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Using Management Intensive Grazing of Cover Crops to Add Another Rotational Crop in South Central Idaho

Abstract

Producers are showing a greater interest in cover crops as a forage source for grazing livestock. In a Western SARE project, a producer was looking at the use of cover crops as a forage source for stocker cattle from June – October. To accomplish this, a 148-acre pivot was seeded using a no-till drill with a cool-season mix of forage barley, forage oats, forage peas, common vetch, and purple top turnip the second week of May. To implement management-intensive grazing, 213 heifers of an average weight of 600 lbs were incorporated into the system 40 days after the initial cool season seeding. Forage samples were collected from the pasture before and immediately after grazing. The estimated forage production was 6,020 lbs DM/acre over the growing season. Forage consumption per acre over the season was 2,408 lbs DM/acre. From June-July the forage provided 16.2% crude protein (CP) and 58.6% total digestible nutrients (TDN), meeting the requirements for a 600 lbs yearling gaining 2.5 lbs/day for protein (11.8%), however, it was lacking in TDN (66%). In this project, we saw adequate gains from spayed heifers while maintaining a growing cover crop from June – October.

Introduction

Across the West, the use of cover crops, crops grown for soil cover rather than for being harvested, is growing in acceptance (Myers et al., 2019). When first introduced to the idea of cover crops, many producers are taught the five principles of soil health which are to: (1) protect the soil, (2) minimize soil disturbance, (3) prioritize plant diversity, (4) continuance of live roots in the soil, and (5) introduce livestock (USDA, 2023). As the evolution of cover cropping has progressed, more and more producers are reaching the final principle and are interested in learning how to incorporate livestock into their system. The use of grazing in a cover crop system provides added feed for the livestock, income for the producer, and soil benefits from manure and cover crop incorporation by hooves (USDA, 2023).

In traditional cover crop grazing plans, the cover crop is continuously grazed during either the summer, fall, or winter. Recently producers have shown increased interest in incorporating cover crops specifically for summer grazing into their crop rotations. Like the traditional “cash crop”, producers are interested in planting a spring cover crop that can be grazed throughout the summer months and into the fall. To effectively manage this system for maximum benefit to the producer as well as the cattle, Management Intensive Grazing (MIG) would be incorporated to graze the cover crops to improve soil health and harvest maximum usable forage from the field. In a MIG system, cattle are moved in short rotations, from a few hours to several days before entering a new grazing paddock. Paddocks are sized so that the forage available will meet the nutritional needs of the herd of cattle for the allotted time without being so large that forage is not properly consumed. As cattle rotate through the field the previously grazed areas are rested and cattle enter back into the paddocks after appropriate recovery time. It was theorized that this system would be mutually beneficial in a crop rotation system, as the landowner would generate annual cash income from leasing the cover crops for grazing and gain soil health benefits from cattle grazing and the incorporation of cover crops into the system.

In 2017, a producer from Picabo, ID received a Western SARE Farmer/Rancher grant to investigate if it would be financially beneficial to plant cover crops as a rotational crop and lease the field for grazing. The growing season in the Picabo, ID area is approximately 75 -frost-free days. The climate reduces crop rotation choices to cereals, alfalfa, and orchard grass/smooth brome pasture. The objectives of the study were to utilize MIG as part of the cash-crop rotation to improve the profitability of the farm enterprise by grazing cattle on a multi-species blend of annual plants.

Methods

Field establishment

The study was conducted on a 148-acre pivot irrigated field. The field sits at 4,800 ft elevation, receives 14 inches of annual precipitation, and contains Picabo silt loam and Hapur silt loam with Bickett mucky peat inclusions (USDA, 1991). A multi-species cool-season cover crop mix was planted using a John Deere 1590 no-till drill the second week of May 2017 (Table 1).

Table 1. Cool-season mix established on May 10, 2017.

Variety	Lbs./acre (Planted)
Hayes Forage Barley	30
Forage Oats	14
Common Vetch	4
Purple-top Turnip	1
Forage Peas	12

The cover crop was fertilized using in-row fertilizer and treated with a pre-emergence application of Round-up® (glyphosphate) and Jackhammer® (monocarbamide dihydrogen sulfate, glycerine, alcohol alkoxylate). Fertilizer cost $40/acre and supplied 36 lbs. of N, 15 lbs. of P_20_5, 15 lbs. of K_20 along with 24 lbs. of sulfate/acre. This application was based on soil tests and deficiencies seen in the field historically. The original plan was to double crop the cool-season mix in mid-summer with another

planting of forage wheat, sorghum-sudan, pearl millet, and forage radish, but that turned out to be unnecessary as discussed later in this article.

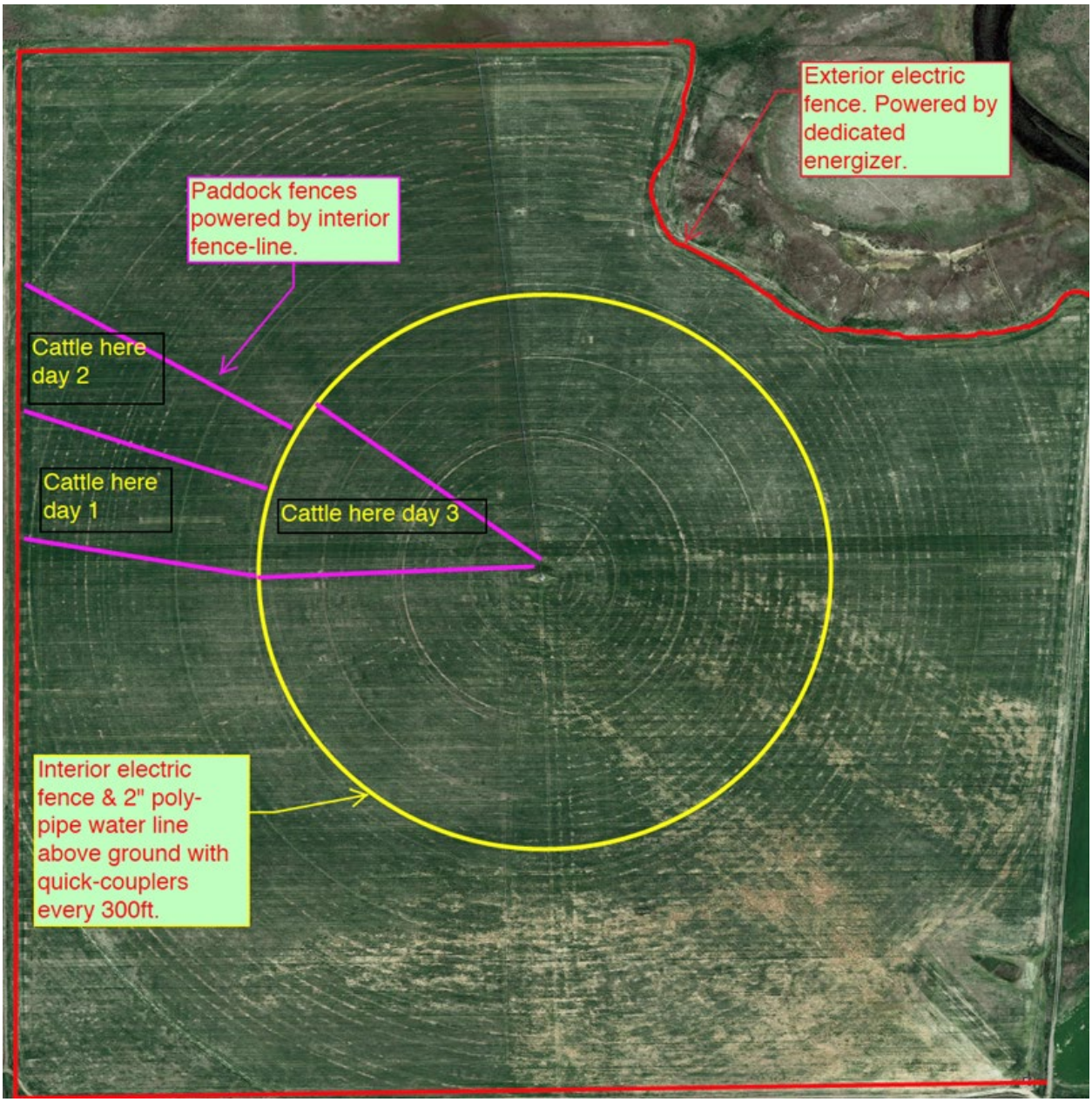

Figure 1. Pivot and paddock map on the field used in 2017.

A paddock system to fit the pivot was designed and installed by an outside consultant (Figure 1). The paddock system was built using the perimeter fence of barbed wire, an interior electric fence (yellow line, Figure 1), and paddock fencing powered from the interior fence line. The fence was a poly-wire electrical fence powered by a dedicated

energizer. The system paddocks, which were from one to three acres in size, allowed for once-a-day moves to facilitate the MIG. Cattle spent two days outside the yellow circle, then moved inside the circle on day three. The fence was raised in the air and cattle went under it. On day four the cattle moved back outside the inner circle for two more days. The cost of the fencing materials and water system is amortized across 5 years (Table 2). Stock water was provided via a water truck that was connected to a 250-gallon tank equipped with a float valve. The intended poly-pipe water line was constructed but was not used all season because of the freezing and thawing of the pipe.

Table 2. Input costs to establish and maintain the field.

Item	Cost	Description
Seed	$5,513	Assume $37/Acre
Fertilizer and Herbicide	$6,854	Assume $40/Acre
Irrigation Power	$7,250	Assume $50/Acre
Daily Labor	$1,650	Assume 1 hr./day
Planting Costs	$2,610	$18/Acre
Depreciation	$1,540	$7,700 water and fence costs, 5-year
Set/Remove Fence and Water	$900	2-days, 3 workers
TOTAL	**$26,317**	Does not include land or overhead

Cattle grazing

Forty days after seeding cattle were placed on the cover crop field on June 22, 2017, the forage at that time was approximately 12-14 inches in height. The herd was comprised of spayed heifers (n = 150) weighing an average of 600 lbs. Another group of like heifers (n = 63) joined the herd on June 28, 2017, for a total herd size of 213 heifers. On August 25, 2017, the heifers were sorted and weighed, 71 were sorted off with an average weight of 805 lbs, and 142 heifers were put back on the field with another 42 heads added. The remainder of the cattle, 188 head, were weighed, and shipped on October 10, 2017. The AUM's consumed by the heifers totaled 708 with an income of $34/AUM. The cattle were moved daily using portable poly wire fences with

the initial goal of grazing one-acre- paddocks. After one week of grazing approximately 1-acre paddocks, the producer saw it was necessary to increase paddock size to six to eight acres to keep up with the maturing forage (Figure 1).

Forage collection

Forage samples were collected from paddocks before and immediately after grazing to determine dry matter yield, nutritive value, and removal rate. One-square-foot sampling square was used to determine the area for yield. The squares were randomly placed three times in each paddock, paddocks varied in size from 3-to 8 acres, and the plant material was clipped to the soil level. The plant material was dried in a drying oven at 100 °F until fully dry to bring the plant material to 100% dry matter for yield calculations. The samples were sent to a commercial lab for analysis of crude protein (CP) and calculation of total digestible nutrients (TDN).

Mid-season mix

On July 1, following the first grazing rotation of the cool-season mix, the producer no-tilled a mid-season mix (Table 3) into 40 acres of the field. The mid-season planting was designed to complement a lagging cool-season species; however, the cool-season species were growing well enough that no additional mid-season mix was planted. The mix that was planted did not compete well with the existing cool season mix.

Table 3. Mid-season mix planted on July 1, 2017.

Variety	Lbs./Acre (Planted)
Forage Wheat	12
Sorghum Sudan	2.5
Millet	2.5
Forage Radish	1

Economics

The expenses for the project included the fertilizer, herbicide, seed, drilling expenses with the no-till drill, fencing and drinking water system (these were both amortized over 5 years), power for the irrigation, labor costs for moving the fence for the MIG and for the construction of the fencing and water system setup. The total cost of the project is referenced in Table 2. The per acre cost of $178 was nearly offset by the income for the project. There was a total of 708 AUM's consumed for $34.00/AUM for a total of $24,072. The per acre income for the project was $163/acre making a loss of $15/acre for the project. These prices and income were the actual income and costs to the producer of the project.

Results

Forage consumption per acre over the season was 2,408 lbs DM/acre, this is a lower-than-expected result due to insufficient stocking rate. The yield estimate is based on 40% of available forage utilized with an average intake of 2.5% body weight (Nutrient requirements of beef cattle (NRC), 2016). To calculate the yield estimate: average weight of grazing animal × number of animals on the field that day ÷ 2.5 %.

From June-July the forage provided 16.2% crude protein (CP) and 58.6% total digestible nutrients (TDN), meeting the protein (11.8%) requirements for a 600 lbs yearling gaining 2.5 lbs/day but failing to meet TDN (66%) (Table 4) (NRC, 2016).

Table 4. Feed value from June to July of grazed cool season cover crop mix.

	Crude Protein, %		TDN, %	
Date	Pre-Grazing	Post- Grazing	Pre-Grazing	Post-Grazing
June 28 – June 29	18.7	16.7	61.2	60
July 12 – July 13	13.7	12.1	56	54

The rapid late spring/early summer growth of the cool-season species, especially the cereal component, out-produced what the cattle could eat. It was estimated an

additional 100 head of 600 lbs stocker animals were needed to effectively use the forage produced.

As the grazing season progressed feed value dropped averaging 9.3% CP and 61.4% TDN (Table 5) in August. The feed was lacking in both CP and TDN for an 800 lbs yearling at 2.5 lb./day gain requiring 9.7% CP and 66% TDN (NRC, 2016) (Table 5).

Table 5. Feed value from August to September of grazed cover crop mix.

	Crude Protein, %		TDN, %	
Date	Pre-Grazing	Post-Grazing	Pre-Grazing	Post-Grazing
August 17 – August 18	9.1	7.8	64	62
August 23 – August 24	9.6	7.4	59	54
August 31 – September 1	9.7	7.2	61.3	57.3
September 11 – September 12	8.9	6.6	57.7	55.4

On August 24, 2017, the cattle were weighed, and 68 head averaging 805 lbs. were shipped. The remaining cattle were put back on the cover crop field with an additional 42 heads for a new total of 184 heads. The final group of cattle was weighed off on October 10, 2017, with an average gain of 2.6 lbs/day for 47 days. The landowner placed his cow-calf pairs on the field to use the remainder of the forage before the snow set in for the winter. A cost-benefit was not calculated for this additional grazing.

Discussion

Forage oats and barley grew quickly and provided early feed. Once grazed, both the oat and barley showed regrowth potential by producing tillers, but the oat was more productive in regrowth. As the days got longer, the barley reached the reproductive stage and started to senescence. Oat headed out but continued to produce new tillers. Oat and barley also dropped seed and growth from seeds dropped continued into the fall, providing additional forage for grazing into September and October. There was

some concern about seed carrying over into the next season's barley crop, but it was not an issue between winter kill and herbicide applications before planting the next spring.

Peas were able to regrow after being grazed early and provided high-quality feed in the early season. Peas were available early, while the vetch, a perennial legume, did not have any prominence in the sward until later in the year when the canopy of the grains was decreased. Turnips grew quickly providing greens and tubers which were excellent feed, especially as the cattle learned to eat them. Cover crop growth and response to grazing indicated the mid-season mix was not needed, as the mix was not able to compete with the regrowth from the cool season species to significantly contribute to forage dry matter (Figure 2).

Figure 2. Arrows indicate the warm-season species, which were outcompeted by the existing cool-season species. Pictures were taken on August 23, 2017, approximately 45 days after no-till seeding.

The feed value of the cover crops in this study met the needs of the class of cattle grazing them. In a cover crop trial conducted in three locations in Utah, similar CP results were seen in cover crop mixes grown in Cache and Sanpete County (Zesiger et al., 2022). In the Utah trials cover crop mixes containing a mix of grass, legume, and forbs that were sampled 45 days after planting had CP values varying from 6.7% to

24.9%. This is comparable to the CP values that were seen in our June-July samples. Also, Zesiger et al.'s cover crop samples from 81 days after planting dropped to CP values of 15.2% to 8.1% like the drop in CP that was seen in our August-September samples (Table 5).

More than 213 heifers were needed to effectively graze the 148-acre cover crop field using MIG. An estimated 60% of available forage was lost. A minimum of 300 higher-class cattle, for example, steers would have been ideal to utilize the abundant forage from cover crop growth. Where grazing was managed intensively, cattle were able to graze 4 times in the season (Figure 3). The results from this study indicate that starting with a large herd of cattle to consume the quickly growing forage is ideal, and as forage growth slows later in the season, reduce cattle by selling those that are heavier and returning the lighter animals to the pasture. Because of the smaller herd available, many of the cover crops went reproductive during the growing season, however, the cattle continued to graze them, and the cover crops continued to produce as the season progressed (Figure 2).

Figure 3. Heifers grazing later season growth.

Although this first year resulted in a loss of $3,380, the producer was confident that this system could be profitable. Economic loss is attributed to a low stocking rate and a

class of cattle and implementing the MIG a week late, resulting in significant forage loss. The $1,200 warm-season cover crop blend did not provide an economic benefit in total forage production. The cattle owner benefited from this system. After grazing the cover crop the heifers were finished in a feedlot on a finishing ration, when slaughtered this cover crop group of cattle graded above expectations.

Many questions arose about the significant regrowth of the spring-planted winter cereal varieties. The cereals planted responded to grazing like grass species regrowing up to three times before the end of the season. To answer questions and form better recommendations on the use of cereals in a cover crop mix, a replicated study on simulated grazing and regrowth of annual cereal forage cover crops is being conducted.

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