Integrated Cranberry Crop Management for Wisconsin

Cranberry

Crop Management Newsletter

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Contents:

CARBOHYDRATE MOVEMENT

In the last article we discussed the probably source of carbohydrates to support cranberry fruit set and development. The rates of photosynthesis of new leaves are roughly double that of one-year-old leaves. In previous article we described indirect evidence that carbohydrates that support fruit growth come primarily from current season leaves. This article will discuss direct evidence showing that fruit growth is supported by current season leaves preferentially to on-year-old leaves.

If one considers the structural makeup of a cranberry vine there are only three potential sources of carbohydrates to support fruit growth: New leaves above the fruit, old leaves below the fruit, and non-fruiting uprights along the same runner.

The best way to track the movement of carbohydrates from the source to where they are utilized is by using radioactive tracers. Using radioactive carbon we were able to track the movement of carbon from the leaves to the fruit. We exposed new leaves above fruit, one-year-old leaves below fruit, or leaves on an adjacent non-fruiting uprights to $^{14}CO_2$ for about 30 minutes then allowed the carbohydrates to move within the vines for three or four days. Samples were then frozen at -80°C and exposed to x-ray film. After the x-ray film was exposed from the radioactivity emitted by the radioactive carbon the radioactivity in the cranberry tissue was quantified by liquid scintillation methods.

We were able to successfully introduce radioactive carbon into cranberry vines using our techniques during both the time of flowering and after fruit set. The results of experiment are shown in Table 1. The amount of radioactivity was high in the leaves where the label was introduced (note above and below). The most important data from this experiment is in the center data column. This shows the amount of radioactivity that moved into the flowers or fruit from leaves above, below, or on an adjacent upright. Clearly the new leaves above developing flowers and fruit move the most carbon into the flowers and fruit. Roughly ten times as much radioactivity was found in fruit when leaves above them were labeled compared to when one-year-old leaves below them were labeled. Surprisingly, almost no carbohydrates moved from adjacent non-fruiting uprights to a fruiting upright along the same runner.

Table 1. Radioactivity counted in leaves and fruit of uprights exposed to $^{14}CO_2$.

^{14}C labeling		Radioactivity in tissue (dpm)		
Tissue	Timing	**Above**	**Flowers/fruit**	**Below**
Above	Flowering	7,709 a	5,592 a	222 b
Above	Fruiting	4,824 b	10,527 a	118 c
Below	Flowering	27 b	342 b	4,308 a
Below	Fruiting	180 b	957 b	3,827 a
Adjacent	Flowering	20	54	32
Adjacent	Fruiting	14	126 a	27 b

Within rows, mean separation by Duncan's new multiple range test.

This research clearly and unequivocally shows that the primary source of carbohydrates to support fruit growth are the new leaves above the fruit. This work supports previous research showing that removing new leaves at fruit set reduced fruit set and yield and that removing new leaves was more detrimental than removing one-year-old leaves. Protecting and maintaining the integrity of these leaves is critical to producing a crop. This also supports the contention that a minimum amount of upright length is required each year to maximize cropping potential.

From this research we learn:

- New leaves above the fruit are the primary source of carbohydrates for fruit growth.
- While one-year-old leaves do move some carbohydrates into fruit it is only about 1/10th as much as new leaves.
- Carbohydrates don't move from non-fruiting uprights to fruiting uprights.

The next article will focus on the effect of nitrogen fertilizer application on yield components.

Teryl Roper, UW-Madison Extension Horticulturist

Reference:

Roper, T.R. and J.S. Klueh 1996. Movement patterns of carbon from source to sink in cranberry. J. Amer. Soc. Hort. Sci. 121:846-847.

IT'S TIME FOR STEM GALL (CANKER)

Cranberry stem gall (otherwise known as canker) has made its 2006 debut. In this article I'll review the basics, but for more information and photos, please see UW-Extension bulletin A3795 (http://s142412519.onlinehome.us/uw/pdfs/A3795.PDF or call me). The most obvious symptom of stem gall is shoot dieback. From the dike, the browning and death of uprights sometimes follows a pattern, as though related to injury at harvest. In other cases, the dying uprights are patchy, especially at the ends of beds where floodwater enters first and exits last. Although gall development starts at the time that plants resume growth in the spring, dieback is usually not noticed until bloom or later. Uprights and runners are swollen and rough with peeling bark. Beneath the bark are small bumps and galls. When galls are so numerous that they encircle a stem, all tissues above the galled area die. The galls start out green and soft, but once the shoot dies back the galls get dry and hard. Below the galls, stems do not die. New shoots arise from below the galls, but it takes these new shoots a year or two to fill in the dead spots and another year or so to become productive. We have never seen galls on current year's growth—just woody stems.

We've seen stem gall on Stevens, Ben Lear, Pilgrim, Searles, and Norman LeMunyon.

Stem gall is caused by bacteria that produce the plant growth hormone indole acetic acid (IAA). Abnormally high levels of IAA disrupt the development of vascular tissues, that is, the cells through which water, nutrients, and carbohydrates flow. These bacteria probably enter plants through wounds created by harvest machinery, winter injury, and/or leaf drop. Damage to the earliest formed vascular tissues suggests that bacteria are already inside the plant at the time they break dormancy.

The bacteria involved in stem gall are common in soil, even where stem gall has never occurred. Also, symptoms can be awful one year and absent the next. This suggests that stem gall is highly dependent on the environment, and not just on the presence of bacteria. Unfortunately, we have not figured out just which environmental factors are right for stem gall. We have noticed, however, that stem gall crops up in areas of the bed that were not well protected with ice or snow the previous winter. We are not currently doing research on stem gall, but if you have an outbreak, I would be curious about the location in the bed, patterns, etc. More clues will shed more light on this curious malady.

By the time stem gall symptoms show up, bacteria are deep within cranberry tissues. We have no evidence that new infections occur anytime later than budbreak. All stems we've look at under the microscope had their vascular tissues messed up from the beginning of the season. We never see vascular tissues start out normal and then go bad in June or July. The areas of dieback will enlarge, but that's because already-infected shoots are dying, not because of new infections. Because stem gall is caused by bacteria, fungicides such as Bravo, Dithane (or other brands of mancozeb), Abound, and Orbit WILL NOT WORK. Copper-based fungicides are bactericidal, but they are ineffective in controlling diseases in which large gobs of bacteria amass inside plants, as is the case with stem gall. Also, the sporadic nature of stem gall—bad one year, absent the next—makes it impossible to know when and where treatment will be needed.

COTTONBALL UPDATE

As part of the pesticide screening project, Jack Perry and I have cottonball trials out at three sites in central Wisconsin. We recently rated primary infection (tip blight) and found very little disease at two sites, and just slightly more at the third site. I spoke with a crop scout who also reported that it seems to be a light cottonball year. Even so, I expect that we will have some infected fruit and some data to report from at least one of our three trials. Unfortunately, chemical companies have little interest in registering their products for control of cottonball. It's a spotty disease of a low-acreage crop and is therefore not much of a money-maker for them. Although I expect Orbit and possibly a related fungicide to be registered by 2007, there are no other new fungicides on the horizon. However, we are testing some biological control products that are quite good on a similar disease of blueberry and which showed some promise in our trials last year. We are also testing Orbit, Abound, and Bravo head to head. I know folks are concerned about negative effects of Bravo, but I am concerned about fungicide resistance developing if we just keep using Orbit and only Orbit. Abound has been around for a few years now, and in some, but not all, trials, it has performed as well as Orbit when applied during bloom. For now, there's not much more to report, but we will have more to say at the winter cranberry school.

AN INTEGRATED APPROACH TO CRANBERRY GIRDLER MANAGEMENT

Biology & Life History

Cranberry girdler can be a serious soil insect pest for growers in Wisconsin. It is one of the few cranberry insect pests that occur in every growing region. Although this particular species is located throughout the state, girdler is not necessarily a pest on all cranberry acreage therefore, carefully monitoring your marsh to detect any potential problems is of the utmost importance.

Cranberry girdler belongs to the Pyralidae family, also known as pyralid, grass, wax or snout moths of the order Lepidoptera (moths and butterflies). This complex of moths is also referred to as sod webworms and are widely known to be pests of cultivated and wild grasses. Girdler overwinters as full-grown larvae in a cocoon buried in the leaf litter on the beds. In the spring, larvae complete their development, pupate and start to fly as adult moths in June. Adult activity periods generally occur from early June to mid-August with peak flight normally occurring during the last week in June or first week in July. Fortunately, there is only one generation per year.

Cranberry girdler larvae damage the vines by attacking the roots and chew through the bark of the underground stems and runners sometimes completely severing the vine. More often, larvae will gnaw or 'girdle' the bark completely around the runners or stems. Depending on the severity of attack, larval feeding can weaken and reduce the vigor of the vine limiting production. Above ground foliage eventually becomes red or brown and under severe infestations, may eventually kill the vines beyond the point of attack. Damage from larvae can often times go undetected but usually can be found in August and continuing into September. The most notable damage is generally found the following spring after the winter flood has been removed and the plants start to grow out. Often times, the foliage drops off leaving areas or patches of dead vines where weed species can soon takeover. Injury from girdler is easily diagnosed by looking for the presence of larvae and chewing on the underground horizontal stems and runners during the summer months.

Scouting for Girdler and Economic Thresholds

Pheromone baits specific to capturing girdler moths are commercially available to growers and should be used to help monitor seasonal adult flight activity. Traps should be placed out in early June in suspected hot spots or areas that have had a history of girdler. In addition to using pheromone traps the sweep net can also serve as a monitoring tool however, adult moth activity can best gauged by walking the fields and observing the amount of girdler moths that you "kick up". If you determine that indeed they are girdler (fruitworm moths may look similar), carefully monitor your weekly trap counts. Currently, no economic thresholds have been established for girdler adults however based on experience, if average counts exceed 50 moths/trap (particularly if peak flight is sustained), keep a close eye out for any potential, subsequent larval activity. Remember too that trap counts can be greatly influenced by the weather.

If vines start to show stress, become discolored or exhibit signs of dieback during the months of July or August, carefully check the underground portion of the plants for girdling or chewing. The best way to do this is by following the upright(s) in question back to runner portion of the plant to determine if there is any damage and/or presence of larvae. Larvae are generally white to cream-colored with a brown head and reach a little over a half inch long. Food waste, excrement or "frass" (little brown pellets) from the larvae is often times found in association with feeding.

Control Strategies

Viable management tools for girdler control are limited. However, by employing the use of multiple control tactics we'll hopefully be able to keep this pest in check. The use and practice of the following control options should help suppress girdler populations and hopefully reduce or prevent them from causing economic plant injury.

- **Cultural practices** such as sanding will help bury overwintering pupae in the soil and hinder the adult moths from emerging the following year. Routine sanding every three to five years should help prevent girdler from becoming established as a major pest problem. Another new cultural practice that may have a positive influence on reducing larval infestations is grass control (see **Notes of Interest**). Additionally,
- **Cultural controls** like flooding have proven to be very effective against girdler. A deep flood over the top of the vines for a period of 24-48 hours in late August and early September will drown the larvae. Try to choose a period of time that will generally be cool, cloudy or even rainy versus sunny, warm weather to help protect the fruit from scald conditions.
- **Biological controls** such as the use of nematodes have also offered decent suppression of girdler larvae. Commercially available insect parasitic nematodes, though expensive, are effective in controlling girdler. Some growers routinely use nematodes each year more as a preventative measure at rates lower then the maximum recommended while others may use the maximum 3 billion/acre rate given severe larval pressure. Timing used for nematode applications should be the same as with Diazinon G-14. Other biological controls like spiders and ground beetles are naturally occurring and can aid in suppressing larval infestations although, the use of broad spectrum organophosphate insecticides can disrupt or hinder these populations.
- **Chemical controls** Diazinon G-14 granular insecticide is currently our only labeled product for cranberry girdler. Granular applications of Diazinon should primarily be applied only when you have had a history of a problem or where there's a current existing infestation and possibly the adjacent beds. Spot treat as warranted as broadcast applications on entire marsh acreage generally isn't necessary. Timing of applications is made approximately 3 weeks following peak flight as first signs of girdler larvae appear, normally between July 21 and August 10. A degree-day model developed by the University of Wisconsin is also available to assist with the timing of this application. Be sure to have the current 24(c) label on hand and abide by all directions outlined. Most importantly, remember to contact the Department of Agriculture at least 24 hours prior to application, do not apply to any ditch, open water or within 10 feet of perimeter or center ditches, do not apply to bare ground, do not apply by aerial means, impound water for 7 days following the application and use only once per growing season. Remember, the label is the law!

Notes of Interest

Recent research suggests that "newly hatched cranberry girdler larvae (neonates) need and prefer soft, succulent plant tissue at or below ground level to feed on to enhance their survival rate. In the cranberry bed, grasses are probably crucial for their survival. Newly hatched larvae become established on grass crowns or roots then move to cranberry at a later stage when their mandibles can process woody substrate.

If grasses can be prevented from growing in a bed, particularly during July and August when the eggs are laid, then the girdlers will also be prevented from establishing themselves in great numbers.

In the lab, when given a choice between reed canary grass and cranberry, most larvae were found in the roots of the grass. In a no-choice situation where neonates were given access to grass plants only or cranberry only, nine times as many neonates survived on the grass than on cranberry, and most were in the roots". (Sheila Fitzpatrick, 2005 presentation at the North American Cranberry Research and Extension Workers Conference and personal communication). Apart from grasses that are generally the preferred host plants, girdler is also known to attack cranberry, Sheep Sorrel, Douglas Fir plantings and Three Square Sedge.

Tim Dittl, Agricultural Scientist - Ocean Spray Cranberries, Inc.

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IN THE WORLD OF A DRAGONFLY

Dragonflies are very common insects throughout Wisconsin. They are seen in many places and are very important to the insect and human world. Currently, there are over 5000 species of dragonflies world wide, and 450 species located in North America (n/a). They are an attractive insect, and their lives interest a lot of people. They catch our attention and are inquisitive creatures.

Dragonflies start out as an egg and then develop into a nymph. Nymphs are larva that later forms a dragonfly. Female adult dragonflies lay their eggs in plant material that is located under water. The nymphs then begin their journey to adulthood (Biggs, 2006).

Provided By: Kathy Biggs
A dragonfly in its nymph form.

When a dragonfly is in its nymph form, they use their labium, which is their lower lip that they extend outward to catch their prey (Briggs, 2006). A Nymphs' prey can range anywhere from mosquito larva to many other insects or objects that are located in the water. They remain a nymph until they are ready to molt. The time for this varies from one month to a couple years. They then molt emerging into an adult dragonfly (Briggs, 2006). Most nymphs molt during the evening or at night during the summer months. (Newman, 2006).

Once an adult, dragonflies are very helpful to humans. Throughout their short life span as an adult, they eat many insects. These can include: mosquitoes, bees, flies, butterflies, and many other flying insects (Wikipedia, 2006). They control the insect population and are a benefit to growers. They are capable of outsmarting other insects because they have compound eyes and very strong wings. They are almost capable of seeing 360 degrees (Wikipedia, 2006).

Provided By: Peter Chew
A female Water Prince dragonfly in its adult stage.

Dragonflies and Damselflies are very similar, but there are a few differences between the two species. Dragonflies have wings that stay at their sides when at rest, while damselflies have wings that touch over their back when at rest. Plus, a damselfly has eyes that are separated, while a dragonfly's eyes are almost touching (Wikipedia, 2006).

There are also differences in the nymph stage between dragonflies and damselflies. Damselflies have three feather-

like gills at the bottom of their abdomen, while dragonflies have projections in their rectum. These projections serve as the dragonfly's gills. Damselflies and Dragonflies breathe differently, but also use their diverse types of gills for different movement purposes. The damselfly uses its three gills as paddles, while the dragonfly uses its projections as a propulsion movement (Silsby).

As you can see dragonflies lead very interesting and fascinating lives. They assist humans and growers and are really a benefit in our world.

Jill Hinrichsen, Lady Bug IPM, Intern

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The flying rumors gather'd as they roll'd,
Scarce any tale was sooner heard than told;
And all who told it added something new,
And all who heard it made enlargements too.

Alexander Pope

HUMAN HEAT STRESS

There are numerous precautions that employers can take against heat stress. Some of them are summarized here:

Training. Train workers and supervisors in how to control heat stress and to recognize symptoms of heat illness.

Monitoring and Adjusting Workloads. Take into account the weather, workload, and condition of the workers, and adjust work practices accordingly. Higher temperatures, high humidity, direct sun, heavy workloads, older workers, and workers unaccustomed to heat are more likely to become ill from heat. Here are things to do:

- Monitor temperature and humidity, and workers' responses at least hourly in hot environments
- Schedule heavy work and PPE-related tasks for the cooler hours of the day
- Acclimatize workers gradually to hot temperatures
- Shorten the length of work periods and increase the length of rest periods
- Give workers shade or cooling during breaks
- Halt work altogether under extreme conditions.

Drinking. Make sure employees drink at least the minimum required amounts of water to replace body fluid lost through sweating. Thirst does not give a good indication of how much water a person needs to drink. Water should always be available to workers.

From the EPA website.

EARLY ROT SCOUTING GUIDE

Enclosed with this issue of the newsletter is a guide for scouting for early rot of cranberry. Early rot is a relatively rare disease, but one that has me concerned for the following reasons. Early rot, as the name implies, rots berries relatively early in the season (August). Other fruit rot diseases in Wisconsin usually don't show up until late September, at which point they don't have much time to cause great losses in the field. Although early rot can be managed with fungicides, most growers in Wisconsin do not use fungicides, and we want to keep it that way. In 2005, early rot was found at five sites on varieties from the UW and Rutgers breeding programs. Because we were so focused on the new varieties, however, we did not scout plantings of traditional varieties such as Stevens. The new varieties are wonderfully promising, but we need to keep an eye on their performance in the field, including disease resistance. If we find early rot in 2006, we can recommend fungicide treatment for 2007 or vine removal if the disease is severe and spreading.

Jack Perry and I will be visiting some sites in the coming weeks to scout newer plantings for early rot. However, time will allow us to visit relatively few locations. Therefore, I hope that growers and others in the field will use the enclosed guide to become familiar with early rot. If you detect symptoms that might be early rot, you should contact your crop consultant or me (Patty McManus, UW Extension Fruit Pathologist, 608-265-2047 or psm@plantpath.wisc.edu). You could also take samples to your county Extension office and ask them to send them to me at 1630 Linden Drive, Madison, WI 53706.

I acknowledge Wisconsin Cranberry Board and the UW cranberry breeding program who are providing funds to scout for this disease in 2006. Thanks also to Teryl Roper and his children Alan, Colin, and Megan who helped with printing, laminating, and mailing the guide.

Patty McManus

WISCONSIN CRANBERRY CROP MANAGEMENT ELECTRONIC LIBRARY SURVEY

This past winter all known Wisconsin cranberry marshes were sent a copy of a CD containing the Wisconsin Cranberry Crop Management Electronic Library. The CD contains a collection of information about cranberry production in Wisconsin including copies of the Wisconsin Cranberry Crop Management Newsletter, Proceedings of the Wisconsin Cranberry school, Pest profiles, a pesticide database (provided by Peter Oudemans of Rutgers University), and conservation planning information.

Funding to assemble, duplicate, and mail the CD was provided by the University of Wisconsin-Extension. As a condition of the funding we are required to report the usefulness of the material produced. Therefore, **enclosed in this envelope is a stamped postcard** with a short survey regarding the usefulness of the CD that you were sent this past winter. Please fill out the survey (it shouldn't take more than a couple of minutes), and drop the postcard in the mail. The survey is completely anonymous. The results will be tallied and reported to Extension administrators (and the industry). This will also guide future editions.

Thank you for taking a few moments to complete and return the survey.

Teryl Roper