

2018 OCIA R&E Scholarship Recipient

Effects of biodegradable mulch on soil physical properties and yield results after year 2

This is a 3 year project, however, treatments were not applied in the first year so this is the first year of data collection. There is one year left in the project, so I have included what I have found to be relevant results as of now. As a refresher on the project:

- A three year, randomized complete block split-split plot experiment is in process at both Lincoln and Scottsbluff, NE
- The first year was organic pepper (*Capsicum annuum* 'Carmen'), the second was organic sweet corn (*Zea mays* cv. 'Xtra-Tender 2171), and the third year will be a *Brassicaceae*
- Two mulch treatments: MaterBi/PBAT a bioplastic (Bio360, St. Remi, Canada) and a polylactic acid plus wood fiber particle biofabric (3M Company, St. Paul, MN)
- Split-plots incorporated the mulch via an articulating spader or the mulch was removed as a control
- Split-split plots included six soil management treatments: no amendment, 10 Mg/ha compost, cover crops, fallow irrigation, compost tea extract, or a combination of compost, compost tea, cover crops, and fallow irrigation ("kitchen sink," SINK hereafter)
- The first season mulch was applied via a bedder and then incorporated into the soil after the fall harvest
- No mulch was reapplied following years
- Soil physical samples were taken either every 6 months or 1 year
- Yield was separated into marketable and non-marketable but only total is presented here

Results

- Corn yield and total ears higher at Scottsbluff for compost and SINK treatments
- Soil tensile strength was higher in PLA mulch compared to bioplastic plots at Scottsbluff
- Sorptivity was increased at Lincoln in incorporated biofabric mulch under SINK treatment versus no application
- Scottsbluff sorptivity was significantly higher under SINK versus no application treatments
- In the spring and fall of 2018 Scottsbluff phosphorous levels were significantly higher for SINK and compost compared to all other treatments
- Spring nitrogen levels at Lincoln were highest in compost, but cover crops did reduce N levels in the SINK treatment. There was no difference in nitrogen levels in the fall
- Spring nitrogen levels at Scottsbluff were also affected in SINK treatments by the cover crop. In the fall compost and SINK treatments had significantly higher N levels than other treatments.

Conclusions

- Incorporated biofabric mulch can increase the tensile strength of soil, which may be useful for soils with poor structure or aggregate stability
- Spring cover crops deplete nitrogen levels, especially noticeable in compost and SINK treatments. However, there were no differences the following fall. Low N levels may slow mulch degradation as N is limited for microbes during cover crop growth and decomposition. Alternatively, cover crops may promote mulch degradation through increased microbial activity in the rhizosphere.
- Yield was increased under compost and SINK treatments in conditions with nutrient poor soils
- Yield was not negatively affected by the incorporation of mulch
- Data on mulch degradation is still in process, however, much of the black plastic has completely degraded by a visual analysis whereas the PLA has not exhibited great degradation. This spring we are implementing a different way of measuring mass loss (by an ash process) to counter the addition of weight to PLA mulch by microorganisms and mineralization.