Livestock Integration

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Why Livestock are Integrated at Dakota Lakes

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Livestock play a vital role in harvesting cover crops and perennial forages used in crop rotations. Livestock grazing generates short-term economic returns while forages provide long-term soil benefits. Grazing crops in the field, rather than removing grain and hay, ensures that organic matter and mineral nutrients remain in place and are returned to the soil.

Perennials offer additional advantages. Their deep root systems stay active deeper in the soil and for a longer portion of the growing season compared to annuals. These roots transport nutrients from deeper layers back to the surface, making them accessible to subsequent crops. In areas with high water tables, perennials also help reduce salinity by drawing down excess water and mitigating saline seeps. When cattle graze cropland and consume supplemental feed such as soybean meal and grain, most of the nutrients and organic matter from those inputs remain on the land, contributing to soil fertility.

May 15, 2023. Dakota Lakes has been utilizing targeted grazing on this land near the Missouri River for the past 5 years. The pasture is grazed intensively in May to hurt the crested wheatgrass and smooth brome. The property contains many native warm-season tallgrasses.

September 2023

On April 3, 2023, ultrasound scanning was conducted on nine Dakota Lakes steers to assess carcass characteristics. Data indicated that three steers (33%) exhibited sufficient marbling to grade as Choice, while the remaining steers graded as High Select. The steers averaged 566 days of age at the time of ultrasounding. Among the High Select group, the five steers with the highest marbling had an average score of 3.88, suggesting potential for reaching Choice grade prior to scheduled butchering in mid-April and early May.

Mean Carcass Data of Nine Dakota Lakes Steers (April 3, 2023)

Weight (lb)	Age (days)	Ribeye Area (REA)	REA/ CWT	Ribeye Shape	Intra-muscular Fat	Backfat (in)	Tenderness (kg)
1248	566	12.62	1.02	0.45	4.07	0.22	2.6

Six steers with the highest fat content were selected for direct marketing and butchering. As in previous years, carcasses were aged for 14 days before one 2.5”-thick striploin from each steer was analyzed for tenderness (Warner-Bratzler shear force) and its fatty acid profile. The average shear force was 3.7 kg, maintaining a three-year trend of “tender” classification, though not “very tender.” Shear force values ranged from 2.8 to 4.5 kg. Longer aging could further improve tenderness.

Fatty acid analysis showed an average omega-6 to omega-3 ratio of 2.6:1 (range: 2.2–2.9), aligning closely with desirable ratios found in grassfed beef (typically 1.5:1 to 3.5:1) and contrasting sharply with ratios found in grainfed beef (~9:1). These results were consistent with 2021 data. In contrast, omega-3 fatty acids were undetected in 2022, attributed in part to insufficient sensitivity of the laboratory methods used that year.

To streamline operations in response to limited labor and infrastructure, the herd management strategy at Dakota Lakes shifted toward annual acquisition of stocker cattle rather than maintaining a cow-calf operation. The cow herd was sold on June 8, 2023, while yearling calves were retained. Heifers were sold on December 7, and the steers are scheduled for butchering on February 7, 2024. Carcass quality data will be collected on these animals.

Targeted grazing was used in May to manage exotic grasses on the Corps land and the Shields pasture. In the Shields pasture, some paddocks received targeted grazing from May 15 to 22 as part of a replicated experiment. Then, all paddocks were grazed from June 26 to July 10.

May 20, 2023. This paddock was intensively grazed in mid-May. The cool season grasses have been grazed short. The residue from last year’s big bluestem and switchgrass remains clearly visible.

July 3, 2023. Cows were released to graze a rehabilitated pasture. This paddock was previously grazed intensively on May 18-19 to control exotic cool-season grasses.

A field ("Jobyna") seeded with pearl millet (22 lb./ac.), Navajo BMR pearl millet (4 lb./ac.), and teff (4 lb./ac.) was grazed from August 8 to September 13. On September 14, cattle were moved to a cover crop mix (6 lb./ac. oats, 13 lb/ac barley, 5.5 lb./ac. triticale, 25.5 lb./ac. German millet), which had been planted after wheat harvest.

The field also contained abundant volunteer winter wheat. This was field "North" at the North Unit, with Promise clay soils. There were noticeable tracks from where the combine passed. Vegetation in the wheel tracks (~33% of the area) was noticeably shorter than between wheel tracks (~67% of the area).

Aug 30, 2023. Fenceline contrast. The area on the left was grazed in May and July. The area on the right was not grazed. The crested wheatgrass in the non-grazed area has senesced and produced abundant seed heads.

Aug. 14, 2023. Cattle are strip grazing a full season cover crop of pearl millet. Teff was also seeded but did not establish. A grazing exclosure can be seen in the top-right corner of the photo.

Forage samples collected on September 14 showed biomass averages of 352 lb./ac. within tracks and 1306 lb./ac. between tracks. Crude protein was 21% within tracks and 20% between tracks, while total digestible nutrients (TDN) were 69% and 68%, respectively. Thus, the tracks had a large impact on biomass but little if any impact on nutritional quality.

Sep. 27, 2023. Steers are grazing a cool season grass cover crop at the North Unit, on heavy clay Promise soils.

Impacts on Cropland

Infiltration testing was conducted on May 23 and 25, 2023, in two fields. In field 0-7, winter wheat was harvested in July 2022 and a cover crop immediately planted. The cover crop was swathed in September and grazed over winter. Four long-term grazing exclosures were maintained in this field and there was abundant residue in both exclosure (a.k.a., "cage") and grazed areas. Infiltration rates were measured inside and outside the exclosures. Although some outliers increased the mean in grazed areas, no statistically significant difference ($p = 0.5$) was found between grazed and caged plots; both averaged an infiltration rate of 0.33 inches per minute.

Bulk density at 0–3" depth, measured June 12, was slightly higher in the caged areas (1.29 g/cm³) compared to grazed areas (1.23 g/cm³), though neither value indicated compaction that would inhibit root growth. Averaging Cage and Grazed areas together, soil at 0-3" was less dense (1.26 g/cm³) than soil at 3-6" (1.48 g/cm³).

In the same field, a chemical analysis was conducted on soil samples collected to 36" on June 7, 2023. Samples were split by depth (0-6", 6-12", 12-24", 24-36"). The results revealed statistically significant ($p < 0.05$) differences in pH, Ca, Na, and cation exchange capacity between grazed and caged plots. However, these differences were relatively small and have not been consistent over the years. There were no statistical differences in organic matter, Olsen P, K, S, Zn, Fe, Mn, Cu, Mg, cation saturation percentages, nitrate, ammonium, or soil respiration.

May 23, 2023. The underside of an infiltration ring. The soil is evenly wet and multiple nightcrawler channels are visible at 3" below the soil surface.

In field 1-3, corn residue was grazed over winter. A heavily trafficked alley on the northern ~30 feet, used as an alley to allow cows to walk to water, showed reduced residue. Infiltration rates (0.20 inches per second) measured in both the alley and adjacent non-alley areas (~25 feet to the south) showed no significant difference ($p = 0.9$).

On June 15, 2023, stand counts were taken in fields 0-7 and 2-3. Both had grown cover crops post-wheat harvest in July 2022, which were later swathed and grazed. In field 0-7, no statistical difference ($p = 0.60$) in stand counts was found between grazed and non-grazed areas, with an average of 14 plants per 10 linear feet. Row spacing was 20 inches. In field 2-3, hay bales were processed and fed on the north half following swath grazing. Residue was heavy on both the north and south sides of the field because the cattle did not eat all of the swaths. The north side appeared to have more residue between swaths because of feeding hay. Stand count analysis showed a difference ($p = 0.04$) between the north (1.1 plants/foot) and south (1.3 plants/ foot). Additionally, sampling above swath residue and between swaths revealed a statistically significant difference ($p < 0.01$), with 1.1 plants/foot above swaths and 1.3 plants/foot in interspaces.

June 6, 2023. This corn field (Field 2-3) was swath grazed during the previous winter. The location of the swaths is clearly visible because of additional residue and a reduced corn population. Swath grazing in previous years did not leave as much residue and did not affect corn stand density.

Despite the reduction in stand counts where some (but not all) of the cover crop swaths had been, the field yielded 223-227 bushels of corn per acre when harvested with a combine. This was the second highest yield on the farm, as it should have been, because it is in a good rotation, including a high percentage of grass crops (75% grass; i.e., corn and wheat) and a two year break before the corn was grown. The full rotation is: corn-corn-soybean-wheat, plus a rotation into a perennial for 4 out of every 12 years.

Small plot measurements in field 2-3 indicated no statistically significant differences in measured variables between swath and interswath areas. However, variability was greater on swaths than between swaths. This is probably because, where swath residue was heaviest, corn populations were suppressed. But, where swath residue was light enough to allow a full corn stand, the residue was not detrimental and may have been beneficial by cooling the soil, stimulating soil microbial activity, provisioning nutrients, and conserving moisture.

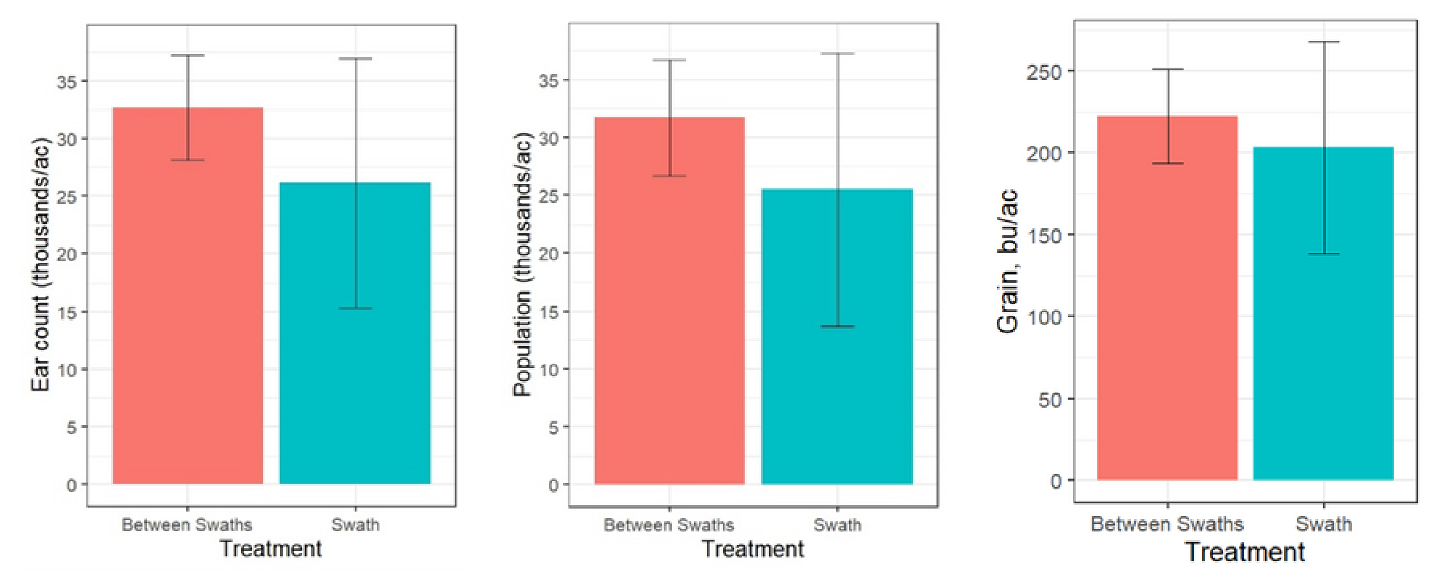

Figure. Corn ear count, population, and grain yield of a corn field that was swath-grazed during the previous winter. All data were collected from small plots. There were no statistical differences for any variables between areas where the swaths were lying ("Swath") or the interspaces ("Between Swaths"). However, variability was greater on Swaths, as indicated by the black bars.

Soil bulk density measurements were taken in field “Jobyna” on September 12, where the millet forage crop had been grazed during late summer. Results revealed higher density in grazed areas (1.11 g/cm^3) compared to grazing exclosures (0.98 g/cm^3) at 0–3” depth. No significant differences were observed at 3–6” depth (1.36 g/cm^3 across treatments).

Aerial views of the same corn field (Field 2-3) in the previous photo. The swaths appear as vertical brown lines in the photo on the left (June 6) because of the lower corn population and higher residue. Also, hay was fed on the northern half of the field, resulting in more residue. In the photo on the right (July 21), swath locations are still visible on the ends of the field, where a 102-day corn was planted -- but now the swath locations appear darker green than the corn between swaths because the corn between swaths has already tasseled. The center of the field was planted to a 108-day corn, which had not yet reached tasseling, so the swath location is indistinguishable. The four bold vertical lines are the irrigator wheel tracks.

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