Biodegradable mulch: How long does it persist and does it affect soil health and crop yield?

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Background

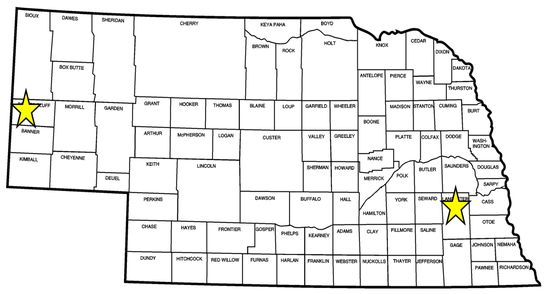
Single-use, petroleum-based polyethylene (PE) mulch film is common, and often essential, in Midwest vegetable production. However, mulch removal from the field and disposal is expensive and an environmental concern.

One alternative to PE mulch is biodegradable mulch (BDM), but some growers are concerned that BDM residues will persist too long in soil with negative effects on subsequent crops or soil health. To address these concerns, **we designed a study to answer two questions:**

1) Can compost, compost extract, or cover crops enhance the degradation rate of biodegradable mulches in a vegetable cropping system?
2) Do mulch residues incorporated in soil have any effect on soil health or subsequent crop yield?

Study Approach

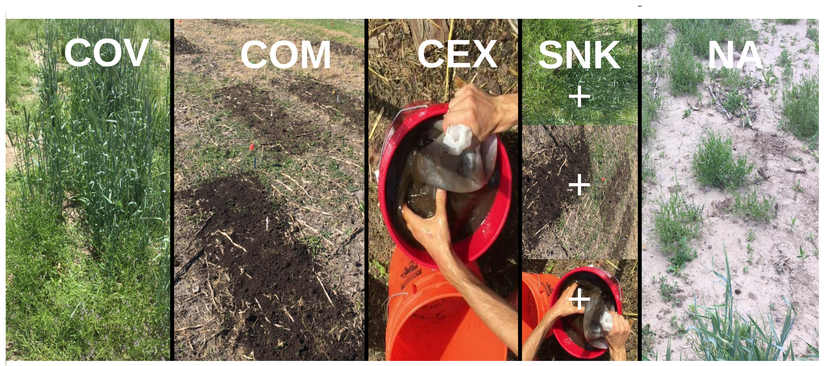
Two contrasting locations in Nebraska: Lincoln and Scottsbluff



Mulch types:

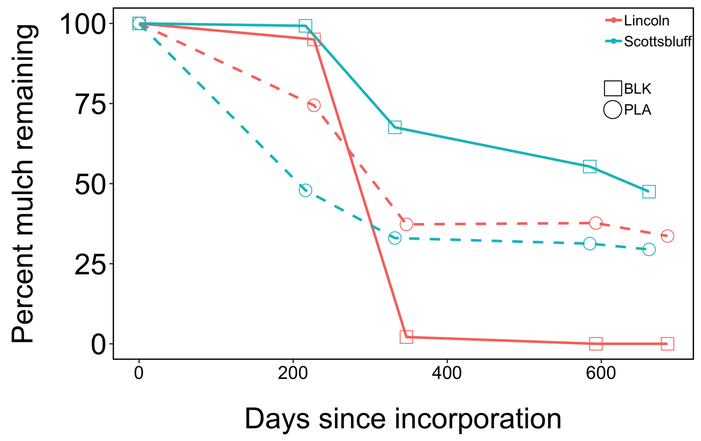
- *PLA*: layered polylactic acid (38% by weight) biofabric with wood particles embedded (62%)
- *BLK*: black biodegradable starch-based plastic film (Bio360)

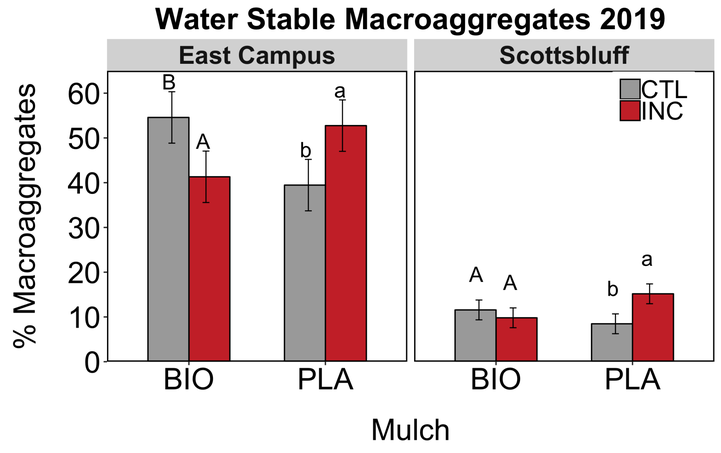
Experimental treatments to speed mulch degradation: Cover crops (COV); Compost (COM), Compost extract (CEX), "Kitchen sink" (SNK), and None (NA)



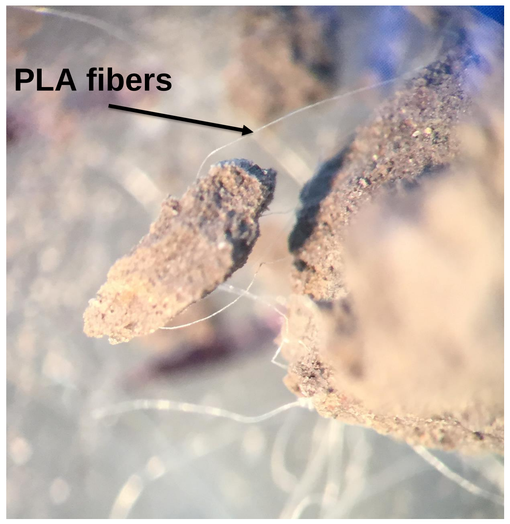
Mulches were incorporated in soil and mulch-containing mesh bags were buried in October 2017 after harvesting red peppers. Sweet corn (2018) and cabbage (2019) were planted in the two years following mulch incorporation. Mulch bags were removed and soil was sampled every six months.

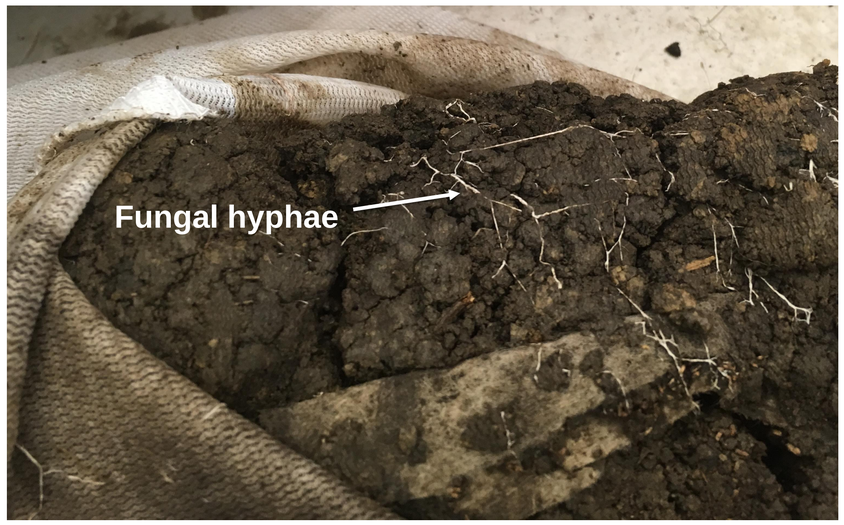
Results



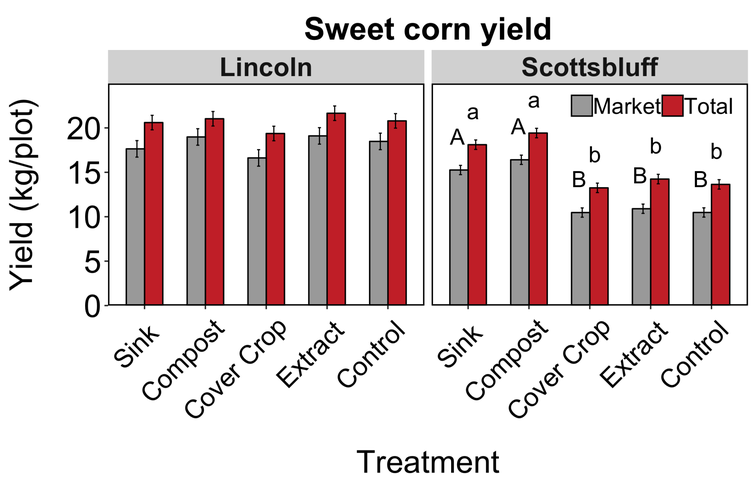


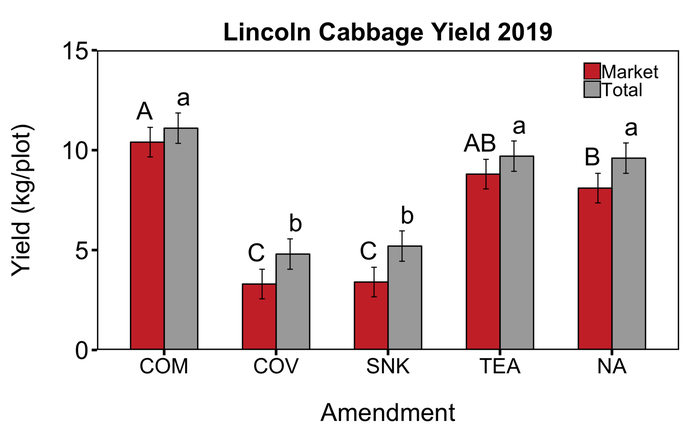
- After nearly 2 years in soil, **only the Bio360 mulch (BLK) reached >90% degradation** (the standard lab threshold for "biodegradable" plastics, and the National Organic Program requirement for biomulch inputs).
- Approximately 30% of PLA mulch remained in soil after 2 years, but these **PLA residues increased soil macroaggregation** (physical indicator of soil health). In contrast, **Bio360 tended to reduce macroaggregates**.





- Increased macroaggregates can be attributed to **increased fungal colonization of PLA and wood particles**. There was also visual evidence that PLA fibers became embedded within soil aggregates.
- **Sweet corn (2018) and cabbage (2019) yield were not affected by mulch residues in soil**, but responded positively to compost addition at Scottsbluff, and negatively to rye cover crop residue at Lincoln.





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