

Organic Small Fruit Training, November 6, 2005, Durham, NC

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Extension & the **Organic** Market

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N.C. A&T State University

November 6, 2005

Organics

- Post WWII- Robert Rodale and the Rodale Institute. (1945-1985)
- National Organic Standards fights and Program. (1990-2002)
- Customer interest in "health and nutrition", environment and animal rights issues. (Increasing)

Distance Organics

- Local "Birkenstock" farmers and customers. (1945-1985)
- Local and emerging Large- Scale Organic Industry. (1990-2005)
- Customer interest in "health and nutrition", environment and animal rights issues- Local Food Systems, Slow Food, etc.

http://www.ams.usda.gov/nop/indexIE.htm



Organic Certification Issues

- Certification-
 - Production, PHH, Retailing
 - Records and "Trackability",
 - Inspections.
 - Truth in Advertising.

Organic

- Can not be used outside the parameters of the NOP (except by a producer grossing less than \$5,000).
- Certification is required for its use.

Organic Certification by an accredited organization

- Needed above \$5,000 in sales.
- Needed in sales to re-sellers.
- Production paper trail.
- Crops, livestock and processing.

Organic Marketing as a Niche Market

The fundamental issue facing Marketing in the United States is Integrity.



Viewing "Organics" in various ways...

- Market demand/ strong growth...
- Adam Smith's "Invisible Hand"...
- Conventional Agriculture facing severe challenges...
- Opportunity for small and medium farms/ local food system.
- Customers asking us for assistance...

ORGANIC FARMING RESEARCH FOUNDATION Venter 2004 Number 1

INFORMATION BULLETIN

The Next Great Challenge: Breeding Seed for Organic Systems by Micaela Colley and Matthew Dillon

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 Organization for organic farmers
 'Its Societies' Organic Symposium
 Sate of the Sates 2nd Edition
 OFEE News & Policy Update



Organics Information- the web base

- Trends-
- Prices-
- Organizations Supporting Organics
- Production Standards-
- Production Resources-
- Partners/ Networking-
- Marketing issues-



Research- Market, Production.

Local Farmer Production Expertise (CFSA, etc).

Niches which satisfy customer wants.





The Organic Market

- Growth for more than a decade (20% per year)
 \$6 Billion
 - National Organic Standards
 - The entire food industry is interested in this customerdriven opportunity.

www.wholefoods.com









farm to table connection

GORP- Good Organic Retail Practices

Segregate Organics from Conventional Products No Commingling; No Contamination.



GORP/ (GRP)/ GOPP/ GOTP

 Goal: Maintain the Organic Quality (INTEGRITY) provided by the producer, during processing, transportation, retail. Organic Production and Marketing Research

- Issues
- Research base
 - CEFS (Goldsboro),
 - NCA&TSU Farm,
 - Market Research- producer managed.











The Organic Market- a major growth global industry

- ISO issues- standards.
- International certifiers.
- **IFOAM-** international federation of organic agricultural movements.

Your Organic Issues- and how will you address

- them?
- Issue?
- Partners in testing hypotheses?
 Resources (SARE, ORF, CFSA funds...)



Are you part of a Shared Vision for Organics in NC?

- Economic viability of our agriculture,
- Improved environmental stewardship,
- Agriculture in the Community.

Information sharing

- Extension needs to meet customers/ stakeholder needs.
- Three areas of information & research needed: Marketing, Production, Certification.

A Resource: The Legal Guide for Direct Farm Marketing

- Neil Hamilton, Drake University Law Center, Des Moines IA, 1999.
- \$20.00
- Tel 515-271-2065

Additional sources of information:

- www.carolinastewardship.org
- www.ifoam.org
- www.attra.org
- www.ota.org
- www.ams.usda.gov/, www.ers.usda.gov/
- www.easterncarolinaorganics.com
- www.chathammarketplace.com
- www.newfarm.org



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NC STATE UNIVERSITY A&T STATE UNIVERSITY **COOPERATIVE EXTENSION** Helping People Put Knowledge to Work
NOP Certification & Organic Certification Resources for Agents

SRSFC Agent Training 2005

TENSION Helping People Put Knowledge to Work

College of Agriculture and Life Sciences, NC State University School of Agriculture and Environmental Sciences, NC A&T State University

Richard Boylan, Area Agent Alternative Agriculture NCA&T State University



Organic Production – Conceptual Framework

 "Organic production" is defined by the NOP regulation as "a production system that is managed ... to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity."

NOP – The time & space factors...

- PAST 3 years (36 months prior to harvest) with no application of prohibited materials (no synthetic fertilizers, pesticides, or GMOs) prior to certification
- PRESENT distinct, defined boundaries for the operation
- FUTURE implementation of an Organic System Plan, with proactive fertility systems; conservation measures; and environmentally sound manure, weed, disease, and pest management practices

NOP – Regulation In Brief

- Proactive management practices must be implemented prior to use of approved inputs.
- Grower can use natural inputs unless they are specifically prohibited by NOP (e.g.- tobacco dust).
- Grower must avoid use of synthetic inputs unless they are specifically allowed by NOP (e.g.horticultural oils for insect control).

More on NOP reg's...

- Grower must keep comprehensive records of farm operations.
- Grower (> \$5,000 gross organic sales) must obtain & maintain certification on eligible ground. Any ingredients used in products to be labeled as organic must come from farms that are certified, regardless of gross sales.

NOP – Recordkeeping Requirements

- All operations producing and/or selling organic products must keep records to verify compliance with the regulation. Such records must:
 - be adapted to the particular operation
 - fully disclose all activities and transactions of the certified operation in sufficient detail as to be readily understood
 - be maintained for at least 5 years beyond their creation
 - be sufficient to demonstrate compliance with the regulation. The operator must make the records available for inspection
- Certifiers will usually provide a grower with the forms they require

NOP – Fertility Inputs

- Manures from conventional systems are allowed in organic production; this includes manure from livestock grown in confinement and from those that have been fed genetically engineered feeds.
- Manure sources containing excessive levels of pesticides, heavy metals, or other contaminants may be prohibited from use. Certifiers may require testing for these contaminants if there is reason to suspect a problem.
- Other fertility inputs mined materials, vegetable matter, composts, blood meal, bone meal and tankage are options.

NOP Fertility – More on manures

- You may *not* apply raw, uncomposted livestock manure to food crops unless it is:
- A) incorporated into the soil a minimum of 120 days prior to harvest when the edible portion of the crop has soil contact. Examples include strawberries and untrellised brambles. Any harvestable portion of a crop that can be splashed with soil during precipitation or irrigation might be considered to have soil contact.

OR

- B) incorporated into the soil a minimum of 90 days prior to harvest of all other food crops.
 - *Incorporation* is generally assumed to mean mechanical tillage to mix the manure into the soil.

NOP – Small Fruit Planting Stock

- Organic growers must make certain that the seeds, transplants, and planting stock they use are not genetically engineered.
- Organically-grown planting stock is encouraged.
- Non-organically produced planting stock to be used to produce a perennial crop may be sold, labeled, or represented as organically produced only after the planting stock has been maintained under a system of organic management for a period of no less than 1 year.

Certification – Planning for Weed & Pest Control

- §205.206—the Crop Pest, Weed, and Disease Management Practice Standard—requires that producers use a threelevel hierarchical approach in deciding how to deal with these problems. This can most easily be explained by designating these levels A, B, and C.
- Level A: The first line of defense in managing weed, insect, and disease pests generally comprises the most sustainable and systems-based practices. Level A practices specifically include:
 - crop rotation and nutrient management [§205.206(a)(1)]
 - sanitation measures to remove disease vectors, weed seeds, etc. [§205.206(a)(2)]
 - cultural practices such as resistant or tolerant varieties, timing of planting, etc. [§205.206(a)(3)]

Further Weed Control Measures

 Level B: Level B is the second line of defense, to be chosen if level A measures are not sufficient to control the weed, insect, or disease problem. Level B practices generally include mechanical and physical practices that are traditional in organics, and the use of nonsynthetic or "natural" materials.

• Level B weed control options include:

- mulching with fully biodegradable materials [§205.206(c)(1)]
- mowing [§205.206(c)(2)] and grazing [§205.206(c)(3)]
- cultivation and hand weeding [§205.206(c)(4)]
- flame, heat, or electrical weeding [§205.206(c)(5)]
- plastic mulches [§205.206(c)(6)]

Further Insect & Disease Control Measures

• Level B insect/animal pest control options include:

- introducing or augmenting predators and parasites
 [§205.206(b)(1)]
- developing habitat for beneficial predators and parasites
 [§205.206(c)(2)]
- nonsynthetic lures, traps, and repellents [§205.206(c)(3)]
- Level B crop disease control options include:
 - management practices (e.g. fire, flooding)
 [§205.206(d)(1)]
 - application of nonsynthetic biological, botanical, or mineral inputs [§205.206(d)(2)]

The third line of defense against insects and disease

- Level C: to be chosen if the level of pest control required is not achieved after A and B control options are applied [§205.206(e)].
- In such instances, you are allowed the wider use of biologicals and botanicals to control pests. You also have the option to use those materials included on the National List under §205.601—"Synthetic substances allowed for use in organic crop production".
- If you anticipate the need for level C control measures, be sure that you indicate this in your Organic Plan. Be specific about the control materials you might be using. Outline the indicators or thresholds you monitor that will trigger the use of those materials.

Certification – Finding a Certifier

- Any certifier accredited by the USDA can certify anywhere in the country. However a local certifier may be more familiar with the challenges that local growers face (i.e.- dry-land certifiers may not see the disease pressure that NC growers face).
- The location of the inspectors used is an issue. Some certifiers may require that you use inspectors that are not located near you. You will have to pay their travel expense, so this can have a major impact on your cost.

Certification – Issues to consider

• Price

The USDA does not regulate fees for certification. Some certifiers charge a flat rate based on acreage. Shop around and see what works for you. Remember to factor in inspector costs.

Turn-around Time

Minimum of 3 to 4 months for the first time applying for certification.

References & Resources

- Growing Small Farms Website: <u>www.ces.ncsu.edu/chatham/ag/SustAg/</u>
- NCAT Organic Crops Workbook: <u>www.attra.org/attra-pub/PDF/cropsworkbook.pdf</u>
- USDA National Organic Program: <u>www.ams.usda.gov/nop</u>



Overview of National Organic Program Requirements

by Jim Riddle, Organic Independents

Having trouble understanding the National Organic Standards? If so, you're not alone! This overview is intended to provide an understandable introduction to the regulation.

The National Organic Standards (NOS) were developed by the USDA to implement the Organic Foods Production Act of 1990 (OFPA). The NOS are based on recommendations of the National Organic Standards Board (NOSB), which was appointed by the Secretary of Agriculture to provide advice to implement OFPA and to review substances allowed in organic production and handling.

As you may recall, the USDA issued the first proposed rule in December, 1997. That proposed set of standards would have allowed genetic engineering, irradiation, sewage sludge, antibiotics, re-feeding of animal by-products, and other practices long prohibited in organic agriculture. That proposal received 275,603 comments and was withdrawn.

The second proposed rule was issued in March 2000. It was much more consistent with existing organic standards than the first proposed rule. It received about 40,000 comments and served as the basis for the "final rule", issued in December 2000.

The final rule contains the National Organic Standards, complete with an extensive list of definitions and the "National List" of allowed synthetic and prohibited natural substances. It also contains labeling, certification, accreditation, enforcement, and testing requirements. The regulation went into effect on October, 21, 2002. The text of the rule, along with policy statements, program updates, a list of accredited certifying agents, complaint procedures, and other related information can be found at the <u>National Organic Program website</u>.

Under the regulation, any agricultural product can be produced using organic methods. The NOS covers all agricultural products labeled and sold as "organic" or "organically produced". The rule covers organic vegetable growers, orchardists, livestock producers, ranchers, processors, and handlers. Parts of the regulation even apply to retailers. As an organic operator, it is good for you to understand the requirements for other sectors, since these may affect your operation.

While the National Organic Standards are relatively new, organic standards and certification have existed in the United States since the mid-1970s, beginning with California Certified Organic Farmers. As the markets for organic products grew, so did the number of organic certification agencies. Though the standards of the different agencies, and the states which defined "organic" through legislation, were similar, there were differences. These differences sometimes resulted in trade difficulties and disputes between regions over whose standards were more "organic".

OFPA was passed by Congress in 1990 to begin the process of resolving the differences and establishing one set of national standards. Those standards are now in place. All certifiers who operate in the U.S., and all certifiers who certify products sold as "organic" in the U.S., must follow the NOS, and they must be accredited by the USDA to show that they have the competence and freedom from conflict of interest to certify organic products.

"Organic production" is defined by the regulation as "a production system that is managed ... to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity."

In simplified terms, the National Organic Standards require:

For crop farms:

- 3 years (36 months prior to harvest) with no application of prohibited materials (no synthetic fertilizers, pesticides, or GMOs) prior to certification
- distinct, defined boundaries for the operation
- implementation of an Organic System Plan, with proactive fertility systems; conservation measures; and environmentally sound manure, weed, disease, and pest management practices
- monitoring of the operation's management practices
- use of natural inputs and/or approved synthetic substances on the National List, provided that proactive management practices are implemented prior to use of approved inputs
- no use of prohibited substances
- no use of genetically engineered organisms, (GMOs) defined in the rule as "excluded methods"
- no sewage sludge or irradiation
- use of organic seeds, when commercially available (must not use seeds treated with prohibited synthetic materials, such as fungicides)
- use of organic seedlings for annual crops
- restrictions on the use of raw manure and compost
- must maintain or improve the physical, chemical, and biological condition of the soil, minimize soil erosion, and implement soil building crop rotations
- fertility management must not contaminate crops, soil, or water with plant nutrients, pathogens, heavy metals, or prohibited substances
- maintenance of buffer zones, depending on risk of contamination
- prevent commingling on split operations (the entire farm does not have to be converted to organic production, provided that sufficient measures are in place to segregate organic from non-organic crops and production inputs)
- no field burning to dispose of crop residues (may only burn to suppress disease or stimulate seed germination flame weeding is allowed)
- no residues of prohibited substances exceeding 5% of the EPA tolerance (certifier may require residue analysis if there is reason to believe that a crop has come in contact with prohibited substances or was produced using GMOs).

For livestock operations:

- implementation of an Organic Livestock Plan
- monitoring of management practices
- organic management from last third of gestation for slaughter stock or 2nd day after hatching for poultry
- one year of organic management for dairy cows prior to the production of organic milk
- mandatory outdoor access for all species when weather is suitable
- mandatory access to pasture for ruminants
- 100% organic feed and approved feed supplements
- DL-methionine allowed through October 21, 2005
- no antibiotics, growth hormones, or GMOs
- operator must implement preventative health care practices
- vaccines are allowed
- parasiticides prohibited for slaughter stock and tightly regulated for dairy and breeder stock
- physical alterations (castration, beak trimming, etc.) are allowed, if done to promote animal's welfare and stress is minimized
- animals must not be rotated between organic and non-organic production
- operator must not withhold treatment in order to preserve an animal's organic status
- manure must be managed to prevent contamination of crops, water, and soil.

For processing operations:

- implementation of an Organic Handling Plan
- may use mechanical or biological processing methods
- no commingling or contamination of organic products during processing or storage
- no use of GMOs or irradiation
- must use proactive sanitation and facility pest management practices to prevent pest infestations
- must take steps to protect organic products and packaging from contamination if pesticides are used
- must keep records of all pesticide applications
- must not use packaging materials that contain fungicides, preservatives, or fumigants
- must use organic minor ingredients in products labeled "organic", when such ingredients are commercially available
- must use approved label claims for "100% organic" (100% organic ingredients, including processing aids), "organic" (at least 95% organic ingredients), "made with organic ingredients" (at least 70% organic ingredients) and proper use of the word "organic" in ingredient list (less than 70% organic ingredients).

All operations producing and/or selling organic products must keep records to verify compliance with the regulation. Such records must:

- 1. be adapted to the particular operation
- 2. fully disclose all activities and transactions of the certified operation in sufficient detail as to be readily understood and audited
- 3. be maintained for at least 5 years beyond their creation

4. be sufficient to demonstrate compliance with the regulation. The operator must make the records available for inspection

Organic System Plan forms are generally provided by certifying agents as part of the application process. The plans must be updated annually, and operators are required to notify their certifying agents of all changes to the operation which might affect the operation's certification status. Operations must be inspected at least annually.

All producers and handlers who sell over \$5000/year in organic products must be certified. Producers and handlers who sell under \$5,000/year do not have to be certified, but they still have to follow the NOS. Non-certified organic producers can sell their products directly to customers or to retail stores, but their products cannot be used as organic ingredients by other operations, and they cannot use the "USDA Organic" seal.

Though the National Organic Standards are similar to previous organic standards, there are some significant differences, and there are areas of continued controversy, confusion, and clarification. Despite the level of detail in the NOS, some interpretation is required for local variations and new conditions. It is always a good idea to check with certification agencies to get your questions answered, especially before purchasing or applying materials.

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This page last updated July 17, 2005.

Comparison of Organic Certification Agencies

Compiled by Molly Hamilton, North Carolina State University

North Carolina Crop Improvement Association

Quality Certification Services

Clemson Certification

	North Carolina Crop Improvement Association (NCCIA)
Contact Information	Dr. Myron Fountain 3709 Hillsborough St Raleigh, NC 27607-5464 Phone: 919-515-2851 or 919-513-3444 Fax: 919-515-7981

Pricing	Organic farm:
	 Administration fee: \$50 Application fee: \$20 Farm certification: \$200 Inspection-organic farm: \$5/acre Organic handler/processor: \$470 total Organic livestock: \$270 total
Inspectors	All located in North Carolina. Do not have to pay inspector's travel expenses.
Average turn-around time	4 months (busiest times: May and September)
Other organic certification	Yes - livestock, processors/handlers, farmers
Experience	Certifying organic operations since summer 2002
Activism	Involved in state and federal level organic organizations. Mostly focused on NC though

	Quality Certification Services (QCS)
Contact Information	QCS Office P.O. Box 12311 Gainesville, FL 32604 Phone: 352-377-0133
Pricing	First time applicant fee: \$75
	Standard Farm Certification:
	 Inspection fee (is based on how far away farm is from inspector and how long it takes the inspector) Fee for size of operation: 0-100 acres: \$175 101-500 acres: \$225 201-300 acres: \$300
	Assessment fee: 0.5% of gross sales (max annual assessment \$5000) due twice a year
	Contract Producers:
	Flat rate fee: \$1000 per contract producerInspection fee (varies)

Inspectors	Three NC inspectors located in Maconville, Pittsboro, and Asheville
Average turn-around time	About 90 days
Other organic certification	Yes - livestock, processors/handlers, farmers, wildcrafting
Experience	Certifying organic operations for 16 years - formerly Florida Organic Growers (FOG)
Activism	Involved in many state and federal level organic committees and advisory boards

	Clemson Certification
Contact Information	Dr. David Howle Department of Plant Industry Clemson University 511 Westinghouse Rd Pendleton, SC 29670 Phone: 864-646-2140
Pricing	Initial application fee: \$500 (non-refundable) Annual renewal fee: \$400 Inspection fee (based on acreage):
	 first 20 acres (minimum 10 acres): \$10/acre above 20 acres: \$5/acre Out-of-state travel for inspectors: mileage and expenses at Clemson rate
Inspectors	None located in NC. Most at Clemson, with one in Columbia, SC and one on contract basis in Greensboro, NC
Average turn-around time	About one month
Other organic certification	Yes - livestock, processor, farmers
Experience	Certifying organic operations since April 2002
Activism	Involved with some local organic organizations such as CFSA

Notes:

- If a farmer wants to market product outside of the US, certifying agencies with more international experience and involvement such as QCS, <u>Organic Crop Improvement</u> <u>Association</u>, or <u>Oregon Tilth, Inc</u>. should be considered.
- NCCIA fees will probably be raised slightly in the next few years.
- Farmers who want to work with a certifier that has more experience with conventional and/or large farmers often choose NCCIA.
- Farmers who wish to work with a certifier that has a lot of experience with organic certification and organic philosophy often use QCS.
- Farmers located nearer to Columbia or Clemson, SC sometimes choose Clemson University as a certifier.
- Turn-around time: It is recommended that farmers send in completed applications to make turn-around time as short as possible. It is also recommend that a farmer back off from the date that certification is needed by the length of the turn-around time to turn in the completed application.

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This page last updated July 17, 2005.

How to Pick a Certifier

by Tony Kleese, Carolina Farm Stewardship Association

Choosing a certifier is just like choosing any other service provider. You will be the most satisfied if you do a little research up front to ensure that you are getting the most for your hard earned money. We recommend using the following criteria to evaluate which certifier is right for you.

Location

First recognize that it is not necessary for the certifier to be located in your state. Any certifier accredited by the USDA can certify anywhere in the country. They may self-limit their range but

they do not need to have an office in your state. The location of the inspectors they use is an issue. Some certifiers may require that you use inspectors that are not located near you. You will have to pay their travel expense, so this can have a major impact on your cost. Ask the certifier about who their inspectors are and how far away they are from your farm.

Price

The USDA does not regulate fees for certification. Some certifiers charge a flat rate based on acreage, some charge a base fee and then charge an assessment based on sales. Both fee structures are intended to make it scale-specific so a small operation is not charged the same as a large operation. Shop around and see what works for you. Remember to factor in inspector costs.

Turnaround Time

We suggest that you budget a minimum of 3 to 4 months for the first time through the system. It can take as much as 6 months if your operation is complicated or there are other delays in the process. Ask the certifier what their average turnaround time is and be very thorough in your application/farm plan as this will reduce the need to collect additional information. It may also be helpful to ask the certifier if they have recommendations on the times of year when their load is lighter and they can move faster.

Service Area/History/Activism

Certifiers are accredited to perform certification services for the USDA for crops, livestock, and handling. Some certifiers may not offer services in all of these areas. Some may be more oriented to the manufacturer market instead of the small farmer market. Make sure you are very clear about what products you want to have certified so you can ensure that the certifier can meet your needs. Some certifiers are just getting into organic certification and some have been at it for years. You may find that this impacts the service you receive. Some certifiers, especially the older ones, are very active at the federal and state level by participating on committees and advisory boards. If this activism is important to you, you may want to support a certifier who participates in these activities.

End Product Issues

If the crop you are certifying will end up in a manufactured product, you may want to consider being certified by the same certifier as the final product. Technically, this should have no impact because in the eyes of the USDA, all certifiers and certifications are equal, but it may make the sale and distribution of your product go smoother if they are the same.

Organic Certification Recordkeeping

National Organic Program Recordkeeping Requirements for Certified Operations:

(a) A certified operation must maintain records concerning the production, harvesting, and handling of agricultural products that are or that are intended to be sold, labeled, or represented

as "100 percent organic," "organic," or "made with organic (specified ingredients or food group(s))."

(b) Such records must:

(1) Be adapted to the particular business that the certified operation is conducting;

(2) Fully disclose all activities and transactions of the certified operation in sufficient detail as to be readily understood and audited;

(3) Be maintained for not less than 5 years beyond their creation; and

(4) Be sufficient to demonstrate compliance with the Act and the regulations in this part.

(c) The certified operation must make such records available for inspection and copying during normal business hours by authorized representatives of the Secretary, the applicable State program's governing State official, and the certifying agent.

Recordkeeping Templates - all of these templates were designed to comply with the requirements of the USDA's National Organic Program

Farm Recordkeeping Form Templates - includes multiple forms:

- List of Organic Certification Records
- Field History Sheet
- Newly Purchased Land or Rented Land Verification
- Seed Verification Form
- Field Activity Log
- Input Use Record
- Compost Production Record
- Neighbor Notification Letter
- Verification of Adjoining Land Use
- Buffer Crop Usage
- Crop Harvest Record
- Crop Harvest & Storage Record
- Clean Transport Affidavit
- Split Operation or Parallel Production Crop Record
- Audit Control Summary
- Complaint Log

Vegetable Recordkeeping Templates/Examples

Livestock Recordkeeping Templates/Examples

Grain Recordkeeping Templates/Examples

The National List in the Final Rule

Subpart G - Administrative

The National List of Allowed and Prohibited Substances

§ 205.600 Evaluation criteria for allowed and prohibited substances, methods, and ingredients.

The following criteria will be utilized in the evaluation of substances or ingredients for the organic production and handling sections of the National List:

(a) Synthetic and nonsynthetic substances considered for inclusion on or deletion from the National List of allowed and prohibited substances will be evaluated using the criteria specified in the Act (7 U.S.C. 6517 and 6518).

(b) In addition to the criteria set forth in the Act, any synthetic substance used as a processing aid or adjuvant will be evaluated against the following criteria:

(1) The substance cannot be produced from a natural source and there are no organic substitutes;

(2) The substance's manufacture, use, and disposal do not have adverse effects on the environment and are done in a manner compatible with organic handling;

(3) The nutritional quality of the food is maintained when the substance is used, and the substance, itself, or its breakdown products do not have an adverse effect on human health as defined by applicable Federal regulations;

(4) The substance's primary use is not as a preservative or to recreate or improve flavors, colors, textures, or nutritive value lost during processing, except where the replacement of nutrients is required by law;

(5) The substance is listed as generally recognized as safe (GRAS) by Food and Drug Administration (FDA) when used in accordance with FDA's good manufacturing practices (GMP) and contains no residues of heavy metals or other contaminants in excess of tolerances set by FDA; and

(6) The substance is essential for the handling of organically produced agricultural products.

(c) Nonsynthetics used in organic processing will be evaluated using the criteria specified in the Act (7 U.S.C. 6517 and 6518).

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

In accordance with restrictions specified in this section, the following synthetic substances may be used in organic crop production:

(a) As algicide, disinfectants, and sanitizer, including irrigation system cleaning systems

(1) Alcohols

(i) Ethanol

(ii) Isopropanol

(2) Chlorine materials - <u>Except</u>, That, residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.

- (i) Calcium hypochlorite
- (ii) Chlorine dioxide
- (iii) Sodium hypochlorite
- (3) Hydrogen peroxide
- (4) Soap-based algicide/demisters
- (b) As herbicides, weed barriers, as applicable.

(1) Herbicides, soap-based - for use in farmstead maintenance (roadways, ditches, right of ways, building perimeters) and ornamental crops

- (2) Mulches
- (i) Newspaper or other recycled paper, without glossy or colored inks.
- (ii) Plastic mulch and covers (petroleum-based other than polyvinyl chloride (PVC))
- (c) As compost feedstocks

Newspapers or other recycled paper, without glossy or colored inks

(d) As animal repellents

Soaps, ammonium - for use as a large animal repellant only, no contact with soil or edible portion of crop

- (e) As insecticides (including acaricides or mite control)
- (1) Ammonium carbonate for use as bait in insect traps only, no direct contact with crop or soil
- (2) Boric acid structural pest control, no direct contact with organic food or crops
- (3) Elemental sulfur
- (4) Lime sulfur including calcium polysulfide
- (5) Oils, horticultural narrow range oils as dormant, suffocating, and summer oils.
- (6) Soaps, insecticidal
- (7) Sticky traps/barriers

(f) As insect attractants

Pheromones

(g) As rodenticides

(1) Sulfur dioxide - underground rodent control only (smoke bombs)

(2) Vitamin D3

(h) As slug or snail bait

<None>

(i) As plant disease control

(1) Coppers, fixed - copper hydroxide, copper oxide, copper oxychloride, includes products exempted from EPA tolerance, <u>Provided</u>, That, copper-based materials must be used in a manner that minimizes accumulation in the soil and shall not be used as herbicides.

(2) Copper sulfate - Substance must be used in a manner that minimizes accumulation of copper in the soil.

(3) Hydrated lime - must be used in a manner that minimizes copper accumulation in the soil.

- (4) Hydrogen peroxide
- (5) Lime sulfur
- (6) Oils, horticultural, narrow range oils as dormant, suffocating, and summer oils.
- (7) Potassium bicarbonate
- (8) Elemental sulfur
- (9) Streptomycin, for fire blight control in apples and pears only
- (10) Tetracycline (oxytetracycline calcium complex), for fire blight control only
- (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, floatation agent
- (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. Soil 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

(k) As plant growth regulators

Ethylene - for regulation of pineapple flowering

- (I) As floating agents in postharvest handling
- (1) Lignin sulfonate

(2) Sodium silicate - for tree fruit and fiber processing

(m) As synthetic inert ingredients as classified by the Environmental Protection Agency (EPA), for use with nonsynthetic substances or synthetic substances listed in this section and used as an active pesticide ingredient in accordance with any limitations on the use of such substances.

(1) EPA List 4 - Inerts of Minimal Concern

(n)-(z) [Reserved]

§ 205.602 Nonsynthetic substances prohibited for use in organic crop production.

The following nonsynthetic substances may not be used in organic crop production:

(a) Ash from manure burning

- (b) Arsenic
- (c) Lead salts
- (d) Sodium fluoaluminate (mined)
- (e) Strychnine
- (f) Tobacco dust (nicotine sulfate)

(g) Potassium chloride - unless derived from a mined source and applied in a manner that minimizes chloride accumulation in the soil.

(h) Sodium nitrate - unless use is restricted to no more than 20% of the crop's total nitrogen requirement.

(i)-(z) [Reserved]

§ 205.603 Synthetic substances allowed for use in organic livestock production.

In accordance with restrictions specified in this section the following synthetic substances may be used in organic livestock production:

- (a) As disinfectants, sanitizer, and medical treatments as applicable
- (1) Alcohols
- (i) Ethanol disinfectant and sanitizer only, prohibited as a feed additive
- (ii) Isopropanol disinfectant only
- (2) Aspirin approved for health care use to reduce inflammation

(3) Chlorine materials - disinfecting and sanitizing facilities and equipment. Residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act

(i) Calcium hypochlorite

- (ii) Chlorine dioxide
- (iii) Sodium hypochlorite

(4) Chlorohexidine - Allowed for surgical procedures conducted by a veterinarian. Allowed for use as a teat dip when alternative germicidal agents and/or physical barriers have lost their effectiveness

- (5) Electrolytes without antibiotics
- (6) Glucose

(7) Glycerin - Allowed as a livestock teat dip, must be produced through the hydrolysis of fats or oils

- (8) Iodine
- (9) Hydrogen peroxide
- (10) Magnesium sulfate
- (11) Oxytocin use in postparturition therapeutic applications
- (12) Parasiticides

Ivermectin - prohibited in slaughter stock, allowed in emergency treatment for dairy and breeder stock when organic system plan-approved preventive management does not prevent infestation. Milk or milk products from a treated animal cannot be labeled as provided for in subpart D of this part for 90 days following treatment. In breeder stock, treatment cannot occur during the last third of gestation if the progeny will be sold as organic and must not be used during the lactation period of breeding stock. (13)

Phosphoric acid - allowed as an equipment cleaner, <u>Provided</u>, That, no direct contact with organically managed livestock or land occurs.

(14) Biologics

Vaccines

(b) As topical treatment, external parasiticide or local anesthetic as applicable.

(1) lodine

(2) Lidocaine - as a local anesthetic. Use requires a withdrawal period of 90 days after administering to livestock intended for slaughter and 7 days after administering to dairy animals

(3) Lime, hydrated - (bordeaux mixes), not permitted to cauterize physical alterations or deodorize animal wastes.

(4) Mineral oil - for topical use and as a lubricant

(5) Procaine - as a local anesthetic, use requires a withdrawal period of 90 days after administering to livestock intended for slaughter and 7 days after administering to dairy animals

(6) Copper sulfate

(c) As feed supplements

Milk replacers - without antibiotics, as emergency use only, no nonmilk products or products from BST treated animals

(d) As feed additives

(1) Trace minerals, used for enrichment or fortification when FDA approved, including:

(i) Copper sulfate

(ii) Magnesium sulfate

(2) Vitamins, used for enrichment or fortification when FDA approved

(e) As synthetic inert ingredients as classified by the Environmental Protection Agency (EPA), for use with nonsynthetic substances or a synthetic substances listed in this section and used as an active pesticide ingredient in accordance with any limitations on the use of such substances.

EPA List 4 - Inerts of Minimal Concern.

(f)-(z) [Reserved]

§ 205.604 Nonsynthetic substances prohibited for use in organic livestock production.

The following nonsynthetic substances may not be used in organic livestock production:

(a) Strychnine

(b)-(z) [Reserved]

§ 205.605 Nonagricultural (nonorganic) substances allowed as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))."

The following nonagricultural substances may be used as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))" only in accordance with any restrictions specified in this section.

- (a) Nonsynthetics allowed:
- (1) Acids
- (i) Alginic
- (ii) Citric produced by microbial fermentation of carbohydrate substances
- (iii) Lactic
- (2) Bentonite
- (3) Calcium carbonate
- (4) Calcium chloride
- (5) Colors, nonsynthetic sources only
- (6) Dairy cultures
- (7) Diatomaceous earth food filtering aid only

(8) Enzymes - must be derived from edible, nontoxic plants, nonpathogenic fungi, or nonpathogenic bacteria

(9) Flavors, nonsynthetic sources only and must not be produced using synthetic solvents and carrier systems or any artificial preservative.

- (10) Kaolin
- (11) Magnesium sulfate, nonsynthetic sources only
- (12) Nitrogen oil-free grades
- (13) Oxygen oil-free grades
- (14) Perlite for use only as a filter aid in food processing
- (15) Potassium chloride

- (16) Potassium iodide
- (17) Sodium bicarbonate
- (18) Sodium carbonate
- (19) Waxes nonsynthetic
- (i) Carnauba wax
- (ii) Wood resin
- (20) Yeast nonsynthetic, growth on petrochemical substrate and sulfite waste liquor is prohibited
- (i) Autolysate
- (ii) Bakers
- (iii) Brewers
- (iv) Nutritional
- (v) Smoked nonsynthetic smoke flavoring process must be documented.
- (b) Synthetics allowed:
- (1) Alginates
- (2) Ammonium bicarbonate for use only as a leavening agent
- (3) Ammonium carbonate for use only as a leavening agent
- (4) Ascorbic acid
- (5) Calcium citrate
- (6) Calcium hydroxide
- (7) Calcium phosphates (monobasic, dibasic, and tribasic)
- (8) Carbon dioxide

(9) Chlorine materials - disinfecting and sanitizing food contact surfaces, <u>Except</u>, That, residual chlorine levels in the water shall not exceed the maximum residual disinfectant limit under the Safe Drinking Water Act.

- (i) Calcium hypochlorite
- (ii) Chlorine dioxide
- (iii) Sodium hypochlorite

(10) Ethylene - allowed for postharvest ripening of tropical fruit

(11) Ferrous sulfate - for iron enrichment or fortification of foods when required by regulation or recommended (independent organization)

(12) Glycerides (mono and di) - for use only in drum drying of food

- (13) Glycerin produced by hydrolysis of fats and oils
- (14) Hydrogen peroxide
- (15) Lecithin bleached

(16) Magnesium carbonate - for use only in agricultural products labeled "made with organic (specified ingredients or food group(s))," prohibited in agricultural products labeled "organic"

(17) Magnesium chloride - derived from sea water

(18) Magnesium stearate - for use only in agricultural products labeled "made with organic (specified ingredients or food group(s))," prohibited in agricultural products labeled "organic"

(19) Nutrient vitamins and minerals, in accordance with 21 CFR 104.20, Nutritional Quality Guidelines For Foods

- (20) Ozone
- (21) Pectin (low-methoxy)
- (22) Phosphoric acid cleaning of food-contact surfaces and equipment only
- (23) Potassium acid tartrate
- (24) Potassium tartrate made from tartaric acid
- (25) Potassium carbonate
- (26) Potassium citrate
- (27) Potassium hydroxide prohibited for use in lye peeling of fruits and vegetables

(28) Potassium iodide - for use only in agricultural products labeled "made with organic (specified ingredients or food group(s))," prohibited in agricultural products labeled "organic"

(29) Potassium phosphate - for use only in agricultural products labeled "made with organic (specific ingredients or food group(s))," prohibited in agricultural products labeled "organic"

- (30) Silicon dioxide
- (31) Sodium citrate
- (32) Sodium hydroxide prohibited for use in lye peeling of fruits and vegetables

(33) Sodium phosphates - for use only in dairy foods

(34) Sulfur dioxide - for use only in wine labeled "made with organic grapes," <u>Provided</u>, That, total sulfite concentration does not exceed 100 ppm.

(35) Tocopherols - derived from vegetable oil when rosemary extracts are not a suitable alternative

- (36) Xanthan gum
- (c)-(z) [Reserved]

§ 205.606 Nonorganically produced agricultural products allowed as ingredients in or on processed products labeled as organic or made with organic ingredients.

The following nonorganically produced agricultural products may be used as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s))" only in accordance with any restrictions specified in this section.

Any nonorganically produced agricultural product may be used in accordance with the restrictions specified in this section and when the product is not commercially available in organic form.

- (a) Cornstarch (native)
- (b) Gums water extracted only (arabic, guar, locust bean, carob bean)
- (c) Kelp for use only as a thickener and dietary supplement
- (d) Lecithin unbleached
- (e) Pectin (high-methoxy)

§ 205.607 Amending the National List.

(a) Any person may petition the National Organic Standard Board for the purpose of having a substance evaluated by the Board for recommendation to the Secretary for inclusion on or deletion from the National List in accordance with the Act.

(b) A person petitioning for amendment of the National List should request a copy of the petition procedures from the USDA at the address in § 205.607(c).

(c) A petition to amend the National List must be submitted to: Program Manager, USDA/AMS/TMP/NOP, Room 2945, South Building, P.O. Box 96456, Washington, DC 20090-6456.
Resources for Organic Small Fruit Production

Debbie Roos, Agricultural Extension Agent North Carolina Cooperative Extension, Chatham County Center 919-542-8202; debbie_roos@ncsu.edu

November 6, 2005

Books and Other Publications

- The Grape Grower: A Guide to Organic Viticulture, by Lon Rombough
- <u>Manage Insects on Your Farm: A Guide to Ecological Strategies</u>, by Miguel Altieri and Clara Nicholls, Sustainable Agriculture Network; *to order, call 301-374-9696 or visit http://www.sare.org/publications/order.htm*
- <u>Pests of the Garden and Small Farm: A Growers' Guide to Using Less Pesticide</u>, by Mary Louise Flint
- <u>Plow Sharing</u>, written and edited by Debbie Roos; *bi-monthly sustainable agriculture newsletter from Chatham County Cooperative Extension; to subscribe, call 919-542-8202 or email Debbie_roos@ncsu.edu*
- <u>Growing for Market</u>, edited by Lynn Byczynski; monthly magazine; to subscribe, call 800-307-8949 or email growing4market@earthlink.net
- <u>The New Organic Grower</u>, by Eliot Coleman
- <u>Four-Season Harvest</u>, by Eliot Coleman
- <u>Building Soils for Better Crops</u>, by Fred Magdoff and Harold van Es, Sustainable Agriculture Network; *to order, call 301-374-9696 or visit http://www.sare.org/publications/order.htm*
- <u>Managing Cover Crops Profitably</u>, by the Sustainable Agriculture Network; *to order*, *call 301-374-9696 or visit http://www.sare.org/publications/order.htm; also on-line at http://www.sare.org/publications/covercrops/covercrops.pdf*

Web Resources

• Chatham County Cooperative Extension's **Growing Small Farms** Sustainable Agriculture Website: www.ces.ncsu.edu/chatham/ag/SustAg/index.html

- check out the **Organic Pest Management** section for photos and information on 40 major pests and beneficials
- check out the **Web Resources** section for over 500 links, including those for small fruits, pest management, and much more
- the **Grower Resource List** includes books, seeds, equipment and supplies, season extension, fertilizers and soil amendments, and more
- the **Crop Production** section provides information on cover crops, pest management, local crop problems, and much more
- the **Marketing** section provides information on farmers' markets, CSAs, PYO stands, restaurants, and retailers
- Strawberries: Organic and IPM Options ATTRA http://attra.ncat.org/attra-pub/strawberry.html
- Organic Grape Production ATTRA http://www.attra.org/attra-pub/grape.html
- Organic Grape and Wine Production Cornell University http://www.nysaes.cornell.edu/hort/faculty/pool/organicvitwkshp/tabofcontents.html
- **Organic Blueberry Production ATTRA** http://www.attra.org/attra-pub/blueberry.html
- **Transition to Organic Highbush Blueberry Production Rutgers University** http://hortweb.cas.psu.edu/extension/vegcrops/vegetable_gazette/2003/may2003.htm #transition
- Suggestions for Organic Blueberry Production in Georgia http://www.smallfruits.org/Blueberries/production/04organic.pdf
- Organic Culture of Bramble Fruits ATTRA http://www.attra.org/attra-pub/bramble.html
- A Whole-Farm Approach to Managing Pests http://www.sare.org/publications/farmpest/index.htm

Organizations

• Alabama Sustainable Agriculture Network (ASAN) http://www.asanonline.org/ 256-318-0537

- Appropriate Technology Transfer for Rural Areas (ATTRA) http://attra.ncat.org/ 800-346-9140
- Carolina Farm Stewardship Association (CFSA) http://www.carolinafarmstewards.org/ 919-542-2402
- Georgia Organics http://www.georgiaorganics.org/ 678-702-0400
- Florida Certified Organic Growers & Consumers, Inc. http://www.foginfo.org/ 352-377-6345
- Local Harvest http://www.localharvest.org/ 831-475-8150
- National Organic Program http://www.ams.usda.gov/nop/indexIE.htm 202-720-3252
- Southern Sustainable Agriculture Working Group (SSAWG) http://www.ssawg.org/
- The New Farm Rodale Institute http://www.newfarm.org/
- Virginia Association for Biological Farming http://www.vabf.org/ 540-463-6363

Pest Management Supplies

• Consult the **Grower Resource List** on the Growing Small Farms website at www.ces.ncsu.edu/chatham/ag/SustAg/index.html for a list of suppliers

Organic Certification Guide

• Growing Small Farms website: www.ces.ncsu.edu/chatham/ag/SustAg/orgcertguide.html

Soil Management for Organic Small Fruit Production

Keith R. Baldwin NC A&T State University

Landscape position affects SOM dynamics



lime and nutrients











Soil Fertility and Crop Nutrient Management Goals

 Manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances.

Soil Fertility and Crop Nutrient Management Goals

- Select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion.
- Manage crop nutrients and soil fertility through rotations, cover crops, and the application of plant and animal materials.

Crop Rotation Goals

The producer should implement a crop rotation including but not limited to sod, cover crops, green manure crops, and catch crops that provide the following functions:

- Maintain or improve soil organic matter
- Provide for pest management
- Manage deficient or excess nutrients
- Provide erosion control.

Benefits of Organic Matter

- Increases soil CEC
- Provides nutrients in stable forms
- Builds soil friability and tilth
- Reduces soil splash

Benefits of Organic Matter

- Reduces compaction and bulk density
- Provides a food source for microorganisms
- Increases earthworm activity

HUMUS

Extreme chemical complexity
Resistance to further decomposition
High specific surface and negative charge
Dark color

Humus adsorbs ions and molecules



Adapted from Brady and Weil (2002)

Humus increases plant available H₂0



Adapted from Brady and Weil (2002)















Summer Grasses/Buckwheat

	Biomass	Biomass-N	C:N
	(tons/ac)	(lbs/ac)	
Sorghum sudangrass	8.0-10.0	65-100	53
Japanese millet	3.0-4.0	25-45	42
Pearl millet	5.0-8.0	45-90	50
Buckwheat	2.0-3.0	15-40	34

Biomass 60 Days After Planting (kg ha⁻¹)

	Piedmont	Coastal Plain
Sunnhemp	4410	6415
Cowpea	3136	3480
Soybean	2991	3165
Millet/Cowpea	6222	10085
Millet/Soybean	8033	9330

Biomass-N 60 Days After Planting (kg ha⁻¹)

	Piedmont	Coastal Plain
Sunnhemp	120	127
Cowpea	99	102
Soybean	81	103
Millet/Cowpea	107	193
Millet/Soybean	137	198









Japanese millet






How will the crops get the nutrients they need?

- Organic amendments such as composts and manures
- Green manure cover crops
- Plant and animal by-products
- Mined rock materials
- Blended commercial fertilizers

applying organic nutrients

WERSIZE LOAD

Raw Manure Must be Composted

- Unless applied to land used for a crop not intended for human consumption
- Unless incorporated into soil not less than:

 a) 120 days prior to harvest of a product whose edible portion has direct contact with the soil surface or soil particles or b) 90 days prior to harvest of a product whose edible portion does not have direct contact.





Nutrients in Manure (lbs/ton)

Туре	NH ₄ -N	Total N	P_2O_5	K ₂ O
Poultry	10	26	17	11
Broiler	11	72	78	46
Turkey	16	57	72	40
Stockpile	8	36	80	34
Swine	7	13	12	9
Dairy	3	10	6	9

Nutrient Availability in Manures

- 60% of total N if incorporated
- 50% of total N if left on surface
- 80% of total P_2O_5
- 70% of total K₂O

Calculating Organic N Rates

- Determine total N.
- Pick an availability coefficient to determine what percentage of the total N will be available to the crop.
- Multiply the availability coefficient times the total N in the material.
- Adjust for the moisture in the material.

Example of N Calculation

- One ton of wet material that has a 30% moisture content (70% dry content).
- The material is 1.5% N on a dry weight basis (most labs report nutrients this way).
- Dry weight of one ton of material with 30% moisture is 1400 lbs (2000 X 0.70).

Example of N Calculation

- 1.5% N in 1400 lbs = 1400 X 0.015 = 21 lbs
- There will be 21 lbs of total N in the ton of wet material.
- If we broadcast that material and leave it on the surface 50% will be available.
- ~10 lbs of N per ton of wet material

Example of N Calculation

- All of the organic nutrients are usually added before the crop is planted.
- Assume the crop needs 100 lbs/ac N.
- To provide 100 lbs of N, we will have to add 10 tons of the organic material per acre.
- 10 lbs/ton X 10 tons = 100 lbs.

Benefits of Compost

- Improves soil physical properties.
- Provides nutrients in stable forms.
- Provides food for soil microbes.
- Increases soil biological activity.
- Increases earthworm activity.

Benefits of Compost

- Reduce erosion.
- Provide refugia for beneficials.
- Promote soil mycorrhiza.
- Suppress weeds by competition.
- Suppress weeds by allelopathy.
- Suppress pathogens.

Compost Rules

- Establish an initial C:N ratio between 25:1 and 40:1.
- Maintain a temperature between 131 and 170 F for 3 days (in-vessel or static-aerated)
- Maintain a temperature between 131 and 170 F for 15 days (windrow) with a minimum of 5 turnings.

Compost N Availability

- N availability may be very low in compost.
- Availability will depend on C:N ratio of the compost and the types of products that were used to make the compost.
- Availability may range from 50% (C:N =6) to 5% (C:N ratio = 15) to 1% or less (C:N ratio > 20).













Animal & Plant Materials

- Raw manure
- Composted plant and animal materials
- Uncomposted plant materials

Animal By-products

- Bat guano (10-3-1)
- Feather meal ~12% N
- Blood meal (14-0-0)
- Fish meal (10-6-2)
- Fish emulsion (4-2-2)
- Pelleted mixtures (e.g. 6-6-6)

Plant By-products

- Soybean meal (4-1-1)
- Cottonseed meal (6-1-1)
- Alfalfa meal (7-1-1)
- Wood ashes (0-2-6)

Seaweed Products

- Primarily derived from kelp
- Usually foliar-applied by farmers seeking a natural, supplemental source of micronutrients
- Plant growth regulators present in seaweed, cytokinins, can have beneficial effects on crops;
 e.g., increased numbers or size of fruits or seed heads, synchronization of flowering within a field, delayed senescence, and reduction of transplant stress when used as a root dip

Humates

- Humates are sometimes used to increase soil organic matter.
- The top 6" of one acre of soil weighs 2,000,000 pounds. To increase soil organic matter in one acre by 0.1% would require 4000 lbs of humate.
- However, there may be some microbial benefits, depending on the formulation.

Phosphate Sources

- Bone meal- $\sim 27\%$ by weight P_2O_5
- All P_2O_5 in bone meal is available
- Bone meal may also be sold as a feed supplement. In this case P is expressed as total P. To convert to P_2O_5 , multiply by 2.3
- Manures generally contain $1-3\% P_2O_5$

Phosphate Sources

- Colloidal phosphate- ~2-3% available (total P₂O₅ is ~20%)
- Rock phosphate is $30\% P_2O_5$ by weight
- Rock phosphate- ~1-2% available generally, but higher quality rock (6-8%) is sold
- Hard-rock phosphate- <0.5% available even though total P₂O₅ may be as high as 40%

Mined Potash (K_20) Sources

- Potassium sulfate- ~50% available
- Langbeinite (Sulpomag or K-Mag)- ~22% available
- Kiln dust- ~6% available
- Greensand (glauconite)- <1% available
- Granite dust, feldspar- generally unavailable

Other Mineral Nutrient Sources

- Dolomitic limestone (Ca, Mg)
- Epsom salts (Mg)
- Gypsum or landplaster (Ca, S)
- Sulfur (S)
- Solubor or Borax (B)
- Metal chelates (Fe, Zn, Mn, Cu)

Liquid Organics

- Earth Juice (various, low analysis nutrients)
- Hydrolyzed fish powder (11-0.25-1)
- Omega (6-6-6)
- Phytamin 800 (7-0-0)





OMRI

• OMRI assists the organic community by performing the necessary research and information dissemination to allow certifiers, growers, handlers, processors, and suppliers to make decisions about the status of generic materials and brand name products.

Generic Materials List

- The OMRI generic Materials List represents recommendations and opinions regarding the acceptability or unacceptability of using certain materials in organic production.
- ALWAYS CAREFULLY READ THE LABEL to guard against the possibility of contamination and negative ecological impacts.
Contact Information

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Identification of Diseases and Disorders of Blueberry in North Carolina





Blighted cuttings; orange fungal fruiting bodies on cutting (inset) and infested area of rooting bed (*Calonectria illicicola*)

ABIOTIC FACTORS





Hail injury to green fruit and to stems



Edema



Rain splitting

(Cracking)



Hurricane winds strip leaves but petioles remain attached





Dodder (Cuscuta sp.) a parasitic higher plant, in summer (top), and winter. Inset shows dodder in bloom



Berries not destroyed by late spring freezes may have internal damage (left) or scars around the calyx (right)



Powdery mildew (Microsphaera vaccinii)



Septoria leaf spot lesions on stems (Septoria albopunctata)

HERBICIDE OR CHEMICAL INJURY



Glyphosate injury from applications made the previous year



Severe spray burn caused by a phytotoxic fungicide



Distortion and scars caused by surfactant burn on fruit (right)



Poor pollination results in uneven sizing, yellowing and shedding of unpollinated berries



Gramoxone droplet injury on green stems – girdled stems die rapidly and may be confused with stem blight symptoms

Organic Blueberry Agent Training Southern Region Small Fruit Consortium

Gerard Krewer, Bill Cline, Katie Jennings, Jerry Larsen, James Clark, Elvin Andrews, Danny Stanaland, and Roosevelt McWilliams UGA/Ft. Valley State Cooperative Extension

Blueberry Health Benefits

- Research supported by the "check off" on berries to US Highbush Council is paying off
- Most North Americans who are well read know about the health benefits

Blueberry Health Benefits

- Very low in fat and sodium.
- Contains Vitamin A, C, Potassium and Folate
- 16% DV of Fiber.
- #1 in Antioxidant Activity
- Anti-Aging
- Reduces bad cholesterol
- Reduces Urinary Tract Infection
- Eases Eye fatigue and improves eyesight
- Improves memory
- Contains Polyphenols fights Alzheimer's and heart disease





What kind of price increase should you base a budget on?

- Increase above normal is highly variable
- 20-100% is commonly quoted
- Maybe 25% would be a good number to use?
- Remember "in transition" fruit can not be labeled as organic
- Higher price unlikely for "in transition" fruit

Blueberry Basic Chemistry

- An acid loving plant
- Sandy soils: pH 3.8-5.3
- Clay soils: pH 4.5-5.3
- Avoid sites high in calcium
- Generally avoid sites with pH above 6.0
 Sulfur used to lower the pH

The Three Southern Species or Types

- Rabbiteye- Vaccinium ashei
- Highbush-Vaccinium corymbosum
- Southern Highbush-Vaccinium corymbosum X darrowi





Spring Freezes

- Avoid frost pockets if practical
- Often the best blueberry soil is in frost pockets
- Plant late blooming cultivars or use overhead irrigation for freeze protection



Organic Matter Required

- Rabbiteye- 2% organic matter is desirable
- 2% = 20,000 lbs. / acre
- This is typical soil where rabbiteyes will grow well without organic amendments
- Highbush –3-4% organic matter or higher is needed in the South



Other Rabbiteye Soils

- Will grow on a wide range of soils with organic matter addition if the chemistry is right
- Sands
- Loamy sands
- Loams
- Sandy clay loams



Red Clay

- Much of the piedmont of the SE has little top soil left
- Rabbiteye blueberries can be grown, but addition of pine bark (3 inches) plus mulch is recommended in Ga.



Natural Highbush Soils

- Spodic soils in Carolina Bays in Carolina
- Allowed if drained before 1985
- Soul searching?? Compromise possible
- Or the first terrace above the swamps in parts of Georgia- low pine lands



Pine Bark Culture

- Pine bark alone used as growing medium
- Renewable resource
- Can be in rows or beds
- Mostly used for high value southern highbush
- No organic production in this system yet?-has good potential



Pine Bark Bed Culture



Irrigation-Drip or Overhead? Pros and Cons



Organic Soil Amendments

- Use pine or peat products
- Pine Bark and Peat- BEST
- 300:1 C:N ratio-some N tie up
- Pine post (75% bark) and pole peelings (25% bark)-MAYBE
- Pine chips and sawdust-MAYBE-Needs a lot of nitrogen for break down
- 1000:1 C:N ratio
- Yard waste, compost-NOT STRONGLY ACID



Table 3. Effect of alternative organic amendments on the growth of 'Reveille' southern highbush, 2005-Starting with very acid soil-pH 4.3

	% Survival	Width in row (cm)	Width across row (cm)	Height (cm)	Growth index (cm)
Control (no amendments)	80 a ^z	32.6 bc	34.5 a	59.9 bc	42.3 bc
Pine bark (15 cm/6 inches)	85 a	57.4 a	58.3 a	115.3 a	77.0 a
Acidified yard waste (15 cm/6 inches)	80 a	52.9 ab	54.6 a	97.1 ab	68.3 ab
Pine bark (7.5 cm/3 inches) plus acidified yard waste (7.5 cm/3 inches)	100 a	61.1 a	57.4 a	111.3 a	76.6 a
Acidified compost (7.5cm/3 inches)	32 b	27.9 с	38.2 a	49.7 c	38.7 c

Z = M eans with the same letter in a column are not significantly different (P \ge 0.05) according to the

Mixing Organic Matter

- Hole treatment
- Mix in hole 18 inches in diameter
- Strip treatment- Apply in band three or four feet wide



Methods of Adding Organic Matter

- Wagon and shovel
- Good for a few rows
- Peanut wagon
- A few acres
- Live botton wagon-Chicken litter or side delivery



Organic Blueberry Cultivars for Georgia

- Rabbiteye
- Premier?, Alapaha, Brightwell, Ira, Tifblue, Powderblue
- Southern highbush
- Emerald, pollinate with V1, Abundance?
- Star, pollinate with O'neal or Windsor

Suggestions for NC

- Rabbiteye (Premier, Tifblue, Powderblue, Ira, Columbus, Onslow) <2500 ft, Coastal Plain and Piedmont
- Southern Highbush (O'Neal, Legacy, Blue Ridge) Coastal Plain and well-drained upland Piedmont soils
- Northern Highbush for Mtns >2500 ft (Duke, Bluecrop, Jersey)

Some "Store Bought" Organic Fertilizers

- Perdue Pasturized
 Chicken Litter (4-2-3)
- Production Prince(5-3-4)
- Nature Safe (8-5-5)
- Organic cotton seed meal (6-1-1)



Preplant organic fertilization

- Preplant chicken litter on virgin soil (very low P and K)-1 or 2 tons/acre??? Especially if pine products are added
- Weeds???
- Organic cotton seed meal added to planting hole if soil has moderate K and P

UGA Alapaha Est. Trial

- Plants set in July 2002
- Control- organic burndown herbicides or hand weeding
- Pine bark
- Pine straw
- Landscape fabric



Organic Plots after 36 Months





 Table 4. Effect of mulching treatments on organic blueberry growth and weed cover, 2005.

	Treatment	Width in row (cm)	Width across row (cm)	Height (cm)	Growth index (cm)	Weed cover %)
Cont	rol	78.4 c ^z	78.0 b	127.9 b	94.7 b	7.5 b
Pine	bark	106.8 ab	103.8 a	152.4 a	121.0 a	3.8 b
Pine	straw	118.2 a	113.9 a	156.0 a	129.4 a	5.0 b
Land	lscape fabric	93.7 bc	89.7 b	136.7 ab	106.7 b	60.0 a

^z= Means with the same letter in a column are not significantly different ($P \ge 0.05$) according to the DIFF option in PROC MIXED (SAS,2000) with Satterthwaite option on the model statement



Table 7. Effect of mulching treatments on the mechanical harvested yield of organically grown 'Brightwell' blueberries 36 months afterplanting, 2005

		Yield per plant (Kg) (1 Kg = 2.24 lbs)					
				Total			
Control	0.31 a ^z	0.22 b	0.08 b	0.66c			
Landscape fabric	0.69 b	0.29 b	0.06 b	1.03 b			
Pine straw	0.89 b	0.42 a	0.07 b	1.38 a			
Pine bark	0.77 b	0.49 a	0.13 a	1.38 a			

^Z= Means with the same letter in a column are not significantly different (P≥0.05) according to the DIFF option in PROC MIXED (SAS,2000) with Satterthwaite option on the model statement

Comments on Results

- Mulching was highly beneficial
- Pine bark and pine straw produced similar growth and yield results
- Organic "burn down" herbicides helped control some weeds, but failed on crabgrass

White-on-Black Plastic

- A "weed free" system was developed by modifying a plastic mulch layer
- This was trialed at Alapaha Station



White-on-Black "Weed Free"





Organic Grower White-on-Black Plastic



Organic Grower Use of Landscape Fabric



Experiments with Maintaining Bearing Fields

- 2002-2004 Mulching Trial
- 2004-2005 Mulching Trial
- Eight Organic "Burn Down" Trials- Screening OMRI approved compounds
- Several Fertilizer Trials
- One Pest Control/ Growth Regulator Trial
- Grower Observations
Management of Mature Bushes Taylor Organic Farm-Bacon Co.,Ga.

- Mulch and weed control was applied in spring 2002
- Treatments were:
- Control
- Wheat straw
- Pine Bark



Wheat Straw Results

- Low fertility site
- Wheat straw only lasted one year, but controlled weeds for two yearspreemergent herbicide effective
- Wheat straw enhanced growth in year one and two

 N
 P
 K

 Control 1.05
 .06
 0.5

 Pine Bk.1.08
 .06
 0.5

 Wheat S.1.3
 0.1
 0.7

Pine Bark

- Still providing significant weed control after four years
- Will provide additional root area on sites with poor soil
- Supplies few nutrients in the short term
- Equipment to handle is becoming widely available



2004-05 Trial Miles Organic Farm, Appling Co., Ga.

- Three mulches tested in organic transitional field
- Pine straw
- Pine bark
- Wheat straw



Modified Silage Wagon Results



Mulching Bearing Bushes

- Wheat straw was a practical mulch in a ag area
- 5 acres of wheat will mulch one acre of berries
- Can be applied with a silage wagon
- Wheat straw last for about two years, increased N, P, K and S
- Pine straw is also good but expensive

Table 1. Effect of mulching treatments on organically grown 'Powderblue' blueberryweed cover & berry weight at last harvest, second year, 2005.

Mean berry				
Treatment	Weight (g)	Weed coverage (%)		
Pine bark	0.92 a ^z	47.5 a		
Wheat straw	0.83 a	17.5 b		
ine straw	0.84 a	11.3 b		

^Z= Means with the same letter in a column are not significantly different (P≥0.05) according to the DIFF option in PROC MIXED (SAS,2000) with Satterthwaite option on the model statement

Weed Control Beyond Mulches

- Mowing
- Cultivation-Hand Hoeing, Harrowing, Rotary Hoe
- Hand Pulling
- Corn Gluten Preemergent
- Flame Cultivation
- OMRI Approved Organic "Burn Down" Materials

Mowers

- Off set mowers available
- On a small scale-big wheel lawn mower with blade slightly exposed in front?? Safe?? I don't know
- String trimmers with blade attached



Cultivation

- Remember-Blueberries are shallow rooted!
- Control depth of cut
- Cross harrow method
- Steel and drip tape don't mix well

Florida's early blueberry industry: Oklaloosa County Agent R. J. Hart (right) is shown instructing grower Joe Holland in proper methods of blueberry culture.



Rotary Cultivars

- Can be used during the winter to clean up serious weed problems
- Also stir up more weed seeds
- Maybe be useful before mulching
- Great for removing drip tape!
- Can be fitted with mower blade



Flamers-Whoa!



Organic "Burn Down" Herbicides for Weed Break Through



Experiments with OMRI Approved "Burndown" Compounds

Compounds tested:

- 1. Vinegar (5% acetic acid)
- 2. Xpress (10.4% thyme oil, 10.4% clove oil plus acetic acid, etc.)
- 3. Alldown (5% citric acid, plus yucca, etc.)
- 4. Matran (clove oil plus lecithin, 3 formulations)

Fall Weed Control Experiments Oct. 2003-Results after 9 days



Matran Results



Organic "Burndown" Exps.

- Matran was the best tested
- Very good on spring weeds
- Very poor on most grasses and S.Ga. summer weeds
- Good potential for use on some woody weeds and woody weed regrowth after pruning

Aisle Management

- Plant rye in year one
- If soil is fertile it may be possible to grown rye and blow it under plants
- Keep close mowed in future years
- Trash culture
- Try to keep Bermuda grass from getting established in the field



Disease Control

- Drainage/site selection
- Avoidance/isolation
- Cultivar selection/Resistance
- Proper plant health, avoid excessive fertility
- Sanitation i.e., rake and bury mummies, re-mulch
- Pruning (canker, stem blight)
- Summer hedging for leafspots
- Clean planting stock
- Dormant sprays with lime-sulfur, Serenade 'fair' for mummy berry, Sulfur for powdery mildew
- Timely, complete harvest
- Post-harvest cooling



Insect control

- Diatomaceous earth works well on flea beetles
- Apply as a dust



Insect Control (continued)

- Avoidance/Isolation
- Resistant cultivars
- Bt for fruit worms (cranberry fruitworm, cherry fruitworm)
- Spinosad 'Entrust' for Blueberry maggot fly
- Plum curculio (shown) <u>if</u> <u>present</u>, hard to control organically



Please note this information regarding the following chart on the next slide:

Dr. Bill Sciarappa at Rutgers University is responsible for development of this chart. It is for educational purposes only.

The efficacy of some of these materials have not been extensively tested.

<u>Crop Stage</u>	Pest Problem	Organic Management Methods
Dormant	Scale, phomopsis	lime sulfur
	Botrytis, anthracnose	Prune old canes & twiggy wood
	Scarab beetles	Milky spore, predaceous nematodes
	Curculio, weevil, fruit worm, fruitfly	Rotary hoe or rake middles and cultivate alleyways
Bud Break	Blueberry thrips	Entrust
	Mummyberry	Disc, rake, sweep, hoe & mulch
	Weevils, curculio	Disc, rake, sweep, hoe & mulch
Pre-bloom	Leafrollers, caterpillars	Bt's – Dipel, Javelin
Bloom	Botrytis blossom blight	Serenade
Post-bloom	Various diseases	Armicarb, Bordeaux, Serenade - rotation
Fruiting	Blueberry maggot	GF120 bait – spinosad
	Blueberry maggot	Entrust, Agroneem, PyGanic - rotation
	Leafrollers & caterpillars	Bacterial insecticides
	Leafhoppers & aphids	Stylet oil
	Scarab beetles	Pheromone disruption & attractant traps
	Birds & mammals	Netting, auditory & visual scare devices, dogs
Pre-harvest	Anthracnose	Oxidate, Trilogy - clarified neem oil
Post-harvest	Bud mite, scale	Horticultural oil, neem oil, prune old cane

Practical considerations for organic production of blueberries

- Establishment (yrs 1-3) can be a challenge due to weeds – start conventional then transition to organic?
- Avoid planting near old blueberry fields that may harbor disease and insect pests.
- SULFUR as needed to lower pH
- Flaming with propane burner at night? Fire risk, operator risk

Organic Fruit Set Enhancement

Treatments	No. of flowers tagged per bush	Fruit set (%)	Branches with mummy berry strikes (%)
Control ^z	25.9a ^y	44.7b	46.0a
Entrust	25.7a	38.8b	36.7a
Gibberellic acid	24.4a	61.1a	51.9a
LSD	0.61	12.0	60.2

Summary

- Pine bark (4 inches) was the longest lasting mulch, but wheat and pine straw (4 inches) are good for two years.
- Pine straw was excellent in establishment phase
- Enhanced growth occurred with wheat straw on low fertility mature field
- Landscape fabric and white-black-plastic have good potential in some situations. Much lower cost for farmers with limited start up budget or lack of special equiment

Summary

- Matran 2 was the best organic "burn down" herbicide tested
- Several organic fertilizers look good. Consider release rate when applying
- Serenade appears to have performed well on mummy berry in GA

Thanks to.....

- Georgia Organic Growers Association
- Southern Region Small Fruit Consortium
- MBG Marketing, Inc.
- EcoSmart, Summerset and other suppliers
- Perdue, NatureSafe Products
- Taylor Organic Farm
- Byne Organic Farm
- Hardage Organic Farm
- Miles Organic Farm

2004 Organic "Burn Down" at Bynes' Organic Blueberries Matran 2 at 15% rate

Mean growth on	28 June	(\mathbf{cm})
----------------	----------------	-----------------

	Smilax	Blackberry	Virginia Creeper
Woody weeds not pruned or sprayed	165	79	135
Pruned woody weeds	64	30	67
Pruned woody weeds, then Matran II on regrowth	4	2	2

Practical considerations for organic production of blueberries

- Establishment (yrs 1-3) can be a challenge due to weeds – start conventional then transition to organic?
- Avoid planting near old blueberry fields that may harbor disease and insect pests.
- Mulch incorporated and on surface: peat moss, pine needles, pine bark, wood chips, sawdust
- Drip irrigation preferred not overhead

Fertilization (N,P,K) and pH lowering (S) based on soil testing

- NITROGEN from "meals" (blood, fish, cotton seed) or from animal manures – usually composted to avoid human pathogens. <u>High</u> <u>Ca, Na can be a problem – have it tested!!</u> (note: Cotton seed meal from non-organic cotton may be prohibited
- PHOSPHORUS from bone meal, rock phosphate, broiler litter
- POTASSIUM from mined potassium sulfate, broiler litter
- SULFUR as needed to lower pH (~1 lb/100 sq ft)

Weed Control

- Cultivation, Hand weeding, hoeing
- Mulch and/or weed barrier fabrics – be creative!
- Organic "burn-down" materials (acids, including vinegar?)
- Flaming with propane burner (at night? Fire risk, operator risk)



Disease Control

- Drainage/site selection
- Avoidance/isolation
- Cultivar selection
- Resistance
- Proper plant health, avoid excessive fertility
- Sanitation/Pruning
- Clean planting stock
- Dormant sprays with limesulfur
- Timely, complete harvest
- Post-harvest cooling



Insect Control

- Avoidance/Isolation
- Resistant cultivars
- Bt for fruit worms (cranberry fruitworm, cherry fruitworm)
- Spinosad 'Entrust' for Blueberry maggot fly
- Plum curculio (shown) <u>if present</u>, hard to control organically



Organic Information:

- Blueberries: Organic Production. National Sustainable Agriculture Information Service -http://attra.ncat.org/attra-pub/PDF/blueberry.pdf
- Organic Farm Certification & the National Organic Program -http://attra.ncat.org/attra-pub/PDF/organcert.pdf
- Suggestions for Organic Blueberry Production in Georgia http://www.smallfruits.org/Blueberries/production/04orga nic.pdf

Weed Control in Organic Blueberry Production

Katie Jennings and David Monks Dept. of Horticultural Science NC State University
Weed Control in Organic Blueberry Production

Prevention
Mulch
Mechanical
Biological
Organic Herbicides

Prevention

Keep new weeds out. Prevent further spread of weed seed or perennial plant parts. Prevent weed seed production. Maintain non-crop areas weed free. Sanitation – clean equipment between fields. Contamination in compost, straw, manure, and other materials.

Plastic Mulch or Fabric Barrier

Use in early years.

Provides a physical barrier on the soil surface and blocks light.

- Nutsedge is able to penetrate plastic mulch.
- Disposal is an issue.

Possible alternatives are corn and soybean based biodegradable plastics (In research).

Organic Mulches

Make sure the mulch is free of weed seed.

- Straw Identify source early in season prior to use.
- Sawdust, bark, wood chips
- Municipal greenwaste
- Must refresh periodically.

Maintain a weed-free strip 6 to 12" between mulch and sodded middle to reduce competition.

Mechanical Weed Control

<u>In-Row</u>

Hand removal – best when weeds are small (less than 3 inches).

Cut weeds (greater than 3 inches) in crop holes when they are too big to remove without damaging the crop roots.

Mechanical Weed Control

Row Middles

Cover crops – weed-free source. - Identify a good, clean source. Hand removal/hoe. Cultivate middles. Mow middles. Steaming – expensive. Flaming – risky!?.

Mechanical Weed Control

Flaming

- Heat causes cell walls to explode; does not burn the weeds.
- Best performance if weeds have 2 leaves or less.
- Grasses are difficult to kill because the growing point is beneath the ground.

Biological Weed Control

Chinese Weeder Geese

- Preferred over typical geese because they tend to walk around crop versus walking on crop.
- Prefer grass species; will eat broadleaf weeds when grass is not present (will also eat fruit).
- Must provide drinking water, shade, and protection from predators.



Bradfield vinegar



Vinegar, citric acid, and clove oil



Bitter almond extract



Clove oil

Only a limited number of organic herbicides are available.

- Contact herbicides which are nonselective (similar to paraquat in activity).
- Weeds that are present at time of application are controlled - typically no soil activity.
- Can be made more selective by manipulating timing and placement.

Non-selective postemergence weed control.

- Keep spray solution off of crops.
- Fast acting observe activity within minutes with some products on some weeds.
- Activity is best on small weeds.
- Activity decreases as the size of the weed increases.
- Air temperature and relative humidity may be important.

Typically spray at 25 to 75 GPA.
 Organic DOES NOT equal safety to the user.
 Wear PPE as instructed.

Natural Horticultural Vinegar

Formulation: 20% Acetic acid (Vinegar)
 Ingredients: Horticultural White Vinegar (200 grain) and yucca extract as a natural surfactant
 Manufacturer: Bradfield Industries

- <u>http://www.bradfieldind.com/</u>
- Breaks down the waxy cuticle leads to dessication.
- Use rate: Equivalent to GPA sprayer output.
- Not a certified organic product according to OMRI.
- Retail: \$19.95/gallon

Matran 2

Active Ingredient: Clove oil Mode of Action: Cell membrane disruptor Manufacturer: EcoSMART Technologies, Inc. (http://www.ecosmart.com) Use rate: 5 gallons per acre (broadcast) Reentry interval: 0 hours Retail Cost: \$170.00/2.5 gallon

Matran 2

- Requires an approved organic adjuvant.
- Apply to small weeds.
- To prevent crop injury apply with hooded sprayer.
- Rainfall within 3 hours may reduce control.
- Cool weather following treatment may slow activity.

 Constant agitation is required.
 USDA National Organic Program Compliant.

Natural Wet Surfactant

Active ingredient: Yucca plant extract
 Use rate: ½ Tbsp. per gallon of spray solution
 Retail cost: \$18.95/quart

BurnOut II

Active ingredient: Clove oil (12%) Inert ingredients: Vinegar and citric acid Manufacturer: St. Gabriel Laboratories (http://www.milkyspore.com/index.htm) **Use rate:** 3:1 or 2:1 (Water:BurnOut II) Retail cost: \$89.95/2.5 gallon Use on borders, driveways, fencerows, around buildings, etc. Currently NOT registered for use in food crops. Apply to small weeds. No adjuvant needed.

Weeditol

Active Ingredient: Bitter almond extract Manufacturer: Champon Millenium Chemicals (http://www.champon.com) Use rate: Spray solution should consist of 98% bitter almond extract and 2% water. Not currently labeled. No adjuvant needed. Works within minutes on some weeds (carpetweed). May have some soil activity.

Corn Gluten

Preemergence weed control
9-0-0 fertilizer
Active Ingredient: 60% protein
Manufacturer: Various
OMRI certified as an organic product.
Fair weed control.

Natural Products Efficacy Table

	Matran 2	Burnoutll	Weeditol	Vinegar
Weeds				
Y. nutsedge	Р	Р	Р	P
Henbit	E	E	Е	E
C. geranium	E	E	N/A	E
Curly dock	E	E	N/A	E
Carpetweed	E	E	E	G
Primrose	Е	Е	E	E
P. purslane	Е	G	E	G
Corn spurry	F-G	F	Ε	E

Control is based on spraying broadleaf weeds less than 1" in diameter or yellow nutsedge less than 3 inches tall.

Bitter Almond Extract 2WAT









Nontreated



BurnOut II



Bradfield Vinegar



Matran 2



Weeditol



Entireleaf Morningglory 3DAT









Pitted Morningglory 3DAT









Organic Bramble Production: site selection cultivars floor management fertilization

Types of Brambles

• Raspberry

- Black, yellow, red or purple
- Primocane fruiting or floricane fruiting
- Blackberry
 - Erect, semi erect, trailing(dewberries)
 - Thorny or thornless
 - Primocane fruiting or floricane fruiting
- Blackberry X Raspberry hybrids
 - Tayberry, wyeberr

Plant Growth

- Biennial top and perennial root system
- First year shoots develop from vegetative buds on roots or from the basal buds of second year canes
- Canes are usually vegetative the first growing season (primocanes)
- Canes become reproductive in the 2nd growing season (floricanes)
- Floricanes die after fruiting
- Each year new primocanes emerge
- The plant crown and roots live many years

Organic / Conventional – Similar Recommendations

- Cultivar Selection
 - Pruning
 - Irrigation

Site Selection & Preparation

Site selection is the most important of the thousands of decisions a grower will have to make over the life of a planting.

Virtually **every** aspect of production and marketing will, at least in part, be affected by the choice of site.

Elevation

- Elevation
 - Air circulation & water drainage
 - reduced pest pressures
 - Passive frost protection
 - (in windy areas, tops of hills may result in plant damage & dessication)

Direction of Slope

- South-facing:
 - Greater potential for winter injury & frost damage
 - Soils tend to be thinner, lower in organic matter, droughty
- North-facing:
 - Canes break dormancy later in spring
 - Harvest delayed
- East-facing:
 - Morning sun dries off plant earlier in the day, thus reducing disease pressure
Soils

- Well-drained
- Deep
- Fertile
- High organic matter content
- pH 6.0 to 6.5

Site History

- Fruit crops
 - Crown gall
- Verticillium-susceptible crops:
 - tomatoes, potatoes, peppers, eggplant, tobacco
- Verticillium susceptible weeds:
 - Nightshade, ground cherry lambsquarter, horsenettle, pigweed, cocklebur

Site Preparation

- Elimination of perennial (noxious) weeds
- Adjust soil pH & fertility based on soil test recommendations
- Eliminate "wet spots" in field
 - Consider constructing raised beds for raspberries
 - Tile drainage
- Remove barriers to air drainage from site
- Remove wild brambles within 300 to 400 ft. of planting site

Cultivar Selection

Cultivar Selection

- Disease resistance
- Reputable Nurseries
 - Virus-free
 - Nematode-free
- Chilling requirement

Blackberry Disease Susceptibility

Variety	Rosette	Orange Rust	Anthracnose
Chickasaw	S	?	S
Choctaw	S	R	R(?)
Kiowa	S	R(?)	S
Shawnee	VS	R	R
Arapaho	R	?	R(?)
Apache	R(?)	R(?)	R(?)
Navaho	R	VS	R(?)
Ouachita	R	R(?)	S
Prime Jim	S*	R	S
Prime Jan	S*	R	S

R = resistant R(?) = none observed S = susceptible VS = very susceptible

* = Not an issue with primocane bearers grown for fall crop only

Chilling Requirements - Blackberry

- Kiowa
- Choctaw
- Arapaho
- Ouachita
- Chickasaw
- Navaho
- Apache
- Chester
- Triple Crown
- Hull

200 hours 300 (?) 400 - 500400 - 500 (?) 500 - 700800 - 900800 - 900 (?) 900 (?)900(?)

Raspberries

- Red
 - Do best in areas having relatively cool summers & moderate winters
- Black
 - Less tolerant of cold winter temperatures than Reds, more subject to diseases, lower yielding
- Purple
 - Hybrid of red & black, posses many characteristics of black raspberries
- Yellow
 - Similar to reds

Red Raspberry Cultivars - TN

Summer Bearers

Higher Elevations:

Latham, Titan

Other Areas:

Dorman Red, Titan, Latham, Southland

Primocane Bearers

Higher Elevations:

Heritage, Caroline, Amity(?)

Other Areas:

Autumn Bliss, Heritage, Southland

Raspberry Cultivars - TN

<u>Yellow</u>

- Fall Gold
 - everbearing, hardy
- KiwiGold -
 - everbearing

Purple

Royalty -

immune to raspberry aphids (transmit mosaic virus)

Brandywine -

very winter hardy

Estate (?) -

hardy, ripens 3 – 5 days after Brandywine

Black Raspberry Cultivars - TN

• Black Hawk –

- Hardy, resistant to anthracnose

• Jewel –

- Resistant to anthracnose, hardy

- Cumberland (Blackcap)
 - Large fruit, hardy

Floor Management

Floor Management

- Clean cultivation
 - Shallow cultivation to avoid damage to root systems
 - Establishment of winter cover crop in row middles
 - Rye or annual ryegrass

- Sodded row middles*
 - Reduced erosion potential
 - Support for equipment
 - Use non-aggressive sods
 - Legumes can be a source of nitrogen
 BUT can harbor stinkbugs, tarnished plant bugs

Mulching

- + Conserves moisture
- + Moderates temperatures in root zone
- + Decreases weed pressure
- + Increases yields
 - Harbor voles
 - Increase problems of Phytophthora root rot (especially on heavy soils, irrigated sites)

Types of Mulches

- Straw
- Landscape fabrics
 - High initial cost
 - May last several years
 - Will become less permeable to water over time

Weed Management

- Pre-plant weed control
- Suppression by use of cover crops
- Cultivation (grape hoe, Weed badger, Green Hoe)
 - Must be shallow to avoid root damage
- Hand weeding & hoeing
- Weeder geese
 - Control grasses & young broadleaf weeds
 - May eat ripe fruit, newly emerging primocanes

Pruning & Trellising

Pruning Blackberries, Black & Purple Raspberries Involves:

- Floricane removal following harvest
- Topping primocanes during the growing season (except for red raspberries)
- Removal of excess canes and weak canes
- Heading laterals in late winter
- Removal of lower laterals



Pruning Red Raspberries -Floricane fruiting, annual system Involves:

- Remove floricanes
 - Immediately after harvest for organic production

Late Winter:

- Remove weak and broken canes
- Thin remaining canes to $3 4 / ft^2$
- Top remaining canes @ 4 5 ft.
 aboveground (remove at least 6 8")

Pruning Red & Yellow Raspberries



Pruning Primocane-fruiting Brambles Involves:

- Mowing off planting close to the ground in late winter
- (To delay havest until late summer, mow again when new cane growth is about 1 ft. high)

Floricane Removal

- Reduce insect & disease pressure
 - Remove immediately after harvest
 - Burning
 - Shredding and soil incorporation
- Increase light, air & spray penetration throughout the canopy

Topping Primocanes During the Growing Season:

- Increases the erect nature of canes
- Promotes the development of lateral branches for increased yields
- Blackberries top when primocanes are 6+ inches taller than topping height
 - Top at 42" for non-supported canes, 65" for supported canes
- Black & purple raspberries top when primocanes are 4+ inches taller than topping height
 - Black raspberry top at 28 to 30 inches
 - Purple raspberry top at 36 to 42 inches

Removal of Weak, Broken and Excess Canes:

- Erect Blackberries leave 6 strong floricanes / linear ft. of row
- Semi-erect blackberries leave 4 to 8 strong floricanes / crown
- Red raspberries thin to about 4 canes/ ft²
- Black & purple raspberries leave 5 to 6 strong floricanes / hill

Heading Laterals in Late Winter

- Blackberries
 - Prune to 12 18" in length depending on strength of lateral
 - Remove laterals within 12 18" from ground
- Black & purple raspberries
 - Cut large laterals back to 10 to 14" length
 - Remove or cut weaker laterals back to 4 10" in length
 - Remove laterals within 12' of ground

Trellising

- Cane support
- Increased sunlight exposure, air movement, spray penetration throughout the canopy
- Easier management
 - Cleaner picking results in reduced attraction to picnic, sap, June and Japanese beetles

*for trailing & semi-erect cultivars, trellising is necessary to keep the fruit off the ground



2 Wire Trellis for Semi-Erect Blackberries



Alternate Year Cropping

Rotation -

- 1st year:
 - Crop $\frac{1}{2}$ of the field, mow off canes in winter
- 2nd year
 - Crop the 2nd half of the field, grow primocanes on the 1st half
- Repeat sequence in following years

Alternate Year Cropping

- Increased primocane growth
- Heavier yields in floricane rows
- Easier management
- Reduced pruning costs
- Alternate row cropping increases air movement through planting

Fertilizing Brambles

Determining Fertilizer Rates

- Soil Testing, Pre & Postplant
 - Tissue Analysis
 - Growth
 - Yields and quality

Preplant Soil Preparation

- Begin in the year prior to planting
 - Adjust soil pH to 6.0 to 6.5
 - Avoid high levels of phosphorus
 - May increase problems with zinc deficiency
 - (poultry litter may be high in phosphates)
 - Avoid pre- or post-plant use of potassium chloride
 - Brambles are sensitive to chlorine salts

Nitrogen Applications for Blackberries

- 1st year
 - 25 to 50 lb/acre of actual N
 - 30 to 60 days after planting
- 2nd year -
 - 35 to 65 lb actual N/acre
 - Apply as a single or a split application
- 3rd & subsequent years
 60 to 80 lb N/acre, single or split application
- Collect leaf samples for foliar analysis from primocanes immediately after harvest

Fertilizing Established Raspberries

- Total of 50 to 80 lbs. N per year
 - ¹/₂ in March
 - $-\frac{1}{2}$ in May
- Apply over a 3 ft. wide band on each side of row
- Collect leaves for foliar analysis from promocanes shortly after harvest
Timing of Nitrogen Applications

- Establishment year
 - Delay application until canes have emerged
- Maintenance
 - Single prebloom spring application

OR

 Split with 2nd application immediately after harvest

Organic Nitrogen Sources

- Manures
- Compost
- Animal byproducts
- Vegetable or seed meals

Nitrogen Availability

- Manures and compost
 - 50% available during year of application
 - 90% available in application year with fresh poultry manure
 - Balance available during subsequent years
 (be sure to figure it in annual applications)

Manure as Fertilizer

- Fertilizer value usually highly variable
- Unbalanced in regards to N, P, K
- Specific application rates will be impossible to recommend
- Typical application rates:
 - Most manures 1 to 4 tons/acre
 - Poultry manures 1 to 2 tons/acre

Timing of Manure Applications

- 120 days pre-harvest in crops where fruit may be in contact with the soil or soil can be splashed onto the fruit from rainfall or irrigation
- 90 days preharvest where fruit is elevated or shielded from soil contact
- Properly composted manures can be applied at higher rates & at times closer to harvest

Other Organic Fertilizers

- Cottonseed Meal: 7-2-2 (NPK)
- Blood Meal: 12-1.3-0.7 (NPK)

Organic Bramble Production

Bramble Diseases

- Major
 - Viruses
 - Double blossom
 - Rusts
 - Crown Gall
 - Cane Blight
 - Phytopthora root rot

- Minor
 - Leaf spot
 - Verticillium wilt
 - Antracnose
 - Grey mold
 - Spur blight

Disease control

- Prevention
 - Good site
 - Proximity to other brambles
 - Clean plants (start with and maintain)
 - Air drainage/ open canopy
 - Alternate year bearing
 - Mulching
 - Harvest carefully/early/often

Resuce

- Organically approved (check with your state)
 - Copper
 - Sulphur

Alternative controls??

- AC10
- Armicarb 100
- Galltrol
- Kaligreen
- Messenger
- Mycostop
- Oxidate
- Serenade
- Tricodex
- Trilogy

Bramble Disease Control Strategies

Disease control considerations	Viruses	Double blossom	Verticillium wilt	Orange rust	Cane blights	Powdery mildew	Fruit rot
Good air/water drainage	-	-	-	-	++	+	++
500+ ft from wild brambles	++	++	-	-	-	-	-
Rotation	+	+	++	-	-	-	-
Cultivar tolerance or resistance	++	++	++	++	-	+	-
Avoid adjacent plantings	++	++	-	++	-	+	-
Eliminate all wild brambles	++	++	-	++	-	+	-
Disease free stock	++	++	++	++	++	+	-
<u>Aphid control</u> (vectors)	++	-	-	-	-	-	-

Bramble Disease Control Strategies

Disease control considerations	Viruses	Double blossom	Verticillium wilt	Orange rust	Cane blights	Powdery mildew	Fruit rot
Aphid control (vectors)	++	-	-	-	-	-	-
Rouge infected plants	++	+	-	++	-	-	-
Speed drying (weeds pruning)		-	-	++	++	-	++
Prune 3 days before rain	-	-	-	-	++	-	-
Dispose of diseased pruned canes	-	++	+	+	++	-	-
Maintain plant vigor	-	+	-	-	++	-	-
Fungicide sprays	-	+	-	++	++	++	-
Harvest before overripe	-	-	-	-	-	-	++
Fruit storage conditions	-	-	-	-	-	-	++

Pest ID

- <u>http://www.hort.cornell.edu/department/f</u> aculty/pritts/BerryDoc/Berrydoc.htm
- State and county Extension personnel

Organic Bramble Production

Blacksburg Football Loss

Friday night:Salem High School50Blacksburg High School7

Band receives Superior rating



Other football news: VT squeaker:

Virginia Tech 7

Univ. Miami 27

Bramble Arthropod Basics

- Direct pests and key pests
- Indirect pests and secondary pests

- Blossom/berry feeders
- Leaf feeders
- Cane feeders

Bramble Blossom and Berry Feeders

- Blossom
 - Tarnished plant bug
 - Thrips
 - Blossom midge
- Berry
 - Japanese beetle
 - Green June beetle
 - Yellowjackets
 - Raspberry fruitworm

Bramble Leaf Feeders

- Japanese beetle
- Raspberry sawfly
- Blackberry psyllid
- Spider mites

Bramble Cane Feeders

- Raspberry cane borer
- Raspberry crown borer
- Rednecked cane borer

Caneberry pesticides: VA recommendations - Organic

- Entrust? Geographic restrictions
- Surround
- Aza-direct, Neemix
- Bt
- M-Pede
- Pyrellin
- Stylet oil

Caneberry pesticides: VA recommendations – "Almost" Organic

- SpinTor
- Confirm
- Savey

Caneberry pesticides: VA recommendations – What's left?

- Guthion
- Malathion
- Capture
- Brigade
- Asana
- Sevin
- Kelthane

Pests with organic recommendations:

- Thrips Pyrellin
- Rednecked cane borer remove galled canes, habitat modification
- Raspberry cane borer remove infested canes, habitat modification
- Blackberry psyllid Surround, site selection
- Mites Pyrellin, Stylet oil, biological control
- Japanese beetle Aza-Direct, Neemix, Surround

New Bramble Resource: IPM web site sponsored by NABGA

http://www.nabgaipm.shorturl.com

- Bramble Pest Management
 - <u>Caneberry pests</u>
 - Pesticide recommendations
 - Insects and mites
 - Diseases
 - <u>Pesticide rates, labels and MSDS sheets</u> for caneberries
 - Your Nearest Poison Control Center (800) 222-1222
 - Pesticide regulatory changes (New! Bramble Pest and Pesticide Updates by e-mail! To be added to this listserv, contact Doug Pfeiffer (e-mail link) at Virginia Tech)

- Bramble Pest Management
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- Pests affecting berries
 - <u>Tarnished plant bug</u>
 - Thrips
 - Japanese beetle
 - Green June beetle
 - <u>Yellowjackets</u>, (Northwest InfoNet Grape and Berry site)
 - <u>Raspberry Fruitworm (VT Fact sheet) (Ohio State University link)</u>
 - Strawberry sap beetle
 - Blossom midge
- Pests affecting canes
 - <u>Rednecked cane borer</u>
 - Raspberry crown borer
 - Raspberry cane borer
- Pests affecting foliage
 - Japanese beetle
 - Green June beetle
 - <u>Spider mites</u>, (Northwest InfoNet Grape and Berry site)
 - Blackberry psyllid
 - <u>Raspberry sawfly</u>

- Bramble Pest Management
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• Insecticides

- Asana XL 4.8-9.6 fl oz/A (REI=12h; PHI=7d) (toxic to predators) (Label, MSDS)
- Aza-Direct 12.5-42 fl oz/A (REI=4h; PHI=0d) (**Organic**) (Label, MSDS)
- Brigade WSB 8-16 oz/a (REI=12h; PHI=3d) (toxic to predators) (<u>Label</u>, <u>MSDS</u>)
- Capture 3.2-6.4 fl oz/A (6.4 for TSM) (REI=12h; PHI=3d) (toxic to predators) (Label, MSDS)
- Capture 2EC drench 6.4 fl oz/A, as drench in at least 200 gal, in spring or fall. (REI=12h; PHI=3d) (<u>Label</u>, <u>MSDS</u>)
- Confirm 2F 16 fl oz/A (REI=4h; PHI=14d) (Label, MSDS)
- Dipel ES 1-4 pt/A (REI=4h; PHI=0d) (Organic) (Label, MSDS)

- SpinTor 2SC 4-6 fl oz/A (REI=4h, PHI=1d) (<u>Label</u>, <u>Caneberry</u> <u>Supplemental Label</u>, <u>MSDS</u>)
- Stylet oil 3-6 qt/100 gal (REI=4h; PHI=0d) (Label, MSDS; Organic Stylet oil Label, MSDS))
- Surround 95WP 12.5-50 lb/A (REI=4h; PHI=0d) (Organic) (Label, MSDS)

- Bramble Pest Management
 - Caneberry pests
 - Pesticide recommendations
 - Insects and mites
 - Diseases
 - Pesticide rates, labels and MSDS sheets for caneberries
 - Your Nearest Poison Control Center (800) 222-1222

 Pesticide regulatory changes (<u>New!</u> Bramble Pest and Pesticide Updates by e-mail! To be added to this listserv, contact Doug Pfeiffer (<u>e-mail link</u>) at Virginia Tech)

- Active Alerts and Announcements
- **bifenthrin** EPA has approved bifenthrin (Capture 2EC) as a drench treatment for <u>raspberry crown borer</u>. Apply postharvest (fall) or pre-bloom (spring), as a drench application directed at the crown of plants in a minimum of 200 gal water/A. Greater efficacy has been observed at higher water gallonages up to 400 gal/A, or in an application prior to a significant rainfall event. Do not make a prebloom foliar *and* prebloom drench application. <u>See supplemental label</u>.
- malathion On 23 Sep 05, EPA announced availability of revised risk assessment for malathion. Click <u>here</u> for links to documents in docket. Number <u>OPP-2004-0348-0002</u> contains an overview of the assessment. Public comment must be received by 22 Nov 05. Enter EPA's <u>e-docket</u>, search on docket number OPP-2004-0348.

<u>New!</u> Bramble Pest and Pesticide Updates by e-mail!

To be added to this listserv, contact Doug Pfeiffer at Virginia Tech)

dgpfeiff@vt.edu
Questions?



Weed Control in Organic Bramble Production

Katie Jennings and David Monks Dept. of Horticultural Science NC State University

Weed Control in Organic Organic Production

- Prevention
- Mulch
- Mechanical
- Biological
- Organic Herbicides

Prevention

- Keep new weeds out.
- Prevent further spread of weed seed or perennial plant parts.
- Prevent weed seed production.
- Maintain non-crop areas weed free.
- Sanitation clean equipment between fields.
- Contamination in compost, straw, manure, and other materials.

Organic Mulches

- Make sure the mulch is free of weed seed.
 - Straw Identify source early in season prior to use.
 - Leaf mulch
 - Newspaper
 - Municipal greenwaste
- Must refresh periodically.
- Excessive in-row mulching can reduce primocane emergence.
- Geotextiles life of 5 to 10 years.
 - Cut slits to encourage emergence of primocanes.

Organic Mulches

- Excessive in-row mulching can reduce primocane emergence.
- Can harbor rodents.
- Aggravate phytophthora root rot on susceptible red raspberry cultivars grown on heavy clay soils.

In-Row Weed Control

Maintain a weed-free strip.

- Four feet wide in the row to reduce competition.
- Hand removal best when weeds are small (less than 3 inches).
- Cultivation grape hoe, Weed Badger, Green Hoe.
 - Shallow to avoid root damage.

Row Middle Weed Control

Cover crops – weed-free source.

- Identify a good, clean source.
- Hand removal/hoe.
- Cultivate middles.
- Permanent sodded middles.
 - Non-aggressive species (bluegrass, fescue, perennial ryegrass).
 - Competition has been documented may need to add additional water and fertilizer.
- Mow middles.
- Steaming.
- Flaming.

Mechanical Weed Control

Flaming

- Heat causes cell walls to explode; does not burn the weeds.
- Best performance if weeds have 2 leaves or less.
- Grasses are difficult to kill because the growing point is beneath the ground.

Biological Weed Control

Chinese Weeder Geese

- Preferred over typical geese because they tend to walk around crop versus walking on crop.
- Prefer grass species; will eat broadleaf weeds when grass is not present (will also eat fruit and emerging primocanes).
- Must provide drinking water, shade, and protection from predators.



Bradfield vinegar



Vinegar, citric acid, and clove oil



Bitter almond extract



Clove oil

- Only a limited number of organic herbicides are available.
- Contact herbicides which are nonselective (similar to paraquat in activity).
- Weeds that are present at time of application are controlled - typically no soil activity.
- Can be made more selective by manipulating timing and placement.

- Non-selective postemergence weed control.
- Keep spray solution off of crops.
- Fast acting observe activity within minutes with some products on some weeds.
- Activity is best on small weeds.
- Activity decreases as the size of the weed increases.
- Air temperature and relative humidity may be important.

- Typically spray at 25 to 75 GPA.
- Organic **DOES NOT** equal safety to the user.
- Wear PPE as instructed.

Natural Horticultural Vinegar

- Formulation: 20% Acetic acid (Vinegar)
- Ingredients: Horticultural White Vinegar (200 grain) and yucca extract as a natural surfactant
- Manufacturer: Bradfield Industries
 - <u>http://www.bradfieldind.com/</u>
- Breaks down the waxy cuticle leads to dessication.
- Use rate: Equivalent to GPA sprayer output.
- Not a certified organic product according to OMRI.
- Retail: \$19.95/gallon

Matran 2

- Active Ingredient: Clove oil
- Mode of Action: Cell membrane disruptor
- Manufacturer: EcoSMART Technologies, Inc. (http://www.ecosmart.com)
- Use rate: 5 gallons per acre (broadcast)
- Reentry interval: 0 hours
- Retail Cost: \$170.00/2.5 gallon

Matran 2

- Requires an approved organic adjuvant.
- Apply to small weeds.
- To prevent crop injury apply with hooded sprayer.
- Rainfall within 3 hours may reduce control.
- Cool weather following treatment may slow activity.
- Constant agitation is required.
- USDA National Organic Program Compliant.

Natural Wet Surfactant

- Active ingredient: Yucca plant extract
- Use rate: ½ Tbsp. per gallon of spray solution
- Retail cost: \$18.95/quart

BurnOut II

- Active ingredient: Clove oil (12%)
- Inert ingredients: Vinegar and citric acid
- Manufacturer: St. Gabriel Laboratories (<u>http://www.milkyspore.com/index.htm</u>)
- Use rate: 3:1 or 2:1 (Water:BurnOut II)
- Retail cost: \$89.95/2.5 gallon
- Use on borders, driveways, fencerows, around buildings, etc.
- Currently **NOT** registered for use in food crops.
- Apply to small weeds.
- No adjuvant needed.

Weeditol

- Active Ingredient: Bitter almond extract
- Manufacturer: Champon Millenium Chemicals (<u>http://www.champon.com</u>)
- Use rate: Spray solution should consist of 98% bitter almond extract and 2% water.
- Not currently labeled.
- No adjuvant needed.
- Works within minutes on some weeds (carpetweed).
- May have some soil activity.

Corn Gluten

- Preemergence weed control
- 9-0-0 fertilizer
- Active Ingredient: 60% protein
- Manufacturer: Various
- OMRI certified as an organic product.
- Fair weed control.
- Add something about weed spectrum.

Natural Products Efficacy Table

	Matran 2	BurnoutII	Weeditol	Vinegar
Weeds				
Y. nutsedge	Р	Р	Р	Р
Henbit	E	E	E	E
C. geranium	E	E	N/A	E
Curly dock	E	E	N/A	E
Carpetweed	Е	Е	Е	G
Primrose	E	E	E	E
P. purslane	E	G	E	G
Corn spurry	F-G	F	E	E

Control is based on spraying broadleaf weeds less than 1" in diameter or yellow nutsedge less than 3 inches tall.

Bitter Almond Extract 2WAT









Nontreated



BurnOut II



Bradfield Vinegar



Matran 2



Weeditol



Entireleaf Morningglory 3DAT









Pitted Morningglory 3DAT









Organic grape production: Agent training

Southern Region Small Fruit Consortium Nov. 5-7, 2005

Grape pesticides: VA recommendations - Organic

- Superior oil
- Bt
- Entrust
- Isomate GBM-Plus
- Surround
- JMS Stylet oil
- Pyrellin
- Aza-direct?
- M-Pede?

Grape pesticides:

VA recommendations – "Almost" Organic

- SpinTor
- Intrepid
- Agri-Mek

Grape pesticides: VA recommendations – What's left?

- Danitol
- Sevin
- Imidan
- Diazinon
- Lannate
- Assail
- Provado
- Malathion
- Nexter

Grape pesticides: VA recommendations – What's left?

- Thionex
- Kelthane
- Vendex
- Acramite
- Lorsban 4E

Organic grape pest management

- Bud feeders
- Berry feeders
- Leaf feeders
- Root feeders
- Bud feeders
 - Climbing cutworms
 - Entrust, Intrepid
 - Bt?
 - Grape flea beetle
 - Site selection, habitat modification?

- Berry feeders
 - Grape berry moth
 - Redbanded leafroller
 - Yellowjackets

- Grape berry moth
 - Mating disruption?
 - Entrust
 - Bt?
 - Intrepid ("Almost" category)
 - Site selection, habitat modification?

- Leaf feeders
 - European red mite
 - Adult grape flea beetle
 - Grapeleaf skeletonizer
 - Grape leafhopper

- European red mite
 - Biological control
 - Stylet oil
 - Pyrellin
 - Superior oil?

- Root feeders
 - Grape root borer
 - Weed control
 - Nematodes?
 - Habitat modification?
 - Grape rootworm
 - Aim at foliar feeding adults

Organic Muscadine Grape Production

Southern Region Small Fruit Consortium

Agent Training November 6, 2005

Organic Grapes in SE US?

- Most organic grapes come from arid production regions (west coast of US)
- Organic production of bunch-type grapes in the eastern US is very difficult (diseases, weeds)
- Muscadines are a good candidate for commerical organic production
- Muscadines in backyard plantings

Major Disease Concerns

- Fungal pathogens are of primary concern (Powdery mildew, fruit rots, leaf spots, dead arm)
- Bacteria -- Muscadines resistant to Pierce's disease, and to Crown gall ??
- Viruses, nematodes are not a problem
- Abiotic/Cultural Poor site selection, wet soils, lack of adequate drainage

Muscadines are a good candidate for organic production --

- Immune to Downy Mildew
- Immune to Bunch Grape Anthracnose
- Resistant to Phomopsis
- Physically tough, thick-skinned
- Sulfur can be used to control the biggest disease threat, Powdery Mildew

Powdery mildew is the greatest threat, but easy to control with Sulfur



Fruit Rots









Leaf Diseases









Cultivars vary greatly in susceptibility to rots. In general, the dark-fruited types are more resistant



Table 1. Comparison of diseases observed on 'Carlos' muscadine grapevines from sprayed and unsprayed sites in NC during harvest 2001.

'CARLOS' 2001 (% infected)	Macro - phoma rot	Bitter rot	Powdery Mildew (fruit)	Black rot (fruit)	Black rot (leaf)*	Other leaf spots*
Unsprayed (Site # 1)	1.0	12.0	6.0	2.0	12.5	10.0
Unsprayed (Site # 2)	<1.0	7.5	45.0	21.0	32.0	60.0
(Avg. Unsprayed)	(1.0)	(9.75)	(25.5)	(11.5)	(22.25)	(35.0)
Sprayed (Site # 3)	<1.0	<1.0	0	0	0	<1.0
Sprayed (Site # 4)	0	0	<1.0	<1.0	0	22.5
(Avg. Sprayed)	(<1.0)	(<1.0)	(<1.0)	(<1.0)	(0.0)	(11.25)

* % of leaves with one or more spots. "Other leaf spots" includes Angular Leaf spot and Bitter rot.

Table 2. Comparison of disease levels observed on unsprayed vines of bronze 'Carlos' and black 'Noble' muscadine grapes at a single location in Bladen County, NC in 2001.

'CARLOS' vs	Macro-	Bitter	Powdery	Black	Black	Other
'NOBLE'	phoma	rot	mildew	rot	rot	leaf
Site # 2	rot		(fruit)	(fruit)	(leaf)*	spots**
(% infected)						
'Noble'	0.0	2.8	22.5	0.0	0.0	5
'Carlos'	<1.0	7.5	45.0	21.0	32.0	50

* % of leaves with one or more spots

** % leaf area affected, includes both Angular leaf spot and Bitter rot leaf infections.

Major Insect Concerns on muscadine grapes

- Grape Root Borer -- Primary insect threat, can use soil mounding in July and August
- Japanese Beetle -- Feed on foliage, developing fruit clusters
- June Beetles, Wasps Feed on fruit
- Aphids Occasional pests of growing tips

Major Weed Concerns

- Competition during establishment --Consider starting the planting conventionally, then switching to organic, use grow tubes, weed matting
- Large-seeded carry-over weeds --Sicklepod, Morning Glory
- Woody weeds Trees, woody vines eventually invade around trunk and post

Web Sites

- Southern Region Small Fruit Consortium www.smallfruits.org
- Fruit Disease Information Notes http://www.ces.ncsu.edu/depts/pp/notes/Fr uit/fdin012/fdin012.htm
- Organic Grape Production http://attra.ncat.org/attrapub/PDF/grape.pdf

Weed Control in Organic Grape Production

Katie Jennings and David Monks Dept. of Horticultural Science NC State University

Weed Control

Research in NC has shown that in order to maximize growth during the establishment year vines must be maintained weed-free for 12 weeks after planting.

In-Row Weed Control

Fig. 2. Differences in Vine Growth as a Result of Weed-Free Interval.



Weed Control in Organic Grape Production

- Prevention
- Mulch
- Mechanical
- Biological
- Organic Herbicides

Prevention

- Keep new weeds out.
- Prevent further spread of weed seed or perennial plant parts.
- Prevent weed seed production.
- Maintain non-crop areas weed free.
- Sanitation clean equipment between fields.
- Contamination in compost, straw, manure, and other materials.

Plastic Mulch

- Provides a physical barrier on the soil surface and blocks light.
- Clean cultivation followed by laying of plastic.
- Nutsedge is able to penetrate plastic mulch.
- Remove plastic after harvest and plant a cover crop.

Plastic Mulch

- Disposal is an issue.
- Possible alternatives are corn and soybean based biodegradable plastics (In research).

Organic Mulches

- Make sure the mulch is free of weed seed.
 Identify source early in season prior to use.
- Replenish periodically.
 - Straw
 - Leaf mulch
 - Newspaper
 - Wood chips
 - Hay

In-Row Weed Control

- Hand removal best when weeds are small (less than 3 inches).
- Weed Badger, Green Hoe, Grape Hoe



Row Middles

- Cover crops weedfree source.
 - Identify a good, clean source.
- Hand removal/hoe.
- Cultivate row middles.
- Permanent sodded middles.
- Mow middles.



Mechanical Weed Control

Flaming

- Heat causes cell walls to explode; does not burn the weeds.
- Best performance if weeds have 2 leaves or less.
- Grasses are difficult to kill because the growing point is beneath the ground.
- Lower leaves will be damaged (may not be viable).
- Modify traditional flamers add shield.

Flaming Weed Control



Biological Weed Control

Chinese Weeder Geese

- Preferred over typical geese because they tend to walk around crop versus walking on crop.
- Prefer grass species; will eat broadleaf weeds when grass is not present (will also eat fruit).
- Must provide drinking water, shade, and protection from predators.



Bradfield vinegar



Vinegar, citric acid, and clove oil



Bitter almond extract



Clove oil

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- Breaks down the waxy cuticle leads to dessication.
- Use rate: Equivalent to GPA sprayer output.
- Not a certified organic product according to OMRI.
- Retail: \$19.95/gallon

Matran 2

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- Mode of Action: Cell membrane disruptor
- Manufacturer: EcoSMART Technologies, Inc. (http://www.ecosmart.com)
- Use rate: 5 gallons per acre (broadcast)
- Reentry interval: 0 hours
- Retail Cost: \$170.00/2.5 gallon

Matran 2

- Requires an approved organic adjuvant.
- Apply to small weeds.
- To prevent crop injury apply with hooded sprayer.
- Rainfall within 3 hours may reduce control.
- Cool weather following treatment may slow activity.
- Constant agitation is required.
- USDA National Organic Program Compliant.

Natural Wet Surfactant

- Active ingredient: Yucca plant extract
- Use rate: ½ Tbsp. per gallon of spray solution
- Retail cost: \$18.95/quart

BurnOut II

- Active ingredient: Clove oil (12%)
- Inert ingredients: Vinegar and citric acid
- Manufacturer: St. Gabriel Laboratories (<u>http://www.milkyspore.com/index.htm</u>)
- Use rate: 3:1 or 2:1 (Water:BurnOut II)
- Retail cost: \$89.95/2.5 gallon
- Use on borders, driveways, fencerows, around buildings, etc.
- Currently **NOT** registered for use in food crops.
- Apply to small weeds.
- No adjuvant needed.

Weeditol

- Active Ingredient: Bitter almond extract
- Manufacturer: Champon Millenium Chemicals (<u>http://www.champon.com</u>)
- Use rate: Spray solution should consist of 98% bitter almond extract and 2% water.
- Not currently labeled.
- No adjuvant needed.
- Works within minutes on some weeds (carpetweed).
- May have some soil activity.

Corn Gluten

- Preemergence weed control
- 9-0-0 fertilizer
- Active Ingredient: 60% protein
- Manufacturer: Various
- OMRI certified as an organic product.
- Fair weed control.

Natural Products Efficacy Table

	Matran 2	BurnoutII	Weeditol	Vinegar
Weeds				
Y. nutsedge	Р	Р	Р	Р
Henbit	E	E	E	E
C. geranium	E	E	N/A	E
Curly dock	E	E	N/A	E
Carpetweed	Е	Е	Е	G
Primrose	E	E	E	E
P. purslane	E	G	E	G
Corn spurry	F-G	F	E	E

Control is based on spraying broadleaf weeds less than 1" in diameter or yellow nutsedge less than 3 inches tall.

Bitter Almond Extract 2WAT









Nontreated



BurnOut II



Bradfield Vinegar



Matran 2



Weeditol



Entireleaf Morningglory 3DAT









Pitted Morningglory 3DAT









SOUTHEAST STRAWBERRY EXPO NOVEMBER 7, 2005 JOHN VOLLMER

ORGANIC STRAWBERRY PRODUCTION

<u>Site Selection</u>- The most critical factor is for water to be able to move off the field particularly at the ends of rows. There is a lot of water applied during frost-freeze protection time and this must have a place to go and not stand in the field. Proper field drainage needs to be set-up prior to laying plastic and then the finishing touches put to the field immediately after plastic is laid. Often this requires some shovel and rake work around the ends.

Windbreaks on the North and NW sides of the field are helpful. Usually the "Alberta Clippers" are coming to us from about February 20^{th} to March 20^{th} - - and this is when berries are putting on their 1^{st} blooms. Wind breaks help slow the wind that usually accompany these advective freezes - - temps are often in low 20's to low teens.

<u>Fertility</u> – Soil pH 6.0 - 6.2

Conventional fertility recipe calls for 60-40-120 applied in the fall (broadcast) prior to laying plastic- - followed in the spring with 60 more pounds of N through the drip. For organic culture the first thing is to get a soil test ASAP. Get the ground torn up and apply 30 cubic yards of compost/acre. This is enough compost to cover the ground with hardly a bare spot showing anywhere. A spreader truck with gate wide open and spinners slowed way down can cover 10-12 feet per pass and can accomplish this. The truck will have to make more than 1 pass- - usually splitting the 1st track to get more uniform spread. Disk this compost in the same day as applied. As soon in May as you can plant a cover crop of soybeans and millet. Use untreated seed – no Roundup Ready. 2 bushels of soybeans plus 30 pounds millet/acre. Mix in a grain drill and seed when there is good moisture in the ground. Do not seed when the soil is as dry a "doodle dust" and expect good results. This cover crop is important to your overall fertility plan and must work with the compost to provide nutrients that will be needed when plants hit the field on October 1st.

The cover crop should be <u>flail</u> mowed to shred in small pieces prior to seed formation in the millet. Both millet and soybeans will still be green. As soon after mowing – even the same day – work the field with any implement that you think can put the cover crop in the ground the best. Get as much of it down deep if you can. Do not allow the cover crop to dry out like hay. Get it into the soil as best you can. Naturally, there will be some of your cover that will be left on top and will require a couple of additional passes over a 2 week period to get it completely mixed in the soil. This should be done prior to August 1st!!

After August 1st apply 20 cubic yards of compost/acre and disk in immediately. This can be done as a part of the plastic laying operation – usually in late August or early September. You will need time for the beds to settle and volunteer weeds to come up which will help the field tolerate equipment and people traffic come planting time. Also remember that hurricane season starts at this same time of the year - - I think early is better than late.

There is an advantage in that there is no fumigant applied, so plastic can be put down even just a day or two ahead of setting out plugs. It may be necessary to apply 10-20 units of N through drip after plants are two weeks old. Source and need to be decided later.

Fall Drip

After plastic is laid it should be hooked up and checked out. You will need to pre-wet beds before setting plugs and possibly add some fertility through drip 2 weeks after setting.

Fall Monitoring and clean up

Watch for deer damage and act as soon as you see a small amount of damage. I like the product Plantskydd at the damage site and along the perimeter both ways from the initial damage site.

Watch for dying plants – rouge them from the field and send samples to the plant disease lab for positive ID. You cannot possibly know what to do unless you know what the disease is. First clean up should occur Dec. $1-10^{\text{th}}$. Clean any weeds from the plant holes. Also at the same time, remove any dead and dying leaves. More than 50% of the botrytis innoculum can be removed when this operation is performed. It is OK for the leaves and weeds to be put in the row middles, but it would be better if the trash was collected in buckets and carried out of the field and dumped away from the field (this will take more time and adds to cost).

Watch for mites - - anytime after plants are established and prior to mid-December mites should be monitored. If you have mites, you should spray with M-Pede insecticidal soap. Rate is 2 gal/100 gal at minimum of 150 PSI and 100 gal/acre. It is easy to kill mites at this stage because plants are small and you can bounce the spray off the plastic and hit the underside of the leaves where the mites are. This is why high pressure is important. It will take 2 applications about 10 days apart. M-Pede controls adults and you have to make a 2^{nd} application to control the newly hatched that were eggs at the time of 1^{st} application. If you clean up mites at this stage chances are that you will remain mite free into the spring and through the picking season.

Spring Clean up/Row Covers

This operation is exactly the same as fall clean up, and usually takes place during the first 2 weeks of March. The purpose is to clean any weeds and remove any dead and dying leaves that were killed by cold temperatures during the winter. If row covers are used, this will minimize the amount of dead and damaged foliage, and row covers can bring the

crop in 10-14 days earlier. Covers work well for Sweet Charlie and Camarosa but in general are not recommended for Chandler. I like to apply row covers at the end of December and leave them on until late February.

Disease/Insect Control in Picking Season

The first line of defense against disease if Anthracnose or Phytopthora or Botrytis crown rot is to remove plants from the field. In the case of Angular leaf spot, botrytis fruit rot, I spray Oxidate at 1 gal/100 gal water. This product (Oxidate) is in my mind still somewhat unproven and I'm not sure how well it actually works since thee is no university data on it. I have never actually run any trials myself either. Oxidate was originally OMRI approved and then removed. Now just recently (Sept.05) OMRI listed as approved once more. Cost/application is about \$40.00/acre. I think Oxidate can help if disease situation is in early stages and if sprayed on a 5-7 day schedule. Oxidate can burn your skin - - be careful handling.

If mites or aphids are a problem in season I would spray with M-Pede plus Oxidate. I have found that these two actually do a pretty good job of knocking down a population. Follow with a second application 7 days later.

Supplemental Spring Fertility

I apply a product (preplant) from Nature Safe 8-5-5 at 800 lbs./acre and don't usually have to worry about fall fertility or about early spring N applications. With conventional culture, N applications will usually begin around March 1st. With ht Nature Safe product, I plan to monitor nutrient needs with tissue tests and apply supplemental N as needed.

Post Picking/Cover Crop/ Rotation

Field clean up and planting a summer cover crop needs to take place as soon as possible after picking is complete.

Cover crop for summer that I like is Millet (30-40 lbs.) plus Soybeans at 50-60 lbs./Acre. A fall winter cover that works well is Crimson Clover at 30 lbs./A plus Oats at 40 lbs./A.

I think it is best if you can rotate your berry field and that allows for plant debris to rot completely between crops. It also allows for 2 different types of cover crops to be in the rotation. If space or location are not issues, strawberries every other year will be best.

Weed Control in Organic Strawberry Production

Katie Jennings and David Monks Dept. of Horticultural Science NC State University

Weed Control in Organic Strawberry Production

- Prevention
- Mulch
- Mechanical
- Biological
- Organic Herbicides

Prevention

- Keep new weeds out.
- Prevent further spread of weed seed or perennial plant parts.
- Prevent weed seed production.
- Maintain non-crop areas weed free.
- Sanitation clean equipment between fields.
- Contamination in compost, straw, manure, and other materials.

Plastic Mulch

- Provides a physical barrier on the soil surface and blocks light.
- Clean cultivation followed by laying of plastic.
- Nutsedge is able to penetrate plastic mulch.

Nutsedge



Plastic Mulch

- Remove plastic after harvest and plant a cover crop.
- Disposal is an issue.
- Possible alternatives are corn and soybean based biodegradable plastics (In research).
- Fields in plasticulture have up to 15 times more soil erosion than fields mulched with organic material.
 - Seed middles with winter small grain.

Organic Mulches

- Make sure the mulch is free of weed seed.
 - Straw Identify source early in season prior to use.
 - Leaf mulch
 - Shredded newspaper
 - Living mulch

Mechanical Weed Control

<u>In-Row</u>

- Hand removal best when weeds are small (less than 3 inches).
- Cut weeds (greater than 3 inches) in crop holes when they are too big to remove without damaging the crop roots.
 - Damage to crop roots can result in crop death or slow crop development.

Mechanical Weed Control Row Middles

- Cover crops weed-free source.
 Identify a good, clean source.
- Hand removal/hoe.
- Cultivate middles.
- Mow middles.
- Steaming expensive.
- Flaming risky?.

Mechanical Weed Control

Flaming

- Heat causes cell walls to explode; does not burn the weeds.
- Best performance if weeds have 2 leaves or less.
- Grasses are difficult to kill because the growing point is beneath the ground.

Biological Weed Control

Chinese Weeder Geese

- Preferred over typical geese because they tend to walk around crop versus walking on crop.
- Prefer grass species; will eat broadleaf weeds when grass is not present (will also eat fruit).
- Must provide drinking water, shade, and protection from predators.



Bradfield vinegar



Vinegar, citric acid, and clove oil



Bitter almond extract



Clove oil

- Only a limited number of organic herbicides are available.
- Contact herbicides which are nonselective (similar to paraquat in activity).
- Weeds that are present at time of application are controlled - typically no soil activity.
- Can be made more selective by manipulating timing and placement.

- Non-selective postemergence weed control.
- Keep spray solution off of crops.
- Fast acting observe activity within minutes with some products on some weeds.
- Activity is best on small weeds.
- Activity decreases as the size of the weed increases.
- Air temperature and relative humidity may be important.

- Typically spray at 25 to 75 GPA.
- Organic **DOES NOT** equal safety to the user.
- Wear PPE as instructed.

Natural Horticultural Vinegar

- Formulation: 20% Acetic acid (Vinegar)
- Ingredients: Horticultural White Vinegar (200 grain) and yucca extract as a natural surfactant
- Manufacturer: Bradfield Industries
 - <u>http://www.bradfieldind.com/</u>
- Breaks down the waxy cuticle leads to dessication.
- Use rate: Equivalent to GPA sprayer output.
- Not a certified organic product according to OMRI.
- Retail: \$19.95/gallon

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- Mode of Action: Cell membrane disruptor
- Manufacturer: EcoSMART Technologies, Inc. (http://www.ecosmart.com)
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Cutleaf Eveningprimrose





Curly Dock





Henbit







Bitter Almond Extract 2WAT









Nontreated



BurnOut II



Bradfield Vinegar



Matran 2



Weeditol



Entireleaf Morningglory 3DAT









Pitted Morningglory 3DAT







