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Ohio Fruit ICM News

Vegetable & Fruit Insecticide News for 2010-2011

Celeste Welty, Extension Entomologist, Ohio State University

New products:

Product	A.I.	Target pests	Crops	Date	Registrant
Scorpion 35SL	dinotefuran (same A.I. as Venom)	leafhoppers, whiteflies, bugs, some beetles	potato, lettuce & other leafy veg., cole crops, cucurbits, tomato & other fruiting veg.	May 2010	Gowan
Tourismo (1.17 + 2.33 SC)	flubendiamide (same A.I. as Belt) + buprofezin (same A.I. as Centaur, Applaud)	caterpillars	grapes, pome fruit, stone fruit	Nov. 2009	Nichino America
Vetica (0.33+2.33SC)	flubendiamide (same A.I. as Synapse) + buprofezin (same A.I. as Courier)	caterpillars	tomato & other fruiting veg., lettuce & other leafy veg., cabbage & other cole crops, cucurbits	Aug. 2009	Nichino America
Onager 1EC	hexythiazox (same A.I. as Savey)	mites	grapes, pome fruit, stone fruit	Feb. 2008	Gowan

Products with registration expanded to additional **crops**:

Product	A.I.	Target pests	Crops	Date	Registrant
Hero 1.24EC	zeta-cypermethrin (same A.I. as Mustang Max) + bifenthrin (same A.I. as Brigade)	beetles, caterpillars, aphids, leafhoppers	now for use on grape, blueberry, brambles, radish & other root crops, potato, cucurbits, greens	May 2010	FMC
Voliam Xpress (0.835 + 0.417 EC)	lambda-cyhalothrin (same A.I. as Warrior) + chlorantraniliprole (same A.I. as Coragen)	beetles, caterpillars, leafhoppers, grasshoppers, stink bugs	now for use on sweet corn, legumes	May 2010	Syngenta
Voliam Flexi (20+20WDG)	thiamethoxam (same A.I. as Actara) + chlorantraniliprole (same A.I. as Coragen)	aphids, leafhoppers, whiteflies, caterpillars, some beetles	now for use on strawberry, mint	May 2010	Syngenta
Belay 2.13SC	clothianidin (same A.I. as Clutch)	aphids, leafhoppers, beetles, bugs, thrips	now for use on peach, pome fruit, grapes, tomato & other fruiting veg., cole crops, greens, cucurbits, lettuce & other leafy veg.	April 2010	Valent
Danitol 2.4EC	fenpropathrin	Japanese beetle, caterpillars	now for use on brambles	Mar. 2010	Valent
Rimon 0.83EC	novaluron	caterpillars, beetle larvae, immature whiteflies & bugs, immature thrips	now for use on blueberry, strawberry, peach, plum, beans, cucurbits, eggplant, pepper	Feb. 2010	Chemtura
Coragen 1.67SC	chlorantraniliprole	caterpillars	now for use on sweet corn, asparagus, legumes, potato, herbs, mint, spices, strawberry	Jan. 2010	DuPont
Altacor 35WDG	chlorantraniliprole	caterpillars	now for use on brambles	Jan. 2010	DuPont
Portal 0.4EC	fenpyroximate (same A.I. as Fujimite)	mites, whiteflies, leafhoppers, mealybugs, psylla	now for use on strawberry, grapes; also melons, tomato & other fruiting veg., pome fruit	Dec. 2009	Nichino America
Centaur 70WDG	buprofezin (same A.I. as in Courier)	scales, mealybugs	now for use on plum, cherry	Nov. 2009	Nichino America
Courier 40SC	buprofezin (same A.I. as in Centaur, Applaud)	leafhoppers and whiteflies	now for use on strawberry, cole crops, eggplant, pepper, celery, parsley, spinach	Oct. 2009	Nichino America
Avaunt 30DG	indoxacarb	armyworms	now for use on blueberry, beets	July 2009	DuPont
Baythroid XL (1EC)	beta-cyfluthrin	leafhoppers, cutworms, flea beetles	now for use on beets	June 2009	Bayer
Zeal 72WP	Etoxazole	spider mite eggs and immatures	now for use on cucumber, stone fruit, mint	2009	Valent

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Inside This Issue

If you have articles for the newsletter that you would like to have considered to be included in upcoming issues, please submit to either Howard Siegrist at siegrist.1@cfaes.osu.edu or Melissa Swearingen at swearingen.34@cfaes.osu.edu

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Celeste Welty, Extension Entomologist, Ohio State University Extension

New or improved formulations:

• Lorsban Advanced is a new Lorsban 4E.

Registration modifications:

• Altacor (chlorantraniliprole): PHI on apples and pears was shortened from 14 days to 5 days.

• Zeal (etoxazole): PHI on apples and pears was shortened from 28 days to 14 days.

• Onager (hexythiazox): PHI on grapes was shortened from 28 days to 7 days.

• Guthion 50WP Solupak (azinphos-methyl): limit **per year** for 2011 and 2012 is reduced to 3 lb/A for apple and pear, 1.5 lb/A for cherry, 2 lb/A for parsley. Guthion can not be used after 2012. Made by Makhteshim (MANA).

Products being cancelled:

• Endosulfan (Thionex): Date for use to end is 7/31/2012 for strawberry (annual), peach, plum, cherry, cabbage, kale, cucumbers, melons, summer squash, lettuce; 7/31/2013 for pear; 7/31/2015 for blueberry, apple, pepper, potato, pumpkin, sweet corn, tomato, winter squash; 7/31/2016 for strawberry (perennial).

New or anticipated pests:

• Spotted wing Drosophila on cherries, raspberries, blackberries, blueberries, strawberries, grapes, peaches, plums, apples. Detected in California in 2008, in Florida and Oregon in 2009, and in Michigan in 2010.

• Brown marmorated stink bug: on peaches, apples, grapes, sweet corn, tomatoes, peppers, other crops; moving into Ohio from the east

• Western bean cutworm on sweet corn; moving into Ohio from the west

• Swede midge on cole crops; moving into Ohio from Ontario and western New York

• Silverleaf whitefly on tomatoes; moving into Ohio on transplants from Florida

Recent 2ee labels for new or anticipated pests:

• Brown marmorated stink bug:
    - Danitol on stone and pome fruit, strawberry, blueberry, pepper, tomato, peas, cucurbits, cole crops.
    - Carzol on apple.
• Spotted wing Drosophila
    - Pounce on cherries.
    - Mustang Max on berries (black, rasp, blue), cherries, grapes.
    - Danitol on stone and pome fruit, grapes, strawberries, berries (black, rasp, blue).

Old pests that have been increasing or difficult to manage:

• Corn earworm in sweet corn

• Onion thrips on cabbage

• Woolly apple aphid in apples

• Dogwood borer in apples

• Oriental fruit moth in apples

10/15/2010, rev. 10/21/2010, 1/7/2011, 1/25/2011, 2/25/2011

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Continued from page 1& 2: Vegetable & Fruit Insecticide News for 2010-2011

Celeste Welty, Extension Entomologist, Ohio State University Extension

Summary of Vegetable & Fruit Insecticide Changes, 2008-2010

NEW REGISTRATIONS:

sweet corn
- Voliam Xpress (5/2010)
- Coragen (1/2010)
- Belt (8/2008)

tomato, pepper, & eggplant
- Scorpion (5/2010)
- Belay (4/2010)
- Rimon (2/2010, 2009)
- Courier (10/2009)
- Vetica (8/2009)
- Portal, FujiMite (7/2009)
- Voliam Flexi (7/2009)
- Movento (9/2008)
- Synapse (8/2008)
- Durivo (8/2008)
- Voliam Xpress (8/2008)
- Coragen (5/2008)
- Brigadier (5/2008)

cucurbits
- Hero (5/2010)
- Scorpion (5/2010)
- Belay (4/2010)
- Rimon (2/2010)
- Vetica (8/2009)
- Voliam Flexi (7/2009)
- FarMoreDI400 (8/2008)
- Synapse (8/2008)
- Durivo (8/2008)
- Voliam Xpress (8/2008)
- Coragen (5/2008)
- Warrior (1/2008)
- Assail (1/2008)

cucumbers & melons only
- Zeal (2/2008, 12/09)

melons only
- Portal, FujiMite (7/2009)

cole crops
- Scorpion (5/2010)
- Belay (4/2010)
- Courier (10/2009)
- Vetica (8/2009)
- Voliam Flexi (7/2009)
- Movento (9/2008)
- Synapse (8/2008)
- Durivo (8/2008)
- Voliam Xpress (8/2008)
- Coragen (5/2008)
- Brigadier (5/2008)

greens (collard, kale, mustard)
- Hero (5/2010)
- Belay (4/2010)
- Voliam Flexi (7/2009)
- Synapse (8/2008)
- Durivo (8/2008)
- Coragen (5/2008)
- Brigadier (5/2008)

radish, beets, turnip, carrot
- Hero (5/2010)

beets only
- Avaunt (7/2009)
- Baythroid (6/2009)

lettuces, endive, spinach, parsley
- Scorpion (5/2010)
- Belay (4/2010)
- Courier (10/2009)
- FarMoreDI400 (2009)
- Vetica (8/2009)
- Voliam Flexi (7/2009)
- Movento (9/2008)
- Synapse (8/2008)
- Durivo (8/2008)
- Coragen (5/2008)

lettuces only
- Voliam Xpress (8/2008)

lettuce, head only
- Brigadier (5/2008)

spinach only
- Brigadier (5/2008)

herbs and/or mints
- Coragen (1/2010)
- Zeal (2009)

beans & peas
- Voliam Xpress (5/2010)
- Coragen (1/2010)
- Acramite 4SC (2/2007, 6/'09)
- Brigadier (5/2008)
- Assail (1/2008)

beans only
- Rimon (2/2010)

peas (dry) only
- Leverage (3/2008)

onions
- Intrepid (2/2008)
- Assail (1/2008)

potato
- Hero (5/2010)
- Scorpion (5/2010)
- Coragen (1/2010)
- Voliam Xpress (7/2009)
- Regent (2008)
- Movento (10/2008)
- Voliam Flexi (8/2008)
- Endigo (7/2008)
- Altacor (5/2008)
- Brigadier (5/2008)
- Warrior (1/2008)

asparagus
- Coragen (1/2010)

strawberries
- Voliam Flexi (5/2010)
- Rimon (2/2010)
- Coragen (1/2010)
- Portal (12/2009)
- Courier (10/2009)
- Assail (1/2008)

brambles /caneberries
- Hero (5/2010)
- Danitol (3/2010)
- Altacor (1/2010)
- Assail (1/2008)

blueberries
- Hero (5/2010)
- Rimon (1/2010)
- Tourismo (11/2009)
- Avaunt (7/2009)
- Intrepid (4/2008)
- Assail (1/2008)

grapes
- Hero (5/2010)
- Belay (4/2010)
- Portal (11/2009)
- Movento (9/2008)
- Belt (8/2008)
- Voliam Flexi (8/2008)
- Altacor (5/2008)
- Brigadier (5/2008)
- Kanemite (4/2008)
- Onager (2/2008)

apples & pears
- Belay (4/2010)
- Tourismo (11/2009)
- Voliam Xpress (7/2009)
- Movento (9/2008)
- Belt (8/2008)
- Voliam Flexi (8/2008)
- Altacor (5/2008)
- Onager (2/2008)
- Portal (1/2008)

peach, plum, & cherry
- Zeal (2/2008, 12/2009)
- Tourismo (11/2009)
- Voliam Xpress (7/2009)
- Centaur (11/2009; 7/2009)
- Movento (9/2008)
- Belt (8/2008)
- Voliam Flexi (8/2008)
- Altacor (5/2008)
- Onager (2/2008)
- Assail (1/2008)

peach & plum only
- Rimon (1/2010)

peach only
- Belay (4/2010)

CANCELLATIONS:

tomato, potato
- Monitor 4L (2009)

beans, cabbage, lettuce, pepper
- DiSyston 8EC, 15G (2009)

cucurbits, sweet corn, potato
- Furadan 4F (2009)

strawberry
- Lannate (~2008)

10/15/2010

Top 10 Strategies for Farmers Market Vendors

By Eric Barrett and Hal Kneen, Extension Educators
OSU Extension Education and Research Area—Washington & Meigs counties

Based on a market research trip through New York State and New York City visiting fourteen farmers' markets. This project was sponsored by the OSU Extension Specialization Grant Program and the James M. Barrett Family Endowment Fund.

1. **Tell your farm's story.** Post pictures of the farm with the owner and the employees who are working the market(s) in action shots. Have photos of them working on the farm in various settings to help customers make a visual connection with the farm and its products.
2. **Brand your stand.** Besides having a great logo and having it everywhere in your stand (aprons, farm sign, boxes, etc.), the stand should be tied together with colors, matching tables/table covers and pricing signage consistent with the image. Be known for something. Nothing is worse than another vendor offering the same product as you – and sometimes at a lower price! You can avoid getting caught up in price wars by having other great products and being known as having the best of certain products.
3. **Differentiate yourself as a grower** if the market allows resellers. If you are selling a neighboring farms' items – it should be posted as such. Consider going to farmer only markets. From our experiences, you'll probably notice the higher prices you can get for your products.
4. **Educate your customers.** Why should they be coming to your stand? Will they keep coming? Explain why your products are healthier, more sustainable, local and more beneficial to the local economy. Additionally, it is your job as a producer to be sure they understand current agricultural practices used to produce the food you are selling.
5. **Do some simple research.** Making a sale can be as easy as making conversation with customers. Ask questions which cannot be answered 'yes or no' or give them a suggestion regarding a product. Once they feel comfortable with you, try to find out what other products they may want to purchase. Then, find a way to grow those products for the market.
6. **Tell them how to use it.** Many items will not sell unless the consumer can see themselves serving it up for a meal. Offer recipes and tell them how to prepare – broil, braise, steam, blanche or just eat it raw! Encourage the market to have cooking demonstrations using the market manager, inviting local chefs or simply showcasing customers as masters of locally grown products in the kitchen.
7. **Provide convenience.** Make paying for items as easy as possible. Think about this when setting prices and when deciding what forms of payment to collect. Line decorative baskets in displays with the bags customers will take home so they can just pull it out and go about their shopping (and this may help with your food safety requirements). Consider recycleable, reuseable or biodegradeable bags. Let customers know what other markets you participate in and on what days those markets are open.
8. **Mix it up and make it colorful.** Even if you don't have a large mix of products available, consider growing a variety of colors/shapes of the same products to make the display and offerings look as new and fresh as possible. There are endless varieties available to 'mix it up a bit.' Try mixing different colors of tomatoes for a 'salad mix' basket, different romas for a 'sauce mix' or just a variety of similar vegetables/fruit to market towards smaller households.
9. **Pay more to be a vendor.** The more serious the business plan for the market, the more likely you are to be profitable as a vendor. Markets which pay a manager and pay attention to a succinct marketing plan seem to have more customers and happier, more profitable vendors. A great plan will allow customers to find market hours, location(s), website, social media and special events whenever and wherever they decide they need it. And, as a market grows, do not be afraid to help start a second market with a different focus.
10. **Work with the community.** Whether it's the chamber, tourism bureau, business improvement district or a non profit – find a way to connect and partner to better the entire community. Accept coupons for nutrition programs and other government programs which will help many segments of the local population.

Safe Pesticide Storage Tips

Diane Brown, Commercial Horticulture
Michigan State University Extension

Check your storage area to ensure you are taking advantage of these practices for best results

Here is a checklist for evaluating your pesticide storage area this spring:

- Whether your pesticide storage area is an entire building, a room, a closet or a cabinet devoted to pesticide storage, keep it locked to prevent unauthorized entry, vandalism or theft.
- Post warning signs on doors and windows to let people know that pesticides are stored inside.
- "No Smoking" signs should also be posted, since many pesticides are flammable.
- Regularly check containers for leaks. Transfer the contents of leaking containers to a sound container with the exact same formulation and label. Follow label recommendations for disposal of damaged containers.
- Store pesticides in their original containers with the labels intact
- Put the heaviest containers and liquids on the lowest (preferably metal) shelves. Be sure that shelves are sturdy enough to handle the load.
- To avoid cross-contamination, store each type of pesticide (herbicides, insecticides, fungicides) in a separate location or on a separate shelf within the storage unit.
- Store pesticides away from food, pet food, feed, seed, fertilizers, veterinary supplies and flammable materials.
- Outdated or unusable pesticides can be taken to a community "clean sweep" day for free, safe disposal. Check with your local county Extension office for a list of dates and locations.

Conducting a Pre-Harvest Risk Assessment

Phil Tocco, Extension Educator, Pre-Harvest and Post-Harvest Food Safety
Michigan State University Extension

A major first step in creating a GAP Manual for your farm is to identify the food safety risks – some are obvious, some are not. This article walks you through some of the risks you may not be considering.

A pre-harvest risk assessment is a catalog of all the potential risks to the safety of the food produced on your farm. Not all potential risks are probable risks, but they should be included if for no other reason than to keep you thinking about preventing these risks from becoming realities. If you have ever written an emergency management plan for your farm, the process of writing a pre-harvest risk assessment is similar.

You begin by drawing a map of your farm and the surrounding land features. Be as detailed and specific as you can. Pay particular attention to where livestock operations are in relation to the food production areas. Include areas that can harbor wildlife, such as forested and riparian areas. If the ground is prone to flooding from creek overflows, note that on the map. Be sure to indicate where pesticides and equipment are stored. Any septic fields on the property should also be included on the map. An example map can be seen in the image below.

Some growers find using Google Maps to be helpful in visualizing the area around their farms. They may forget that there's a feedlot less than a mile from one of their far flung fields. The creek running near their low muck ground may not have entered into consideration, but with an aerial photo, it becomes hard to miss.

Once you have assessed your risks, you can alter your growing practices to avoid contamination or implement countermeasures to mitigate the potential threats. In the example shown in the map, the grower may opt not to plant crops in a portion of the low ground on years when the creek floods. This would avoid potential E. coli contamination on any crops grown in the flooded area. The grower may also wish to avoid harvesting the five acres closest to the forested area when evidence of deer and birds in the field are found to decrease the potential contamination of the food.

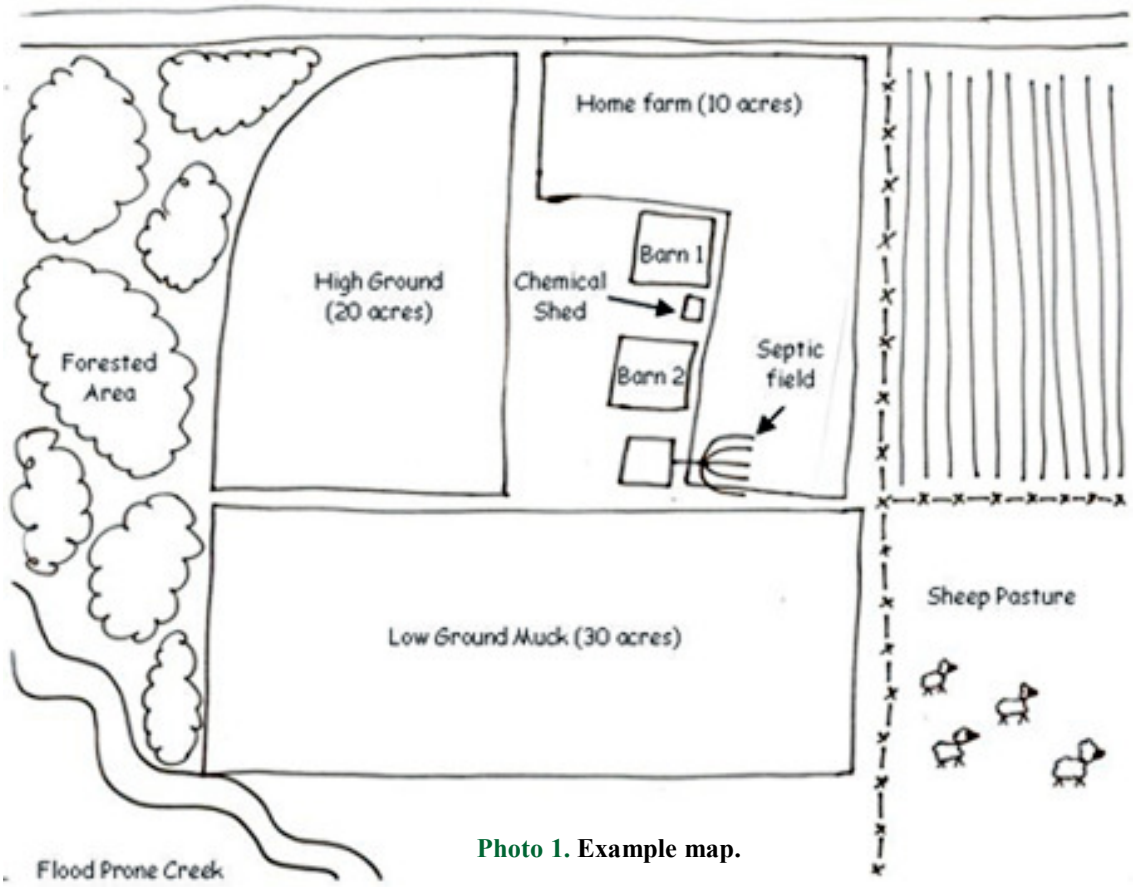

Photo 1. Example map.

Always remember to spell out any alteration of growing practices in your GAP Manual. Even if you are actively doing GAP, the auditor won't give you credit unless there is visual evidence of a food safety practice, documentation in your manual as to your strategy and a record that it has been carried out. Growers with specific questions about Google Maps or having difficulty tailoring GAPs to their farms, are welcome to contact the Agrifood Safety Work Group at gaps@msu.edu or 517-788-4292. To obtain a factsheet on creating a farm map with Google maps, ask for AFSM001-01.

Visit the Agrifood Safety Work Group website: http://gaps.msue.msu.edu/afsm.htm

Preventing Alternate Bearing in Fruit Crops

Dr. Jim Schupp, FREC Pomologist
Penn State University
Article from Fruit Times - Volume 30 Issue 2 - February 2011

Alternate Bearing (AB) refers to an alternating cropping pattern that is internally regulated by the plant. This phenomenon is widespread throughout many perennial trees and shrubs, but is not universal. Perennial fruit crops initiate flower buds for next season's crop in the current season, and for most deciduous fruit species, the alternation of large and small crops is caused by competition between the current season's crop and the coming season's flower buds. Excessive crop in the ―on year‖ depletes the nutrients needed to form new fruit buds; however there also is evidence that seed-produced hormones exported from the developing ovules have a direct inhibitory effect on flower development. Apple is a heavily-studied species with regard to AB, and research indicates that floral inhibition is caused by seed produced hormones, especially gibberellins (Jackson, 2003), while the data for pear are much less clear in this matter (Dennis, 2003).

This "on-off" sequence does not always follow a regular biennial pattern. For example, Bosc pear, a cultivar that is highly susceptible to AB, may exhibit two consecutive off-years following a heavy crop. For this reason, the term "biennial bearing" is a less appropriate label for this phenomenon.

While internally regulated, AB is often triggered by an external factor (such as unfavorable weather or poor crop management). Once triggered, the fluctuation is likely to continue for years after the triggering event. This "ripple effect" differentiates AB from other cropping irregularities.

Alternate bearing is a significant economic problem for a number of fruit and nut industries worldwide. In a heavy "on-crop" year, the problem is too many small fruit that have a low cash value because of their small size and over-abundance. In an "off-crop" year, fruit are generally too large and of poor quality, with increased potential for physiological disorders. Net return to the grower is low in an off-crop year because there are too few fruit. Thus, AB results in price instability and erratic annual returns to growers. The limited supply of fruit in the off-crop year also can lead to loss of market share that is not always regained the following year.

The severity of AB can be calculated in two ways (Monselise and Goldschmidt, 1982):
Formula 1: Alternate bearing index (I) = (year 1 yield) - (year 2 yield)/(year 1 yield + year 2 yield), where I = 0 is no alternate bearing and I = 1.0 is complete alternate bearing; and
Formula 2: Alternate bearing = (current year's yield) - (5-year running average yield)/5-year running average yield; when the current yield is 20% greater than the 5-year average yield, it is an on-crop and when the current yield is 20% less than the 5-year average, it is an off-crop.

Among deciduous fruits, AB is documented in apple, pear, plum, prune, apricot, cranberry and blueberry (Monselise and Goldschmidt, 1982). Cultivars (varieties) within a given species vary in the degree of crop regularity, along the full spectrum of regularity. Comparing several commercial apple cultivars for example, Gala, Jonagold, Granny Smith and I dared have a low AB index, Rome shows mild susceptibility to AB, Delicious and McIntosh show moderate susceptibility to AB, Golden Delicious shows strong susceptibility and Fuji is highly susceptible to AB. Additionally, specific strains of a given cultivar may differ in susceptibility to AB. A typical example of this variation would be standard growth habit (more regular) versus spur type (more alternate) strains of Delicious.

Other crops, especially peach (including nectarine), have the internal capacity for a full crop every year. Peach flower buds are not as cold hardy as apple in winter and bloom earlier, thus are more susceptible to crop losses caused by unfavorable weather. However these increased risks for crop irregularity are strictly due to unfavorable weather, and peach has the potential to return to a regular pattern of full crops unless winter cold injury is so severe that it damages the perennial parts of the tree. Peach yields are influenced only by external factors in the previous winter and current growing season.

Photo by M. Seetin

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Continued from page 7: Preventing Alternate Bearing in Fruit Crops

Dr. Jim Schupp, FREC Pomologist, Penn State University

Role of Cultural Practices and Pollination: Since AB is a naturally occurring and internally regulated process, good management practices are necessary to minimize its occurrence. Generally speaking, flower formation in perennial deciduous fruit crops is promoted under growing conditions that contribute to good plant health and promote moderate vigor. It is cliché, but moderation is truly a key to production of annual crops. For example, both extremes—excessive fertilization (especially nitrogen) or mineral nutrient deficiencies—can lead to reduced flowering and low productivity (Dennis, 2003). Adoption of a production philosophy that promotes the principal of moderation can help to alleviate loss of profitability caused by AB and other cropping irregularities.

Practices that promote plant health and moderate vigor include annual pruning, irrigation to prevent water stress, regular testing for leaf and soil mineral nutrient content, use of fertilizer to maintain optimal nutrient levels, timely mowing and irrigation to minimize water stress and maintenance of tree health through the judicious use of herbicides and crop protectant sprays. While none of these practices are sufficient to promote annual cropping, it would be difficult to prevent AB if these preconditions were not adequate.

All deciduous fruit crops are pollinated by insects, thus providing for adequate pollination by bringing bees into the planting at bloom is a standard management practice. As with the cultural practices listed above, providing bees for pollination does not directly influence AB, rather it reduces the risk of cropping irregularities, which could trigger AB.

Site Selection and Pre-Plant Practices: Site and cultivar selection can contribute to reducing the risk of AB and other cropping irregularities. Spring flowering deciduous orchards are preferentially planted on sites with low risk of frost or freeze damage. Upland sites with slope and elevation greater than the surrounding land allow cold air drainage and are preferred, as are sites situated near large bodies of water that moderate springtime temperatures. Woodlands, windbreaks or other obstructions below orchards may prevent good air drainage and increase the risk of frost damage.

Orchards perform best on fertile, well drained soils with adequate aeration to promote root health. Among deciduous tree fruits, pear is the most tolerant of excess soil moisture and peach is the least tolerant. Because of the fairly exacting site requirements, most new orchards are situated on existing orchard land. Orchard replant sites should be tested for adequate soil physical and chemical properties, and for the presence of replant disease organisms. Pre-plant remedial action should be taken when testing shows it is warranted.

Cultivar selection is primarily a marketing decision; however consideration should also be given to crop bearing potential, as certain cultivars are known to produce more reliable crops. A listing of cultivars that are considered to be regular croppers and well-adapted to the region can be found in the *Penn State Cooperative Extension Tree Fruit Production Guide*.

Most cherry cultivars, many plum cultivars, and almost all apples and pears are self-incompatible (Westwood, 1978). In these instances, reliable annual cropping is greatly promoted by the placement of adequate pollinizers in the planting. By contrast, most peach and nectarine cultivars are self fertile. The nursery can provide specific information on pollinizer requirements when fruit plants are purchased.

Crop Load Management: The single most important practice for minimizing alternate bearing is judicious crop load management. Perennial fruit crops tend to set more fruit than a) can be matured to adequate size and quality to meet market expectations; and b) than can allow for adequate flower production for the subsequent season. Thus adjusting crop load is important not only for annual bearing, but for economic sustainability in the current season as well as the next. Several production practices can be used to reduce crop load, but the chief practices for doing so are fruit thinning and pruning.

In order for fruit thinning to increase return bloom, it must be done in the four to six weeks following petal fall. This window of time is thought to correspond to the period when floral initiation occurs, and no amount of crop removal after this time can be relied upon to promote flowering in any but the most annual cultivars. There is evidence that this window of opportunity is shorter for strongly alternating cultivars and longer for more annual bearers. Early thinning timing also is the most beneficial for enhancing fruit size and quality in the current season.

Apple and pear can be thinned chemically using several materials labeled for this purpose (Agnello, et al., 2004). These materials are applied during or shortly after bloom by means of conventional air-blast spray equipment. The following paragraphs summarize the characteristics of the most commonly used chemical thinners, and are not intended to be used as guidelines for the application of these registered compounds. Refer to the *Penn State Cooperative Extension Tree Fruit Production Guide* and your local crop advisor for details on the regulatory status and current recommendations for use of chemical thinners.

Certain carbamate insecticides have thinning activity, and carbaryl (e.g., Sevin®) and oxamyl (Vydate®) are labeled for this use. Carbamates at concentration of about 600 parts per million (PPM), have an established track record of being mild but dependable chemical thinners with a relatively wide window of time for efficacy. Being mild thinners, carbamates are often used in combination with stronger thinners, or tank mixed with oil to boost thinning response.

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Dr. Jim Schupp, FREC Pomologist, Penn State University

Napthaleneacetic acid (NAA) is a synthetic auxin (a class of plant hormone) with strong thinning activity at concentration between 2.5-20 PPM. NAA (e.g., Fruitone®) has been labeled as a thinner for both apple and pear for several decades, and detailed recommendations have been developed for specific cultivars and different regions. Apple thinning activity is strongest when fruit diameter is between 10 and 15 mm, and progressively milder when applied earlier. Thinning activity becomes less certain as fruit diameter exceeds 17mm, and fruits become insensitive to NAA when diameter exceeds 20 mm. Pears also are responsive to NAA, but typically require earlier timing (4 to 7 days after petal fall) and higher rates (7.5-15 PPM) than most apple cultivars. NAA can have negative side effects of growth retardation and leaf chlorosis with certain cultivars of apple and pear, and an amide salt formulation (Amid Thin®) is labeled for use with sensitive cultivars. In addition to fruit thinning, NAA has a direct promoting effect on flower formation (see the following section on Return Bloom sprays).

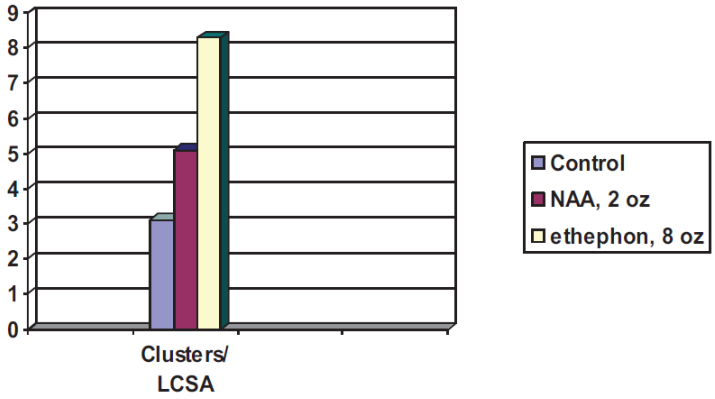

Figure 1. Effect of three post-thinning sprays of ethephon or NAA on return bloom of Fuji apple (trials conducted in Pennsylvania orchards in 2005).

Benzyladenine (6BA) is a synthetic cytokinin also known for strong chemical thinning efficacy at 75-175 PPM. 6BA was registered as an apple thinner in the mid-1990s, and several formulations are now labeled as chemical thinners for apple (MaxCel®, Excelis Plus®, and RiteSize®). MaxCel® was registered for pear in 2007. For thinning apple, 6BA is usually tank-mixed with a carbamate as the combination is more effective than either product applied separately. 6BA has none of the negative side effects of NAA, and promotes cell division in developing fruit, an effect which can increase fruit size over that obtained from thinning alone. 6BA does not stimulate flowering, thus return bloom is only enhanced by the resulting reduction in crop load.

Ethephon (e.g., Ethrel®) is an ethylene releasing plant growth regulator used for apple thinning at 150–600 PPM. Ethylene is a naturally-occurring plant growth regulator that directly stimulates fruit abscission as well as flower formation. Thinning results with ethephon can be unpredictable, and the potential for over-thinning is perhaps the strongest with this material. Ethephon is a strong thinner out to about 23 mm fruit diameter, and frequently is used as a ―rescue ‖ treatment when earlier attempts to adjust crop load have failed to remove enough fruit. Ethephon also may be applied after fruits become unresponsive to chemical thinners for its direct promotion of flower formation (see the following section entitled “Return Bloom Spray”).

Obtaining the optimal crop load for fruit size, quality and return bloom with chemical thinning is challenging. Any factor that influences tree health or vigor also will have an impact on fruit set, thus it is challenging to determine the amount of chemical thinning that is required to supplement the endogenous crop load adjustments that are taking place naturally. Weather, especially incident sunlight and air temperature have a profound effect on both natural and chemical fruit thinning. Choice of materials, rates used, timing and spray application method all influence the outcome. Many fruit growers consider chemical thinning to be the single most important and most challenging practice they perform each season.

Still, there is evidence that AB has become a less significant problem for apples and pears than it once was (Monselise and Goldschmidt, 1982). This may be attributed in part to selection of annual bearing cultivars, but far more so to the commercial development of effective chemical thinners. Chemical thinning provides apple and pear growers with an economical means of removing excess crop early enough in the season to permit adequate floral induction for the coming year. It is the first line of defense against AB in apple and pear, and without an adequate thinning program, no other practice can be relied upon to provide adequate numbers of flowers for annual cropping.

Crop load management also can be accomplished by pruning and by hand thinning. While these methods, especially pruning, are used for apple and pear, the role of these alternative methods is somewhat diminished on these two crops because chemical thinning is both timely and more labor efficient. These practices remain vitally important for adjusting crop load of most other deciduous fruit crops. Most commonly, both practices are utilized as a crop load management system to obtain an optimal crop load reduction with maximum labor efficiency.

Pruning removes bearing surface (fruit buds) and stimulates vegetative growth from remaining buds. This promotion of vegetative vigor prevents many of the remaining buds from becoming floral. Thus pruning reduces cropping by two mechanisms. Pruning is a nonselective mass-thinning technique, and therefore is reasonably labor-efficient compared to hand thinning.

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Environmental factors, especially sunlight, play an important role in flower induction. Apple buds and especially the supporting spur leaves must receive at least 30% of incident solar radiation in order to initiate flowers (Dennis, 2003). Proper pruning practices for maintaining the fruiting potential of tree fruit include the use of thinning cuts, in which whole branches are removed to open the canopy to light penetration (Ferree and Schupp, 2003). By contrast, excessive pruning or the use of heading cuts can lead to invigoration of vegetative growth and insufficient flowering. Size-controlling rootstocks also play a role in maintaining good light distribution in apple tree canopies (Dennis, 2003).

Hand thinning serves one of the same purposes as chemical thinning—that of removing a portion of the crop, thereby alleviating some of the competition between an excessive crop and its inhibitory effect on flower formation. Hand thinning is labor-intensive, and it must be done early in the growing season in order to have a beneficial effect on AB. Hand thinning can be done by selectively plucking individual fruits from a branch, a technique commonly used with larger fruited species, or by striking the limbs with a rubber- or cloth-covered stick. The latter method is more labor efficient, being a non-selective technique; however it is difficult to obtain consistent results with limb tapping. Large-fruited species may be "pre-thinned" using a combination of pruning and limb tapping, to reduce the cost of selective hand thinning to make the final crop load adjustment.

Return Bloom Sprays: Chemical thinning alone may not be sufficient to promote annual bearing for several commercially important apple cultivars that possess a strong genetic tendency to AB. Examples include York Imperial, Mutsu, Fuji, Macoun, Honeycrisp and spur-type strains of Delicious. In these special cases, plant growth regulators that directly stimulate flower formation should be considered. Two thinner chemistries are labeled for this use (Figure 1). Several weekly or bi-weekly sprays of 3-5 PPM NAA, or 100-200 PPM ethephon may be used, starting when fruit diameter has exceeded 24 mm, (about five weeks after bloom), and up until eight weeks after bloom. These low rates of chemical are recommended to avoid undesirable side effects of these treatments, such as reduced fruit size and premature fruit ripening.

Cropping and Tree Age: Yields of deciduous fruit crops tend to decline gradually with plant age. Although this decline is not solely attributed to AB, the additional tree stress and limb breakage from excessive over-cropping in repeated ―on‖ years can shorten the productive life of an orchard. This decline can be attributed either to a decline in plant vigor and tree health as exhibited in both fruit number and size, or to a decline in plant number per acre caused by mortality. These two mechanisms are not mutually exclusive, but the extent to which each mechanism contributes to yield decline differs by crop. For example, pome fruit (apple and pear) yield decline is attributed mainly to declining number and size of fruit, and is very gradual. Yield decline of these crops may only become evident after 40 years in
well-maintained orchards. On the other hand, peach trees tend to have a shorter life (Westwood, 1978), and tree mortality often closely follows any perceived decline in fruiting. Peach orchard yields decline much more rapidly, due primarily to tree mortality.

Summary: Alternate Bearing (AB) is an alternating pattern of large and small crops occurring in many fruit species that is internally regulated by the plant. AB has a number of undesirable consequences that cause economic losses to fruit growers. Cultural and pollination practices, and variety and site selection are important preconditions to achieving annual production, but are not adequate in themselves to prevent AB. Adjusting crop load to a moderate level early in the growing season is the single most important key to preventing AB. Crop can be adjusted by a variety of methods, depending on the fruit type, and often several methods are used in combination. The development and use of effective chemical thinners has been successful in reducing AB in apple and pear production over the past 50 years. Apple varieties that are strongly AB can also benefit from sprays of growth regulators that promote flowering.

Planning Ahead Will Increase Your Trees' Survival From Rodent Damage

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Assessing rodent damage, collecting and preserving scion-wood determines bridge grafting success

Cold, long and snowy winters – just like the one we are experiencing – turn our orchards into "all-you-can-eat" hot spots for voles, field mice and rabbits. The trees are a rodent's next best choice after the deep snow makes grass seeds and fallen fruit inaccessible. It seems that apple orchards become particularly popular, and, as luck would have it, the varieties that bring highest economic return to the growers, like Honeycrisp and Galas, are also favorites on the menu of these little gluttons. If there are no apple or pear orchards around, they will frequent cherry, peach and plum orchards as well. Since stone fruit does not respond successfully to bridge grafting, further discussion in this article refers to apples and pears.

Damage could be very significant and will not only always be confined to the base of the trunk above the soil line. Often, injury extends below the soil surface as well as above the snow line affecting the lower scaffolding. With cambium layer compromised, there is a good chance of losing that tree. The easiest way to kill the tree is to girdle it, but how do you save girdled trees?

This is where planning ahead can help. It is still a good time to collect scion-wood to be used for bridge grafting. This should be easy now that the crews are still out pruning. One-year-old growth about 3/8 inches in diameter and 15-18 inches long are most desirable. Water sprouts work real well. Naturally, branches should be collected from healthy trees and, preferably, fire blight resistant trees.

The next step is to make sure trees stay dormant and viable until about full pink-early bloom when the actual grafting will take place. The scion-wood must be kept moist and in a cool and dark place. Wood should be wrapped in moist but not soggy paper towels or burlap, placed in a perforated plastic bag (to avoid molding and rotting) and set inside a cooler (temperature above freezing) or refrigerator that is not used for saving food (to avoid any exposure to ethylene). Ethylene will induce bud break, thus compromising graft "take." Personally, I had best results (98-100 percent took) when using dormant scion-wood.

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