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RESISTANCE TO PESTICIDES

Pesticide resistance is the inherited ability of a pest to tolerate the toxic effects of a particular pesticide. As resistance becomes more widespread in a population, you have to apply more pesticide more often to control the pest. Over time that pest may not be controlled with applications of that particular pesticide. Once that happens, that pesticide is no longer a useful tool. Hundreds of pest species, mostly insects, have become resistant to one or more pesticides.

Where does pesticide resistance come from? When organisms reproduce, the offspring receive copies of the parent genetic material. However, the copies are not always perfect. Mistakes appear. These are called mutations. Many times the mistakes are of no consequence or are lethal. Sometimes, however, a mutation benefits an organism. An example is a mutation that confers pesticide resistance. Because pest populations are large, it is likely that within a population there will be a small percentage that are resistant to a particular pesticide along with a small percentage that are extremely susceptible. Resistant individuals survive pesticide applications and are able to pass along this resistance to at least a portion of their offspring. Because the pesticide kills most of the non-resistant individuals, the resistant individuals begin to make up a larger percentage of the surviving population. As this continues, eventually most of the population is resistant.

In many cases, pest populations that become resistant to one pesticide in a group also become resistant to other related pesticides. This is called cross-resistance. Cross-resistance happens because closely related pesticides kill pests in the same way; (all organophosphates inhibit cholinesterase) if a pest can resist the toxic action of one pesticide, it can usually resist other pesticides that act in the same manner.

Given that pesticide resistance is an ever present threat, you need to understand what influences its development. In this way you can manage pests to minimize the chances for resistance to develop. The most important factors that influence the development of resistance are:

- The frequency of resistance in the pest population before using the pesticide of interest. Resistance may be entirely absent from a pest population, or it may be present in relatively few individuals. Obviously, no resistance is best.
- The chemical diversity of the pesticides used. If you always use the same pesticide or the same group or family of pesticides you won't be killing pests that are resistant to that pesticide or family of pesticide. When this happens the proportion of

resistant individuals will increase more rapidly in the population.

- Persistence and frequency of use of a given pesticide. Resistance is more likely to develop against pesticides that have greater persistence ad that you apply often during a treatment season. These factors are less important for herbicides than for insecticides and fungicides. Even short lived herbicides can provide season-long weed control, and normally you apply the same herbicide only once per season.
- The proportion of the population exposed to the pesticide. Insect life cycles are generally very predictable, and you usually apply a pesticide when most of the insects are at the same susceptible stage. Thus, most non-resistant individuals are killed, which increases the proportion of resistant individuals in the surviving population. On the other hand, insects that migrate in from non-treated areas dilute this population.
- The length of the pest's life cycle. As with any other inherited trait, pesticide resistance will increase more rapidly if the pest has a short life cycle and many generation in a single season. This largely explains why; insect populations become resistant faster than weed populations.

In the past we responded to resistance by switching to different chemistry. New products became available regularly. Unfortunately, this is no longer the case. Today's new pesticides are more complex, difficult to synthesize and more expensive to develop and use. Even these products are subject to development of resistance. Obviously, switching products is no longer enough.

In developing your pest management program you should assume that pests can (and will) develop resistance to any pesticide you use against them. This means placing greater emphasis on resistance management. This may be more work in the short run, but will pay dividends in the long run as effective chemistry can be maintained.

Resistance management includes reducing frequency of application of any material, utilizing non chemical approaches (BT's, nematodes), and population monitoring. This is part of the "integration" of integrated pest management.

Adapted from: Pest management principles for the commercial applicator: Fruit Crops, 3rd edition. UWEX, Madison.

Cottonball Season

With all the talks and articles on cottonball that I've done over the past few years, I hope that I've impressed upon you the importance of spraying during bloom if you're going to spray at all for this disease. The fungicide of choice (actually, there's not much choice) is Orbit (propiconazole). When used at the recommended rate (4-6 oz per acre), in enough volume (e.g., 30 gallon per acre or more), and at the right time (15-20% bloom and then again at full bloom) Orbit has proven very effective. Please be sure that you have the current Section 18 label on hand—this is a legal requirement. Call the WSCGA office or me (608-265-2047), or check with your chemical dealer to get the label. Under low to moderate disease pressure, the lower rate should suffice. But under high disease pressure, the higher rate is recommended. Cottonball is a disease that is hard to "clean up" if it gets out of hand, because the mummified fruit can survive many years buried in the bed. So, even though crop prices aren't up sky-high yet, you shouldn't skip cottonball management altogether. There are no clean-cut definitions of low, moderate, and high

disease pressure, but use the following as a guide:

- **Low disease pressure:** Cottonball berries never or only rarely detected at harvest; OR during early bloom, primary cottonball (tip blight) not found after 10-15 minute search.
  Recommendation: Don't spray or make just 1 spray at the 4-oz rate at about 15-20% bloom.
- **Moderate disease pressure**: Bed has a history of cottonball berries at harvest (1-10%) OR during early bloom, primary cottonball (tip blight) found after 5-10 minute search.
  Recommendation: Do spray at the 4-oz rate 1-2 times during bloom; if only 1 spray, make it at 15-20% bloom.
- **High disease pressure**: Bed has a history of severe cottonball at harvest (greater than 10%) OR during early bloom, you can easily find primary cottonball (tip blight) within the first few minutes. **Recommendation:** Do spray 2 times during bloom at the 6-oz rate.

Bravo (chlorothalonil), although not specifically labeled for cottonball control, is permitted during bloom for other fruit rot diseases and is effective against cottonball. However, some growers in Wisconsin have had problems with phytotoxicity from Bravo. In my own small-plot trials, I've seen a reduction in fruit set, but this did not translate into a loss in yield. In the East where fruit rot is an annual terror, nearly all growers use Bravo during bloom without phytotoxicity, perhaps because they use larger volumes of water in their chemigation systems than we do with booms and helicopters. Nevertheless, if you're only mildly concerned about cottonball, but really worried about other fruit rots in the field or in storage, you might consider spraying Bravo instead of Orbit. However, in order to control cottonball at all, this spray would have to be no later than full bloom.

Other conventional fungicides include copper and mancozeb (no control of cottonball and dubious for fruit rot control); Aliette and Ridomil (only for Phytophthora root and runner rot—not fruit fungicides); and some others that have not been tested for cottonball (ferbam). And then there's a whole host of "soft" chemicals and biologicals coming on the market. I have not tested Messenger (active ingredient is a protein that turns on host defenses) for control of cottonball, but another unregistered compound that also acts by turning on defenses did not work. In general, wherever Messenger has been tested for disease control on various crops, it has not fared as well as conventional pesticides. This being the case, the manufacturer admits disease "suppression" rather than control but touts yield increases. A scientist formerly at Rutgers apparently found a yield increase in cranberries treated with Messenger, but I have been unable to reach her for the data. So—sorry, I cannot be of more help at this time. Other "soft" products that you might see advertised are Serenade, Phyton, and Oxidate. These all are registered on a wide range of crops for a wide range of diseases, but to my knowledge, none have been tested on cranberry.

Patty McManus, UW-Madison Extension Plant Pathologist

My heart leaps up when I behold
A rainbow in the sky;
So was it when my life began;
So is it now I am a man;
So be it when I shall grow old;
Or let me die!
The child is father of the man;
And I could wish my days to be
Bound each to each by natural piety

William Wordsworth

Wisconsin Field Update Week of June 10, 2002

Recent temperatures in the upper 70's and low 80's have really pushed things along across the state. Hooks can be commonly found throughout the central growing area and we expect to see some early-scattered bloom by next week. We had some heavy rains in the south and central areas of the state early last week but northern growers didn't receive nearly as much. Some properties may have received as much as 3-6 inches of rain in a 48-hour period. Some signs of "winter damage" are now becoming more apparent on several properties (particularly south and central) as the vines continue to emerge and grow from their winter dormancy. Evidence of injury is appearing in the form of uprights side-shooting around the bud, uprights sending out an umbrella bloom directly from the bud and fewer total hooks present on individual uprights (1-4 hooks/upright *vs.* a healthy, normal 6-8 hooks/upright). In terms of Growing Degree Days, in general the state is still running behind the historical average and we are probably seven to fourteen days behind normal.

Insect activity has also progressed since the warm temperatures. We've had a few growers experience problems with insecticide treatments and some were forced to retreat areas for hotspot areas of spanworm or fireworm. Growers in the northern area of the state are nearing economic thresholds and will probably be treating real soon if they haven't already, particularly in the northwest. Growers who have seen problems with insects like spiny loopers (spanworm) should avoid applications of acephate (Orthene & Address). This insect tends to be tolerant of acephate applications and in some instances growers are forced to retreat areas where these insects have begun to do damage. Growers with spiny looper problems should look at treating with Guthion or Lorsban types of materials. **Note:** Diazinon is not labeled for control of spanworms but may provide some suppression. On another note, we are seeing mixed results with chlorpyrifos applications (Dow's Lorsban & other generic brands) on several properties particularly for fireworm but not sure why.

As we approach bloom time, growers should be on the lookout for the tipbight form of the disease Cottonball. During early bloom infected uprights begin to display an inverted "V" pattern forming on the new leaves and eventually a crooked over upright with a white spore mass (mantle). Growers with a history of Cottonball should consider using an application or two of Orbit during bloom. The first application should be applied at 10-20% in-bloom followed by a second application 7-10 days later. Rates ranging from rates of 4-6oz/acre are recommended depending on disease pressure.

Tim Dittl, Ocean Spray Cranberries

TIDBITS FROM THE FIELD

In the spring while the "Bug Patrol" was out sweeping cranberry beds for early pests, we discovered that we were picking up an exceptional amount of aborted pinheads in every series of sweeps.

Upon further investigation we noted that these growers did not have bees the season prior. When we were faced with an allotment we chose not to have honey or bumble bees because why raise a hearty crop and then toss it away. We learned a very valuable lesson in 2001. Pollination is indeed important in setting berries but also influential in fruit size.

The Cranberry Magazine had a very interesting and noteworthy article on

pollination. Please take time to read it and then call your bee keeper.

We are observing Drought and Frost damage again this year. The winds played havoc with our frost protection evenings and it did not allow our sprinklers to reach to some pies and corners. Those areas are showing umbrella hook and tons of side shooting at this time. As a matter of fact in the 14 years that I have been out scouting this is indeed the Trophy year for umbrella or baldie bloom. Some of it would date back to after harvest because the bud never moved.

The drought we see is wide spread, numerous growers are experiencing it - some worse than others. Just remember hot humid weather plus drying winds should raise a RED FLAG out there and a special eye must be keen during those times.

Even though our spring was slow in coming I believe we will still have peak bloom near the 4th of July. We are witnessing the Jewel stage at this time. A beautiful Crimson hook surrounded by a green upright, with a pastel pink blossom is just an AWESOME sight to see - take a moment to enjoy.

The Lady Bug IPM team

YIELDS AND HOT WEATHER

Growers in Central Wisconsin have been wondering how this hot weather in June and July will affect yields in October. Since weather patterns are unique from year to year, it is impossible to look at individual cases and draw broad conclusions. However, a little research has been done relating weather and yield. A study in New Jersey examined the relationship between weather and yields for the period of 1906 to 1984 and two subsets within that time. These researchers found that temperature and sunshine are two important variables. In general, warm temperatures from mid-May to late June, mid-October to mid-November and cold temperatures in early-February through March corresponded to good yields. Sunny weather in early May through mid-June also corresponded to high yields. On the other hand, hot temperatures (above 90°F) during the immediate pre-bloom period (400 to 530 GDD) or during July corresponded to lower yields.

In a two year study of hybrid cranberry cultivars in the five cranberry growing states, we found that the rate of growth of cranberry fruit was best predicted by the number of moderate temperature days, between 60 and 85°F. This accounted for more than 80% of the variation in rate of fruit growth across states. One cool year in Wisconsin slowed fruit growth by 11 days compared to a more average year the year following. Including sunlight intensity improved the prediction above 90% accuracy.

A recent study of berry scald in New Jersey found that a severe scald event in 1990 included clear skies, air temperatures above 80°F, canopy temperatures up to 106°F, soil temperatures at 1 inch at about 80°F, dry soils from lack of rainfall **AND** dry air (dewpoints <54°F). However, growers who sprinkle irrigated during the heat of the day reported much lower incidence of scald (<0.5%) than on unirrigated beds (≈25%). The rule of thumb used by New Jersey growers is to begin irrigation when air temperatures reach 84°F. Irrigation replaces lost soil moisture and serves to cool the vines from the cooler water temperatures and from evaporative cooling.

What can growers do to alleviate the detrimental effects of extremely hot weather? Four suggestions follow.

1. Make sure soil moisture is adequate and continuous. Irrigate in the mornings to saturate the root zone. Morning irrigation minimizes evaporation.
2. Check soil temperatures. Unvined areas on sand may be very hot and will lose soil moisture quickly.
3. Irrigate during the heat of the day. Vine and soil temperatures will be reduced from the cooler water temperatures as well as from evaporation (although with dew points in the upper 70's evaporation is very slow). Water droplets remaining on vines **DO NOT** act like little magnifying glasses leading to scald spots on vines. This has no basis in fact! *(See next article.)*
4. Consider draining mainlines if you plan to irrigate during the heat of the day. Water sitting in aluminum pipe heats up quickly and will scald vines when it is pumped through the sprinklers.

Careful thought and good management practices will allow you to beat the heat and still produce good yields.

Teryl Roper, UW-Madison Extension Horticulturist

Come, blessed peace, we once again implore,
And let our pains be less, or power more.
Alexander Brome

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