

**National Organic Standards Board
Crops Subcommittee Discussion Document
Aeroponics/Hydroponics/Aquaponics**

February 15, 2017

Introduction

The National Organic Standards Board (NOSB) has taken up the issue of hydroponics several times in the past, and has made several recommendations to the National Organic Program (NOP). To date, the NOP has not undertaken rulemaking based on any of the NOSB recommendations. This discussion document suggests some language that could be used for rulemaking in the future and solicits comments from organic stakeholders on the suitability of that language and on other considerations that the Crops Subcommittee should take into account as it prepares a proposal for the NOSB meeting in fall of 2017.

This document was originally written as a proposal, with recommendations to be voted on by the full NOSB at the spring 2017 meeting. The proposal was reformatted as a discussion document in order to give new NOSB members more time to study the issues. Therefore, parts of this discussion document may read somewhat like a proposal; however, the Crops Subcommittee invites and will consider all comments that stakeholders wish to offer.

Background

In 1995, in the NOSB *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 the Organic Foods Production Act (OFPA) to guide them. Also, the statement indicates that an analysis had not been made of whether or not hydroponics met the provisions of OFPA.

In 2010 the NOSB issued a recommendation titled *Production Standards for Terrestrial Plants in Containers and Enclosures (Greenhouses)*. The recommendation contained the following statement:

"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...certainly 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."

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."

Accredited organic certification agencies have been permitted to certify hydroponic operations as organic by the National Organic Program, with some agencies certifying hydroponic operations and some choosing not to certify this distinct production system. The lack of clear and detailed standards for this water-based nutrient delivery growing system has led to the need for the National Organic Standards Board to review this issue in a holistic way, and recommend a path forward to the National Organic Program.

In 2015, the NOP established a Hydroponic/Aquaponic Task Force (henceforth referred to as Task Force) to further explore this issue and write a report giving guidance to the 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.

In consideration of the information presented in the Task Force Report and from past NOSB recommendations, the Crops Subcommittee prepared a proposal for consideration by the full NOSB at the Fall 2016 NOSB meeting. The proposal included the following motion:

"Motion to allow bioponic² (including hydroponic, aeroponic, or aquaponic) as consistent with organic production under the provisions and recommendations to be developed by the NOSB in 2017."

The motion was worded "to allow bioponic" in order to require a 2/3 majority of the board to overturn the previous NOSB recommendation (in 2010) that soilless production is not consistent with organic production. The Crops Subcommittee vote on the motion to allow bioponics failed by a vote of two in favor and five opposed.

At the fall 2016 NOSB meeting, questions were raised about the wording of the motion. Particularly, it was noted that if the vote were to result in a failed motion, there would be no recommendation going forward from the NOSB to the NOP. Therefore, the NOSB did not vote on the proposal, but voted to send it back to the Crops Subcommittee for further work. However, the NOSB did pass the following resolution at the fall 2016 meeting:

"The NOSB respects the efforts of the former NOSB that led to their 2010 recommendation on terrestrial plants in greenhouses. The NOSB recognizes that the foundation of organic agriculture is based upon a systems approach to producing food in the natural environment, which respects the complex dynamic interaction between soil, water, air, sunlight, plants and animals needed to produce a thriving agro-ecosystem.

"At the heart of the organic philosophy is the belief that our responsibilities of good stewardship go beyond production of healthy foods and include protection of natural resources, biodiversity and the ecosystem services upon which we all depend. We encourage future NOSB to consider this wider perspective as the board undertakes the challenges of assessing and defining innovations in agriculture that may be compatible in a system of organic production.

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

² While "bioponics" was used in the Fall 2016 NOSB proposal, that term is not used in this proposal. Operations popularly referred to as "bioponic" fit within the definitions of hydroponics, aeroponics and aquaponics used in this proposal.

“In the case of the hydroponic/bioponic/aquaponic issue, it is the consensus³ of the current members of the NOSB to prohibit hydroponic systems that have an entirely water based substrate. Although that was the original intent of the proposal before us today, the current proposal as structured does not achieve this objective.

“While the NOSB does not believe that the liquid substrate systems should be sold under the USDA organic label, these growers deserve the chance to promote their very commendable qualities and objectives in their own right.”

Relevant areas in the Rule
Organic Foods 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.

³ Because two members of the NOSB did not support this resolution, the resolution was amended to substitute the word “majority” for “consensus.” However, it wasn’t recognized until later that that word change confused the sentence syntax. It should also be noted that the two NOSB members who did not support the resolution went on record as being opposed because they did not think the resolution was strong enough, but they too were opposed to “hydroponic systems that have an entirely water based substrate.”

§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.

§205.200 General.

The producer or handler of a production or handling operation intending to sell, label, or represent agricultural products as “100 percent organic,” “organic,” or “made with organic (specified ingredients or food group(s))” must comply with the applicable provisions of this subpart. Production practices implemented in accordance with this subpart must maintain or improve the natural resources of the operation, including soil and water quality.

§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

Arguments for Hydroponics

As is pointed out in the Task Force report and in public comments received in preparation for the Fall 2016 NOSB meeting, hydroponics has a long history in agriculture from societies that worked with limited resources in challenging conditions. Hydroponics is an innovative system that results in efficient water and nutrient use. Due to its controlled environment, hydroponic operations have been able to lessen use of pesticides, and operators have been able to develop systems that rely on organically approved inputs for crop nutrition and health.

Hydroponics can be an appropriate way to address challenges in farming as a whole, such as drought, food safety, limited access to arable land, and provide food in urban areas by using indoor growing systems. Practitioners have developed some innovative systems that are integrated, use only materials on the National List, and in some cases incorporate 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 with an integrated system.

In the Organic Integrity Quarterly Newsletter from May 2014, a publication from NOP, it is noted that organic hydroponic production is allowed as long as the producer can demonstrate compliance with the USDA organic regulations. The hydroponic proponents of the Task Force cited this, and the fact that some certifiers are accepting Organic System Plans for such operations, as approval. However the NOP publication did state that there may be additional guidance issued in the future for these methods. The allowance of hydroponic certification without organic hydroponic production standards has led to inconsistent approval by certifiers and confusion in the organic marketplace.

The hydroponic proponents on the Task Force contended that advantages of hydroponic systems included water conservation, food safety, disease suppression, nutrient conservation and retention, and soil conservation (because of lack of soil). They argued 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 hydroponic systems comply with §205.203 (soil fertility and crop nutrients) and §205.205 (rotations) have been given 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 bioptic (hydroponic) 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 bioptic (hydroponic) production." (Task Force report, p. 149).

Arguments Against Hydroponics

Natural soils are generally 95% or more 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 a great diversity of 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 which 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 systems that are input-based rather than soil-based. Also, when hydroponic operations pave over soil with cement or gravel, soil and natural resource conservation can be compromised.

Loss of arable land and the need to feed a growing world population are cited by pro-hydroponic advocates. However, organic agriculture, with its focus on soil building and protection or enhancement of natural resources, offers the opportunity to continually improve soil productivity and the natural resource base while producing crops. Additionally, it can transform land, which has been degraded by poor farming practices or is of low productive capability, to sustainable farming systems. Moreover, productivity *per se* is not a measure of the legitimacy of organic agriculture. Maintenance and improvement of the natural resources of the operation is also mandated under the organic regulation. On soil-based organic farms, the production of food and fiber is accomplished in concert with improving habitat for wildlife of all types, including pollinators, mammals, amphibians and soil microbes. Increased soil organic matter, cover crops, rotations, contour strips, reduced tillage and other activities continually improve the soil's structure and lessen erosion, which negatively affects water and soil quality. This integration of working lands with ecosystem stewardship is a foundational principle of organic agriculture.

While production of a crop in an aeroponic or hydroponic system can in some cases require less water 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. Furthermore, many farmers grow in temperate climates where annual rainfall provides most or all of a crop's water needs during all or part of the year.

Hydroponic production is highly dependent on continual use of fertilizer inputs to the production system, rather than relying on a productive soil and natural recycling of nutrients through decaying organic matter to regenerate the fertility needs of the crop. The "input substitution" approach of hydroponics has long been considered incompatible with a system of organic agriculture.

Another consideration is that unless there is careful attention paid to managing water runoff when siting and building hoopouses 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 hoopouses are present⁴.

⁴ <http://www.rcdmonterey.org/pdf/RCDMCValleyRunoffandErosion.pdf>

Specific language from OFPA and the Organic Rule that disqualify soilless production (hydroponic) from organic certification include the following:

- §6513 Organic Plan: “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...An organic plan shall not include any production or handling practices that are inconsistent with this chapter.”
- § 205.200 General: “Production practices implemented in accordance with this subpart must maintain or improve the natural resources of the operation, including soil and water quality.”
- § 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...”

Aeroponic, hydroponic, and aquaponic production systems can be productive cropping systems which can be appropriate and well adapted to specific situations. However, that does not mean those systems are compatible with the principles of organic production or should qualify them for organic certification.

Public Comments

Numerous comments were received from the public in response to both the Task Force report and the NOSB crops subcommittee proposal on Hydroponics/Aquaponics/Bioaponics of September 6, 2016.

Those in favor of allowing hydroponics to carry the organic label in the marketplace discussed the efficient use of water and nutrients as important considerations. They also stated that there were fewer disease and pest problems in their controlled-environment production systems, leading to lower use of organically approved pesticides – although organic growers using soil in greenhouses disputed that claim. Soil and water were considered to be equally acceptable as a conductor of nutrients to plant roots. Food safety, worker health, providing food to urban food deserts, or aiding inexperienced or small scale growers were also cited as benefits of hydroponics, although some organic growers argued that organic production in soil in greenhouses provides similar benefits. Also, those are not factors that are used to determine a system’s compliance with organic principles and regulations.

Those against allowing hydroponics to carry the organic label in the marketplace discussed the foundational principles of organic as originating with care and improvement of the soil and the overall ecosystem. Longer term improvements such as the use of nitrogen fixing crops, cover crops for improved organic matter, and an overall regenerative system that protects water and wildlife as well as supporting biodiversity, were also noted in numerous comments. The OFPA and organic regulations were cited, illustrating where soil- and ecosystem-based production systems are in the basic description of certified organic production. Many agreed hydroponics can be an innovative system of production, but did not agree that it met the letter nor spirit of the organic law or regulations.

Suggested Recommendations for Discussion

The Crops Subcommittee has divided the suggested recommendations in this discussion document into three parts: aeroponics, hydroponics, and aquaponics. This discussion does not refer to the production of edible sprouts or to aquatic plants growing outdoors in their native ecosystems.

Further research will be done that will result in a Crops Subcommittee proposed recommendation on container-based systems that deal with plants grown in soil or soil and substrate mixes. The proposal will examine the various systems of growing crops to maturity in containers and address minimum soil requirements as well as the amount of plant nutrients that can be supplied from liquid nutrients. Particular attention will be given to the needs of annual plants versus perennials. The standards of Canada, the EU, and other countries will be examined, and a proposal will be developed to try to provide consistent standards for growers and ease of trade for the organic produce industry.

The following are suggestions for additions to 205.105

§205.105 Allowed and prohibited substances, methods, and ingredients in organic production and handling.

To be sold or labeled as “100 percent organic,” “organic,” or “made with organic (specified ingredients or food group(s)),” the product must be produced and handled without the use of:

- (a) Synthetic substances and ingredients, except as provided in §205.601 or §205.603;
- (b) Nonsynthetic substances prohibited in §205.602 or §205.604;
- (c) Nonagricultural substances used in or on processed products, except as otherwise provided in §205.605;
- (d) Nonorganic agricultural substances used in or on processed products, except as otherwise provided in §205.606;
- (e) Excluded methods, except for vaccines: *Provided*, that, the vaccines are approved in accordance with §205.600(a);
- (f) Ionizing radiation, as described in Food and Drug Administration regulation, 21 CFR 179.26; and
- (g) Sewage sludge.

Aeroponics

Discussion: Aeroponics does not require a root-zone medium. The roots are intentionally suspended in midair, in part to expose them to more atmospheric oxygen to aid plant growth. The roots are regularly sprayed with water that contains water-soluble nutrients.

Are aeroponic production systems – that do not include the use of soil or incorporate biological processes that mimic the biological processes that occur in soil – compatible with organic farming systems?

Suggested language for a new definition to be added to 205.2 Terms defined.

Aeroponics

Definition: A variation of hydroponics in which plant roots are suspended in air and misted with nutrient solution.

Suggested language to amend §205.105 Allowed and prohibited substances, methods, and ingredients in organic production and handling.

To be sold or labeled as “100 percent organic,” “organic,” or “made with organic (specified ingredients or food group(s)),” the product must be produced and handled without the use of:

Add (h) Aeroponics.

Hydroponics

Discussion: In its 2010 recommendation, the NOSB stated that hydroponics “cannot be classified as certified organic growing methods due to their exclusion of the soil-plant ecology.” The definition of hydroponics used for that recommendation was “The production of normally terrestrial, vascular plants in nutrient rich solutions or in an inert, porous, solid matrix bathed in nutrient rich solutions.”

Today, plant-based materials – like coconut coir, wood shavings, and peat – are often used in place of inert materials for the solid matrix for hydroponics. These plant-based materials serve as effective matrix materials for hydroponics because they are porous, hold water well, allow for aeration of the plant roots, and do not biologically degrade readily. These plant-based materials are not technically inert (will not chemically react with anything under normal circumstances)⁵ but are biologically recalcitrant (resistant to microbial attack)⁶. They will break down slowly over time but do not serve as a substantive source of nutrients for the plants being grown.

The term “recalcitrant” is used by soil scientists to describe organic materials that are resistant to microbial degradation, but will degrade slowly over time. For example, most models of soil organic matter describe three pools of organic matter: 1) the “active pool,” comprised of microbial biomass and labile organic compounds (e.g., fresh plant residues), 2) the “slow pool,” where much of the plant-associated nutrients reside for mineralization, and 3) the “recalcitrant pool,” associated with the humus fraction of soil organic matter, that degrades very slowly (Rice, 2016)⁷.

Are hydroponic production systems that use growing media comprised of inert or recalcitrant materials consistent with organic farming systems? Are production systems that rely on outside liquid fertility inputs for all or most of their fertility needs compatible with organic principles or a system of sustainable agriculture?

Suggested language for a new definition to be added to 205.2 Terms defined.

Hydroponics

Definition: The production of normally terrestrial, vascular plants in nutrient-rich solutions, or in a medium of inert or biologically recalcitrant solid materials to which a nutrient solution is added.

Suggested language to amend §205.105 Allowed and prohibited substances, methods, and ingredients in organic production and handling.

To be sold or labeled as “100 percent organic,” “organic,” or “made with organic (specified ingredients or food group(s)),” the product must be produced and handled without the use of:

Add (i) Hydroponics.

⁵ <http://www.biology-online.org/dictionary/Inert>

⁶ <http://www.biology-online.org/dictionary/Recalcitrant>

⁷ Rice, C.W., Organic Matter and Nutrient Dynamics. pp. 1080-1081. *In* Lal, R., Encyclopedia of Soil Science. 2016 CRC Press, 3rd edition.

Aquaponics

Discussion: Aquaponic systems use rooting media similar to hydroponic systems but get some or all of the plant nutrients from fish waste. Common rooting media include coconut materials, coconut/vermiculite mix, clay pellets, expanded shale, and lava rock (Task Force report).

The NOP has strict standards for handling animal manure in terrestrial organic production, but no such standards exist to ensure the safety of plant foods produced in the fecal waste of aquatic vertebrates. Also, the NOP has not yet issued standards for organic aquaculture production, upon which aquaponic plant production would be dependent.

Suggested language for a new definition to be added to 205.2 Terms defined.

Aquaponics: A recirculating hydroponic system in which plants are grown in nutrients originating from aquatic animal waste water, which may include the use of bacteria to improve availability of these nutrients to the plants. The plants improve the water quality by using the nutrients, and the water is then recirculated back to the aquatic animals.

Suggested language to amend §205.105 Allowed and prohibited substances, methods, and ingredients in organic production and handling.

To be sold or labeled as “100 percent organic,” “organic,” or “made with organic (specified ingredients or food group(s)),” the product must be produced and handled without the use of:

Add (j) Aquaponics.

Discussion Questions

- 1) The soil science term “recalcitrant” is used in the definition of hydroponics to identify substrates that are used in some hydroponic systems that are not completely “inert” but do not contribute substantive plant nutrition. Is this term and the intent of including it in the definition understood by the organic community, and should it be included in the definition?
- 2) Please provide feedback on the definitions of aeroponics, hydroponics, and aquaponics used in this proposal.
- 3) Some stakeholders have proposed an option of alternative labeling under OFPA for organic hydroponics. Please address opportunities or weakness to this suggestion.
- 4) Some proponents of hydroponics have stated that some commercial organic in-ground farmers may rely on liquid fertility inputs for most of their fertility needs. Please provide information to either support or refute this statement. Should that issue be addressed in the future?

Discussion Questions Regarding Container Production

At the fall 2016 meeting, the Crops Subcommittee (CS) presented a [discussion document on Container and Greenhouse Production](#). The CS posed some questions for public comment there, and would like to follow up with additional questions here for consideration as a proposal on container production is developed for the fall 2017 meeting.

The CS recognizes there are numerous operations that are using containers for both annual and perennial plants. However, in order to develop standards for this production system, which has different needs and practices than in-ground production, the CS would like more information from the organic stakeholder community. In addition, the CS will be looking at organic standards in place by our trading partners in Canada and the European Union to inform our final recommendation on growing crops in containers. This container discussion will not pertain to plants grown in pots for eventual replanting into a field or in-ground situation, instead this container discussion pertains to plants that are grown to maturity to produce a final crop for sale to consumers.

The following questions refer to systems of annual and perennial terrestrial plants grown in containers in soil and/or compost-based mixes. Terrestrial plants growing in inert or recalcitrant substrates, with reliance predominantly on liquid nutrient solutions, are considered to be hydroponic.

When answering the questions below, please provide information that relates to your current practices, or to practices you know to be in use when growing annual and perennial crops in containers. You may also comment on what you think should be allowed and not allowed for organic certification.

Container Discussion Questions:

1. For both annual and perennial container growing, can you clarify if you rely on artificial lighting and/or artificial heating for the majority of the plant's needs?
2. For both annual and perennial container growing, do you use plastic mulch or petroleum-based landscape cloth under your containers? If so, when is this removed; once per year when it starts to decompose, or does it have organic mulch on top of it to prevent decomposition and it is never removed?
3. For both annual and perennial container growing, is this done inside a greenhouse situation or under hoops that are covered for part of the year by plastic?
4. Crops that grow to maturity for sale within a 12 month period are considered annuals. Do you grow annuals in containers? Could you meet a standard such as the Canadian container regulation? If not, how would you modify this standard?

Excerpt from Canadian Standards:

7.5.5 *The following conditions apply to containerized, staked crops (for example, tomatoes, sweet peppers, cucumbers, and eggplant):*

- a) at the start of production, the total volume of soil shall consist of at least 10% compost;*
- b) compost shall be included in the fertility program;*
- c) the soil volume shall be at least 70 L/m² (15.4 gal./10.8 ft²), based on the total growing area.*

5. Plants that produce crops for sale after 12 months, and produce crops each year thereafter are considered perennials. It is understood that over time, the container-grown plants will be more reliant on outside nutrient sources, as the plants grow and the original soil or compost substrate will lose its fertility and nutrient availability.
 - A. Could these perennial plants meet the Canadian container standard described in question 4? If not, how would you modify this standard?
 - B. Would there need to be additional requirements beyond this Canadian container standard to address long-term perennial plants?

- C. How many years are your perennial plants producing crops in these containers?
6. Some organic standards limit the amount of liquid nutrients that can be added after planting. The Task Force Subcommittee that reviewed the 2010 recommendation recommended that liquid nutrients be limited to 20% of the total nutrients supplied. Should there be a maximum amount of liquid fertility inputs allowed in organic container production? If so, what should that maximum be?
 7. Most European countries do not allow container production to be certified organic, with the exception of a few kinds of plantings. They require that organic crops be grown in the ground, except for transplants, ornamental potted plants, and potted herbs, which can be grown in containers. Should the NOP adopt that European standard?
 8. Would a decision tree be useful for evaluating the various systems of production to determine how an operation would be classified?

Vote in Crops Subcommittee:

Motion to accept the discussion document on aeroponics/hydroponics/aquaponics

Motion by: Francis Thicke

Seconded by: Emily Oakley

Yes: 6 No: 0 Abstain: 2 Absent: 1 Recuse: 0

Approved by Francis Thicke, Subcommittee Chair to transmit to NOSB, February 16, 2017

Glossary of terms

Aeroponics—A variation of hydroponic in which plant roots are suspended in air and misted with nutrient solution.

Aquaponics—A recirculating hydroponic system in which plants are grown in nutrients originating from aquatic animal waste water, which may include the use of bacteria to improve availability of these nutrients to the plants. The plants improve the water quality by using the nutrients, and the water is then recirculated back to the aquatic animals.

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.

Greenhouse—Permanent enclosed structure that allows for an actively controlled environment used to grow crops, annual seedlings or planting stock.

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".

Hydroponics—The production of normally terrestrial, vascular plants in nutrient-rich solutions, or in a medium of inert or biologically recalcitrant solid materials to which a nutrient solution is added.

Inert material—A material that will not chemically react with anything under normal circumstances

Nutrient solution—Growing solution used in traditional hydroponic production that is commonly composed of immediately plant-available soluble mineral salts in water

Recalcitrant— Resistant to microbial attack.

Soil—The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (ii) The unconsolidated mineral or organic matter on the surface of the earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics (Soil Science Society of America Glossary).