NORTH DAKOTA– Grazing Management Practices to Enhance Soil Health in Northern Great Plains

Erin Gaugler, Miranda Meehan, Kevin Sedivec, North Dakota State University

A 3-year project was initiated during the spring of 2020, to identify the impacts of livestock grazing management on the environmental and economic sustainability of an integrated crop and livestock system. This project is evaluating the influence of stock density and forage utilization on soil physical and chemical properties, crop production, livestock production, and economics.

North Dakota State University (NDSU) Extension partnered with farmers to establish 6 demonstration sites in central ND, along with a host site on the main NDSU campus. An annual forage crop was subjected to 2 grazing density treatments, moderate and high. Two forage utilization rates were also evaluated, 50% and 75%. A non-grazed treatment is the control. Treatments will be imposed for 2 years, followed by a cash crop. The annual forage crop planted by mid-June of 2020 and 2021 included oats, sorghum-sudangrass, foxtail millet, sunflower, radish, kale, turnip, flax, and forage pea seed seeded at a rate of 18, 3, 2, 1.5, 1, 0.75, 0.75, 2, and 10 lbs/ac, respectively. The third year, corn will be planted.

Cattle were randomly assigned to grazing density treatments and carrying capacities were determined based on available forage production and estimated utilization. Stocking rates were determined based on available forage and anticipated DM intake per day. Available forage for 50% and 75% utilization treatments was calculated at 35% and 50% of the total forage produced, respectively. Moderate stock density was based on the recommended stocking rate for a 30-day period. High stock density was set at double the moderate stock density and the grazing period reduced so as to ensure the treatment was not overgrazed. Soil samples were collected to characterize physical, chemical, and biological properties. Soil physical properties were collected pre- and post-treatment: bulk density, infiltration, and soil aggregate stability. Soil chemical properties were collected annually with assessment of nutrient distribution occurring pre- and post-treatment only: soil nutrients, pH, and organic matter.

In year one, growing-season conditions (Table 1) and field preparation appeared to impact germination of annual forage species and production (Table 2). Production varied greatly between sites, ranging 3,914-14,437 lbs/ac. Stocking rates were adjusted for locations with a significant amount of weed competition as forage utilization was likely reduced. It was also noted that seeding depth impacted germination of brassica species with any location that seeded the annual to a depth >¾" experiencing little to no germination. Grazing start dates ranged late August to early October 2020. An early September frost slowed down or halted plant growth, impacting forage quality.

Table 1. Average monthly precipitation levels and seasonal totals (inches) by month at each project location during the 2020 growing season.

Location	Rainfall (inches)	Month						Seasonal Total
		May	Jun	Jul	Aug	Sept	Oct	
Fargo[1]	Total	1.5	2.6	5.3	4.8	0.9	0.9	16.0
	Normal Total	2.8	3.9	2.8	2.6	2.6	2.2	16.9
Jamestown[1]	Total	2.2	0.4	3.5	2.4	0.2	0.4	9.1
	Normal Total	2.7	3.5	3.3	2.1	2.3	1.7	15.6
McKenzie[1]	Total	0.7	0.9	3.5	0.7	0.5	0.5	6.8
	Normal Total	2.4	3.2	2.9	2.3	1.6	1.3	13.7
Napoleon[2]	Total	2.0	1.5	2.8	2.0	0.7	0.5	9.5
	Normal Total	2.8	3.5	3.0	2.2	1.7	1.6	14.8
Lehr[1]	Total	1.7	1.6	3.1	2.9	0.7	0.2	10.2
	Normal Total	2.6	3.0	2.7	2.0	1.3	1.6	13.2
McClusky[2]	Total	1.0	2.0	2.4	3.8	0.2	0.4	9.8
	Normal Total	2.4	3.2	2.6	2.1	1.6	1.4	13.3
Tappen[1]	Total	1.5	2.4	2.3	4.0	0.3	0.2	10.7
	Normal Total	2.6	3.2	3.2	2.2	2.0	1.5	14.7

[1]Data obtained from the North Dakota Agricultural Weather Network (2020) from or near specific locations.
[2]Data obtained from National Weather Service (2020).

Cattle grazing the multi-species cover crop near McKenzie, ND.

Table 2. Average forage production (lbs/ac), carrying capacity (AUMs/ac), number of grazing days and degree of use (%) by grazing treatment and location during 2020.

Location	Treatment		Peak Production (lbs/ac)	Carrying Capacity (AUMs/ac)	Degree of Use (%)
	Stock Density	Grazing Utilization (%)			
Fargo	High	50	4,892	1.40	38
		75	5,671	2.32	58
	Moderate	50	6,940	1.99	63
		75[1]	6,249	2.56	64
	Control	0	3,914		
Jamestown[1]	High	50	7,181	2.06	44
		75	6,490	2.66	52
	Control	0	6,548		
McKenzie	High	50	9,333	2.68	53
		75	7,714	3.16	68
	Control	0	8,079		
Napoleon[2]	High	50	5,593	0.72	52
		75	4,917	0.91	66
	Control	0	4,669		
Lehr	Moderate	50	12,725	3.65	51
		75	11,017	4.52	55
	Control	0	14,437		
McClusky[3]	Moderate	50	7,164	2.06	34
		75[4]	6,893	0.99	40
	Control	0	6,375		
Tappen[5]	Moderate	50	10,536	3.02	39
		75	8,782	3.60	56
	Control	0	6,444		

[1]Livestock pulled early due to inclement weather and limited feed.
[2]Forage production consisted of 50-60% weeds. Stocking rate was adjusted accordingly.
[3]Livestock pulled early due to inclement weather.
[4]Forage production consisted of 65% weeds. Stocking rate was adjusted accordingly.
[5]Livestock pulled early due to issues with water. Degree of use is based on the first two sections within each treatment.