

# TROUBLING WATERS:

## How Hydroponic Agribusiness and the USDA Diluted Organics by Sanctioning Soil-less Growing



Profiling Illicit Produce  
Brands Grown in Liquid  
Fertilizer Rather Than  
Nutrient-Rich Soils



**CORNUCOPIA**  
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# INTRODUCTION TO THE ORGANIC HYDROPONICS CONTROVERSY



**HYDROPONICS REFERS TO A TECHNOLOGY** for growing terrestrial plants with the roots in nutrient solutions rather than soil. Although interest in hydroponic methods began in the early 1900s, it was not widely adopted on a commercial scale until recently. The advent of cheap plastics in the 1970s and present-day availability of inexpensive oil for plastic containers, tubing, and greenhouse covers now allows hydroponics to be a financially viable production method.<sup>1</sup>

Hydroponic systems depend on the use of purchased soluble fertilizers, rather than naturally cycling nutrients in soil. USDA's advisory panel to the National Organic Program (NOP) on organic regulations, the National Organic Standards Board (NOSB), did not consider the concept of growing organic crops without soil when they first sought to define the term "organic," and hydroponic production is not mentioned in the Organic Foods Production Act (OFPA) of 1990. Rather, OFPA makes it clear that maintaining soil fertility is foundational to organic farming.<sup>2</sup>

## THE BENEFITS OF GROWING IN SOIL VERSUS SOIL-LESS SYSTEMS

Most producers within the organic community agree that the most important aspect of organic farming is ensuring that organic matter and fertility in the soil is maintained or increased. Farming practices that improve the soil are often costly, but they benefit the environment on both a local and global scale. Some of these benefits include preventing nutrient run-off, capturing carbon in the soil, and integrating humane animal husbandry.

For example, excess nutrients in the form of animal waste can impact water quality, but planting specific cover crops, rotating smaller numbers of livestock, establishing buffer zones, and building soil organic matter are

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The Organic Foods Production Act makes it clear that maintaining soil fertility is foundational to organic farming.

some methods organic farmers utilize to prevent nutrient pollution.<sup>3</sup> These practices not only minimize nutrient run-off, but also sequester carbon from the atmosphere that is stored in soils by the interactions between plant roots and soil microorganisms.<sup>4</sup> At the same time, livestock on well-managed pasture are often healthier than animals housed in confinement.<sup>5</sup> Adopted in this way, organic farming can provide solutions to the biggest environmental issues of our time: climate change, erosion, declining aquifers, and eutrophication.

The economic survival of *authentic* organic farmers depends on the enforcement of organic law which requires improving soil fertility. Without this requirement, these environmentally responsible farms face unfair competition from agribusinesses using less expensive and unsustainable production practices under the same organic label. Rather than cycling nutrients on the farm, hydroponic operations use nutrient-free planting media and apply a continuous supply of liquid fertilizers, commonly from hydrolyzed conventionally grown soybeans or fish emulsion (that may be wild caught, impacting native fisheries).<sup>6</sup>



Hydroponic production relies on energy-expensive infrastructure, including inert growing media, plastic containers, and plastic tubes that deliver fertilizer to plants.

Not unlike the marketing used by “livestock factories” to obscure how they confine thousands of animals in feedlots, the hydroponic industry likes to use small, urban and family farms as their poster children. In reality, the preponderance of “organic” hydroponic production comes from massive corporate-owned, industrial-scale facilities in the desert Southwest and Mexico or is imported from countries where marketing soil-less production as ‘organic’ domestically is illegal.

Hydroponic produce is grown in substrates that are designed to remain inert while they provide structural support for plant roots. For hydroponic berry production (e.g., Driscoll’s), the nutrient-free growing medium is usually peat moss mined from wetland bogs, freeing carbon from the soil instead of capturing it. For hydroponic tomato, cucumber, and pepper production (e.g., Wholesum Harvest), the planting medium is commonly coco coir, ground-up waste from predominantly conventional coconut shells. The plants are fed with a liquid fertilizer solution at every watering. Hydroponic growing media do not provide the multiple other benefits real soil does. Labels on these “organic” products do not differentiate hydroponic crops from soil-grown crops, despite the fact that nutrient-dense food grown in soil is in high demand by informed consumers.

## THE NOSB WEIGHS IN ON HYDROPONICS UNDER THE ORGANIC LABEL

The question of whether hydroponics should qualify for USDA organic certification gets at the very heart of the legal and philosophical definition of organic agriculture. The NOSB has been embroiled in a heated debate on the issue for the last couple of years.

On August 14, 2017, the NOSB held an unprecedented two-hour conference call to discuss whether hydroponic systems should be considered under the organic label.

The call was scheduled to help the Crops Subcommittee write proposals to define hydroponics and container growing for the fall NOSB meeting. Note that the term “container growing” is a euphemism widely adopted by the hydroponic industry in an effort to avoid negative publicity.

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Labels on these “organic” products do not differentiate hydroponic crops from soil-grown crops, despite the fact that nutrient-dense food grown in soil is in high demand by informed consumers.

During the public conference call, NOSB members were strongly divided on the issue—so much so that a compromise could not be reached. Pro-hydroponic NOSB members articulated that the organic label is appropriate for any crop produced without the materials prohibited in organic production. Pro-soil NOSB members maintained that organic production is also defined by what farmers *are doing* (i.e., diversifying fields, rotating different species of animals on pasture, minimum or no tillage, etc.), rather than simply what they are *not doing* (i.e., using toxic agrichemicals).

At the subsequent fall 2017 NOSB meeting in Jacksonville, Florida, the board remained evenly divided on the issue of the organic certification of hydroponic production, and they were unable to pass a supermajority vote on this issue.

What remains is a state of confusion, where individual certifiers are allowed to decide for themselves whether or not hydroponic producers meet USDA organic standards. These decisions are based on the current regulations, previous NOSB recommendations, and conflicting messages from the NOP.

In the following report we review the history of NOSB and NOP actions that led up to this vote, summarize the organic community’s concerns with soil-less organic production, and recommend actions the NOP and equivalency trade partners should take from here.

## THE DEFINITION OF ORGANIC

The Federal Trade Commission (FTC) was the first government entity to officially define organic in 1978. Having banned the use of the word organic in 1974 (likely due to pressure that it would condemn conventional agriculture), four years later the FTC reversed its stance due to overwhelming consumer demand. The agency defined organic as:

*Organically grown food is produced on **humus-rich soil** whose fertility has been maintained with organic materials and natural mineral fertilizers. No pesticides, artificial fertilizers or synthetic additives are used in the production of organic foods. [emphasis added]*<sup>7</sup>

In 1995, the USDA's newly created National Organic Standard Board (NOSB), an expert panel mandated by Congress, defined organic agriculture as:

*...an ecological production management system that promotes and enhances biodiversity, biological cycles, and **soil biological activity**. It is based on **minimal use of off-farm inputs** and on management practices that restore, maintain, and enhance ecological harmony [emphases added].*<sup>8</sup>

In light of the above definitions, how can the term organic be applied to soil-less systems, such as hydroponic crop production?

The NOP has stated that “organic hydroponic production is allowed.”<sup>9</sup> However, this statement directly contradicts the most recent recommendations issued by the NOSB. More important, the NOP's position conflicts with the organic label's enabling legislation, OFPA. The aforementioned definitions of organic would, in fact, exclude all production systems that do not involve soil, including hydroponics, aquaculture\*, and aquaponics.



Adding organic matter to soil—like the straw groundcover pictured—supports both the biological activity and humus of the soil as it breaks down.

The USDA has redefined organic without the legally-mandated collaboration of the NOSB or the organic community.

Later definitions of organic created by the NOP removed the reference to soil. In 2002, the NOP defined organic agriculture in CFR §205.2:

*Organic production [is] a production system that...respond[s] to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of **resources, promote ecological balance, and conserve biological diversity**. [emphasis added]*

Since hydroponic systems do not cycle nutrients, this requirement was also eventually removed from the definition of organic. In fact, hydroponic systems largely rely on nutrients derived from conventional agriculture (often soybeans), rather than cycling organic matter (like animal manure, cover crops, compost, etc.) back into the soil.

Organic is currently described as “a labeling term that indicates that the food or other agricultural product has been produced through approved methods.”<sup>10</sup> The organic standards go on to detail the specific requirements that must be verified by a USDA-accredited certifying agent before products can be labeled USDA organic.

The USDA website currently states, “Overall, organic operations must demonstrate that they are protecting natural resources, conserving biodiversity, and using only approved substances.”<sup>11</sup>

Whether organic agriculture is considered a “production system” or defined by the USDA merely as a “labeling term,” it is clear in OFPA that organic agriculture is more than input substitution (the substitution of approved “organic” materials for prohibited synthetic chemicals). Organic agriculture was intended to work in concert with ecological cycles.

The USDA has redefined organic without the legally-mandated collaboration of the NOSB or the organic community.

\* Aquaculture is the production of aquatic plants (algae) and animals (fish, crustaceans), whereas aquaponics involves the production of crop plants in nutrient solutions produced from aquaculture.

## OVERVIEW OF “PONICS” PRODUCTION SYSTEMS

### HYDROPONIC SYSTEMS

The term **hydroponics** encompasses a diversity of production systems that provide the plant’s fertility needs through the irrigation system. On a basic level, the definition of hydroponics is “the cultivation of plants without soil.”



Looks can be deceiving! Though some substrate can look like soil, it only serves to hold roots in place.

Terrestrial plants have evolved to obtain nutrients through complex interactions with soil microorganisms in their roots. In a hydroponic system, terrestrial plants have their roots in air, water, or an inert medium, rather than soil. The roots are either immersed in water or periodically sprayed with a nutrient solution.

There are several types of “ponics” technology. Various terms describe whether plant roots are in a solid substrate, whether the nutrient solution is recycled, and whether fish are part of the system.

“**Aggregate systems**,” also called “medium culture,” allow plants to be rooted in coco coir, peat, sand, gravel, vermiculite, rock wool, or other virtu-



ally nutrient-free substances, while continuously fertilizing the plant as it grows. These systems are increasingly referred to by the industry as “container systems” to boost their marketing success, though all hydroponic systems use containers.

“**Solution culture**” is when the plant roots are continuously immersed in a liquid nutrient solution, rather than in a more solid substrate. Plants may be grown on floating rafts of polystyrene or similar materials, with roots suspended in the nutrient solution. Alternatively, roots may be encased in plastic channels, in the nutrient film technique (NFT). Instead of being immersed in water, roots can also be suspended in air and misted with water, a technique called “**aeroponic production**.”

Hydroponic systems are further categorized as “open systems,” where the nutrient solution is not reused, or “closed systems,” where surplus solution is recovered, replenished, and recycled.

### AQUAPONIC SYSTEMS

When fish are added to the hydroponic system, it is called aquaponics—the integration of aquaculture (growing fish or algae) with hydroponics. An aquaponic system fosters the cycling of nutrients because the nutrient-rich wa-

ter from fish tanks is used to fertilize (or “fertigate”) the plants. Fertility is generated from biological cycles, rather than from off-farm inputs, although the feed fed to the fish or other aquatic species



Aquaponics facility at Berea College in Kentucky.

almost exclusively comes from off-farm sourcing. Plants act as biological filters, so that the water can be recirculated and reused.

Aquaponic systems may be highly sustainable *if* the nutrients that are brought in for the fish food are obtained in a sustainable way.<sup>12</sup> However, the fish feed may come from unsustainable sources.<sup>13</sup>

Another hurdle faced by organic aquaponics is that applying fresh manure to plants is prohibited in organically managed systems.



In hydroponic production, all of a plant's nutrients are generated off-site.

## HYDROPONIC PRODUCTION AND ECOLOGICAL SYSTEMS

Hydroponic producers claim they use less water than soil-based production, which is a wise use of resources in arid areas. However, it isn't sustainable to feed the nation and export throughout the world from operations located in the continent's deserts. Driscoll's and Wholesum Harvest, for example, have enormous hydroponic operations based in the desert southwest regions and Mexico.

Although many of these mammoth hydroponic operations tout their efficiency in terms of water usage, they use tremendous amounts of energy and petroleum-based plastics for pumping the fertilizer solutions, artificial lighting, and climate control.

Hydroponic production also minimizes on-farm biodiversity. Because hydroponic production is typically done indoors in a greenhouse, the crops are also isolated from the entire terrestrial ecosystem—including soil flora and fauna, as well as all insects, birds, and other plant life. Typical hydroponic greenhouses do not “*promote ecological balance, and conserve biological diversity,*” both of which are part of the definition of organic production systems.

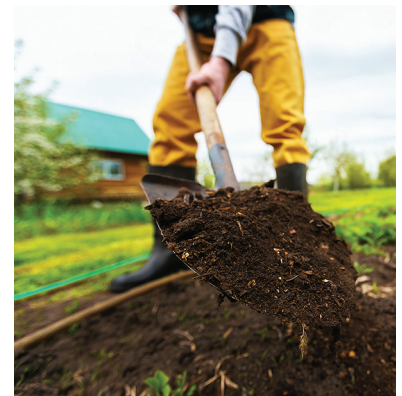
“Organic” hydroponic production is merely “input substitution,” the process of substituting organically approved inputs for conventional inputs without changing other production techniques. In contrast, organic production is premised on an ecological production system that fosters the cycling of nutrients. Crop production systems that require all nutrients to be generated off-site do not represent an ecological system or cycle nutrients; therefore, they should not be labeled organic.

Though hydroponic producers may use the same fertilizers as other organic farmers, hydroponic producers completely rely on these fertilizers for the entire life of the crop, whereas organic farmers use these fertilizers in limited quantities as amendments. When plants are grown in soil, the breakdown of organic matter by microbes and invertebrates releases most of the nutrients plants need slowly, as the plants need them. Organic farmers build fertile soil by adding organic matter from crop residues, animal manure, and cover crops, providing the conditions that allow the organic matter to decompose and form humus over time.

From the book, *Building Soils for Better Crops*:<sup>44</sup>

*It's true that you can grow plants on soils with little organic matter.... However, as soil organic matter decreases, it becomes increasingly difficult to grow plants... But if attention is paid to proper organic matter management, the soil can support a good crop without the need for expensive fixes.*

Soil, even sandy or poor soil, is an ecological system. Soils are not sterile; they have bacteria, fungi, and soil-dwelling invertebrates that increase availability of nutrients by breaking down organic matter. More importantly, the ecological approach of organic farming can improve poor soils. The use of cover crops, compost, natural sources of minerals, or grazing animals can improve the organic matter content and biodiversity in the soil. This is the fundamental process of regeneration that makes organic agriculture truly sustainable, able to grow food over the long term. Soil-less systems such as hydroponics seek to diminish the ecological complexity of the system.



Soil-based organic production relies on the health of the soil—including its natural microbiome—for the majority of plant nutrition.

Crops grown in intensively managed greenhouse environments can require less acreage, therefore may be more suitable near urban environments. However, these systems still must be designed to operate in fertile soil to be considered organic.



# HISTORY OF THE NOSB'S DELIBERATION ON SOIL-LESS SYSTEMS

**IN 2001, THE NOSB WROTE** a recommendation on greenhouse production without specifically mentioning hydroponics. By 2003, the NOSB had prepared a guidance document for hydroponics and other soil-less growing systems. The background material considered various growing systems and posed questions to consider in regards to organic hydroponics, but the body did not present any formal recommendations.<sup>15</sup> There was a need to distinguish between hydroponics and other soil-less systems, such as mushrooms on wood substrate, microgreens, and transplants.

Five years later, the Crops Subcommittee again began gathering information about hydroponics, presenting a discussion document at the spring 2008 NOSB meeting.<sup>16</sup> Using the term “soil-less growing systems,” the discussion requested public comment relative to limiting hydroponic systems to naturally aquatic plant species, but no recommendation was voted on by the full NOSB.

In 2009, the NOSB presented a discussion item at their spring meeting.<sup>17</sup> The document noted, “Hydroponics ... certainly cannot be classified as certified organic growing methods due to their exclusion of the soil-plant ecology intrinsic to organic farming systems...” The NOSB referenced OFPA’s requirement for an organic system plan designed to foster soil fertility<sup>18</sup> and the following regulations:

- §205.203(a) *The producer must select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of the **soil**.*
- §205.203(b) *The producer must manage crop nutrients and **soil** fertility through rotations, cover crops, and the application of plant and animal materials.*
- §205.203(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... [emphasis added]*

At the fall 2009 meeting, the NOSB presented another recommendation for rulemaking: the addition of §205.209, concerning Greenhouse Production Systems.<sup>19</sup> That recommended rulemaking included a prohibition of hydroponic systems.

After public comment was received, the Crops Subcommittee wrote a recommendation entitled “Production Standards for Terrestrial Plants in Containers and Enclosures.” The full NOSB approved the document and made a formal recommendation, which was submitted to the NOP on April 29, 2010.<sup>20</sup> This document is a result of years of work by the volunteers on the NOSB and public



Miles McEvoy visits a hydroponic operation in 2012.

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“Hydroponics ... certainly cannot be classified as certified organic growing methods due to their exclusion of the soil-plant ecology intrinsic to organic farming systems...”

comment by organic stakeholders. The document recommended further rulemaking action by the NOP.

These 2010 recommendations regulations stated, in part:

*§205.209(b) Growing media shall contain sufficient organic matter capable of supporting natural and diverse soil ecology. For this reason, **hydroponic and aeroponic systems are prohibited** [emphasis added].*

The discussion section of the recommendation continued:

*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 elimi-***

***nate soil from the system, such as hydroponics or aeroponics, cannot be considered as examples of acceptable organic farming practices*** [emphasis added].

It is clear that the NOSB and the organic community still intended organic farming to be based on ecological principles, as is stated in the definition of organic.

## PUBLIC COMMENTS TO THE NOSB

The NOSB received very few comments that addressed hydroponic crop production in 2010. This was probably because the Crops Subcommittee recommendation focused primarily on greenhouse production, and at the time hydroponic production was not common in organics. Hydroponics and aquaponics were included in the recommendation because they involve growing crops in greenhouses.

At the time, both Pennsylvania Certified Organic (PCO) and Oregon Tilth Certified Organic (OTCO) supported the recommendation to prohibit hydroponics, citing the importance of soil in organic agriculture. Oregon Tilth later noted that they certified 25 aquaponic operations and commented to the NOSB in favor of aquaponic organics:

*We agree with the Subcommittee's findings that hydroponic and aeroponic systems, as defined in this proposal, do not comply with the National Organic Standards (NOS). These systems are input-dependent, relying on large volumes of soluble fertilizers with little nutrient cycling. Prohibition of hydroponic and aeroponic production methods clarifies how and why certain systems are consistent with NOS. In addition, it ends inconsistency between certifiers, while increasing consumer confidence in products adhering to organic production standards.*

*However, we urge the Subcommittee to reconsider their proposed prohibition of aquaponic plant production. Aquaponics offers environmental and socio-economic benefits, and Oregon Tilth believes that these systems can be managed in compliance with the organic standard and should be eligible for certification.*<sup>21</sup>

In 2010, the Organic Trade Association (OTA) supported the soil requirement and the exclusion of hydroponic methods in organic crop production based on the Canadian prohibition on organic certification of hydroponic production. However, as corporate agribusiness began to heavily invest in organic hydroponics, the powerful industry lobby group soon became one of its strongest proponents.

The largest USDA accredited certifier in the country and one of OTA's biggest donors, California Certified Organic Farmers (CCOF), strongly disagreed with the NOSB's recommendation. CCOF stated that they have certified

"It is clear that the NOSB and the organic community still intended organic farming to be based on ecological principles, as is stated in the definition of organic."

organic hydroponic operations and that they support the continuing organic certification of hydroponic and aeroponic systems.

Through documents secured by The Cornucopia Institute through the Freedom of Information Act (FOIA), it was discovered that CCOF quietly negotiated with the head of the NOP, Miles McEvoy, for authorization to certify over 100 hydroponic operations, netting the certifier substantial revenue over the interceding years. McEvoy would leave his post in 2018 to work as a consultant for CCOF and other certifiers.

With input from many organic stakeholders and much volunteer time from individual board members, the full NOSB developed a recommendation to prohibit organic hydroponics in 2010. Still, the NOP has never adopted this formal recommendation.

## NATIONAL ORGANIC PROGRAM AND HYDROPONICS

In response to this confusing state of affairs, long-time Vermont organic farmer Dave Chapman drafted a petition to the NOP in 2014, requesting that they formally accept the 2010 NOSB recommendation. The "Keep the Soil in Organic" petition had over 1,300 signatures, roughly half of which were farmers.<sup>22</sup> Chapman would reiterate the points made in that petition during the spring NOSB meeting in 2017.<sup>23</sup>

On January 29, 2014, producers certified by Vermont Organic Farmers (VOF) voted to approve the following resolution: "Vermont Organic Farmers demand that the National Organic Program accept the 2010 NOSB recommendation to prohibit soil-less hydroponic vegetable production as certified organic." VOF still refuses to certify hydroponic operations and publicly supports the "Keep the Soil in Organic" petition.

On February 7, 2014, the National Organic Coalition (NOC) released their Position on Hydroponic Production.<sup>24</sup> They agreed with the NOSB recommendation from 2010 that stressed "organic farmers are not just tillers of the soil, but also stewards of soil ecology on the farm." NOC stated; "Until a clear definition has been provided by the NOP, certifiers should not be allowed to certify hydroponic systems."<sup>25</sup>

After receiving the petition organized by Chapman and the comments from NOC, the NOP quickly clarified its stance. On February 21, 2014, McEvoy issued a statement of several paragraphs, including “*Organic hydroponic production is allowed as long as the producer can demonstrate compliance with the USDA organic regulations,*” on their webpage under “Organic Topics of Interest.” The text was also included in the Organic Integrity Quarterly.<sup>26</sup> (The full text is in Appendix 1 of this report.)

This statement on the NOP website does not constitute a regulation or guidance, but it does provide support for certifiers who wish to certify hydroponic crop production systems. It indicates that crop production can be considered organic even when terrestrial plants are grown in pure nutrient solution or in an inert medium.

Because of its direct conflict with the regulations, the enabling legislation OFPA, and the 2010 NOSB resolution, McEvoy’s statement should never have been issued. The 2010 NOSB recommendation was promulgated after extensive public discussion and input from industry stakeholders. The NOP statement was issued without public input and without regard for the decades-old, established process of standards development.



## 2016 USDA HYDROPONIC AND AQUAPONIC TASK FORCE

When the NOSB recommended to prohibit the organic certification of hydroponics in 2010, they stated: “*Growing media shall contain sufficient organic matter capable of supporting natural and diverse soil ecology. For this reason, hydroponic and aeroponic systems are prohibited.*” However, the NOSB also noted that there are some exceptions for the soil requirement, including transplants (because the majority of the crop’s growth occurs in the soil after transplanting), and products that don’t naturally grow in soil such as mushrooms, honey, aquatic plants, and sprouts (because nutrients primarily come from the seed, not enhanced irrigation water).

Since industrial agribusiness and the OTA didn’t like the outcome of the 2010 NOSB recommendation, the corporate-friendly USDA forced the organic community to go through the process of deciding on hydroponics all over

again. In 2016, the NOP formed a “Hydroponic and Aquaponic Task Force.”<sup>27</sup>

A stated primary objective of the USDA/NOP-created Task Force was “to clarify the NOSB’s 2010 Recommendation.”<sup>28</sup> There was widespread concern regarding the actual purpose of the task force. The majority of the members of the task force seemed to have a vested interest in advancing organic certification of hydroponics rather than in clarifying the 2010 NOSB recommendations.

Selection of task force members by the NOP was initially limited to those with at least three years of experience in hydroponic or aquaponic production. After extensive blowback in the organic community, that restriction was amended to include some with experience in soil-based organic systems of production.\*

In the end, the NOP stacked the task force primarily with people affiliated with hydroponic and aquaponic production experience.<sup>29</sup> Highly qualified task force applicants known to support the exclusion of hydroponic from organic were not chosen, although a few proponents of the soil requirement were given the nod.

The resultant bias in the task force, coupled with the absence of clear and consistent regulations and USDA’s predisposition to allow hydroponics certification, sparked increasing discontentment with the NOP by the wider organic community. Opaque decision-making runs counter to the practices that the organic sector expects from the USDA and the NOP — a process mandated by Congress in the original legislation.

Predictably, the NOP task force was divided as to whether hydroponics could be considered for organic certification.<sup>30</sup>

While the NOSB prolonged their decision on standards, the European Parliament tightened its existing ban on organic hydroponics. The European Commission voted to prohibit “demarcated beds” under their organic label.<sup>\*\*31</sup>

The EU has made a clear statement that hydroponics is not organic.

\* Because the restriction was never amended in the Federal Register, questions remain about whether the panel had any legal standing.

\*\* Demarcated beds are a hydroponic container production system where liquid nutrients are routinely applied.

## THE HYDROPONIC LOBBY'S INFLUENCE

In 2016, large corporate hydroponic growers formed an “Astroturf group” (a lobbying effort masquerading as a grassroots organization), ironically called the Coalition for Sustainable Organics (CSO). Members of CSO are predominantly growing in the desert Southwest and Mexico, where water is limited. The coalition’s chief lobbyist, Anne McMillan, was Deputy Chief of Staff to former USDA Secretary Tom Vilsack. These ties enabled her to testify before congress supporting hydroponics under the organic label.

CSO’s members are not public,<sup>32</sup> but several major industrial hydroponic businesses have acknowledged their involvement. These businesses include Driscoll’s, the



largest hydroponic berry operation in the world, and Wholesum Harvest, which has approximately 281 acres of organic greenhouse hydroponic tomatoes, peppers, cucumbers, and eggplants. The vice president of Wholesum Harvest, Theo Crisantes Jr., sits on the board of CSO. Crisantes testified at the Senate Agriculture Committee Hearing in July 2017 on behalf of organic hydroponics and in support of reducing NOSB authority in regulatory actions.<sup>33</sup>

CSO continues to lobby for the allowance of synthetic fertilizers in organic production, such as hydrolyzed soybeans, aqueous potassium silicate, micronutrients, and acidified fish emulsion. Their influence in Congress to reduce the power of the NOSB came to fruition in the first draft 2018 Farm Bills passed by the House and Senate.<sup>34</sup>

## THE FALL 2017 NOSB HYDROPONIC VOTE — SHOWDOWN IN JACKSONVILLE

In the fall of 2017, the NOSB Crops Subcommittee put forth a proposal that would define hydroponics and limit the amount of fertility that could be applied to a container grown crop. The motion stated that *“for container production to be certified organic, a limit of 20% of the plants’ nitrogen requirement can be supplied by liquid feeding, and a limit of 50% of the plants’ nitrogen requirement can be added to the container after the crop has been planted. For perennials, the nitrogen feeding limit is calculated on an annual*

*basis. Transplants, ornamentals, herbs, sprouts, fodder, and aquatic plants are exempted from these requirements.”*<sup>35</sup>

Organic farmers of different farm sizes and from around the country testified at the 2017 NOSB meeting. Most supported “in-the-soil, in-the-ground” growing for compliance with organic standards, given regulatory requirements for cover cropping, soil fertility, and biodiversity. Many were the pioneering, family-scale farmers who have farmed their soil for as many as 40 years. These farmers helped to build the organic industry, literally, from the ground up.

The grassroots growers were joined by larger organic soil-based producers, including Gerald Davis of Grimmway Farms, a former NOSB member himself. Grimmway Farms is the largest grower of organic produce in the United States, and their brands include Bunny-Luv and Cal-Organic. Davis testified that plants in containers require constant liquid feed, causing plants to be vulnerable to insects and disease.

Tom Beddard of Lady Moon Farms, the largest organic produce operation east of the Mississippi, testified that hydroponic systems would be inherently difficult to catch cheating the organic rules, stating that systemic pesticides and fungicides could easily be delivered to plants through the feeding tubes.

Yet despite compelling testimony from organic farmers, the system was rigged against the organic farmers from the beginning.

With nothing to codify hydroponic production in organic regulations, the NOSB should have voted on a proposal to “allow” certification. Instead, the NOP forced the NOSB to vote on a “ban” of organic hydroponics.



National Organic Standards Board members at the fall 2017 meeting.

The NOP had already illegally allowed certification of hydroponic “container” operations without NOSB approval, and NOP Deputy Administrator McEvoy insisted that the vote should be structured to prohibit the practice.

The vote to limit liquid feeding for container grown crops ultimately failed; seven in favor, eight opposed. With a decisive “partisan” split on the NOSB, between corporate interests affiliated with the OTA and independent voices backing family-scale farmers and traditional organic values, the supermajority (at least ten out of 15 board members) required for a decisive vote could not be achieved. A proposal to “allow” hydroponics would have failed eight-to-seven, and the organic farmers would have gone home victorious. Instead, as it was worded, the proposal to “ban” hydroponics failed, and the hydroponic industry won.<sup>36</sup>

Despite this real-world result, the wording of the vote meant no actual policy changes were enacted. Some have argued that the result of this vote was, in fact, a reversion back to the only other existing NOSB recommendation on hydroponics: the 2010 recommendation prohibiting it.

Neither the NOSB nor the NOP has the authority to create regulations that conflict with OFPA. OFPA clearly expresses the will of Congress, mandating that organic farmers demonstrate their management plans for stewarding soil health before becoming certified.

At the same 2017 meeting, the NOSB voted unanimously to prohibit aeroponic production (i.e., feeding with liquid fertilizer through a fine mist). The difference between aeroponic and hydroponic systems essentially comes down to the droplet size used to deliver liquid fertility. This contradiction—allowing hydroponics but not aeroponics—is likely due to the fact that there is no aeroponic industry lobby in the organic sector.

## ORGANIC HYDROPONIC PRODUCTION IS PROHIBITED BY INTERNATIONAL REGULATIONS

Concerns about organic hydroponic systems are shared by other countries. The U.S.-Canada Equivalency agreement states that “Agricultural products produced by hydroponic or aeroponic production methods shall not be sold or marketed as organic in Canada.”



Organic farmers and other stakeholders marched to Protect Organic during the fall 2017 NOSB meeting.

It’s not clear how these standards are being enforced when crops are exported to Canada or Europe because, as noted above, organic certificates issued by ACAs are not required to specify which crops are grown hydroponically.

Mexico, Canada, Japan, New Zealand, and 24 European countries (including Holland, England, Germany, Italy, France, and Spain) all currently prohibit the sale of organic hydroponic vegetables in their own countries, although it may be exported as “organic” to the U.S. Further, the European Union revised its organic standards in April 2018 to prohibit hydroponic production under their organic label and included a clear definition of organic soil-bound production. Beginning in 2021, it will be illegal for any country in the EU to import produce labeled “organic” if it was grown hydroponically.

Since the United States is one of the few countries that allow hydroponic production systems to be labeled organic, “organic” hydroponic producers in other countries often grow exclusively for a U.S. market, even though they cannot market the same product domestically. At the time of this writing, imported “hydroponic organic” produce sold in this country is primarily grown in Mexico, Canada, or Holland exclusively for the U.S. organic premium market.<sup>37</sup>

# ORGANIC CERTIFIER RESPONSE TO NOP POSITION ON HYDROPONICS

**EVEN THOUGH THE NOP** has never issued guidance or regulations on certifying “ponics” operations, some accredited certifying agents (ACAs) have gone ahead anyway. Due to their increasing size and number, it has proven to be a lucrative practice green-lighted by the regulators. As of June 2018 there are at least 16 ACAs out of approximately 44 domestic certifiers that certify hydroponic/aquaponic systems or have done so in the past. They include:

- ABO (A Bee Organic)
- AI (Americert International)
- BOC (Baystate Organic Certifiers)
- CCOF (California Certified Organic Farmers)
- CDA (Colorado Department of Agriculture)
- CUC (Control Union Certifications)
- ECO (EcoCert), GOA (Global Organic Alliance)
- ICO (Indiana Certified Organic)
- MCIA (Minnesota Crop Improvement Association)
- MOSA (Midwest Organic Services Association)
- OC (Organic Certifiers, Inc)
- OTCO (Oregon Tilth Certified Organic)
- PCO (Pennsylvania Certified Organic)
- PL (Primus Labs)
- PRO (Pro-Cert Organic Systems)
- QAI (Quality Assurance International)

There may be others, but it is difficult to determine whether an ACA certifies hydroponic farms because production methods are not required to be listed in the official database of certified USDA organic operations on the NOP website, called the Organic Integrity Database. A search of the Organic Integrity Database in 2018 resulted in only two listings for hydroponics,<sup>38</sup> one certified by OTCO (Oregon Tilth) and the other certified by MCIA (Minnesota Crop Improvement Association). Cornucopia’s research subsequently identified more than 50 hydroponic operations, none of which are registered as hydroponic producers (see Cornucopia’s Hydroponic Buyer’s Guide). To add to the confusion, some soil-less operations are disingenuously claiming they are not hydroponic and are “container” growers instead.

The NOP has still not issued a proposed rule or established regulations based on the 2010 NOSB recommendation, nor has the NOP issued guidance to certifiers on how to inspect hydroponic farms. This means that certifiers must interpret the regulations on their own. This leads to a lack of uniformity, with some ACAs choosing not to certify hydroponic systems as organic while others accept organic hydroponic systems, as well as significant variation in how inspections are conducted.

One certifier, Oregon Tilth Certified Organic (OTCO), has posted some FAQs on their website (attached in appendix 1). Although Cornucopia disagreed in their decision to certify these operations, OTCO’s efforts to provide transparency by posting information about their interpretation of organic standards on their website were appreciated. Although no longer available online, the FAQs did provide information about the types of hydroponic systems that are being certified. Since these systems may be based on sterile water rather than fertile soil, hydroponic farmers are concerned about obtaining a source of plant nutrients. OTCO addressed the problem as follows:

*Can synthetic micronutrients be applied? What is required to document deficiency?*

*Synthetic micronutrients can be used in a hydroponic system. Most hydroponic systems are obviously deficient of micronutrients, however deficiency must still be documented (205.601(j)(6)). Documentation of deficiency could include water or tissue tests, notes of visual observations, extension or advisor recommendations, etc.*

According to this interpretation, farmers can simply grow plants in water plus micronutrients. That is a system that does not integrate biological practices, foster cycling of nutrients, or promote ecological balance. In other words, hydroponic farmers can grow certified organic crops in a system that does not meet the NOP’s own definition of organic.

# KEEP THE SOIL IN ORGANIC AND THE REAL ORGANIC PROJECT

**PIONEERING ORGANIC FARMERS** decided to organize, forming a movement called “Keep the Soil in Organic,” a grassroots effort to reclaim organic standards from industrial hydroponic influence.<sup>39</sup> Between 2016 and 2017, the movement resulted in 15 rallies across the country protesting the allowance of both hydroponic and factory farming production under the organic seal.<sup>40</sup> Vermont Senator Patrick Leahy, Vermont Representative Peter Welsch, and Maine Representative Chellie Pingree spoke at the Vermont rally, in addition to several widely-respected, pioneering organic farmers including Eliot Coleman.

Those efforts resulted in the formation of a non-profit called The Real Organic Project (ROP)<sup>41</sup>, aimed at greater transparency under the organic label. ROP will offer an add-on label to certified organic farms that meet ROP’s additional standards. These standards specify that vegetable producers must grow in soil and livestock producers must provide increased pasture for ruminants and true outdoor access for poultry production.<sup>42</sup> ROP expects to roll out labeling in 2019.



Sen. Patrick Leahy, sponsor of the Organic Foods Production Act of 1990, spoke at the Vermont rally to Keep the Soil in Organic.

# MARKETING “PONIC” SYSTEMS

**THE ORGANIC COMMUNITY** is not alone in its interest in a marketing label for “ponics” crops. Certified Naturally Grown (CNG) is developing a new certification for aquaponic operations. CNG is a peer-reviewed (alternative) certification program that is based on the USDA organic regulations.

They state on their website:

*A meaningful certification program would require a new set of standards specific to aquaponic production. And developing standards is about more than simply saying “no chemicals”. CNG’s certification programs must also take into account the materials used in production, energy use, and impacts on natural resources, among other things.<sup>43</sup>*

As CNG considered the issues, they determined:

*[H]ydroponic operations are not a good fit for CNG certification because there are currently few sources of natural fertility well-suited to hydroponic operations. Commercial hydroponic operations typically rely on synthetic fertilizers.*

This reasoning by CNG is relevant to the NOP as it decides whether to continue to allow organic hydroponic operations. If no action is taken by the NOP, it will allow other programs, such as CNG and the Real Organic Program label, to be viewed as the gold standard for consumers.



## ORGANIC HYDROPONIC PRODUCTION IN THE MARKETPLACE

There is currently no way to tell whether an organic crop is grown hydroponically or in soil. The Cornucopia Institute published a buyer’s guide listing hydroponic operations<sup>44</sup> based on information available in the media and online, but new hydroponic operations are constantly entering the organic market now that the NOP has allowed it.

The high upfront infrastructure costs limit small-scale operations from entering the hydroponic market, and the cheap cost of production once established will result in industrial hydroponics dominating the organic marketplace. The only way to ensure that small family farms are not outcompeted by industrial hydroponic operations is for consumers to avoid purchasing products from these companies.

The Cornucopia Institute is engaged in marketplace education and a pressure campaign which collected thousands of signed proxy letters addressed to the CEOs of the largest retailers of organic foods in the country, ranging from Walmart and Costco to Amazon’s Whole Foods. Cornucopia is currently negotiating with retailing executives in an attempt to encourage them to institute volunteer labeling that identifies the hydroponic produce they sell. The goal is to give consumers the “right to choose” in the marketplace even while the NOP does not.



## RECOMMENDATIONS GOING FORWARD

**HYDROPONIC GROWERS** are currently achieving organic certification illegally, without clear regulations that are specific to their system. The Cornucopia Institute is researching how to make a strong challenge to these alleged government-sanctioned improprieties in court.

This situation needs to be remedied. If hydroponic production is to continue to be certified organic, regulations specific to hydroponic systems are needed. The labeling of hydroponic crops should also be required so consumers aren't deceived in the meantime.

The Cornucopia Institute acknowledges our Hydroponic Buyer's Guide is incomplete because there is limited transparency among certifiers and agribusiness giants.

At a minimum, if organic stakeholders do not prevail through litigation, a new section of the National List is needed for hydroponic crops. It is particularly important to develop guidelines on sources and types of fertilizers that are allowed for organic crop production. The synthetic micronutrients that have been approved by the NOSB for terrestrial crop production, including boron, zinc, copper, iron, manganese, molybdenum, selenium, and cobalt, are to be used only if a soil deficiency is documented. These micronutrients, and indeed all the synthetic fertilizers on the National List, were reviewed by the NOSB for use in terrestrial systems.

When the NOP declared that hydroponic production was allowed, that decision allowed the use of all the synthetic nutrients on the National List (although they were never reviewed for use in a hydroponic system).

As part of the development of standards for hydroponic production, there needs to be some requirement for evidence that synthetic micronutrients are needed. If organic certifiers simply replace the requirement for soil testing with a requirement for water testing, all synthetic micronutrients will be allowed.

Legal or not, if organic hydroponics is to continue, synthetic materials on §205.601 should be re-evaluated for hydroponic production. When materials are petitioned to be added to §205.601 of the National List, the evaluation assumes use on terrestrial crops in soil. Some materials may be appropriate only for terrestrial, and not for hydroponic, production systems.

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The synthetic micronutrients that have been approved by the NOSB for terrestrial crop production, including boron, zinc, copper, iron, manganese, molybdenum, selenium, and cobalt, are to be used only if a soil deficiency is documented. These micronutrients, and indeed all the synthetic fertilizers on the National List, were reviewed by the NOSB for use in terrestrial systems.

An example of this is aqueous potassium silicate (APS), a highly soluble synthetic fertilizer. The initial petition requested use of APS as a source of potassium fertilizer for hydroponic crops. Although APS is on the National List for use as an insecticide or plant disease control, it can also be used as a source of synthetic macronutrients in hydroponic production.

Even with the convoluted and apparently illegal approach by the NOP, the NOSB and the organic community should have addressed questions specific to soil-less growing systems. As it is operating, hydroponics is an out-of-control, renegade sector of the organic industry.

The regulations for hydroponic systems must clarify specific requirements for crop producers, including:

- What types of growing media are allowed?
- What sources of fertility are allowed?

In addition, there should be recognition of the ways in which the hydroponic operation is part of the larger ecological system. Otherwise, there will be little to differentiate organic hydroponic systems from conventional systems. Organic regulations require farmers to use practices that build or maintain soil health, such as cover cropping and crop rotations. Hydroponic systems should also address practices that regenerate the ecosystem. This may include the effects on the soil, water, and solid waste systems connected to the production.

# CONCLUSION

**IN 2010, THE NOSB** made a clear recommendation: hydroponic systems should not be eligible for organic certification. The Cornucopia Institute urges the NOP to respect and enforce that decision.

OFPA established the NOSB “to assist in the development of standards for substances to be used in organic production and to advise the Secretary on any other aspects of the implementation of this title.”

The recommendation of the NOSB represents a major investment in both time and money by the federal government, non-profits, industry, organic certifiers, farmers, and other organic stakeholders. The NOP has stated that they are not legally required to follow NOSB recommendations, and a lawyer might uphold that interpretation. However, it is doubtful that that Congress intended the NOP to do the opposite of what the NOSB recommends.

Cornucopia suggests a common-sense interpretation: When a board is created to advise the federal government, the intention is that the government will follow that expert advice. The intention of OFPA was to involve a volunteer citizen board (the NOSB), along with the en-

tire organic community, in creating organic regulations based on consensus. If the original writers of OFPA wished to have the federal government draft regulations without input from citizens, they would not have established the expert board with diverse representation from the organic community and mandated their input. They chose a democratic approach, believing that federal regulators would honor their intentions.

In the long term, if court challenges do not prevail and the USDA continues to allow organic hydroponic certification, the NOP should request that the NOSB recommend standards specific for hydroponic production. Until then, there is a desperate need for additional scrutiny of synthetic and non-organic crop production materials, recognizing that they may be used in hydroponic production under the current NOP policy. At the very least, organic produce on the store shelves should be labeled “hydroponic” so that consumers are not misled.



# APPENDIX 1. OREGON TILTH CERTIFIED ORGANIC (OTCO) HYDROPONIC FAQs

## QUESTIONS AND ANSWERS REGARDING ORGANIC HYDROPONIC OPERATIONS<sup>45</sup>

### DOES THE LAND ON WHICH A HYDROPONIC SYSTEM IS CONSTRUCTED NEED TO BE FREE OF PROHIBITED MATERIALS FOR 36 MONTHS (205.202(B))?

No. A soil-less system is not required to meet the land history requirements.

### WHAT TYPE OF GROWING MEDIA CAN I USE?

Only non-synthetic growing media is allowed. Any substance which supports the root system must be non-synthetic. Note that rock wool is a prohibited synthetic due to its chemical methods of production (see OMRI, and definition of “Synthetic” in 205.2).

### ARE SYNTHETIC RAFTS, FLOATS, TABLES, CONTAINERS, GUTTERS, ETC. ALLOWED?

Yes. Any structure that merely surrounds or supports the plant, and is not a media for the root system, can be synthetic. This is analogous to a plastic pot or seedling tray in a greenhouse.

### WHAT IS ALLOWED FOR PH ADJUSTMENT?

Only non-synthetic (natural, mined) or National List synthetic materials are allowed for pH adjustment. Examples of allowed materials for pH adjustment: citric acid (produced by a non-GMO organism), vinegar, calcium carbonate (oyster shells, etc.). Examples of prohibited materials: nitric acid, phosphoric acid, potassium hydroxide, calcium hydroxide.

### IS REGULAR WATER TESTING REQUIRED?

No, but the water must not contaminate the organic crop with prohibited substances.

### WHAT NEEDS TO BE IN PLACE FOR AN INSPECTION TO OCCUR?

The system must be complete with all equipment and ready to begin production, but plants do not need to be growing to be inspected.

### AM I ALLOWED TO PAINT THE INSIDE OF MY GALVANIZED TANK OR OTHER EQUIPMENT IN THE GROWING SYSTEM?

Yes, but you must show that the paint is not contaminating the organic crop (i.e., leaching or peeling).

### CAN I USE PRESSURE-TREATED LUMBER FOR CONSTRUCTION OF MY BUILDING OR BEDS?

Yes, but pressure-treated wood must not contact the water the plant is grown in or the organic crop (205.206(f)).

### CAN THE OPERATION BE INDOORS (I.E., IN A HOUSE OR GARAGE)?

Yes. There is no requirement in the organic standards that plants be grown outdoors.

### ARE FILL & DRAIN (EBB & FLOW) SYSTEMS ALLOWED?

Yes. Fill and Drain is a method of water management and is allowed.

### CAN MANURE BE USED IN A GROWING MEDIA MIX?

Yes, the restriction on manure is the same as applied to any other cropping system (205.203(c)). If the water or manure touches the organic crop then a 120-day pre-harvest interval is required.

### CAN SYNTHETIC MICRONUTRIENTS BE APPLIED? WHAT IS REQUIRED TO DOCUMENT DEFICIENCY?

Synthetic micronutrients can be used in a hydroponic system. Most hydroponic systems are obviously deficient of micronutrients, however deficiency must still be documented (205.601(j)(6)). Documentation of deficiency could include water or tissue tests, notes of visual observations, extension or advisor recommendations, etc.

### CAN I OPERATE A SPLIT PRODUCTION SYSTEM?

Yes, but they must be physically separate and there can be no commingling of water or inputs. Records must be maintained to confirm that contamination and commingling has not occurred.

### DOES FISH FOOD OR MEDICINE NEED TO BE ORGANIC?

No. OTCO considers that fish feed is consumed by the fish and not used by the plants. All fish feed and medicine inputs are allowed. However, chemicals which modify the pH of the water, or which can be taken up directly as plant nutrients (potassium hydroxide, phosphoric acid, etc.), are not considered fish food and are therefore not allowed.

**CAN FISH FOOD CONTAIN ANTIBIOTICS?**

Yes, provided that antibiotics will not contaminate the organic crop. Antibiotics may not be administered in the same solution used by the organic crop. Antibiotics which are solely used for fish production are allowed, as long as it is not intended as a crop production input.

**DOES AN AQUAPONIC SYSTEM REQUIRE A PRE-HARVEST INTERVAL FOR FISH MANURE, OR TESTING OF WATER THAT INCLUDES FISH EXCREMENT?**

No. The NOP definitions in 205.2 states that “Manure” is produced by livestock, and the definition of “Livestock”

excludes aquatic animals. No pre-harvest interval or testing of water is required. However, the water used for organic production must not contain chemicals (nitrates, etc.), which could contaminate the organic crop.

**FOR EFFLUENT, WHAT ARE THE REQUIREMENTS FOR THE PREVENTION OF LEACHING AND/OR DISPOSAL OF EXCESS NUTRIENTS?**

The operation must manage effluent in a way that does not contribute to the contamination of crops, soil, or water. This must be included within the operation’s Organic System Plan.

## APPENDIX 2. NOP STATEMENT ON ORGANIC CERTIFICATION OF HYDROPONIC CROPS

*This text was published in the Organic Integrity Quarterly, May 2014 Newsletter, page 13.<sup>46</sup>*

**ORGANIC HYDROPONICS IS A METHOD** of growing plants using mineral nutrient solutions, in water, without soil. Terrestrial plants may be grown with their roots in the mineral nutrient solution only or in an inert medium, such as perlite, gravel, biochar, or coconut husk. Some organic farms are utilizing hydroponic growing methods to produce organic crops under the USDA organic regulations. These producers use the same fertilizers and pest control practices as other organic farmers—primarily natural fertilizers and pest control methods. Organic hydroponic production is allowed as long as the producer can demonstrate compliance with the USDA organic regulations.

Accredited certifying agents are certifying organic hydroponic operations based on the current organic regulations and the operation's Organic System Plan. In the future, the NOP may provide additional guidance regarding organic hydroponic production and how the regulations apply to such methods.

The National Organic Advisory Board (NOSB) completed their final recommendations on crop production in containers and enclosures (e.g. greenhouses) in 2010. The NOSB's 2010 recommendation included a provision for not allowing organic hydroponic production. The NOP continues to work on evaluating and implementing a backlog of older NOSB recommendations

including the greenhouse recommendation. Any proposed changes based on the NOSB's greenhouse recommendation that would affect organic hydroponic operations would involve opportunities for public comment.

## APPENDIX 3. USDA ORGANIC REGULATIONS

§ 205.601 Synthetic substances allowed for use in organic crop production.

(j) As plant or soil amendments.

(1) Aquatic plant extracts (other than hydrolyzed)—Extraction process is limited to the use of potassium hydroxide or sodium hydroxide; solvent amount used is limited to that amount necessary for extraction.

(2) Elemental sulfur.

(3) Humic acids—naturally occurring deposits, water and alkali extracts only.

(4) Lignin sulfonate—chelating agent, dust suppressant.

(5) Magnesium sulfate—allowed with a documented soil deficiency.

(6) Micronutrients—not to be used as a defoliant, herbicide, or desiccant. Those made from nitrates or chlorides are not allowed. Deficiency must be documented by testing.

(i) Soluble boron products.

(ii) Sulfates, carbonates, oxides, or silicates of zinc, copper, iron, manganese, molybdenum, selenium, and cobalt.

(7) Liquid fish products—can be pH adjusted with sulfuric, citric or phosphoric acid. The amount of acid used shall not exceed the minimum needed to lower the pH to 3.5.

(8) Vitamins, B1, C, and E.

(9) Sulfurous acid (CAS # 7782-99-2) for on-farm generation of substance utilizing 99% purity elemental sulfur per paragraph (j)(2) of this section.

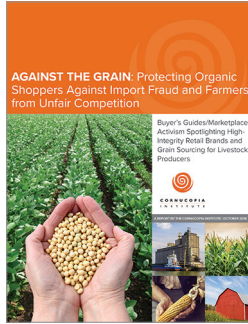
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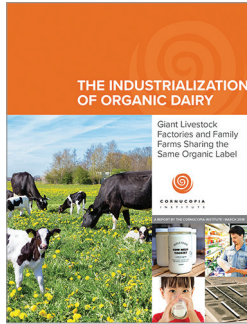
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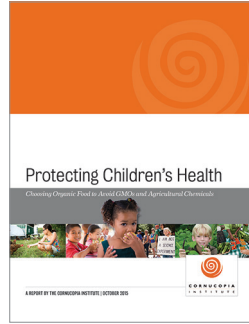
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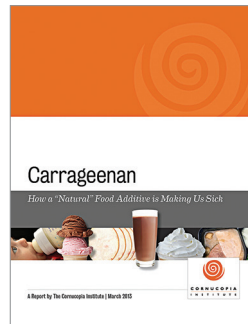
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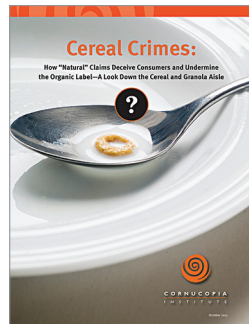
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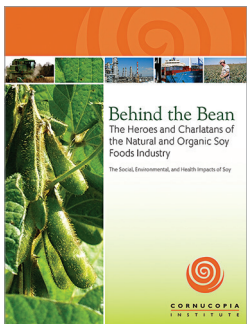
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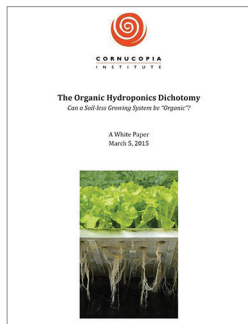
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