USDA National Organic Standards Board Research Priorities, 2017

Executive Summary

Overall: The National Organic Standards Board requests that integrated research be undertaken with consideration of the whole farm system, recognizing the interplay of agroecology, the surrounding environment, and both native and farmed species of plants and animals.

Livestock

1. Evaluation of methionine in the context of a systems approach in organic poultry production.
2. Prevention and management of parasites, examining breeds, geographical differences, alternative treatments, and pasture species.
3. Organic livestock breeding for animals adapted to outdoor life and living vegetation.

Crops

1. Examination of decomposition rates, the effects of residues on soil biology, and the factors that affect the breakdown of biodegradable biobased mulch film.
2. Organic no-till practices for diverse climates, crops, and soil types.
3. Alternatives to antibiotics (tetracycline and streptomycin) for fire blight control in apples and pears.
4. Alternatives to copper for plant disease and algae control: development of disease-resistant varieties, and particular research on algae control in rice.
5. Plant disease management through crop rotations, sanitation practices, plant spacing and disease-resistant varieties, and biopesticides.
6. Mitigation measures for pesticide residues in compost, including identification of problematic feedstock.
7. Management and control of spotted wing drosophila in fruits.

Coexistence

1. Outcome of genetically engineered (GMO/GE) material in organic compost.
2. Evaluation of public germplasm collections of at-risk crops for the presence of GE traits, and ways to mitigate small amounts of unwanted genetic material in breeding lines.
3. Techniques for preventing adventitious presence of GE material in organic crops, and evaluation of the effectiveness of current prevention strategies.

Food Handling and Processing

1. Comparison of alternatives to chlorine materials in processing: impact mitigation, best management practices, and potential for chlorine absorption by produce.
2. Production of celery for celery powder yielding nitrates sufficient for cured meat applications, and investigation of agriculturally derived alternatives.
3. Suitable alternatives to BPA (Bisphenol-A) for linings of cans used for various products.

National Organic Standards Board
Materials Subcommittee Proposal
2017 Research Priorities
August 8, 2017

INTRODUCTION

For the past six years, the National Organic Standards Board (NOSB), 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 at its annual fall board meeting, and reflect both written and oral public comments received by the Board. The topics listed below by Subcommittee are the 2017 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: 2017 RESEARCH PRIORITIES

The NOSB encourages integrated, whole farm research into the following areas:

<u>**Livestock**</u>

1. Evaluation of Methionine in the Context of a System 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. One former NOSB member stated, in §205.237(5) (b), "We have seemingly made vegetarians out of poultry and pigs". As the organic community moves toward reducing, removing, or providing additional annotations to synthetic methionine in the diets of poultry, a heightened need exists for the organic community to rally around omnivore producers to assist in marshaling our collective efforts in finding 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 unanimous resolution passed at the La Jolla, California, Spring 2015 full board meeting. A systems approach that includes industry and

[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.

independent research by USDA/ARS, on farms, and by agricultural land grant universities is needed for (1) 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, (2) 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 (3) 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. Certainly, the fruition of these types of research topics 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 to bring them into commercial production is also encouraged. Additionally, management practices impacting the flock's demand for methionine should be included, 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 be raised in a manner which approximates the animal's natural behavior. The organic farmer can use synthetic parasiticides in an emergency but not prophylactically. Synthetic parasiticides have many limitations. 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, herd or flock management systems have shown the best results with parasite control over the last 20 years? What regional differences are there in the US 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 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?

3. Organic Livestock Breeding (*new in 2017*)

Organic rules require livestock products originate from animals that are not confined and are adapted to outdoor living as well as obtaining feed from living vegetation. A current FAO report states that globally one third of pigs, half of all egg layers, two thirds of milk animals, and three quarters of meat chickens are produced with breeds more suited to confinement or "industrial" production systems than a typical organic farm or ranch. Similar to plant breeding, the organic community sees a great need for regionally-adapted and publicly available livestock breeds that can thrive in organic systems.

Heritage, native regional breeds, and breeds used in the EU and other areas of the world that are typically more adapted to organic systems are still present but in small numbers. Increased research on the breeding, production needs, and improvement of these breeds is needed. Traits for good conversion rates from grazing to milk or meat, meeting consumer expectations for quality, as well as having the constitution and temperament to thrive outdoors would increase both the profitability and resiliency of organic livestock operations. Animal breeds that may have immunity to a variety of diseases and parasites would be useful traits to research and incorporate in a breeding program.

Crops

1. Biodegradable Biobased Mulch Film

This type of mulch film was recently approved 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 answers to the following questions would be useful to develop more clarity on mulch films and possibly develop an additional annotation to address any concerns:

- How rapidly do these mulches 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 testing regimens available adequate to meet the decomposition standards in our definition and to validate the non-GMO status of source materials?
- Even though petroleum-based polymers may be developed so they are consumed completely by the microbiological life in the soil, is the balance of various nutrients and/or biological life different from the decomposition of biologically-based materials? Is there any comparison between decomposing petroleum-based polymers and the effects that petroleum based fertilizers and other inputs have on soil biological life in nonorganic agricultural systems?

2. Organic No-Till

Organic no-till practices are quite different from herbicide-based no-till systems. Organic no-till, using a terminated cover crop for in-place mulching, 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. There can also be some challenges from organic no-till using a cover crop, such as occasional insect infestation associated with the cover crop.

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 done. Increased research is needed to develop organic no-till systems that

[2] Policy Memo 15-1

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.
- Which mulch crops, systems, and timing of practices provide specific weed management benefits to support crop growth and yield?
- 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 cover crop, 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.
- How does the lessened soil disturbance of this system contribute to pest, weed, and disease management?
- What specific insect problems can be caused or exacerbated by cover crops used as mulches, and how can those problems best be managed?
- In perennial cropping systems, such as fruits, what are the benefits or drawbacks of using this mulching system on weed, pest and disease management, as well as soil fertility?
- How can the use of this system be managed to improve water infiltration and retention in annual and perennial cropping systems?
- What are the biodiversity benefits to these living and/or killed mulches, and how does this contribute to pest, weed, and disease management?
- Does this system affect the nutrient balance of the soil and subsequent fertilization practices, including use of outside inputs?
- Based on the improved soil health when there is less soil disturbance and more plant decomposition resulting in higher organic matter, how does this system affect soil microbial life and nutrient availability, and does this then result 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 throughout the United States in many regions, these 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 fewer alternatives of 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 and crops on which copper is used. 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 that copper is now used on.
- Evaluating plant nutritional strategies to mitigate the impacts of plant diseases.
- Particular research on scum and algae control in rice and whether sodium carbonate peroxyhydrate or other materials are suitable alternatives 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. Genera of 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 measure 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 are required. This is more important than ever with events of 2016 regarding contamination in compost.

7. Management and Control of Spotted Wing Drosophila in Fruits (*new in 2017*)

There is a large pool of research on the control of insects and diseases using organic methods. Many controls use a systems approach and are quite effective. The introduction of new invasive species into cropping systems threatens these systems approaches, and in several cases the organic control options are very limited or nonexistent. Spotted wing drosophila is a relatively recent invasive insect that infests soft fruits, such as berries, and many other fruits as well. Infestation renders fruit unusable since insect larvae feed inside the fruit and may reach critical levels before fruit is harvested. This insect is particularly problematic in that it has the ability to oviposit in green fruit and that it has multiple generations throughout the summer, creating an extensive control period. There is only one control material available, spinosad, and it is in danger of overuse. The control period may also extend so long that maximum label rates are used before the season ends. A second invasive insect is brown marmorated stink bug, and at this time there are no organic control measures beyond attempts at mass trapping. Research into organic control options for both these invasive pests is critical so that organic growers can integrate controls into their organic systems.

<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.
- Could the rotation of materials for cleaning and disinfecting 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 products (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 is examining the issue of whether to prohibit BPA in packaging materials used for organic foods in light of direct evidence that these uses result in human exposures and mounting evidence that these exposures may be harmful. There is a need for increased research about alternatives for the linings of cans and jars used for organic products that do not result in human exposures and health risks.

<u>Materials/GMO</u>

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 a Genetic Integrity of Seeds Ad Hoc Working Group.

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 thuringiensis*) 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 Unwanted Genetic Material

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 Crop 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 examples could be 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 the role may be of pollinators 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.

<u>Previous Years' Research Priorities</u>

For more detailed information about each topic, please see the relevant research priorities recommendations. 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)
Consumer Demand (2013, 2016)

Subcommittee Vote:
Motion to adopt the proposal on 2017 NOSB Research Priorities
Motion by: Emily Oakley
Seconded by: Dave Mortensen
Yes: 5 No: 0 Abstain: 0 Recuse: 0 Absent: 0

Approved by Harriet Behar, Subcommittee Chair, to transmit to NOSB August 22, 2017