Biodegradable mulch effects on soil physical properties and yield

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Background

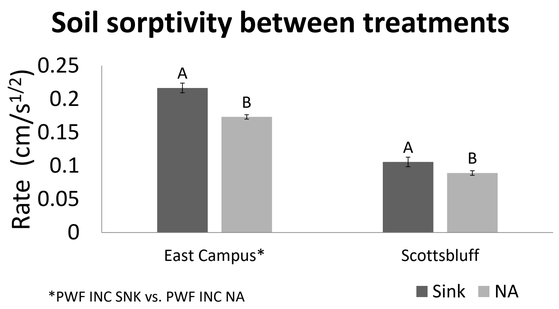
- Organic growers face challenges for weed control and often use plastic or biodegradable plastic mulches to prevent weeds
- Biofabrics offer a more sustainable option to plastic mulches
- Biofabrics, such as polylactic acid (PLA) based fabrics may be incorporated into the soil, unlike plastics and many bioplastics
- Incorporating biofabrics could reduce labor for growers and be a potential organic option
- Additional soil amendments could increase mulch degradation and have an effect on soil physical properties and yield
- We are interested in the effects of incorporated PLA on soil physical properties and vegetable yield

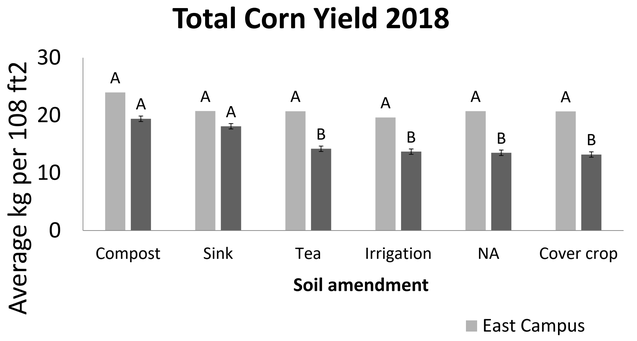
Methods

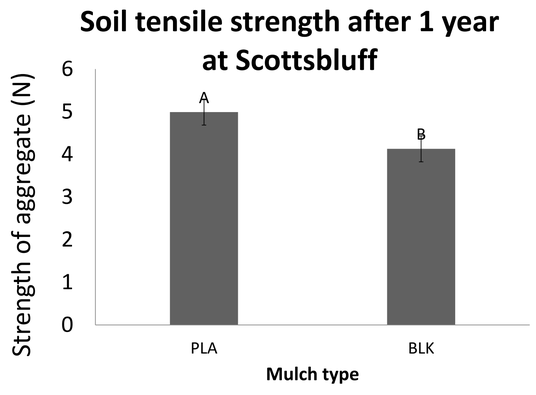
- A three year, randomized complete block split-split plot experiment is in process at both Lincoln and Scottsbluff, NE
- The first year was organic pepper (*Capsicum annuum* 'Carmen'), the second was organic sweet corn (*Zea mays* cv. 'Xtra-Tender 2171), and the third year will be a *Brassicaceae*
- Two mulch treatments: MaterBi/PBAT (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

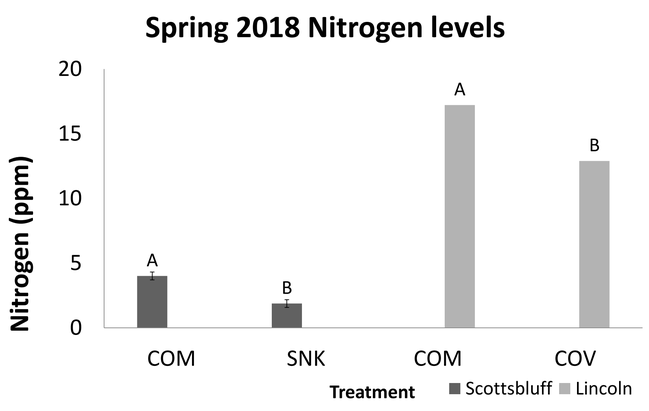
Results

- 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 PLA mulch under SINK treatment versus no application control
- Scottsbluff sorptivity was significantly higher in SINK compared to no application control treatment
- 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 the SINK treatment by the cover crop. In the fall, compost and SINK treatments had significantly higher N levels than other treatments.









Conclusions and take-aways

- Incorporated PLA 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 versus kitchen 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 more nutrient poor soils
- Yield was not negatively affected by the incorporation of mulch

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