A Hemp Crop in the Continuation of a Long-Term Copper Fertility Study

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Introduction

During a long-term broiler litter experiment it was determined that copper was correlated with soybean yield, and a separate copper study was started in 2009 (Scott, 2010). This research is a continuation of a long-term copper fertility experiment. The previous six years have been planted in corn and there was a statistically significant yield increase at the 11.2 kg Cu ha^{-1} rate when all six years were added together (Unpublished data). Following these positive results, the question arose as to how the copper might effect hemp growth and production. The objective of this experiment is to study the residual effects of copper on hemp fertility parameters including cannabinoids THC and CBD. THC is a regulated compound and CBD is one of the major commodities of hemp production.

Materials and Methods

This experiment is a randomized complete block design with three treatments and four replications (Fig.1). Prior to transplanting, plots were fertilized with 112 kg N ha^{-1}. The hemp cultivar 'Queen Dream' was transplanted on June 13th, 2020 in 1.02-meter wide rows with intra-row spacing at 0.914 meters. On August 12th , ten fully developed leaves were taken from each plot and sent off for plant tissue analysis. Following the plant tissue analysis on August 21st potassium magnesium sulfate was hand-spread to provide 33.63 kg K_2O ha^{-1}, 16.45 kg Mg ha^{-1}, and 33.63 kg S ha^{-1} . The hemp plants were hand-harvested and stripped of all flower bud on October 3rd–October 5th . Soil analysis was done post-harvest by taking composite samples from each plot. Hemp samples were prepared and sent to the lab for THC and CBD analysis.

Treatments (kg Cu ha^{-1})			
22.4	11.2	0	Rep. 1
11.2	22.4	0	Rep 2.
0	11.2	22.4	Rep 3.
0	22.4	11.2	Rep 4.

Fig. 1. (Left to Right) Plot map and drone photograph of copper plots




Results

Table 1. Mean values for copper tissue analysis, amount of copper in soil, and hemp flower yield for each of the three copper treatments.

Copper Treatments (kg ha^{-1})	Tissue Analysis of Cu (ppm)	Amount of Cu in Soil (kg ha^{-1})	Hemp Flower Yield (kg ha^{-1})
0	12.95	3.08	2462
11.2	13.26	7.25	2866
22.4	13.75	13.25	2442
Pr > F	0.5498	<.0001	0.4789
LSD (P =0.1)	n.s.	0.77	n.s.
% CV	7.45	8.05	20.21

The mean values of copper from the plant tissue analysis were not significant. However, copper levels within the soil were significant. In addition, the hemp flower yield between treatments was not significant, although the yield from the 11.2 kg Cu ha^{-1} treatment was a higher value.

Table 2. Mean values for total THC and total CBD for each of the three copper treatments.

Copper Treatments (kg/ha)	Total THC (%)	Total CBD (%)
0	0.561	11.40
11.2	0.649	13.13
22.4	0.577	11.89
Pr > F	0.3268	0.3196
LSD (P =0.1)	n.s.	n.s.
% CV	13.47	12.47

The mean values of THC and CBD were not significant between treatments. However, the mean values of THC and CBD were higher from the 11.2 kg Cu ha^{-1} treatment.

Conclusions

The higher yield value of the 11.2 kg Cu ha^{-1} treatment deserves further study. These results are similar to previous research done on this field within this long-term study. The soil analysis of copper levels still showed a statistically significant difference between treatments since the initial application. In addition, the hemp plants did not uptake a significant amount of copper even though the amount of copper in the soil was significant.

Following the THC and CBD data analysis it was determined that the values from the 11.2 kg Cu ha^{-1} treatment followed a similar trend to the hemp flower yield values.

References

Scott, J.L. (2010). *Identifying Factors Affecting Soybean Productivity From Previous Broiler Litter Fertilization, Including A Possible Copper Nutritional Effect.* [Master thesis, Murray State University].

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