bale graze the cattle on permanent pasture. Since the cattle are out in fields in the fall regardless of if they are grazing cover crops, we did not assume there would be a change in animal health or vet bills. Darren plants his cover crop mixture even in years when he does not plan to graze, thus, it is not included in the following budget. After successful grazing, a corn crop was planted in the field during the following spring. The 11-species cover crop mix was interseeded into the corn but was overtaken by water hemp and had to be terminated.

Year 1:

Business as Usual: Bale Grazing in Pasture				
	$/unit	unit	#units	$
Hay feeding	$ 2.25	AUD	2800	$6,297.48
Bale Grazing Costs				$ 6,297.48

Rotational Grazing Cover Crops				
	$/unit	unit	#units	$
Animal hauling	$480.00	season	1	$ 480.00
Fencing	$ 0.11	linear foot	10400	$ 1,192.08
Daily watering	$ 10.00	day	40	$ 400.00
Daily transportation	$ 2.21	mile/ day*	120	$ 265.57
Cover Crop Grazing Costs				$ 2,337.65
			Cost Difference:	$3,959.38

* Mile/day is the distance to the field one-way.

Year 2:

Business as Usual: Bale Grazing in Pasture				
	$/unit	unit	#units	$
None				
Bale Grazing Costs				$ -

Rotational Grazing Cover Crops				
	$/unit	unit	#units	$
None				
Cover Crop Grazing Costs				$ -
			Cost Difference:	$ -

Darren sustained some additional costs hauling the animals and bringing water to the cattle daily, but grazing cover crops for 40 days still reduced costs by ~$4,000 compared to buying hay bales for his 70 beef cattle. When the cover crop forage did not adequately establish, Darren found no difference in costs between grazing cover crops and bale grazing.

Ron Bula

Ron Bula and his family wondered if relay cropping using cover crops could provide additional forage for their livestock (22 cow/calf pairs, 18 stockers, and 6 finishers) during the summer, particularly in drought years. A 14-acre row crop field was planted next to a rotationally grazed pasture, where the animals grazed for 50 non-consecutive days during the late spring through the fall, as part of their pasture rotational grazing. Rye and medium red clover were planted in the fall after wheat, then pea and oats were sown the following April. In June, a 10-species warm-season mix was planted. While the medium red clover proved to be a little too competitive in these mixtures, the Bula family still found success grazing the cover crops instead of using a feedlot on hot summer days. Relay cropping allowed their pasture to regenerate while keeping their cattle outside grazing fresh forage. Since the Bula's could rotate their cattle directly into the cover crop field from the pasture, there were no additional labor costs. The following year, they saved some costs by not using a spring cover crop. However, due to the high soybean price, they would have made $700 more if they had produced soybeans instead of grazing the field. Had soybean prices been less than $11.00 per bushel, the Bula's would have saved money by grazing cover crops.

Year 1:

Business as Usual: Corn Production and Feedlot

	$/unit	unit	#units	$
Hay feeding	$ 2.97	AUD	2437	$ 7,235.99
Bedding	$ 0.19	AUD	2437	$ 471.12
Manure management	$ 0.12	AUD	2437	$ 283.09
Vet bills	$ 0.60	AU	49	$ 29.23
Feedlot Costs				**$ 8,019.43**
Corn production costs*	$860.20	acre	14	**$12,300.86**
Corn revenue	$ 4.76	bushel	3003	$+14,294.28
Corn Production Income				**$+1,993.42**
Total Feedlot Costs**				**$ 6,026.01**

Rotational Grazing Relay Cover Crops

	$/unit	unit	#units	$
Fencing	$ 0.00	linear ft.	4000	$ 9.46
Water infrastructure	$ 219.29	field	1	$ 219.29
April cover crop (seeds + planting)	$ 36.05	acre	14	$ 515.46
June cover crop (seeds + planting)	$ 55.28	acre	14	$ 790.50
Fertilizer (fall + spring)	$ 144.51	acre	14	$ 2,066.49
Composted manure (spring)	$ 25.79	acre	14	$ 368.80
Supplemental hay	$ 0.10	AUD	2437	$ 254.52
Relay Cover Crop Grazing Costs				**$4,224.52**
Cost Difference:				**$1,801.49**

Year 2:

Business as Usual: Soybean Production and Feedlot

	$/unit	unit	#units	$
Hay feeding	$ 2.97	AUD	2437	$ 7,235.99
Bedding	$ 0.19	AUD	2437	$ 471.12
Manure management	$ 0.12	AUD	2437	$ 283.09
Vet bills	$ 0.60	AU	49	$ 29.23
Feedlot Costs				**$ 8,019.43**
Soybean production costs*	$326.70	acre	14	$ 4,671.81
Soybean revenue	$ 11.81	bushel	786.5	$+9,288.57
Soybean Production Income				**$+4,616.76**
Total Feedlot Costs**				**$ 3,402.68**

Rotational Grazing Relay Cover Crops

	$/unit	unit	#units	$
Fencing	$ 0.00	linear ft.	4000	$ 9.46
Water infrastructure	$ 219.29	field	1	$ 219.29
June cover crop (seeds + planting)	$ 32.60	acre	14	$ 446.18
Fertilizer (spring)	$ 238.00	acre	14	$ 3,403.40
Relay Cover Crop Grazing Costs				**$4,098.33**
Cost Difference:				**$ -695.65**

*Production costs include seed, fertilizer, crop insurance, planting, post-harvest, labor and operating loan interest as referenced in UW Crop Enterprise Budget Tool.[12]

**Total feedlot costs consider the revenue from the crop production.

By replacing his corn crop with relay cover crops for his 46 cattle, Ron reduced his costs by ~$1,800 over the crop season. In Year 2, Ron lost ~$700 since he did not grow soybeans, which were selling high.

Lessons Learned

1. Budgets from Year 1 reflected cover crops planted after wheat, with plenty of time for cover crop biomass accumulation in the late summer and early fall before grazing. In the following year, when corn was the main commodity, many farmers could not graze because of insufficient biomass or a shortened season after corn harvest.

2. Reliable cover crop growth affects the economic and environmental benefits of grazing cover crops. Proper cover crop establishment is essential to having enough biomass to graze. Farmers should aim to graze about half of the cover crop biomass, leaving significant residual biomass for water quality and soil health benefits.

3. When cover crops were well established, all four farmers found a positive economic benefit from rotationally grazing cover crops. The largest upfront costs were fencing and water infrastructure, but most successfully used temporary electric fencing with one wire strand and a portable stock tank filled with a hose. Grazing a row crop field close to the cattle barn can save on transportation and fence battery costs, but Echo-Y Farms still reduced costs by grazing cover crops, even after hauling animals to a field three miles away. These cost differences will vary year-to-year based on annual fluctuations in hay markets, cover crop seed, and other costs.

4. Despite some issues with cover crop establishment after corn, all four farmers are excited to continue grazing cover crops. They found that an extended grazing season and reduced feed costs overcame the risks of needing a backup plan when the cover crop did not produce enough biomass to graze.

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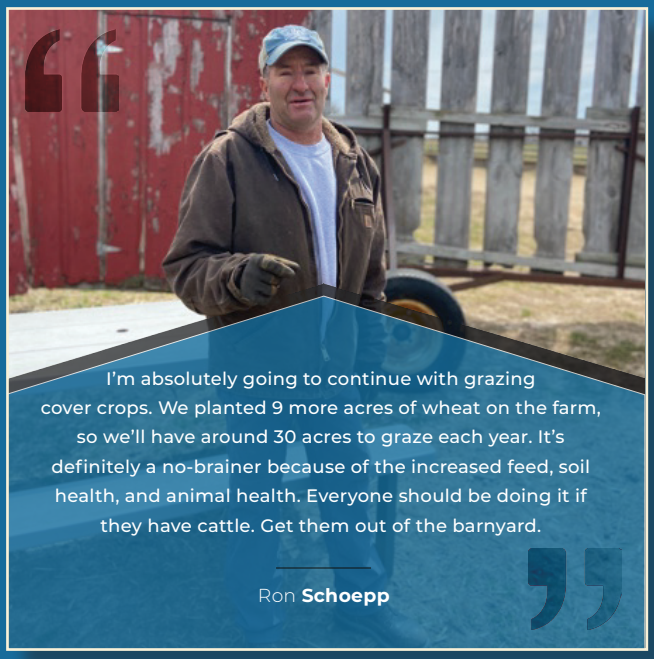
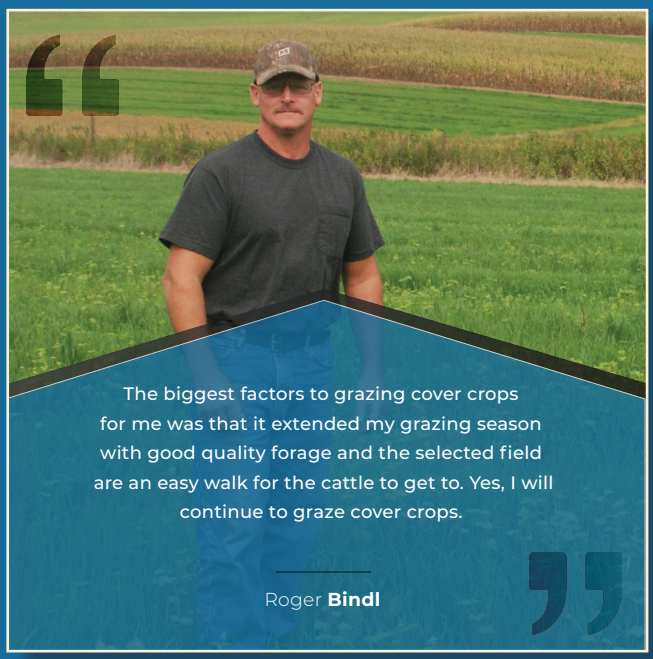


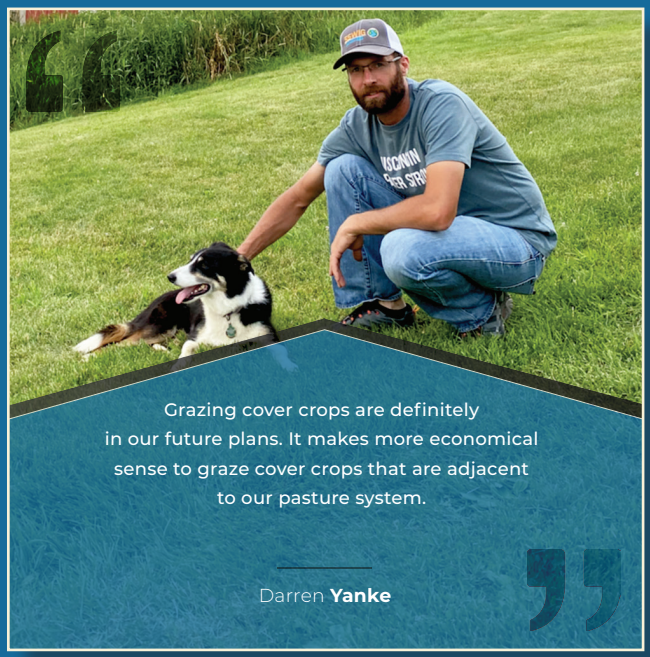
I'm absolutely going to continue with grazing cover crops. We planted 9 more acres of wheat on the farm, so we'll have around 30 acres to graze each year. It's definitely a no-brainer because of the increased feed, soil health, and animal health. Everyone should be doing it if they have cattle. Get them out of the barnyard.

Ron **Schoepp**



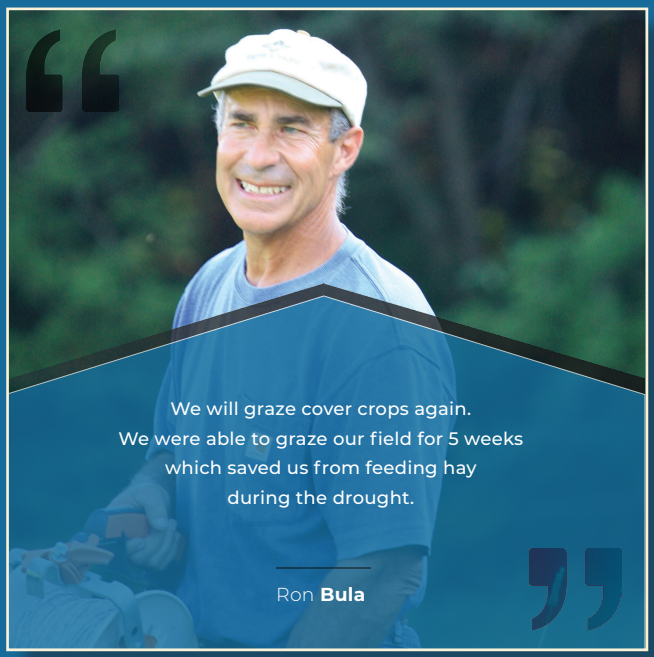
The biggest factors to grazing cover crops for me was that it extended my grazing season with good quality forage and the selected field are an easy walk for the cattle to get to. Yes, I will continue to graze cover crops.

Roger **Bindl**



Grazing cover crops are definitely in our future plans. It makes more economical sense to graze cover crops that are adjacent to our pasture system.

Darren **Yanke**



We will graze cover crops again. We were able to graze our field for 5 weeks which saved us from feeding hay during the drought.

Ron **Bula**

Sand County Foundation inspires and empowers a growing number of land owners and managers to ethically care for the land to sustain water resources, build healthy soil, enhance wildlife habitat, and support outdoor recreation.

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