Organic Vegetable Production and Management

Thursday afternoon 1:00 pm

Where: Grand Gallery (main level) Room D
MI Recertification credits: 2 (1B, COMM CORE, PRIV CORE)
CCA Credits: PM(2.0)
Moderator: Vicki Morrone, Outreach Specialist for Organic Fruit and Vegetable Growers, MSU

1:00 pm	Insect Pest Management and Organic Pest Product Evaluation for Organic Vegetables • Alan Schreiber, Executive Director, Washington Asparagus Commission -- Researcher will share results of field studies to identify best management practices to reduce pest problems in vegetables, including an evaluation of organic insecticides. As an organic farmer and ag consultant he will share how he successfully manages most pests in his organic wholesale and retail operation, selling to organic markets across the state (Washington).
1:40 pm	Evaluation of Biodegradable Mulches • Carol Miles, Horticulture Dept., Washington State Univ. -- Learn how different biodegradable mulch films are effective to prevent weeds, their ease of use and ability to degrade after they have been tilled into the soil, as their name implies. Data will be shared from field research studies, and discussion will include the current status of NOP regarding bio- degradable mulches.
2:20 pm	Weed Management Approaches in Organic Systems • Dave Mortensen, Weed and Applied Plant Ecology, Pennsylvania State Univ. -- Balancing the pros and cons - based on levels of management intensity and effectiveness. Practices will be discussed based on recounts of different systems from organic farmers in Pennsylvania.
3:00 pm	Session Ends

Evaluation of Biodegradable Mulch Films for Organic Agriculture

Carol Miles and **Shuresh Ghimire**, Department of Horticulture, Northwest Washington Research and Extension Center, Washington State University; **Mark Peyron**, Department of Engineering & Design, Western Washington University; and **Douglas Hayes**, Biosystems Engineering and Soil Science, University of Tennessee

There are many agricultural mulches that are marketed as "biodegradable." The goal for a biodegradable mulch is that it will remain relatively intact during the growing season so as to provide weed control and moisture retention, and at the end of the growing season it can then be incorporated into the field where it will biodegrade fully over a relatively short period of time (i.e., within 2 years). Being able to till the mulch into the soil after the crop harvest eliminates removal and disposal costs for growers and reduces landfill waste for communities.

Biodegradable mulch film feels and looks like plastic. This presentation will focus on biodegradable film mulch, however, it is important to note that biodegradable paper mulch is allowable in certified organic production systems.

On October 30, 2014, the USDA National Organic Standards Board (NOSB) passed a new rule which added 'biodegradable biobased mulch film' to their list of allowed substances for organic crop production ["7 Code of Federal Regulations (CFR) section 205", available at http://www.regulations.gov/#!documentDetail;D=AMS-NOP-13-0011-0125]. Under this rule, to be considered biodegradable and biobased, a mulch film MUST:

- Achieve at least 90% biodegradation in the soil within two years, in accordance with the ISO 17556 or ASTM D5988 testing methods
- Be biobased, with biobased content measured using ASTM D6866
- Meet compostability specifications of one of the following standards: ASTM D6400, ASTM D6868, EN 13432, EN 14995, or ISO 17088 (*Section 205.2*)
- Be produced without organisms or feedstock derived from excluded methods [*Section 205.601(b)(2)(iii)*]
- Be produced without the use of synthetic (non-biobased) polymers; minor additives such as colorants and processing aids are not required to be biobased (*NOP Policy Memo 15-1*)

To be considered 'biobased' the feedstocks used to make the mulch must be derived from a renewable resource (plant and/or animal mass derived from carbon dioxide recently fixed via photosynthesis). The feedstock must be made using biological processes and may not be derived from, or using, GMO organisms. Biodegradable mulch films currently on the market contain only 10 – 20% biobased content and the remaining content includes polymers derived from fossil fuels (petroleum or natural gas) as well as dyes, minerals, and in some cases heavy metals (OMRI report to USDA-NOP, June 5 2015).

Based on the rule which passed in October 2014, none of the biodegradable mulch films have been approved for use in the U.S. because, so far, none meet the requirement of using only biobased feedstock. However, there may be discussion at the NOSB meeting scheduled for October 26, 2015 to revise the rule such that mulch films do not need to be biobased. Updates from this meeting, if they are available, will be presented at the conference.

Feedstocks for biodegradable mulch film. The most common biobased materials used to make biodegradable mulch films are starch, polylactic acid (PLA), and polyhydroxyalkanoate (PHA). Each of these three biopolymers is most commonly blended with non-biobased polymers and minerals, and then processed using synthetic procedures. Starch starts as a natural polysaccharide but is typically processed into a thermoplastic material by extruding with water and organic alcohols (usually glycerol, a biobased co-product from biodiesel manufacture), or it may be esterified chemically. Corn starch sourced from the U.S. is most likely derived from a genetically modified organism (GMO); however, there are no cost-effective assays for determining GMO status. PLA is derived from starch and oxidized by yeasts or other microorganisms to produce lactic acid, which is subsequently polymerized synthetically through a series of reaction steps. PHAs are biopolymers that are biosynthesized through fermentation by bacterial enzymes. PLA and PHA are most commonly produced using GMOs.

Measuring biodegradation. Under the NOP rule, the grower is responsible for ensuring that the mulch reaches 90% biodegradation within 2 years after soil incorporation. All the biodegradable testing procedures cited by the NOP are laboratory procedures that utilize controlled conditions including temperature, moisture, and organic matter substrates; and the material being tested is ground into a fine powder. In the field, there is variability in environmental conditions: heat, UV light, wind, soil type, pH, microbes, irrigation, aeration of the soil, and other production practices. Environmental conditions during the period of time when the mulch is being used on the soil surface may also affect biodegradation. For example, PBAT (a constituent of several biodegradable mulch films) can undergo photochemical reactions that form cross-links, and the cross-links reduce the extent of biodegradation that can be achieved. If the mulch does not adequately biodegrade in the soil, the grower may be in non-compliance.

Biodegradable mulch research. In 2009, the USDA-Specialty Crop Research Initiative (SCRI) funded project *Biodegradable Mulches for Specialty Crops Produced Under Protective Covers* (Ref. No: 2009-02484) followed four biodegradable mulches (BioAgri, BioTelo, PLA Experimental, WeedGuard) in the soil for 2 years at three locations in the U.S. (Knoxville TN, Lubbock TX, Mount Vernon WA) post-incorporation using a mesh-bag protocol. Results from this study showed that WeedGuard biodegraded at all locations, BioAgri and BioTelo (very similar products) biodegraded at different rates at each location, and the PLA mulch did not biodegrade at any location. A new 5-year field study initiated in 2015 (USDA-SCRI Ref. No. 2014-51181-22382) *Performance and Adoptability of Biodegradable Plastic Mulch for Sustainable Specialty Crop Production* at Washington State University Northwest Washington Research and Extension Center and the University of Tennessee–Knoxville is testing 5 biodegradable mulch products, WeedGuard, BioAgri, Naturecycle, Organix, and an experimental PLA/PHA-based mulch film. Evaluation includes mulch impacts on crop production and soil micro-organisms, and mulch biodegradation in the soil over 4 years of repeated applications. Soil sampling methods will be developed to enable growers, certifying agencies and scientists to determine how much mulch is remaining in the soil post-incorporation. For more information about this research project, see www.biodegradablemulch.org.

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