

**National Organic Standards Board
Crops Subcommittee Proposal
Biodegradable Biobased Mulch Film
August 13, 2021**

I. Summary of biodegradable biobased mulch film

The NOP rescinded policy memorandum 15-1 in October 2019, stating that it was redundant with current regulations. The requirement for 100% biobased feedstocks is articulated in the preamble of the final rule and the status quo remains. Removal of the policy memorandum provides an opportunity for the NOSB to revise the current definition (§ 205.2) to consider reducing the biobased content requirement. The Crops Subcommittee is now planning to vote on an annotation at the Fall 2021 meeting addressing biodegradable mulch (BDM) film that is not 100% biobased.

II. Discussion

Biodegradable biobased mulch film has been on the National List of approved synthetic substances since September 30, 2014, based on an October 2012 NOSB recommendation. Historical information on this material is as follows:

Reference on the National List: § 205.601(b) As herbicides, weed barriers, as applicable (2) Mulches (iii) Biodegradable biobased mulch film as defined in §205.2. Must be produced without organisms or feedstock derived from excluded methods.

Technical Report: [2012 TR](#); [2015 Report](#); [NOP Policy Memorandum 15-1](#); [Supplemental Technical Evaluation Report 2016](#)

Petition(s): [2012](#)

Past NOSB Actions: [10/2012 NOSB Recommendation](#); [Memo to the NOSB with Report on Biodegradable Biobased Mulch Films in Organic Crop Production \(Michigan State University, September 2019\) \(pdf\)](#).

Recent Regulatory Background: Final Rule published 09/30/14 ([79 FR 58655](#)); Sunset renewal notice published 10/08/2019, [84 FR 53577](#)

Background from Subcommittee

Biodegradable biobased mulch films were approved for placement on the National List of approved synthetics (Biodegradable Mulch Film Made from Bioplastics) without detailing if non-biobased content would be allowed. The vast majority of mulch films in this category contain 20% or less of biobased materials (i.e., carbon sources are ~80% petroleum derived). There are some products that might meet the biobased aspect of this material's definition on at §205.2, but they are either not biodegradable or are not used in production due to brittleness or other production issues.

In January 2015, the National Organic Program issued Policy Memorandum 15-1, to clarify that biodegradable biobased mulch film must not contain any non-biobased synthetic polymer feedstocks. The NOSB requested a limited scope technical report (TR) in 2016. The questions asked for this limited scope TR from 2016 were as follows:

1. What is the effect on overall soil health, including soil biology, when this material biodegrades?
2. What is the cumulative effect of the continued use of this biodegradable biobased mulch film, on soil nutrient balance, soil biological life, and soil tilth, when used in the same area of the field for 3-5-10 years?
3. What effect does the breakdown of these polymers have on soil and plant life as well as

livestock that would graze either crop residues or forages grown the subsequent year after this mulch film was used?

4. Are there different cropping systems, climate, soil types or other factors that affect the decomposition rate (Examples would be long cold winters, or exceptionally dry conditions, such as found in a desert)?
5. Are there metabolites of these mulches that do not fully decompose, and if so, is there an effect upon soil health or biological life?

The TR focused on biobased biodegradable mulches that contain polymers and the soil and crop health effects they may have as they biodegrade. This supplemental TR was inconclusive, since research on these materials is currently limited, and the questions above were not answered to the NOSB crop subcommittee's satisfaction.

An argument can be made that even though the non-biobased polymers degrading into the soil originate from petroleum (a nonrenewable fossil fuel), the use of this product could be considered environmentally friendly because:

- Many organic production systems rely on enormous amounts of fossil fuel-derived plastic, mostly polyethylene (PE) films, to produce organic crops;
- PE films likely shed micro plastics and leach chemicals into organic soil over the growing season;
- Before and during removal, PE films can tear and breakdown, leaving plastic in the soils or migrating off-site into aquatic habitats;
- PE films are generally not recyclable due to contamination by soils or the lack of recycling infrastructure;
- Plastic used in annual production systems end up in landfills;
- Biodegradable mulches potentially save labor and time, and likely fuel, since the mulch does not have to be removed from the field and transported for disposal;

The current listing of biodegradable mulch on the National List is aspirational: there are no products on the market that are commercially viable made from 100% biobased carbon sources (i.e., no petroleum). In fact, some public commenters have recommended that BDM films be taken off the National List since the 100% biobased requirement essentially prohibits use of these materials. Despite the lack of products meeting the annotation, the NOSB reviewed this material for its five-year sunset renewal in 2017 and decided to relist it as written, with the understanding that there were no products on the market that were commercially viable made from 100% biobased materials. The Crops Subcommittee felt more information was needed that addressed the key questions above before considering a change to the annotation. The Crops Subcommittee also felt that if biodegradable mulch remained on the National List manufacturers would be able to develop a product that met the requirement of 100% biobased "ingredients", which was the preferred outcome.

The National Organic Program also reached out to Dr. Ramani Narayan, a researcher with the Department of Chemical Engineering and Materials Science at Michigan State University, to provide more information beyond the Technical Report, which was completed in 2016, to the NOSB. The focus of Dr. Narayan's report is the biodegradability of both biobased and petroleum-based mulch films with limited research on the effect of these products degrading into the soil over time. Section 2.7 of the report states:

Environmental studies have not shown any adverse impacts associated with the incorporation of biodegradable mulch films (BDMs) into the soil to date. More research is needed to monitor any potential formation of terrestrial micro and nanoplastics from biodegradable mulch films and ensure that there is no residual soil ecotoxicity. There is need for tuning the physicochemical properties of the biodegradable mulch films with the needs of specific cropping systems and climates Sintim et al. showed that there was no significant effect on soil health over two years of monitoring and that the soil microbial communities did not differ much either. They found significant enrichment in bacterial and fungal gene copies under BDM treatments over 2 years, but no significant change under PE and no mulch. Another important observation was that repeated tillage of BDMs into the soil across 4 years did not impact crop yield significantly and had no major effect on crop quality.

While this section points out possible negative issues with some polymers used in the biodegradable mulch, the majority of the report focused on the positive aspects when the mulch does biodegrade. The report also discussed current regulations that protect organic integrity and would not allow the use of excluded methods (some of the polymers are extracted from petroleum through the use of bacteria created through excluded methods) and do not allow materials to be used that “contribute to contamination crops, soil or water.” Organic producers in the European Union are allowed to use petroleum based biodegradable mulch with no requirement on the percentage of bio-based ingredients. The EU will be reviewing these mulches in 2024 with possible changes to their annotation.

Key concerns of current and past NOSB members include the possibility of soil, aquatic, and other environmental contamination by partially decomposed BDM films even if the materials pass ASTM laboratory-based standards. Of particular concern to NOSB members is the possibility that BDM films will not decompose thoroughly in dry or cold environments where there is less biological activity in soils. A related concern is that BDM films ploughed into soils may be out of reach of peak biological activity to break it down. For example, most soil biological activity occurs in the top 4-6 inches, with only a small fraction below that level. If ploughing results in BDM film plastic mixed into soil 7-10 inches deep, there may be fewer microbiotic fauna available to consume BDM carbon sources. Figures 2 and 3 show examples of relatively complete biodegradation after less than one year and another case where visible material after 2 months “burial” (source: <https://eorganic.org/node/8260>).



Figure 2. (a) Starch-based biodegradable plastic mulch (BioAgri[®]) in experimental field plots during harvest, 135 days after laying mulch. (b) 9 months post-harvest on soil surface, 348 days after laying mulch. (c) 9 months post incorporation, 348 days after laying mulch. Photo Credits: J. Cowan (2a) and C. Miles (2a, 2b), Washington State University. From Corbin et al., 2013.

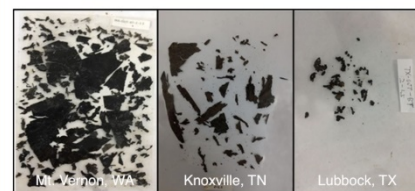


Figure 3. Samples of starch based biodegradable plastic mulch (BioTELO[®]) recovered after twenty four months burial in the field at three experimental locations. Photo credit: J. Moore-Kucera, Texas Tech University.




Organic Strawberry PE Film Plasticulture (Source: <https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=31015&>)

Extensive public comments and up-to-date scientific reviews have been submitted to the NOSB, and in some cases submitters note sampling and/or other analytic methods are not yet developed enough to answer all questions about potential residues in soil.

The Board has also weighed the merits of comparing the risk to soils and the environment from BDM films versus risk from PE films. Board members are torn on this issue. Use of plastic in organic production is increasing rapidly. Many small- and large-scale growing systems,

Monterey County Agriculture Plastic Waste – Organic and Conventional. Source: P. Krone, NOAA



MRWMD received 5700 tons of ag plastic last year

- It is considered a problem waste
- It is dangerous for equipment to drive on
- It creates runoff issues
- Dumping fees are \$95 per ton for problem wastes

such as organic “plasticulture” strawberry production, are highly dependent on PE films, with thousands of acres of plastic used annually to essentially containerize soil, resulting in enormous amounts of plastic waste and agricultural soil and general environmental contamination (see figures). For example, the Monterey County Regional Waste Management District in California receives 5,700 tons (11.4 million lbs.) of agricultural plastic annually. Based on the acreage of organic strawberries, (approximately 20%), up to ~1-2 million lbs. is likely from organic fields each year. Board members are also concerned about the precedent of allowing petroleum-derived products

to be added directly to soils. The comparative risk of the two production aids leaves some organic community members uncomfortable. In essence, the thinking is “I don’t think the reason to add a new material to the National List should be because we’re trying to mitigate the harms caused by another NL material.”

Precedents of Allowing the Addition of Petroleum Products to Soil

The National List currently allows the use of petroleum-derived products on organic soils. For example, horticultural mineral oils used in crop production are refined from petroleum. Mineral oils are closer in chemistry to petroleum jellies and paraffin, versus other more volatile and toxic petroleum constituents.

PE Mulch Removal and Disposal


Current responsible disposal is to the regional waste management facility



Complete removal is difficult due to breakage



Bank Surveys: Mulch pieces, including microplastics, are found in river and ditch drainages; water carries these plastics to the ocean



Abandoned plastic is costly to remove



Source: DeVetter, Bolda, Krone. https://s3.wp.wsu.edu/uploads/sites/2181/2020/11/2_Use-of-PE-Mulch-in-Strawberry.pptx

However, these materials pose some environmental and health risks, and their use on crops results in direct entry into soil ecosystems.

The NOSB is also proposing allowance of paper pots as planting aids, with the listing to read as follows:

Paper-based crop planting aid. A material that is comprised of at least 60% cellulose-based fiber by weight, including, but not limited to, pots, seed tape, and collars that are placed in or on the soil and later

incorporated into the soil, excluding biodegradable mulch film. Up to 40% of the ingredients can be non-synthetic, other permitted synthetic ingredients at §205.601(j), or synthetic strengthening fibers, adhesives, or resins. Contains no less than 80% biobased content as verified by a qualified third-party assessment (e.g., laboratory test using ASTM D6866 or composition review by qualified personnel). Added nutrients must comply with §§205.105, 205.203, and 205.206.

This proposal requires 80% biobased content, **but allows 20% of the material to be non-biobased**, potentially including nylon and other *non-biodegradable* plastics in the paper pots. The paper-pot proposal is notable because it allows the direct application of non-biodegradable plastics to soil, although the long-term hope is that future products will be 100% biobased. Paper-pot production aids are generally used by small farmers and their contribution to soil plastics is likely to be small compared to the thousands of acres of soil covered by PE films and their possible future BDM film replacements.

Possible Use Restrictions

The Board has considered several options to guide use of BDM films with less than 100% biobased content, if they are approved. Specifically:

1. Allow BDM film use followed by ploughing into soil (with some consideration for off-site transport), with monitoring and assessment to determine whether there are adverse impacts;
2. Restrict BDM film use based on soil types and climates where the BDM film may not biodegrade rapidly;
3. Allow BDM film use but require that it be gathered up at the end of the season followed by on-farm or off-farm composting.

In response to public comments, the Crops Subcommittee has concluded that Option 1, above, is the only reasonable option on which to vote. Soil types and climate are complex, and it is not possible to pre-identify regions and growing practices where use of the BDM films may or may not work (Option 2). Finally, Option 3 does not work because the films become brittle toward the end of the season and cannot be removed intact for later composting.

Public commenters at the April 2021 meeting remain divided, although many farmers and certifiers agreed reducing the requirement of 100% biobased content by a small margin is reasonable. Groups supporting the change included, Oregon Tilth, OWPC, MOSA, PCO, QCS, VOF, NOFA. Many farmers also supported the change. Those opposed included NOC, BP, MOGFA, Cornucopia, and OEFFA, raising concerns about the product being “not ready for prime time”, the potential for environmental contamination, the replacement of plant-based mulches, and that use may not reduce use of PE film-based plasticulture on soils.

III. Proposal

Weighing the risks and benefits of using PE and BDM films, the Crops Subcommittee proposes to allow BDM films that are at least 80% biobased by weight, with the remaining 20% by weight consisting of materials that meet one of the following composting standards: ASTM D6400, ASTM D6868, EN 13432, EN 14995, or ISO 17088 (all incorporated by reference; see [§ 205.3](#)). The CS understands that this recommendation is still aspirational in the sense that no current BDM films meet the 80% biobased content criteria. However, several manufacturers have reported that producing 80% biobased film may be

feasible, and this proposal sets a realistic goal. The CS recommends that use of >80% biobased material be required if and when these materials become available, The CS also recommends ongoing monitoring of new research on BDM and other plastic films and that the NOSB should consider changes to this annotation as information and new products become available.

The CS proposes the following annotation change for biodegradable biobased mulch film:

§205.601 Synthetic substances allowed for use in organic crop production.

(iii) Biodegradable biobased mulch film as defined in §205.2. Must be produced without organisms or feedstock derived from excluded methods.

§205.2.

Biodegradable biobased mulch film. A [synthetic mulch](#) film that meets the following criteria:

(1) Meets the compostability [specifications](#) of one of the following standards: ASTM D6400, ASTM D6868, EN 13432, EN 14995, or ISO 17088 (all incorporated by reference; see [§ 205.3](#));

(2) Demonstrates at least 90% biodegradation absolute or relative to microcrystalline cellulose in less than two years, in soil, according to one of the following test methods: ISO 17556 or ASTM D5988 (both incorporated by reference; see [§ 205.3](#)); and

(3) Must be **at least 80%** biobased with content determined using ASTM D6866 (incorporated by reference; see [§ 205.3](#)).

Vote in Crops Subcommittee

Motion to accept the biodegradable biobased mulch film annotation recommendation.

Motion by: Asa Bradman

Seconded by: Brian Caldwell

Yes: 7 No: 1 Abstain: 0 Absent: Recuse: 0

Approved by Rick Greenwood, Crop Subcommittee Chair, to transmit to NOP August 15, 2021.