

Produce Safety Factors to Consider when Using Biological Soil Amendments of Animal Origin (BSAAO)

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The Food Safety Modernization Act (FSMA) Produce Safety Rule (PSR), a regulation intended to reduce the number of foodborne illness outbreaks associated with fruits and vegetables, establishes requirements for certain agricultural inputs ([FSMA PSR](#))¹. Regulated inputs include biological soil amendments that consist, in whole or in part, of materials of animal origin (FDA [BSAAO factsheet](#))². [Examples of biological soil amendments of animal origin \(BSAAO\) include](#)³ untreated manure, composted manure, animal mortalities, blood meal, fish hydrolysate, and other non-fecal animal byproducts. It is important to note that the term ‘BSAAO’ does not include any form of human waste, because human waste may contain pharmaceuticals, heavy metals, and human pathogens, though the FSMA PSR does allow “sewage sludge biosolids used in accordance with the requirements of 40 CFR part 503, subpart D, or equivalent regulatory requirements”¹.

Current Soil Amendment Challenges

Growers are currently facing disrupted shipments of chemical fertilizers, food, and other products. Due to these global supply chain disruptions, the price of chemical fertilizers in the United States has more than doubled since 2021 ([USDA](#))⁴. High prices and lack of access to chemical fertilizers have resulted in growers looking for alternatives for chemical fertilizers ([Washington Post Article](#))⁵.

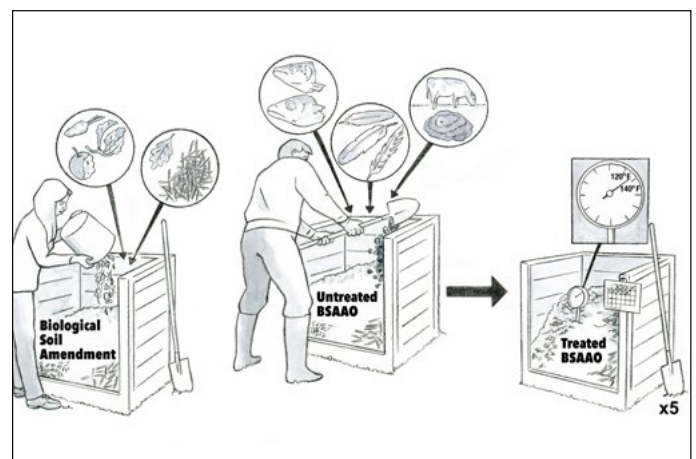
BSAAO containing animal manure or compost may be used as a substitute or supplement for chemical fertilizers; these amendments help to improve soil fertility and health by incorporating organic matter into the soil, adding supplemental nutrients, and improving soil structure, porosity, and [water holding capacity](#)⁶.

Despite these benefits, there are limitations and risks to the use of certain BSAAO. BSAAO often have a lower nutrient content than chemical soil amendments, meaning that when BSAAO are used to replace chemical soil amendments a larger volume may be needed to provide an equivalent nutrient load. BSAAO can also be a source of human pathogens, however such risks can be managed with the proper knowledge, training, and practices.

Managing BSAAO Risks for Microbial Safety in Fresh Produce: Treatment Status

BSAAO can pose a food safety risk by introducing human pathogens into the soil and to fresh produce. Growers selecting and applying soil amendments on produce fields should be familiar with the risks and practices to mitigate those risks. The primary factor that growers should consider when selecting a BSAAO is whether the amendment is treated or untreated.

Scientifically validated treatment processes, such as composting, kill human pathogens through high temperatures and microbial competition.



In addition to destroying human pathogens, insect larvae, and weed seeds, the composting process has the additional benefit of stabilizing nutrients to minimize leaching while creating a uniform soil amendment with minimal odors. Untreated or partially treated manure poses a higher risk to produce due to the likely prevalence of human pathogens that could contaminate produce in the field. Examples of untreated BSAAO include raw manure, 'aged' manure, untreated manure slurries or teas, agricultural teas with supplemental microbial nutrients, and any soil amendment mixed with raw manure. If untreated, non-manure BSAAO such as bone meal, blood meal, feather meal, and fish emulsion may also pose risks to produce.

Considerations when Selecting and Applying a BSAAO for Produce Production

- Avoid contact with the harvestable portion of the crop during and after BSAAO application.
- If possible, select a BSAAO that has been treated through a scientifically validated process. Two compost treatment processes are listed in the FSMA PSR as validated to kill pathogens: [windrow composting](#)⁷ and [aerated static](#)⁸ composting.
- Preferentially apply untreated BSAAO to crops not intended for fresh consumption. For instance, agronomic crops and crops that are rarely consumed raw (RCR).
- Maximize the time between BSAAO application and harvesting, especially if an untreated BSAAO is being applied. The National Organic Program (NOP) 90/120-day Rule is a prudent step to minimize risks. The NOP requires growers wait 120 days between applying untreated animal manure and harvesting the crop when the crop is intended to contact the soil, and 90 days between application and harvest when the produce does not have direct contact with the soil surface. See the [NOP](#)⁹ guidance for more details.
- Train employees who handle BSAAO to reduce risks by properly managing raw manure or compost, changing clothes and shoes after handling BSAAO and making sure gloves are clean before handling produce. Employees must wash their hands after handling BSAAO.

- Use designated equipment and tools for handling soil amendments to reduce the risk of cross-contamination. [Standard Operating Procedures](#)¹⁰ (SOPs) can be developed for cleaning and sanitizing tools and equipment used to handle soil amendments.
- Minimize traffic between manure/compost piles, fields, and packinghouses to reduce cross-contamination.
- Properly store and cover manure piles to reduce risk of BSAAO runoff into produce fields. If an untreated BSAAO contaminates a treated BSAAO, both sources must be considered untreated, so keep piles separate.
- A [decision tree](#)¹¹ outlining soil amendment recommendations, recordkeeping templates, and template language can be found on the National Good Agricultural Practices Program website.

Impacts Beyond Food Safety

- The [presence of herbicide residues](#)¹² in compost and manure can pose additional risks associated with the use of soil amendments in the field. It has been reported that [herbicides can be active in manure and compost](#)¹³ for long periods of time. Growers should be aware of this when sourcing BSAAO and inquire about herbicides used in animal pastures.

BSAAO Documentation

- For BSAAO treated by the grower and applied on their own farms, the FSMA [PSR requires documentation](#)¹⁴ that shows that the process controls (i.e., time, temperature, and turnings) were achieved.
- For treated BSAAO purchased from a third-party supplier, growers must have a certificate of conformance to demonstrate that the BSAAO meets all treatment and handling requirements. Please review this PSA factsheet for [additional documentation requirements](#)¹⁵.
- Growers applying untreated BSAAO should [document](#)¹⁶ the type of amendment, rates, and dates of application. This is not required by the PSR, but it is the best way for growers to understand their practices, establish complete traceability records, and this type of documentation may be required by buyers.

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