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Organic Blueberries

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Organic Overview

The organic segment in the United States currently accounts for over 2% of food sales. Annual growth of organic sales is 20% or more and expected to continue. Certified organic operations have doubled in the last ten years and now stand at over 7,000 farms in the United States. Over 5% of apples are organic; 10% of California strawberries, and 15% of west coast grapes. A rise from 0 to 200 acres of organic blueberries has occurred in New Jersey within the last five years. In the northeast market a ten pound flat of organic blueberries will return $18 to $25 compared with $8 to $14 for the conventional product. Iowa is now giving a tax advantage to organic growers.

Four new developments encourage organic highbush blueberry production. 1. The USDA's national organic labeling rules and production practices are standardized. This has evened competition locally and nationally. 2. Increase of small fruit sales is related to human health benefits which drives today's organic market. 3. New controls are becoming available to organic growers that reduce the risk of pest problems, improve quality and yield. 4. University and federal research and organic grower groups have minimized production pitfalls. Therefore, profits are promising through the organic certification process.

Organic Rules. It takes a lot of planning to get started in organics. Three main areas to concentrate on are planning, paperwork and production. Go to the USDA and Northeast Organic Farming Association websites listed at the end of this chapter. Learn organic rules and regulations. Organic farming is defined by the USDA as a "production system that is managed by integrating cultural, biological and mechanical practices. . . ." The main requirements are to use only OMRI-approved materials for fertilizer and pesticides when necessary. OMRI is the Organic Materials Resource Inventory that disallows many synthetic compounds. For example, pyrethrum insecticide from the chrysanthemum flower is organically approved but Asana insecticide is not allowed because it is a synthetic version of pyrethrum. Nitrogen, phosphorus and minor elements must come from natural sources like chicken manure and rock phosphate but not synthetic chemical versions like 10-10-10 fertilizers from industry. Check market outlets early.

The organic certification process takes about three years to convert a conventional block. When starting an entirely new block of blueberries there is little or no harvest the first three years. A faster way into the organic market is to renovate an older, unused or unsprayed block. Berries may actually be sold before the three-year certification period is complete and labeled as "transitional organic." It is surprising how an abandoned block can be restored by brush-hogging the bushes down to the ground and beginning anew. New canes and yields can rapidly rebound to respectable yields within the first two seasons. Organic practices must be adhered to during this time and a third party certifying agent must approve compliance to national standards.

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Original Organic Crop. Since the native blueberry is one of only two solely native American fruits, it has evolved good natural resistance to local diseases and insects. The crop also has an inherent vigor because it has been domesticated for only a hundred years. This long-lived, perennial crop is a natural fit with these new organic rules. When wild blueberries were first selected and cultivated in the early 1900's, farming practices were essentially organic in nature. Early farmers established effective cultural practices, initiated mechanical weed control and took advantage of naturally occurring biological controls. This chapter selects some of these old useful practices and introduces the grower to new production techniques in creating a functional system for today's organic operation.

Grower Profile

A successful organic grower must commit to handling some additional office work and a few new field challenges.

Also, the grower needs to sincerely adjust to an organic mentality and work within the rules. He must:

- Visualize a holistic farm management system.
- Develop an organic farm plan.
- Establish a record keeping system.
- Buffer his crop from nearby conventional operations.
- Separate non-organic from organic products.

From a production standpoint, the grower must:

- Take basic steps to create soil health.
- Feed the soil for pest-tolerant plants.
- Inspect fields frequently to assess plant growth.
- Distinguish between pests, predators, pollinators and parasites.
- Tolerate a few weeds.
- Diagnose regularly any plant injury and pest signs.
- Establish levels of unacceptable pest damage.

If this grower profile appeals to you, then you can move to the following field tasks.

Cultural Management

Currently, about two thirds of what "conventional" growers already do culturally is approved for organic production. Examples include sanitation, raised mounds, water conservation, selection of generally resistant varieties and adding organic amendments such as peat and humus in building better soil. The remaining third of horticultural practices are more specifically designed for organic operations and some methods are still "works in progress."

Soil conditioning. Building a fertile soil is the cornerstone of the organic method. Blueberry does not require large amounts of nitrogen. Focus on an active living soil rather than concentrating only on the crop. Adding peat and compost encourages beneficial microorganisms in the soil (Fig. 1). These organisms then produce an abundance of nutritive substances that feed the plant. Symbiotic endo-mycorrhizal fungi within the blueberry root system will naturally respond well to this organic soil conditioning.

When feeding the soil with compost and manures, you should plan for about a 2 to 4 week lag time before nutrients become available to feed the crop. Synthetic fertilizer may act a lot faster but can burn tender crop roots and hinder soil life. Read the Organic Materials Resource Inventory (OMRI) list of approved fertilizers. Examples like fish emulsion are "easier" on the root and soil organisms yet will act quickly like a synthetic fertilizer. "Nature Safe" is a 12-2-0 nitrogen source on the market.

Sanitation. Keep the field free of leaves, prunings and trash to reduce fall and winter shelter for maggot and diseases like mummyberry and canker.

Composting. Recycle locally available leaves, grass clippings, wood chips, food wastes and livestock manures to enrich your soil. Put a 3:1 ratio of carbon and nitrogen substances (brown and green plant material) in compost piles (Figs. 2 and 3). Turn the pile frequently to encourage high temperature composting that eliminates insects and diseases, and decomposes any pesticide residues. On-farm composting becomes an integral cost-saving feature that can turn into a "side business."

Figure 1. Heavy incorporation of peat, compost and/or humus improves soil and root health.

Pruning, air circulation. Unpruned "tight" bushes have poor air circulation, encouraging diseases. Closely planted bushes have the same effect (Fig. 4).

Water Management

A good water supply is essential for consistent growth of blueberries. They have a shallow root system that lacks root

Figure 2. A 3 to 5 inch layer of mulch suppresses weeds, improves soil, evens temperature and helps to maintain moisture.

Figure 3. Compost is a key organic component. Pine mulch, municipal leaves, coffee grinds and hardwood chip mulch are used.

hairs. In today's organic culture, trickle irrigation has many advantages compared with overhead sprinklers (Fig. 5).

Trickle irrigation:

- Keeps foliage, fruit and flowers dry.
- Conserves water. Saves energy.
- Is inexpensive.
- Emits the water within the bush dripline.
- "Spoon-feeds" liquid fertilizers.
- Gently reduces soil pH with liquid sulfur solution.

Overhead solid set irrigation structures provide frost protection in spring and heat control in summer. Major disadvantages include:

- Encourages weed growth.
- Promotes diseases.
- Costs much more.
- Considerable water loss in evaporation.
- More fertilizer leaching.

Both systems combine all the best cultural options.

Weed Management

Weed control ranks as the number one problem in organic crop production. Young blueberry plants have a long establishment period and are poor competitors against weeds for moisture, nutrients and sunlight. Weedy fields have been shown to significantly reduce fruit yields and growth. A 30-60 inch weed-free strip for blueberry plants is essential for good growth. Even in well-established blueberries, weeds remain a major economic threat. They harbor diseases like scorch and canker, provide shelter for destructive insects and rodents, may attract away pollinators, disrupt irrigation and hamper harvest. Some common weed species in organic fields include annual grasses like hairy crabgrass (*Digitaria sanguinalis*) and foxtail species (*Setaria* spp.). Perennial weeds include quackgrass (*Agropyron repens*), goldenrod (*Solidago*) and aster. These weeds can create problems within and between rows. Such tough weeds need to be well managed early and before establishment during the first five years of crop growth. Organic practices include:

- Mechanical cultivation
- Flaming
- Organic herbicides
- Mulching
- Ground cover crops
- Mowing

Figure 4. Pruning improves airflow, temperature, moisture and sunlight penetration throughout the blueberry block.

Figure 5. Drip tube or trickle irrigation is highly recommended for organic blueberries.

Prior to planting. Plan a new field planting a year in advance. Manage existing perennial weeds with a combination of cultivation, flaming and/or application of a non-selective herbicide as Roundup (glyphosate). Wear weeds down and rake them out. Do not allow weeds to go to seed. Then plant a green manure crop as rye to suppress weeds. Plow it in deeply before it becomes woody to build soil and organic matter. Other suggested cover crops include buckwheat, oats, or rape which have individual advantages and characteristics.

Mulch types include pine bark, hardwood, municipal leaves, sawdust, coffee grinds, cocoa grinds, composted tea leaves and food from industry by-products. Three to four inches of these mulches as a 30-inch band under each plant should provide a weed control level of maybe 95% (Fig. 4). In combination with black landscape fabric, weed control can become complete. Chart 1 compares these mulches with and without landscape fabric in a new commercial planting of Duke highbush blueberry.

Weed suppression in the walkways can be achieved with fine leafed turf fescues and monthly mowings. These fescues are very low, slow growing and need only a few mowings

MULCH SOURCE COMPARISON TRIAL

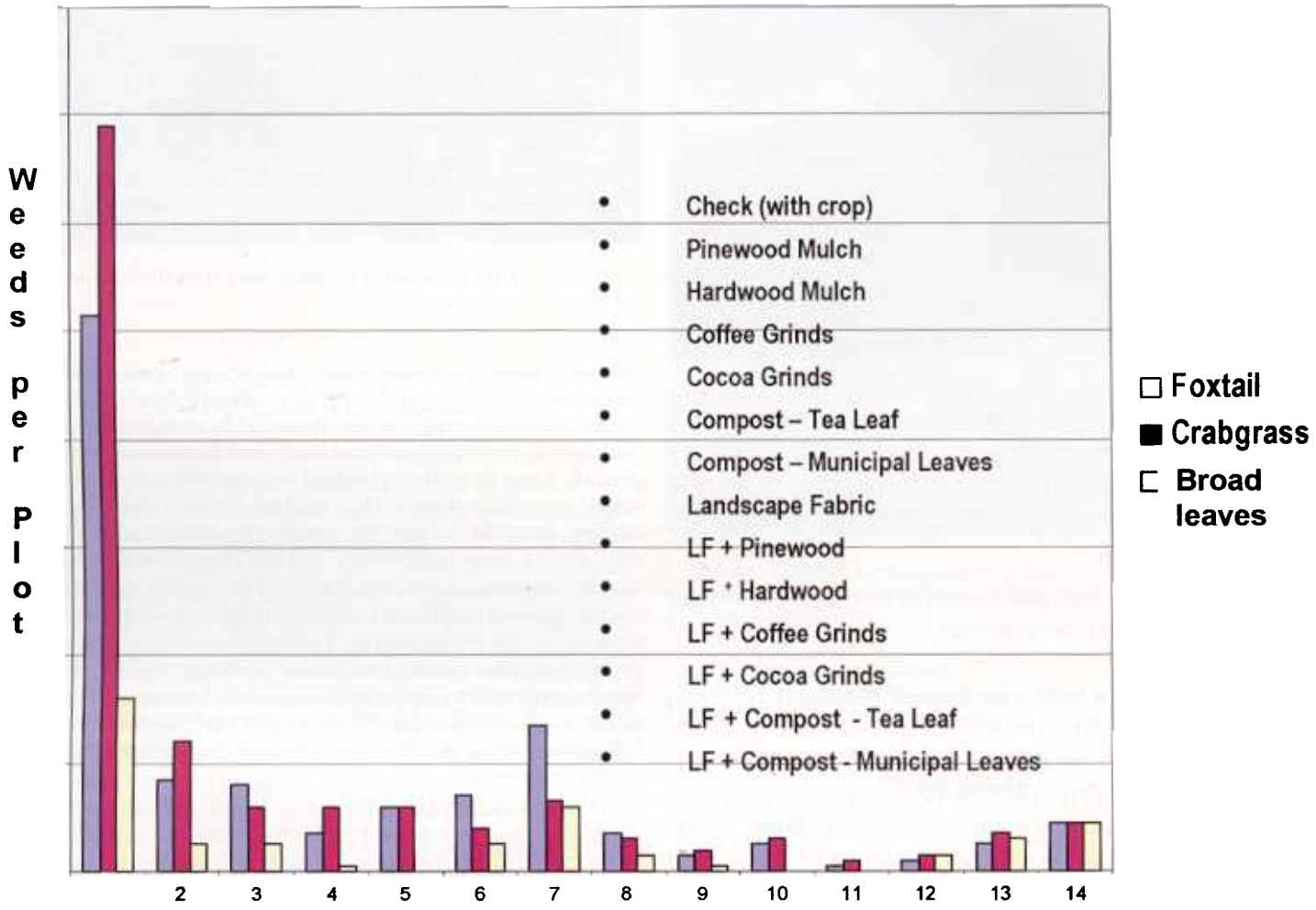

Chart 1. Weed pressure from hairy crabgrass (blue), foxtail species (red) and broadleaved weeds (white) were controlled with mulch applications of pine wood, hard wood, coffee grinds, cocoa grinds and leaf compost. When these composts were placed on top of perforated landscape fabric, control exceed 95%.

throughout the entire season compared with standard turfgrasses (Fig. 6). New varieties have good germination, require little water and use limited nitrogen. Once established, these "cover crops" can squeeze out weeds by releasing natural herbicidal substances through their roots. Use a few pounds of organic nitrogen in both the fall seeding and a spring feeding. Spring seeding can be successful also, but coverage will be slower with less competition against early season weeds.

In established blueberry blocks, regular mowings alone can gradually change a mixed stand of weeds to a native perennial grass cover. No-till planted turfgrass will also cover the floor which allows equipment and customer traffic in wet spring periods. With bare ground middles, cultivation equipment will uproot small germinating weeds and provide weed-free middles. With overhead irrigation, the tractor-mounted, hand-maneuvered rotary cultivator is very effective at navigating within the crop row and removing weeds with shallow cultivation (Fig. 7). If the grower uses trickle irrigation and wishes to employ rotary cultivation, the drip tube must be buried permanently or lifted up without water temporarily. Hand-hoeing may be needed.

Propane flaming with small hand-held devices is an inexpensive but effective weed killing method. Unfortunately, it can quickly become expensive if a few blueberry bushes are injured. Targeting in-row weeds may get the flame too close and directly singe the crop. Also, an invisible heat effect can cause indirect damage to the plant. A grower should do a lot of preliminary practicing or testing.

On occasion, OMRI approved herbicides such as Scythe, Burnout and white vinegar can be used. These non-selective and non-persistent herbicide materials find a place in pre-plant situations on bare ground. In established plantings, use a shielded sprayer to avoid drift problems. This "burn down" activity can be compared with the synthetic herbicide, Paraquat (*gramoxone*), which quickly desiccates the weed top growth but does not penetrate the root zone. Expect re-growth from perennials.

Corn gluten herbicide is a waste product made from corn meal. It inhibits root growth of seeds but does not harm estab-

Figure 6. Fine fescue grows low and slow, suppresses weeds in the walkway and uses little water or fertilizer.

lished plants. At high rates, corn gluten suppresses annual grass with several years of use. Corn gluten must be applied two to three weeks before weed seeds germinate in spring. It is moderately effective against crabgrass, dandelions, pigweed, plantains and curly dock at an application rate of 20 pounds per 1,000 sq. ft. Offsetting some of the high cost and inconvenience is the fact that it also serves as an organic fertilizer.

Insect Management

Prevention and detection are the keys to organic blueberry insect management. Before starting a new field, a fallow period followed by a cover crop of rape or marigold will significantly suppress some soil pests like beetle grubs, weevils, ants and nematodes. For established plantings, Utilize good sanitation practices and timely raking of the soil to eliminate breeding sites for blueberry maggot, curculio and fruit worms.

Figure 7. Tractor mounted, rotary cultivator can weave between plants in the row.

Scouting. In-season insect management employs several integrated methods. First, select early blueberry varieties to avoid later pests like blueberry maggot. Late season varieties avoid early season pests like weevils. Regular field scouting helps locate potential pests on the bush through their diagnostic signs and symptoms. Yellow sticky traps hung on the branches in various field sections provide an early warning system. Count the number of captures for each insect pest once or twice a week. If pest populations begin to rise to economic levels, an organic insecticide may be considered.

Organic tools. The organic toolbox is brimming with a good selection of approved materials—old and new (Table 1). For good efficacy, these materials must be applied early in the pest cycle, sprayed with good coverage and reapplied as needed. These organic substances are generally short-lived, non-persistent, weather dependent and selective in nature.

Dormant oils on the bark smother over-wintering scale insects and bud mites. Neem based sprays will also reduce scale and bud mites. Older plantings may develop a scarab beetle grub problem below ground. Use biocontrol agents like milky spore disease and parasitic nematodes in the soil to help manage these underground pests.

Troublesome moth larvae emerge from eggs in June. Large populations of these caterpillars can quickly chew up blueberry fruit and foliage. *Bacillis thuringiensis* spray is recommended at this time. "Bt" is an effective biological toxin derived from various bacterial strains that control young worms. Soon after ingestion, caterpillars will stop feeding and then gradually die. Larger larvae may be managed with pyrethrum sprays like PyGanic. This natural nerve toxin is effective against many other insects and is relatively safe.

There is another side benefit to "going organic" and avoiding synthetic insecticides. Secondary pests do not "explode" into major problems like they do in conventional fields where all the beneficial predators and parasites have been killed by broad-spectrum organophosphates and carbamate insecticides. More selective organic insecticides maintain survival of these "farmers' friends" which then suppress secondary pests like aphids and leafhoppers. Sucking pests not only injure by withdrawing plant juices but can spread viral diseases. If these "suckers" do begin to increase, applications of stylet-oil or soap-based insecticides will clog their mouth parts or smother them.

Spinosad—Entrust and GF-120. The best new organic registered material is Spinosad—a by-product of a soil bacteria which is effective against various fruit flies. Blueberry maggot fly is the number one problem in commercial highbush blueberry (Fig. 8). It is repulsive to discover a large, white wiggling maggot in the middle of your blueberry packages. This maggot is the legless "immature" stage of the adult fly. Early season varieties like Early Blue, Bluetta and Weymouth can nearly escape maggot infestation because they come to harvest before most of the blueberry maggot adult is ready to lay eggs. On the other hand, mid-season varieties like Duke and Blue Crop are much more susceptible. Fortunately a new formulation called Entrust has been labeled for organic blueber-

Table 1. Managing blueberry insects, diseases and weeds in an organic growing program.

	Pest Problem	Management Method
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[1], 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

[1]4lbs. copper sulfate; 6 lbs. hydrated lime; 100 gal. water, equivalent; or ??? on the market.

ry growers. Entrust also has activity on caterpillars and thrips. This sprayable formulation is applied ten days after the first adult maggot flies are captured in yellow sticky traps. Airblast sprayer applications should be made at 2 ounces product per acre with 20-25 gallons per acre. Two more applications 7-10 days apart may be needed if populations continue to emerge.

Another spinosad formulation called GF-120 naturalyte fruit fly bait is formulated exclusively for fruit fly control. This formulation has proteins and sugars known to enhance feeding. Thus, lower dosages of spinosad bait are acting as a stomach poison versus the contact action of a broadcast spray. GF-120 also shows promise as a perimeter spray when pest populations invade; coming from adjacent fields or forests (Fig. 9).

These two formulations join other organic fruit fly materials, pyrethrum (PyGanic) and neem oil (Agroneem/Aza-Direct) to establish a rotational spray program. Growers should not rely on just one material but switch to different chemical modes of action. Chemical rotation will avoid insect resistance and preserve the high level of efficacy of spinosad.

Another recent breakthrough in insect management is not commercially available yet. Oriental beetle is the other major scarab beetle pest in many northeastern blueberry fields. Larval beetle grubs consume blueberry roots underground. The

Figure 8. Adult blueberry maggot fly inserts egg underneath the berry skin in June and July.

Figure 9. Low gallonage sprayer setup on 4-track for spinosad bait sprays.

Figure 10. Adult Oriental beetle (left) and immature white grub (right) in soil.

adult's pheromone has been shown to be extremely potent (Fig. 10). Retrievable traps dispense this pheromone throughout the field which confuse the flying males and disrupts mating over 95% (Fig. 11). Subsequently, egg laying is prevented. These retrievable dispensers have been granted tolerance exemption on food and non-food crops.

Overview. From an insect management standpoint, these tools provide an effective commercial control, reasonable cost and environmental advantages. This reduced risk encourages rapid growth of organic blueberry acreage. Similarly, conventional growers can more confidently switch to organic certification. Marketing insect-free fruit produced through organic programs provides a win-win situation for consumers and growers alike. These breakthroughs may just be the beginning of safer and more effective plant protection programs.

Disease Management

The organic grower cannot simply rely on synthetic fungicides sprayed on a calendar schedule to "save the day" in a disease emergency. When it comes to disease management, prevention of problems is again the key concept to use in an organic program. Learn how to accurately diagnose disease symptoms, minimize crop susceptibility, anticipate certain climatic conditions and adjust factors that feed pathogen growth. The preventative plan for a new blueberry block should incorporate most of the following methods.

OMRI approved fungicides will provide a safety net but can not be relied upon alone. Use a good disease management program. Some of these suggestions (in Table 1) are old standbys like Bordeaux and others are very new like Serenade. Read labels carefully. Talk with your county agent or agricultural specialist.

Figure 11. A beetle trap is anchored with hollow metal tubing. This trap uses pheromones to monitor adult Oriental beetles.

Varietal selection. When choosing what blueberry varieties to plant, an organic grower needs to consider disease resistance as important as yield, maturity, berry size, color and taste. Varieties show considerable differences in susceptibility to some key diseases. Disease types and intensity may vary in each section of the county or country. Nursery stock producers and transplant catalogues provide information on varietal disease tolerance. Information from university breeding programs also helps to decide upon the best adapted cultivar for your area. Examples are shown in Table 2.

After the choice of varieties is made, the next consideration is orientation and spacing of the planting.

- Plant rows north to south to capture maximum sunlight without shading.
- Orient rows with the prevailing winds to use air drying of the entire bush if possible.
- Expand spacing between rows to have more wind circulation.
- Expand spacing between bushes from 2-3 feet to 3-5 feet in order to increase air circulation aroundthe bush.

Regular maintenance of your established block will build a good disease defense, reduce disease incidence and better protect the plant's foliage, fruit and flowers.

Table 2. Relative responses of 26 major cultivars to mummy berry blight, mummy berry fruit-rot, anthracnose fruit-rot, and other diseases—high inoculum conditions. minimum 2 years data, normalized to selected standards. (Mark Ehlenfeldt, USDA)

Cultivar	Mummy blight	Mummy Fruit-rot	Anthracnose Fruit-rot		Miscellaneous observations
Weymouth	M	L			
Bluetta	L	M		H	Extremely RRSV susceptible
Chanticleer	M	L		H	
Duke	L	M		M	Some RRSV, suspect to stem blight
Spartan	M	H		H	
Bluejay	L	L		M	
Bluehaven	H	H			
Blueray	H	H	71.5	H	Susceptible to RRSV
Bluecrop	M	M	79.8	H	
Reka	M	L	52.0	M	
Legacy	M	M	34.3	L	
Jersey	L	H	38.9	L	
Ruble	L	H	44.2	M	Susceptible to stunt, resist to RRSV
Brigitta Blue	L	L	16.7	L	Susceptible to scale insects, leafy in Fall
Elliott		H	12.5	L	

Disease severity evaluations L = low; M = medium; H = high.

- Prune to reduce bush size and speed drying period.
- Prune to create a hollow, vase-shape to better aerate.
- Cultivate and/or rake soil in spring to disrupt fungal life cycles.
- Remove clippings, prunings and leaf litter to sanitize the soil surface.
- Rogue out entire plants showing viral symptoms.
- Use liberal amounts of compost in soil and mulches to suppress soil diseases.
- Avoid excessive fertilizer and rapid growth, young tissue is soft and susceptible.
- Don't overwater—let new growth "harden."

Information

Important sources of information for an organic grower are:

- USDA United States Department of Agriculture 202-720-3252 http://www.ams.usda.gov/nop/indexIE.htm
- OMRI—Organic Materials Resource Inventory 541-343-7600 or www.omri.org
- Organic Trade Commission—413-774-7511 or http://www.ota.com/index.html
- ATTRA—Appropriate Technology Transfer for Rural Areas 800-346-9140 or www.attra.org
- NOFA-NJ—Northeast Organic Farming Association 609-737-6848 or http://www.nofanj.org/
- Cooperative Extension Service at Land Grant Universities. Use yellow pages in telephone book under "Government, County."

Marketing organic blueberries. The grower must accurately meet the market. Marketing organic blueberries in advance is the best way to start. Early in your market planning, study available retail and wholesale outlets and determine your sales direction. Most organic growers go fresh market retail for maximum return, such as:

- U-Pick
- Pre-pick for customers
- Local sales to farm markets and restaurants
- Regional sales to supermarket chains

You can add value by supplying pies, muffins, cookies, blueberry type drinks or flavored iced teas. You can connect with yogurt or ice cream producers and national bakeries. Flash freeze the berries for later sales. Sales season can be extended even more with blueberry wine on farm or off farm. In recent years, conventional fresh berries have ranged from $1.09 to $1.20 per pound. Conventional frozen processing berries throughout the United States have risen from 63 cents to 87 cents per pound. Organic production may be priced considerably higher. Progressive growers should test these markets, minimize competition and diversify the marketplace.