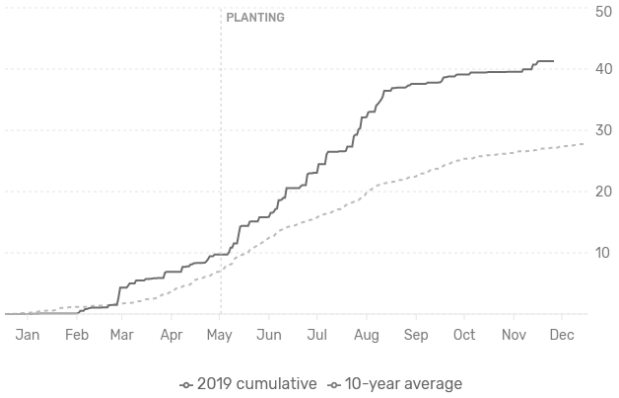
Impact of Manure and Cedar Mulch on Crop Production and Soil Properties

Study ID: 0925093201901
County: Howard
Soil Type: Hord silt loam 0-1% slope
Planting Date: 5/16/19
Harvest Date: 10/26/19
Seeding Rate: 32,000
Row Spacing (in): 30
Variety: DEKALB® DKC62-98RIB
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1.8 qt/ac Bicep II Magnum® ***Post:*** 16 oz/ac DiFlexx®
Seed Treatment: None

Foliar Insecticides and Fungicides: None
Irrigation: Pivot, Total: 1.32" (0.33" 4 times)
Rainfall (in):



Introduction: In regions of intensive livestock production, such as Nebraska, significant amounts of livestock manure are produced and, at times, underutilized. Manure can be a reliable source of nutrients for crops and it can also positively impact soil health when applied responsibly. Additionally, in Nebraska, populations of eastern redcedar trees (*Juniperus virginiana* L.) have multiplied substantially and are now an invasive species with negative ecological and economic impacts. Identifying alternatives for cedar trees management and utilization has become a priority for multiple agencies in the state. Thus, the goal of this research project was to document the effects of land-applied manure and cedar mulch on agronomic and soil health variables.

On-farm research plots were established near Saint Paul, NE, using a randomized complete block design with four replications, to test four treatments: (1) commercial fertilizer (control/check), (2) manure with cedar woodchips, (3) manure, and (4) cedar woodchips. Plots measured 350-feet in length and 40-feet in width to accommodate equipment size, and corn was planted. This is the first year of a 2-year study.

Treatments and Nutrients Applied:

Check: No amendments were applied. To compensate the P and N received by the plots where manure was applied, this treatment also received 100 lb/ac of AMS, 138 lb/ac of 11-52-0, 250 lb/ac of potash, and 132 lb/ac of ESN (44-0-0).
Manure + Woodchips: This treatment received 21 ton/ac of beef manure, and 12 ton/ac of cedar woodchips, both on January 31, 2019.
Manure: The manure treatment received 21 ton/ac of beef manure (surface application) on January 31, 2019.
Woodchips: The woodchips treatment received 12 ton/ac of cedar woodchips, applied on January 31, 2019. To compensate the P and N received by the plots where manure was applied, this treatment also received 100 lb/ac of AMS, 138 lb/ac of 11-52-0, 250 lb/ac of potash, and 132 lb/ac of ESN (44-0-0).
All treatments received the farmers management of 1000 lb/ac lime applied pre-planting, 3 gal/ac of 7-21-3 starter as Midwestern BioAg™ L-CBF liquid carbon-based monopotassium phosphate, 12 gal/ac 32% UAN at planting, and 30 gal/ac of 32% UAN applied through fertigation (split into three applications).

Total nutrients received by treatment*				
	Nitrogen (lb N/ac)	Phosphorous (lb P_2O_5/ac)	Potassium (lb K_20/ac)	Sulfur (lb S/ac)
Check	245	79	151	24
Manure + Woodchips	245	178	357	24
Manure	245	178	357	24
Woodchips	245	79	151	24

* Includes total nutrients from organic (manure) and inorganic (commercial fertilizers) sources.

Methods: Light horizontal tillage was done after harvest, with cover crop planting (rye). Soil measurements and samples were taken after tillage was implemented. For bulk density, a total of three samples were taken in three different rows within each rep (0-2" and 2-4"), and averaged. For the chemical analysis in the top soil layers, approximately 15 random cores were taken within each plot, and composited in two depths (0-4" and 4-8"). For deeper layers, a total of three cores were randomly taken within each plot and composited in two depths (8-20" and 20-36"). All samples and measurements were taken after harvest, on November 3, 2019.

Results:

	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)	Bulk Density		OM (%)	
			(0-2")	(2-4")	(0-4")	(4-8")
Check	180 A*	549.70 A	2 A	2 A	2.68 A	1.75 A
Manure + Woodchips	168 A	-1,675.74 C	2 A	2 A	2.73 A	1.83 A
Manure	164 A	399.67 B	2 A	2 A	2.45 A	1.55 A
Woodchips	171 A	-1,574.15 C	2 A	2 A	2.70 A	1.68 A
P-Value	0.733	<0.0001	0.316	0.403	0.533	0.280

	Soil Nitrate (ppm)				Soil P (ppm)		Soil K (ppm)	
	(0-4")	(4-8")	(8-20")	(20-36")	(0-4")	(4-8")	(0-4")	(4-8")
Check	12.5 B	4.5 B	4 A	3 A	20 B	7 A	329 AB	213 A
Manure + Woodchips	12.3 B	5.6 AB	3 A	3 A	31 AB	8 A	392 A	276 A
Manure	17.2 A	7.2 A	4 A	4 A	35 AB	8 A	264 B	209 A
Woodchips	11.4 B	3.7 B	2 A	2 A	41 A	11 A	335 AB	223 A
P-Value	0.021	0.021	0.605	0.886	0.067	0.765	0.097	0.262

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

†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.

‡Marginal net return based on $3.83/bu corn, $138.81/ac for control treatment fertilizer, $227.97/ac for manure treatment fertilizer, $2,229.20/ac for woodchip treatment, and $2,318.40/ac for woodchip and manure treatment.

Summary:

- There was no difference in yield between the treatments evaluated.
- Net return was highest for the check inorganic fertilizer treatment. The manure was pro-rated over 4 years according to N availability. Mulch expense was very high due to costs of cedar woodchips and transportation, and was not pro-rated as good information does not yet exist to indicate how many years this should be prorated over. For this specific study, a source of woodchips located far away from the research site was used. Using a local source may reduce these costs.
- Of the soil properties measured, only P and K in 0-4" and N in the 0-8" range showed differences between treatments. The inorganic fertilizer check had lower P than the woodchip treatment; the manure treatment had lower K than the manure + woodchip treatment; the manure treatment had higher N than all other treatments in the 0-4" depth and higher N than the check and woodchip treatment in the 4-8" depth.

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