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THE OHIO STATE UNIVERSITY Newsletter Extension

Fruit ICM News

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Calendar

May 6: Cider HACCP Training, Fisher Auditorium, South Exhibit Area, OARDC, Wooster, 10 am to 1 pm. Sponsored by Ohio Department of Agriculture. For more information contact Duane Murray at 614-728-6348.

May 10-12: Ohio Wine Competition, Fisher Auditorium, North Exhibit Area and Conference Room, OARDC, Wooster, 2 pm to 6:30 pm. For more information contact Todd Steiner, 330-263-3881.

June 30: Ohio Fruit Growers Society Summer Tour, OARDC Horticulture Unit 2, Wooster, 8 am to 3 pm. Registration fee. For more information contact Tom Sachs at 614-246-8292 or email at growohio@of f.org.

August 19: Ohio Grape Research Day, OARDC, Wooster, OH.

Pest Management Surveys

Source: Margaret Huelsman, OSU Extension Associate, Entomology

The Integrated Pest Management Program is once again collecting information about pest management practices used by Ohio fruit growers. This year we are assembling data on apples and strawberries. The information will be used to update the existing crop profiles for these commodities. Crop profiles are used by EPA as reliable sources of information about important crop production methods, including critical pest management practices and tools. OSU Extension specialists have been handing out these surveys at some of the winter meetings. If you already received a survey and returned it, we thank you. If you still have your survey and stamped return envelope, please take a moment to complete the survey and send it in. If you have not yet received a survey and would like to participate or if you have

questions please contact Margaret Huelsman at 614-688-8431.

The Apple Crop Profile that Margaret is updating can be found at: http://pestdata.ncsu.edu/cropprofiles/docs/ohapples.html.

The Strawberry Crop Profile is at: http://pestdata.ncsu.edu/cropprofiles/docs/ohstrawberries.html.

Using Fungicides to Control Strawberry Fruit Rots in Ohio 2004

Source: Michael A. Ellis, Department of Plant Pathology, The Ohio State University, OARDC, Wooster

The most common fruit rots on strawberry in Ohio are: Botrytis fruit rot (gray mold), caused by *Botrytis cinerea*; anthracnose fruit rot, caused by *Colletotrichum acutatum*; and leather rot caused by *Phytophthora cactorum*. Especially in wet growing seasons, successful strawberry production may depend on the simultaneous control of all of these diseases.

Generally, all three diseases do not occur simultaneously in the same planting, but this can occur. Botrytis fruit rot or gray mold is the most common disease and generally requires some level of fungicide for control each year. Anthracnose is a problem in years with warm to hot temperatures combined with prolonged rainfall prior to and during harvest. Anthracnose is generally not a problem in most plantings; however, when it does develop, it can be devastating. New fungicide chemistry with good to excellent activity against anthracnose has recently been registered for use on strawberry and should be helpful in providing effective control.

Leather rot is a problem in years with excessive rainfall or in fields with poor drainage that have standing water (all of these diseases are a problem in situations such as this). Many growers do a good job of controlling leather rot by planting on sites with good soil drainage and maintaining a layer of straw mulch to prevent contact of berries with soil. In years with excessively wet weather or on sites with problem soil drainage, fungicides may be beneficial for leather rot control.

As previously mentioned, Botrytis or gray mold is the most common disease and is probably the easiest to control with effective fungicide use. Most fruit infections by Botrytis occur only during bloom. Therefore, most growers that apply fungicide during bloom generally do a good job of controlling Botrytis and do not need to apply fungicides pre-bloom or during harvest.

If anthracnose and leather rot **are not a problem**, fungicide sprays during bloom only are generally all that is required. Obviously this is an ideal situation in relation to reducing costs and overall fungicide use.

In plantings and in growing seasons (warm and wet) where anthracnose or leather rot are problems, the need for a more intensive fungicide program is greatly increased. The following information provides guidelines for developing an effective fungicide program for control of the major fruit rots in Ohio.

Prebloom
In most years, there is generally little or no need for fungicides prior to bloom for control of Botrytis. If weather is exceptionally wet from rain or overhead irrigation from frost protection, some early season fungicide may be required prior to bloom. If anthacnose is a concern, especially in plastic culture berries, prebloom applications of fungicide may be beneficial in reducing the buildup of inoculum in the planting. This is especially true if prebloom temperatures are abnormally warm and conditions are wet.

Applications of Captan or Thiram alone at the highest rate (Captan 50WP, 6 lb/A; Captan 80WDG, 3.75 lb/A; Captec 4L, 3 qts/A, Thiram 75WDG, 4.4 lb/A) should be effective in reducing inoculum buildup of all three diseases. A seven day application interval should be sufficient.

During Bloom

This is the critical period for control of Botrytis. In addition, in fields infested with *Colletotrichum* (anthracnose), the fungus may be able to build up inoculum on symptomless (apparently healthy) foliage during warm, wet weather. Increased inoculum could result in increased fruit infections if weather remains favorable for disease development.

The main fungicides for control of Botrytis are Topsin-M 70WSB, Elevate 50WG, and Switch 62.5WG. All of these materials have excellent efficacy for control of Botrytis, but only Switch has efficacy against anthracnose. This is an important point to remember if anthracnose is a problem in the planting. I also recommend that all of these materials be tank-mixed with Captan or Thiram during bloom. Captan and Thiram are protectant fungicides that provide some additional control against Botrytis (gray mold), anthracnose fruit rot, and leather rot. In addition, mixing the materials should also aid in reducing the risk of fungicide resistance development.

Topsin, Elevate, and Switch are all at high risk for development of fungicide resistance in Botrytis. None of these fungicides should be used alone in a season-long program for Botrytis control. They all have different chemistry so they can be alternated with each other as a fungicide resistance management strategy. It is wise not to apply any of these fungicides in more than two sequential sprays without alternating to a different fungicide.

For successful Botrytis control, it is important to provide fungicide protection throughout bloom. Remember that early blooms (king bloom) may be your largest and best quality fruit, so protection needs to be started early (at least 10% bloom). The number of bloom sprays required depends upon the weather. If it is hot and dry, no fungicides are required.

All of the fruit rot diseases discussed here require water on the flowers and fruit in order to infect. If it is very dry and overhead irrigation is used for supplemental water, irrigation can be applied in early morning so that plants dry as fast as possible. Keeping plants dry reduces the need for fungicide application. Fortunately, most years are not this dry and fungicides are generally applied on at least a 7-day schedule through bloom. If it is extremely wet, a shorter interval (4-5 days) may be required in order to protect new flowers as they open.

Although Botrytis is the primary pathogen we are trying to control during bloom, the selection of the proper fungicides should also aid in reducing the buildup of anthracnose as well. This is important to remember in plantings where anthracnose is a problem or threat.

Post Bloom Through Harvest

As bloom ends and green fruit are present, the threat from Botrytis infection is generally over. Green fruit are resistant to Botrytis. If you got fruit infection by Botrytis during bloom, the symptoms (fruit rot) will not show up until harvest as fruit start to mature. At this point, it is too late to control it.

As new fruit form through harvest, the threat of anthracnose fruit infection increases. In many plantings, anthracnose is not present or is not a problem. In these plantings no additional fungicide should be required after bloom through harvest. Unfortunately, you cannot determine if anthracnose is a problem until you see it. Often, this is too late to control it.

In plantings with a history of anthracnose fruit rot, or if the disease is identified in the plantings, fungicides with efficacy for anthracnose control may be required from the end of bloom through harvest. Remember, anthracnose is favored by warm to hot, wet weather. In addition, anthracnose appears to be a greater problem in plastic culture plantings.

Quadris 2.08F, Cabrio 20EG, and Pristine 38WG are the most effective fungicides currently registered on strawberry for control of anthracnose fruit rot. These fungicides are also registered for control of powdery mildew, and they also provide good suppression of Botrytis fruit rot (gray mold). All of these fungicides are at high risk for fungicide resistance development in the anthracnose fungus. In addition, they are all in the same class of chemistry; therefore, they cannot be alternated with each other as a fungicide resistance management strategy.

In order to delay the development of fungicide resistance, the label states that no more than four applications of Quadris or five applications of Cabrio or Pristine can be made per season. In addition, the label states that no more than two sequential sprays of each fungicide can be made without switching to a fungicide with a different type of chemistry. For anthracnose control, the only fungicides that currently can be used in such a rotation are Captan, Thiram, or Switch.

The following are suggestions for developing a fungicide program for simultaneous control of strawberry fruit rots.

Fungicide and (Rate/A)	**Comments**
Prebloom Captan 50 WP (6 lb) or Captan 80WDG (3.75 lb) or Captec 4L, 3 qt or Thiram 75WDG (4.4 lb)	Prebloom applications should be required only if excessive water from rain or irrigation is a problem early in the season. Fungicides here could help reduce build-up of Botrytis and Colletotrichum inoculum. In dry or more "normal" seasons, fungicide is probably not required until bloom starts.
During bloom Switch 62.5WG (11-14 oz) or Elevate 50WG (1-1.5 lb) or Topsin-M 70WSB (1 lb) **PLUS** Captan 50WP (4-6 lb) or Captan 80WDG (3.75 lb) or Captec 4L (2-3 qt) or Thiram 75WDG (4.4 lb) **OR** Captevate 68WDG (3.5-5.25 lb)	This is the main time to control Botrytis, and if temperatures are high, Colletotrichum could build up in the planting. Switch is excellent for control of Botrytis and has been reported to be good for control of anthracnose. Obviously, this is ideal. The addition of Captan or Thiram provides additional protection against both diseases and may aid in reducing fungicide resistance development. Topsin-M and Elevate are both excellent for control of Botrytis, but have no activity against anthracnose. Where anthracnose is not a threat, these fungicides will provide excellent Botrytis control. When Elevate or Topsin-M are combined with the high rate of Captan or Thiram, the combination should provide some level of anthracnose control. Captevate is a package-mix combination of Elevate plus Captan. If anthracnose is a concern, Switch would be the fungicide of choice. None of the fungicides (Switch, Elevate or Topsin-M) should be applied more than twice before alternating with a fungicide of different chemistry. This is to aid in reducing fungicide resistance development. Quadris, Cabrio, and Pristine are the fungicides of choice for anthracnose control, and all of them provide some control of Botrytis. Although they could be used during bloom, I prefer to use them after bloom when the threat of anthracnose fruit infection is greatest.

Post bloom through Harvest Quadris 2.08F (6.2-15.4 fl oz) or Cabrio 20EG (12-14 oz) or Pristine 38WG (18.5 - 23 oz) or Switch 62.5WG (11-14 oz) tank-mixed or alternated with Captan 50WP (3-6 lb) or Captan 80WDG (3.75 lb) or Captec 4L (1.5-3 qt) If more than two applications of Quadris, Cabrio, or Pristine are required, Switch can be considered as an alternating fungicide.	As green fruit develop, the threat of anthracnose infection increases, especially under warm, wet conditions. Quadris, Cabrio, or Pristine are the most effective materials for anthracnose control. If anthracnose is a problem, the highest label rate should be used. This may be the best time to use Quadris, Cabrio, or Pristine. Switch also has some activity for control of anthracnose. If the risk of anthracnose is high or the disease has been observed in the planting, Quadris, Cabrio, or Pristine plus Captan should be applied 7 days after the last bloom spray for Botrytis. If anthracnose remains a threat, sprays should probably be repeated on a 7 day interval through harvest. As harvest approaches, Captan should be removed from the program. Captan applied close to harvest could result in visible residues on fruit and this can be a big problem. Quadris, Cabrio, Pristine or Switch applied alone should result in minimal visible residues on fruit and can be applied on the day of harvest (0-day PHI). Remember, **these preharvest sprays are required only if anthracnose is a threat or problem.**

The extensive use of Captan in this program could result in problems with visible residues on fruit. This needs to be considered, but under heavy disease pressure for anthracnose a high level of Captan usage may be required. The Captec 4L (flowable) should result in less visible residue than the Captan 50W (wettable powder) or Captan 80WDG formulation. The use of Quadris, Cabrio, Pristine or Switch alone in the last spray or two before harvest should aid greatly in reducing visible residues.

Leather Rot

As mentioned previously, leather rot should be controlled by good soil drainage (no standing water) and a good layer of straw mulch to prevent berries from soil contact. If leather rot is a threat or a problem, fungicides may be required. Quadris, Cabrio, and Pristine have excellent activity against Phytophthora diseases on other crops. Although not on the label, Quadris, Cabrio, and Pristine should have good activity for control of leather rot in addition to anthracnose and Botrytis gray mold. If applied at the time suggested here (green fruit through harvest) for anthracnose, Quadris, Cabrio, and Pristine may be beneficial for control of leather rot as well. Recent research at Ohio State indicated that these materials have good to excellent activity against leather rot.

Fungicides for Leather Rot Control

As previously mentioned, emphasis for leather rot control should be placed on the use of cultural practices such as planting on well drained sites or improving water drainage in the planting and a good layer of straw mulch to prevent berry contact with the soil. When needed, the following fungicides are labeled specifically for control of leather rot.

Ridomil Gold is labeled for control of Red Stele (caused by *Phytophthora fragarieae*) and Leather Rot (caused by *Phytophthora cactorum*). The label for perennial strawberries reads as follows:

"Established Plantings: Apply Ridomil Gold EC at 1 pt. per treated acre in sufficient water to move the fungicide into the root zone of the plants. Make one application in the spring after the ground thaws and before first bloom. A second application may be applied after harvest in the fall."

Note: Although not labeled for leather rot control, the early spring application for red stele control should provide some control of leather rot.

For supplemental control of leather rot, an application may be made during the growing season at fruit set. This application at fruit set (as green fruit are present) has been very effective for leather rot control.

Aliette 80WDG is labeled for control of Red Stele and Leather Rot. For Leather Rot, apply 2.5 to 5 lb/A. Apply as a foliar spray between 10% bloom and early fruit set, and continue on a 7-14 day interval as long as conditions are favorable for disease development. Applications can be made the same day as harvest (PHI=0 days). Do not exceed 30 lb product per acre per season. **Phosphorous Acid** (Agri-Fos) is labeled for control of Red Stele and Leather Rot on strawberries. This material has essentially the same active ingredient as Aliette and the use recommendations for red stele and leather rot are very similar to those of Aliette; however, Aliette is a wettable powder and Agri-Fos is a liquid. Agri-Fos is recommended at the rate of 1.25 quarts per acre in 90 gallons of water or 2.5 gallons per acre in 200 gallons of water. For leather rot, apply at 10% bloom and early fruit set, then at 1 to 2 week intervals as needed. Several Phosphorous acid fungicides are currently being registered for use on several crops in the U.S. and others will probably be registered for use on strawberry in the near future.

Remember, these are only suggested guidelines for a fruit rot control program. It is always the grower's responsibility to read and understand the label. For the most current pesticide recommendations in Ohio, growers are referred to Bulletin 506-B, *Ohio Commercial Small Fruit and Grape Spray Guide.*

If growers have questions regarding the information covered here, they should contact Mike Ellis at 330-263-3849 or e-mail: ellis.7@osu.edu.

Revising Scab Control Strategies for 2004

Source: Dave Rosenberger, Bill Turechek, & Wolfram Koeller, Plant Pathology, Highland and Geneva, Scaffolds Fruit Journal, Volume 13, #1, 03/22/04

Controlling apple scab in 2004 may be more difficult than at any time in the past 25 years because of the following factors:

- Most orchards have significant carry-over inoculum due to less-than-perfect scab control during the wet summer of 2003.
- Scab populations with multiple resistance to apple scab fungicides are present in some (perhaps many?) orchards, but there is currently no way to determine where resistant populations are lurking.
- Apple growers have become accustomed to limited-risk prebloom scab control strategies that may prove ineffective for managing scab in orchards where the scab population is resistant to dodine, Topsin M, and SI fungicides (Rubigan, Nova, and Procure).

The rest of this article address each of these issues and then provides specific recommendations for a conservative scab control program in 2004.

High inoculum contributes to more scab control failures than is generally recognized. In high-inoculum orchards, the first infections often occur earlier than in low-inoculum orchards, and the slightest gap in prebloom fungicide protection can result in economically significant scab infections.

Orchards with visible scab on leaves at the end of last season are automatically considered high-inoculum orchards. However, there is increasing evidence that some symptomless leaves may also harbor overwintering inoculum. This may occur if infections were only suppressed by use of SI

fungicides applied on a post-infection timing or if infections occur in autumn. The latter is of special concern for spring of 2004.

Exceptionally wet conditions persisted from August throughout September of 2003 in many parts of the Northeast. In the Hudson Valley, 9.1 inches of rain fell in September, with 4.2 inches in the first four days of September. In Geneva, 9.2 inches of rain fell in August and September with nearly 5 inches falling in the first 13 days of August. These rains removed all fungicide residues, thereby allowing ample opportunity for late-season infections to occur in any orchard that had visible scab lesions prior to the start of the rains and that were not resprayed with fungicides after the rains. Late-season infections may remain invisible or may be only faintly visible on the underside of the leaves, so the severity of late-season infections may be underestimated.

High inoculum alone increases the potential for severe scab infections at green tip, but the risk for infection skyrockets if high inoculum is combined with early ascospore maturity. Ascospore maturity is often advanced compared to tree phenology in years where continuous snow cover and cold wet spring weather combine to allow rapid advances in spore maturity. Prebloom temperatures between 32 and 40F (assuming adequate moisture to keep leaf litter damp) favor advanced maturation of apple scab ascospores when trees reach the green tip bud stage. Even worse, pseudothecia that develop under cool temperatures produce more ascospores than those that develop under warm temperatures. In one study, pseudothecia incubated at 43F produced 1000 spores per pseudothecium as compared with only 584 spores per pseudothecium when incubated at 54F. Thus, a cool wet spring will make a bad year worse.

Fungicide resistance has been identified (via extensive lab testing) as the cause of high incidences of fruit scab in at least four NY orchards over the past year. We suspect that similar levels of resistance are present in many other orchards, but major scab epidemics were averted only because scab was held in check by the contact fungicides (mancozeb, Polyram, captan) that are used with SI fungicides. Low rates of contact fungicides tank-mixed with SI fungicides can control SI-resistant scab so long as inoculum levels remain low. With high inoculum levels anticipated for spring of 2004, more growers will probably see control failures if they omit green tip sprays and use SI+contact sprays at 10-day intervals.

There is no way (at this time) that we can test hundreds of orchard blocks to determine whether scab in those orchards is resistant to SI fungicides, dodine, or Topsin M. Thus, the only safe approach to scab control in 2004 is to assume that every orchard contains some level of resistance to all of the fungicides noted above.

Grower attitudes toward apple scab may adversely affect prospects for good scab control in 2004. Scab control strategies developed and adopted over the past 25 years were based on the assumption that growers could afford a small risk of less-than-perfect scab control during the prebloom period because fungicides applied starting at tight cluster or pink would eradicate any missed infections.

These limited-risk strategies included delaying the first scab spray, spraying alternate rows without reducing the spray interval, and using low rates of contact fungicides (often <50% of the rates recommended in 1960). These strategies were cost effective, thanks (in part) to the availability of fungicides with post-infection and pre-symptom activity (dodine, Benlate, Topsin M, SI fungicides). Success in controlling fungicide-resistant apple scab will largely depend on how quickly apple growers can react to the need for conservative scab control programs. For some large farms, an additional sprayer and sprayer operator may be required if trees are to be sprayed every 5-7 days rather than every 8-12 days.

No new fungicides are available to resolve the fungicide resistance problems. The strobilurin fungicides

(Sovran, Flint) were originally promoted as substitutes for the SI fungicides, but we increasingly recognize that these fungicides are excellent protectants with only limited post-infection activity. Perhaps more importantly, the strobilurin fungicides do NOT have pre-symptom activity (activity from 72 hour after infection until scab lesions appear). It is precisely the pre-symptom activity of dodine, Benlate, Topsin M, and SI fungicides that made them so effective in eliminating the "misses" that occurred as we cut back on pre-bloom scab control. Using Sovran or Flint to arrest epidemics after scab lesions become visible in spring will only speed development of complete resistance to this class of fungicides.

Vangard, an anilinopyrimidine fungicide, is of questionable value for scab programs under New York conditions. Protection provided by Vangard is never better than that provided by 3 lb/A of mancozeb, and the 48-hour post-infection activity of Vangard is most reliable at low temperatures (<45 F). We do not expect that Vangard will ever match the qualities that dodine, Benlate, Topsin M, or the SI's had before resistance compromised their activity against apple scab.

A conservative scab program for 2004 will include the following:

- Apply a urea spray (40 lb/A) to the leaf litter before green tip in orchards that were clobbered with scab last year. A spring application of urea can significantly reduce inoculum production in the leaf litter, thereby reducing pressure on fungicides.
- Apply a fungicide at green tip or at least before the first scab infection period. A copper spray applied at green tip to suppress fire blight will also control scab and will suppress the superficial bark cankers caused by Botryosphaeria species.
- Follow up at 5-7 day intervals (or before rains) with applications of captan, mancozeb, or Polyram.
- Use either a strobilurin fungicide or an SI+contact fungicide starting at pink or bloom to initiate mildew control and to enhance scab control during the period of peak risk for development of fruit scab. (The SI will help with scab control only where scab is still sensitive to SI fungicides).
- After the first strobilurin or SI+contact spray, continue with additional strobilurin or SI+contact sprays through second cover. Alternating strobilurin with SI+contact sprays may be more effective than using two applications of one group followed by two applications of the other. Using the high label rates of strobilurin fungicides will slow development of resistance to these fungicides. Use the strobilurin and SI+contact fungicides with shorter spray intervals (i.e., 7-9 days rather than 8-12 days) if the season is highly favorable for apple scab, and maintain these short spray intervals through second cover if scab lesions are visible on leaves at petal fall.

By using shorter spray intervals and depending primarily on contact fungicides, growers should be able to completely control prebloom scab infections even in orchards with high inoculum. Effective scab control from green tip to petal fall virtually eliminates risks of significant fruit infection, and more extended fungicide spray intervals can be employed after the supply of scab ascospores is depleted (usually around petal fall) so long as no scab lesions are evident on cluster leaves.

Bottom Line: Fungicide resistance has eliminated the safety net that allowed for limited-risk prebloom fungicide strategies that were developed over the past 25 years. Any shortfall in prebloom scab protection now can explode into a serious fruit scab problem if weather conditions favor scab development. Using a conservative prebloom scab control program will prolong the effectiveness of those fungicides to which resistance has not yet developed.

Pest Phenology

Coming Events	Degree Day Accum. Base 50 F
Pear psylla adults active	0 - 49
Pear psylla 1st oviposition	1 - 72
Redbanded leaf roller 1st catch	5 - 251
Green fruitworm 1st catch	9 - 101
Spotted tentiform leafminer 1st catch	17 - 251
Tarnished plant bug active	34 - 299

Thanks to *Scaffolds Fruit Journal* (Art Agnello)

Degree Day Accumulations for Ohio Sites March 17, 2004

Ohio Location	Degree Day Accumulations Base 50	
	Actual	Normal
Akron-Canton	12	24
Cincinnati	35	53
Cleveland	12	23
Columbus	20	34
Dayton	21	33
Kingsville	10	15
Mansfield	10	23
Norwalk	12	18
Piketon	37	63
Toledo	6	15
Wooster	14	20
Youngstown	11	19

Captan 80-WP Label Details for Re-entry

Source: http://www.cdms.net/ldat/ld0TJ003.pdf

The new Captan label will make life easier for strawberry growers concerned about re-entry interval:

Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 4 days.

Exception: For the last 48 hours of the REI, workers may enter the treated area to perform hand labor or other tasks involving contact with anything that has been treated, such as plants, soil, or water, without time limit, if they wear the early-entry personal protective equipment listed below.

Exception: The restricted early entry interval (REI) for strawberries is 24 hours. After expiration of the 24 hour period, no personal protective equipment is required.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated such as plants, soil, or water, is:

6. Coveralls
7. Waterproof gloves
8. Shoes plus socks
9. Protective eyewear

Notify workers of the application by warning them orally or by posting warning signs at entrances to treated areas.

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