

# Soil Amendments Overview

A soil amendment refers to any material added to the soil to improve its physical or chemical properties. With fresh fruits and vegetables, food safety concerns are most often associated with biological contamination by **pathogens** in manure-based soil amendments. However, chemical hazards associated with **inorganic fertilizers** can represent a chemical risk to crops as well as to those who apply the fertilizers. Many inorganic fertilizers are federally regulated so the first rule is to always **follow the label** because the **label is the law**. Proper storage practices and controlling access to these chemicals is also important to meet federal requirements and reduce the chance of chemical contamination on the farm.

Manure-based soil amendments can harbor pathogens that can cause illness in humans and may contaminate produce when introduced into the production environment. This overview is intended to provide general guidelines and recommendations to reduce the likelihood of produce microbial contamination when using manure-based soil amendments.

- If it is unknown whether the manure-based soil amendment is raw or fully composted, it should be considered raw manure.
- Recommended time intervals from application of raw manure to the harvest of the produce crop vary from 90 days to 1 year. These recommendations are discussed in more detail below.
- Composting manure can significantly reduce the risk of contamination.
- Recordkeeping is important for all soil amendment applications. Document what, where, when, how, and how much was applied. For compost, the composting process including monitoring time, temperatures, and turnings should also be documented.

## Raw Manure

When a crop is grown on land on which raw manure has recently been applied, there is a risk that the crop could be contaminated because of the likelihood of foodborne illness pathogens being present and the increased risk of crop contamination. If raw manure is used as a soil amendment or fertilizer, it should never be applied during the growing season and always be incorporated into the soil within 72 hours after application. The interval between raw manure application and harvest should be maximized. The required time frame between application and harvest varies throughout the industry. The Leafy Greens Marketing Agreement (LGMA)<sup>1</sup> requires an interval of at least one year. The National Organic Program<sup>7</sup> (Rule 7 CFR Part 205.203) recommends applications be at least 90 days before harvest for crops that have edible portions which **do not** come in contact with the soil and at least 120 days before harvest of crops that have edible portions which **do** come in contact with the soil (crops in or near the soil are most vulnerable to contamination). The proposed Food Safety Modernization Act (FSMA)<sup>13</sup> Produce Rule would require nine months between a raw manure application and harvest of a produce crop covered by the rule. Some research even shows that pathogens can persist in the soil well beyond this time frame<sup>2,3,4,5</sup> and therefore some leafy green buyers require a five year interval.<sup>6</sup>

Aside from raw manure purposely applied to fields, it is important to consider manure that may enter the field through runoff, wildlife animal intrusion, or movement from adjacent lands that have domesticated farm animals. Please see the *Wildlife and Animal Management* and *Land Use Decision Trees* to assess these risks.

## Compost

Composting animal manure can reduce microbial pathogens and greatly reduce the risk of contamination to fruit and vegetable crops. Simply piling manure without actively managing and monitoring it, or using an anaerobic system (also called 'aging'), is not composting and therefore must be considered raw manure. If the same equipment or tools are used on raw, cured, or curing piles, be sure to clean and sanitize them after use on raw manure to avoid recontamination of the other piles.

Compost must maintain a temperature of between 131 and 170°F for 3 days (enclosed system) or 15 days (windrow system), during which period the composting materials must be turned a minimum of five times. After these steps, the compost pile should cure for 45 days. Finished and curing compost piles should be covered in order to prevent recontamination. Acceptable organic materials for compost include, but are not limited to: animal manure, by-products of agricultural commodities processing, yard debris, and kitchen wastes. Detailed records should be kept of pile type (aerobic vs. anaerobic, enclosed, windrow, etc.), temperature and moisture management, dates turned, and the duration of high temperatures. The Northeast Recycling Council<sup>11</sup>, and the Cornell Waste Management Institute's Compost Fact Sheet Series 1–8<sup>12</sup> provide specific guidelines and tips for composting manure to assure its safe and effective use as a fertilizer. Furthermore, if commercial compost is treated by a scientifically valid controlled physical or chemical process, or combination of these processes, in accordance with the FSMA requirements to meet the microbial standard, there is a 0 day interval between application and harvest.

## Leachates and Teas

Leachates and teas are used as foliar fertilizers and soil amendments to suppress pests and diseases, as well as enhance soil biology. Compost leachate is the liquid coming out of compost when water

from irrigation, rain, or snow filters through the compost. Compost tea is made from compost steeped in water. There are two basic types of compost tea, aerated and non-aerated.

- Aerated tea = manure/compost mixed with water (1:10-50) and then aerated by injection or re-circulated water for 12–24 hours.<sup>15</sup>
- Non-aerated tea = manure/compost mixed with water (1:3-10) and left untouched for several days (1–3 weeks).<sup>15</sup>

To reduce the risk of pathogen contamination of produce:

1. Use potable water when mixing compost teas. The proposed FSMA Produce Rule requires any tea be mixed with water that is free of generic *E.coli* determined through testing.
2. Use properly composted manure. There is no application restriction on using compost tea made from properly composted manure, though it should only contact the soil and not the edible portion of the crop.
3. Raw manure teas can only be applied to soil and not directly to plants, and should follow the one-year harvest interval.
4. Additives (molasses, yeast, etc.) must follow the same one-year application to harvest interval as raw manure.
5. Compost leachate may be applied to the soil with the 90/120 day rule. It may NOT be applied directly to plant.
6. Teas may NOT be applied to edible seed sprouts.<sup>15</sup>

## Recordkeeping

Recordkeeping should always be part of your food safety program. Developing a recordkeeping system that is easy to use will encourage soil amendment

applicators to properly document their activities and support the implementation of a farm food safety plan. Documentation should include:

- Type of soil amendment being applied
- Composting method and microbial testing (if applicable)
- Fields receiving application
- Date of application
- Rate (quantity applied per acre)
- Method of application
- What crops will be planted

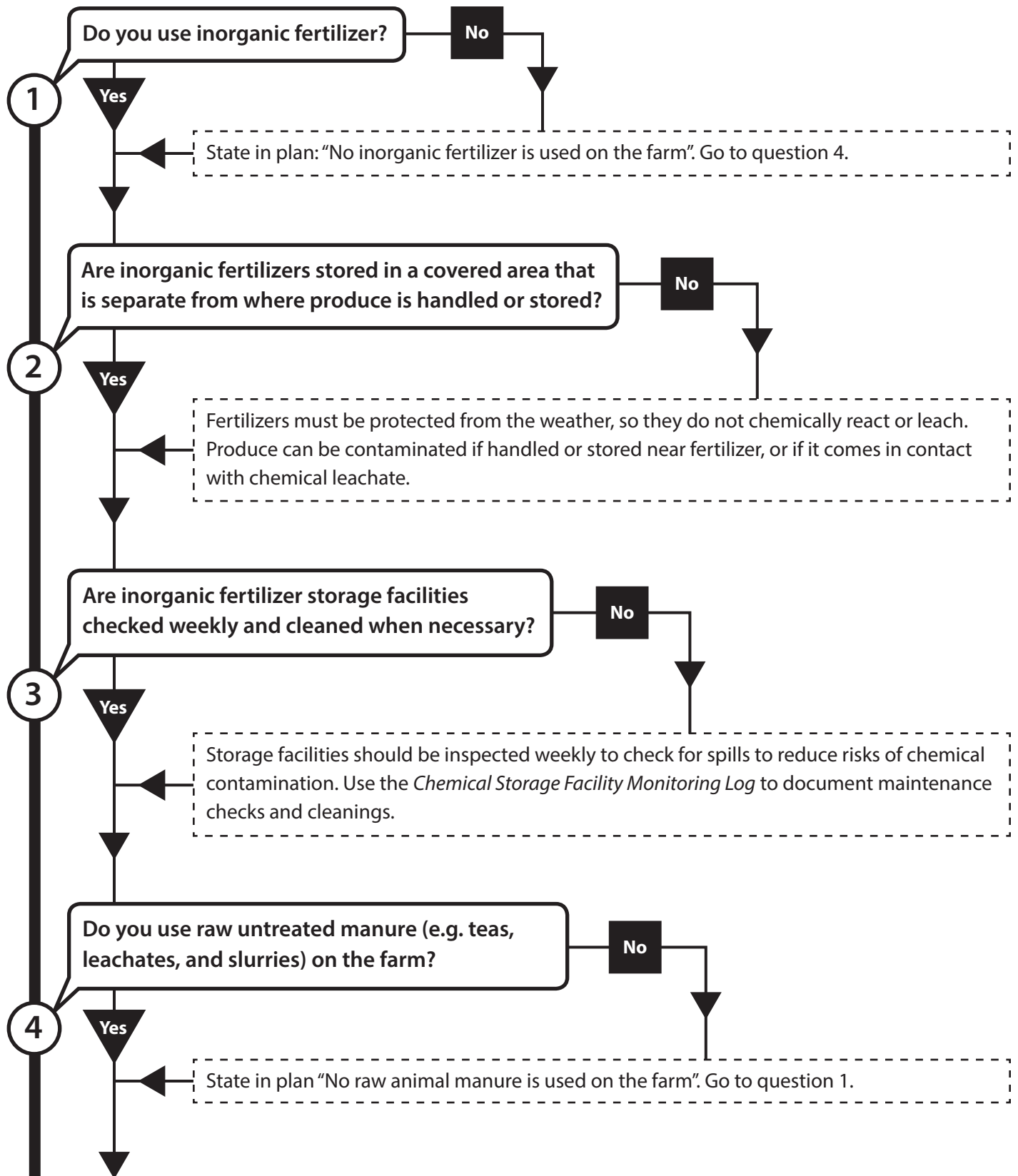
## References

1. Leafy Greens Marketing Agreement. 2010. Commodity Specific Food Safety Guidelines for the Production and Harvest of Lettuce and Leafy Greens. Pg 25.
2. Fukushima, H., K. Hoshina, and M. Gomyoda. 1999. Long-Term Survival of Shiga Toxin-Producing *Escherichia coli* O26, O111, and O157 in Bovine Feces. *Applied and Environmental Microbiology* 65(11): 5177-5181.
3. Gagliardi, J. V., and J. S. Karns. 2000. Leaching of *Escherichia coli* O157:H7 in Diverse Soils under Various Agricultural Management Practices. *Applied and Environmental Microbiology* 66(3): 877-883.
4. Islam, M., M. P. Doyle, S. C. Phatak, P. Millner, and X. Jiang. 2005. Survival of *Escherichia coli* O157:H7 in Soil and on Carrots and Onions Grown in Fields Treated with Contaminated Manure Composts or Irrigation Water. *Food Microbiology* 22: 63-70.
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7. National Organic Program. 2012. Rule 7 CFR part 205.203. Soil fertility and crop nutrient management practice standard. <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div5&view=text&node=7:3.1.1.9.32&idno=7#7:3.1.1.9.32.3.354.4>
8. National Resources Conservation Service. 2012. Code 590, Nutrient Management.
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11. Northeast Recycling Council. 2008. Manure management for small hobby farms. [http://www.nerc.org/documents/manure\\_management/manure\\_management\\_handbook.pdf](http://www.nerc.org/documents/manure_management/manure_management_handbook.pdf)
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13. Food and Drug Administration. 2013. Proposed Food Safety Modernization Act Rules. Federal Register vol. 78, no. 11, p. 3503. <http://www.fda.gov/Food/guidanceregulation/FSMA/ucm334114.htm>
14. Leafy Green Guidance Handbook. <http://www.leafygreenguidance.com/node/103>
15. National Organic Standards Board. 2004. Compost Task Force Report. 21 p. <http://www.ams.usda.gov/AMsv1.0/getfile?dDocName=STELPRDC5058470>
16. Erickson, M., F. Critzer and M. Doyle. 2010. Composting Criteria for Animal Manure. Produce Safety Project Issue Brief on Composting of Animal Manures. 13 p. <http://www.pewtrusts.org/en/research-and-analysis/reports/0001/01/01/issue-brief-series-analyses-of-possible-sources-of-produce-contamination>

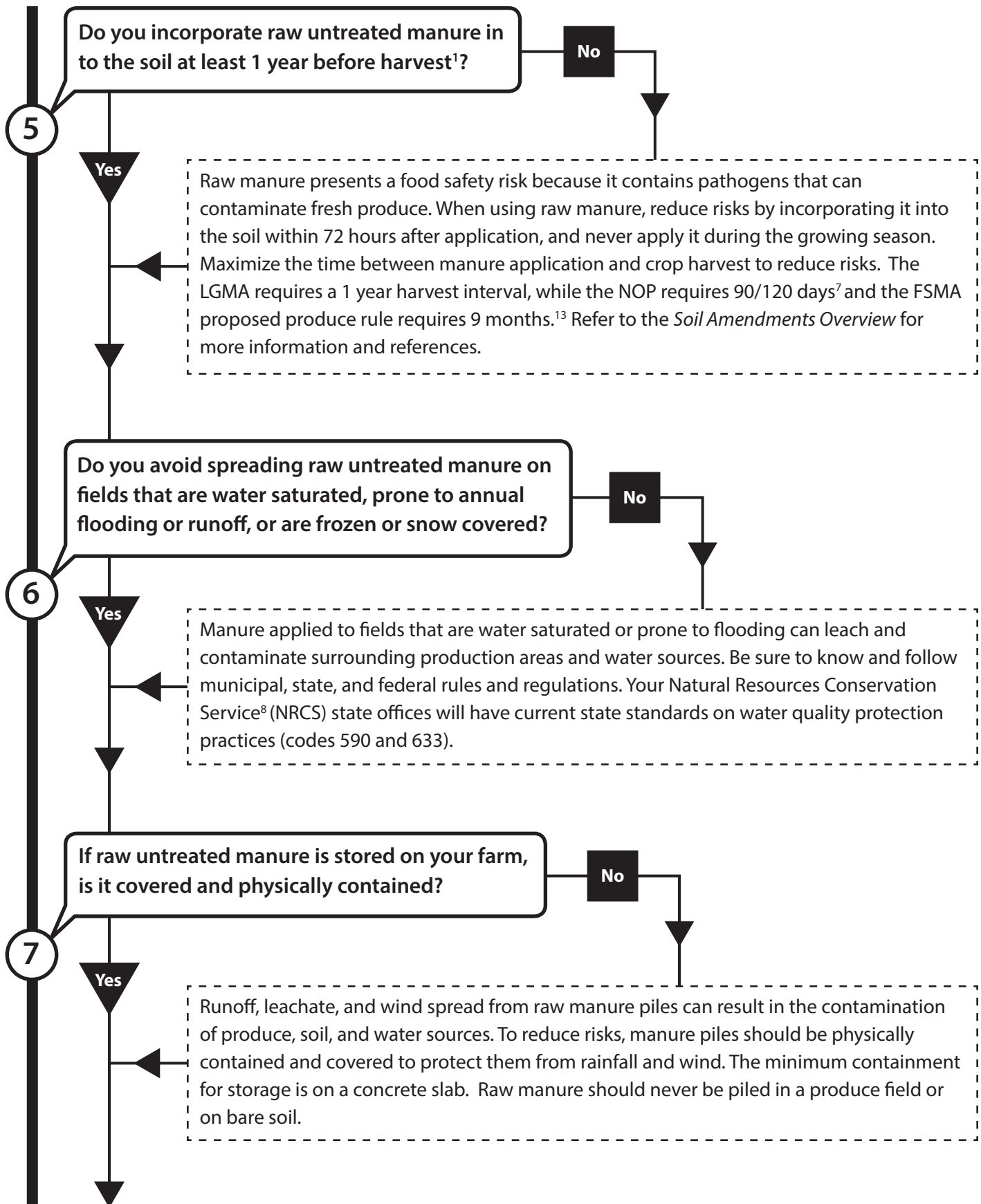
The information in the template food safety plan, SOPs, and recordkeeping logs are examples you can use. They are not intended to be used directly. Tailor each to fit your farm operation and practices. These documents are guidance for risk reduction and for educational use only. These documents are not regulatory and are not intended to be used as audit metrics. These documents are subject to change without notice based on the best available science.



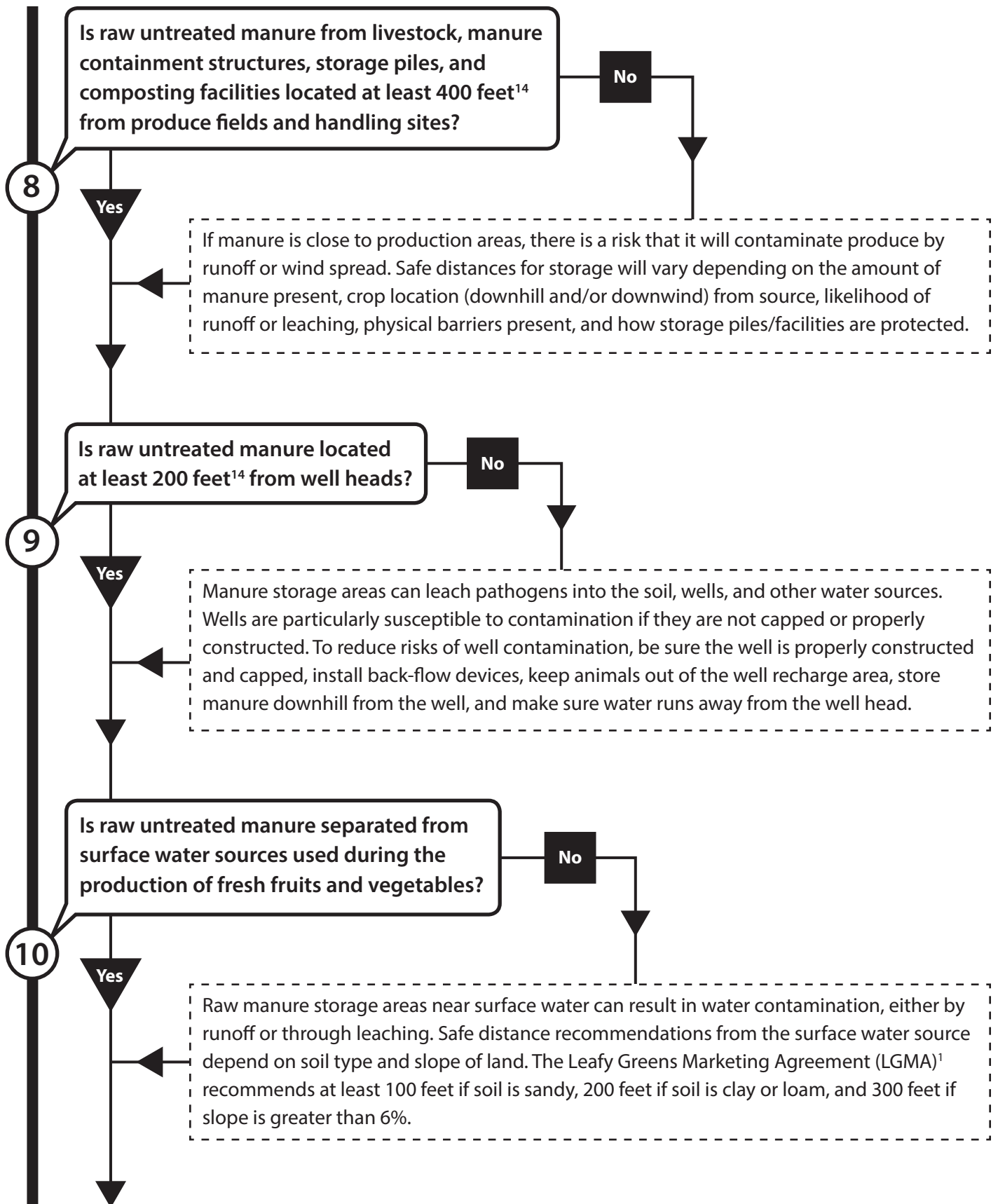
# Soil Amendments Decision Tree



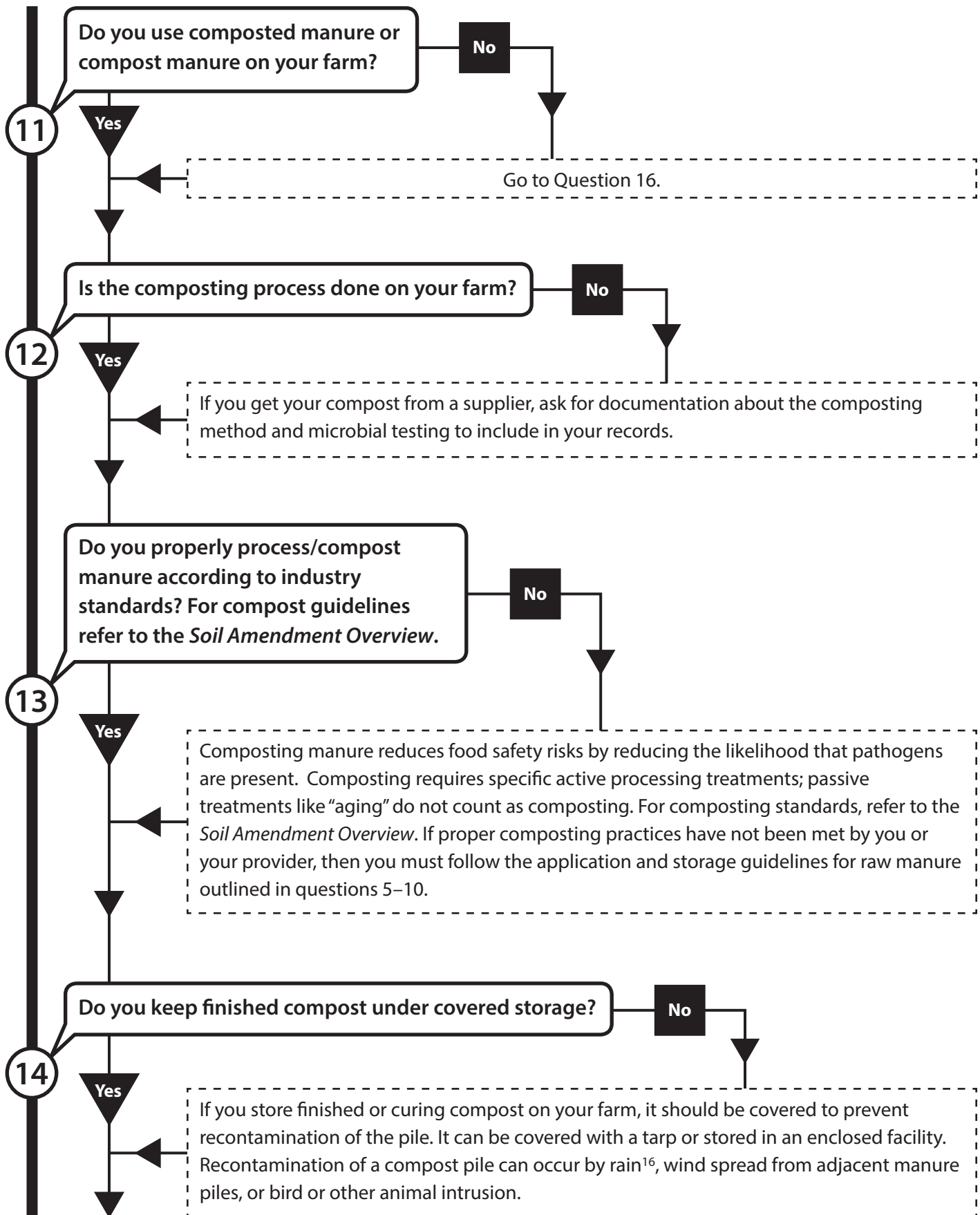
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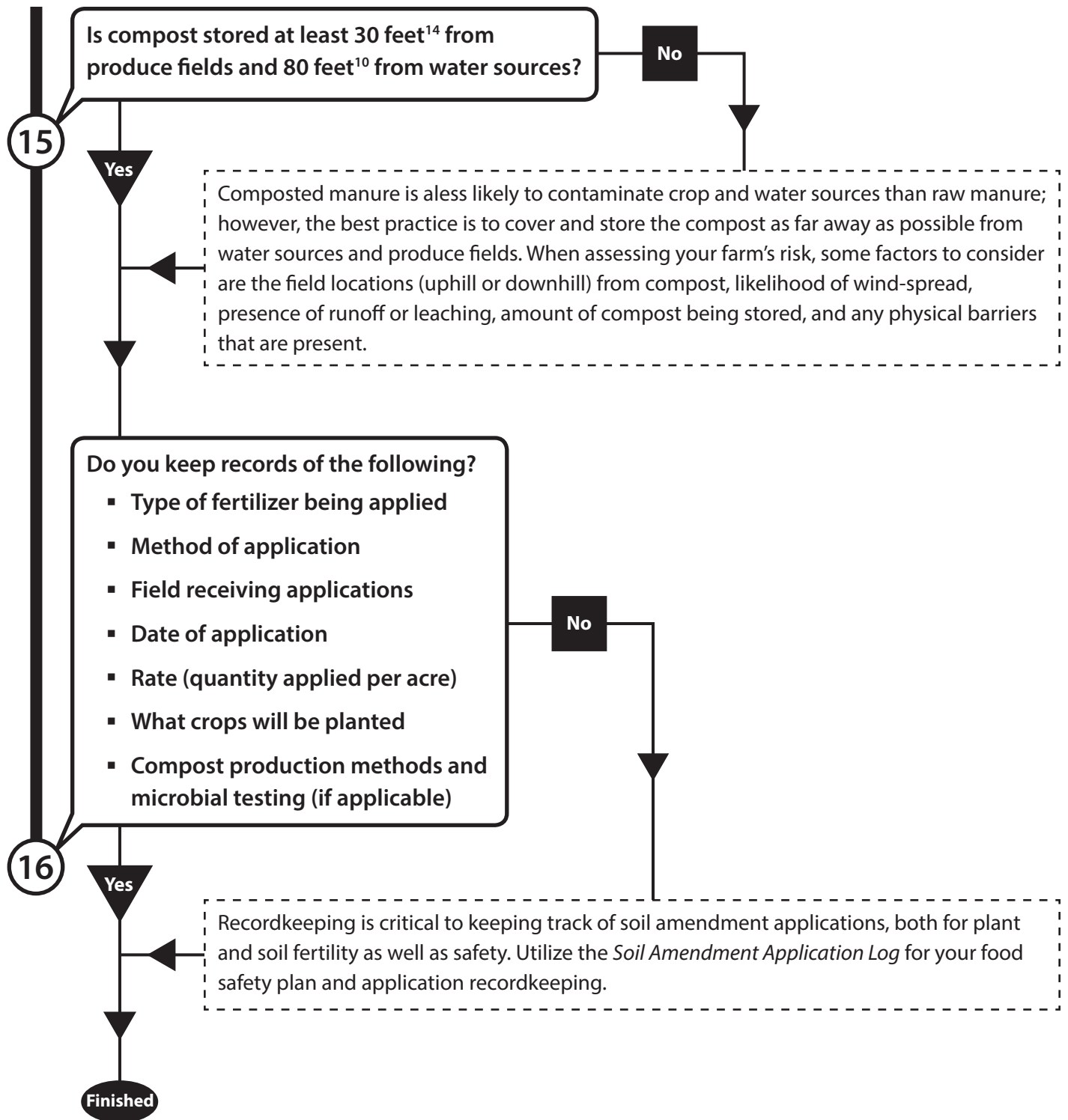


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16. Erickson, M., F. Critzer and M. Doyle. 2010. Composting Criteria for Animal Manure. Produce Safety Project Issue Brief on Composting of Animal Manures. 13 p. <http://www.pewtrusts.org/en/research-and-analysis/reports/0001/01/01/issue-brief-series-analyses-of-possible-sources-of-produce-contamination>

# Soil Amendments Decision Tree

## References

1. Leafy Greens Marketing Agreement. 2010. Commodity Specific Food Safety Guidelines for the Production and Harvest of Lettuce and Leafy Greens. Pg 25.
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4. Islam, M., M. P. Doyle, S. C. Phatak, P. Millner, and X. Jiang. 2005. Survival of *Escherichia coli* O157:H7 in Soil and on Carrots and Onions Grown in Fields Treated with Contaminated Manure Composts or Irrigation Water. *Food Microbiology* 22: 63-70.
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8. National Resources Conservation Service. 2012. Code 590, Nutrient Management.
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11. Northeast Recycling Council. 2008. Manure management for small hobby farms. [http://www.nerc.org/documents/manure\\_management/manure\\_management\\_handbook.pdf](http://www.nerc.org/documents/manure_management/manure_management_handbook.pdf)
12. Cornell Waste Management Institute factsheets. <http://cwmi.css.cornell.edu/resources.htm#compost>
13. Food and Drug Administration. 2013. Proposed Food Safety Modernization Act Rules. Federal Register vol. 78, no. 11, p. 3503. <http://www.fda.gov/Food/guidanceregulation/FSMA/ucm334114.htm>
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15. National Organic Standards Board. 2004. Compost Task Force Report. 21 p. <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5058470>
16. Erickson, M., F. Critzer and M. Doyle. 2010. Composting Criteria for Animal Manure. Produce Safety Project Issue Brief on Composting of Animal Manures. 13 p. <http://www.pewtrusts.org/en/research-and-analysis/reports/0001/01/01/issue-brief-series-analyses-of-possible-sources-of-produce-contamination>

# Sample Compost Process Log

Name of farm: Pleasant Valley Farm  
 Type of compost method: Windrow      Date piled: 9-15-2012      Date finished: \_\_\_\_\_      Row number: 2

List all ingredients added to compost: Poultry manure, kitchen scraps, dried leaves, straw

Use this log if you produce compost on your farm. Record all ingredients and your composting method including the date piled, turning dates, and the temperatures maintained. Use one sheet for each pile or row.

Date Turned	Temp Test Area 1	Temp Test Area 2	Temp Test Area 3	Temp Test Area 4	Initials
9-25-2012	135	138	140	135	abc

Proper compost production requires that a temperature of between 131°F and 170°F be maintained for 3 days using an enclosed system OR a temperature of between 131°F and 170°F for 15 days using a windrow system, during which the materials must be turned 5 times (National Organic Program. 2012. Rule 7 CFR part 205.203. Soil fertility and crop nutrient management practice standard. <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div5&view=text&node=7:3.1.1.9.32&idno=7#7:3.1.1.9.32.3.354.4>).

Reviewed by: \_\_\_\_\_      Title: \_\_\_\_\_      Date: \_\_\_\_\_



# Sample Soil Amendment Application Log

Name of farm: Pleasant Valley Farm

This log should be used to record soil amendments applied to fields on your farm. Use one log for each crop for each season.

Date:	Plot:	Crop:	Quantity Used:	Type of Amendment:	Date Planted:	Date Harvested:	Application Method:	Initials:
5/2/2013	*A-1	Tomato	1.5 tons/acre	Composted manure	5/15/2013	7/1/2013	Broadcasting	ska

\*This is the code name of the field/plot/row you have designated for that area (same as you will use in your traceability program). For example, A is the field and 1 is the plot within that field.

Reviewed by: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_



# Sample Chemical Storage Facility Monitoring Log

Name of farm: Pleasant Valley Farm

Date	Floors swept	Floors washed	Foreign material removed	Checked for signs of rodents	Checked for leakage	Initials
6/11/13	√			√	√	ALW

Reviewed by: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_





# Template Language for Soil Amendments

## Section of a Farm Food Safety Plan

### Risk Assessment

Inorganic fertilizers represent a chemical contamination risk to crops. We are aware of the chemical hazards associated with inorganic fertilizers and have implemented practices to reduce these risks. Practices are outlined below.

Biological soil amendments, including raw manure, represent a food safety risk because they can carry foodborne illness pathogens that can contaminate fields and fresh produce when they are applied. We have completed a risk assessment of the soil amendment applications we use on the farm and implemented practices to reduce identified risks. Our composting practices have also been assessed and are documented to ensure the processes we use are effective at minimizing food safety risks.

### Actions

Inorganic fertilizers are never kept near where produce is grown, handled, or stored to reduce the risk of chemical contamination. Documentation of storage area monitoring and cleaning is kept in the *Chemical Storage Facility Monitoring Log* and can be found **[state location]**. We always follow the label for determining rates of applications.

Raw manure is applied and incorporated in the field at least **[state # of days]** before planting and at least **[state # of days]** before harvest. Manure applications are documented in the *Soil Amendment Application Log* located **[state location]**. In order to minimize leaching and contamination, raw manure is never spread on fields that are water saturated, prone to annual flooding, runoff, or are frozen or snow covered [OR Manure is sometimes spread on fields that are water saturated, prone to annual flooding, runoff, or are frozen or snow covered but is done in accordance with state regulations **[describe regulations]**].

*(You must choose either A or B depending on whether or not you store manure on your farm.)*

- A. Manure is applied to fields immediately, requiring no storage areas on the farm.
- B. Manure stockpiles are stored on farm and therefore all possible precautions are taken to prevent contamination of crop production areas, water sources, and produce handling facilities. Manure stockpiles are covered with a **[state material]**, physically contained by **[describe containment]**, and stored **[state distance]** from water sources, **[state distance]** from produce production and handling areas. **[Describe any other precautions taken to minimize contamination by runoff and windspeed, such as downhill, downwind, or use of vegetative buffers]**

## Composting Practices (if applicable)

*(You must choose either C or D depending on if you buy or make compost.)*

- C. We purchase composted manure from **[state company name]**. We keep the compost microbial test results and certificate of their process on file and keep the records **[state location]**.
- D. Manure is processed on our farm and is properly composted before application to reduce pathogens. Our **[state type of compost pile]** system reaches a temperature of at least **[state temperature (must be at least 131°F)]** for **[state # of days]** days, after which it cures for at least 45 days. It is turned **[state # of turns]** times. We keep a Compost Process Log to document these procedures.

## Compost Storage (if applicable):

*(You must choose either E or F depending on your farm situation.)*

- E. Composted manure is applied immediately after it is received, requiring no storage on farm.
- F. To prevent recontamination of compost piles and contamination of nearby water sources by runoff, compost piles are covered with a **[state material]**, and stored **[state distance]** from surface water, **[state distance]** from well heads, and **[state distance]** from produce fields. **[Describe any other precautions taken to minimize contamination by runoff and windspray, such as downhill, downwind, or use of vegetative buffers].**

## Recordkeeping

Records are kept of fields receiving soil amendments, including type (raw, composted manure, or inorganic), quantity, application method, dates of application, fields where it was applied, and crops planted (pertains to raw manure users – at least 1 year). We keep a Soil Amendment Application Log to document all application practices. All recordkeeping logs are located **[enter location here]** and stored for **[enter time period here-should be at least 2 years]**.