The Vegetable & Small Fruit Gazette

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Anxiety is the interest paid on trouble before it is due.

~Dean William R. Inge from The Harper Book of Quotations

So You Grow Your Own Vegetable Plants

Jeff Mizer, Penn State Horticulture Educator— Snyder County

Vegetable growers who grow their own transplants can maintain a certain degree of control not possible when buying transplants. Along with the control, however, the farmer gets more work, more risk, and more potential problems. Make sure you have a management plan to address the following situations.

Don't sow seeds too early. If you end up with leggy transplants year after year, don't blame the weather. Unless you provide excellent frost and cold weather protection in the field, there is no sense in rushing your field setting date. Often, later-transplanted vegetables catch up to the early-planted crops simply due to warmer soil temperatures and increasing heat units. Once you have selected that reasonable field setting date, then you can calculate when to sow your seeds. Remember, you can sow your seeds later and take advantage of increasing solar radiation and day length in your greenhouse and still get transplants ready in time. The following chart shows the maximum number of weeks that it takes to get a field-ready transplant.

Tomato	5-6 weeks
Pepper	8-9 weeks
Eggplant	7-9 weeks
Muskmelon	2-3 weeks
Squash	2-3 weeks
Cucumber	2-3 weeks
Celery	9-12 weeks
Onion	9-12 weeks
Cabbage	6-7 weeks
Cauliflower	6-8 weeks
Broccoli	6-7 weeks
Endive	5-7 weeks

Don't let the greenhouse get too cool. -- You don't have to have ice or freezing temperatures to get cold temperature injury. Everyone has seen the purplish foliage on vegetable plants that comes from phosphorus deficiency. At cold temperatures, plant roots can't uptake phosphorus properly. Don't let the high cost of fuel be your excuse for growing your transplants too cold.

Hardening off transplants before field planting is a worthwhile practice, but it must be done precisely. There is a fine line between hardening off and stunting. Yes, you will want to withhold water from your plants, but you don't want them to wilt. Yes, you will want to lower the growing and watering temperature, but you don't want them to chill. Yes, you will want to expose the plants to wind, but you don't want them to desiccate. Improper hardening-off procedures can stunt plants beyond the point of economic recovery, as occurs frequently in peppers.

Even cool season crops like cabbage, broccoli, and cauliflower can be damaged irreversibly and it doesn't matter if it occurs in the greenhouse, the cold frame, or the field. If a spring crop of one of these crucifers is subjected to 10 continuous days with temperatures between 35-50 ^{o}F, they will either bolt (cabbage) or "button" (broccoli and cauliflower.)

In general, harden off warm season vegetable transplants (tomato, pepper, eggplant, vine crops) no more than 5^{o}F lower than the normal greenhouse growing temperature, and the cool season crops (crucifers, endive, escarole, celery, onion) no more than 10^{o} F. lower than the normal growing temperature. The transplants should be sufficiently acclimated in about a week's time.

Avoid devastating diseases by treating your seed. -- A farmer I once knew was counting on a bumper vegetable crop to save the farm. Unfortunately, the next year, he was forced to hang out the "For Sale" sign. The crop he was depending on was devastated by a disease-- one that might have been prevented if he had treated the seed with hot water. The lesson here is that if a particular vegetable species is susceptible to a disease, figure that sooner or later that disease will hit your farm. If the disease can be prevented by seed treatment, then resolve to treat your seed. Learn the life cycle of the important diseases. Some can carry over on the seed coat, while others can survive inside the seed coat. You need to know this before you can determine whether hot water is necessary, or if a bleach treatment will suffice. If you treat your seed, sow it into the flats immediately after treatment or your germination rate may be affected. Contact your local extension educator for precise details on seed treatment.

Provide adequate ventilation. -- During late winter and early spring, growers try to save fuel by shutting up the greenhouses as tightly as possible and by not exhausting the heated air. This act of conservation can result in devastating effects. Anyone who has grown vegetable transplants is familiar with the grayish-brown, fuzzy spores of Botrytis. In a poorly ventilated greenhouse, Botrytis can ruin crops. At about a half to three-quarters hour before sunset each day, raise the temperature in the greenhouse about 5-10^{o}F. Warming the air will allow it to hold more moisture. Then exhaust this air so that cooler, drier air is pulled in and the relative humidity is maintained below 60 percent. Also, don't water your plants late in the afternoon.

Another indoor air quality issue you must monitor is air pollution. Sulfur dioxide, which can come from coal stoves or high sulfur fuels, can cause bleached white or tan, dead areas between the veins. Sulfur dioxide damage is especially bothersome when it dissolves in condensate and drips off the inner greenhouse cover onto the crops. Another common air pollutant that can damage crops is ethylene. Ethylene is produced in tight greenhouses when burners are running frequently. If a large volume of fresh air is not ducted into the greenhouse stove or burner, the fuel does not burn completely and ethylene (as well as carbon monoxide) will be produced. Ethylene can cause leaf yellowing and blossom drop. In tomato plants, it causes epinasty—a downward bending and curling of leaf petioles—which looks something like 2,4-D injury.

When you grow your own vegetable transplants, there are plenty of things that can go wrong. With a little attention to detail, however, you can produce high quality, pest-free transplants, and have them when you want them.

On-Farm Food Safety – An Emerging Issue for Pennsylvania Growers

Luke LaBorde, Penn State Food Science

Each year, we hear more about people becoming sick after eating raw fruits and vegetables contaminated with harmful microorganisms. Most of the outbreaks have been traced to crops grown in other parts of the U.S. or in other countries. But microbial contamination of fresh produce can happen anywhere. As consumer demand continues to shift away from heat processed fruits and vegetables and toward fresh, ready-to-eat produce, Pennsylvania growers need to join in the fight to keep our food supply safe.

Although there are no federal or state farm food safety regulations, the U.S Food and Drug Administration (FDA) has assembled a list of recommendations in a guidance document titled "The Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables". Strategies for preventing on-farm produce contamination are termed "Good Agricultural Practices" or "GAP". A farmer who practices Good Agricultural Practices implements proactive food safety control measures to prevent crop contamination. GAP guidelines can be grouped into four categories; health and hygiene, water quality, soil supplements, and environmental hazards. A brief discussion of each is discussed.

Health and Hygiene – Growing fresh produce requires a significant amount of hand contact during harvesting, sorting, and packing. A worker who shows signs of diarrhea, vomiting, or sudden yellowing of the skin or eyes may have a disease that can be transmitted through food and should not handle fresh produce. Every food handler should wash his or her hands before starting work, after breaks, and especially after using the restroom. It may be difficult to provide the necessary sanitary facilities, but clean, accessible, and appropriately stocked restroom and hand washing stations are essential for preventing product contamination.

Water Quality – Water has a many pre- and post-harvest uses for irrigation, pesticide application, washing harvested produce, cleaning harvest containers, and for drinking and hand washing. Food safety risks are greatest when surface water from ponds, streams, or rivers comes into contact with the edible parts of fruits and vegetables. Ground or well water is usually a safer choice, but it should be tested regularly and wells should be inspected to make sure they are intact and not located in areas that are subject to runoff during storms or floods. Municipal water is the safest source because you can be sure it has met government safety requirements. The choice of water to use and the level of risk is determined by the timing and application method. For instance, a safer source of water should be used as harvest time approaches or when overhead irrigation is used since the edible portions of the plant is likely to come into contact with the water just before harvest. Water used after harvesting should be free of human pathogens. If the safety of the water is in doubt, a sanitizer should be added to the water.

Soil Supplements – Healthy soils contain abundant populations of microorganisms and most are harmless to people. In fact, they are beneficial to crops because they break down organic matter into more readily available plant nutrients. However, when animal manure is used as a soil conditioner or a source of nutrients, contamination risks increase. It should be assumed that all raw manure contains microorganisms that can make people sick. Therefore, proper manure management and application techniques are essential. If raw manure is applied to fields where fresh produce is grown, allow a minimum of 120 days between manure application and harvest. Working it into the soil in the fall of the previous year is even better since long term exposure to the elements greatly reduces pathogen levels. A better choice when using animal manures is to follow established aerobic composting techniques that will raise core temperatures to above 130^{o}F for at least 5 days. Turn the pile several times to ensure even heat exposure to all parts of the pile. It is also important to store raw and incompletely composted manure as far away as possible from crop growing areas and to prevent runoff after heavy rains or flooding.

Field and Packinghouse Hazards – Farms and packing houses are by no means sterile environments and there are ample opportunities for contamination from harvest equipment and containers, harvest implements, packing equipment, storage facilities, and during transportation. Growers need to be aware of potential contamination sources from adjacent properties such as junk yards, toxic waste sites, and dairy or cattle operations and, to the extent possible, keep wild animals away from the crop. Harvest containers and totes should be cleaned before each use and stored so they are protected from sources of contamination.

The voluntary recommendations described above are applicable to all fresh produce growers. But growers who supply fresh produce to grocery stores and restaurants are increasingly being asked to supply documented evidence that GAP standards are being followed. An inspection from an independent third party auditor is typically required at some point during the harvest season. There are resources available to those who have received certification notices from their wholesale buyers. A new United States Department of Agriculture audit service is available that is supported by funds from the Pennsylvania Department of Agriculture. Currently under development from Penn State Extension and the Department of Food Science is a training program that will help growers understand farm food safety risks and develop a food safety plan. For more information on Good Agricultural Practices and upcoming farm food safety programs, visit the Penn State GAPs web site at http://foodsafety.psu.edu/gaps.

Biological Fungicides and Bactericides; Using Fungi and Bacteria for Disease Management

Steve Bogash, Regional Horticulture Educator, Penn State based on an article by Cathy Thomas

Direct application of beneficial fungi and/or bacteria to soil, potting media, and plant foliage is a relatively recent practice which is rapidly catching on with producers. The methods and philosophy of using biofungicides such as Actinovate AG and Plant Shield are distinct from our past practices of starting with "sterile" media and fighting to keep it clean. We've typically fought the plant disease wars through the application of various chemical fungicides in rotation as we attempt to slow the development of resistance.

Standard chemical fungicides fall into two main categories: protectant and systemic. Protectant materials such as chlorthalonil (Bravo, Daconil, and many other trade names) provide fungal disease protection by creating a chemical barrier to disease penetration. Systemic materials such as Azoxystrobin (Quadris, Heritage, and other trade names) move into plant tissue to provide disease management from within. Protectants cannot manage a disease once it has infected a plant; however, systemic materials will provide a measure of "clean-up" disease control activity. The mindset of relying completely on non-biological materials assumes that growers take a long series of "fall back" positions as there are always new strains of disease causing organisms as well as diseases that get missed until our crops have received serious damage.

The application of beneficial organisms (biofungicides) is another tool to add to our arsenal in managing diseases in the greenhouse and field. These materials have unique modes of action (MOA) that can provide levels of disease management not possible with our traditional fungicides. Since these are living organisms, their application requires strict adherence to the labeled application instructions. Often pH, tank mixing, and surfactant instructions are very precise in order to reach reasonable levels of efficacy. Even with these challenges, field experience over the past few years has proven that these biological materials can provide disease management in situations where traditional chemistries have failed to do so. Also, since they are living materials, many of these biological materials have short storage lives and specific storage instructions.

How biological fungicides work

Direct Competition: Before infection can occur, the pathogen must gain access to the root zone then penetrate plant tissue. An effective biofungicide will grow faster than the pathogen and out compete it for nutrients and space.

Antibiosis: Some biological materials produce chemical compounds such as antibiotics and toxins that kill or inhibit pathogen growth. These compounds can prevent germination of fungal spores or restrict growth.

Predation and or Parasitism: Some materials such as Actinovate AG, Plant Shield, and SoilGard 12G claim that their materials actively seek out pathogens and destroy them.

Induced Resistance: While plants do not have immune systems like animals, they do have defense mechanisms. Certain biological controls will induce plants to produce defensive compounds such as salicylic acid (similar to aspirin). Salicylic acid can travel throughout the plant and stimulate the plants own defense mechanisms prior to infection.

All of these biological fungicides require application before the plant becomes infected with a pathogen. Most commonly, a producer will drench transplants or cuttings either just before or during the planting process. Products like SoilGard 12G are incorporated directly into potting media. Those with foliar activity are applied (as a foliar spray) in much the same manner as protectant fungicides such as Chlorthalonil. These living materials colonize the root zone (rhizosphere) and surface of leaves (phylosphere), fruit and flowers. For those growers using fumigants, it is very important to inoculate soil with a beneficial organism immediately after fumigation in order to have the desired organism (biological fungicide) dominates. Most fumigants require a waiting period before planting so that the fumigant can do its' job and move out of the soil or breakdown. Talk to your fumigant supplier's technical support for advice on when to apply a biofungicide after treatment.

This is a different way of thinking about disease management. As we rapidly move from the age of miracle chemicals to solve all of our production challenges further into the era of IPM, these biological materials are a great fit. Many of these materials are OMRI approved. Used properly, they can provide cost effective, proactive disease management when used with other IPM practices. Crop rotation, variety selection, cover cropping, organic matter management, and nutrient management are other parts of our current toolbox.

Current Biological Fungicides and Bactericides

Material	Active Ingredient / Organism	Greenhouse or Field	Labeled diseases controlled	Foliar or Soil Application	Mode of action
Actinovate AG	*Streptomyces lydicus*	Greenhouse & Field	Fusarium, Rhizoctonia, Pythium, Phytophthora, Verticillium….	Foliar and Soil drench	Defensive barrier & parasitism
Companion	*Bacillus subtillus* GB03	Greenhouse only	Rhizoctonia, Pythium, Fusarium, Phytophthora	Soil drench	Defensive barrier and antibiosis
Mycostop	*Streptomyces griseoviridis* K61	Greenhouse and Field	Fusarium, Alternaria, Botrytis, Pythium, Phytophthora & Rhizoctonia	Foliar, soil drench and seed treatment	Defensive barrier and growth enhancer
PlantShield & RootShield	*Trichoderma harzanium* T-22	Greenhouse and Field	Botrytis, Powdery mildew, Pythium, Rhizoctonia, Fusarium, & *Thielaviopsis*	Foliar and soil drench	Defensive barrier, parasitism, & nutrient enhancer

Rhapsody	*Bacillus subtillus* QST 713	Greenhouse, Field, Turf, Interiorscapes, Landscapes, and Forests	Rhizoctonia, Pythium, Fusarium, & Phytophthora…	Foliar, soil drench & post harvest cut flower dip	Defensive barrier (multiple MOA's)
Serenade	*Bacillus subtillus* QST 713	Field: fruits and vegetables	Botrytis, Mildews, Alternaria, Bacterial spot & speck, Rusts…	Foliar	Defensive barrier (multiple MOA's)
SoilGard 12G	*Gladicladium virens* GL-21	Greenhouse, Field, Interiorscapes, & nurseries	Pythium, Rhizoctonia	Soil drench	Defensive barrier, parasitism & Antibiosis

As I am completing this article, I ran across a column in the March 2008, Grower Talks by Roger McGaughey of Michael's Greenhouses, Conn. He claims to be not only committed to Plant Shield as a root drench, but attributes a good deal of his success with his 2007 poinsettia crop to it as well. Read and follow label instructions carefully since these materials have specific mixing instructions, varying compatibility with other materials, pH requirements, shelf life and storage conditions. This article is largely a revision of a number of earlier articles on this subject using products that are labeled for 2008 coupled with field and greenhouse experience. For a list of or copies of those articles please contact the author at smb13@psu.edu.

Know Your Enemy: Common Cocklebur

Dave Johnson, PSU Southeast Research and Extension Center

Common cocklebur (*Xanthium strumarium*) is a weed problem in many areas in Pennsylvania. It is an annual plant that mainly occurs in agricultural fields, but also occasionally in pastures and waste areas. It is in the Asteraceae family (formerly called Compositae), is native to the Mediterranean area, and grows in temperate and tropical regions throughout the world. It probably came to North America with European settlers as seed contamination in crop seeds.

Common cocklebur is probably best known for its seed capsule, which is covered with many stiff spines (burrs) that makes the seed stick to clothing and animal fur, facilitating its spread. It should not be confused with burdock (*Arctium minus*), which is a biennial plant that also has burrs on its seed heads and sticks to your socks. The cocklebur plant itself has large, heart-shaped leaves with wavy margins that feel stiff to the touch and are covered with very fine hairs. The leaves are often dull green in color, and have a distinct smell when crushed, and generally have dark petioles. The cotyledons are long, thin, and fairly fleshy (see photo). The stems are hairy and usually have many small dark spots on them. The mature plant turns "woody", and will persist well into the winter.

Being an annual, common cocklebur reproduces by seed. Each seed capsule contains two seeds. One seed may germinate immediately (I have seen seedling cockleburs in September) or the next spring, while the other may remain dormant one or more years. This interesting survival technique allows the species to "wait" until conditions are good for germination, and makes it very difficult to eradicate this species from fields. The seeds and seedlings contain a substance that is toxic to livestock. Fortunately the seeds are generally not ingested due to the burs, and the toxicity in the plants rapidly decreases when the true leaves emerge. The seedlings, however, are palatable and have been known to cause poisoning in sheep. Drying does not remove the poison, so care must be taken in ensuring the young plants don't get into hay.

Common cocklebur is usually a larger problem in tilled fields. In no till, the large seed is left on the soil surface, where it is more susceptible to insect seed predators. The large cocklebur seed can emerge from rather deep in the soil, so tillage is not an effective method of reducing the amount of viable seed. I have seen mixed results with mulches. The extra energy reserves in the large seed can help the seedlings penetrate through a mulch layer. Control of young plants is effective with cultivation, and the large seedlings are relatively easy to pull by hand.

Several herbicides are effective on cocklebur. In sweet corn, the atrazine products give good initial control. Use the fully loaded (non-"Lite") versions, and Lexar instead of Lumax, because higher atrazine rates are needed. Basagran (or Laddok), Callisto, Impact, Laudis, Sandea, Stinger, and 2,4-D amine are a good postemergence products in sweet corn. In beans and peas, Basagran, Pursuit (peas and lima beans only), Reflex (snaps only), and Raptor (snaps only, must be mixed with Basagran) are very good. In tomatoes and peppers, Sandea will control cockleburs postemergence. Sencor (tomatoes), Command (pumpkins, peas, beans, peppers), and Strategy (pumpkins) will give partial control.

Common cocklebur is a great example of a weed where "an ounce of prevention is worth a pound of cure." Do your best to prevent this weed from becoming established on your farm, and remove plants before they can set seed. Once established, it is very difficult to eradicate.

Figure 1. Common cocklebur plant showing long, fleshy cotyledons and first true leaves

Dave Johnson photo

Lettuce Production Systems in High Tunnels

Mike Orzolek, Penn State Horticulture

Because lettuce can be grown in high tunnels 12 months of the year throughout the U.S., lettuce is the number 2 crop grown in high tunnels in the U.S. There are several lettuce types and several hundred lettuce varieties that are commercially available for growers and differ by color, texture, maturity and head size. They include the following; Romaine - green and red, Bibb – green, Oakleaf - green and red, Butterhead - green and red, Summer Crisp (Batavia) - green and red and Baby lettuce mixtures - mild mesclun mix, spicy greens mix and braising mix. Depending on the location of the high tunnel, maturity of the lettuce variety is very important for scheduling production and implementing marketing plans. Lettuce types range in maturity from 42 to 58 days for full size heads. Baby lettuce types are ready from seeding to harvest in 28 to 30 days. Cooler air temperatures, below 40°F will slow growth of lettuce plants and increase time to maturity 7 to 10 days. There are several techniques available that growers can use to grow lettuce in high tunnels.

Conventional Production in Soil after Bed Preparation in the High Tunnel. Either direct seeding or transplants can be used to establish the lettuce crop. In most cases, the crop would be maintained with drip irrigation applied during the growing season. With this particular production system, a very dense plant population of lettuce can be grown (6" x 8" spacing) that would reduce volunteer weed problems, but may increase insect and disease pressure. Lettuce plants should be monitored weekly for aphid or whitefly problems and control measures applied as necessary. Certainly cool, damp soil is ideal for the development of Botrytis Gray Mold and Sclerotinia Drop.

Annual Raised Beds with Plastic Mulch and Drip Irrigation. Using a bed forming implement that produces an 18" wide bed 3" to 4" tall and applying the black plastic mulch and drip tape placed 2" beneath the soil surface has been used for many years in both field and high tunnel production. Most growers would establish the lettuce crops as transplants either in double rows with an in-row-spacing of 8". The black plastic will help eliminate weeds in the row and reduce the incidence of both Botrytis Gray Mold and Sclerotinia Drop.

Permanent Raised Beds. Permanent Raised Beds come in all Sizes and Orientation. Generally they are 12" in height, but can be shorter or taller based on individual growers' needs. If common lumber is used to construct the raised bed, then 6-mil greenhouse plastic film can be used to line the sides and ends of the bed to prevent long term wood rot. Applying organic matter to the soil in the bed will eventually increase soil organic matter to 4.5% or higher value and increase the water holding capacity of the soil. If lettuce seeds or transplants are planted in the bed without a piece of polyethylene plastic film covering the surface of the raised bed, then both weed problems and Botrytis Gray Mold and Sclerotinia Drop infection may occur. Lettuce is generally watered with drip tape with this technique.

Non-Circulating Hydroponic System. Recently, Dr. Bernie Kratky from the University of Hawaii was on sabbatical leave here at the Penn State Center for Plasticulture. One of Bernie's objectives here at Penn State was the production of lettuce in a non-circulating hydroponic system. The two tanks for the hydroponic system were constructed in the high tunnel and lined with 6-mil greenhouse-grade plastic. Each tank was 50" x 24' and 5" deep. When filled with water, each tank held 300 gallons of water. Blue, Styrofoam insulation boards float on top of the water and rest on 2 plastic pipes supported by the tank floor when the nutrient solution level decreases as the crop grows. Holes were cut into the insulation board such that lettuce plants were spaced 8" x 12" – each tank then was used to grow 144 lettuce plants. Plastic net pots were filled with the lettuce transplants grown in soilless media and then placed into the holes cut into the Styrofoam board. Fertilizer was added to the water before the lettuce plants were placed into the Styrofoam boards and no additional water or fertilizer was added to the crop. Equal amounts of 2 stock nutrient solutions were added once per crop prior to transplanting such that the EC (electrical conductivity) of the nutrient solution in the raceways ranged between 1.5 to 2.0 mS. One nutrient stock solution consisted of 120 grams of soluble greenhouse grade calcium nitrate per liter of water, and the other stock solution consisted of a mixture of 72 grams of magnesium sulfate and 120 grams of Chem-Gro 8-15-36 Lettuce Formula (Hydro-Gardens, Colorado) per liter of water. The Chem-Gro formulation also contained micronutrients. Large batches of stock solutions (95 liters) were stored in 2 opaque plastic trash containers and mixed prior to use. One preparation of these stock solutions was more than adequate for these trials. Dr. Kratky grew 4 lettuce crops that required 28 to 39 days from transplanting. Bibb, romaine and leafy lettuce types were grown successfully in this hydroponic system without any disease problems and a minor insect problem – grasshoppers. At the High Tunnel Research and Education Center at Rock Springs, there must have been 100 grasshoppers per square yard at the peak of their population this summer, but screening the sides of the tunnel helped moderate the problem. This large grasshopper population ate everything from lettuce to cucumber and broccoli transplants. When harvested, the lettuce heads have averaged about 0.5 pounds in weight and were of excellent quality. There was no incidence of diseases on the lettuce plants on any of the four plantings.

Figure 1. Mature lettuce crop on left and juvenile crop on right growing in non-circulating hydroponic system (B. Kratky, Univ. of Hawaii – 2007) and grown on Styrofoam insulation boards floating on the top of water.

Growing Greens

Mike Orzolek, Penn State Horticulture

Vegetable crops that are classified as "Greens" include; mustard greens, turnip greens, collard, kale, Swiss chard, cabbage, and pac choi.

Yield Potential of the different greens

Cabbage – 30,000 to 45,000 pounds per acre
Mustard greens – 15,000 to 20,000 pounds per acre
Turnip greens - 10,000 to 15,000 pounds per acre
Collard – 12,000 to 20,000 pounds per acre
Kale – 25,000 to 35,000 pounds per acre
Swiss chard – 15, to 25,000 pounds per acre
Pac choi – 25,000 to 30,000 pounds per acre

Recommended Varieties

Cabbage – Caramba F1
Caraflex YR F1 - all available at Seedway, Inc. – Elizabethtown, PA
Murdoc F1

Mustard greens - Savanna – slow to bolt
Southern Giant Curled – Tolerant to bolting – both available from Stokes Seed – Buffalo, NY

Turnip greens – Seven Top – heat may affect leaf color - Stokes Seed – Buffalo, NY
All Top - Seedway, Inc. – Elizabethtown, PA
Southern Green – Good bolt resistance. - Seedway, Inc. – Elizabethtown, PA

Collard – Hi-Crop F1 - Stokes Seed – Buffalo, NY
Flash F1 - Stokes Seed – Buffalo, NY
GA Southern - Seedway, Inc. – Elizabethtown, PA

Kale – Darkibor F1 – Bolt resistant - Seedway, Inc. – Elizabethtown, PA
Blue Ridge F1 – Slow to bolt - Stokes Seed – Buffalo, NY
Winterbor F1 – Frost tolerant - Stokes Seed – Buffalo, NY

Swiss chard – Silverado – Slow to bolt - Stokes Seed – Buffalo, NY
Bright Lights – Unique stem colors. - Stokes Seed – Buffalo, NY
Oriole – Good as baby green. - Seedway, Inc. – Elizabethtown, PA

Pac choi – Joi Choi F1 – Slow bolting - Seedway, Inc. – Elizabethtown, PA
Mei Qing Choi F1 - Seedway, Inc. – Elizabethtown, PA
Black Summer F1 – Slow bolting. – Johnny Selected Seeds, Albion, ME.

F1 – indicates hybrid variety

Kale and Collards

Kale leaf yields can be as much as 400 cwt/acre. Kale and collards can be harvested three ways: whole plants, bunched leaves, or "stripped" leaves. "Stripped" kale is pre-packaged for fresh market. In all methods, yellow or damaged leaves must be removed before packing. Kale can be harvested on demand 2-4 times over a 4-month period but leaf harvest may be done weekly when demand is high. A skilled laborer can harvest and bunch 4 boxes/hour. Yields are about 3200 dozen 1-lb bunches/acre.

Storage (Quoted or modified from USDA Ag. Handbook 66 and other sources)

Leafy greens such as collards, kale, rape, Swiss chard, and beet greens are handled like spinach. Because of their perishability, they should be held as close to 32°F as possible. At this temperature, they can be held for 10 to 14 days. Relative humidity of at least 95% is desirable to prevent wilting. Air circulation should be adequate to remove heat of respiration, but rapid air circulation will speed transpiration and wilting. Satisfactory precooling is accomplished by vacuum cooling or hydrocooling. These leafy greens are commonly shipped with package and top ice to maintain freshness. Research has shown that kale packed in polyethylene-lined crates and protected by crushed ice keeps in excellent condition for 3 weeks at 32°F but only 1 week at 40°F and three days at 50°F. Vitamin content and quality are retained better when wilting is prevented.

Packaging

Collards are packaged in bushel baskets, crates and cartons, 24 pack, 23-24 pounds; 1.4-bu, 23-24 pounds; or crates and cartons, 12-24 bunches.

Kale is commonly packaged 1 or 2 dozen bunches/box. Bunches are 4-8 leaves or about 1 lb each.

Swiss Chard

The crop can be marketed from about two months, when the leaves have attained a good size. The outer leaves are successionally harvested as soon as they are large enough. They are usually cut with a sharp knife about 5 cm above the ground, taking care not to harm the younger leaves, or are simply wrenched off the plant with a sideways twist. Plants should not be over-harvested at any one picking, to avoid weakening them and affecting the size of later picks, as well as reducing total yield. Old leaves should not be marketed, as fiber content increases with age; the leaves should be picked as soon as they reach full size. Harvesting from the same plants can continue for several months, often until leaf-spot disease becomes too severe or the plants run to seed. After picking, the leaves are generally washed before being tied in bunches for marketing. Bunches should retain a fresh appearance on the greengrocer’s shelves and have good eye appeal.

That's a Berry Good Question!!!

Kathy Demchak, Penn State Horticulture

Q. I see that Prowl H_2O is labeled for strawberries. Right now I don't have many weeds between my rows of plasticulture strawberries. Do you recommend Prowl H_2O for springtime application between the rows? (Harvey Sauder, New Holland, PA)

A. Using Prowl H_2O as a shielded application between rows of plasticulture strawberries is a perfect fit for use of this product, assuming that the weeds that are likely to emerge are a match with Prowl's control spectrum. Prowl H_2O is a water-soluble formulation of pendimethalin from BASF. It works well for controlling annual grasses, and some of the broadleaf weeds that are commonly problems in strawberries such as purslane, pigweed, and lambsquarters. A number of years ago, I had done some work with Prowl in its EC formulation, and was fairly impressed with the weed control and it seemed fairly safe for most cultivars. This is a different formulation however, and one on which relatively little work with strawberries has been done. So, I'd urge growers to err on the side of caution, make sure you stay within the labeled rates and usage patterns, and use it only on a small area until you know how it performs under your growing conditions. What are the labeled rates and usage patterns you ask? Prowl is labeled for use *prior* to transplanting matted-row strawberries as a soil surface broadcast application (it's not for use under plastic) at a rate of 1.5 to 3.0 pints per acre. It also can be used at 1.5 to 3.0 pints per acre between the rows after plants are growing, calculated on a treated area basis, not the entire area. There is a 35-day PHI for this second application timing.

Got a question? Chances are that someone else has the same question, but isn't asking! Send your question to Kathy Demchak, at 102 Tyson Bldg., University Park, PA 16802, or via email to kdemchak@psu.edu. You will be credited with the question, or can remain anonymous, as you wish.

Mid-Atlantic Berry Guide on Web

Kathy Demchak, Penn State Horticulture

Besides being available as a hard copy, the 2008 Mid-Atlantic Berry Guide is now posted on the Web at http://pubs.cas.psu.edu/freepubs/MAberryGuide.htm. Chapters can be accessed separately (important for those with a slow connection) for this version, which is an improvement over the last version. If you want the entire publication, it's still probably easier (and less costly) to get a bound copy from your local extension office (call ahead, as not all offices stock it), or the Publications Distribution Center. Instructions on how to order it from Publications Distribution are available at http://pubs.cas.psu.edu/PubTitle.asp?varTitle=berry+guide or call 814-865-6713. The cost is $18 + tax and shipping where applicable.

In fact, while you're at it, you might want to spend a little time browsing around the Ag Pubs Web site at http://pubs.cas.psu.edu/. From this page, you can find 731 other publications, browse them by subject area, or search for a particular topic. Most are available as free downloads as well.

Upcoming Meetings

If you have a meeting you would like to announce, please send the meeting title, date, location and contact information to esanchez@psu.edu.

Local

- ✓ May 21, 2008. **Rodale Research Tour**, Emmaus, PA. Sponsored by Pennsylvania Women's Agriculture Network (PA-WAgN), Pennsylvania Department of Agriculture, Southeast RC&D, the Pennsylvania Association of Sustainable Agriculture (PASA) and the Rodale Institute. Registration $15, which includes lunch. For more information visit http://wagn.cas.psu.edu/Register0805.html.

- ✓ July, 2008 (date TBD). **Summer Vegetable Growers Meeting,** Kutztown, PA. For more information contact Mena Hautau at (610) 378-1327 or mmh10@psu.edu.

- ✓ August 7, 2008. **Building a High Tunnel Hands-On Workshop**, Josie Porter Farm, Stroudsburg, PA. Pennsylvania Women's Agricultural Network (PA-WAgN) sponsored event. Registration $15, which includes lunch. For more information visit http://wagn.cas.psu.edu/Register0810.html.

- ✓ September 11, 2008. **Taste of Harvest Winery Tour**, J. Maki Winery at French Creek Vineyards, Chester Co. Pennsylvania Women's Agricultural Network (PA-WAgN) sponsored event. Registration $15, which includes wine tasting. For more information visit http://wagn.cas.psu.edu/Register0813.html.

- ✓ November 18, 2008 (tentative date). **Western Pennsylvania Vegetable & Berry Seminar**, Butler, PA. For more information contact Eric Oesterling at 724 837 1402 or reo1@psu.edu or Lee Young at (724) 228-6881 or ljs32@psu.edu.

Regional

- ✓ July 23, 2008. **2008 Vegetable and Small Fruit Field Day**; Horticulture Research Farm, Russell E. Larson Research Center, Rock Springs, PA. For more information contact Mike Orzolek at (814) 863-2251 or mdo1@psu.edu.

- ✓ January 13 – 15, 2009. **Atlantic Coast Agricultural Convention and Trade Show** (NJ Vegetable Meeting); Trump Taj Mahal. For more information contact Mel Henninger at (732) 932-9711 x 120 or henninger@aesop.rutgers.edu.

- ✓ February 3-5, 2009. **2009 Mid-Atlantic Fruit and Vegetable Convention**, Hershey Lodge and Convention Center, Hershey, PA. For more information contact William Troxell at 717-694-3596 or visit www.mafvc.org.

National

- ✓ August 10-14, 2008. **92nd Annual Meeting of The Potato Association of America**; Buffalo, NY. For more information contact Don Halseth at (607) 255-5460 or deh@cornell.edu or the website at http://www.hort.cornell.edu/PAA2008/.

International

- ✓ Sept. 7-10, 2008. **19th International Pepper Conference**; Sheraton Hotel and Conference Center, Atlantic City, New Jersey, USA; contact Dr. Wesley Kline by phone (856) 451-2800 or email wkline@aesop.rutgers.edu or Dr. Andy Wyenandt by phone (856-455-3100 X4144) or email wyenandt@aesop.rutgers.edu

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The newsletter is also posted within three days on the Department of Horticulture Vegetable program website at: http://hortweb.cas.psu.edu/extension/vegcrops/newsletterlist.html.