

Diagnosing Blueberry Problems Kathy Demchak, Penn State Department of Horticulture

Blueberries are a popular crop in the state, and more people are growing them all the time. Last November's Fruit Times Feature Article outlined steps to get a planting off to a good start. This one covers what might be wrong when plantings are not doing so well. There are always exceptions, but here are some general guidelines to use when trying to figure out blueberry (and even other crop) problems.

First, it is easy to assume that when plants are not growing well that they must have a disease, but that is not always the case. Disease organisms may be affecting the plants, but often other problems contribute to poor growth. Just meeting basic plant needs goes a long way toward having a healthy planting. This means: 1) getting the soil pH into the right range (4.5 - 5.0) for blueberries, hopefully before planting, 2) making sure the plants have plenty of water (which does not mean planting them in a

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spot with poor drainage), and 3) growing them in a soil with plenty of organic matter. It also helps if you have a soil to which blueberries are naturally adapted. If acid-loving plants (wild blueberries, rhododendrons, mountain laurel, and teaberries) abound in nature where you live, your soil is one to which blueberries are suited. Unfortunately, this is not the case with many of our agricultural soils, which are often high in calcium. Blueberries are in a group of plants known as calcifuges, which means "calcium-fleeing." If you have a high calcium soil (soil test shows more than 2000 lb of calcium per acre) either naturally or from liming it for decades, and you do everything else right but your blueberries still do not do well, the site just may not be a good site for blueberries. Besides providing these basics, other practices that help are keeping the planting well-pruned, fertilizing with the right rate and type of fertilizer (ammonium nitrogen, not nitrate nitrogen), and managing weeds.

If you have met the plants' basic needs and problems still develop, there are a few steps to take in figuring out what is Wrong. Look for clues and patterns, and think about the following questions.

 Does the problem affect the whole field evenly or is it worse in certain areas? Root rots such as phytophthora root rot usually occur to the greatest extent in low spots.

2. When did you first notice the problem relative to any spray applications or unusual weather conditions? In the past several years, I have received quite a few calls on all berry crops that were related to phytotoxicity, either due to tank mixtures, warm temperatures during application, or too many applications of the same product. Look for patterns – for example, if you drive

every other row and use an airblast sprayer, see if symptoms look worse on the side of the row closest to the nozzles, and check the foliage that would have

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Growing Season Models and Alerts: http://frec.cas.psu.edu

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received the lightest amount to see if it looks better. Disease symptoms are often worse where the foliage is the densest, but phytotoxicity symptoms often disappear there. To the untrained eye (that is any eye that does not belong to a plant pathologist, as far as I can tell), it is pretty difficult to tell the difference between a brown spot caused by phytotoxicity and a brown spot caused by a disease. However, brown spots from phytotoxicity are usually oblong or on tissue on which the material would have pooled, with the exception that damage from a small droplet may be circular. Brown spots from diseases are usually circular or oval if caused by a fungus, or are delineated from healthy tissue by leaf veins if caused by a bacteria. Often diseased tissue is a different color at the border where unhealthy tissue meets healthy tissue, and the color is different in the middle of the spot.

- 3. Are all varieties affected to the same degree? If only certain varieties are affected, do they have something in common, such as growth stage relative to a weather event? Usually with diseases, the incidence will vary with variety, but not necessarily with seasonality. If weather events were a problem, such as the frosts we had last spring, blueberry varieties with the same harvest season were affected similarly. If all varieties were affected the same, the problem may have been environmental or cultural.
- 4. Can you see a pattern on the plant? Let's go through some possibilities: a) The whole plant is dead. This could be from a root disease, nematodes, grubs, or something that girdled the plant, so check the roots and crown area for symptoms. b) Tips of canes are dead. Could be winter injury, phomopsis twig blight, botrytis blight, or boron deficiency especially on lighter soils. c) Young or old leaves are affected the most. Could be nutrition (see #5), as usually either older or younger leaves are affected, depending on which element is deficient or toxic. There could have been more time for symptoms to accrue from a disease if older leaves look worse (also see #5), or something might have happened during a certain growth stage. Some insects, e.g.,

aphids, prefer younger, more tender foliage. d) One or a few canes are affected. Check for borers, cankers, or chew marks from voles on the affected canes.

5. Can you see a pattern on individual leaves? With nutritional problems or a translocated herbicide injury (this does not include burndown herbicides — they are different), the leaf would look relatively symmetrical — if you folded the leaf on the midrib, you would see the same coloration on the left half of the leaf as on the right half, and in the same places, more or less. With nutrient deficiencies, the part that has access to more of the deficient element (near the midrib) stays green, and yellowing or reddening first shows up between the smallest veins (hence the "Christmas tree effect" with iron deficiencies). With diseases, spots on the leaves or canes are fairly random, because the disease develops wherever the spore lands. However, areas of the plant that have high moisture levels (areas of dense foliage, or the canes near their base) are likely to have greater disease problems. With injury from a burndown herbicide such as paraquat, brown spots appear wherever the spray — including small droplets that may have drifted — contacted the leaves or bark. Entire young canes can be killed from contact.



Magnesium deficiency on blueberries.

Cross-section of stem with

Botryosphaeria stem blight Healthy tissue is light

Botryosphaeria stem blight canker progressing into healthy tissue.

If the problem is a disease organism, here are the common diseases that we have seen in Pennsylvania. (We do not have room to cover insects here, so consider attending the blueberry IPM workshop described on page 8):

Phomopsis twig blight and canker. Tips of twigs die back, and the pith appears discolored. Cankers appear in the crown area and may kill individual canes.

Botryosphaeria stem blight. Leaves turn yellow, then red, and then individual canes die. Eventually the entire plant may be killed. Young plants are most severely affected, as the entire plant can be girdled.

Mummy berry. Berries dry up and fail to mature, eventually resembling tiny gray pumpkins. They fall to the ground, and ¼ inch mummy cups grow from them in the spring, which release spores that cause new shoots to wilt and turn brown. Spores released from infected shoots then infect flowers and thus fruit.

Botrytis blight. Any plant part can be affected, but most often blossoms and new growth are blighted. If the weather is wet, a gray mold may cover affected plant parts.

Alternaria leaf spot. Leaves develop tan to grayish spots, with lower leaves affected the worst. A black or dark-green mold appears on the blossom end of the berry before harvest.

Anthracnose fruit rot. Canes and leaves may be affected with brown to black lesions, but often the only symptom noticed is that after harvest, fruit develop a sunken area with orange to salmon-colored spores.



Anthracnose canker on blueberry stem.

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Asymmetrical discoloration consistent with viral symptoms.

Viruses and phytoplasmas. Symptoms of viruses vary markedly but may include mottling or crinkling of leaves, unusual leaf shapes and colors, poor growth, reduced yields, and plant death.

Phytophthora root rot. Plants in wetter areas of the field become defoliated and die.

Additional information on cultural management such as site selection, pruning, and fertilization; symptoms and epidemiology of diseases; cultural and chemical controls, appear in the *Mid-Atlantic Berry Guide*, on-line at http://pubs.cas.psu.edu/freepubs/MAberryGuide.htm. Printed copies may be obtained in many county extension offices or ordered directly from Ag Publications by calling 877-345-0691. Cost for a printed copy is \$20 plus tax and a \$5 shipping/handling fee, with all major credit cards accepted. An excellent resource for helping to diagnose problems is the *Berry Diagnostic Tool*, developed by folks at Cornell University, North Carolina State University, and

the Small Fruit Germplasm Repository in Corvallis, and is found at http://www.fruit.cornell.edu/berrytool/index.html. These resources and more can also be accessed from the Penn State Small Fruit web site, http://smallfruits.psu.edu/.

Degree-Day Table

Accumulated degree-days base 43°F from Jan 01 for each reported year (courtesy of SkyBit, Inc.). The accumulated degree-days for the last date of the current year (Sep 01) mentioned in the table are based on the weather forecast.

Site/Date		7/28	8/04	8/11	8/18	8/25	9/01
Biglerville,	2010	3145	3366	3612	3833	4043	4248
Biglerville,	2009	2637	2858	3078	3310	3541	3743
Biglerville,	2008	2727	2955	3150	3335	3529	3710
Biglerville,	2007	2732	2974	3218	3433	3603	3819
Biglerville,	2006	2771	3043	3260	3458	3676	3880
Biglerville,	2005	2676	2898	3130	3370	3571	3777
Biglerville,	2004	2782	3013	3185	3367	3564	3782
Rock Spring,	2010	2742	2941	3156	3356	3542	3710
Rock Spring,	2009	2218	2411	2598	2814	3016	3184
Rock Spring,	2008	2324	2528	2696	2859	3034	3193
Rock Spring,	2007	2339	2596	2818	3011	3168	3360
Rock Spring,	2006	2391	2641	2837	3012	3203	3376
Rock Spring,	2005	2331	2551	2766	2986	3167	3347
Rock Spring,	2004	2419	2624	2772	2926	3102	3301

Pheromone Trap Counts

2010 season - weekly capture of adult moths in pheromone traps located at Penn State FREC Biglerville, PA (Adams County):

Species	7/08	7/15	7/22	7/29	8/05	8/12	8/19	8/26
RBLR	37	7	4	15	34	36	33	37
STLM	85	144	177	193	54	51	118	270
OFM	13	3	31	27	44	41	97	30
CM	10	11	48	63	54	30	28	15
TABM	0	1	3	11	8	15	7	2
LPTB	0	0	1	1	3	2	3	1
OBLR	0	1	2	5	1	1	0	0
DWB	19	16	27	25	26	26	17	28
PTB	0	1	1	0	1	1	0	1

Key to acronyms: RBLR - redbanded leafroller; STLM - spotted tentiform leafminer; OFM - Oriental fruit moth; CM – codling moth; TABM – tufted apple bud moth; OBLR – obliquebanded leafroller; LPTB – lesser peach tree borer; DWB – dogwood borer; PTB – peach tree borer.

Insect Bytes

Drs. Greg Krawczyk and Larry Hull, Penn State FREC Entomologists

Increased Pressure from Stink Bugs in Apple Orchards

During our continuous stink bug observations this summer we noted significant increases of stink bug adults and nymphs in apple orchards. By far, the dominant species is the brown marmorated stink bug (BMSB), Halyomorpha halys. with the green stink bug (GSB), Acrosternum hilare, a distant second. All mobile stages (adults and various instar nymphs) were observed feeding on apples, pears, Asian pears and remaining stone fruits. Since BMSB most likely will continue feeding on fruit until its late fall movement inside dwellings (or houses) in search of overwintering shelters, additional insecticide applications may be needed in some orchards. Based on our BMSB control tests conducted this past summer on peaches, it appears that only broad-spectrum, contact insecticides such as Lannate, Danitol (and probably other pyrethroids) or high rate neonicotinoids (i.e., Assail or Belay) provided good control. If you use any insecticides for stink bug control, please observe the pre-harvest interval (PHI) (see below). The stink bug injury on pome fruit appears similar to the common corking symptoms caused by calcium deficiency in fruit. Higher incidences of SB injuries are usually observed on edges and border rows of orchards, especially next to woods or other unsprayed vegetation.





Fresh injury on apple fruit caused by stink bug feeding. Photo by Greg Krawczyk.

Pre-Harvest Intervals for Commonly Used Insecticides

Following our tradition from the last several years, we again submit an updated version of this article to help you in deciding which compounds can be used at this time of the season, when harvest is just around the corner.

There is a high probability that in some orchards additional insecticide treatments will still need to be applied later this season. In addition to choosing the most effective compound, it is very important to always check the legal pre-harvest intervals (PHI) before deciding which pesticide can be used at this time of the season. The following information is a reminder only, and the label on each insecticide has to be checked before any pesticide application.

- ◆ <u>Acetamiprid</u> (IRAC Group 4A) (Assail 30 SG) 7 day PHI on pome and stone fruit, no more than 32.0 oz of formulated product per acre per season.
- ◆ <u>Azinphos-methyl</u> (IRAC Group 1B)(Guthion) 14 day PHI on applied less than 1.0 lb of active ingredient (AI) per acre; 21 days on applies if more than 1 lb AI per acre; 14 days on pears. On applies and pears no more than 2.0 lb per acre of AI can be applied during a season. Please check special regulations for "pick-your-own" operations.
- Carbaryl (IRAC Group 1A)(Sevin) 3 day PHI on apples; 3 days on pears; 3 days on peaches and nectarines.
- ◆ <u>Chlorantraniliprole</u> (IRAC Group 28)(Voliam flexi and Voliam xpress) Voliam flexi [mixture of chlorantriniprole and thiamethoxam (IRAC Group 4A)] has 35 day PHI on pome fruit and 14 day PHI on stone fruit. Voliam xpress [mixture of chlorantraniloprole and lambda—cyhalothrin (IRAC Group 3)] can not be used on pome fruit within 21 days of harvest and 14 days on stone fruit. Neither product can be used with adjuvant within 60 days of harvest on pome fruit.
- ◆ <u>Clothianidin</u> (IRAC Group 4A)(Belay) 7 days PHI on apples and pears; 21 days PHI on peach, no more than 0.2 lb AI per acre per season is allowed.
- ◆ Codling moth granulosis virus (Cyd-X, Carpovirusine) can be applied up to the day of harvest.

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- ◆ <u>Cyfluthrin</u> (IRAC Group 3)(Baythroid, Tombstone) 7 day PHI on both pome and stone fruit; no more than 2.8 fl oz per acre per season on pome fruit; no more than 5.6 fl oz per acre per season on stone fruit
- ◆ <u>Deltamethrin</u> (IRAC Group 3)(Battalion, Decis, Delta Gold) 21 day PHI on pome fruit; do not apply more than 0.042 lb AI per acre per season.
- ◆ Emamectin benzoate (IRAC Group 6)(Proclaim) 14 day PHI on pome fruit; no more than 14.4 oz per acre per season.
- ◆ Esfenvalerate (IRAC Group 3)(Asana) 21 day PHI on apples; 28 days on pears; 14 days on stone fruit. On apples no more than 0.525 lb of AI per acre per season is allowed.
- ◆ Fenpropathrin (IRAC Group 3)(Danitol) 14 day PHI on apples and pears; 3 days on stone fruit. No more than 0.8 lb of AI is allowed per acre per season.
- ◆ Flubendiamide (IRAC Group 28) (Belt, Tourismo) Belt label requires 14 day PHI on pome fruit, 7 day PHI on stone fruit; no more than 15.0 fl oz on pome fruit and 12.0 fl oz on stone fruit per season. Tourismo [mixture of flubendiamide and buprofezin (IRAC Group 16)] carries 14 day PHI on both stone and pome fruit.
- ◆ <u>Gamma-cyhalothrin</u> (IRAC Group 3)(Proaxis) on pome fruit do not apply within 21 days of harvest; on stone fruit the PHI is 14 days; do not apply more than 0.1 lb AI per acre per season.
- ◆ Indoxacarb (IRAC Group 22)(Avaunt) 14 day PHI on apples and stone fruit; 28 days on pears. On all three crops no more than 0.44 lb of AI is allowed per acre season.
- ◆ <u>Lambda-cyhalothrin</u> (IRAC Group3) (WarriorII with Zeon Technology, Taiga Z) 21 day PHI on pome fruit, 14 day PHI on stone fruit.
- ◆ Methomyl (IRAC Group 1A)(Lannate) 14 day PHI on apples; 7 days on pears; 4 days on peaches; 1 day on nectarines (PA only). On apples no more than 4.5 lb of AI per acre is allowed, on peaches no more than 5.4 lb of AI per acre per season; on pears no more than 1.8 lb of AI per acre per season.
- ◆ Methoxyfenozide (IRAC Group 18)(Intrepid) 14 day PHI on apples, 7 day PHI on peaches and nectarines. No more than 1.0 lb of AI allowed per acre per season.
- ◆ Novaluron (IRAC Group 15)(Rimon) 14 day PHI on apples. The compound is not registered on any other fruit crop. No more than four applications is allowed per season, no more than 150 oz per season.
- ◆ Phosmet (IRAC Group 1b)(Imidan) 7 day PHI on apples; 14 days on peaches; 14 days on nectarines. On apples no more than 21 lb of AI per acre per season is allowed, on peaches no more than 11.9 lb of AI per acre per season.
- ◆ Rynaxypyr (IRAC Group 28)(Altacor) 5 day PHI on pome fruit, 10 days PHI on stone fruit. On pome fruit do not use adjuvant with application of Altacor within 60 days of harvest.
- ◆ <u>Spinetoram</u> (IRAC Group 5) (Delegate) 7 day PHI on apples; 14 days on peaches; 1 day on nectarines. No more than 0.438 lb of AI allowed per acre per season on registered fruit crops
- ◆ Thiacloprid (IRAC Group 4A)(Calypso) 30 day PHI on apples and pears, no more than 16 fl oz per acre per year

Always read the label before applying any pesticide.

Endosulfan Phase-Out Agreement

The following information is a reprint from the *EPA Pesticide Program Updates* from EPA's Office of Pesticide Programs, 08/03/2010 http://www.epa.gov/pesticides.

Endosulfan Phase-out Agreement to Protect Health of Farmworkers and Wildlife: The U.S. Environmental Protection Agency (EPA) is taking action to end the use of the pesticide endosulfan because it can pose unacceptable health risks to farmworkers and wildlife and can persist in the environment. A formal Memorandum of Agreement with manufacturers of the agricultural insecticide will result in voluntary cancellation and phase-out of all existing endosulfan uses in the United States. Terminating uses of endosulfan will address its unacceptable risks to agricultural workers and wildlife.

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Endosulfan is an organochlorine insecticide that can be used on a wide variety of vegetables and fruit, cotton, and ornamental plants. It has no residential uses. Endosulfan is used on a very small percentage of the U.S. food supply and does not present a risk to human health from dietary exposure.

Under the agreement, most currently approved endosulfan crop uses will end in two years, including over 30 crop uses plus use on ornamental trees, shrubs and herbaceous plants. About 12 other crop uses will end over the following four years. Of these 12, the last four endosulfan uses will end on July 31, 2016. The agreement provides extra time for the later uses to phase out so that growers may successfully transition to lower risk pest control strategies, especially where endosulfan affords significant benefits and few alternatives are available. For all uses except the first ones to phase out, EPA is requiring additional mitigation measures during the phase-out period to minimize worker risks associated with endosulfan use on these crops.

By the end of 2010, each endosulfan end-use product label will include a table showing the exact dates when it will become unlawful to use the product on the crops included on the label. A list of endosulfan uses and phase-out dates is available in the agreement and on EPA's Web site at http://www.epa.gov/pesticides/reregistration/endosulfan/endosulfan-agreement.html.

EPA plans to publish a Federal Register notice by September announcing receipt of the registrants requests for voluntary cancellation and amendments of endosulfan product registrations. Public comment will be invited for 30 days. The Agency expects to grant the requested cancellations and amendments shortly after the close of the comment period.

The Memorandum of Agreement is available at EPA-HQ-OPP-2002-0262-0181, and other documents related to EPA's reevaluation of endosulfan are also posted in docket EPA-HQ-OPP-2002-0262 at http://www.regulations.gov.

For more information, visit: http://www.epa.gov/pesticides/reregistration/endosulfan-agreement.html.



Dwarfing Rootstocks for Peach

Jim Schupp, Rob Crassweller, Edwin Winzeler and Don Smith Penn State Department of Horticulture

Orchard intensification is a proven method to increase the production of high quality fruit and hasten grower return on investment in apple; however the primary peach production system is low density open vase. This system has not changed significantly in over 150 years. A key missing factor needed for peach orchard intensification is an efficient size-controlling rootstock. Tree size control in peach orchards has potential to increase labor efficiency in this labor-intensive fruit crop, and to increase the usefulness of new labor-efficient technologies, such as labor platforms and mechanical thinners. We began rootstock trials at the Fruit Research and Extension Center (FREC) mainly to explore the potential for dwarfing effects, but rootstocks can impact orchard performance in other ways too. These include factors such as adaptation to climate (cold hardiness), adaptation to soil types (tolerance to wet soils), disease and nematode resistance, or productivity (increased precocity, yield or fruit size). These important factors are not limited to dwarfing rootstocks, so several non-dwarfing rootstocks were also included in these trials.

Pennsylvania participated in a 2002 NC-140 trial of Redhaven on eight different rootstocks. This planting had to be removed in 2006 after only 5 seasons of growth; however one dwarf and one semi-dwarf rootstock in this trial showed early promise and have been included in new trials. Further study of these and other new rootstocks is again underway to determine how well these trees survive and perform under our conditions, and what the final tree size of each will be at full maturity.

Four plantings were established in 2008, and one in 2009 to evaluate a number of potential size controlling rootstocks using regionally-important varieties. The rootstocks under consideration purportedly range in tree size from standard to semi-dwarf through fully dwarf (Table 1), and thus may provide growers with a range of size control options, as is the situation with apple. The 2008 trials include nine rootstocks with the variety Johnboy. The trial plantings were established at the FREC in Biglerville, the Horticulture Research Farm (HRF) at Rock Springs, and at grower sites in Franklin and Adams Counties. One of the commercial sites is a high density perpendicular V planting, while all others are conventional open vase systems at wider spacing. The Rock Springs location was selected to provide a challenging site for cold hardiness evaluation.

The 2009 NC-140 project tests Redhaven on 16 rootstocks. This trial is planted at several locations throughout North America. The trees in both years were planted and maintained with support provided by the State Horticultural Association of Pennsylvania and Penn State's Agricultural Experiment Station.

Seven of the rootstocks are peaches. Lovell and Bailey are included as local standards, and Guardian is included in the NC-140 trial as the southeastern U.S. standard, where it is used for its tolerance to peach tree short life complex. All three of these rootstocks are propagated as open pollinated seedlings. Two HBOK selections from California exhibit tree size control, while little is known about tree size from two new "KV" selections from Ralph Scorza's breeding program in Kearneysville, WV. Four rootstocks are plum; one being a selection of *Prunus Americana* with potential for dwarfing from Bailey's nursery in MN. The other three are European plums from Italy. Penta, now named Empyrean®2, performed well in earlier trials. Both Penta and Tetra reportedly provide some tree size control and are tolerant of heavy wet soils.

Twelve of the rootstocks are *Prunus* hybrids that contribute traits that peach rootstocks lack, such as tolerance or adaptability to cold winter temperatures, poor soil drainage, or soil alkalinity, as well as tree size control and/or disease resistance. Bright's Hybrid#5, Empyrean®1, Atlas and Viking are examples of high vigor rootstocks with broad tolerance to poor soils and with good disease resistance that are selected for replant sites where standard rootstocks fail to thrive.

There is much interest in the northeastern and mid-Atlantic U.S. about the Kyrmsk series of rootstocks from Russia. These rootstocks are reportedly very tolerant of cold winter temperatures and heavy soils, while Krymsk 1 and 2 offer a good degree of dwarfing. California rootstocks, Controller 5 and 9 are reportedly 50% and 90% the size of peach seedling trees respectively. Over the next 10 years these rootstocks will be evaluated for survival, adaptation to the climate, tree size control, yield, fruit size and quality and freedom from physiological defects, such as graft incompatibility or root suckers.







Krymsk 1 Lovell Controller 5

Horticulture Happenings

Monday, September 20, 1:00 to 4:45 pm, Blueberry IPM Training, Dymonds Farm and Farm Market The *Blueberry IPM Training Workshop* will provide growers and extension educators with general information on pest management practices in blueberries. Focus of the workshop is sampling and identification of insect pests and diseases. Admission is free. Handouts, refreshments and some seating will be provided, but we suggest you bring a folding chair for portions of the presentation if you have one.

Please register for this workshop by calling the Luzerne County extension office at 570-825-1701 by 4:30 pm on September 16th. Please provide your name, an email address or phone number where we may contact you if necessary, and tell us how many people from your operation plan to attend.

Tuesday, November 16, 2010, Western Pennsylvania Vegetable and Berry Seminar, Butler, PA For more information contact Eric Oesterling at 724-837-1402 or reol@psu.edu, Lee Young at 724-228-6881 or ljs32@psu.edu or Bob Pollack at 724-465-3880 or reo32psu.edu.

January 1-11, 2011, Young Grower Alliance Specialty Crop Tour of Chile

For additional information, contact Katie Ellis, Penn State Extension, 717-334-6271 ext. 331

Hispanic Heritage Month honors Latino contributions to American culture, and festivals and educational activities will be held throughout the Commonwealth. Individual growers, the Young Grower Alliance and the Agricultural Human Resource Management Association are assisting with the sponsorship of a Salsa on the Square on Friday, October 1, in Gettysburg.



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