The Vegetable and Small Fruit Gazette

Vol. 7, No. 2- February 2003

Horticulture Department
The Pennsylvania State University

In this Issue:

Tip for the Month: "Education is not the filling of a pail, but the lighting of a fire" - William Butler Yeats

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Comments from the Editor

Bill Lamont, Department of Horticulture

The month of February is full of educational opportunities, so be sure to check the list of upcoming meetings at the end of gazette. I want to thank Scott Guiser for his excellent article "Sinbar for First-year Strawberry Plantings", and I look forward to Tim Elkner's article that will appear in the March issue and also want to encourage my colleagues from other departments to contributed articles throughout the year. If you have an event that you would like to advertise, please send it to me. As always, the Vegetable and Small Fruit Gazette Team encourages your feedback so that we can better serve your needs and address your concerns.

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Schedule for Agent Articles

Bill Lamont, Department of Horticulture

March	Tim Elkner
April	Lee Young
May	George Perry
June	Tom Butzler
July	Eric Oesterling
August	Tom Ford
September	Cheryl Bjornson
October	Mary Conklin
November	John Esslinger
December	Andy Muza

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Sources of Asparagus Crowns and Seeds- 2003

Michael D. Orzolek, Department of Horticulture

Jersey Asparagus Farms, Inc. - Has most of the Male Hybrid varieties from the Rutgers
P. O. Box 307, RFD #3 Breeding Program.
Newfield, NJ 08344
Phone: (609) 358-2548

Nourse Farms, Inc.
Box 485, RFD
So. Deerfield, MA 01373
Phone: (413) 665-2658
Johnny's Selected Seeds
955 Benton Ave.

Winslow, ME 04901-2601
Phone:(800) 854-2580

W. Atlee Burpee & Co.
300 Park Ave.
Warminster, PA 18991-0001
Phone: (800) 888-1447

Park Seed Co.
1 Parkton Ave
Greenwood, SC, 29649
Phone: 800-213-0076

Otis S. Twilley Seed Co., Inc.
121 Gary Road
Hodges SC 29653
Phone:(800) 622-7333

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2002 Sweet Spanish Onion Variety Trial

Mike Orzolek, Department of Horticulture

Layout: Plot size: Two rows/bed 12.5' long x 6"apart

Transplanting Date: April 10, 2002

Production system: raised bed with silver mulch and 2 rows of drip tape

Harvest Date: August 9, 2002

Date Graded: September 10, 2002

Design: Randomized Complete Block with 4 replications

Varieties	Seed Source	Bulb color
Redwing	Seedway	red
Mars	Seedway	red

Cascade	Emerald	yellow
EMSP 944	Emerald	yellow
EMSP 966	Emerald	yellow
Condor	American Takii	yellow
Eagle	American Takii	yellow
T-433	American Takii	yellow
T-441	American Takii	yellow
T-439	American Takii	yellow
Renegade	SunSeeds	yellow
Ranchero	SunSeeds	yellow
Granero	SunSeeds	yellow
Candy	Seedway	yellow
Super Star	Harris Seeds	white

After grading the onions on September 10, 2002, 10 bulbs per replicate per variety were placed in 20 lb paper potato bags and brought on campus to Dr. Luke LaBorde's Lab in the Food Science Building for sugar and pyruvate analysis of bulbs. Also on the same day, 16 bulbs of each onion variety were placed in wooded crates and placed on a wooden pallet in the potato storage to evaluate how long each variety would store under a temperature range of 50°F in September to 38°F in December.

Table 1. The marketable yield and grade of Sweet Spanish onion varieties grown on the Horticulture Research Farm, Russell E. Larson Research Center, Rock Springs, PA - 2002

Variety	Marketable	Percent Grade				
	Yield T/A	Med.	Large	Jumbo	Colossal	Super
Colossal						
Redwing	21.3	0.0	2.3	27.4	59.0	10.7

Mars	24.3	2.1	8.0	27.0	51.3	11.6
Cascade	27.9	1.5	2.0	14.3	62.9	19.4
EMSP 944	25.7	0.0	2.7	18.6	62.2	15.8
EMSP 966	23.0	3.7	4.7	24.1	59.3	8.2
Condor	29.4	0.0	1.6	11.1	67.4	19.8
Eagle	29.0	1.0	3.1	12.8	66.2	16.9
T-433	30.4	1.0	1.0	11.6	63.0	23.6
T-441	19.2	0.0	1.0	39.7	55.7	3.6
T-439	27.6	1.0	1.0	19.4	61.2	17.3
Renegade	26.9	0.0	2.7	14.5	61.6	21.3
Ranchero	24.5	0.0	1.7	24.9	60.8	12.0
Granero	26.9	0.0	2.0	18.8	64.5	14.7
Candy	28.3	0.0	1.0	10.0	68.3	21.1
Super Star	29.4	0.0	0.0	13.0	56.5	30.4

°Super Star was an observational variety that was transplanted 6 days later than the other varieties.

Table 2. The varietal characteristics of Sweet Spanish onions grown on the Horticulture Research Farm, Russell E. Larson Research Center, Rock Springs, PA - 2002

Variety	Total Bulbs	No.	No.	No.
	Avg. Brix			
	Harvested	Rot	Doubles	Cull
		per 50		

planted

Redwing	44.9	1.0	2.3	0.0	9.6
Mars	47.4	1.8	0.0	0.0	9.0
Cascade	49.0	0.3	0.0	0.3	7.8
EMSP 944	47.4	0.3	0.0	0.5	8.0
EMSP 966	48.9	0.3	0.0	0.0	8.3
Condor	49.4	0.5	0.0	0.0	8.4
Eagle	49.1	0.5	0.0	0.0	9.3
T-433	50.0	0.0	0.0	0.0	7.6
T-441	49.9	0.0	0.0	0.0	9.3
T-439	49.0	0.0	0.0	0.0	8.4
Renegade	48.4	0.0	0.5	0.5	7.2
Ranchero	48.2	0.3	0.0	0.3	7.6
Granero	49.6	0.0	0.0	0.5	8.3
Candy	49.8	0.0	0.0	0.0	8.1
Super Star	46.0	0.3	0.0	0.0	7.9

°Super Star was an observational variety that was transplanted 6 days later than the other varieties.

Table 3. Storage evaluation of Sweet Spanish onion varieties grown on the Horticulture Research Farm, Russell E. Larson Research Center, Rock Springs, PA - 2002

Variety	October 18 % marketable bulbs	December 18 % marketable bulbs
Redwing	92.3	84.6
Mars	92.8	85.7
Cascade	100.0	93.5
EMSP 944	100.0	92.8
EMSP 966	100.0	100.0
Condor	100.0	100.0
Eagle	100.0	100.0
T-433	100.0	100.0
T-441	93.8	93.8
T-439	100.0	100.0
Renegade	100.0	100.0
Ranchero	100.0	100.0
Granero	100.0	100.0
Candy	100.0	93.8

Onion varieties were placed in wooded crates and placed on a wooden pallet in the potato storage facility at 50°F in September dropping to a low 38°F in December - storage was unheated.

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Thirsty Sweet Corn

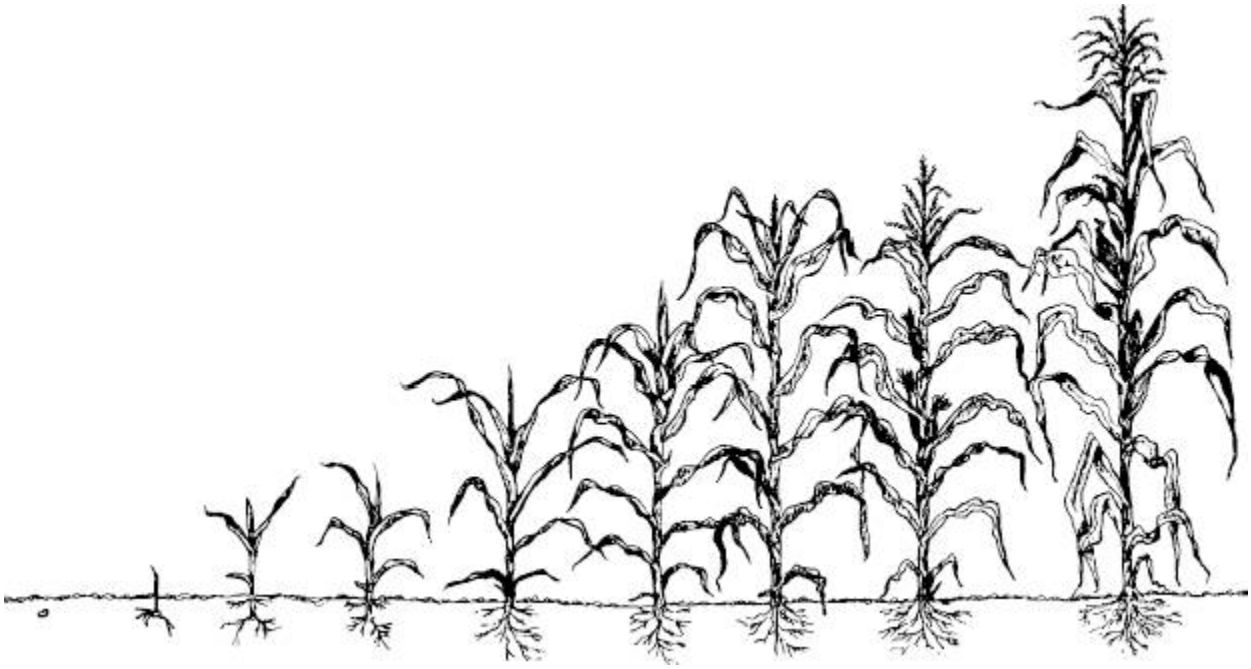
Thomas M. Butzler, PSU Cooperative Extension, Clinton County

I was working with a grower this year trying to determine various fertility practices on sweet corn and their effects on yield and sugar content. The design was set up nicely and we waited for the season to progress to start collecting data.

Murphy's law states that "if anything can go wrong, it will". Mother Nature wanted no part in assisting us with our project. In normal years, Pennsylvania generally receives enough rainfall to produce abundant, high quality sweet corn crops; however, the summer of 2002 brought very little rain during the growing season. In fact, Ann Venneman, Secretary of Agriculture for the U.S. Department of Agriculture declared 54 counties in Pennsylvania disaster areas because of the drought.

Irrigation was applied but it was too late. I wondered, what are the critical stages of sweet corn growth as it relates to moisture stress? When would it pay to set up the irrigation system?

First, it is necessary to understand the various growth stages of sweet corn. The identification system divides plant development into vegetative (V) and reproductive (R) stages. Figure 1 illustrates the various stages of growth in corn.



Seed VE V2 VT R1 R2

Figure 1. "How A Corn Plant Develops", Special Report No. 48, Iowa State University, Reprinted February, 1996

Vegetative Stages	Reproductive Stages
VE (emergence)	R1 (silking)
V1 (first leaf)	R2 (blister)
V2 (second leaf)	R3 (milk)
V3 (third leaf)	
V(n) (nth leaf)	
VT (tasseling)	

Short periods of moisture stress in early crop development usually will not affect yield unless poor germination occurs (VE). Sweet corn goes through many vegetative growth stages (V1-V(n)) during the first several weeks. Research has shown that moisture stress at this time will affect yield but not as greatly as other life stages (Table 1). This is not to say that moisture is important at vegetative stages. Demand for moisture at V10-V11 and beyond greatly increases to meet the need of increased growth rate.

Research from several land grant universities show that the importance of moisture stress increases more as plant growth advances toward the tasseling/silking (VT/R1) stages. A sixty percent reduction in yield can occur at this time because of poor pollination and seed set (nubbins, barren tips).

Another critical stage is the kernel fill stage (R2-R3). The kernels swell, grow rapidly, and concentrate sugars in the kernel. Moisture stress at this time can cause a thirty-two percent reduction in yield.

Table 1. Approximate susceptibility to water deficits at several stages of crop development. Mark Bennett, Dept of Horticulture & Crop Science, The Ohio State University

		Reduction in yield (%)		
Crop	**Vegetative**	**Flowering & fruit set**	**Enlargement**	**Ripening**
Corn	**25**	**60**	**32**	**12**

Bean	12	52	44	12
Pea	14	46	40	-
Tomato	25	52	43	25
Watermelon	35	45	45	20
Cabbage	13	-	28	36
Onion	30	-	45	21
Potato	30	-	41	13

Of course, it would be beneficial for a grower to prevent moisture stress from ever occurring in a sweet corn field. This, however; is not always possible. Many growers have several different crops in their production mix and need to move irrigation systems around to various fields. For example, a grower may have sweet corn and strawberries in production. Along comes a dry spell during the middle of the summer and crops need to be irrigated. Although strawberry picking is more than likely done, the farmer needs to maintain the health of the strawberry plant for next spring's crop. On an acre basis, profits are greater from a strawberry operation than sweet corn operation. This grower makes an economical decision to irrigate the strawberry acreage first before moving on to sweet corn. Knowledge of corn's growth stages and periods of critical moisture stress can help a grower mitigate extensive yield reduction in their fields, especially if they have a diversified operation.

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Investigating Consumer Awareness And Potential Market Segments For Edamame

Kathleen M. Kelley and Elsa S. Sánchez, Department of Horticulture

To further understand which consumers would potentially purchase edamame and to develop a viable marketing strategy, a telephone survey was administered in the Metro-Philadelphia area from November 20 though December 1, 2002. This metro area was chosen due to the diverse representation of demographics including income, education and ethnicity. TMR, Inc., a marketing firm located in Parsippany, NJ, randomly contacted households within the metro area, resulting in a total of 401 completed responses. Participants answered questions about produce including edamame. Responses were segmented by selected demographic variables (i.e. male

vs. female) to determine if one group had more positive responses than their counterparts and therefore were essentially more likely to be potential purchasers.

Based on statistical analysis, participant responses to edamame questions were significantly different when segmented by gender (male vs. female), education (high school education vs. some college), household income (more than $50,000 vs. less than $50,000) and primary food shopper (participant vs. other household member) (Table 1). Participants who had some level of college education were more likely to: 1) be familiar with edamame; 2) purchase vegetables based on nutritional content; 3) purchase edamame after listening to statements about potential health benefits; and 4) purchase soy and soy based products in the past, than those who had a high school education. When responses were analyzed by household income more participants in the higher income category (>$50,000) had more positive responses than participants in the lower income category (<$50,000).

When responses were compared based on gender, more females reported that they purchased vegetables based on nutritional content and were familiar with or had heard of edamame than the males in the sample. If participants responded that they were the primary food shopper then they were also more likely to answer the questions with a positive response than participants who were not the primary food shopper, except when asked whether they would be likely to eat edamame after told about the health benefits. In this case 66% of both groups would be willing. No significant differences were found when responses were analyzed based on participants being vegetarian, age (= 47 vs. = 48), number of adults in the household (1 vs. 2 or more), number of children in the household (0 vs. 1 or more) and ethnicity (Asian vs. other ethnicity).

These survey results will be combined with sensory evaluation results (December 2002 issue) to develop an effective marketing strategy. Based on these results we will target selected consumer segments who are more likely to purchase edamame.

Table 1. Effect of gender, education, household income and primary food shopper on consumers' responses to questions asked during a telephone survey from November 20 through December 1, 2002 in the Metro-Philadelphia area.

	Gender		Education		Household income		Primary food shopper	
Attribute	Male	Female	High school	Some college	< $50 K	> $50K	Participant	Other
Sample size (no.)	131	269	122	279	132	166	297	104
Purchases vegetables based on nutritional content (%)	57	72*	58	71*	65	70*	72	53*

Familiar with or had heard of edamame (%)	4	14*	5	13*	6	12*	13	5*
Would likely eat edamame after told about benefits (%)	62	69^{NS}	58	70	65	73	66	66^{NS}
Has purchased soy or soy based products (%)	53	59^{NS}	43	63	51	59	60	48*

Nonsignificant (^{NS}) or significantly (*) different at P=0.05 within in categories (Gender, education, etc.) based on 2 tailed t-test.

The authors would like to thank the USDA Federal State Marketing Improvement Program for supporting current and future edamame marketing and production studies conducted by Kathleen M. Kelley and Elsa S. Sánchez.

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Soil-Borne Diseases Of Vegetable Crops

Robert L. Wick, Professor Plant Pathology, University of Massachusetts (This article taken from "Vegetable Notes" produced by the University of Massachusetts, Vegetable Program)

Soil-borne diseases are caused by plant pathogens (mostly fungi and nematodes) that can survive in the soil indefinitely. Indeed, soil is their natural habitat. Typically, soil-borne pathogens cause root and crown rot but several cause fruit rot and foliage blight. Most plant pathogens that cause disease of the foliage, such as Alternaria, and Septoria, cannot survive in soil. Despite a few exceptions to these generalizations, it is useful to categorize pathogens as either soil-borne, or not soil-borne, because it helps us understand how to manage them more effectively.

Soil-borne pathogens are difficult to control because they have the ability to survive for many years in the soil. Plowing crops into the ground after the growing season does not help reduce soil-borne pathogens; it's like throwing brier rabbit into the briar patch. The most important practice is to avoid planting susceptible crops into contaminated soil.

Crop rotation, along with other cultural practices, and fungicide applications, are important tools for managing plant diseases. An integration of management practices is the most effective approach. This article addresses practices that can be targeted to specific soil-borne diseases. Knowing exactly what diseases you are dealing with is the most important first step in developing an integrated pest management program. Make sure your diseases are accurately diagnosed.

Oomycetes

Pythium, Phytophthora, and the downy mildews are often referred to as "water-molds or primitive fungi". They are not "true fungi" but we refer to them as fungi because they look like and behave like fungi. They are more properly known as oomycetes. Oomycetes survive for many years in the soil by producing specialized resistant spores called oospores. These thick-walled structures germinate only when root secretions from a susceptible host are present, and soil moisture is abundant.

Pythium is a common inhabitant of all field soils and has a very wide host range. Though it is a weak pathogen in the field, and rarely a cause for concern, it often causes damping-off in the greenhouse. This is because Pythium does not compete well with other soil-inhabiting fungi and bacteria, which are generally absent in soilless growing media used in greenhouses. When starting transplants in the greenhouse choose a soilless growing medium that drains well. Avoid contaminating the medium with soiled hands, hose-ends and tools. Avoid overwatering and overfertilizing. Pythium occasionally causes disease to seedlings in the field when soil is excessively wet and cool. Also, transplants are more susceptible during the first week or two after setting out.

Phytophthora is closely related to Pythium but is different in several ways. Phytophthora is much more pathogenic but unlike Pythium it is not widely distributed. Also, Phytophthora species that attack vegetable crops generally have relatively narrow host ranges.

Phytophthora infestans attacks only tomato and potato. It behaves like a downy mildew in that it causes blights of the foliage, and spores are easily blown throughout the field. It generally does not take up residence in the soil because it needs two different mating types (similar to male and female) to produce the oospores that allow long-term survival. For this reason, we don't see this disease repeating itself in the same field year after year. Typically, it is brought in on seed potatoes, and its spores can be blown for a mile or so in a good storm. Phytophthora infestans can survive in potato cull piles. Diseased plants should be plowed into the ground to prevent further spread. It is especially important to bury cull piles of potatoes and tomatoes. There are several fungicides registered for use on potatoes and tomatoes but they may not perform well when disease pressure is significant.

Phytophthora capsici causes blight of cucurbits, tomatoes, peppers and eggplant. Crown rot and fruit rot are the most common symptoms (Fig 4, next page). Often, a powdery or mealy bloom of whitish growth appears on the surface of infected fruit. This Phytophthora species can survive for very long periods of time in the soil. Plowing infected plant debris into the ground will not help, and may increase the level of soil contamination. However, chisel plowing may improve drainage, and that can help reduce Phytophthora blight. There may be some benefit gained from removing the diseased fruit from the field. However, do not dispose it on agricultural land. Diseased fruit should be landfilled or placed where cucurbits, peppers and tomatoes will never be grown. Phytophthora capsici can contaminate farm ponds if fields with diseased plants drain into the pond. Avoid planting susceptible crops on land known to be contaminated with

Phytophthora capsici. Avoid bringing contaminated soil to clean fields with plows, etc. Plow and disc contaminated lands last and spray the soil off equipment before moving to new fields.

Downy mildews are caused by a number of different species. Most have a narrow host range, attacking a single genus or family of plants. They cause blights of the foliage rather than root and crown rot. **Peronospora tabacina** is one of the most destructive species and causes blue mold of tobacco. This pathogen does not survive in the northern states and must travel up the eastern seaboard, hopscotching from field to field. It can also overwinter on ornamental tobacco and volunteer tobacco in greenhouses.

Downy mildews of crucifers are caused by **Peronospora parasitica**. Most crucifers, including weeds are susceptible. Disease occurs when temperatures are between 50 and 60 F and plants are wet for 12 to 24 hours. The pathogen can survive in the soil by forming oospores. Rotate away from crucifers for at least two years. Some broccoli cultivars are resistant, see your seed catalogues. Registered fungicides include: Bravo Ultrex, Aliette, Maneb and Ridomil Gold EC/Bravo.

True Fungi

Rhizoctonia causes damping-off, crown rot and root rot of a variety of vegetable crops. As is the case with Pythium, Rhizoctonia is mostly a problem in the greenhouse. Several fungicides are available to protect seedlings. Occasionally, head rot of cabbage, "soil rot" of squash, or stem rot of crucifers will occur in the field. Rhizoctonia is generally not a problem in field soil and fungicide applications are usually not warranted.

Sclerotinia blight affects a wide range of vegetable crops but not corn or grasses. **Sclerotinia sclerotiorum** survives in the soil by producing sclerotia, hard black structures that are 1/8 to 1/2 inch in length. They are usually embedded in the fruit and stems of the plants. Sclerotia that are within 1 to 2 inches of the soil surface germinate when the soil has been saturated for about a week and temperatures are between 50 and 70 F. They may directly infect stems, or produce tiny mushrooms, which disperse millions of spores. The spores do not have enough energy to germinate and infect healthy tissue. However, spores that land on dying flowers germinate and develop enough growth to cause infection once the flower drops to a stem or fruit. If conditions for disease are present, fungicides should be used when the plants come into flower. Once the disease has become established there is no point in using fungicides because there are no secondary disease cycles. Sclerotia that develop after infection cannot germinate until the following year.

If practical, remove diseased plants and fruit from the field. A single head of cabbage can have thousands of sclerotia. If removal is not practical, it is better to plow the infected plants into the soil than disking them in. Plowing under the diseased plants will bury the sclerotia to a depth that will inhibit germination, while disking will tend to place the sclerotia in a more favorable place to germinate. Like many seeds, sclerotia will only germinate when they are within an inch or two of the soil surface. Improving drainage by chisel plowing would also be of value. When a soil is infested with Sclerotinia, it is recommended to rotate away from susceptible crops for 7

years.

Fusarium crown rot of squash and pumpkin **Fusarium solani** causes a crown rot of squash, gourds and pumpkins. The disease appears to be more prevalent now than in previous years. Plants develop a soft, water-soaked rot at the crown of the plant. Wilting and collapse soon follow . Fungicides are of no value, rotate away from cucurbits for at least 4 years.

Fusarium wilt is caused by **Fusarium oxysporum**. Unlike Fusarium solani, F. oxysporum, does not cause rotting. This fungus enters through the roots and grows up through the water-conducting cells of the plant into the stem. Symptoms of Fusarium wilt include yellowing and wilting, often on one side of the plant. A cut through the stem often shows discoloration of the vascular system. This fungus is highly host specific. For example, Fusarium wilt of basil occurs by a specific strain that can only cause wilt in basil. Fusarium wilt of tomato only affects tomato. Fungicides are of no value, rotate with another crop for at least 4 years. Some cultivars have been bred to be resistant to Fusarium oxysporum.

Verticillium wilt is caused by **Verticillium dahliae**. Verticillium infects plants in the same way that F. oxysporum does. Yellowing, scorching and wilting follow infection. Discoloration of the vascular system may be evident. This fungus has a very wide host range but some specificity exists. For example, strains that infect maple trees may be weak pathogens of vegetable crops. A variety of vegetable crops can be infected by the same strain. Eggplant is particularly susceptible. A combination of lesion nematodes and Verticillium causes "early dying" in potato. Fungicides are of no value. Avoid planting susceptible crops in contaminated fields. Some resistant cultivars are available.

Nematodes

There are many species of plant parasitic nematodes, and most of them have wide host ranges. Every handful of soil has a few plant parasitic nematodes but they are not a problem unless they build up to high numbers. Root-knot, lesion and stubby root nematodes occasionally build up enough to cause problems. Dagger and stubby-root nematodes can transmit viruses such as tobacco ringspot virus and tomato ringspot virus. **Root-knot nematode (Meloidogyne hapla)** is the most serious nematode pest in the New England region. It is not widely distributed, but there are fields where it is a perennial problem. Root-knot nematodes can result in significant losses to tomato, lettuce, carrots, parsnips and a few other crops. Above ground symptoms, wilting and stunting, are not unique to nematodes. Below ground symptoms are fairly unique, small galls occur on the roots.

Galls are similar in size to the nitrogen fixing nodules on legumes. Some clubroot galls can be of similar size but crucifers are not good hosts of root-knot nematodes. Root-knot is very difficult to control short of fumigation or nematicides, both rather risky ventures. Resistant cultivars are available for some crops, and non-susceptible crops can be grown. Corn and grains are not hosts of root-knot. Sudangrass and rapeseed may reduce populations of some nematodes and reduce their damage. Soil incorporation of two month-old Sudangrass was found to be more effective against root-knot than three month old plants.

Lesion nematodes (Pratylenchus) are widespread in soils and are not a problem unless they build up to large populations. This can happen when a susceptible crop is grown year after year. With potatoes, lesion nematodes plus Verticillium results in a disease called "early dying". Corn and potato plantings occasionally develop high populations. A soil and root assay is necessary to determine if populations are damaging. Resistant cultivars are not available but lesion nematodes are not frequently a problem.

Stubby-root nematodes (Trichodorus), along with the dagger nematode, can transmit viruses. When populations are high, they can also cause injury by themselves. The presence of tobacco ringspot and tomato ringspot virus indicates that one or both of the nematodes are present. Resistant cultivars are not available but stubby-root nematodes are not frequently a problem.

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Bug vs. Bug - Managing Plant Diseases with Biofungicides

Cathy Thomas, Integrated Pest Management Program
Pennsylvania Department of Agriculture

Insect Growth Regulators (IGR) are a class of chemicals considered to be biorational or a compound that is less harmful to man and beneficial insects. For most IGRs there are minimal re-entry restrictions. IGRs interrupt or inhibit the life cycle of a pest in one of several ways: 1) they can mimic juvenile hormones, so that insects never enter the reproductive stage of development (become and adult); 2) they interfere with the production of chitin, which makes up the shell of insects; or 3) they can interfere with the molting process.

Timing and application of these compounds is critical since they only affect immature life stages of insects. IGRs typically take several days to have an affect on pest populations so don't expect quick results. In some cases, an insecticide must be used in conjunction with an IGR to provide adult knockdown. It is very important to inspect your crop for the insect stages that are present before using and IGR.

Because IGRs do not affect mature insects and have no toxic residues, adult beneficials released into the greenhouse after an IGR application are not likely to be affected. For example, poinsettia growers may use an insect growth regulator in conjunction with a parasite to control whiteflies. This integrated control technique offers growers a safety net when using biological controls and reduces the risk of developing unmanageable whitefly populations. For information on chemical compatability contact your biocontrol supplier or visit the Koppert BV Web site with Side Effects Database (www.koppert.nl/e0110.shtml). Always consult your biocontrol supplier before using a pesticide when using biological controls.

Most of the IGRs are synthetic compounds, however there is one IGR that is derived from the tropical neem tree, *Azadirachta indica*. Azadirachtin is an isolate from the seeds of the neem tree. For many years, the neem seed and its constituents have been studied for their possible role in pest control. Azadirachtin is a potent disrupter of insect growth in many insect orders. Several products containing Azadirachtin are now commercially available to producers and may contain varying amounts of the active ingredient. Two products currently available to growers are Neemix 4.5 ™ and Azatin XL™. These products control many different pests on both vegetable and ornamental crops.

Always read and follow pesticide labels to determine if the intended use has been approved.

Cathy Thomas
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Pruning Brambles and Blueberries

Elsa Sánchez, Department of Horticulture

It's time for dormant pruning brambles and blueberries. Actually, dormant pruning of brambles and blueberries can occur anytime during the dormant season (winter through early spring). However, in Pennsylvania March is an ideal time because any winter injury the plants may have sustained will be evident and can easily be removed.

Two main types of cuts are used in pruning brambles and blueberries; heading cuts and thinning cuts. To make a thinning cut, the branch is cut back to a side branch or to its point of origin. Thinning cuts result in a more open plant habit. To make a heading cut, the branch is cut back to a bud or stub. Heading cuts are also commonly called tipping. They result in vigorous and dense new growth.

Pruning Techniques
Summer-Bearing Red Raspberries
Pruning summer-bearing red raspberries consists of dormant pruning and floricane removal. For dormant pruning, thin damaged, diseased and weak canes. Remove canes to maintain a 1 foot wide hedgerow. Next, thin the remaining canes for 4 to 6 inch spacing between canes, which should result in 3 to 4 canes per linear foot of row remaining. Then head canes with winter injury back to living tissues and head the remaining canes to 48 to 60 inches in height, removing about 20% of the cane that had

been there.

The timing of floricane removal depends on the cold hardiness of the cultivar. For cold hardy cultivars, like 'Latham', spent floricanes are removed immediately after harvest. In plantings with disease problems thinning floricanes immediately after harvest can help with disease suppression because spent canes can be possible sources of disease-causing inoculum. It also results in increased air circulation and sunlight penetration into the planting. This will promote drying and help manage diseases that are favored by high moisture conditions. Research has shown that less cold hardy cultivars could suffer from increased winter injury if spent floricanes are removed immediately after harvest. For less cold hardy cultivars, like 'Titan', floricane removal should take place in the fall.

Ever-bearing Raspberries
Ever-bearing raspberries can be pruned to produce two crops or, more commonly, one crop. When pruning for two crops employ the same methods as used for summer-bearing red raspberries.

For one crop, mow the canes as close as possible to the ground during the dormant season. As with summer-bearing red raspberries, maintain a 1-foot wide hedgerow. This pruning strategy will eliminate the summer crop.

Black and Purple Raspberries
Pruning of black and purple raspberries consists of dormant pruning, floricane removal and summer tipping. For dormant pruning, thin diseased, damaged and weak canes. Then thin to 5 to 10 canes per clump. Tip the canes to 36 to 48 inches in height if they hadn't been tipped during the previous summer. Lastly, head lateral branches to 4 to 7 inches long for black raspberries and to 6 to 10 inches long for purple raspberries.

During the summer remove spent floricanes immediately after harvest. Summer tipping will begin in June and ends at the start of harvest. Summer tip the canes to 36 to 48 inches high when 3 to 4 inches of the cane needs to be removed. If more than 3 to 4 inches is removed at a time the risk of the canes becoming diseased with cane blights increases. The canes will vary in length and will not need to be summer tipped at the same time. For this reason it will be necessary to check the planting several times, generally every 2 weeks.

Blackberries
Blackberry pruning is dependent on the habit of the cultivar. Erect cultivars are pruned similar to black and purple raspberries and consists of dormant pruning, floricane removal and summer tipping. Erect cultivars can be further grouped based on the presence or absence of thorns. Erect thorny cultivars include 'Chesapeake', 'Chickasaw', 'Choctaw', 'Darrow', 'Illini Hardy', 'Kiowa' and 'Shawnee'. Erect thornless cultivars include 'Apache', 'Arapaho' and 'Navaho'. When dormant pruning erect blackberries thin the canes to 10 inch spacing in the hedgerow. Then head lateral branches to 12 to 18 inches long. In the summer remove spent floricanes immediately

after harvest. For summer tipping employ the same methods as used for black and purple raspberries.

Trailing blackberry cultivars include 'Chester', 'Dirksen', 'Hull' and 'Triple Crown'. These cultivars are tied to trellises in during the summer. To dormant prune trailing blackberries thin for 4 to 6 canes per clump. Next, remove the lateral branches on the lower 3 feet of the cane. Then head the remaining lateral branches to 12 to 18 inches in length.

Floricanes of trailing blackberries are removed after harvest. In the summer, tip canes to 6 inches above the highest trellis wire when 3 to 4 inches of the cane needs to be removed. As with black and purple raspberries the planting will need to be checked several times in the growing season for summer tipping.

Blueberries
After planting, the only pruning blueberries need is dormant pruning. For a newly established planting (2 years or less in the ground) thin weak and low branches. Then head the vigorous branches back 4 to 6 inches. Lastly, remove all of the flower buds. Flower buds are typically located on the terminal 3 inches of the canes and are plumper than leaf buds. Leaf buds are located on the lower parts of the branches and are more pointed than flower buds. By removing the flower buds the plant will direct more energy to establishment. A well established planting can be fruitful for up to 50 years.

For a planting that has been in the ground for 2 years or more, aim for 15 to 20 percent of young canes (less than 1 inch diameter at the base) and 15 to 20 percent of old canes (2 inch diameter at the base). The remaining canes will fall somewhere in the middle. A mature plant (after about 6 years in the ground) will have 10 to 15 canes. Pruning consists of thinning damaged and diseased canes and thinning spindly fruiting branches. Then remove 1 to 3 more canes so the plant has 10 to 15 canes. Canes will generally not need to be removed until the plants are 6 years in the ground unless they are damaged, diseased or the planting is extremely vigorous. Prune cultivars with an open or spreading habit to be more erect than their tendency and those with erect or upright habits to be more open. Open or spreading cultivars include 'Berkeley', 'Bluetta', 'Coville', 'Weymouth' and 'Patriot'. Erect or upright cultivars include 'Bluecrop', 'Blueray', 'Collins', 'Darrow', 'Elliot', 'Jersey' and 'Lateblue'.

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Sinbar for First-year Strawberry Plantings

Scott Guiser, PSU Cooperative Extension, Bucks County

Weed control in the establishment year of matted row strawberries isn't easy. But recent changes to the Sinbar label give growers a new tool in the battle against annual weeds.

Actually, Sinbar is one of the oldest preemergence herbicides used in strawberries. Previous labeling allowed use only at renovation and during dormant periods. Now it may be used at low rates (2-4 ounces of Sinbar 80 WP per acre) at planting and during the establishment year.

Research and field experience has shown that strawberries are tolerant of 2-3 ounces of Sinbar when it is applied just after planting and before new growth begins. It can be tank mixed with 3-4 lbs Devrinol 50 WP to broaden the spectrum of weeds controlled.

Later in the season as weeds break through, growers may cultivate, then reapply Sinbar at 3-4 ounces per acre. However, at this time it is important to wash the Sinbar off strawberry leaves through irrigation or timely application that coincides with rainfall. Injury to strawberry plants can occur through foliar absorption of Sinbar.

A late summer/early fall application of 3-4 ounces per acre will aid in control of winter annual weeds such as chickweed. Growers should note that the maximum amount of Sinbar that may be applied is per 8 ounces per year. Lower rates, as specified on the label, are recommended for light textured soils and soils with 1-2 % organic matter. Sinbar should not be used on soils with less than 0.5 % organic matter.

Strawberry varieties vary in their sensitivity to Sinbar. Some varieties are tolerant (Earliglow) while others are known to be sensitive (Guardian). Each grower should try small plots to observe tolerance before making whole field applications.

All growers should get a copy of the Sinbar supplemental label (http://www.cdms.net/ldat/ld193000.pdf) and read it thoroughly before using Sinbar on first-year strawberries. Sinbar 80 WP is a Dupont product.

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Pesticide Groups for Berries- Part II

Kathy Demchak, Department of Horticulture

As mentioned last month, this month we'll cover the groups that berry insecticides and miticides fall into based on target site of action for resistance management purposes. Fungicides were covered last month and herbicides will be covered next month. Only groups which contain insecticides labeled for berries are listed below. This information was almost entirely obtained from "Pesticide Registration (PR) Notice 2001-5, Guidelines for Pesticide Registrants on Pesticide Resistance Management Labeling" on EPA's Web site (http://www.epa.gov), with additional info from IR-4.

Insecticides and Miticides:
Where subgroups are listed, compounds between subgroups can generally be alternated with each other for resistance management.

Group 1 is the acteylcholine esterase inhibitors (interrupt the transmission of nerve impulses).
Group 1A - Carbamates: carbaryl (Sevin), methomyl (Lannate)
Group 1B - Organophosphates: azinphos-methyl (Guthion), chlorpyrifos (Lorsban), diazinon, malathion, naled (Dibrom), and phosmet (Imidan)
Group 2 is GABA-gated chloride channel antagonists (cause repetitive nervous discharges).
Group 2A - Chorinated cylodiones: endosulfan (Thiodan, Phaser)
There is a Group 2B, phenylpyrazoles, but no insecticides labeled for berries fall into this group.
Group 3 - Sodium channel modulators, which also results in repetitive nervous discharges, leading to paralysis. This group consists of the synthetic pyrethroids, and pyrethrins: fenpropathrin (Danitol), bifenthrin (Brigade), esfenvalerate (Asana) and one of the active ingredients in Pyrellin.
Group 5 - acetylcholine receptor modulator: spinosyns (Success, SpinTor)
Group 6 - Chloride channel activators - Avermectins (interfere with insect nerve receptors): abamectin (Agri-Mek)
Group 10 - Mite growth inhibitors with unknown or non-specific target sites of action: hexythiazox (Savey)
Group 11 - Bt microbials with various subgroups depending on the strain: Bt (Dipel, others)
Group 12 - Organotin miticides: fenbutatin oxide, aka hexakis (Vendex)
Group 18 - Ecdysone agonist disruptor (disrupts insect molting): tebufenozide (Confirm)
Group 20 - Site II electron transport inhibitors - dicofol (Dicofol and Kelthane)
Group 21 - Site I electron transport inhibitors - rotenone (the other ingredient in Pyrellin)

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Potato Musings

Bill Lamont, Department of Horticulture

Hope to see everyone at the potato sessions to be held on Tuesday afternoon, February 4, 2003 and all day Wednesday, February 5, 2003 at the Mid-Atlantic Fruit and Vegetable Convention held at the Hershey Lodge and Convention Center, Hershey, PA.

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Upcoming Meetings

Bill Lamont, Department of Horticulture

Local

February 11, 2003: Cambria and Somerset Regional Vegetable and Potato Meeting, Ebensburg, PA. Contact: Mike Harteis (814) 472-7986

February18, 2003: Northeast Vegetable Growers Meeting, Thompson's Dairy Bar, Clarks Summit, PA. Contact: John Esslinger (717) 963-4761

March 4, 2003: Schuylkill County Regional Vegetable Growers Meeting, Extension Office, Pottsville, PA. Contact: George Perry (570) 622-4225

March 5, 2003: Lehigh/Schuylkill County Potato Growers Meeting, Schnecksville Grange in Neffs PA. Contact: Bob Leiby (610) 391-9840

March 5, 2003: Southeastern Vegetable Growers Meeting, Heritage Restaurant, Franconia, PA. Contact: Mary Conklin (610) 489-4315

March 6, 2003: Kutztown Vegetable Auction Growers Meeting, Fleetwood Grange Hall, Kutztown, PA. Contact: John Berry, Lehigh County Extension Office (610) 391-9840 or Laura McNutt, Berks County Extension Office (610) 378-1327

March 18, 2003: Central Vegetable Meeting, Pleasant Gap, PA. Contact: Tom Butzler, (570) 726-0022

March 19, 2003: Erie County Potato and Vegetable Growers Meeting. Contact: Andy Muza (814) 825-0900

March 20, 2003: North Central Vegetable Producers Conference, Emporium, PA. Contact: Tom Butzler (570) 726-0022

March 21-22, 2003: Passive Solar Greenhouse Workshop: Design, Construction and Year Round Production, Sonnewald Natural Foods, Spring Grove, PA. Contact: Steve or Carol Moore (717) 225-2489, or sandcmoore@juno.com.

Regional

Februrary 4-6, 2003. Mid-Atlantic Fruit and Vegetable Conference, Hershey, PA. Contact: Bill Troxell (717)-694-3596 or e-mail: wt.pvga@tricountyi.net

National

August 16-19, 2003. 31st American Society for Plasticulture Congress. The Crown Plaza, Grand Rapids, MI. Contact: Pat Heuser (814) 238-7045 or http://www.plasticulture.org

International

World Potato Conference. Kunming, China. See www.potatocongress.org