Keeping Organic Strong

Paper and Plastic Challenge Organic Values and Principles

Beyond Pesticides participates in the public standard setting process.

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FROM THE EDITOR

The transition to organic land management as a solution to looming environmental and public health threats could not be more urgent. As a part of the group that drafted the *Organic Foods Production Act* (OFPA), and having served on the National Organic Standards Board (NOSB), which was created by OFPA, Beyond Pesticides believes in the importance of public engagement in organic policy making and standard setting. To that end, OFPA established the NOSB as a stakeholder board to advise the Secretary of Agriculture on all aspects of the National Organic Program (NOP), and determine which synthetic substances are allowed in organic production and handling. At twice-a-year public meetings, the board convenes to address issues that are critical to organic integrity, evaluate standards and materials, and issue recommendations that ultimately determine whether those seeking out organic food will trust the USDA organic label and help to grow the organic market. The Spring and Fall 2020 NOSB meetings were held virtually, following a comment period during which the public could submit comments on NOSB proposals. Beyond Pesticides submitted comments on all the proposals, and those comments are posted on our "Keeping Organic Strong" webpage (*bp-dc.org/kos*). We chose to use our comment time during the online meeting to focus on big picture issues that are critical to organic serving as a long-term solution to the devastation caused by chemical-intensive agriculture. We feel compelled in this piece to review the vision of organic, the common ground that is the foundation of a holistic system of soil and plant management in the context of the natural world and all that offers us in sustaining life. We do this to reinforce with the NOSB and the NOP at USDA, the foundational basis of our comments to the board.

Everywhere we turn, we see signs of ecological collapse—wildfires, the insect apocalypse, crashing populations of marine organisms, organisms large and small entangled in plastic, more and more species at risk, rising global temperatures, unusual weather patterns, horrific storms, and pandemics. As an organization focused on one of the most blatant examples of environmental abuse—the dispersal of toxic chemicals across the landscape—Beyond Pesticides, since its formation, has looked to organic land management, agricultural and nonagricultural, as a solution. In this context, we analyze practices and materials that can be harmful to the environment and people. So, it is not surprising that we need to look at the use of plastics and paper in organic production.

From its very beginnings, the organic sector has been driven by an alliance of farmers and consumers who defined organic standards as a holistic approach to protecting health and the environment, with a deep conviction that food production could operate in sync with nature and be mindful of its interrelationship with the natural world—protecting and enhancing the quality of air, water, land, and food. Organic is not just an alternative for people seeking better food—though it is that—or a more profitable way of farming—though we hope it is that, too. It is a path to prevent total ecological collapse. We constantly return to the foundations of organic for inspiration and guidance. When we comment

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on organic policy and standards, we are not interested in what is simply *less harmful*. In fact, because we are faced with an urgency to prevent ecological disaster and collapse, it becomes increasingly important that the organic agriculture sector lead the way in modeling a truly sustainable relationship with the environment. This requires an ongoing assessment of practices and materials (products) that are allowed and prohibited in organic systems through a public process of stakeholders in the organic community—the National Organic Standards Board (NOSB)—who adhere to the standards in the *Organic Foods Production Act* (OFPA).

In contrast to the reductionism of "conventional" chemical-intensive agriculture, the origins of organic agriculture are in holistic and ecological thinking. Historically, perhaps the most important principle of organic production is the "Law of Return," which, together with the foundational philosophy "Feed the soil, not the plant" and the promotion of biodiversity, provide the ecological basis for organic production.[1] Together these three principles describe a production system that mimics natural systems.

The Law of Return. In an organic system, residues are returned to the soil by tillage, composting, or mulching. While most organic growers depend on some off-site inputs, most of the fertility in a soil-based system comes from practices that recycle organic matter produced on-site. The cycling of organic matter and on-site production of nutrients—as from nitrogen-fixing bacteria and microorganisms that make nutrients in native mineral soil fractions available to plants—is essential to organic production. The Law of Return is not about feeding plants, but about conserving the biodiversity of the soil-plant-animal ecological community.

The Law of Return says that we must return to the soil what we take from the soil. Non-crop organic matter is returned directly or through composting plant materials or manures. To the extent that the cash crop removes nutrients, they must be replaced by cover crops, crop rotation, or additions of off-site materials, when necessary.

Feed the soil, not the plant. The dictum to "Feed the soil, not the plant" reminds us that the soil is a living super-organism that supports plant life as part of an ecological community. We do not feed soil organisms in isolation, to have them process nutrients for crop plants; we feed the soil to support a healthy soil ecology, which is the basis of terrestrial life.

Biodiversity. Finally, biological diversity is important to the health of natural ecosystems and agroecosystems. Biodiversity promotes ecological balance, which protects farms from outbreaks of damaging insects and disease. It supports the health of the soil through the progression of the seasons and stresses associated with weather and farming. It supports our health by offering a diversity of foods. Ultimately, holistically

healthy, truly organic, farms produce healthy plants that require far fewer applications of insecticides and fungicides (even if approved for organic production).

The definition of "organic production" in the organic regulations requires the conservation of biodiversity. As stated in the National Organic Program (NOP) Guidance on Natural Resources and Biodiversity Conservation (NOP 5020),

> The preamble to the final rule establishing the NOP explained, "[t]he use of 'conserve' [in the definition of organic production] establishes that the producer must *initiate practices to support biodiversity* ***and*** *avoid, to the extent practicable, any activities that would diminish it.* Compliance with the requirement to conserve biodiversity requires that a producer incorporate practices in his or her organic system plan that are beneficial to biodiversity on his or her operation." (76 FR 80563) *[Emphasis added.]*

Thus, it is not enough to say one is *not diminishing* soil and plant biodiversity–organic practitioners must take active steps to *support* biodiversity. On an organic farm, many practices support biodiversity–from crop rotations to interplanting to devoting space to hedgerows and other nonproductive uses.

At the time of the passage of the OFPA, the organic community's characterization of soil as alive was viewed with amusement by the "conventional" agriculture experts, who saw soil as a structure for supporting plants, while farmers poured on synthetic nutrients–and the poisons that had become necessary to protect the plants growing without the protection of their ecological community. Interestingly, organic producers at that time compared conventional agriculture to hydroponics.

A quote from the *Omnivore's Dilemma* (2006) by Michael Pollan can help give us some perspective on the importance of organic as envisioned by the pioneers of the practices and the drafters of OFPA:

> To reduce such a vast biological complexity to NPK represented the scientific method at its reductionist worst. Complex qualities are reduced to simple quantities; biology gives way to chemistry. As [Sir Albert] Howard was not the first to point out, that method can only deal with one or two variables at a time. The problem is that once science has reduced a complex phenomenon to a couple of variables, however important they may be, the natural tendency is to overlook everything else, to assume that what you can measure is all there is, or at least all that really matters. When we mistake what we can know for all there is to know, a healthy appreciation of one's ignorance in the face of a mystery like soil fertility gives way to the hubris that we can treat nature as a machine.

Newspaper and Other Recycled Paper

When OFPA was passed, and when the first NOSB worked on the first rule, organic growers saw newspapers as a natural, or nearly natural, solution to difficult mulching situations. In those cases, newspaper or other repurposed paper could be combined with other natural mulches to provide a more impermeable layer between plants—a layer that would decompose, adding organic matter to the soil, thus enhancing soil biological activity. It was also seen as recycling plant-based material in order to return nutrients to the land, thus minimizing the use of non-renewable resources. The content of newspaper and paper generally has changed over time.

When newspaper was first evaluated for the National List of Allowed and Prohibited Substances in 1995, it was seen as basically wood pulp with additives. The additives in black ink were considered to be mostly innocuous, while colored inks and glosses were prohibited because of the hazards they posed. The listing of recycled paper was a fulfillment of the value that organic agriculture should "recycle materials of plant and animal origin in order to return nutrients to the land, thus minimizing the use of non-renewable resources."

Now, fast-forward to NOP's most recent technical review (TR) on newspaper and other recycled paper in 2017. Although being mostly composed of cellulose, starch, and lignin, the TR finds:[2]

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Modern paper products also use a wide variety of synthetic polymers and co-polymers that change the functionality and performance of the paper compared with simple cellulose-starch blends. Aluminum foil and paraffin waxes are added to paper and paperboard used in food packaging. Newspaper and other printed matter have inks, dyes and toner (a solid powder used for electrostatic or electrophoretic printing). Most ink in newsprint and office paper is black, but colored inks and dyes are used on various printed material and packaging. With the advent of color printing processes, more newspapers and office paper applications involve colored ink. More printing is done with colored toner as well. Some papers do not use inks or toner for printing. Thermal paper changes color when heat is applied. The prevalent reactant acid used in thermal paper is bisphenol A (BPA). BPA is also used in flyers, magazines, newspapers, napkins, paper towels, toilet paper and paper cups.

No longer can paper be regarded as "basically wood pulp." In fact, the paper produced with polymers, which may persist after the degradation of the cellulose and lignin from wood pulp, are microplastics and present a range of environmental and public health hazards. Scientists are increasingly concerned about the impacts of microplastics—plastic fragments less than 5mm—on a wide range of organisms. Although concerns were first raised about microplastics in the marine environment, impacts on terrestrial organisms are increasingly documented. Microplastics can cause harmful effects to humans and other organisms through physical entanglement and physical impacts of ingestion. They also act as carriers of toxic chemicals that are adsorbed to their surface.

More fundamental than the issue of balancing resource recovery, by keeping newspaper out of the waste stream, against potential soil contamination are the issues of whether these uses of paper meet OFPA criteria: Are these uses of paper "necessary to the production or handling of the agricultural product because of the unavailability of wholly natural substitute products"? Are they "consistent with organic farming and handling"?

Beyond Pesticides position: As every technical review and NOSB review has stated, there are many natural materials that can be used as mulch. In addition, weed control alternatives include "cultivation, living mulches, hand weeding, flame weeding, crop rotation, and biological control of weeds." For the use of newspaper or other recycled paper to meet the criterion of necessity—as opposed to convenience—it must be required not only that other sources of mulching materials are unavailable, but also that other means of weed control are unavailable.

Plastic in Organic Production

Biodegradable biobased mulch film (BBMF) has been allowed in organic production since 2014, but no products meeting the requirements set by the NOSB are produced. As stated by NOP, BBMF must not contain any non-biobased synthetic polymer feedstocks. At its Fall meeting, the NOSB issued a discussion document that raises the possibility of loosening these requirements (annotation). BBMF results in bits of microplastic that are not fully degraded.

Although microplastics in soil have been less studied, presumably, microplastics in soil make their way in runoff to surface water. Agricultural soils may receive microplastics from sludge/compost fertilization, plastic mulches, and wastewater irrigation.[3]

Microplastics can cause harmful effects to humans and other organisms through physical entanglement and physical impacts of ingestion. They also act as carriers of toxic chemicals that are adsorbed to their surface. Some studies on fish have shown that microplastics and their associated toxic chemicals bioaccumulate, resulting in intestinal damage and changes in metabolism.[4] Soil organisms and edible plants have been shown to ingest microplastic particles.[5] Earthworms can move microplastics through the soil, and microplastics can move through the food chain to human food.[6] Microplastics can have a wide range of negative impacts on the soil, which are only beginning to be studied, but include reduction in growth and reproduction of soil microfauna.[7] When looking at the impact of microplastics, it is important to include the impact of associated substances. As noted above, they can carry toxic chemicals. A review by Zhu et al. cites several studies showing, "[M]icroplastics can serve as hotspots of gene exchange between phylogenetically different microorganisms by introducing additional surface, thus having a potential to increase the spread of ARGs [antibiotic resistance genes] and antibiotic resistant pathogens in water and sediments." [8]

Biodegradable biobased mulch film (BBMF) was approved by the NOSB for use in organic production in October 2012, and the listing was finalized September 30, 2014 as:

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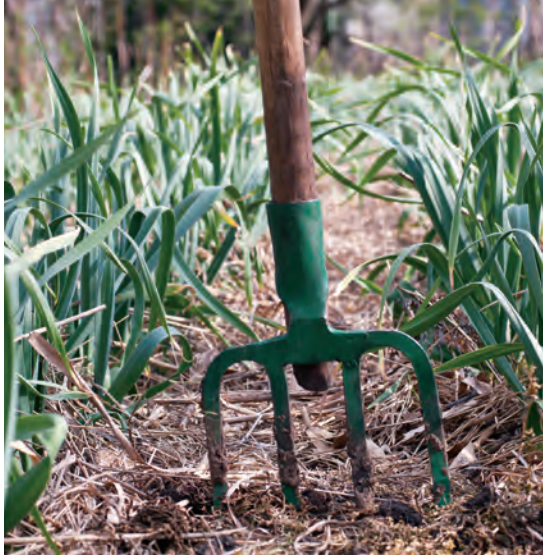

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(iii) Biodegradable biobased mulch film as defined in §205.2. Must be produced without organisms or feedstock derived from excluded methods [e.g., genetic engineering].

The NOP also adopted a definition in §205.2 of the regulations:

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 biobased with content determined using ASTM D6866 (incorporated by reference; see §205.3).

While BBMF was supported enthusiastically by those who saw an opportunity to have the benefits of traditional plastic mulch without the wasteful and labor-intensive practice of carting it off to the landfill at the end of every growing season, others (including Beyond Pesticides) warned that the available products were "not ready for prime time." As predicted, the Organic Materials Research Institute (OMRI) soon announced that no products met the criteria in the National List—that is, 100% biobased and biodegradable. Before long, we were seeing declarations by OMRI, NOP, and the newer members of the NOSB that "there was confusion among Material Review Organizations (MROs) and certification agencies about how much of the feedstocks must be biobased." This so-called confusion existed in spite of clarity from the NOSB in deliberations and listing and despite clarity on the part of NOP in its clarifying memo[9] that the BBMF approved by the NOSB is 100% biobased.

BBMFs are not removed from the field by the grower. Instead, they are tilled into the soil. The tillage process purposefully creates microplastics, with the intention that the action of soil organisms will degrade these small particles. However, as reported in OMRI's 2016 Supplemental Technical Review (STR),[10] many growers report that fragments persist in the soil. OMRI reports that research on the eventual fate of biodegradable mulch films is ongoing. There is, nevertheless, research reported by OMRI indicating that the BBMFs do not completely degrade and may degrade more slowly when tilled under the surface, that they contain components that may be hazardous, and particles may adsorb persistent toxicants.

Beyond Pesticides position: Synthetic mulches should not replace natural mulches like hay, straw, and wood chips. The annotation of BBMF should not loosen restrictions on the bioplastic film.

Natural organic mulches should be the norm in organic production. The use of natural organic materials in compost and mulch is foundational to organic. In 2001, the NOSB[11] gave this definition:

> Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. These goals are met, where possible, through the use of cultural, biological, and mechanical methods, as opposed to using synthetic materials to fulfill specific functions within the system.

The NOSB went on to say that, among other things, an organic production system is designed to: "optimize soil biological activity;" "utilize production methods and breeds or varieties that are well adapted to the region;" "recycle materials of plant and animal origin in order to return nutrients to the land, thus minimizing the use of nonrenewable resources;" and "minimize pollution of soil, water, and air." The use of natural mulches—including cover crops—contributes to all of these values.

Organic production systems are also intended to mimic natural ecosystems. In natural systems, plants are fed by the action of soil organisms breaking down plant residues and excreting substances that are plant nutrients. Natural mulches provide a steady diet of organic matter for those soil organisms. This function is one way that we can judge the compatibility of synthetic mulches with organic values.

Virgin Paper, Paper Production Aids

In August of 2018, the NOSB received a petition to add chain paper pots to the National List for growing and transplanting plants. This petition introduced a number of new issues for consideration:

- The use is not for mulching or composting, but as a pot that would be placed in the ground along with the transplant.
- Although paper pots are not necessary, the chain paper pot system allows transplanting in a relatively low-tech process (without motorized propulsion) that saves the grower much tedious work.
- The paper, as petitioned, contains synthetic ingredients that are not on the National List, but which do occur in recycled paper that is currently allowed.
- The paper is not recycled, but is virgin paper, produced from unbleached Kraft pulp and adhesives. Non-paper synthetic fibers have been used up to 15% in the paper pots, but the manufacturer has proposed that these fibers be replaced by a natural hemp fiber.
- Some of the ingredients may not be biodegradable.
- The Crops Subcommittee also considered expanding the listing to other uses of paper.

From an environmental perspective, the most significant aspect of the paper pots petition is the use of virgin paper. Using recycled paper as a farm input does add a number of synthetic chemicals—not all known—to the farm. However, the use of virgin paper has far-reaching environmental impacts. As summarized by the 2019 TR,[12]

> The environmental impacts of manufacturing virgin paper are considered to be significantly greater than recycling paper. Harvesting trees to make virgin pulp and paper predictably results in soil erosion and water sedimentation through road-building activity, exposure of bare soil, and accelerated water runoff. While forestry best management practices (BMPs) may mitigate these effects, BMPs are not always implemented and there are still environmental quality concerns that have not been addressed by BMPs. Reduction of forest disturbance by recycling is seen as an environmental benefit. One ton of virgin kraft paper requires 4.4 tons of trees to produce; the same amount of recycled kraft paper requires 1.4 tons of recovered paper to produce.
>
> The ability of the forest to sequester carbon is curtailed by harvest. Additionally, recycling waste paper consistently uses less energy and results in fewer greenhouse gas emissions compared with landfilling or incinerating it. Agricultural by-product sources of pulp fiber can mitigate the adverse impacts of the reliance on wood from forests. However, the workers who are making the paper pots are more likely to be exposed to chemicals that have adverse health effects than the farmers and farmworkers using the paper pots or those who eat the food grown from the transplants.
>
> The harvest of trees results in the loss of soil and water-holding capacity in forests and reduces atmospheric carbon sequestration. Biomass cultivation can result in potential loss of biodiversity, soil carbon depletion, increased soil erosion, deforestation, and increased greenhouse gas emissions."

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Beyond Pesticides position: We agree with the decision of the NOSB to send the decision on paper pots back to subcommittee to craft specific language that does not allow paper materials that contain hazardous synthetics or introduce other environmental hazards.

Traditional Plastic for Ground Cover and Mulch

By the time OFPA was passed and the first National List was promulgated, plastic mulch was so routinely used that it was approved unanimously by the NOSB. Nevertheless, some misgivings are reflected in the language of OFPA, prohibiting the use of plastic mulches "unless such mulches are removed at the end of each growing or harvest season." The regulations also prohibit PVC plastic as mulch. Testimony at NOSB meetings indicates that this language is understood by many, but not all, certifiers to allow the continuous use of plastic mulch in perennial crops, such as fruit trees because the "growing season" is continuous. Those using plastic mulch in annual crops report taking truckloads of mulch to the landfill at the end of the growing season.

Does plastic mulch meet OFPA criteria? OFPA requires that a synthetic material on the National List meet three criteria:

1. It is not harmful to human health or the environment;
2. It is necessary to the production or handling of the agricultural product because of the unavailability of wholly natural substitute products; and
3. It is consistent with organic farming and handling.

The NOSB's 2015 sunset review of plastic mulch looked at these criteria in greater depth than before. With regard to impacts on human health and the environment, the NOSB said:

- Polyethylene (PE) is usually derived from either modifying natural gas (a methane, ethane, propane mix) or from the catalytic cracking of crude oil into gasoline, though it may be made from biological sources.
- Use of plastic mulch leads to environmental contamination because used plastic gets taken to landfills, and pieces are left behind on fields.

With regard to the need for plastic mulch "because of the unavailability of wholly natural substitute products," the NOSB and technical reviews have pointed out alternatives. Natural alternatives are organic mulches and living mulches. Alternative practices that could be used include: for weed control, tillage and other mulches; for soil warming, planting adapted plants.

The NOSB and technical reviews have also pointed out reasons that plastic mulch is not compatible with organic farming:

- Solarization kills microorganisms.
- Loss of water: In one season, the loss of water was 2-4 times higher and the loss of soil sediment was three times higher in plots where PE mulch was used compared to those where hairy vetch residues were used.
- The substitution of plastic for natural mulches reduces inputs of organic matter.

Beyond Pesticides position: Organic is a process of continuous improvement and we are advancing practices and materials that move away from plastic in production systems.

Conclusion

Organic mulches have always been a central aspect of organic production. The Rodale *Encyclopedia of Organic Gardening*, for example, begins its long entry on "mulch" with this: "A layer of material, preferably organic material, that is placed on the soil surface to conserve moisture, hold down weeds, and ultimately improve soil structure and fertility. As with composting, mulching is a basic practice in the organic method; it is a practice which nature employs constantly, that of always covering a bare soil."[13]

Reliance on synthetic mulches for functions that can be performed by organic mulch is not compatible with organic production. In addition, more is known about the hazards of the paper and plastic mulch materials that are currently available. If there are necessary functions of synthetic mulches that cannot be supplied by natural mulches, then the entries for paper and plastic mulches should be annotated to limit the synthetic mulches to those uses.

This discussion has not included the use of plastic in packaging of organic products, which is a large issue that the NOSB should also address. Much of the plastic used in packaging ends up in the environment, so the environmental issues discussed above are also relevant. In addition, toxic chemicals may migrate from the packaging into food, and there is a resource conservation issue since plastics are generally sourced from petroleum.

NOTES

1 See Sir Albert Howard. The Soil and Health: The Study of Organic Agriculture (1940), and An Agricultural Testament (1947).

2 2017 TR, Newspaper or Other Recycled Paper. Lines 51-63.

3 Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology, 102*(6), pp.741-749.

4 Li, J., Liu, H. and Chen, J.P., 2018. Microplastics in freshwater systems: A review on occurrence, environmental effects, and methods for microplastics detection. *Water Research, 137*, pp.362-374.

5 Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology, 102*(6), pp.741-749.

6 He, D., Luo, Y., Lu, S., Liu, M., Song, Y. and Lei, L., 2018. Microplastics in soils: analytical methods, pollution characteristics and ecological risks. *TrAC Trends in Analytical Chemistry, 109*, pp.163-172.

7 He, D., Luo, Y., Lu, S., Liu, M., Song, Y. and Lei, L., 2018. Microplastics in soils: analytical methods, pollution characteristics and ecological risks. *TrAC Trends in Analytical Chemistry, 109*, pp.163-172.

8 Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology, 102*(6), pp.741-749.

9 NOP, January 22, 2015. Policy Memo 15-1. Subject: Biodegradable Biobased Mulch Film. From Miles McEvoy, Deputy Director of NOP.

10 OMRI, 2016. TR Biodegradable Biobased Mulch Films.

11 NOSB Principles of Organic Production and Handling. NOSB Recommendation Adopted October 17, 2001.

12 TR Paper Pots and Containers, 2019. Lines 601-622; 675-678.

13 Rodale, J.I. and the staff of Organic Farming and Gardening magazine, 1959. *The Encyclopedia of Organic Gardening*, Rodale Books, Inc., Emmaus, PA. P. 722.

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