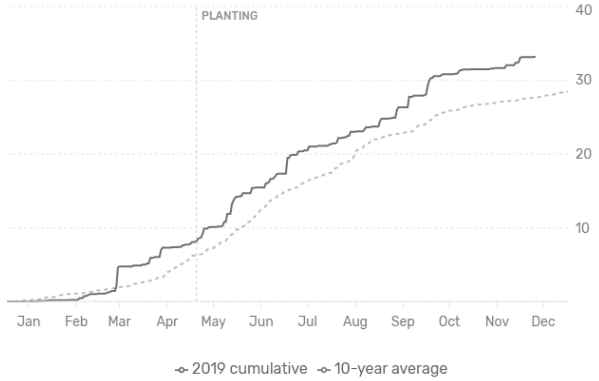
Impact of Manure and Cedar Mulch on Crop Production and Soil Properties

Study ID: 0924139201901
County: Pierce
Soil Type: Ortello sandy loam terrace, 0-2% slope
Planting Date: 5/4/19
Harvest Date: 10/26/19
Seeding Rate: 32,000
Row Spacing (in): 30
Variety: Pioneer® P1197
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 2.1 qt/ac Bicep II Magnum®, 1 qt/ac Roundup®, 0.66 pt/ac 2,4-D ***Post:*** 4 oz/ac Realm® Q, 1 qt/ac Roundup®, 0.5 fl oz/ac Callisto® at V4
Seed Treatment: Poncho® 1250 + VOTiVO®

Foliar Insecticides: 5 fl oz/ac Capture® via chemigation at R1
Foliar Fungicides: 10 fl oz/ac Quilt Xcel®, via chemigation at R2
Irrigation: Pivot, Total: 5.6"
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 Pierce, NE, using a randomized complete block design with four replications, to test three treatments: (1) commercial fertilizer (control/check), (2) manure and cedar woodchips, and (3) mulch. Plots measured 20-feet in length and 40-feet in width, and corn was planted. This is the first year of a 2-year study.

Treatments and Nutrients Applied:

Check: No organic amendments were applied (no beef slurry). On top of the farmer´s fertilization program, 196 lb/ac of 15-23-10 and 27.2 lb/ac of 32-0-4 were applied to balance out the N and P levels, relative to those plots where beef slurry was applied ("Manure" and "Manure + Woodchips" treatments).
Manure + Woodchips: This treatment received an average of 5,700 gal/ac of beef slurry on April 19, 2019, and 10 ton/ac of cedar woodchips applied on May 24, 2019 (both surface applications).
Manure: The manure treatment was beef slurry applied at an average of 5,700 gal/ac on April 19, 2019 (surface application).

All treatments received the following application as part of the farmer´s fertilization program: 200 lb/ac 8-20-5-5S-0.5zn at planting, 80 lb N/ac as ESN slow release (44% N) at V1, 75 lb N/ac as 30-0-0 2S at V6 via coulter injected sidedress, 35 lb N/ac as 30-0-0 2S at V10 via fertigation, 25 lb N/ac as 30-0-0 2S at V16 via fertigation, and 25 lb N/ac as 30-0-0 2S at R2 via fertigation.

	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	294	85	31	15
Manure + Woodchips	292	83	136	20
Manure	292	83	136	20

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

Methods: For bulk density, a total of three samples were taken in three different rows within each rep (0-2" and 2-4"), and averaged. Sorptivity was also measured; sorptivity corresponds to the initial water infiltration in the soil, which is especially relevant to water capture in the soil profile. The higher a sorptivity value, the better the infiltration of the water in the system. For sorptivity, five measurements were made within each replication to a depth of 2.5 cm (~1.0 in), covering at least three different rows. One cm (~0.4 in) of water was poured in the ring and the period of time for infiltration to occur was timed with a stopwatch. 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 9, 2019.

Results:

	Yield (bu/ac)†	Bulk Density (g/cm^3)		Sorptivity	OM (%)	
		(0-2")	(2-4")	(cm $s^{-1/2}$)	(0-4")	(4-8")
Check	248 A*	2 A	2 A	0.14 A	1.40 A	0.80 B
Manure	241 A	2 A	2 A	0.17 A	1.70 A	1.03 A
Manure + Woodchips	238 A	2 A	2 A	0.19 A	1.65 A	0.88 AB
P-Value	0.562	0.555	0.831	0.195	0.149	0.084

	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	11.1 A	7.1 B	6 A	11 A	39 A	36 A	148 B	130 B
Manure	19.6 A	15.0 A	7 A	4 A	50 A	45 A	255 A	198 A
Manure + Woodchips	18.1 A	8.5 B	6 A	6 A	42 A	29 A	223 A	130 B
P-Value	0.270	0.045	0.709	0.263	0.471	0.193	0.015	0.010

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre not adjusted for moisture.

Summary:

- There was no yield difference between the treatments evaluated.
- Soil measurements for K and N from (4-8") where higher for the beef slurry treatment. Soil K was also higher in the 0-4" layer for the manure and manure + woodchips treatments.

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