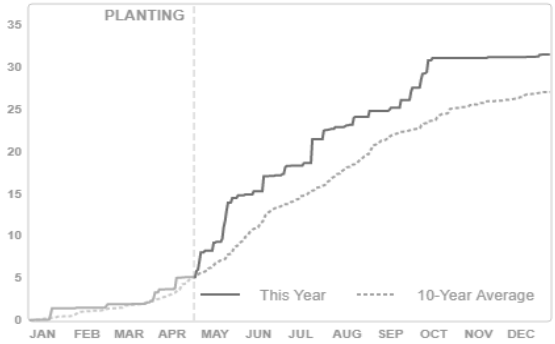
Effects of Grazing Cover Crops in a Three-year Non-Irrigated Rotation

Study ID: 720129201701
County: Nuckolls
Soil Type: Hastings silt loam 0-1% slope
Planting Date: 5/15/17
Harvest Date: 10/25/17
Population: 25,000
Row Spacing (in): 30
Hybrid: Pioneer 1151
Reps: 4
Previous Crop: Wheat
Tillage: No-Till
Herbicides: ***Pre:*** 24 oz/ac Glyphosate and 8 oz/ac 2,4-D and 5 oz/ac Balance® Flex and 1.3 lb/ac Atrazine ***Post:*** 32 oz/ac Glyphosate and 2.5 oz/ac Status®

Fertilizer: 15 ton/ac manure after wheat harvest, 160 lb/ac actual N Anhydrous Ammonia and 6 gal/ac 10-34-0 starter
Irrigation: None
Rainfall (in):



Introduction: In rainfed systems with limited precipitation, adding cover crops into the rotation can decrease yields, but the use of these cover crops for forage may offset the costs while retaining soil benefits. This study evaluated four treatments: grazed cover crop, ungrazed cover crop, ungrazed wheat stubble, and grazed wheat stubble. The cover crop treatments were planted on August 14 following wheat harvest and consisted of a mix of winter peas, spring triticale, oats, collards, and purple top turnip. Grazed treatments were grazed in the fall of 2016. Corn was planted in 2017 across all treatments.

Cover crop biomass was measured in the fall. Baseline soil samples were taken in April, prior to planting corn. Soil moisture was recorded from August 2016 through corn harvest in 2017 with Watermark soil moisture sensors. Soil moisture status from from March through July 2017 (pre-corn planting and first few months of corn growth) is presented in Figures 1 and 2. Corn stand counts, stalk lodging, yield, grain moisture and marginal net return were collected.

Results:

Table 1. Cover crop composition (% of biomass on DM basis).

Grass	53.5%
Winter Pea	1.5%
Collards	8.7%
Turnip Tops	20.9%
Turnip Bottoms	14.5%
Other	0.9%

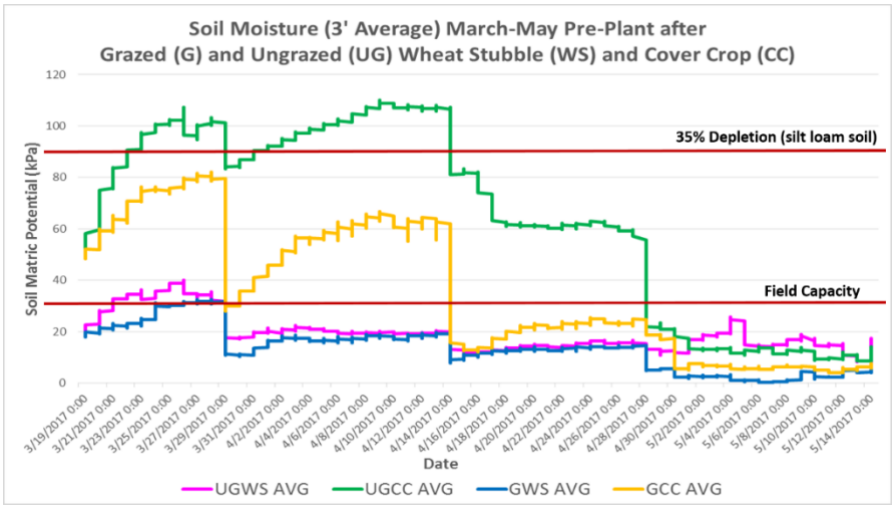


Figure 1. Soil moisture data for three feet depth from March through May 2017 for the four treatments. UGWS = ungrazed wheat stubble, UGCC = ungrazed cover crop, GWS = grazed wheat stubble, and GCC = grazed cover crop.

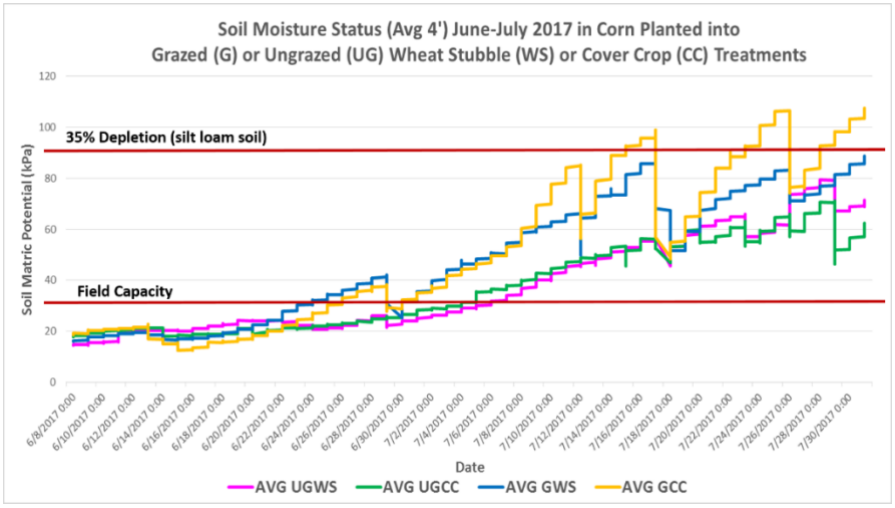


Figure 2. Soil moisture data for four feet depth from June through July 2017 for the four treatments. UGWS = ungrazed wheat stubble, UGCC = ungrazed cover crop, GWS = grazed wheat stubble, and GCC = grazed cover crop.

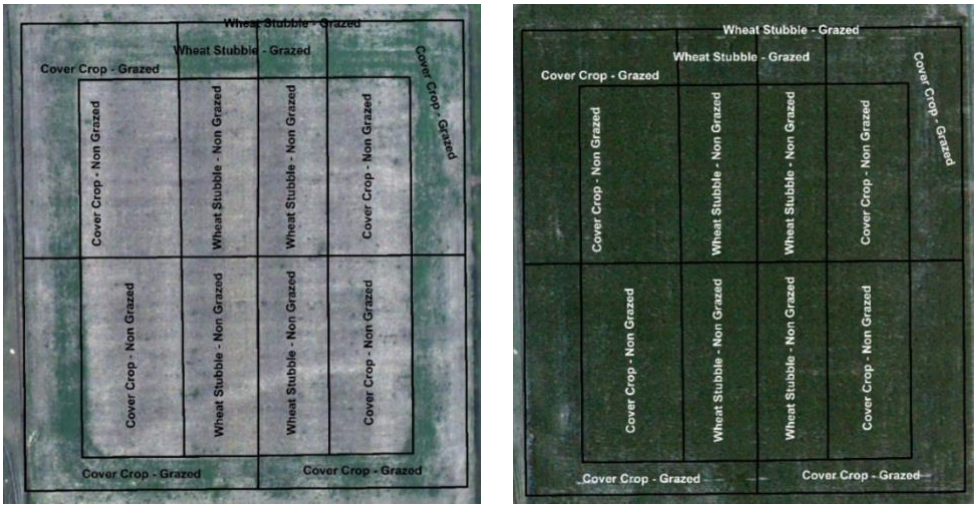


Figure 3. True color imagery from June 20 (left) and July 16 (right).

Table 2. Soil analysis taken prior to corn planting in April.

	Soil pH	OM %	0 to 8 inches Nitrate-N ppm	Nitrogen lb N/A
Cover Crop – Non Grazed	5.52 A	3.1 A	5.4 B	9.3 B
Cover Crop – Grazed	5.68 A	3.1 A	7.3 B	12.6 B
Wheat Stubble – Non Grazed	5.40 A	3.1 A	12.9 A	24.5 A
P-value	0.38	0.90	0.01	<0.01

	Solvita CO2-C (ppm)	0 to 4 inches Total Biomass (ng/g)	Total Bacteria Biomass (ng/g)	Total Fungi Biomass (ng/g)	Diversity Index
Cover Crop – Non Grazed	133	4,225 A	2,187	351	1.44
Cover Crop – Grazed	161	3,927 AB	2,142	333	1.44
Wheat Stubble – Non Grazed	128	3,046 B	1,605	306	1.5
P-value	0.19	0.09	0.12	0.90	0.90

Table 3. Lodging, moisture, test weight, harvest stand count, yield, and marginal net return.

	Corn Stalk Lodging (%)	Corn Moisture (%)	Corn Test Weight	Corn Stand Count at Harvest	Corn Yield (bu/acre)†
Cover Crop - Non Grazed	5 A*	15.0 A	61 A	22,500 A	213 A
Cover Crop - Grazed	8 A	14.9 A	61 A	22,167 A	211 A
Wheat Stubble - Non Grazed	5 A	15.2 A	61 A	22,500 A	218 A
Wheat Stubble - Grazed‡	18	14.6	62	23,750	212
P-Value	0.626	0.129	0.267	0.952	0.141

*Values with the same letter are not significantly different at a 90% confidence level.

†Bushels per acre corrected to 15.5% moisture.

‡Wheat Stubble – Grazed treatment is not included in statistical analysis due to only having 2 replications and cows congregating in this area.

Summary:

Cover crop biomass measured on October 19 was 3,401 lb/ac and consisted mainly of grass and turnip. Starting in early November, 28 (1,100 lb) first-calf heifers grazed 9.6 acres for 22 days resulting in the cover crop carrying 2.4 animal unit month (AUM)/ac. Post-grazing 2177 lb/ac of biomass was still present.

During March through May, prior to planting corn, the cover crop treatments were around 35% depletion (the typical trigger point for irrigation on these soil types) while the wheat stubble treatments remained near field capacity (full soil moisture profile) *(Figure 1)*. In May, 8 inches of rain recharged the soil profile, and all treatments had a full 4 feet soil moisture profile at the beginning of June *(Figure 2)*; therefore, the cover crop treatments did not result in lower beginning moisture which could limit yield potential. The grazed treatments began to show greater soil moisture depletion than the ungrazed treatments as time progressed. The soil moisture status at harvest is not available at this time.

Aerial imagery was obtained throughout the growing season *(Figure 3).* On the June 20 imagery, green vegetation is observed in the grazed treatments and along the border of the non-grazed treatments. Ground observation showed that the green vegetation was palmer amaranth which was concentrated where the cattle created trails walking the electric fence and where they lay in the grazed wheat stubble.

No significant yield differences occurred among treatments. Corn yield where the cover crop was planted and not grazed (213 bu/ac) did not differ from where it was grazed (211 bu/ac). There were only two replications of the grazed wheat stubble treatment and cows tended to congregate in these areas; therefore, this data was not included in the statistical analysis. Means for this treatment are presented in *Table 3*.

Costs for the non-grazed cover crop treatments were $46.64/ac ($28.64/ac for seed and $18/ac for drilling). Costs for the grazed cover crop treatments were $61.94/ac ($46.64/ac for the cover crop seed and planting, $5/ac for fencing, and $10.30/ac for water). Water cost was calculated assuming hauling water (1,000 gal) 15 miles every two days at $2 per loaded mile and $6 per 1,000 gal. Costs for the grazed cover crop treatments equaled $30.97/AUM. Value of the forage is estimated to be $84.80/ac (based on rental rates of $53/pair/month (1.25 AUM) or $42.40/AUM).

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