

**National Organic Standards Board
Crops Subcommittee Proposal
Hydroponic/Aquaponics/Biaponics
September 6, 2016**

Introduction

The National Organic Program (NOP) established a Hydroponic/Aquaponic Task Force (referred to as Task Force throughout) in 2015 to write a report to the National Organic Standards Board (NOSB) on whether hydroponic/aquaponic production should be allowed under the current organic regulations; and if not, how the regulations could or should be changed. The report was completed in July 2016¹ and now it is up to the NOSB to formulate the input from the report into recommendations.

The issues involved are complicated, not only because of lack of clarity in current regulations, but because of a continuum of growing methods for plants in containers and the lack of a clear set of definitions around containers, growing media, soil, and other terms both in the regulations and in general. Also, there have been contradictory statements from the NOSB in the past and gaps in the NOSB recommendations, which have resulted in gray areas that the NOP does not know how to address in rulemaking.

All of the ramifications are going to take time to sort through and work out by the NOSB Crops Subcommittee, with stakeholder input along the way. We have chosen to break this into three potential components or sections so that we can take a systematic approach to this complex issue. Two of the components will be presented at the Fall 2016 NOSB meeting while the third may be drafted in pending the outcome of the Part 1 proposal. For the purposes of moving forward with uniform terminology, from here on we will use the term "Biaponics," as suggested by the Task Force, to refer to the combined term "Hydroponic/Aquaponic" systems currently employed by organic hydroponic/aquaponics producers.

- Part 1 (this part) is whether Biaponics fits into the Organic Foods Production Act (OFPA) and the USDA organic regulations in CFR Part 205 (referred to throughout as the NOP rule). This is a proposal that will go before the NOSB in Fall 2016.
- Part 2 is a Discussion Document on container systems for solid substrates, including which ones could or should be allowed under the existing NOP Rule and/or which would require a change in the Rule, along with suggestions for what changes need to be made.
- Part 3 will be a Discussion Document on the standards needed for biaponic systems to be allowed under the NOP organic rules, along with possible limits on what sort of systems would qualify as Biaponics. This will occur for spring 2017 if the proposal in part 1 passes.

Background

The NOSB has made several past recommendations on the subject of greenhouse production, which have relevance to this discussion. In a 1995 *Standards for Greenhouses* recommendation, the following statement is made:

“Hydroponic production in soilless media to be labeled organically produced shall be allowed if all provisions of the OFPA have been met.”

This was before there was an NOP rule so the NOSB only had OFPA to guide them.

¹ [Hydroponic and Aquaponic Task Force Report, July 2016](#)

In 2010 the NOSB issued a recommendation titled *Production Standards for Terrestrial Plants in Containers and Enclosures (Greenhouses)*. While this mostly focused on greenhouse production in containers with solid growing media, the following statement is made:

"Observing the framework of organic farming based on its foundation of sound management of soil biology and ecology, it becomes clear that systems of crop production that eliminate soil from the system, such as hydroponics or aeroponics, cannot be considered as examples of acceptable organic farming practices. Hydroponics" "...cannot be classified as certified organic growing methods due to their exclusion of the soil-plant ecology intrinsic to organic farming systems and USDA/NOP regulations governing them."

Furthermore, in 2009 a document titled *Soil-less Growing Systems Discussion Item* contains the following statement:

"In previous Crops Committee discussion documents, the question has been asked: "Should container culture based growing media (typically utilized in greenhouse systems) that are predominately compost and compostable plant materials be considered 'soil'?" As highlighted in earlier portions of this document, a foundational principle of organic farming is the practice of maintaining and nurturing soil health so as to foster the proliferation of the proper soil biology with their accompanying ecologies. Since all typical soil dwelling organisms, such as earthworms, insects, arachnids, protozoa, fungi, bacteria, and actinomycetes can thrive in a properly designed compost based growing media, producing the beneficial symbiotic ecological relationships found in soil, such growing media should be rightfully considered soil."

At the first meeting of the Hydroponic/Aquaponic Task Force in January 2016, the NOP presented information on where they thought there were gaps and inconsistencies in the past NOSB recommendations, both for hydroponics and for greenhouse growing systems in general. Their presentation included the following statement: "Further analysis and clarification is necessary because regardless of what position the NOSB ultimately takes on the issue of hydroponics and aquaponics, the NOP will likely need to undertake rulemaking. Rulemaking requires a comprehensive recommendation from the NOSB that addresses grey (*sic*) areas left by past recommendations."

The gray areas and gaps include the following (paraphrased from original):

- A clear explanation of the basis for each recommendation made.
- Acknowledging the continuum of production methods from field/soil to hydroponic and the role of compost or other biological growing media. Recommendations on each type of production and reasons for allowing or prohibiting.
- Guidelines are needed on exactly how different production types comply with provisions in regulations for soil fertility, rotation, and cover cropping.
- Definitions of vague terms including container, hydroponics, soil-less media, "compost-based", and soil ecology.
- How are OFPA and the NOP rule able to be consistent on other soilless production such as mushrooms, sprouts, aquatic plants and greenhouse in-ground systems?
- What is the justification for requiring soil (as opposed to cycling of resources, promoting ecological balance, and conserving biodiversity) but making an exception for cover crops, crop rotation, etc. when soil is not explicitly required in the regulations, but crop rotation is mandatory?
- Aquaponic systems are not specifically addressed in previous NOSB recommendations.

The lengthy report from the Task Force contains a lot more background information which is too extensive to cover here. Selected portions will be referenced below in the discussion section.

Relevant areas in the Rule

Organic Food Production Act (OFPA)

§6504. National standards for organic production

To be sold or labeled as an organically produced agricultural product under this chapter, an agricultural product shall—

- (1) Have been produced and handled without the use of synthetic chemicals, except as otherwise provided in this chapter;
- (2) Except as otherwise provided in this chapter and excluding livestock, not be produced on land to which any prohibited substances, including synthetic chemicals, have been applied during the 3 years immediately preceding the harvest of the agricultural products; and
- (3) Be produced and handled in compliance with an organic plan agreed to by the producer and handler of such product and the certifying agent.

§6512. Other production and handling practices

If a production or handling practice is not prohibited or otherwise restricted under this chapter, such practice shall be permitted unless it is determined that such practice would be inconsistent with the applicable organic certification program.

§6513. Organic plan

... (b) Crop production farm plan

(1) Soil fertility

An organic plan shall contain provisions designed to foster soil fertility, primarily through the management of the organic content of the soil through proper tillage, crop rotation, and manuring. ...

.... (g) Limitation on content of plan

An organic plan shall not include any production or handling practices that are inconsistent with this chapter.

§6519. Recordkeeping, investigations, and enforcement

(c) Violations of chapter

(1) Misuse of label.... (2) False statement.... (3) Ineligibility

National Organic Program Rule

§205.2 Terms defined.

Crop rotation. The practice of alternating the annual crops grown on a specific field in a planned pattern or sequence in successive crop years so that crops of the same species or family are not grown repeatedly without interruption on the same field. Perennial cropping systems employ means such as alley cropping, intercropping, and hedgerows to introduce biological diversity in lieu of crop rotation.

Field. An area of land identified as a discrete unit within a production operation.

Organic production. A production system that is managed in accordance with the Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity.

§205.202 Land requirements.

Any field or farm parcel from which harvested crops are intended to be sold, labeled, or represented as “organic,” must: (a) Have been managed in accordance with the provisions of §205.203 through 205.206;

§ 205.203 Soil fertility and crop nutrient management practice standard.

- (a) The producer must select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion.
- (b) The producer must manage crop nutrients and soil fertility through rotations, cover crops, and the application of plant and animal materials.
- (c) The producer must manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances....

§205.205 Crop rotation practice standard.

The producer must implement a crop rotation including but not limited to sod, cover crops, green manure crops, and catch crops that provide the following functions that are applicable to the operation:

- (a) Maintain or improve soil organic matter content;
- (b) Provide for pest management in annual and perennial crops;

§205.208 - 205.235 [Reserved]

Discussion

First and foremost, a standardized set of definitions must be adopted to discuss this successfully. Therefore a glossary is appended here of some of the most common definitions taken from the NOSB 2010 Recommendation and the Task Force Report, amended for this proposal.

The writers of OFPA were wise enough to leave many issues somewhat open-ended so that regulations could evolve over time. OFPA also contains several statements that can be perceived to conflict with each other. It then falls to the writers of the regulations to sort through the provisions to develop specific standards. Such is the case with §6512 cited above. This implies that since soil is not specifically mandated, and lack of soil is not specifically prohibited, such practices could be permitted if regulations were written to support them. This is in part what led to the 1995 NOSB statement that hydroponics could potentially be allowed if OFPA requirements were met, and this would be, through regulations, specific to how hydroponic systems are consistent with the rest of organic production. The 1995 NOSB realized that, at that time, hydroponics could not meet the requirements of OFPA, but wanted to leave the door open for future discussions.

The NOP rules as written do not have specific provisions for many specialized areas of production, including mushrooms, aquatic plants, greenhouse, container growing, apiary, or fish. Some of these have been promised for a long time. All of them involve alternative provisions to some of the current clauses in the regulation. In anticipation of this, sections 205.208 - 205.235 were put in as reserved. Under the umbrella of OFPA, such regulations could be recommended by the NOSB and then regulations written by the NOP (*in the future*). In the meantime there are certifiers who have figured out how to certify these operations, presumably with NOP oversight.

The 2010 NOSB made it very clear that they did not believe that hydroponic systems, as they understood them, were compatible with organic production and therefore they recommended that rules be written for "Terrestrial Plants in Containers and Enclosures" but not for hydroponics. They based this decision on the opinion that soil-plant ecology is intrinsic to organic farming systems and USDA/NOP regulations. However there were key gaps in their position:

- Using the parameter of a compost-based growing media without definition of how much compost or how much growing media. Also, there was no definition of soil provided.
- Not recognizing the similarities between crops grown to maturity in containers and hydroponic systems. There is a continuum in container production from plants getting nutrition from the growing media to plants solely getting nutrition from liquid sources. There needs to be specific parameters for growing media components and liquid-based nutrition in organic container systems.
- Not giving adequate reasons for why other soilless productions, such as aquatic plants, mushrooms or sprouts could be organic but not hydroponics.
- Proposing to exempt greenhouse production from crop rotations and cover cropping but not exempt hydroponics with enough reasons.

The decision before the NOSB now is whether to uphold the 2010 recommendation and fill in the gaps so that rulemaking can proceed on greenhouses and/or containers for solid growing media, or to make recommendations that would lead to rulemaking regarding what types of "bioponic" systems might be compatible with organics and what standards are needed to assure that they are.

Since either decision means that there is still a lot of work to do, we are putting forward a discussion document on how to "fill the gaps" by: justifying greenhouse production in the regulations, defining

containers and compliant growing media, discussing provisions of the NOP rule regarding natural resources, land use, rotations and nutrition, and where to draw the line in the continuum for containers.

It is worth noting that in 2016 there are 52 certified organic hydroponic/aquaponic operations and 69 certified operations who grow crops in containers.

Advantages of Bioponics

As is pointed out in the Task Force report, bioponics has a long history in agriculture from societies that worked with limited resources in changing conditions. It has always involved innovation and shares many of the same principles behind organic farming such as recycling, water efficiency, and eliminating the use of toxic pesticides. It is an appropriate way to address challenges in farming as a whole, such as drought, food safety, limited arable land, and climate change. Practitioners have developed some wonderful systems that are fully integrated, use only materials on the National List and depend extensively on microbial action to provide plant health and nutrition. The introduction of fish to create an aquaponic system is especially creative, since it can address production of a protein source and integrate in situ fertilizer production to an integrated system.

In the Organic Integrity Quarterly from May 2014, a publication from NOP, they note that organic hydroponic production is allowed as long as the producer can demonstrate compliance with the USDA organic regulations. The Bioponics proponents of the Task Force cited this and the fact that certifiers are accepting Organic System Plans for such operations as approval. However the article does state that there may be additional guidance issued in the future for these methods.

The Task Force elaborated on the advantages of these systems, focusing on water conservation, increased food safety, disease suppression, nutrient conservation and retention, and soil conservation (because of not using any). They point out that most areas of the rules can be followed as written, including writing and implementing an Organic System Plan, keeping records, preserving natural resources, and using compliant inputs.

The justifications for how bioponic systems comply with §205.203 (soil fertility and crop nutrients) and §205.205 (rotations) are as follows (see rule wording above):

- §205.203 (a) – the lack of tillage and extraction of nutrients from soil is also a way to improve or maintain soil.
- §205.203 (b) – crop nutrient management and growing media fertility can be maintained without contributing to contamination by allowing proliferation of active biology which is equivalent to rotation, or cover crops.
- §205.203 (c) – contamination is avoided by growing in a controlled system and having compliant practices in place for discharges.
- §205.205 – rotation is accomplished by renewal of growing media at the end of each crop cycle or as appropriate for each crop. "As bioponic systems do not impact the soil organic matter below the system as would an in-ground crop, it is expected that the requirement of rotations and cover crops to maintain or improve such surrounding soil organic matter would be inapplicable to bioponic production." (Task Force report, p. 149).

The bioponics proponents of the Task Force have supplied language for a suggested rule change to §205.2 Terms defined and a new section §205.208 Bioponic Production Standard. Depending on the outcome of the vote below, we may need another discussion document on bioponic production,

including justification for it to be written into the rules and consistency with the "applicable organic certification program" (§6512 OFPA), as well as specific parameters and standards that apply regarding systems, growing media, "crop rotation", and possibly labelling.

Arguments against Hydroponics/Biaponics

Natural soils are generally about 95% (plus or minus) mineral matter by weight. Soil mineral particles (clay, silt and sand) are intimately intertwined and complexed with soil organic matter. This mineral/organic matter soil system provides habitat and food sources for soil microorganisms and creates pore spaces in soils for storing water and for air exchange with the atmosphere. The clay/humus complexes also serve a primary function of holding soil nutrients in reserve for plant uptake.

The maintenance and regeneration of this complex, living soil system is a biological process that requires continual recycling of organic materials within the soil system. Crop rotations and cover crops are also important to create and maintain healthy soils, which contribute to healthy plants. It is this complex soil system that pioneer organic farmers learned to work with and optimize, in contrast to the prevalent industrial, input-based model of agriculture that they rejected. Early organic certification standards reflected this system and required on-farm practices and use of materials that fostered soil health by means of managing crop residue, using livestock manures, composting, cover cropping and adding natural rock powders. (Task Force report p. 14). For this reason, many organic producers reject hydroponic and bioponic systems that are input-based rather than soil-based. Also, when bioponic operations pave over soil with cement or gravel, soil conservation goals are not met.

Loss of arable land and the need to feed a growing world population are also cited by the pro-bioponic advocates. Organic agriculture, with its focus on soil building and protection or enhancement of natural resources, offers the opportunity to continually improve land and other natural resources while producing crops, as well as transform land, which has been degraded by poor farming practices or is of low productive capability, to sustainable farming systems. While production of the crop in a bioponic system can require less water to grow the crop than field growing, this ignores the earth's water cycle, where "excess" water is not lost or wasted, but is continually recycled either by recharging the ground water resource or evaporating into vapor to produce rain, snow or fog. Lastly, unless there is careful attention paid to managing water runoff when siting and building hoop houses or greenhouses, the potential for soil erosion can be extreme. There are some areas of the United States, specifically California, which have experienced severe soil loss problems where many hoop houses are present.

Recommendation

The USDA/NOP regulations require proper stewardship toward improving and maintaining the soil ecology within an organic farming system for terrestrial plant production. Therefore the NOSB supports the decisions by previous boards by recommending that hydroponics, aeroponics, biaponics or aquaponics are not consistent with organic production due to their exclusion of the soil-plant ecology intrinsic to organic farming systems. We believe that action from this board would be needed to overturn the previous recommendation of the NOSB in 2010, and therefore the motion as worded would require a 2/3 majority.

The NOSB plans to work further on defining the systems and practices that are allowed, and delineating what is not allowed with regard to containers for solid substrate and growing media.

Committee Vote

Motion to allow bioponics (including hydroponics, aeroponics, or aquaponics) as consistent with organic production under the provisions and recommendations to be developed by the NOSB in 2017.

Motion by: Zea Sonnabend

Seconded by: Emily Oakley

Yes: 2 No: 5 Absent: 0 Abstain: 0 Recuse: 0

Glossary of terms

Source in (Parentheses)

Aquaponics – A system in which plants are grown in waste water from aquatic organisms, which in turn purifies the water. *(Task Force Report)*

Aeroponics – A variation of hydroponics in which plant roots are suspended in air and misted with nutrient solution. *(2010 NOSB Recommendation)*

Bioponics – A contained and controlled growing system in which plants in growing media derive nutrients from natural animal, plant and mineral substances that are released by the biological activity of microorganisms and delivered in water. *(Task Force Report with slight modification by CS)*

Compost – The product of a managed process through which microorganisms break down plant and animal materials, including allowed feedstock materials (either nonsynthetic substances not prohibited at § 205.602, or synthetics approved for use as plant or soil amendments), into more available forms suitable for application to the soil. Compost must be produced through a process that combines plant and animal materials with an initial C:N ratio of between 25:1 and 40:1 and processes it to a low final C:N ratio (in the range of 5:1 to 20:1). Producers using an in-vessel or static aerated pile system must maintain the composting materials at a temperature between 131 °F and 170 °F for 3 days. Producers using a windrow system must maintain the composting materials at a temperature between 131 °F and 170 °F for 15 days, during which time, the materials must be turned a minimum of five times. *(USDA organic rule)*

Compost Tea – A water extract of compost produced to transfer microbial biomass, fine particulate organic matter, and soluble chemical components into an aqueous phase, intending to maintain or increase (it may be brewed) the living, beneficial microorganisms extracted from the compost. *(Task Force Report)*

Container – Any vessel and associated equipment used to house growing media and the complete root structure of terrestrial plants and to prevent the roots from contacting the soil or surface beneath the vessel, such as, but not limited to, pots, troughs, plastic bags, floor mats, etc. *(Task Force Report)*

Greenhouse – Permanent enclosed structure that allows for an actively controlled environment used to grow crops, annual seedlings or planting stock. *(2010 NOSB Recommendation)*

Hydroponics – The growing of normally terrestrial vascular plants in mineral nutrient solutions with or without an inert growing media to provide mechanical support. *(Hybrid definition adopted by CS from Task Force report)*

Growing media – Material which provides sufficient support for the plant root system and enables the plant to extract water and nutrients. Used interchangeably with the term "substrate". *(Adopted by CS from Task Force and internet sources)*

Microbial solution – Growing solution used in bioponic production which is commonly composed of organic substances and a diverse ecosystem of beneficial microorganisms in water. *(Task Force Report)*

Nutrient solution – Growing solution used in traditional hydroponic production which is commonly composed of immediately plant-available soluble synthetic mineral salts in water *(Task Force Report)*

Soil – The outermost layer of the earth comprised of minerals, water, air, organic matter, and living organisms, in which plants grow. (Modified from *Task Force Report*)

Soil Ecology – A term used to describe the incredible diversity of organisms that live in the soil and the complex interactions between them that contribute to plant nutrition and plant and soil health. They range in size from the tiniest one-celled bacteria, algae, fungi, and protozoa, to the more complex nematodes and microarthropods, to the visible earthworms, insects, small vertebrates, and plants. (Hybrid definition adopted by CS from *Task Force report*)