National Organic Standards Board
Materials Subcommittee Proposal
2016 Research Priorities
August 9, 2016

INTRODUCTION

Since adopting its Research Priorities Framework in 2012, the National Organic Standards Board or NOSB, a Federal Advisory Committee, has presented a list of research priorities for organic food and agriculture. The priorities are proposed by the NOSB's Livestock, Crops, Handling, and Materials/GMO Subcommittees and are published each year, prior to the fall meeting. The final priorities include feedback from organic stakeholders, which is publicly available through the Federal Register. This document reflects an effort by each Subcommittee to review and prioritize all previous years' priorities from 2012-2015. The topics listed below by subcommittee are the 2016 priorities, including some from previous years that the NOSB thinks are still relevant. The older priorities and their dates of adoption can be found in a list at the end of this proposal.

BACKGROUND

Research needs are prioritized along the following criteria: 1) persistent and chronic, 2) challenging, 3) controversial, 4) nebulous, 5) lacking in primary research, and 6) relevant to assessing the need for alternative cultural, biological, and mechanical methods to materials on the National List[1].

The NOSB encourages collaboration with and between laboratories, federal agencies, universities, foundations and organizations, business interests, organic farmers, and the entire organic community to seek solutions to pressing issues in organic agriculture and processing/handling.

PROPOSAL: 2016 RESEARCH PRIORITIES

Although the NOSB often deliberates on the merits of a single material or process, we recognize that organic operations are a part of a larger whole. The entire farm as a system impacts the welfare of the environment and the animals that are part of that environment. Therefore, the NOSB urges that all research topics presented should be undertaken with consideration of the whole farm system.

---

[1] The National List of Allowed and Prohibited Substances identifies the synthetic substances that may be used and the nonsynthetic (natural) substances that may not be used in organic crop and livestock production. It also identifies a limited number of non-organic substances that may be used in or on processed organic products. The NOSB advises the National Organic Program (NOP) on which substances should be allowed or prohibited.

A whole-farm, systems-based research framework will ensure that the research questions posed demonstrate an understanding of the interplay of the agroecology and the necessary biodiversity of both native and farmed species of plants and animals. This whole-farm, agroecological framework will ensure that confounding variables are carefully recorded as part of a comprehensive and practical approach to the research. Such research could contribute to answering some of the broader questions in organic agriculture such as:

- How can crop species and varieties be specifically adapted to site-specific conditions through plant breeding or cultural practices?
- How does biodiversity contribute to pest and disease resistance?
- What is the relationship between nutrient balancing fertilization practices and microbial life in the soil to susceptibility or resistance to pests?
- How can the need for a diverse agroecological system be balanced with food safety concerns for sustainable organic farming systems?
- How can the complex whole environmental system inform, support, and educate a farmer in developing a farming system plan?

The NOSB encourages integrated research into the following areas:

Livestock

Introduction

In previous years the Livestock subcommittee has suggested basic research priorities on prevention and treatment of pneumonia and mastitis. The consumer expects all organic livestock to be treated well and be healthy. Animal welfare is of critical importance to producers, and consumers expect to be able to observe that their meat, wool, and egg-producing organic livestock are in good health.

In 2015, the NOSB suggested that the research priorities on herd and flock health be changed to reflect a systems review of successful models of livestock production nationwide. Which breeds are doing best under organic management? Are we selecting the most appropriate breeds for high levels of herd and flock health? Which grazing management systems and natural resource conservation practices are producing the highest quality organic product from the healthiest flocks and herds? What factors appear to be contributing to healthy livestock? What agroecosystem and management factors contribute to the healthiest herds and flocks?

In the context as described above, the Livestock subcommittee proposes the following research topics as priorities for 2016:

1. **Evaluation of Methionine in the Context of a Systems Approach in Organic Poultry Production**
   Methionine is an essential amino acid for poultry. Prior to the 1950's, poultry and pigs were fed a plant and meat-based diet without synthetic amino acids such as methionine. As the organic community moves toward reducing, removing, or providing additional restricting synthetic methionine in the diets of poultry, a heightened need exists for the organic community to encourage omnivore producers to assist in marshaling our collective efforts

to find viable alternatives to synthetic methionine, and to help find approaches for making them more commercially available.

Continued research on the use of synthetic methionine in the context of a systems approach (nutrition, genetic selection, management practices, etc.) is consistent with the NOSB's unanimous resolution to encourage the industry to move away from the use of synthetic methionine passed at the La Jolla, California, Spring 2015 full board meeting. A systems approach that includes industry and independent research by USDA/ARS, on-farms, and agricultural land grant universities is needed for:

a. evaluation of the merits of natural alternative sources of methionine such as herbal methionine, high methionine corn, and corn gluten meal in organic poultry production systems,
b. evaluation of poultry breeds selection that could be adaptive to existing organic production systems – inclusive of breeds being able to adequately perform on less methionine, and
c. assessment of management practices for improving existing organic poultry welfare under different conditions.

Research findings and collaborations under various climates, housing types, geographical regions, and countries should be noted and researched, where applicable. These types of research topics are complex, and it could take years to achieve the expressed NOSB resolution. However, an aggressive and/or heightened research focus could lead to findings that can positively impact the organic poultry industry and the organic brand. The continued focus on methionine with a systems approach is imperative and necessary.

The key research areas should include the efficacy and viability of alternatives such as: herbal methionine, corn gluten meal, potato meal, fishmeal, animal by-products, and other non-plant materials. Additional research on the more promising alternatives related to bringing these alternative sources into commercial production is also encouraged. Furthermore, research should be conducted on management practices that impact a flock's demand for methionine, such as flock management practices, access to pastures, and pasture management.

2. Prevention and Management of Parasites

Livestock production places large numbers of cattle, sheep, goats, poultry, etc. into relatively close contact with each other on fields and in barns. Organic production does not allow antibiotic use and requires that livestock are raised in a manner that accommodates the animal's natural behavior. The organic farmer can use a limited number of approved synthetic parasiticides in an emergency but not prophylactically. Use of synthetic parasiticides is limited in organic systems. Even if prophylactic treatment with parasiticides were possible, it is clear that parasite immunity to chemical control will inevitably occur. Thus prevention of parasites is critical.

The research question on prevention and management of parasites must be systems based. What farm systems, animal breeds, and herd or flock management systems have shown the best results with parasite control over the last 20 years? What regional differences exist in the U.S. in parasite prevention? Are there specific herbal, biodynamic, or other alternative treatments that have been proven to work over time? What are the parasite-resistant animal breeds? Are there plant species in pastures and scrublands that could be incorporated into the annual grazing system to reduce the spread of parasites or to provide prevention through the flora, fauna, and minerals ingested? Which pasture management systems appear to be best for parasite prevention in various parts of the country? Are pasture mixes being developed that include plants known to prevent parasites in various breeds?

Crops

1. **Biodegradable Biobased Mulch Film** (*new priority in 2016*)
   This type of mulch film was recently recommended by the NOSB but did not include a specific percentage of biobased components it must contain. In 2015, NOP issued a Policy Memo[2] that states that certifiers and material organizations should review biodegradable biobased mulch film products to verify that all of the polymer feedstocks are biobased. This requirement makes biobased mulches unavailable to organic producers, due to the petroleum-based polymers in these mulch films. In order to provide a recommendation to the NOP addressing the presence of petroleum-based polymers in these mulches, the NOSB requests answers to the following questions:
   - How rapidly do biodegradable biobased mulch films fully decompose, and does the percentage of the polymers in the mulch film affect the decomposition rate? Are there metabolites of these mulches that do not fully decompose?
   - Are there different cropping systems, climate, soil types, or other factors that affect the decomposition rate?
   - What type of 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?
   - Does the use of these synthetic polymers over time affect the balance of soil biology?
   - Is there any cumulative effect if this mulch film is used 3-5 years or more in the same location?
   - Are the available testing regimens adequate to meet the decomposition standards in our definition and to validate the non-GMO status of source materials?

2. **Organic No-Till**
   Organic no-till practices are quite different from herbicide-based no-till systems. Organic no-till, using a terminated, in-place mulching system, can increase soil health and provide for increased biodiversity. Organic no-till preserves and builds soil organic matter, conserves soil moisture, reduces soil erosion, and requires less fuel and labor than standard organic row crop farming. Even though this killed-in-place mulch practice has been used for more than a decade, widespread adoption has not occurred. This type of production is also attractive to conservation minded nonorganic farmers, and more practical information could result in the growth of domestic organic production. There are some land grant universities and federal agencies doing research on this type of production, but more work needs to be

[2] Policy Memo 15-1

done. Increased research is needed to develop organic no-till systems that function for a wide variety of crops in diverse climates and soil types. Annual crops, such as commodity row crops and specialty crops, as well as perennial crops, such as tree fruits, berries, and grapes, would all benefit from these organic no-till practices. Research areas that could be covered include:

- Development of plant varieties that have specific characteristics, such as early ripening, to aid in the effectiveness and practicality of organic no-till.
- Identification of mulch crops, systems, and timing of practices that provide weed management benefits with minimum interference to the crop and yields?
- Research on various techniques that would provide a variety of options for diverse cropping systems including, but not limited to: strip tillage within a killed mulch, mowing or other organically approved techniques versus rolling to terminate the mulch, and living mulches in standing crops.
- Development of systems that allow for either continuous no-till organic crops or for multiple years of organic no-till in the crop rotation.
- Research on how reduced soil disturbance contributes to pest, weed, and disease management?
- Benefits or drawbacks of using this mulching system on weed, pest and disease management, as well as soil fertility, in perennial cropping systems, such as fruits.
- Research about how the use of this system can be managed to improve water retention and permeation, both in annual crops and especially in perennial cropping systems.
- Biodiversity benefits to the living and/or killed mulches, and how they contribute to pest, weed, and disease management.
- Research into what effect the system would have on nutrient balance of the soil and subsequent fertilization practices, including use of outside inputs.
- Research into how this system affects soil microbial life and nutrient availability, given that less soil disturbance improves plant decomposition and therefore provides higher organic matter, and if it results in crops that are less susceptible to disease and pests.

3. Alternatives to Antibiotics (Tetracycline and Streptomycin) for Fire Blight

Prior to October 2014, oxytetracycline and streptomycin were allowed for the control of fire blight in apple and pear trees only. Since 2014, neither substance may be used in any organic practice. Organic apple and pear growers must now find suitable alternatives to control the deadly fire blight disease. Since apples and pears are grown in many regions throughout the United States, alternatives must work in a variety of climates and management systems. The following research issues are important to investigate: location; planting density; choice of varieties of cultivar and rootstock; soil improvement practices; pruning practices and general sanitation; groundcovers or intercrops; pollinator management; dormant copper sprays; bloom thinning/lime sulfur; early, full bloom, and late sprays with approved organic materials to prevent fire blight establishment; surveys for fire blight activity; and other cultural and preventative techniques.

4. **Alternatives to Copper for Disease and Algae Control**

Organic producers have few alternatives to synthetic chemicals to control diseases. Copper has been used for more than a century to control serious diseases in crops such as late blight in tomatoes and fire blight in pears. Because the copper products degrade to elemental copper, continued use over time can cause copper to accumulate in soil. If used improperly or to excess, copper can be toxic to aquatic life and wildlife.

Alternative materials are not yet available to address the many diseases which copper treats. Targeted research is needed to identify management practices and less toxic alternative materials for a wide range of crops. More research is needed on many of the crop/disease combinations.

Some avenues for research:

- Comprehensive, systems-based approaches for managing individual crops in a way that decreases the need for copper-based materials, including researching crop rotations, sanitation practices, plant spacing, and other factors that influence disease.
- Breeding plants that are resistant to the diseases that copper controls.
- Developing alternative formulations of materials containing copper so that the amount of elemental copper is reduced.
- Developing biological agents that work on the same diseases on which copper is now used.
- Evaluating plant nutritional strategies to mitigate the impacts of plant diseases.
- Determining if alternatives, such as sodium carbonate peroxyhydrate or other materials, are suitable alternatives to control scum and algae in rice in an aquatic environment.

5. **Plant Disease Management**

There is a need for research into plant disease management practices and alternative materials, particularly for the humid areas of the country, that decrease reliance on copper or other substances that might have a negative impact on the soil and health of farmworkers. Pathogens include, but are not limited to: Alternaria, Erwinia, Pseudomonas, Xanthomonas, Cercospora, Colletotrichum, Cladosporium, powdery mildew, downy mildew, Phytophthora, Pythium, Mycosphaerella, Phomopsis, Taphrina, Elsinoe, Gnomonia, Fusicladium, Nectria, Phyllosticta, Diplocarpon, Albugo, Guignardia, Botrytis, Exobasidium, Entomosporium, Exobasidium, Pestalotia, Phoma, Cristulariella, and Monilinia fruticosa.

Citrus greening, caused by the bacterium Candidatus Liberibacter, and spread by a disease-infected Asian citrus psyllid, is an emerging problem. Promising avenues of research include disease-resistant varieties, predators and parasites and how they interact with approved materials, nutrition (calcium, boron, and nitrogen have been identified), and botanical oils.

In particular, both biological control of plant diseases and bio-pesticides should be a research priority to support organic growers. A large body of research has shown that plant diseases caused by bacteria and fungi can often be prevented by the application of a non-pathogenic microorganism before infection occurs. Although much basic research has been done to identify microbial biological control agents, there is still a need for commercial development, field testing, and adoption by growers. Biological controls have been researched for late blight of potato and tomato (Phytophthora infestans), several diseases caused by Botrytis cinerea, and powdery mildew (several species) controlled by mites, fungi, and bacteria.

Although many biological controls and bio-pesticides have demonstrated effectiveness in research plots, they have often not succeeded commercially because they can't compete with inexpensive synthetic chemicals used by non-organic farmers. Biological materials are often more expensive than conventional pesticides, and they need be applied before disease is apparent. In the past, there was little market for biological controls because the organic acreage was limited. Now that organic acreage has increased, the market for alternative plant disease controls has also increased which can spur commercialization of natural methods of disease control. The availability of biological controls for plant diseases can also make it more feasible for conventional farmers to transition to organic, thus benefitting organic consumers.

6. Mitigation Measures for Residues in Compost

Residues of pesticides in compost material are a problem that requires research, according to the Organic Materials Research Institute (OMRI). Because of the importance of compost to organic management systems, research is needed on: types of mitigation measures that are efficacious; identification of problematic feedstock (e.g. cotton-based materials and yard waste); types of corrective action; and if thresholds for allowable residues are established, testing guidelines. This is more important than ever with events of 2016 regarding contamination in compost.

<u>Handling</u>

1. Chlorine Materials and Alternatives

The three chlorine materials currently allowed for use in organic agriculture are widely used in farming and handling to clean and disinfect equipment, surfaces, and produce. There have been some concerns raised about these materials and their impact on the environment and human health when/or if they form trihalomethanes and other toxic compounds. New FDA regulations on food safety (Food Safety Modernization Act) and best management practices for cleaning in handling operations both require a suitable level of cleanliness and disinfection to prevent pathogens from entering the food supply. Producers and handlers are looking for alternatives to chlorine while continuing to provide a safe end product to their customers and the consumer. Addressing food safety while adhering to the fundamental organic principles involving human health and environmental impact is a concern.

The organic industry needs better information on how either alternative materials or appropriate chlorine materials are best suited for a specific use and control measure. This is especially important in determining if the industry can move away from the use of chlorine compounds in the future.

Points of consideration for future research activities:

- Comparison of alternatives to chlorine such as: citric acid, hydrogen peroxide, ethanol, isopropanol, peracetic acid, and ozone. How would each compare to the different chlorine materials for specific uses? The strengths and weaknesses would need to be considered.
- Potential human health and environmental impacts of each chlorine material versus the possible alternative materials listed above. Are there ways that these impacts can be mitigated and still allow the material to work as needed?
- Determination of which of the above mentioned alternatives would NOT be a suitable substitute for chlorine. What specific uses and/or conditions would this apply to?
- Identification of practices that could be used to help reduce the formation of trihalomethanes in those specific situations where chorine is the best material to use.
- Research about whether rotation of materials for cleaning and disinfecting could help lower the risks from chlorine materials and still be effective in providing the desired control of pathogens.
- Research on the absorption of chlorine by produce from its quantity and use in wash tanks, including information about amount of time of exposure. Would this be a persistent residual effect or temporary (if temporary – how long is it a viable residue), and would it be harmful if consumed at these levels?

2. **Celery Powder**

Celery Powder is used in a variety of processed meat product (hot dogs, bacon, ham, corned beef, pastrami, pepperoni, salami, etc.) to provide “cured” meat attributes without using prohibited nitrites (note: products must still be labeled “uncured”). Celery powder is naturally high in nitrates that are converted to nitrites during fermentation by a lactic acid culture. It has proven difficult to produce celery powder under organic production practices with sufficient levels of nitrates for cured meat applications. Are there growing practices or regions that could produce celery under organic conditions that would yield a crop with sufficient nitrate content for cured meat applications? Are there agriculturally derived substances (other than celery) that could be produced under organic production practices that provide nitrate levels sufficient for cured meat product applications of comparable quality?

3. **Alternatives to Bisphenol A (BPA)**

The Handling subcommittee plans to take up the issue of whether to prohibit BPA in packaging material used for organic foods in light of mounting evidence that it may be harmful. There is a need for increased research about suitable alternatives for the linings of cans used for various organic products such as tomatoes, beans, and soups.

4. **Consumer Demand**

The NOSB often receives comments from stakeholders that consumers have expectations about what organic means and what inputs and ingredients should be in organic food. Sometimes there is a wide difference between what consumer activist groups claim and sales of specific categories of organic products in the marketplace. How can the NOSB determine whether the consumers and groups who speak up are truly representing all consumers of organic, and is there a better measure of consumer preference and expectations for organic products than sales figures? Research showing the distribution curve of consumer preferences and expectations around organic products would be helpful.

Materials/GMO

In previous years, the Materials subcommittee has prioritized the Reduction of genetically modified content of breeding lines (2013) and seed purity from GMOs (2014). These issues are currently being addressed through an NOSB Seed Purity task force.

1. **Fate of genetically engineered plant material in compost**
   What happens to transgenic DNA in the composting process? Materials such as cornstalks from GMO corn or manure from cows receiving rBGH are often composted, yet there is little information on whether the genetically engineered material and traits break down in composting process. Do these materials affect the microbial ecology of a compost pile? Is there trait expression of Bt (*bacillus thuringienses*) after composting that would result in persistence in the environment or plant uptake?

2. **Integrity of breeding lines and ways to mitigate small amounts of genetic presence**
   Are public germplasm collections that house at-risk crops threatened by transgenic content? Breeding lines may have been created through genetic engineering methods such as doubled haploid technology, or they may have had inadvertent presence of GMOs from pollen drift. The extent of this problem needs to be understood.

3. **Prevention of GMO contamination: Evaluation of effectiveness**
   How well are some of the prevention strategies proposed by the NOSB working to keep GMOs out of organic crops? For instance, how many rows of buffer are needed for corn? How fast does contamination percentage go up or down if there are more or fewer buffer rows?

   Other questions could include: whether cleanout of combines and hauling vehicles reduces contamination using typical protocols for organic cleaning; whether situating at-risk crop fields upwind from GMO crops can reduce contamination; and what role pollinators may have in spreading GMO pollen.

   Lastly, research is needed on a mechanism to provide conventional growers incentives to take their own prevention measures, to prevent pollen drift and its impact on organic and identity-preserved crops. This is policy research rather than field research but is equally as important.

Previous Years' Research Priorities

For more detailed information about each topic, please see the relevant research priorities proposals. Each topic's listing year is indicated.

Whole Farm Systems (2012, 2013)
Evaluation of Copper Sulfate for Rice (2012)
Evaluation of Genetically Modified Vaccines (GMO) (2012, 2013)
Organic Aquaculture (2012, 2013)

Carageenan (2012)
Aquatic Biodiversity (2013)
Pastured Poultry and Salmonella (2013)
Commercial Availability Assessments (2013)
Herd and Flock Health (2013, 2014, 2015)
Risk Reduction from Off-Target Exposure to Non-Permitted Materials (2014)
Seed Purity from GMO (2014)
Mastitis (2014)
Pneumonia (2014)
Plant Extracts (2014)
Soil Building Practices (2014)

Subcommittee Vote:

Motion to adopt the proposal on 2016 NOSB Research Priorities
Motion by: Emily Oakley
Seconded by: Trace Favre
Yes: 6 No: 0 Abstain: 0 Recuse: 0 Absent: 0