http://ipm.osu.edu/fruit/index.html

THE OHIO STATE UNIVERSITY Newsletter Extension

# Fruit ICM News

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**In This Issue:**



## 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@off.org.

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

## Mills Tables for Apple Scab Prediction

*Source: From: B. Turechek, J. Carroll and the Cornell Tree Fruit Guidelines*, http://www.nysaes.cornell.edu/pp/extension/tfabp/mills.shtml

**Introduction**

The Mills curves, published in 1944, were the first attempt at using forecasting to help growers time the application of sulfur dusts for apple scab management. The Mills curves relate the hours of leaf wetting and temperature during a wetting period to the likelihood of scab infection. The first fungicide spray is

applied during the first predicted infection event, and subsequent applications are applied relative to the residual activity of the pesticide and other predicted infection events.

The Mills curves have been modified over the years as more was learned about the disease, but the overall premise behind the use of these curves remains the same. Jones' modification of the curves are referred to as the **Modified Mills Table** and MacHardy and Gadoury's modification is referred to as the **Revised Mills Table** curves.

**Which of the two Mills tables should be used?**

The Revised Mills Table reflects the most up-to-date information available on the infection process of apple scab and is preferred over the Modified Mills table because of this (this is the table used at Cornell). The Modified Mills table is kept there for reference because many older computerized forecast models still use this table.

**Three findings led to the development of the revised table.**

- **Shorter times for infection**. Infection by ascospores or conidia can occur in less time than reported by Mills. This is especially true at temperatures below 42F. For example, the minimum time required for infection at 37F is 30 hours. This is 11-18 hours less than reported in previous infection period tables.

- **Equal requirements for primary and secondary infection**. Earlier tables stated that infection by conidia (secondary infections) required less time than by ascospores (primary infections). However, subsequent research has demonstrated that both spore types infect at similar rates at equivalent temperatures. Furthermore, both spore types are frequently present in the orchard between tight cluster and petal fall, a critical period for scab control. Therefore, a single set of conditions should be used for determining primary and secondary infections.

- **Only minimum times are listed in the new table**. Unlike previous tables, the new version does not rate the severity of infection periods. Longer wetting at any given temperature often causes more disease, and a 2- to 6-fold increase in severity generally results when wetting is extended beyond the minimum times specified in the new table. However, the actual quantity of disease that will develop from any infection period is affected to a much greater degree by factors other than the duration of wetting. Thus, the rating of severity based on duration of wetting alone is frequently misleading. Severe infection can result from "light" Mills periods if other factors (tree growth and susceptibility, inoculum availability) are optimal. Likewise, severe disease often fails to materialize following "heavy" Mills periods if these same factors are limiting.

**Intermittent Wetting Periods**

Growers who rely on the Mills Table to predict apple scab infections often ask, "How should I handle intermittent wetting periods?" Several studies have been conducted in an attempt to answer this question, but none of the studies provided answers for all of the various combinations of temperatures and wetting and drying intervals. Yet, results from the experiments that have been conducted DO provide us with enough information to derive a good rule of thumb.

The most detailed study to date was conducted by Chris Becker and Tom Burr in the early 1990's. In their approach, they asked if apple scab conidia could cause disease after exposure to various wet-dry-wet intervals at either 50, 59, 68, or 77F. Three initial wet intervals were tested, either: 1) 15 minutes, 2) the time at each temperature required for ~50% of conidia to germinate, which turned out to be 7, 5, 4, and 5

hours at 50, 59, 68, and 77F, respectively, or 3) the time at each temperature required for ~20% of the conidia to also form an appresorium (i.e., 20% of the spores penetrated the host) which was 12, 8, 7, and 8 hours at 50, 59, 68, and 77F, respectively. An appresorium is the structure the fungus produces to penetrate the host plant. After exposure to the initial wet interval, plants were exposed to 0, 0.25, 6, 12, 24, or 96 hours of drying at either 60% (low) or 90% (high) relative humidity. This was followed by a final wet interval of 24 hours. After exposure to the final wet period, they assessed the proportion of ungerminated conidia and germlings (i.e., germinated conidia) with or without an appresorium that were killed.

Results of this study showed that ungerminated conidia were not killed by exposure to dry intervals until drying exceeded 96 hours within the range of temperatures and relative humidities studied. Germlings with or without an appresorium were more sensitive to drying than ungerminated conidia. Twenty percent of germlings were killed after the first 15 minutes of drying and an additional 10-30% after 96 hours. Germlings with appresoria were killed after 24 and 96 hours, too, but the attrition rate was lower than for germlings without appresoria. Even after 96 hours of drying, over 75% of ungerminated conidia and germlings were still able to penetrate the apple leaf during the second 24-hour-long wet interval.

Becker and Burr proposed the following rule based on their results: "If the interval of drying is less than 48 hours in length, the initial and subsequent intervals of wetting should be summed to calculate Mills infection periods." This rule is more conservative than the "typical" rule of "summing wetting periods separated by less than either 8 hours of sunny weather or 12 hours of cloudy weather."

Where did this rule come from? In a review of the scientific literature MacHardy found NO scientific basis for the establishment of this rule. In fact, nearly all the research that has been conducted shows that a high proportion of both ascospores and conidia survive drying periods of 24 hours or more whether it is sunny or not. Has this rule worked in the field? Perhaps. If it has, though, it is not because spores have died after only 12 hours of drying.

Several other factors affect the amount of disease that develops after a predicted infection event. These include:

- the amount of primary inoculum in an orchard, assessed via PAD (potential ascospore dose) counts in the fall;
- the stage of development of ascosporic inoculum in the spring, assessed via squash mounts, spore traps, and degree day model calculations;
- the time of day and season when rain and leaf wetness occurs because ascospore discharge occurs during daylight, whereas conidia can be disseminated anytime by splashing rain; and
- whether the principal source of inoculum is ascospores or conidia.

MacHardy suggests a less conservative rule than Becker and Burr's to follow for combining successive wetting periods: "two successive wetting periods, the first started by rain, should be considered a single, uninterrupted wet period if the intervening dry period is less than 24 hours, regardless of weather conditions (sunshine, temperature, and RH) during the intervening dry period." This rule, in our opinion, should be the rule adopted by NY growers. This rule is easier to apply, slightly more conservative, and, most importantly, consistent with the results of research.

**Day vs. Night Release of Ascospores**

This issue is separate from the use of the revised table, but is related to its application in low-inoculum orchards. Extensive research has shown that under most circumstances, over 95% of the available ascospores are not released until after sunrise when rain begins after sunset. Thus, in low inoculum orchards, it is often safe to assume that primary infection periods begin at dawn when rain begins at night. This assumes that the low percentage of night-released ascospores, coupled with the already low seasonal "crop" of ascospores at low-inoculum sites, is insignificant. However, secondary spores (conidia) are not affected by light or darkness. Therefore, DO NOT ignore wetting hours during darkness if scab infections have already been observed in the orchard or if you are not certain of excellent control for all previous infection periods.

**References:**

Becker, C.M., and Burr, T.J. 1994. *Discontinuous wetting and survival of conidia of Venturia inaequalis on apple leaves*. Phytopathology 84:372-378.

MacHardy, W.E. 1996. *Apple Scab: Biology, Epidemiology, and Management*, APS Press, St. Paul, Minnesota, pp. 545.

# A Bustling in the Hedgerow

*Source: Art Agnello, Entomology, Geneva, Scaffolds Fruit Journal, Volume 13, No. 4, April 12, 2004*

We haven't exactly bolted into the warmer spring temperatures just yet, but the long-range predictions are tending to show more highs in the 50's and 60's during the next week, so we're bound to start noticing some insect activity soon that bears a certain resemblance to the goings on at spring break in Myrtle Beach. Not all of this will happen overnight of course, but just to keep you from being taken by surprise when the developmental alarm clocks go off, here's a brief checklist of some prebloom arthropod activity to consider before the season cranks up.

**Mites**

Oil applications should go on before we reach pink in apples or white bud in pears, and as there's not much freezing weather in the extended forecast, any calm period of sufficient duration would be a suitable spray window. Start with 1.5 to 2.0% at first, and reduce to 1.0 to 1.5% as the trees reach tight/green cluster. Also, don't forget the usefulness of this tactic in stone fruit plantings (cherry, peach and plum) with a history of ERM. In apples, Savey and Apollo can be delayed until pink, and if everything else runs away with your time and a miticide application before bloom is impossible, consider Agri-Mek at petal fall in problem blocks. Besides saving some time during the hectic prebloom period, this is also a sensible rotation program for purposes of resistance management.

**Rosy Apple Aphid**

In particularly susceptible varieties (Cortland, Ida Red, Golden Delicious, R.I. Greening), a material such as Lorsban or Supracide can provide effective prevention through tight cluster, and will pick up any San Jose scale at the same time. Actara is also a good prebloom fit for rosy apple aphid and other pests besides, including leafminers and early plum curculio. You'll also get some side rosy control if you're using Esteem for scale at this time.

**San Jose Scale**

Besides the Lorsban and Supracide noted above, delayed dormant oil applications will do a good job of reducing scale populations. If you're not treating for rosies but are concerned that SJS might be increasing in some blocks, Esteem is an insect growth regulator with good activity on scale. The label calls for it to be mixed with oil, so if you're applying oil for mites anyway, this might be a tactic to try in severe cases.

**Dogwood Borer/American Plum Borer**

A coarse spray of Lorsban directed at trunk burr knots between half-inch green and petal fall is effective against both species that can be a problem in dwarf plantings.

**Pear Midge**

The first adults generally appear when Bartletts and Clapps are in the swollen bud to tight cluster bud stage, but no successful egg-laying occurs until the flower buds are a little more developed. In pear blocks with a history of midge infestation, concentrate on those portions of the orchard most protected from the wind by trees, high ground, or buildings, as the midges tend to be most numerous in these spots. Organophosphates like Guthion are the most effective materials; 2 sprays are recommended, one between swollen bud and first separation of the sepals, and another 7 days later (or at white bud, whichever comes first).

**Pear Psylla**

If you're just starting on your oil sprays, one application at 2% or two at 1% until white bud should provide adequate protection against egg deposition until an insecticide spray might be elected. Esteem at white bud or after petal fall has shown good activity in suppressing psylla numbers. Agri-Mek used shortly after petal fall has given good control if applied correctly (well-timed, adequate coverage, combined with an oil adjuvant), and split applications of Nexter or Provado, also starting soon after petal fall, will keep nymph numbers down through the early summer.

**Oriental Fruit Moth**

The first adults could start flying during the next two weeks, depending on how much of a warming trend we get, but we don't necessarily recommend pheromone disruption against this brood in peaches or apples, as your plum curculio sprays will serve double duty against OFM as well. However, be prepared to start these at petal fall even in peaches, as shuck split will be too late to get the first egg-laying moths.

**Black Cherry Aphid**

In (sweet especially) cherry plantings with a history of infestation by this pest, which curls and stunts leaves, a prebloom inspection for these shiny black metallic insects can warrant an application of Thionex or a pyrethroid (Asana or Warrior).

**Tarnished Plant Bug**

Early season feeding by overwintered adults in peaches can damage flower buds and cause bleeding of sap from twigs and shoots. If you note several bleeding sites per tree, a pink application of a pyrethroid or Carzol can offer some control. In apricots, choose either Asana or Warrior.

# Purple Raspberry Cultivars for Ohio

*Source: Richard C. Funt, Department of Horticulture and Crop Science, The Ohio State University*

When black raspberries are crossed with red raspberries (mainly floricane types), a purple raspberry can be created. Purple raspberry plants have been available for a long time with the latest introduction in 1982.

Royalty is a complex cross using Newburgh, a summer red and Cumberland, a high quality black raspberry. In New York, Royalty's berry size averages 3.0 grams (range 2.0 to 3.7) and is similar in size to Titan. Royalty produces vigorous canes, which requires a double cross arm four-wire trellis. Fruit begins to ripen in early July, is soft, reddish-brown in color, and is of excellent quality. Plants are immune to large raspberry aphid. Royalty is pruned similar to a summer red. It is described as similar to Titan for winter hardiness. Titan is considered to be lower in quality than Royalty. In central Ohio, Royalty ripens between July 7 and 20th. Generally, summer reds and black raspberries have completed their harvest by early July.

Brandywine (NY631 and Hilton) is a tall, upright plant similar to a black raspberry, and requires a single cross arm trellis system. It can be more vigorously than most black raspberries and is pruned like a black raspberry. In two studies, Brandywine has had higher yields than Royalty. Fruit are round, firm, large, and somewhat tart, making it excellent for jam and jellies. Brandywine is susceptible to verticillium wilt, raspberry aphid, and crown gall. It is considered to be more winter hardy than Royalty. It does not tolerate wet soils. Raised beds with organic matter are suggested. In central Ohio, Brandywine ripens at approximately the same time as Royalty.

# Planting Fruit Trees in 2004

*Source: Ron Perry, MSUE Horticulture, Fruit Crop CAT, Vol. 19, No. 2, April 13, 2004*

Planting trees at an incorrect depth can be a serious mistake that can ruin a new orchard for life. Generally, this mistake is most serious if trees are planted too deep. Shallow-planted trees can usually be corrected and have less serious consequences, if there are any at all. The consequences for deep-planted trees can range from them having a slow start to scion rooting.

Stone fruit can be most sensitive to root systems that have been deep-planted. Deeper portions of the soil profile possess more free water, lower temperatures and less oxygen. These conditions inhibit new root growth and lend to a slower start for trees. A grower may not intentionally plant trees excessively deep. Trees that are augured in (trees planted in holes made with an auger) have a tendency to settle following rains or irrigation as much as three to five inches in depth. Mechanically planted trees will settle less at two to four inches.

**Apple and pear trees**

Scion rooting of apple trees on dwarfing rootstocks is a serious and common problem caused by deep planting. At the time of planting, the orchardist may have thought that the trees were planted correctly, only to find out five to seven years later that the unions are not visible and trees appear abnormally vigorous. As a consequence, adventitious roots arising from the scion become dominant and the trees take on the normal vigorous level, which approximates seedling.

Unfortunately, at that point nothing can be done to correct the problem. Digging down to expose the unions and cutting roots causes a depression in the soil that allows water to fill causing Phytophthora (height) for each inch the union is above soil line. Many growers use this knowledge in attempting to

match scion and rootstock vigor with the soil. If they are too high, growers are advised to cover a large part of the exposed shank with a berm or mound of soil. This remedy works well to correct a shallow-planted tree, and may need follow-up attention annually or biannually.

**Stone fruit trees**

For stone fruit, scion rooting is less of a problem when deep-planted. Nonetheless, experience has taught us that planting so the original union is slightly above the soil line is still a good policy. While the union can be buried on cherries, plums, and peaches without fear of scion rooting, excessively deep planting can place roots in an oxygen-starved soil environment, lending to a slow regeneration of new roots and subsequent overall growth.

We have found that in stone fruit, the depth of the uppermost lateral roots can be the best index of optimum planting depth. That depth should be so that the first lateral roots are 1.5 to 2 inches. For stone fruit the union will often end up being close to one to two inches above the soil line (thickness of a 2" x 4" board).

The budding height in commercial nurseries can vary for stone fruit, and thus the depth of first lateral roots makes a better gauge for planting depth. Mound (berm) the soil up on the tree shank (trunk), where the budding height in the nursery was low, and thus in close proximity to the upper lateral roots.

**Mounding**

We began a project sponsored by project GREEEN (Generating Research and Extension to meet Economic and Environmental Needs) funding in 1998 to assess the impact of soil mounding on dogwood borer infestation. As reported in previous CAT Alert articles in 1999, we found that mounding reduced larval counts by five- to ten-fold. Infestation rates were found to be highly correlated with trunks (exposed rootstock shanks) covered by burr knots.

In our rootstock trials, we found that the rootstocks that produce the largest area covered by burr knots are Mark and M.26. The rootstock M.26 and M.9, which also has a tendency to produce burr knots at a high rate, depending on the clone, make up more than 50 percent of new trees being planted today in North America. Therefore, for newly established orchards in Michigan, we recommend that trees be mounded (bermed) within one year following planting to avoid dogwood borers.

Mounding can also help trees avoid phytophthora infection in finer textured soils by encouraging water to drain away from the trunk/ground interface. Some growers have started mounding soil on tree trunks where trees are weak as in apple on Mark rootstock or in some cases, where trees are planted on M.9 with a weak growing scion or in a droughty soil.

Generally, it takes a few years before the adventitious roots from the scion begin to influence scion vigor. Unfortunately, this strategy can yield unpredictable results, depending on the rate and intensity of root development and on the soil conditions. Plum growers have had some success in mounding soil on the trunk of "Stanley" and encouraging scion rooting. Eventually scion roots take over and provide a bypass around occluded unions in cases of brown line disease caused by tomato ringspot virus.

If you error, be less concerned with shallow-planted trees and more concerned with deep-planted trees.

# What to Consider for Spring Grape Disease Management

*Source: Annemiek Schilder, MSUE Plant Pathology, Fruit Crop CAT, Vol. 19, No. 2, April 13, 2004*

**Disease history of the vineyard**

Most vineyards do not have a history of all grape diseases. Growers should focus their disease control efforts on the diseases they know are a problem for them. Disease pressure depends on the weather conditions, the cultivar grown, the age of the vineyard, the location, and the training system. For instance, humid weather is more conducive to powdery mildew, and hedged vineyards typically have more Phomopsis than hand-pruned vineyards.

**Clean-up of vineyard**

Prune out dead canes and stubs as much as possible since they are the main sources of phomopsis spores. Remove any fruit mummies still hanging on the vine, since these may release black rot spores. Also remove large pieces of wood from the vineyard and burn them. This is especially important in Eutypa-infected vineyards, since dead wood remains a source of Eutypa inoculum for multiple years.

While it is recommended to remove pruned canes from vineyards, most growers find it more practical to chop them up. This may be okay, provided that the canes are well pulverized so that they can decompose quickly. Make two passes with a brush-chopping mower if necessary.

**Timing of disease control measures**

Timing of disease control measures is critical to success. Protectant fungicides have to be used before an infection period occurs. Between one and five inches of shoot growth, Phomopsis cane and leaf spot is the primary disease of concern. Clusters and shoots are vulnerable as soon as they become exposed. Young tissues are most susceptible.

Spray timing trials have indicated that this stage is important for controlling cluster stem (rachis) and shoot infections. Wet weather conditions during this period of rapid shoot elongation are ideal conditions for the infection and spread of Phomopsis.

Applications should be made 10 days to two weeks apart, depending on weather conditions. If there are frequent rain events (several per week, with rainfall totals greater than one inch since the last spray) then the spray interval should be 10 days. Protectant materials will protect the shoots and leaves for two weeks if rain events occur weekly with rainfall totals less than one inch since the last fungicide application. Powdery mildew control should not be delayed in vinifera and susceptible French hybrid vineyards past the 10 to 12 inch growth stage. However, in most Concord vineyards, powdery mildew control is not imminent at this time.

Phomopsis is still the primary concern at this stage of growth. Black rot may be an issue in vineyards that had a problem the previous year. There is an abundance of succulent tissue that is highly susceptible to infection. In addition, the clusters are also exposed to infection at this stage.

Extended periods of wet weather are very favorable to most grape diseases. In general, if the leaves and shoots are wet for eight hours or longer, infection is possible if not protected by a fungicide.

**What fungicides to use early in the season?**

The fungicides most effective in controlling phomopsis are also effective in controlling early-season (foliar) black rot. The broad-spectrum fungicide mancozeb (Dithane, Manzate, Penncozeb and Manex) is

the most effective material for controlling these diseases early in the season.

It is recommended to save the use of SI's (e.g., Nova and Elite) and strobilurins (e.g., Abound, Sovran, Flint) until later in the season when they are needed for control of multiple diseases. Both of these groups of fungicides are prone to resistance development, so are best used at critical disease control periods (immediate pre-bloom until second postbloom). Do not use these materials more than three times per season regardless of the material. Rotating these two fungicide groups can help delay the development of resistance.

JMS Stylet Oil or sulfur may be used to control powdery mildew early in the season. However, powdery mildew generally is not a great concern at this time, except in susceptible cultivars and vineyards that had a problem with fruit infection the previous year. Resistance development to these materials is not a concern, but there are some compatibility restrictions with Stylet Oil and other spray materials. Read the label for details. Do not apply sulfur to sensitive varieties.

**Use of dormant sprays**

Delayed dormant sprays (before budbreak) have shown promising results for Phomopsis control in Michigan. We observed, on average, a 50 to 60 percent decrease in disease severity on the grape leaves as well as clusters from a single dormant spray of Topsin M, lime sulfur, sulfur, Stylet oil, or copper (Kocide) at budswell. Tank mixing Sulfur and Stylet oil did not increase control; rather the combination was worse than each product used singly.

A single dormant application with a sulfur or copper product appeared to be the most inexpensive of the treatments tested. If no green tissue is showing, these products should be safe on sulfur- or copper-sensitive varieties. At this time, only lime sulfur and copper products are explicitly labeled for use as dormant sprays in grapes. The labels on sulfur products are somewhat ambiguous on dormant use. We will be evaluating these and various other products again as dormant sprays in 2004, as well as reduced-spray programs in combination with dormant sprays.

# Herbicide Options for Michigan Blueberries

*Source: Eric Hanson, MSUE Horticulture, Fruit Crop CAT, Vol. 19, No. 2, April 13, 2004*

Preemergent herbicides should go on blueberries in late April to early May. The herbicide choices are described in detail in MSU Extension Bulletin E-154. (Ohio growers can find applicable information in the *Midwest Commercial Small Fruit and Grape Spray Guide 2004*. Extension Bulletin 506B2.) Preemergent herbicides are soil-applied chemicals that kill germinating weed seeds or young seedlings. Many materials applied at high rates also kill established weeds. Properly chosen and applied preemergent herbicides will provide effective weed control throughout most of the growing season. Following are several considerations in using these materials effectively.

Princep 90WG (simazine), Karmex 80DF (diuron), Sinbar 80W (terbacil), and Solicam 80DF (norflurazon) are the workhorse preemergent herbicides in established blueberries. They are moderately priced, reasonably safe on blueberries, and control many germinating annual weeds for one to three months. Princep and Karmex tend to be stronger materials on broadleaf weeds, whereas Sinbar and Solicam are stronger on grasses.

Use these only on established plants that have been in the ground for two years or more. Use rates per acre are 2.2-4.4 lb Princep 90 WG, 2-4 lb Karmex 80DF, 1-2 lb Sinbar 80W, and 2.5-5 lb Solicam 80DF.

These rates are for an acre of treated surface area, so if you treat half the surface by spraying a strip beneath the plants, you will use half these amounts. To prevent injury to blueberries, use the lower rates on smaller plants or on sandy soils low in organic matter. This is particularly true of Sinbar.

Other preemergent herbicides labeled for blueberries are Casoron, Devrinol, Kerb, Surflan, and Velpar. The utility of Casoron, Kerb, and Velpar in blueberries is limited by either cost (Casoron, Kerb) or crop safety (Velpar). Devrinol and Surflan are primarily grass materials that are very safe on blueberries (can be used on new plants), but have no post-emergent activity and must be applied before weeds germinate.

Rely is a postemergent herbicide labeled on blueberries just last winter. This product may do a better job of killing some perennial weeds than Gramoxone, but appears to be safer to use in blueberries than Roundup. Rely will still kill any green blueberry stems or leaves, but it does not seem to translocate out of treated parts to injure the bush. Try Rely this year and learn what weeds it will control.

**Editor's note:** Rely is not listed for use in blueberries in the 2004 Midwest Commercial Small Fruit & Grape Spray Guide. Rely is listed for use in bearing grapes.

Rotate herbicides to avoid resistance. Continued use of herbicides from the same chemical families (see accompanying table) can result in weeds that are resistant to all herbicides in that family. Many weed species have developed resistance to the triazine family, which includes the blueberry herbicides Princep and Velpar. Triazine-resistant weeds may also be more tolerant of herbicides from other chemical families that share the same mode of action. For example, Princep, Karmex, and Sinbar all affect weeds through the same mechanism; they kill weeds by inhibiting photosynthesis.

Triazine-resistant marestail and ladysthumb (a smartweed) are present in Michigan blueberries. If you suspect that triazine-resistant weeds are present on your farm, switch to herbicides with a different mode of action. Solicam and Surflan offer different modes of action and would be good choices to rotate with the photosynthesis inhibitors to control resistant types or to avoid the development of resistant populations.

**Approximate Costs of Blueberry Herbicides[1]**

| **Product** | Common Name | **Rate (Product per acre)** | **$ per Treated Acre[2]** |
|---|---|---|---|
| **Pre-emergent Herbicides** | | | |
| Casoron 4G | dichlobenil | 100 to 150 lb | 200 to 300 |
| Devrinol 50 DF | napropamide | 8 lb | 80 |
| Gallery 75DF | isoxaben | 0.7 to1.3 lb | ? |
| Karmex 80 DF | diuron | 2 to 4 lb | 8 to 18 |
| Kerb 50 WP | pronamide | 2 to 4 lb | 80 to 160 |
| Princep 90 DF | simazine | 2.2 to 4.4 lb | 9 to 18 |
| Sinbar 80 WP | terbacil | 1 to 2 lb | 30 to 60 |
| Solicam 80 DF | norflurazon | 2.5 to 5 lb | 50 to 100 |
| Surflan 4AS | oryzalin | 2 to 4 qt | 45 to 90 |
| Velpar 2L | hexazinone | 2 to 4 qt | 26 to 52 |

**Approximate Costs of Blueberry Herbicides[1]**

| Product | Common Name | Rate (Product per acre) | $ per Treated Acre[2] |
|---|---|---|---|
| **Post-Emergent Herbicides** | | | |
| Fusilade DX 2E | fluazifop-butyl | 1 to 2 pt | 18 to 36 |
| Gramoxone Max 3L | paraquat | 1.7 to 2.7 pt | 9 to 16 |
| Poast 1.5E | sethoxydim | 1 to 2 pt | 9 to 18 |
| Rely | glufosinate | 3 to 5 qt | 50 to 80 |
| Roundup Ultra 4L | glyphosate | 1 to 2 qt | 18 to 36 |

[1] Costs approximated from dealer quotes, 3/04. Actual costs will vary with source.

[2] Product costs for treating an acre of ground. If band-applying under blueberry rows so half the ground surface is treated, costs would be half of those listed. Families and Modes of Action of Blueberry Herbicides

| Herbicide | Chemical Family | Mode of Action |
|---|---|---|
| Casoron | Benzonitrile | Inhibit cell division |
| Surflan | Dinitroaniline | Inhibit active growth processes |
| Princep, Velpar | Triazine | Hill reaction inhibitor (photosynthesis) |
| Karmex | Urea | Hill reaction inhibitor (photosynthesis) |
| Sinbar | Uracil | Hill reaction inhibitor (photosynthesis) |
| Kerb | Benzamide | Inhibit cell wall synthesis |
| Solicam | Pyridazinone | Inhibit carotenoid synthesis |
| Devrinol | Acetamide | Interferes with mitosis |

# Fruit Observations & Trap Reports

**Insect Key**
AM: apple maggot
CM: codling moth
ESBM: eye-spotted budmoth
LAW: lesser apple worm
LPTB: lesser peachtree borer
OBLR: obliquebanded leafroller
OFM: oriental fruit moth
PTB: peachtree borer
RBLR: redbanded leafroller
SJS: San Jose scale
STLM: spotted tentiform leafminer
TABM: tufted apple budmoth
VLR: variegated leafroller

**Site: Waterman Lab, Columbus**
Dr. Celeste Welty, OSU Extension Entomologist

**Apple:** 4/7 to 4/14/04
RBLR: 16 (up from 2)
OFM: 0 (down from 1)
STLM: 241 (up from 27)

Early pink stage on 4/14/04

# Pest Phenology

| Coming Events | Degree Day Accum. Base 50F |
|---|---|
| Spotted tentiform leafminer 1st catch | 17 - 251 |
| Tarnished plant bug active | 34 - 299 |
| Oriental fruit moth 1st adult catch | 44 - 338 |
| Rosy apple aphid nymphs present - 1st egg hatch | 45 - 148 |
| Lesser appleworm 1st flight | 49 - 377 |
| Pear thrips in pear buds | 54 - 101 |
| Green apple aphids present | 54 - 156 |
| Pear psylla 1st egg hatch - nymphs present | 55 - 208 |

Thanks to *Scaffolds Fruit Journal* (Art Agnello)

# Degree Day Accumulations for Ohio Sites April 14, 2004

| Ohio Location | Degree Day Accumulations Base 50 | |
|---|---|---|
| | Actual | Normal* |
| Akron-Canton | 44 | 66 |
| Cincinnati | 121 | 133 |
| Cleveland | 41 | 63 |
| Columbus | 82 | 91 |
| Dayton | 88 | 92 |
| Kingsville | 33 | 41 |
| Mansfield | 40 | 65 |
| Norwalk | 42 | 55 |
| Piketon | 123 | 148 |
| Toledo | 28 | 50 |
| Wooster | 56 | 57 |
| Youngstown | 31 | 56 |

*Normal - Revised to reflect change in base period from 1961-1990 to 1971-2000 by Midwestern Regional Climate Center http://mcc.sws.uiuc.edu/.

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