UF UNIVERSITY of FLORIDA IFAS Extension

Trainer's Manual
Module 3: Soil Quality and Fertility Management

Materials and Preparation

Materials for Trainer
- Completed Soil and Crop Fertility Management section of the Organic System Plan

Advance Preparation
- Carefully review pages 12-20, 30-37 and 45-56 in NCAT'S *Organic Crops Workbook*
- Review the relevant sections of the NOP Standards and Guidelines
- Review the ***completed*** Soil and Crop Fertility Management sections of the Organic System Plan. All of our answers came from the Sweet Briar Farm Module 4 Scenario. Make sure you understand our responses.

Materials for Participants
- *Participant's Guide to Module 3*
- Relevant sections of the NOP Standards and Guidelines (http://www.ams.usda.gov/nop/NOP/standards.html)
- NCAT's *Organic Crops Workbook* (http://attra.ncat.org/attra-pub/PDF/cropsworkbook.pdf)
- OMRI Brand Name Products List (http://www.omri.org/OMRI_brand_name_list.html)
- The National List (http://www.ams.usda.gov/nop/NOP/standards/ListReg.html)
- ***Completed*** worksheets for the topical areas in Exercise 1 -- to be handed out **after** the exercise is completed
- ***Completed*** Soil and Crop Fertility Management sections of the Organic System Plan to be handed out **after** Exercise 2 is completed

Module Delivery (2 Hours, 30 Minutes)

I. Module Objectives and Content (5 minutes)

1. Distribute the *Participant's Guide to Module 3* to all participants.

2. Review and discuss the ***application objectives.***

   After completing this module you will be able to:

   Recommend different methods for improving soil quality on an organic farm
   Recommend soil and water conservation practices for organic production systems
   Help farmers complete the required documentation to gain organic certification

3. Review and discuss the ***learning objectives.***

   After completing this module you will understand:

The principles of and the methods for maintaining soil and water quality in organic production systems
Soil and fertility management practices in organic production systems
Importance of and methods for monitoring soil and water quality
Soil and water conservation practices in organic production systems
The documentation required for organic certification

4. Call attention to the ***topics*** that will be covered in this module.

Healthy soil, healthy plant concept
Soil-building methods, including
1. Crop rotation
2. Crop residues/green manures
3. Manure requirements and acceptable usage
4. Compost use and production
5. Natural and approved synthetic soil amendments

Water use and application
Required evidence of soil and water conservation
Documentation required for certification

III. Materials and Resources (5 minutes)

1. Distribute a copy of the relevant sections of the NOP Standards to each participant if they did not receive them earlier in your training program.

2. Point out that the Guide includes a list of the ***Relevant Sections of the NOP Standards*** that will be covered by this module.

205.202 Land requirements
205.203 Soil fertility and crop nutrient management practice standard
205.205 Crop rotation practice standard
205.601 Synthetic substances allowed for use in organic crop production
205.602 Nonsynthetic substances prohibited for use in organic crop production

3. Draw attention to the ***Additional Reference Materials*** listed in the Guide.

Sustainable Soil Management (http://attra.ncat.org/attra-pub/soilmgmt.html)
Soil Fertility Management for Organic Crops (http://anrcatalog.ucdavis.edu/pdf/7249.pdf)
Protecting Water Quality on Organic Farms (http://attra.ncat.org/attra-pub/PDF/om-waterquality.pdf)
UC SAREP Cover Crop Resource Page (http://www.sarep.ucdavis.edu/ccrop/)
Magdoff, Fred and van Es, Harold. 2000. *Building Soils for Better Crops,* Second Edition. Sustainable Agriculture Network, USDA. Washington, D.C.
Bellows, Barbara. 2002. *Protecting Water Quality on Organic Farms* (http://www.attra.org/attra-pub/PDF/om-waterquality.pdf)

4.. Draw participants' attention to the list of ***Keywords*** in the Guide.

Allowed synthetic. A substance that is included on the National List of synthetic substances allowed for use in organic production or handling.

Compost. The product of a managed process through which microorganisms break down plant and animal materials into more available forms suitable for application to the soil. Compost must be produced through a process that combines plant and animal materials with an initial C:N ratio of between 25:1 and 40:1. Producers using an in-vessel or static aerated pile system must maintain the composting materials at a temperature between 131F and 170F for 3 days. Producers using a windrow system must maintain the composting materials at a temperature between 131 F and 170 F for 15 days, during which time, the materials must be turned a minimum of five times.

Crop residues. The plant parts remaining in a field after the harvest of a crop, which include stalks, stems, leaves, roots, and weeds.

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.

Fertilizer. A single or blended substance containing one or more recognized plant nutrient(s) which is used primarily for its plant nutrient content and which is designed for use or claimed to have value in promoting plant growth.

Manure. Feces, urine, other excrement, and bedding produced by livestock that has not been composted.

Mulch. Any nonsynthetic material, such as wood chips, leaves, or straw, or any synthetic material included on the National List for such use, such as newspaper or plastic that serves to suppress weed growth, moderate soil temperature, or conserve soil moisture.

Nonsynthetic (natural). A substance that is derived from mineral, plant, or animal matter and does not undergo a synthetic process as defined in section 6502(21) of the Act (7 U.S.C. 6502(21)). For the purposes of this part, nonsynthetic is used as a synonym for natural as the term is used in the Act.

Organic matter. The remains, residues, or waste products of any organism.

Sewage sludge. A solid, semisolid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes but is not limited to: domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.
Split operation. An operation that produces or handles both organic and nonorganic agricultural products.

Soil and water quality. Observable indicators of the physical, chemical, or biological condition of soil and water, including the presence of environmental contaminants.

Synthetic. A substance that is formulated or manufactured by a chemical process or by a pro-

cess that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources, except that such term shall not apply to substances created by naturally occurring biological processes.

III. Exercise I: Pop Quiz (40 minutes)

Use a "Pop Quiz" to introduce the participants to some key ideas and sources of information that they can use for Exercise II in this module. This is an "open book" exam. Make sure the participants have the relevant sections of the National Organic Standards and the *Organic Crops Workbook* in front of them (see Table 1 for a listing by topical area). Direct the participants attention the "Pop Quiz" in the *Participant's Manual.* Each participant should complete the exam individually. Give the participants about 20 minutes to complete the exam by marking either "true" or "false" for each statement.

Table 1. Topical Areas & References

Topical Areas	Organic Crop Workbook Page #	NOP Standard
Composting Building Soil Organic Matter	14-20, 34-35	205.203 205.205
Crop Rotation Cover Crops	12-14	205.205
Soil Conservation Water Quality & Irrigation	16-17, 36-37, 45-46	205.203 205.205
Soil Nutrient Management Manure Management	15-20, 32-33	205.601 205.602 205.203 205.239

After the participants have completed the exam, ask individuals to report their response to the individual items on the exam. Use this opportunity to call on specific participants. This can be a good opportunity to involve those who are less apt to speak up on their own. We have provided the answers for you. Encourage discussion about the participants' responses to the exam items by asking them to explain their answer.

Pop Quiz

Topic: Composting:
Principle: Applying composted organic materials builds soil organic matter.

1. Composting made only with vegetative material has to meet time and temperature requirements described in the National Organic Standards. (***FALSE***)
2. Composts applied to crops that are not used for human consumption do not have to meet the C:N, temperature and turning requirements. (***TRUE***)
3. The producer must manage crop nutrients and soil fertility through rotations, cover crops and the application of plant and animal materials. (***TRUE***)
4. Manure of animals that receive antibiotics cannot be used as compost. (***FALSE*** -- the standard is tricky for this question. It says that you cannot add amendments ***to the compost***, such as a synthetic fertilizer, for example. But the original manure can come from animals that receive antibiotics, just as the original plant material could come from plants that were fertilized with synthetic fertilizer.

Topic: Building Soil Organic Matter:
Principle: Increasing organic matter has many beneficial effects on the soil and helps to reduce erosion and leaching of excess nutrients and enhances soil tilth.

5. Not all organic matter is allowed in organic production. Sources that contain prohibited substances include treated wood and industrial waste products. (***TRUE***)
6. Untreated ash products and sewage sludge can be used by producers to help maintain or improve soil organic matter. (***FALSE*** — sewage sludge cannot be used)
7. Avoid using organic matter that contains heavy metals. (***TRUE***)

Topic: Crop Rotation:
Principle: Crop rotation encourages biodiversity, diversification and maintains soil organic matter.

8. The producer should try to manage plant and animal material 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 (***FALSE*** -- Trying is not good enough, he ***must*** manage to avoid these undesirable effects.)
9. Crop rotation can be an effective management tool for disease control. (***TRUE***)
10. Crop rotations should be chosen to enhance the nutrient management plan for the organic farm system. (***TRUE***)

Topic: Cover Crops:
Principle: Cover crops help reduce erosion and build organic matter in the soil.

11. Seeds used for cover crops must be organic if they are commercially available. (***TRUE***)
12. Seeds used for cover crops can be non-organic if organic seeds are not commercially available, including seeds bred through genetic engineering. (***FALSE*** -- cannot use seeds that contain prohibited substances, techniques, etc.)
13. No GMO crops are allowed in organic production. (***TRUE***)

Topic: Soil Conservation
Principle: Soil conservation is a key underlying goal of organic management.

14. Producers should consider using technique to reduce soil loss (***FALSE*** – they have to use practices to minimize erosion, this is mandatory.)
15. Buffers should be created between conventional and organic fields only if there is a possibility of contamination due to erosion. (***FALSE***)

Topic: Water Quality and Irrigation
Principle: Protecting and enhancing water quality is a key underlying goal of organic management.

16. Two nutrients of particular concern for water quality are nitrates and sulfites. (***FALSE*** the two nutrients normally of concern are nitrogen and phosphorus).
17. There are approved synthetic materials allowed for disinfecting irrigation lines. (***TRUE***)
18. The presence of chlorine in irrigation water is not a problem for organic growers. ***FALSE***)

Topic: Soil Nutrient Management
Principle: Applying nutrients to meet crop needs is a major goal of organic management

19. Organic farmers do not need to use the same kinds of analyses to determine crop nutrient needs that other farmers do. (***FALSE*** -- organic farmers cannot just apply nutrients to "build the soil," or for some other general reason. They need to make sure that they apply nutrients in the amounts needed and at the time needed by the crop to avoid nutrient runoff and water contamination.)
20. Soil and plant tissue testing is required for certification (***TRUE***)

Topic: Manure Management
Principle: Manures must be managed in a way to protect environmental quality and ensure consumer safety.

21. Manures from conventional agriculture animal production systems are not allowed in organic production. (***TRUE***)
22. Manure must be soil incorporated not less than 120 days before harvest of a crop whose edible portion is in contact with the soil or soil particles. (***TRUE***)
23. There are no timing restrictions of manure applications for crops not intended for human consumption. (***TRUE***)

IV. Exercise II: Soil Management Plan for Sweet Briar Farm (1 hour)

1. Divide the participants into groups of three.

2. Draw their attention to Sweet Briar Farm Scenario and the Soil and Crop Fertility Management sections of the Organic System Plan in the *Participant's Guide for Module 3*. Also remind them of Table 1, which lists relevant sections of the National Organic Standards and of the *Organic Crops Workbook* by topical area.

3. Direct the participants to complete the Soil and Crop Fertility Management sections of the Organic System Plan. The scenario provides enough information so that participants can fill out the forms and they can use the Sweet Briar Farm Map to help visualize how the farm is organized.

4. Give the participants 45 minutes to read the scenario and complete the forms.

5. Call upon a different group to explain what they recommended for one sub-section of the Soil and Crop Fertility Management Section of the Organic System Plan. The Soil and Crop Fertility Management Section of the Organic System Plan contains four sub-sections: (A) General information and evaluation, (B) Compost use, (C) Manure use, and (D) Natural resources. Sub-section A is the most complex because it includes the list of all fertility inputs that are used on both organic and transitional fields. We suggest that you call upon different groups to list one or two inputs that they included on this list rather than have a single group read their entire list.

6. A completed version of this Section of the Organic System Plan is included in this Trainer's Manual. If there are significant differences between the participants' responses and our suggested answers, get the participants to explain their answer in more depth. Make sure that participants understand the reasoning for each answer that we have provided. Limit this discussion to 15 minutes. Make sure that the following two key points are made. If participants do not make these points, raise them yourself.

Substitute Nature's Intent Granulated All-Purpose 9-3-4 for Nature Safe Fertilizer 8-3-5. The fertilizer that producer was considering is not on the OMRI list, so there is no way to tell if it contains approved substances. There are many approved formulated fertilizers. We suggest the Nature's Intent 9-3-4 because this blend is very similar to the formula that the grower wanted and does not require custom blending.

Note that both the potassium chloride and the potassium sulfate must be from nonsynthetic source materials. The products sold in most feed and seed stores are made from synthetic sources and are not allowed.

7. Distribute the ***completed*** Soil and Crop Fertility Management section of the Organic System Plan ***after*** the discussion.

UNIVERSITY OF FLORIDA
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Module 3
Sweet Briar Farm Scenario

Background

Sweet Briar Farm is a split production farm that has addressed soil management in the organic production areas by taking a holistic approach. In organic agriculture, the soil is regarded by many as the most important component of the farming system. Many of the organic standards are based on enhancing, protecting and building the soil. Organic farming is not based on nutrient substitution or simply amending the soil with exogenous materials to support plant growth. Instead it is based on the concept that the farming system should incorporate practices that increase soil quality. The resulting healthy soil will support and promote healthy plants, thus making them more resistant to disease and pests. The National Organic Standards require that farmers “maintain or improve the physical, chemical, and biological condition of the soil and minimize erosion”. Farmers must have a plan for maintaining and enhancing soil quality. Practices that maintain or improve the physical, chemical and biological condition of the soil and minimize erosion include: rotations, cover cropping, minimal tillage practices, application of plant and animal wastes, compost application, application of naturally mined minerals and amendments and application of crop nutrients and amendments included on the National list of synthetic substances allowed for use in crop production.

Sweet Briar Farm is a large-scale, 450-acre farming operation owned by Rosemary Green. She produces vegetables, both conventionally and organically. The farm is divided into 50-acre fields with 250 acres under conventional production. One hundred and fifty acres on the south side of the farm have been certified organic for the past four years.

The farm is located in a hilly region. Yearly rainfall is moderate. A well is used for irrigation when rainfall is not adequate and supplies drip irrigation to both organic and conventional fields. The conventional fields are fertigated through the drip system. After fertigation the system is flushed out with well water for at least one hour prior to irrigating the organic fields. Records are kept in a log book when these activities are conducted. Every three months Rosemary tests the water quality and disinfects the system with hydrogen peroxide. Rosemary has planted trees as windbreaks around the perimeter of the farm.

The soils on the farm are predominately fine sand in Organic Field 1 and sandy loams in Organic Fields 2 and 3. She monitors her fields for signs of erosion throughout the year, but especially during the rainy season. She looks carefully for signs like rilling, the formation of pedestals, the deposition of sediment in low-lying areas and root exposure.

Table 1: Soil test results

	Organic Field 1	Organic Field 2	Organic Field 3
pH	5.3	5.6	6.5
OM content	0.5%	1.1%	3%
Phosphorus	Low - 12 ppm	Medium - 26 ppm	Very high - 90 ppm
Potassium	Very low - 15 ppm	Low - 30 ppm	Medium - 53 ppm
Magnesium	Very low - 9 ppm	Medium - 34 ppm	High - 60 ppm
Calcium	Medium - 250 ppm	Low - 200 ppm	Medium - 240 ppm
Soil texture	Fine sand	Sandy loam	Sandy loam

The farmer conducts soil tests annually and also performs monthly tissue analysis to ensure that crop nutrition is adequate. No micronutrients have been applied in the past five years and there may be a deficiency. Soil test results from the organic fields are provided in Table 1.

She wants to grow tomatoes in field 1, watermelon in field 2, and peppers in field 3. Recommended fertilizer applications are based on best management practices (BMPs) for those crops and are shown in Table 2. In addition up to the BMP-based recommendations for N, P and K, 40 lbs. of Mg should be applied if a soil tests medium or lower for Mg. Calcium concentration is considered adequate for vegetable at 300 ppm or higher. Where micronutrients are suspected to be deficient, apply 5 lbs Mn, 3 lbs Zn, 4 lbs Fe, 3 lbs Cu and 1.5 lbs B per acre. However, micronutrients can only be applied based on a soil test documenting the deficiency and those made from nitrates or chlorides are not allowed. See the annotation for micronutrients on the National List Section 205.601(j)6.

Table 2. Crop Nutrient Recommendations Based on BMPs

Field	Crop	Recommendations (lbs/acre)		
		N	**P**	**K**
1	Tomato	200	120	225
2	Watermelon	150	100	120
3	Pepper	200	0	100

Since the farmer has a split operation she has numerous soil amendments available, but some may not be allowed in organic production systems. The following list includes all of the amendments available to Rosemary.

Nature Safe Fertilizers 8-3-5 (brand name)
Neptune's Harvest Fish and Seaweed Fertilizer 2-3-1 (brand name)
Fish protein 9-0-0
Granulated gypsum
Sodium nitrate
Urea
Anhydrous ammonia
Lime
Mixed dolomitic limestone
Potassium chloride (0-0-62)
Sulphate of potash or SOP (0-0-52)
Sewage sludge
Horse manure

Step 1. Using the references provided, check and see which, if any, of the products above are allowed in organic production (Section 205.601). Make sure you check OMRI for brand name products.

Step 2. Fill out the first three columns of the table in Section A of the Soil and Crop Fertility Management sections of the Organic System Plan with the products listed above that are allowed under the National Organic Standards. You don't have to fill out the columns showing number of applications per year or reason for use at this time. For the generic name products such as lime, find an approved brand name using the OMRI Brand Name Products List. If a brand name provided above, such as Nature Safe Fertilizers 8-3-5, is not listed by OMRI, find an allowable substitute if possible.

Step 3. The following information will provide more details for the remaining sections of the form including the two columns you left blank in Section A.

In order to keep track of what Rosemary is applying a table is provided to track the amendments she wants to apply and their nutrient contributions to her fields (Table 3).

Table 3: Potential soil amendments

Amendments Organic Field 1	**N lbs.**	**P lbs.**	**K lbs.**	**Ca lbs.**	**Mg lbs.**	**pH**	**Micros**
Cover crop	28	Y*	Y	Y	Y	--	Y
Dolomite/limestone	--	--	--	1840	1520	Raise	--
Compost	90	120	60	6	Y	Y	Y
Sulfate of Potash	--	--	166.6	--	--	--	--
Fish Protein	82.8	--	--	--	--	--	Y
Total lbs./acre	**200.8**	**120**	**226.6**	**1840**	**1520**	--	
Amendments Organic Field 2	**N**	**P**	**K**	**Ca**	**Mg**	**pH**	**Micros**
Cover crop	28	Y	Y	Y	Y	--	Y
Dolomite/limestone	--	--	--	1840	1520	Raise	Y
Compost	75	100	50	Y	Y	Y	--
Sulfate of Potash	--	--	72.8	--	--	--	--
Fish Protein	47.25	--	--	--	--	--	Y
Total lbs./acre	**150.25**	**100**	**120**	**1840**	**1520**		
Amendments Organic Field 3	**N**	**P**	**K**	**Ca**	**Mg**	**pH**	**Micros**
Cover crop	--	Y	Y	Y	Y	--	Y
Gypsum	28	--	--	174.4	--	--	--
Compost	--	--	--	--	--	--	--
Sulfate of Potash	--	--	104	--	--	--	--
Fish Protein	171	--	--	--	--	--	--
Total lbs./acre	**199**		**104**	**174.4**			

Y indicates that the amendment provides a contribution of the nutrient, but in amounts too small or variable to be considered in calculating how to meet the nutrient requirement.

A. Cover Crops

As a first step in building healthy soils and to help protect against erosion on her hilly land, Rosemary has decided to plant cover crops in the off season on all of the fields. Due to price and/or availability considerations and the high nitrogen requirements of the vegetables to be produced, she has decided to use cowpeas as a cover crop.

Using an estimated biomass production of 4000 lbs per acre and nitrogen content of 1.4%, Rosemary calculates that the cowpea cover crop will contribute 56 lbs of nitrogen. Her research indicates that not all of this nitrogen will be available to subsequent crops as it will either be bound in organic forms or lost to the environment by leaching or denitrification. Her research indicates that in most cases only about 50% of the total nitrogen produced will benefit the ensuing crop. Therefore, she will use 28 lbs in calculating her fertility budget.

B. Soil pH

Since the pH in two of the fields is low and should be raised to maximize production Rosemary plans to apply lime ($CaCO_3$) to raise the pH. University recommendations indicate that on sands and sandy loam soils with low buffering capacity an application of one ton of lime per acre will raise the pH one point. Using this information she plans to add two tons of lime to fields one and two. Checking her soil test results she noticed that magnesium is also deficient so she plans to add dolomitic limestone. But before she does she will check the OMRI generic product list to make sure that it is approved for use. It is.

Although the pH in field three is adequate, calcium is slightly below recommended levels and Rosemary is concerned that blossom end rot could develop in her pepper crop. She is unsure of what she can do to raise the calcium in her soil to recommended levels. Checking with the OMRI list she noted that gypsum is an allowed substance and decided to add 800 lbs of gypsum per acre to ensure that adequate calcium is present.

C. Organic Matter

Recognizing that her soils are mostly low in organic matter, especially fields 1 and 2, Rosemary is interested in increasing the organic matter and hopefully the biological activity in her soils. Wood chips are available in nearly unlimited quantities from the local power utility, but Rosemary is aware that while this material may be a component of good quality compost it has a high carbon to nitrogen ratio –approximately 125:1. She plans to mix the chips with manure. She will use the horse manure available from the neighboring farm. Her research reveals that the organic rule does not allow uncomposted manure applications on vegetables to be harvested within 120 days. The horse manure contains little hay bedding and tests performed by Woods End Research Lab indicate that it has a carbon nitrogen ratio of 17:1. Compost will be applied at the rate of 3 tons per acre, which will require 450 tons of compost to treat the entire farm. Rosemary estimates she will have to use a high percent of horse manure to balance the high C: N ratio of the wood chips but only estimates that only about 100 tons are available. Calculations of the proposed feed stocks for this mix indicate that it will still have too high a C: N ratio (101:1) to make good quality compost.

350 tons wood chips @ 125:1 C: N ratio =	43750
100 tons manure @ 17:1 C: N ratio =	1700
	45450 \ 450 = 101:1

Since the C: N ratio is still high, Rosemary knows that she will have to add additional nitrogen to speed the composting process and improve the quality of the resulting product. She would like to use urea – which she thinks might be considered organic because of its high nitrogen content (46%). Checking with OMRI – she finds that urea is not allowed. Another option will be fish protein (9% N) - addition of approximately 50 tons of fish protein to the compost mix will bring the C: N ratio down to 20:1.

Rosemary plans to produce the compost by layering the feed stocks in windrows and using a front-end loader to mix the piles on a weekly basis. Internal temperatures will be taken daily – temperature should peak around 135 - 140 degrees and be maintained at this level for two to three weeks until they begin to decline signaling maturation of the compost.

A nutrient profile of the finished compost reveals a 1.5 – 2 – 1 analysis. Three tons of the finished compost per acre will provide approximately 90 lbs N, 120 lbs P, and 60 lbs of K per acre. Plugging these numbers into the nutrient table she has designed she realizes that this will work on field 1 but that use of three tons of compost on Fields 2 and 3 would exceed stated BMPs for phosphorus applications and could result in ground water contamination and degradation of nearby environmentally sensitive lands.

Using the P value as a criterion for application it becomes apparent that she will only be able to apply 2.5 tons per acre of compost on field 2 and none on field 3.

D. Fertilizing with Allowed Substances

Looking at the other nutrients required to meet her fertilizer recommendations, the farmer plans to use a sulphate of potash (52% K) and fish protein (9 % N) as a nitrogen source. Research indicates that potassium chloride may add detrimental levels of salt to the soil and potassium chloride made from synthetic sources is, of course, not allowed under the NOP. Other sources of nitrogen typically contain phosphorus and could result in environmental problems.

Based on the nutrients supplied from other sources Rosemary plans to apply 320 lbs per acre of sulfate of potash to field 1,140 lbs per acre to field 2 and 200 lbs per acre to field 3.

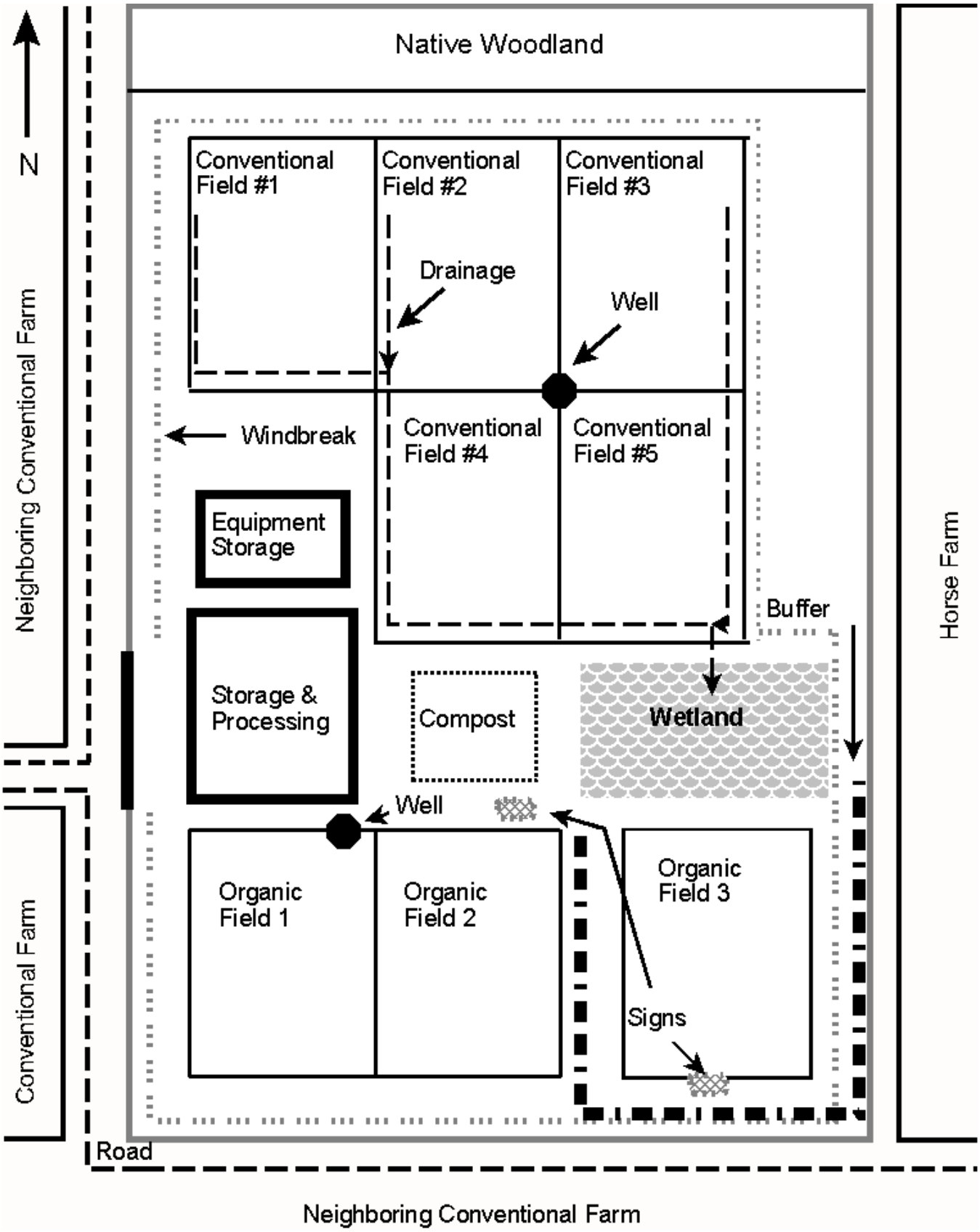
To augment the nitrogen component of the fertility program, Rosemary plans to use fish protein (9% N). Based on fertilizer recommendations she will have to add 920 lbs per acre of fish protein to field 1,525 lbs per acre to field 2 and 1900 lbs per acre to field 3.

Since nitrogen and potassium are both soluble elements, half of the sulfate of potash and fish protein will be applied before planting and the balance applied as a side dressing twice at 6 week intervals during the growing season.

All crop residues will be plowed down immediately following harvest. She has decided not to add any additional micronutrients as she feels that they will be supplied from both the cover crop and compost applications. She does plan to conduct biweekly tissue sampling and observe crop growth throughout the season to detect any potential nutrient deficiencies.

After completing this exercise, she is pleased that her soil fertility program is satisfactory but feels that there is always room for improvement and is willing to learn.

Sweet Briar Farm Map (Module 3)



SECTION 5: Soil and Crop Fertility Management NOP Rule 205.203 and 205.205

A. GENERAL INFORMATION AND EVALUATION:

What are your general soil types?

Fine sand and sandy loam

What are your soil/nutrient deficiencies? ☐ No deficiencies

P, K, Mg, Ca

How do you monitor the effectiveness of your fertility management program? ☒ soil testing

☐ microbiological testing ☒ tissue testing ☐ observation of soil ☒ observation of crop health

☐ comparison of crop yields ☐ crop quality testing ☐ other (specify)

Attach copies of available test results.

How often do you conduct fertility monitoring? ☒ weekly ☒ monthly ☒ annually ☐ as needed

☐ other (specify)

Rate the effectiveness of your fertility management program. ☐ excellent ☒ satisfactory ☐ needs improvement

What changes do you anticipate?

What are the major components of your soil and crop fertility plan?

☐ crop rotation ☒ green manure plowdown/cover crops ☐ interplanting ☐ incorporation of crop residues

☐ subsoiling ☐ summer fallow ☒ compost ☐ on-farm manure ☒ off-farm manure ☒ soil amendments

☒ side dressing ☐ foliar fertilizers ☐ biodynamic preparations ☐ soil inoculants ☐ other (specify)

List all fertility inputs used or intended for use in the current season on proposed organic and transitional fields. *All inputs used during the current year and previous three years must be listed on the Field History Sheet.* ☐ Not applicable

PRODUCT	BRAND NAME OR SOURCE	STATUS: APPROVED (A) RESTRICTED (R) PROHIBITED (P)	NUMBER OF APPLICATIONS PER YEAR	REASON FOR USE
Fertilizers, blended	Nature Safe Fertilizer 8-3-5	A	1	Potential blended fertilizer (if needed)
Fish products, multi-ingredient	Neptune's Harvest Fish and Seaweed Fertilizer 2-3-1	R		Potential blended fertilizer (if needed)
Fish meal and powder	Fish Protein 9-0-0	A	3	Source of N for compost and direct application
Gypsum (mined source)	Granulated Gypsum	A	1	Source of calcium
Sodium nitrate	Natural nitrate of Soda	R		Potential N source (if needed)
Limestone	Cal-Pril Limestone	A	1	Raise the pH
Dolomite, mined	Dolo-Pril	A	1	Potential source of Mg
Potassium chloride	Muriate of Potash 0-0-62	R		Potential K source (if needed)
Potassium sulfate, nonsynthetic	Sulphate of potash	A	3	Source of K
Manure	Made on farm	R	1	Source of nutrients & organic matter

If you use or plan to use restricted (R) fertility inputs, how do you comply with the "annotation"? ☒ Not applicable

Rosemary did not use any restricted products this current season

If you use fertilizers with high salt content (sodium nitrate, potassium sulfate, etc.), how do you prevent salt build-up?

☐ Not applicable

Repeated applications of potassium sulfate are made, but individual applications are low and total amounts applied do not exceed BMP recommendations. Annual soil testing is used to make sure that no problem develops.

Do you burn crop residues? ☐ Yes ☒ No If yes, please describe what materials are burned and why.

Do you apply sewage sludge to fields? ☐ Yes ☒ No If yes, list fields where applied.

B. COMPOST USE:

NOP Rule 205.203(c)(2) requires that the composting process include a C:N ratio of between 25:1 and 40:1 and maintenance of temperatures between 131ºF. and 170ºF for a specific number of days, depending on the method of composting. Keep a compost production record to verify compliance.

List all compost ingredients/additives. ☐ Not applicable

Wood chips, horse manure, fish protein

What composting method do you use? ☐ in-vessel ☐ static aerated pile ☒ windrows ☐ other (specify)

What is your C:N ratio? 20:1 Note: this does not meet the NOP requirement for compost since the C:N ratio must be between 25:1 and 40:1.

Do you monitor temperature? ☒ Yes ☐ No If yes, what temperature is maintained. **135° -140°F**

How long is this temperature maintained? 2-3 weeks

If compost is windrowed, how many times are materials turned? Although she will turn the windrow weekly, the NOP standards requiret that windrows be turned at least five times while the temperature is between 135° -140°F. Since she will only maintain this temperature for 2 to 3 weeks, Rosemary's practice will not meet the requirement.

C. MANURE USE:

NOP Rule 205.203(c)(1) requires that raw manure be fully composted unless applied to fields with crops not for human consumption or incorporated into the soil 120 days prior to harvest for crops whose edible portions has direct contact with the soil, or 90 days prior to harvest for all other crops for human consumption.

What forms of manure do you use? ☐ none ☐ liquid ☐ semi-solid ☒ piled ☐ fully composted

☐ other (specify)

What types of crops do you grow? Check all boxes that apply.

☐ crops not used for human consumption

☒ crops for human consumption whose edible portion has direct contact with the soil or soil particles

☒ crops for human consumption whose edible portion does not have direct contact with the soil or soil particles

If you grow crops for human consumption and use raw manure, complete the following table. *If composting manure, please fill out Section B above.*

CROP(S)	FIELD NUMBERS	DATE MANURE IS APPLIED	EXPECTED DATE OF HARVEST
Tomatoes	1	May 1	Aug. 5
Watermelon	2	April 1	Aug. 5
Peppers	3	May 1	Aug. 5

What is the source of the manure you use? ☐ on-farm ☒ off-farm ☐ Not applicable

List all sources of off-farm manure.

Neighboring horse farm

List all manure ingredients/additives.

Hay bedding

If you use manure, what are the potential contaminants (pit additives, feed additives, pesticides, antibiotics, heavy metals, etc.) from these sources? *Attach residue analysis/additive specifications for manure, if available.*

None

D. NATURAL RESOURCES:

NOP Rule 205.200 and 205.203(a) requires that production practices maintain or improve the natural resources of the operation, including soil and water quality. Practices must minimize erosion. Depending on certifying agent policy, water tests may be required for nitrate and coliform bacteria if water is used for washing/processing organic products or for organic livestock. Irrigation water should not contaminate organic crops with prohibited materials. Methods to conserve water usage should be part of the irrigation plan.

What soil conservation practices are used? ☐ terraces ☐ contour farming ☐ strip cropping ☒ summer cover crops ☐ undersowing/interplanting ☐ conservation tillage ☒ permanent waterways ☒ windbreaks ☐ firebreaks ☐ tree lines ☐ retention ponds ☐ riparian management ☒ maintain wildlife habitat ☒ other (specify) wetland

What soil erosion problems do you experience (why and on which fields)? ☐ none

Northern fields slope towards the south but cover crops minimize loss.

Describe your efforts to minimize soil erosion problems listed above.

Fields always have crops or cover crops to minimize erosion. Windbreaks are planted around the perimeter of the fields to protect against wind erosion.

Describe how you monitor the effectiveness of your soil conservation program.

Physical examination for signs of erosion such as exposed tree roots, rilling, development of pedestals, gullies, build-up of sediment in low areas.

How often do you conduct conservation monitoring? ☐ weekly ☐ monthly ☒ annually ☐ as needed ☒ other (specify) – during the rainy season

WATER USE: ☐ none

☒ irrigation ☐ livestock ☐ foliar sprays ☐ washing crops ☐ greenhouse ☐ other (specify)

Source of water: ☒ on-site well(s) ☐ river/creek/pond ☐ spring ☐ municipal/county ☐ irrigation district ☐ other (specify)

Attach current water tests for nitrates and coliform bacteria, per certifying agent policy.

Type of irrigation system: ☐ none ☒ drip ☐ flood ☐ center pivot ☐ other (specify)

What input products are applied through the irrigation system? ☐ none

Fertilizer – fertigation for conventional fields only

What products do you use to clean irrigation lines/nozzles? ☐ none

Hydrogen peroxide, also flushed with well water

Is the system shared with another operator? ☐ Yes ☒ No If yes, what products do they use?

Is the system flushed and documented between conventional and organic use? ☒ Yes ☐ No

What practices are used to protect water quality?

☐ fencing livestock from waterways ☐ scheduled use of water to conserve its use ☐ tensiometer/monitoring
☐ laser leveling/land forming ☒ drip irrigation ☐ micro-spray ☐ other (specify)

List known contaminants in water supplies in your area. *Attach residue analysis and/or salinity test results, if applicable.*

None

Describe your efforts to minimize water contamination problems listed above. ☒ Not applicable

Describe how you monitor the effectiveness of your water quality program.

Water quality testing

How often do you conduct water quality monitoring? ☐ weekly ☐ monthly ☐ annually ☐ as needed
☒ other (specify) every 3 months