The Mid-Atlantic Berry Guide

for Commercial Growers

2013–2014

Produced by The Pennsylvania State University in cooperation with Rutgers University, the University of Delaware, the University of Maryland, Virginia Tech, and West Virginia University.

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The Mid-Atlantic Berry Guide is intended to provide information for commercial berry growers within the region. Homeowners may use this publication for background information; however, many of the recommendations contained in this guide assume that the production is on a large scale and that producers have a commercial pesticide applicator's license.

Uses of pesticides listed in this publication were current as of July 1, 2012. However, changes in registration status may occur at any time, so please consult the label before use—the label is the law. If there are differences in use patterns between the pesticide label in your possession and those listed in this guide, follow the instructions on the label. If in doubt, consult your cooperative extension educator.

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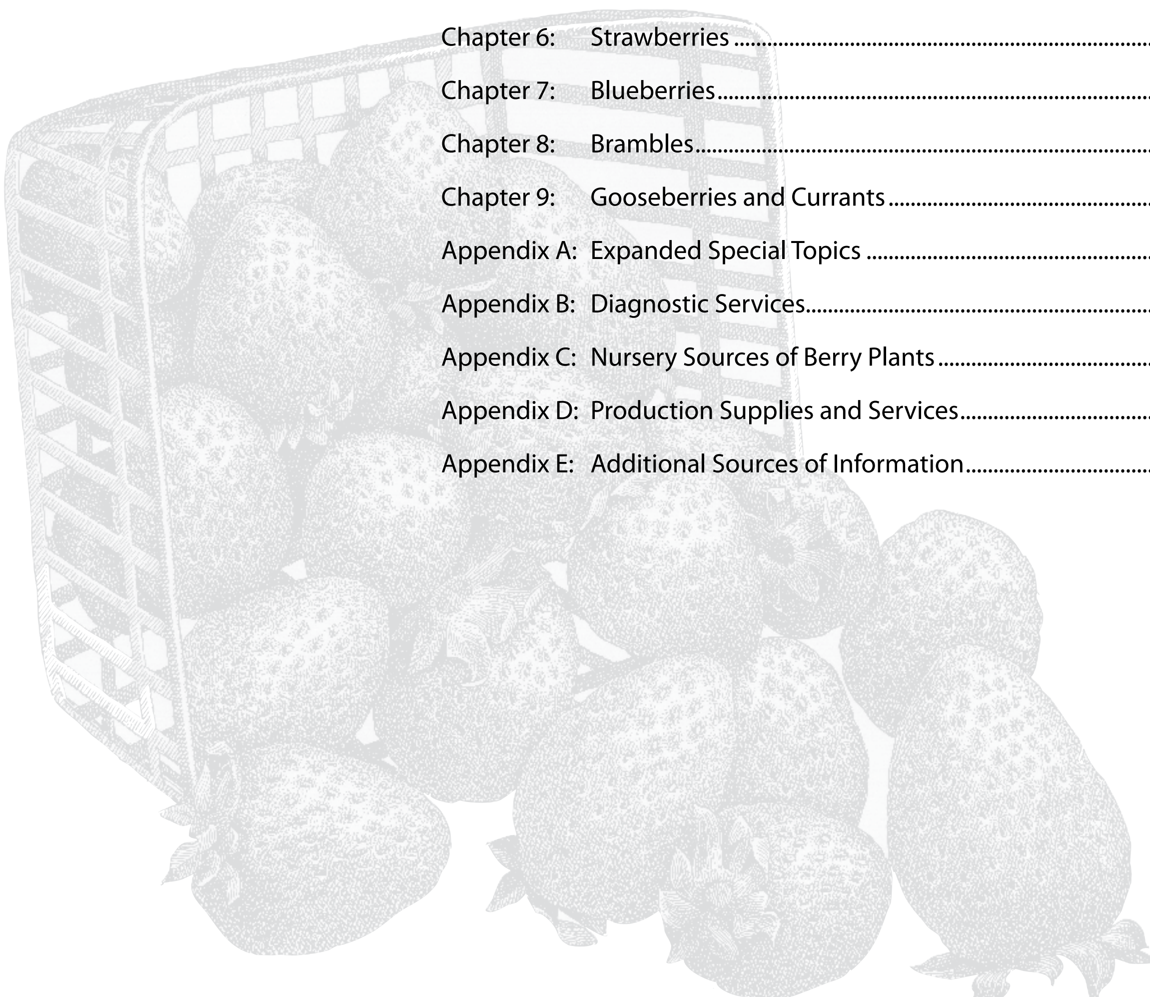

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Preplant Considerations

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INTRODUCTION

Although berry production can be very profitable, berry crops require intensive management and a significant investment of time and resources. Depending on the crop, berry plantings remain productive for varying lengths of time, from as little as 1 to 2 production years for plasticulture strawberries to up to 50 years for blueberries. Good preplant management decisions will benefit the grower throughout the life of a planting, but, alternatively, the grower may have to endure the consequences of early mistakes for many years. Therefore, a significant amount of planning should be done before planting a berry crop. Consideration should be given to both growing and marketing the crop in order to ensure profitability over the long run.

ECONOMICS AND MARKETING

While most of the information in this production guide is intended to help with producing specific berry crops, growers can stay in business only if their operations are profitable. Within each crop's chapter, enterprise budgets are included that outline expected expenses and potential income based on typical costs, technology, and management for the 2011 crop year. The information contained in these enterprise budgets can be used by agricultural producers, extension specialists, researchers, financial institutions, governmental agencies, and others for making decisions in the food and fiber industry.

Small fruit production has the potential to generate significant income on small acreages and limited-resource farms. This profit potential, however, comes with a considerable amount of risk. Unfortunately, it is not uncommon to lose a crop due to frost or disease. Crop insurance is not available for individual berry crops, but whole-farm revenue protection can be obtained through the use of adjusted gross revenue insurance (either AGR or AGR-Lite). Initial investment is high, and substantial annual cost of production requires you to be able to financially weather annual cash flow demands (and the costs associated with preproductive years in fruit crops). Availability of labor, especially for harvest, is another major consideration.

You must be prepared not only to produce a high-quality crop, but also to be an active and aggressive marketer. Before the plants go in the ground, new and established growers alike should develop a marketing strategy for the planned crop. Even well-established operations will need to adjust to changing costs and markets. The marketing plan should consider who your current and potential customers are or will be and how the berries will be sold (pick-your-own, ready-picked for your own market, or wholesale). Consider the demographics of your area. Are a sufficient number of consumers nearby to purchase your fruit? If not, can they be attracted to your location? How will you let potential customers know about the availability of your product? Do you want to produce and market your fruit as organic? Will you market during the main season for each crop or at off-peak times of the year? It is important to carefully consider these aspects before you choose a planting site and begin making major investments in plants and irrigation systems.

SITE SELECTION

When choosing a suitable site, you need to consider and, in some instances improve, many characteristics. These include soil type, fertility, structure and drainage, previous crops and rotations, air drainage and wind exposure, field access, and surrounding crops and/or field borders. Each of these topics is discussed in greater detail as they apply to individual crops and pests in later chapters; general considerations that apply to all berry crops are briefly discussed below.

SOIL TYPE, STRUCTURE, AND DRAINAGE

Growers may not be able to change the soil type (sand, silt, or clay) on their farms, but they can improve its structure, primarily through practices that improve the organic matter content. Berry crops generally perform best in sandy soils; however, a high organic matter content (minimum of 2 percent; 5 percent preferred) can do much for improving plant growth, even in a heavy clay soil.

Small fruit crops grow best on a site with well-drained soil because of their susceptibility to a number of root rots. On sites where internal soil drainage is marginal, small fruit crops have been grown with better success on raised beds where excess water can drain away from the root zone. Tile drainage can provide some benefits as well. Wet sites should be avoided.

AIR DRAINAGE

Select sites with good air drainage. Air drainage refers to a slow movement of air through the planting site due to differences in air temperature and air density. This is not to be confused with wind exposure, where plantings are exposed to high-velocity winds. Good air drainage reduces the potential for frost damage—a serious problem with strawberries and, less frequently, with blueberries. It also promotes drying and less humidity within the planting, which in turn reduces the potential for problems with foliar and fruit diseases.

WIND EXPOSURE

Constant winds can desiccate plantings, especially over the winter. Additionally, while pollination is aided by wind in small fruit, the stigma, a female flower part, can dry and become unreceptive to pollen quickly in hot, dry winds. Protected sites should be selected, or protection should be provided by planting windbreaks or using other means for moderation. In general, 8 feet of wind protection occurs for each foot of vertical height of the windbreak. If a living windbreak is planted, the plant species used should not readily sucker or produce seed. Options besides windbreaks to minimize damage from wind exposure are floating row covers with plasticulture strawberries; straw (or snow in some locations) for matted-row strawberries; and trellising for brambles to minimize cane breakage.

ROW ORIENTATION

Recommendations are often given to orient rows north to south, or to orient rows with the prevailing wind. In practice, however, these two recommendations often conflict with each other. North-to-south rows intercept sunlight more evenly than east-to-west rows; hence, sunscald is less problematic and fruit ripens more evenly. Rows that run with the wind will dry more quickly than those that block the wind. The best orientation for each site will vary. For example, a grower on a level breezy site with prevailing winds from the west may decide to orient the rows east to west, while a grower on a protected site with little wind may prefer north-to-south rows. There are other aspects to consider as well, such as slope and soil erosion potential, which may override other considerations. On sloping sites, rows should run across the slope.

AVAILABILITY OF IRRIGATION WATER

Berry crops have relatively shallow root systems and, consequently, are sensitive to moisture stress during dry spells. In addition, the need for frost protection with strawberries and blueberries makes overhead irrigation capability highly desirable for consistent year-to-year production. Sites with an ample water supply are much better suited to small fruit production than those without access to water, especially considering the value of the crops and potential income lost due to moisture stress or frost damage.

FIELD BORDERS

Uncultivated land and certain crops bordering small fruit crops can be sources of pests and pathogens. These include strawberry clipper beetles from woodlots and fencerows; plant bugs, spittlebugs, and leafhoppers from various forages; Japanese beetles from sod; and sap beetles from various fruits and vegetables. In addition, viruses and orange rust fungus from wild or abandoned small fruit crops can infect new plantings. While eradicating wild berry plants may not be possible, any measures that can be taken to keep plantings as far from wild plants as possible will be helpful. These problems and their management are discussed in detail in crop-specific chapters.

CROP ROTATION

Which crop(s) precede a berry crop can make the difference between having a healthy planting and having a disaster. Certain crops can encourage a buildup of pathogens to which berry crops are susceptible. Other crops have beneficial effects. Previous annual field crops may have residual herbicide carryover, which can damage new berry plantings.

Problematic Preceding Crops

Certain soilborne pathogens that infect many small fruits can build up in association with other crops. Among the most widespread and commonly troublesome of these problems are plant-parasitic nematodes (microscopic eelworms that parasitize plant roots), especially dagger (*Xiphinema* spp.) and lesion (*Pratylenchus* spp.) nematodes. These nematodes feed on many species of plants including previous small fruit and tree fruit crops, legumes such as clover, alfalfa, and vetch, and weeds. Dagger nematodes vector the tomato ringspot virus (TmRSV) to small fruit crops. All sites should be checked for potentially damaging populations of plant-parasitic nematodes 1 to 2 years before planting, when steps to reduce these pathogens can be more easily taken. If high populations of plant-parasitic nematodes are found, special rotational crops (for dagger nematodes) or soil fumigation are usually required to reduce damaging populations (see Chapter 3 for more information on management options). General information on sampling for nematodes is presented in later sections of Chapter 1; Appendix B contains sampling instructions and information specific to various labs to which samples can be sent.

In addition to nematodes, fields previously planted to tomato, potato, tobacco, eggplant, pepper, cucurbits, and some strawberry, black raspberry, and blackberry cultivars may have well-established populations of the verticillium wilt fungus. Fields previously planted to strawberries may have high populations of the soilborne fungus *Phytophthora fragaria*, which causes red stele or other root-rotting diseases. Fields planted to other fruit may harbor other *Phytophthora* species.

Small fruit crops should not be planted immediately after a heavy sod, as the plants may suffer severe root damage caused by high populations of white grubs (large, fleshy, C-shaped larvae of June beetles and other species of beetles) feeding on the roots. If a sod-covered area must be used, plant corn or a small grain for at least 1 year before planting strawberries, use the rapeseed rotation with plow down outlined in Appendix A, or treat with a preplant insecticide. In addition to potential problems with high grub populations, grass can become a serious weed problem in strawberry plantings, as can other certain species. Avoid sites heavily infested with sedge, nutgrass, quackgrass, Johnsongrass, and/or thistles, or treat with systemic herbicides before planting. Cover cropping with certain cover crops for 1 to 2 years before planting is also a good way to reduce weed species at a given site.

Finally, raspberries are particularly susceptible to crown gall disease (caused by the bacterium *Agrobacterium tumefaciens)*. Sites with a history of crown gall are best used for other less-sensitive crops such as strawberries, blueberries, and vegetables. Soil fumigation is not generally effective in eliminating a crown gall problem.

Planting in areas where field crops, particularly field corn and soybeans, were previously grown takes advantage of residual fertility and weed control, but beware of possible herbicide carryover that can seriously damage newly set fruit plants. Tissue culture–produced plants are particularly susceptible to any residual herbicide. A bioassay to test for safety can be conducted by germinating seedlings of a susceptible crop in soil from the field to be used (see Appendix A for details on steps to follow).

Desirable Preceding Crops

Small-grain crops such as oats, rye, and wheat are good choices for the year or two before planting, as they increase organic matter while supporting few of the pests that can attack small fruit plantings. Field and sweet corn, due to herbicides that can be used in corn production, can afford an opportunity to control problem weeds in a field, but herbicide carryover can be a problem. If triazine herbicides were used, a bioassay should be done to test for residual herbicide before planting a berry crop (see Appendix A for information on how to do this). Plants in the grass family (small grains and corn) do not become infected with crown gall or TmRSV. Pumpkins and other vine crops have few pests in common with berry crops, with the exception of nematodes and verticillium wilt on susceptible cucurbit cultivars. Sudangrass or sorghum/sudangrass hybrids can do much to increase soil organic matter content. Cover crops and green manures that can be used in rotations are discussed in detail in the following chapter on soil management and nutrition.

DETERMINING WHETHER FUMIGATION IS WARRANTED

In most cases, small fruit crops can be successfully grown without fumigation. Fumigation is not routinely recommended in the Mid-Atlantic region when long crop rotations can be used for disease, insect, and weed management. Long rotations provide opportunities to minimize many problems during the growth cycle of other crops. Beneficial practices such as selecting cultivars with disease resistance and maintaining a high organic matter content can also contribute substantially toward making fumigation unnecessary. However, in some cases, such as when a grower has limited acreage, long rotations are not possible.

When fruit sites are replanted to fruit crops, the plants often show signs of early plant decline or fail to reach their full productive level. Physical and biological reasons cause such poor performance. Small fruit crops are perennial, and populations of soilborne plant pathogens and plant-parasitic nematodes can increase over time in and around the plant root zone. On new sites with low populations of plant pathogens, plants have a window of several years before pathogen populations reach damaging levels as long as clean planting stock is used. On old fruit sites or other sites with high populations of pathogens and plant-parasitic nematodes, however, the roots of newly set fruit plants come under attack early, shortening the productive life of the planting. In addition, soil compaction with resultant decreased internal water drainage adds to the stress on perennial plants over time. This is especially true for many small fruit crops where the root zone is fairly shallow. For this reason, when old sites are replanted, fumigating first is often necessary to destroy the established soil ecosystem, along with its established population of organisms that feed on berry plants. This can mean chemical fumigation or—in the case where dagger nematodes are the only problem—biofumigation using certain green manure crops. Once this is accomplished, newly set plants can establish themselves. Chemical fumigation is discussed in Chapter 3. Some environmentally friendly alternatives to fumigation, and the topic of biofumigation, are discussed in the chapter on soil management and nutrition. When high nematode populations are suspected, test soil for nematodes as described below.

SAMPLING FOR NEMATODES

Nematode assay packets are available from locations listed in Appendix B. Since nematodes are usually not uniformly distributed in a field, you should follow a carefully prescribed sampling procedure to obtain root and soil samples representative of the area surveyed. Samples can be taken anytime, as long as the soil is moist and the temperature is above 40°F. If there has been a prolonged dry spell, or if the soil has been saturated with water for an extended period, wait until normal soil moisture conditions return before sampling. To take samples, follow these steps.

If the area to be sampled is fairly uniform and not too large (less than one acre), one composite sample will suffice. If the area is larger, divide the site into smaller sections of approximately equal size and take composite samples from each block. Keep in mind that the smaller the area sampled, the more accurately the sample will represent the site.

In each field to be assayed, take a sample from each area that has a common cropping history and that will be planted with a single crop. For example, if a one-acre field is to be planted with strawberries and if half the field was in pumpkins last season and the rest was fallow, collect a sample from each area.

If the soil in the area to be sampled is variable, such as being composed of a heavy clay soil in one portion and a sandy soil in another, take one composite sample from each soil type.

Preferably using a 1-by-12-inch sampling tube (or a trowel, small shovel, or similar tool if a sampling tube is unavailable), take at least 20 cores of soil from each sampling area. Samples should be taken to a depth of 8 to 10 inches.

Soil samples should be taken from the area where the feeder roots are found. Therefore, if a crop is present, take samples from within the rows and avoid the row middles.

Do not sample from dead or nearly dead plants. Nematodes feed on live roots and may migrate away from dying plants. Therefore, when sampling problem areas, take samples from adjacent plants that either appear healthy or show early symptoms of stress.

Handling Nematode Samples

Samples must be properly handled and shipped to ensure that the nematodes remain alive until they are processed in the laboratory. Make certain to include all the information requested on the nematode assay form that you receive with the assay packet. This information is needed for identifying the sample and helping to interpret assay data. If you collect more than one sample, you must assign a field number to each area sampled and place that number in the appropriate area of the form. Each plastic bag should be sealed tightly by tying it with a twist tie. A separate assay packet must be used for each composite sample.

Keep samples out of direct sunlight to avoid overheating. Samples may also be damaged by heat if they are stored in the trunk of a car or other hot location. Use a Styrofoam cooler to keep samples cool. Heat kills nematodes, and dead nematodes are unsuitable for identification. When the assay forms are completely filled out and the plastic bags are sealed, place the samples in a suitable container and send or bring them promptly to your closest nematode diagnostic lab (see Appendix B for addresses). Delivery within 1 to 2 days is imperative.

If results from the nematode test indicate that control is warranted, one option is to use biofumigation with a green manure crop as described in Chapter 2. A step-by-step description of a more involved two-year biofumigation protocol is found in Appendix A: Expanded Special Topics. A second option is to use chemical fumigation. The latter may be warranted especially when soilborne diseases or weeds are a problem as well.

CHOOSING A SOURCE OF PLANTS

The most important decisions affecting the profitability of fruit operations are made before planting. The quality of the plants purchased is important. Plants labeled or sold as “registered” stock, available from nurseries in a few states, are grown from tested virus-free parent plants in isolation under supervision from each state’s Department of Agriculture. When available, these plants are best for any long-term investment. Plants sold as “certified” are good, but they are not the same as registered stock. Certified stock is grown under state supervision and is inspected and found to be free of most diseases and insects, but the plants may still harbor some viruses, diseases, or insects. Plants propagated from your own fields or other unsupervised sources, even when they appear healthy, are a risky choice because they may be symptomless carriers of viruses, pathogenic fungi, insects, and bacteria. Given the cost of establishing the planting and potential profit that can come from a healthy planting, choosing a certain plant source because it is the cheapest option is often a poor way to try to save money. Nursery sources for small fruit plants are listed in Appendix C.

ORGANIC PRODUCTION

Organic produce is currently the fastest-growing market segment in produce sales. If produce is to be grown organically, many factors need to be considered long before planting begins.
Initial investment in organic production is high due to certification costs and increased time and labor for management; however, returns can be on average 10 to 20 percent higher than on conventionally produced products, provided that a premium market can be identified.

The U.S. Department of Agriculture (USDA) regulates the term “organic.” To become certified organic, growers must follow production and handling practices contained in the National Organic Standards (NOS) and must be certified by a USDA-accredited certifying agency. Growers whose annual gross income from organic products is $5,000 or less can be exempted from certification. In this case growers must continue to use production and handling practices in accordance with the NOS, and some restrictions regarding labeling and combination with other organic products apply. Certified organic production is typically preceded by a three-year transition phase during which prohibited materials cannot be used. If prohibited materials have not been applied to an area, the transition phase may be less than three years.

Consider the following questions before initiating organic production:

1. Does a market for organic berries exist in your area?
2. Are adequate resources and materials available to produce an organic crop, particularly in the area of pest and fertility management?
3. Are you willing to devote more time to monitoring pests?
4. Are you willing to devote more time to managing soil fertility?
5. Are you willing to devote more time to record keeping?

If you answered “yes” to all of the above, organic production may be for you.

Organic, sustainable, and conventional small fruit growers use many of the same management practices. However, for organic growers some management practices may differ in following the new production and handling requirements contained in the NOS (the standard can be viewed at **www.ams.usda.gov/AMSv1.0/nop**). Also, the importance of cultural controls is amplified in organic production, and maintenance of soil fertility requires more planning compared to conventional production. This topic is discussed more fully in the next chapter.

Growers beginning the transition from nonorganic to organic production may wish to consider a pretransition phase if pest pressures are high in the planting area. A pretransition phase is a cross between organic and nonorganic production. During this phase, conventional pesticides are used along with organic tactics to reduce pest pressures. Once pest pressures are reduced, organic pest-management measures are used exclusively.

Growers may market berries from wild plantings as organic, providing prohibited products (see **www.ams.usda.gov/AMSv1.0/nop**) have not been applied to the planting in the three years prior to harvesting. Also, the berries must be harvested so that the environment is not harmed and the planting will grow and produce berries in subsequent years. Consult local and state regulations concerning gathering berries from property that is not privately owned.