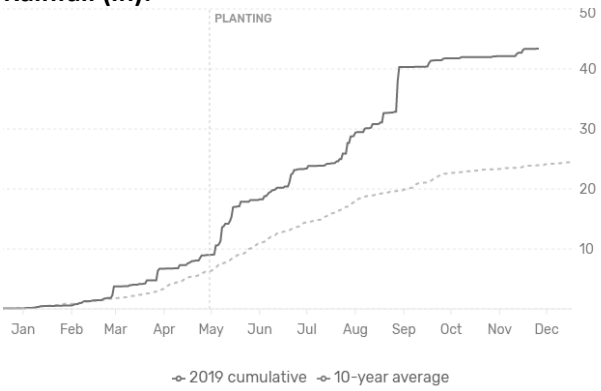
Impact of Manure and Cedar Mulch on Crop Production and Soil Properties

Study ID: 0921017201901
County: Brown
Soil Type: Johnstown fine sandy loam 0-2% slope
Planting Date: 5/14/19
Harvest Date: 11/5/19
Seeding Rate: 32,500
Row Spacing (in): 30
Variety: Croplan® CP4203
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Post:*** Resicore®, and 32 oz/ac Cornerstone® 5 Plus with 2 oz/ac InterLock®, 1.2 qt/ac Class Act® NG® and 1 qt/ac Max-IN® ZMB®
Seed Treatment: None

Foliar Insecticides: None
Foliar Fungicides: None
Irrigation: Pivot, Total: 4.2"
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 Ainsworth, NE, using a randomized complete block design with four replications. Four treatments were tested: (1) commercial fertilizer (control/check), (2) manure with cedar woodchips, (3) manure, and (4) cedar woodchips. Plots measured 350-feet in length and 20-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 manure or woodchips amendments were applied.
Manure + Woodchips: This treatment received 17 ton/ac of beef manure and 10 ton/ac of cedar woodchips, applied on May 11, 2019.
Manure: The manure treatments received 17 ton/ac of beef manure (surface application), applied on May 11, 2019.
Woodchips: The woodchip treatment received 10 ton/ac of cedar woodchips surface applied on May 11, 2019.

All treatments received the farmer's fertilization program, which consisted of: 19 lb/ac 11-52-0, 42 lb/ac 21-0-0-24, 45 lb/ac K-mag, 203lb/ac 34-0-0, 33 lb/ac 0-0-60, and 150 lb/ac pelletized lime. Fertilizer applied as starter in 2019 included 74 lb/ac 32% UAN, 118 lb/ac 10-34-0, and 38 lb/ac 12-0-0-26. Anhydrous ammonia was applied at a rate of 135 lb/ac. Fertilizer applied with cultivation included 118 lb/ac 32% UAN, and 19 lb/ac 12-0-0-26.

	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	271	50	30	35
Manure + Woodchips	305	139	190	48
Manure	305	139	190	48

Woodchips	271	50	30	35

* This calculation 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 24, 2019.

Results:

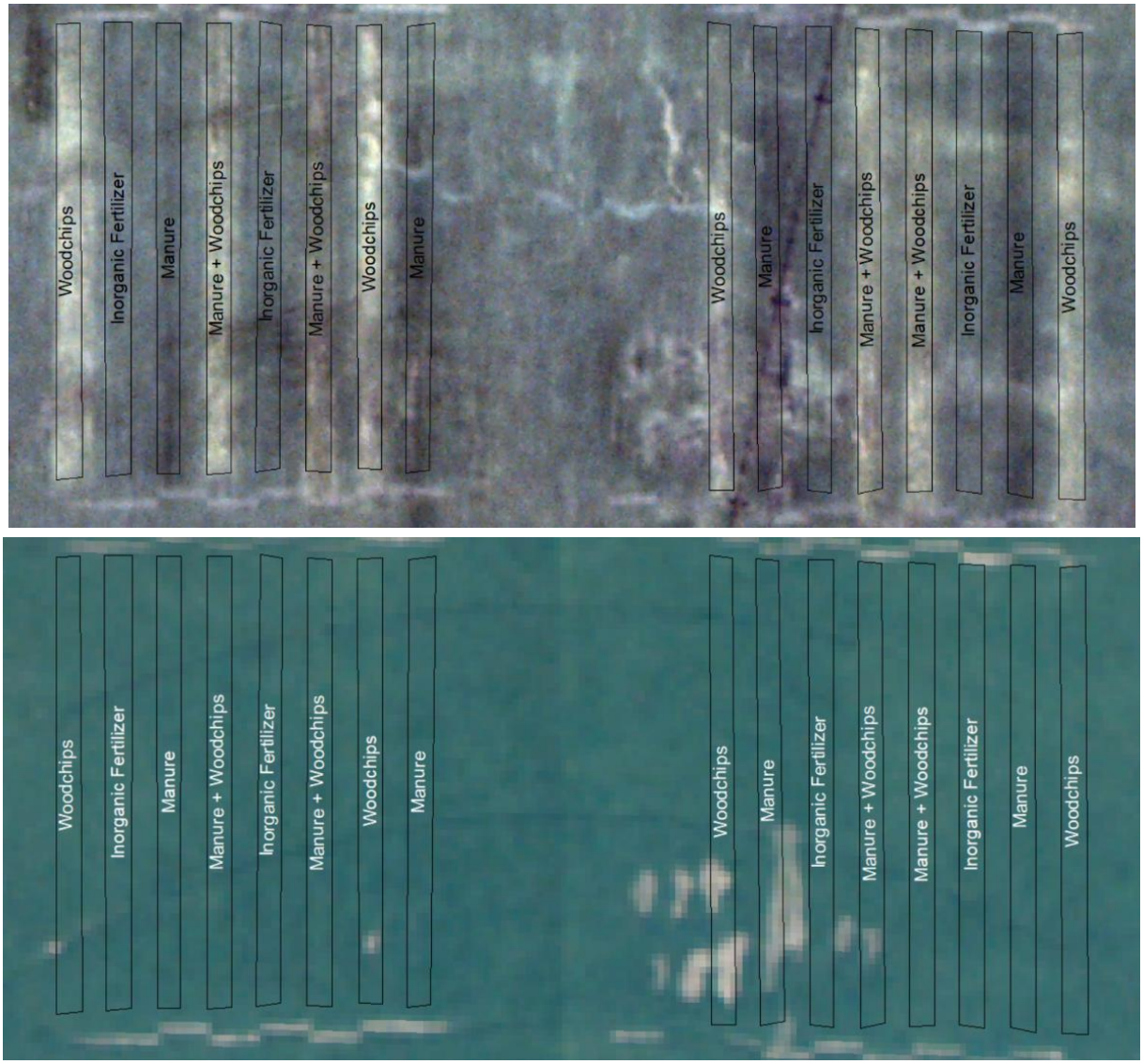


Figure 1. Aerial imagery from June 26, 2019 (top) and August 15, 2019 (bottom). Treatments receiving woodchips are visibly lighter in the June 26 imagery showing woodchips on the surface. By August 15, this difference is no longer visible and all treatments appear equally green.

	Moisture (%)	Yield (bu/ac)†	Bulk Density (g/cm^3)		Sorptivity	OM (%)	
			(0-2")	(2-4")	(cm s $^{-1/2}$)	(0-4")	(4-8")
Check	17.7 A*	225 A	2 A	2 A	0.12 B	1.58 B	0.95 A
Manure + Woodchips	17.8 A	222 A	2 A	2 A	0.21 A	1.85 A	0.98 A
Manure	17.7 A	220 A	2 A	2 A	0.15 AB	1.83 AB	0.95 A
Woodchips	17.9 A	209 A	2 A	2 A	0.19 A	1.60 AB	1.00 A
P-Value	0.585	0.336	0.173	0.899	0.022	0.031	0.797

	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	7.2 BC	3.7 AB	3 A	4 AB	13 B	14 B	141 B	102 A
Manure + Woodchips	10.7 AB	3.9 AB	3 A	2 B	57 A	28 A	189 A	131 A
Manure	11.8 A	4.6 A	5 A	8 A	47 A	24 AB	192 A	132 A
Woodchips	6.5 C	3.3 B	4 A	5 AB	13 B	18 AB	139 B	110 A
P-Value	0.018	0.072	0.473	0.032	0.0002	0.050	0.011	0.213

*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.

Summary:

- There were no corn yield or grain moisture differences between the treatments evaluated.
- There were some differences in sorptivity in the first year of the study: the treatments with woodchips (woodchip and manure + woodchip) had higher sorptivity than the check, which had only inorganic fertilizer.
- Organic matter at 0-4" was also higher for the manure + woodchip treatment compared to the check.
- Soil P and K at 0-4" was higher for the treatments that contained manure compared to the woodchip treatment and the check treatment.
- Soil N (nitrate) was also different with the manure treatment having higher soil N at 0-4" than the check and woodchip treatment. At the 4-8" depth, the manure treatment had higher soil N than the woodchip treatment. No differences were seen at the 8-20" depth.

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