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 who 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 organophospates 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.

The history of liberty is a history of the limitations of governmental power, not the increase of it.

Woodrow Wilson

AVOIDING HERBICIDE RESISTANCE IN WEEDS

To date no reports of herbicide resistant weeds are available for cranberry. The key to minimizing herbicide resistant weed problems in cranberry beds is to avoid continual use of herbicides with the same mode of action (way of killing weeds). Strategies for controlling weeds while avoiding the development of resistance are listed below. These strategies should be used in combinations appropriate to the situation as one alone may not be completely effective.

- **Use herbicides only when necessary to prevent economic loss**. Base herbicides use on the weed species present or expected and their density. Don't use higher amounts than necessary to manage weeds present or expected.

- **Rotate Herbicides**. Make no more than two consecutive applications of herbicides with the same mode of action against the same weeds.
- **Use mechanical weed control methods**. Cutting and removing by hand may be the best approach for some weeds. Use these to complement an herbicide program, not to replace it.
- **Scout beds regularly for weeds**. Respond quickly to increases in weeds with suspected herbicide resistance.

Nutrient and Pest Management Program, UWEX

As laws are necessary that good manners may be preserved, so good manners are necessary that laws may be maintained.

Niccolo Machiavelli

WORK AREA OR TRASH LAYER?

In my travels I see that many of you are checking over your harvest equipment. There is an old cliché that states "All of my machinery works fine while it sits in the shed, but once I need it, it breaks down!" Preventative maintenance is the name of the game. . . . .

While you are getting ready for harvest, I would like you to think about this. For the past several spring, there has been a certain pattern developing in the corners of some beds. We find lethargic growth, frost stress, weak vines, bud injury and crop loss in these areas. Upon further investigation we are observing excessive leaf drop and other trash. When we took soil temps during the month of May, the area had been consistently cooler. In some situations it was as much as 6 degrees cooler than most of the other areas tested in the same bed. What is happening?

I believe that this is an area where we corral the fruit. Could it be that the cranbooms pull not only the fruit but extra trash to this location? Perhaps we are getting most of the debris out, but leaving just enough to create a trouble spot. Is it possible that being the concentrated work area that it is, we pack down old leaves while we walk? Does this extra trash layer act as insulation, not allowing the ground to thaw as quickly as other areas in the bed?

In the eyes of an Integrated Pest Manager, these are areas of concern. Any stress of this nature causes a vulnerability to disease, frost damage, injury to the reproductive bud, and weak vines which weeds thrive in.

Think of your 1993 harvest. Did you have excessive trash last year? This spring did see such a situation on your marsh? As with our machinery in the aspect of preventative maintenance, we need to address this area of concern before we have a serious problem.

Some of our growers are trying a special matting or fine screened pad around this heavy traffic area, others are using their back pack blowers to stir up the old trash before it gets the chance to become part of the make-up of that bed. A game plan that seems to work for another grower was to have a clean up crew come right behind the harvest crew to load all the debris immediately.

LADY BUG OBSERVATIONS

Hail stressed fruit and maturity

In viewing hail stressed fruit lately we are finding that the seeds on the side of the injury are showing signs of early maturity. The have a brownish cast already. The fruit is sound, yet showing a bit more than a blush. I believe that the TACy test may be in our favor.

Fruit Sizing

With the cool temperatures we already see a dormant cast to the vines. The reddish cast is widespread in Crowleys. Most other cultivars are just starting to show red in the leaves. Unfortunately, this weather plays a significant part in berry sizing. We truly need some hot sunny days and warm evenings to bring home this potential. After all we sell our fruit by weight, not by number!

Blackheaded Fireworm

Just as we had expected, some growers experienced third generation BHFW hatch. This little critter started webbing very early (1st instar). Hot spot treating was not uncommon. For the most part what we are seeing is egg development is 1995's pest problem. Flights are unique, these cool temperatures play games with pupation as well.

Jayne Sojka, Lady Bug IPM

The most striking contradiction of our civilization is the fundamental reverence for truth which we profess and the thorough-going disregard for it which we practice.

Vilhjalmur Stefensson

Pesticide Profiles: Glyphosate (Roundup)

Type of Material: Herbicide
Manufacturer: Monsanto
Chemical group: Phosphanoglycine compound
Type of Action: Postemergent, systemic
Mode of Action: Interrupts shikimic acid pathway blocking formation of aromatic amino acids. These are essential for protein production.
Formulation for cranberry: Liquid, 4 pounds active ingredient salt per gallon.

Approved application methods:
Wick or wiper application after fruit set and no later than 30 days before harvest

Maximum rate per acre:
None specified. Apply as a 20% solution to emerged weeds.

Health and Safety precautions:

Restricted entry interval without protective clothing: 12 hours (1994)

Toxicity: Oral toxicity is practically nontoxic with an LD50 of 5400 mg/kg. Dermal toxicity is also practically nontoxic with an LD50 of >5000 mg/kg. It is slightly irritating to the eyes. Inhalation toxicity (breathing vapors) is slightly toxic. If swallowed it will cause gastrointestinal irritation and should be diluted with water or milk and a physician called.
When handling, mixing or loading glyphosate wear chemical splash goggles. If skin contact might occur wear chemical protective gloves. Respiratory protection should not be needed during normal use and handling.

Environmental precautions:

Glyphosate is slightly toxic to honeybees and daphnia. It is slightly toxic to moderately toxic to fish. Glyphosate is not known to bioaccumulate. It is adsorbed on most soils, especially those with high organic matter content.

Compatibility: not labeled for mixing with any other pesticides as a wiper application to cranberry.

General usage comments: Glyphosate is an excellent effective postemergent herbicide for controlling a wide range of weeds in cranberry beds when used according to the label directions. Coverage is the key to good control. Multiple applications over several years may be required to control well established perennial weeds. Glyphosate is selective only be selective application. Do not allow glyphosate to contact cranberry vines.

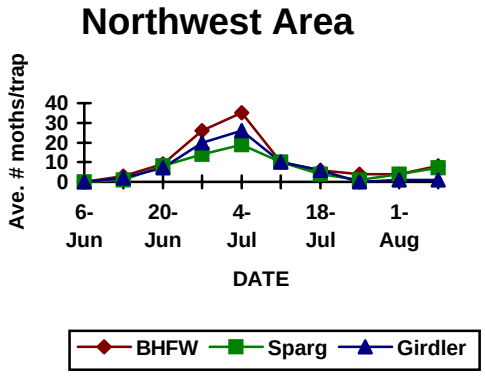
Information derived from the Roundup label, the Roundup Material Safety Data Sheet and other sources.

Teryl Roper, UW-Horticulture

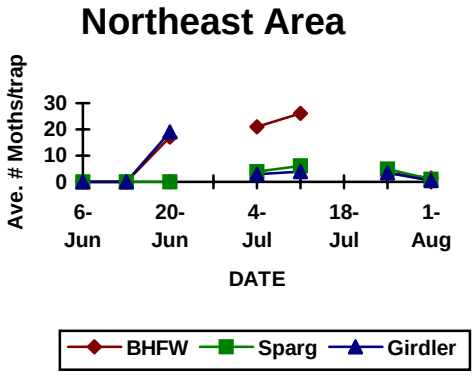
1994 Pheromone trap counts

Cranmoor area includes:	Adams, Portage and Wood counties
Warrens area includes:	Jackson, Juneau and Monroe counties
Northeast area includes:	Forest, Lincoln, Oneida, Price, and Vilas counties
Northwest area includes:	Barron, Burnett, Douglas, Rusk, Sawyer, and Washburn counties

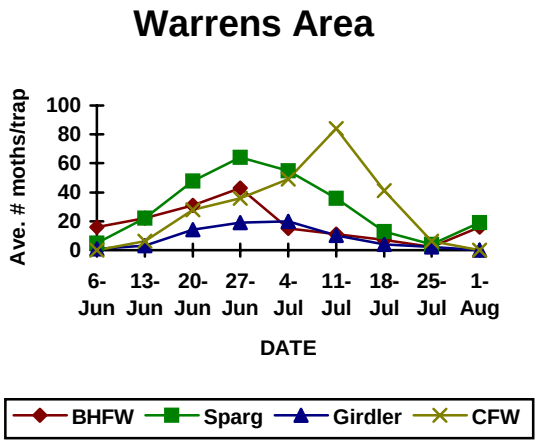
Please note that different regions may have different scales on the left axis. Doing this allows greater accuracy in determining actual values within a region. However, comparisons between regions are more difficult. Please use caution in making comparisons of these averages to trap counts on your marsh.



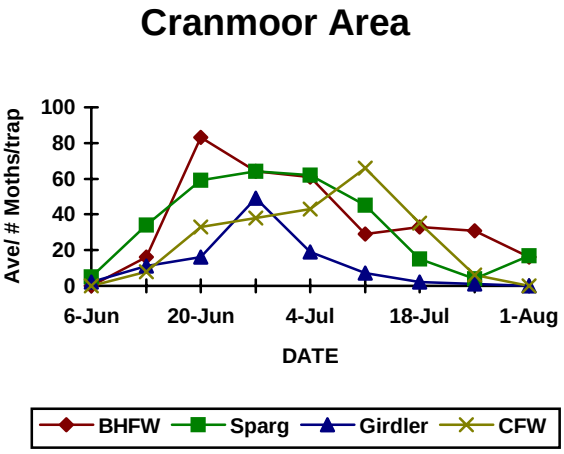
Means from 8 growers



Means from 2 growers



Means from 39 growers



Means from 29 growers

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