Saving Water and Improving Soil Health Through Low Elevation Sprinkler Application (LESA), Cover Crops, No-Till and Management Intensive Grazing (MIG)

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Objectives

Utilize Management Intensive Grazing (MIG) on a multi-species blend of annual cover crops as part of a cash crop rotation

Project Goals:

- Improve soil health by building organic matter and biodiversity
- Reduce water inputs
- Reduce commercial fertilizer inputs
- Reduce soil erosion by eliminating bare soil
- Improve wildlife habitat by eliminating winter fallow

Methods

Figure 1. Reduced irrigation drift on right under LESA (low elevation sprinkler application; heads spaced 10 ft. apart, 12-15 in. above the ground) compared to conventional sprinkler heads on left (heads spaced 10 ft. apart, 5 ft. above the ground).

To monitor water savings with LESA, soil samples at 6 in. depth increments to a maximum depth of 42 in. were taken 5/11 and 11/9/17 at the same 4 locations under both the LESA and adjacent control spans. Samples were weighed and oven dried to determine change in water content in the top 3 ft. During the retrofit, the water discharge from each pivot pipe outlet (one original drop on 10-foot spacing) was cut in half for each of 2 LESA drops. Therefore, the water leaving the pivot remained the same before and after conversion.

A 148-acre field of barley stubble was seeded with a cool-season annual cover crop blend (Table 1) using a no-till drill on 5/11 and 5/15/17.

Cool Season Blend	Lbs. / Acre
Hayes Forage Barley	30
Forage Oats	14
Forage Peas	12
Common Vetch	4
Purple-top Turnip	1

To implement MIG, 213 heifers (avg. wgt 600 lbs.) were incorporated into the system 40 days after the cool season seeding. Using solar powered electrical fencing, the producer moved the herd daily with the initial goal of 1 acre size paddocks. A week in, the producer was forced to increase paddock size to 6-8 acres in order to keep up with the maturing forage. The larger paddock size moved the cattle across the field quicker with the goal of grazing the tops of the barley and oats to prevent heading. The LESA pivot was always three days ahead of the cattle.

Following the first grazing, a warm season mix of 15 lbs/acre sorgum Sudan grass, 5 lbs/acre millet, and 1 lb/acre forage radish were no-tilled into the grazed paddocks starting 7/1/17 with the intent to add additional late summer forage and to provide high-quality fall grazing. Total forage consumed values were estimated based on available cattle, with an average 2.5% body weight consumption rate. The team used technical observations of cover crop growth and grazing to monitor cover crop performance and grazing behavior.

Results and Discussion

LESA

The LESA span delivered 3.1 inches of additional water into the soil over the course of the season relative to the original equipment based on an average of data from three locations around the pivot. The 4th location was flooded for waterfowl before we took the final samples. Some water movement was detected as deep as 32 inches under the LESA and only to about 12 inches under the Control (Figure 2).

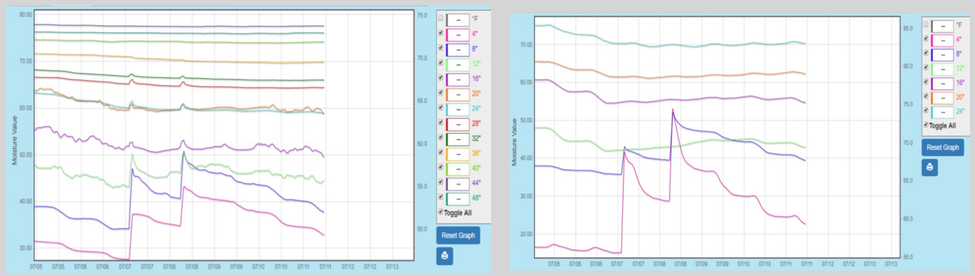

Figure 2. Soil moisture data measured at varying soil depths during hot and dry period (7/01-7/13/17) under LESA (left) compared to the control (right). Soil moisture under LESA was detected down to 32' as compared to only 12' under the control.

Cover Crop Performance and Grazing Response

Where grazing was managed appropriately, the cattle were able to graze four times throughout the season. However, with not enough cattle and implementing the MIG a week late, significant forage was lost throughout the season. For example, in order to keep up with the forage, a total of 40 acres was skipped mid-season, resulting in only two grazing cycles for this portion of the field. Producer notes the importance of implementing MIG a week before the forage is ready, when there is significant ground to cover. Total forage consumed per acre over the season was 2,408 lbs. This is a low estimate due to not enough cattle to effectively consume all the available forage. The cattle were estimated to have consumed a mere 40% of what was available. Thus, researchers estimate 6,020 lbs of forage per acre was produced by the cover crops over the growing season (Figure 3 & 4).

The cool-season mix (table 1) performed well for the area and purpose. Early season growth was dominated by oats, peas, and barley, which reached reproductive stage late June, resulting in reduced forage quality (Figure 5). Moving forward, the producer will seek late maturing or winter varieties to delay forage maturation to better manage forage quality over the season. The cereal varieties responded well to grazing, with oats providing the most regrowth with new tillers longer into the growing season compared to barley. Seed drop from oats and barley provided continued forage into Sep/Oct. The purple-top turnip performed well throughout the growing season and was favored by cattle. Vetch growth was most significant late season. The warm-season mix was not able to compete with the regrowth from the cool season species to significantly contribute to the forage dry matter.

Figure 3. Pre-grazed cool-season mix was dominated by oats, barley, and peas. Left of electrical fencing was first graze on June 22, next to ungrazed paddock for following day consumption. First grazing should have been implemented a week earlier to get ahead of maturing forage.

Figure 4. The 213 heifers proved to be not enough cattle to graze the rapidly maturing forage, resulted in an estimated loss of 60% of available forage and one additional grazing cycle. A producer utilizing this system would want to maximize available cattle for the full economic benefit.

Economics

Although, this first year resulted in a loss of $3,380, the producer is confident that this system can be profitable. The producer attributes the economic loss to a lower number and class of cattle on the field, and implementing the MIG a week late, resulting in significant forage loss. In addition, the $1,200 for the warm-season cover crop blend did not provide an economic benefit in total forage production. The cover crop blends did not exceed $30/acre. However, the cattleman benefited from this system, with cattle grading above expectations (85% of herd ranked choice or above choice beef and 15% ranked prime beef).

Year 1 Conclusions

- 213 heifers were not enough cattle to graze the 148-acre cover crop MIG system, thus an estimated 60% of available forage was lost. A minimum of 300 higher class cattle would have been ideal to more effectively utilize the abundant forage from cover crop growth. However, producer can expect gains in soil health from the ungrazed forage (Figure 5).
- Where grazing was managed correctly, cattle were able to graze 4 times in the season.
- The mid-season warm-season cover crop planting could not compete with the existing cover crop mix and was found to be not profitable.
- A loss of $3,380 was estimated in year one. However, the producer is confident that this system can be profitable by eliminating the mid-season planting and using the proper number of cattle.
- Research team hosted a field tour, resulting in 100% of surveyed producers and professionals likely to use one or more aspects of the project in the next year.

Figure 5. Residue breakdown Oct 31 (left), residue after 30 days (middle), and organic matter layer forming (right); evidence of microbial activity, good soil armor, and soil health benefits from the cover crop and MIG system.

Year 2

- Producer will no-till back into barley, spring 2018, with the hopes of reducing fertilizer inputs while maintaining yields.
- Team will conduct fertilizer reduction trial to monitor yields under replicated plots of 100% recommended fertilizer rate compared to reduced rates of 66%, 33%, and no commercial fertilizer.
- With continued outreach in year-2, this producer led project will help other farmers adopt one or all of these practices, while maintaining yields and promoting a sustainable farming system.

References

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