National Organic Standards Board
Materials Subcommittee
Proposal: Research Priorities for 2015
August 24, 2015

Introduction
A Recommendation for a Framework to set Research Priorities was approved at the National Organic Standards Board (NOSB) meeting in May 2012. Part of that recommendation was that the research priorities from the previous year of NOSB deliberations would be presented at each fall meeting. Additional information about the background and NOSB Research prioritization can be found in the previous Materials Subcommittee papers from fall 2011 and spring 2012.

Background
The reasons for encouraging research into organic production systems are well discussed in the previous two Materials Subcommittee papers from fall 2011 and spring 2012.

The recommendation that was passed recommends that potential topics be prioritized. The criteria for prioritization are for those topics that the NOSB believes will have the largest long-term impact on growth and integrity of organic agriculture. These criteria are not presented in order of importance, but will be evaluated by the Materials Subcommittee in selecting the top research needs.
Criteria for research topics are:
• Persistent and chronic (i.e., perennial topics of debate and need)
• Challenging
• Controversial (i.e., topics on which there are widely differing perspectives or for which there have been close NOSB votes)
• Nebulous (i.e., the research need is hard to identify but the organic agriculture need is clear). For example, improved methods of weed control.
• Lacking in primary research. That is, topics for which there is no active research being conducted, primarily relating to the criteria in OFPA for review of materials.
• Relevant to assessing the need for alternative cultural, biological, and mechanical methods to materials on the National List.

In 2012, the NOSB adopted research priorities and identified topics for future review. In 2013, the Materials Subcommittee proposed research priorities and identified topics for future review; however they were not adopted by the NOSB until spring of 2014 because the fall 2013 meeting was cancelled due to a government shut down. Each fall, after a recommendation is finalized by the NOSB, the Chair of the Board will make sure it is sent to the primary organic research funders and stakeholders.

The NOSB requests the collaboration of national laboratories, foundations, organizations, federal agencies, land-grant institutions, non-land grant colleges, individuals, organic farmers, and the organic community in carrying out research, education, and training activities related to facilitating the development of organic agriculture, handling, processing, and organic foods.

The following research priorities seek to solve critical organic agricultural challenges and problems. The issues are often interrelated and should be viewed through an organic whole farm integrated approach as determined through the criterion of the organic system plan. All of the 2015 research topics are priorities.

The NOSB encourages organic agricultural integrated research in the following areas:

Research Priorities 2015

2015 Materials and GMO ad Hoc Research Priorities

Prevention of GMO Contamination: Evaluation of effectiveness

Last year we posed the research topic to find out how contaminated organic at-risk crops are from different sources; i.e. whether there is more contamination coming in from seed, from drift, or from handling practices.
While this is still badly needed, we also would like to see some data of how well some of the Prevention Strategies proposed by the NOSB work at keeping GMOs out of organic crops. For instance, how wide (or how many rows) of buffer are needed for corn? As a follow up to that, 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 reduce contamination using typical protocols for organic cleaning, whether siting at-risk crop fields upwind from GMO crops can reduce contamination, and what the role may be of pollinators in spreading GMO pollen.

Lastly there needs to be research on a mechanism to provide conventional growers incentives to take their own prevention measures to prevent GMO drift and impact on organic and identity preserved crops. This is policy research rather than field research but is equally as important.

2015 Livestock Subcommittee Research Priorities

Organic Agriculture is a systems based certification program. Systems research is complex. It takes time, perhaps 20 years or more, and is not easily replicable. It takes into account the "confounding variables" and tries to understand the synergy in a system and the impact of internal and external factors. Without a quick clear result, funding for such systems research is hard to obtain.

By contrast the traditional, academic, funded research is to pose a narrow, clearly defined question, usually as a null hypothesis, and develop a research protocol which will allow an answer to the question in as short a time as possible. Results must be replicable in order to have peer reviewed acceptance and satisfy the funder. Such research specifically tries to eliminate the confounding variables, like the context of the farm field, in order to obtain the highest level of accuracy in answering the narrow question posed. Such basic research is typically laboratory based. Basic research provides critical detail and indicates topics for further research.

Over the last 25 years organic agriculture has become a well-established agriculture system and the research questions can now be posed within the context of established farms in various geographic regions of the country. This need for systems research is very clear when looking at trends in organic livestock production.

Asking the Right Question! We need both basic research and systems research, but the emphasis for livestock research priorities for 2015 is a systems approach to questions which the NOSB has raised in various forms in the past, and which continue to be of issue.

1. 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 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.

So 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 which have proven to work over time? What are the parasite resistant breeds? Are there plant species in pastures and scrub lands that could be incorporated into the annual grazing system to reduce 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 which include plants known to prevent parasites in various breeds?

2. Herd and Flock Health

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

In 2015 we suggest that the research priorities on heard and flock health should move to a systems review of successful models of livestock production nationwide. Which breeds are doing best being managed under organic management? Are we selecting the most appropriate breeds to be able to have high levels of herd and flock health? Which grazing management systems are producing the highest quality organic product from the healthiest flocks and herds? What factors on case studied farms appear to be contributing to healthy livestock? What internal and external factors contribute to the healthiest herds and flocks?

3. Evaluation of on Methionine in the Context of a System Approach in Organic Poultry Production

Continued research on the use of synthetic methionine in the context of a system approach (nutrition, genetic selection, management practices, etc.) is consistent with the National Organic Standards Board (NOSB) unanimous resolution passed at the La Jolla, California, spring 2015 full board meeting. Methionine is an essential amino acid in poultry diets. A system approach that includes industry and independent research by USDA/ARS, on-farms, and agricultural land grant universities is needed for (1) evaluation of merits of natural alternatives source of methionine such as herbal methionine, high methionine corn, 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 animal welfare under different conditions. Research findings and collaborations under various climates, housing types, geographical regions, and countries should be noted and research wherein 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 positive findings that can positively impact the organic poultry industry and the organic brand. The continued methionine focus *in globo* with a system approach is imperative and necessary.

2015 Handling Subcommittee Research Priorities

Chorine Materials

The three chlorine materials on the National List are widely used in farming and handling to clean and disinfect equipment, surfaces and produce. There is compelling and building evidence that these materials are harmful to the environment and to humans when they form trihalomethanes and other toxic compounds. Yet the new regulations on food safety and best management practices for cleaning in handling operations both require a suitable level of cleanliness to prevent pathogens from entering the food supply. The organic industry needs better information on alternatives for specific situations to determine if moving away from chlorine compounds can be implemented in the future.

The following points are particular areas for research activities:

- Alternatives that work in some situations include citric acid, hydrogen peroxide, ethanol and isopropanol, peracetic acid, and ozone. Which specific situations will these materials be able to substitute for chlorine?
- Which specific applications will the above materials NOT be able to substitute for chlorine?
- Are there practices which can reduce the formation of trihalomethanes in situations where chlorine must be used?
- Would rotating the choice of materials used for cleaning help lower the risks from the chlorine materials while still being effective against pathogens?
- Can chlorine be taken up by produce from the amount being used in wash tanks and the amount of time of exposure? If so, how much and how harmful is this if consumed?
- Is there a maximum level of chlorine that should be adopted by the NOSB as well as a residual level in rinse water, to prevent absorption by produce or other harmful effects?

2015 Crops Subcommittee Research Priorities

Alternatives to Copper for disease and algae control
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, the 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. The Crops Subcommittee does not feel that a Technical Report (TR) alone will be able to get specific enough about alternatives for each disease in each crop and 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 is necessary for.
- Developing alternative formulations of materials containing copper so that the amount of elemental copper is reduced from current formulations.
- Developing biological agents that work on the same diseases that copper is now used on.
- Evaluating 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 and aquatic environment.

Previous Years Research Priorities
These research priorities are listed to inform institutions and our organic stakeholders of the need for continued relevant research in these critical areas that impact every day organic agriculture, production and management:

1. Organic Whole Farm Systems
a) Whole farm systems and impact on diversity of habitat, cropping systems, biological life, pest and disease resistance, the relationship between nutrient balancing fertilization practices and microbial life in the soil and susceptibility or resistance to pests, the need for diverse ecological systems, food safety and sustainable organic farming systems, etc.

b) Alternatives to antibiotics (tetracycline and streptomycin) for fire blight. The studies should examine 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 is critical.

c) 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 workers. Assessment of pathogens including, 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.

d) 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 examining disease-resistant varieties, predators and parasites and how they interact with approved materials, nutrition (calcium, boron, and nitrogen have been identified), and botanical oils.

e) Biological control of plant diseases and bio-pesticides. 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.

f) Nonsynthetic practices and materials that build soil health and accelerate development of organic matter in the soil, i.e. humates.

g) Evaluating organic no-till practices as a subset of the whole farm systems. Studies that examine the relationship of biodiversity and pest and disease resistance, the relationship between nutrient balancing fertilization practices and microbial life in the soil and susceptibility or resistance to pests, and research into organic no-till should address practices that lead to effective weed control with minimum interference with the crop.

2. Genetically Modified Organisms (GMOs)

a) The fate of genetically engineered plant material in organic compost. Studies that evaluate the microbial ecology of compost. Is there trait expression of BT (Bacillus thuringienses) after composting? The impact of residues of pesticides in compost material. Because of the importance of compost to organic management systems, the 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 are required.

b) Reduction of genetically modified content of breeding lines.

c) Seed purity. Research evaluating how much crop contamination is occurring from seeds as a vector compared to drift or handling practices.

d) Breeding lines, foundation seed and ways to mitigate small amounts of genetic presence in breeding lines. Evaluates public germplasm collections that house at-risk crops for contamination. 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 researched.

e) Risk reduction from off-target exposure to non-permitted materials. Successful coexistence suggests that organic farms can exist without harm, consistent with consumer and farmer choice to avoid or minimize contamination. Avoidance or minimization may be achieved through users of GMOs and pesticides adopting practices that prevent non-permitted materials in OSPs from causing involuntary exposure by moving off their target site. Research efforts are needed that examine alternative strategies that can a) develop and examine management practices that enhance public and farmer awareness of at-risk organic farms, b) identify effective practices and standards that will prevent non-target impacts of materials used on farms not certified organic, and c) best methodologies to provide information and training. Are there strategies in place or that could be put in place that can provide information, training, to enhance public awareness of at-risk organic farms? Which methodologies are successful in ensuring risk reduction from materials not permitted under organic standards?

3. Organic livestock production and management systems

a) Preventative organic practices to improve organic livestock health are critical and of high importance. These include general animal health as it relates to diseases prevention, uterine infections in peri-parturient animals, growth, and identification of vaccine types, nutrition, and production systems. It thus encompasses some of the more specific issues and is also related to the 2012 and 2013 priority of whole farm systems research.

b) Pastured poultry and salmonella. The assessment of preventive organic practices to improve organic livestock health is critical and of high importance. Research that could lead practitioners to better prevention strategies, that would improve health and management practices that minimize health issues are all important topics. Research examining where Salmonella infections can be introduced from, whether the pasture system has some inherent buffering capacity against pathogens getting a foothold, and the risk involved in raising organic poultry on pasture are key research topics.

c) Ways to find materials for the control of internal and external parasites in organic livestock operations. Research is needed that considers the efficacy of organic treatments used by, recommended to, and available to organic producers.

d) Methods to reduce mastitis. Mastitis is a disease that results in inflammation of the mammary gland. It is generally associated with dairy animals. It can be caused by bacteria, physical injury, etc. Mastitis is one of the most common and expensive diseases of dairy cattle. It can result in reduced milk production, discarded milk, treatment, and veterinary expenses. An urgent need exist for looking at ways to reduce mastitis in dairy herds. The research needs include the areas of herbal treatment of mastitis and management practices, and consider the efficacy of organic treatments used by, recommended to, and available to organic producers. Internal and external parasites control is important to animal welfare, growth, reproduction, and production.

e) Efficacy of organic treatments used by, recommended to, and available to organic producers. Pneumonia in a herd or flock means animals are not performing up to their maximum potential, production costs are higher, labor is increased, and food product quality is compromised.

Responsible animal caretakers know it is their duty and responsibility to address animal welfare concerns and ensure a safe and healthy environment for their animals.

f) Plant extracts to organically control methane producing bacteria in livestock. Plant extracts that could be environmentally and economically beneficial to organically control methane producing bacteria in the animal could lead to practices that reduce methane. Reduced methane results in more energy going to the animal from a given amount of feed. This reduces total feed required to meet nutritional needs and particularly helps grazing animals which have high protein availability.

g) Genetically modified (GMO) vaccines for livestock: A need exists for research and/or outreach on easier ways to determine the types of vaccines. A better way of identifying the types of vaccines is critically important to our stakeholders, especially livestock producers. The testing of products that could be alternatives to GMO vaccines in livestock production is a top priority.

Organic Aquaculture

a) Whole system evaluation of organic aquaculture - closed and open systems. Evaluation of the use patterns of synthetic materials permitted on the National List outside of a defined policy on whole aquaculture systems for plants and animals runs contrary to organic process and practice because the use of a synthetic material must be evaluated relative to a practice norm in which few synthetics are added.

b) Impact of fish waste water on the environment, feed and other supplements such as trace minerals that may have synthetic sources, fish health (diseases and parasites), and fish escapes in open and closed systems. The subcommittee also requests research into defining "organic aquaculture" in a framework that is consistent with OFPA and supportive of materials decisions.

c) Aquatic biodiversity. Organic farmers promote biodiversity in cultivated and uncultivated areas, and are expected to maintain areas like hedgerows, woodlands, wetlands, and wildlife corridors to promote non-crop biodiversity on the farm. Evaluation of terrestrial inputs derived from aquatic environments need to be based on an understanding of impacts.

d) Nutrient and mineral cycling in various aquatic systems, the structure of aquatic food webs, the movement of pollutants in various aquatic systems, bioaccumulation and bioconcentration in aquatic organisms, and the status and impacts of overharvesting and other stresses on aquatic/marine plants and animals. Board members, certifiers, and aquaculture operators all need to know how biodiversity conservation measures should be implemented in aquaculture systems and materials decisions.

4) Public health and risk

a) Impact of the use of the food additive carrageenan on human health.
b) Suitable alternatives to BPA (Bisphenol-A) for linings of cans used for various products including organic tomatoes, beans, and soups.

5) Commercial availability Assessments

Research is requested that examines resources that indicate commercial availability.

The NOSB must make assessments of commercial availability or organic sources every time there is a petition or a sunset review for substances on §205.606 in particular (agricultural substances that may used from non-organic sources). The NOSB requests research that indicates national and global commercial availability and how data was developed.

6) Organic Consumer studies
Research is needed that examines organic consumers and consumer demand. The NOSB requests research indicating the relationship of consumer buying habits and their belief about organic products in the market place. This could include evaluation of national organic consumer preferences and expectations beyond sales of organic products.

The NOSB values the support and hopes that this information will be useful for researchers in many fields to defend and solicit funds for research that benefits organic agriculture and organic food.

Subcommittee Vote

Motion to adopt the proposal on NOSB Research Priorities for 2015
Motion by: Jennifer Taylor
Seconded by: Harold Austin
Yes: 6 No: 0 Abstain: 0 Absent: 1 Recuse: 0

Approved by C. Reuben (Calvin) Walker, Subcommittee Chair, to transmit to NOSB August 25, 2015