Soil Responses as affected by Hemp Production in Kentucky

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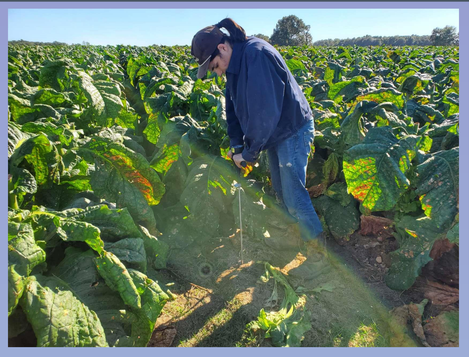


Introduction

Soil is a dynamic medium in which the physical, chemical, and biological processes are changing due to man and nature. Various cropping systems and or land use altered soil properties (Srinivas et al, 2014). Recently, Kentucky has been adopting hemp as one crop to substitute tobacco. To date, research on soil quality property changes due to hemp production is limited, especially related to in-situ soil tests. Therefore, the objective of this study was to investigate the impact of industrial hemp production on selected soil properties including soil compaction, soil pH, soil moisture and soil temperature.

Previous study on tobacco farming indicated higher soil porosity and loss of organic matter after 3 to 5 years of cropping (Srinivas et al., 2014; Handayani, 2009). In addition, frequent farming of tobacco can have a significant impact on soil compaction (Srinivas et al, 2014). However, some evidence reported that hemp's root system can break up compacted soil and provide more aeration to the soil (Schoeneman, 2016).

Study Site

This study was conducted at Murray State's West Farm, located at 2109 College Farm Road, Murray Ky (36.611816, -88.350938). The fields are part of a five-year crop rotation study. The rotation consists of maize, soybeans, tobacco, hemp. The cycle is in order as follows: Maize, hemp, soybeans, tobacco. Of the three hemp sites, one was for fiber, and two were for biomass. One biomass field was wrapped in plastic while the other was conventional. The major soil series for this study included Calloway silt loam, Grenada silt loam, Calloway-Kurk complex, and Purchase-Lax-Brandon complex.

The three hemp fields used in this study are cultivated under different practices. Hemp #1 is grown under plastic with irrigation and will be used for biomass hemp. Hemp #2 is also biomass hemp but is grown without plastic and used a pivot irrigation system. Hemp #3 is the largest field grown for fibers with tight rows, and stalky shoots.

Methods

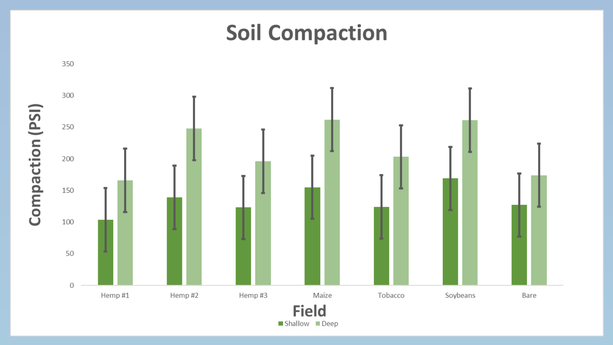
The sites in this study all had equal replications in order to maintain continuity. Each field had four measurements including soil compaction, pH levels, and soil moisture content, and soil temperature. The soil measurements were taken at depths of 0-7.5 cm and 7.5-15 cm to represent A horizon/topsoil. Ten random locations were selected on each field to measure soil compaction via penetrometer at both depths. Following soil compaction, a soil pH and moisture meter was used at ten sites on each field at both depths. Soil temperature measurements followed the same methods as previous measurements. All the data collected during this experiment was statistically analyzed.

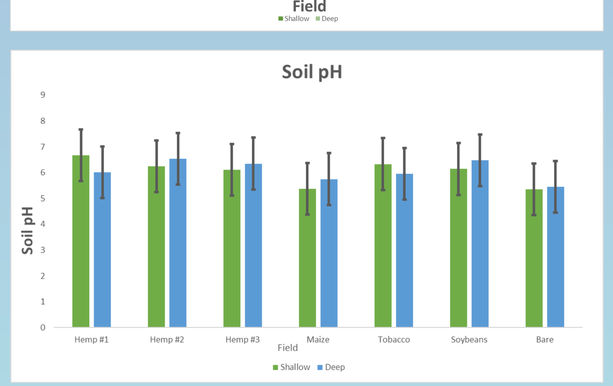


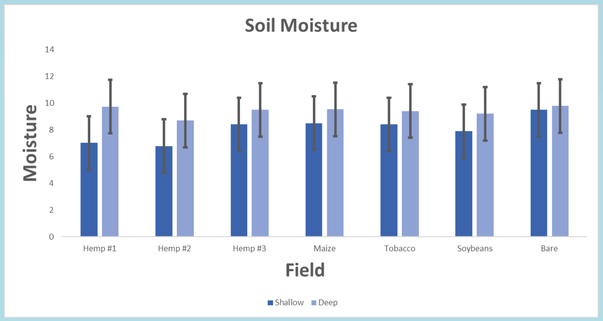


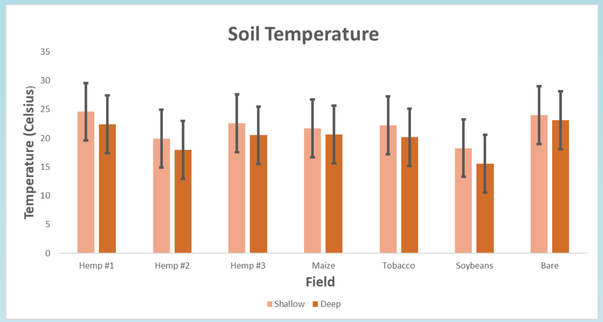


Results









Conclusions

- The fields with the lowest average compaction ratings were hemp field one (103.5/166 PSI) followed by the bare site. The maize field shoed the highest compaction ratings of each of the sites (155/262 PSI) closely followed by soybeans
- During the soybean measurements, it is important to note that an instrument was broken during a replication due to due to the highly compacted soil.
- The soil pH levels remain similar throughout the sites besides the maize and bare fields with averages under 6.0
- Soil moisture levels are also constant regarding the deep measurements. The lowest average moisture levels found in the shallow replications were in hemp fields one and two, and soybeans.
- Soil temperatures are characteristic to the amount of plant coverage above the soil as the lowest temperatures were found in soybeans (18.25/15.55 C) and hemp number two (19.9/17.95). These two fields had the least amount of soil visible to direct sunlight
- Overall, the findings of this study show that hemp cropping could be used as a buffer between tradition maize and soybean rotations in order to break up soil compaction. This study will be continued to monitor seasonally to observe the temporal variability in soil compaction, pH, moisture and temperature.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Acknowledgements

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