Effects of Timing of Food Safe Sources of Organic Matter Amendments on Nutrient Cycling and Water Use

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PROJECT SUMMARY

Objectives:

- Scale organic matter amendment (OMA) source and timing treatments to the field
- Estimate OMA decomposition and nutrient release rates and changes in total soil organic carbon (TOC) and nitrogen (TN)
- Measure nutrient availability in the top soil (0 – 4 in) from OMA sources
- Compare N availability in the active rooting zone (0 – 20 in) between OMA treatments
- Measure the effects of timing applications of composted manure on soil moisture and stem water potential (SWP)

Background and Discussion:

Use of synthetic fertilizer for nitrogen (N), phosphorus (P), and potassium (K) nutrition results in beneficial outcomes for agronomic performance, but also comes with economic and environmental costs. Organic matter amendments (OMA) offer a viable option to supplement or partially substitute synthetic fertilizers. We examined the effects of OMA source and timing treatments. We applied composted manure and green waste compost in either April or October. Multiple effects from OMA source and timing treatments were identified. Total Organic Carbon (TOC) and Total Nitrogen (TN) significantly increased in the soil (0 – 20 in) from both OMA sources. There was no difference in rate of N release between composted manure and green waste compost.

For both materials the N release rate was rapid in April and progressively slowed during the growing season following an exponential decay. Inorganic N adsorbed to resin stakes in the top soil (0 – 4 in) were not different between the normally fertilized control and OMA treatments, however there were significantly greater P, K, Fe and Zn availability from the OMA treatments.

There were no differences between net N mineralization and potential N leaching. These results suggest the N released from OMA is not being lost from the active rooting zone (0 – 20 in) at a rate greater than the control. Soil moisture measured to 6 ft in depth increased in the composted manure treatment with the greatest effect observed from application timed in October.

The increase in TOC and TN from OMA treatment shows decomposition of OMA results in the movement of organic C and N into the soil. Decomposition of OMA leads to nutrient release into soil. After 200 days, approximately 80% of the N from OMA was released. Over time N from OMA is converted to inorganic N or retained in organic form. Net N released does not imply all N from OMA is plant available. However, we can infer this N is contributing to the overall TN pool.

There were no significant differences in inorganic N adsorbed to resin stakes between OMA sources, however both treatments were lower than the control. This result suggests that greater N immobilization occurred with OMA treatments. There were no differences in potential N leaching through the active rooting zone (0 – 20 in) between OMA treatments and the control as determined by inorganic N adsorption to resin beads suggesting that N released from OMA application is not being lost.

Preliminary results indicate greater soil moisture retention under composted manure compared to the control. Trees showed less water stress for both April and October OMA timing treatments compared to the control. Greater soil moisture and tree water status in a high water demand season of summer is potentially due to improved soil quality.

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