The Right Stuff: Biodegradable Alternatives to Plastic Mulch

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What is plastic mulch?

Plastic mulch is polyethylene sheeting laid on the soil surface to increase crop production by suppressing weeds, moderating soil temperature, and conserving soil moisture. Every year farmers around the world use 1.4 million tons of plastic mulch.

Why is it a problem?

Due to limited disposal and recycling options, mulch tends to accumulate indefinitely in landfills or may be burned, releasing toxins into the air. Commercially available biodegradable alternatives to plastic mulch have not gained widespread acceptance due to their high cost, lack of information about performance, and low availability.

GOALS to address the problem:

1. Raise awareness of the issues associated with agricultural plastic use through education and outreach
2. Design and develop a sustainable prototype alternative to plastic mulch
3. Test the performance and biodegradability of plastic mulch, available bio-plastics, and our flax shive-alginate prototype

1) Awareness raising

- Participated in the 2012 OSU Small Farms Conference and the 23rd MOSES Conference
- Reached out to over 140 farming families from Oregon, Idaho and China
- Produced a 12 minute educational film

2) Developing a sustainable prototype: flax shive-alginate

Design objectives:

- Biodegradable and tiltable into soil
- Meets farmers needs: moderates soil temperature and moisture, suppresses weeds, reduces pollution, and labor
- Cost competitive with plastic mulch and biodegradable alternatives

3) Phase II comparative testing of prototype flax shive-alginate mulch

Crop Yield

- Flax 22 and Plastic had highest yields; yields were lower in Control and with Biotello, Flax 20, and WeedGuard. Flax 20 and WeedGuard mulches, though differences are not statistically significant.

Soil Conductivity

- The plastic had a lower mean conductivity than other alternatives and the control, but differences are not statistically significant.

Macro-invertebrates

- Both Flax 20 and 22 have a statistically significant amount of faunal invertebrates than is greater than all other plastic products.

Lifecycle analysis

- Flax fiber mulch uses less energy compared to plastic mulch. Carboxymethyl Cellulose (CMC) mulch is projected to use less energy and water while producing lower emissions.

2012 OSU Small Farms Conference and the 23rd MOSES Conference.

Flax shive-alginate mulch production at the lab scale.

Phase I team (left to right): Kara DiFrancesco, Alison Doniger, Mark Ingman, Courtney Holley, Dustin DeGeorge, Tucker Selko, Isaiah Miller

Conclusions

- Developed and field tested a novel, biodegradable flax shive-alginate prototype mulch
- Produced an educational film
- Statistically compared the performance results of plastic mulch, our developed prototype, and six "biodegradable" alternative products
- Disseminated data and research results to farmers and the public (Best Student Presentation at MOSES conferences)

Future steps

- Identify and collaborate with farmers for locally available agricultural fiber waste products
- Test alternative polymers that do not include sodium, such as carboxymethyl cellulose (CMC), a food grade polymer
- Redesign field testing to include more replicates for more a representative statistical analysis
- Use life cycle "hot spots" design for minimizing life cycle impacts

Team members installing plots with different mulches for summer 2013 field study (Above). Harvesting plots (below).

2012 OSU Small Farms Conference and the 23rd MOSES Conference.