CRANBERRY
CROP MANAGEMENT JOURNAL

DIVISION OF EXTENSION

Volume 34 • Issue 4 UNIVERSITY OF WISCONSIN-MADISON June 30, 2021

Revisiting the Insecticide: Actara

By Christelle Guédot

Actara is registered for use in Wisconsin on several fruit crops including pome fruit, stone fruit, berries and small fruit, and cranberry. It is marketed by Syngenta© under the formulation 25WDG (25% of active ingredient as Water-Dispersible Granules). Actara is in the class of the neonicotinoids (IRAC group 4A), with a mode of action targeting the nicotinic acetylcholine receptors in the nervous system, causing uncontrolled overstimulation. Actara contains the active ingredient thiamethoxam and acts as a systemic insecticide when applied as a seed treatment and as a trans-stemic insecticide when applied foliarly. When applied directly to foliage, the trans-stemic movement from the leaf surfaces into the leaves forms a reservoir of active ingredient within the leaves that provides long residual activity. Actara is fast acting on contact or by ingestion of treated plant surfaces. Affected insects will rapidly stop feeding, become paralyzed, and eventually die. Actara will kill both chewing and sucking insects and has broad spectrum activity on many insect species. Actara, Assail, Venom, Admire Pro, Alias, and Widow have the same mode of action and should NOT be used together in rotation, but rather insecticides from other IRAC groups (other than IRAC group 4) should be used in rotation with Actara to delay insecticide resistance.

Under cranberry, Actara is registered to control aphids, cranberry flea beetle, cranberry weevils, leafhoppers, and Japanese beetle. We have included this product in Jack Perry's trials for several years and have found it to provide excellent control of flea beetle adults post bloom. Trials are ongoing this year to test its efficacy on blunt-nosed leafhopper.

Insecticide: Actara

- Available as 25WDG (25% of AI, water-dispersible granules)
- Restricted re-entry interval (**REI**): 12hrs
- Pre-harvest interval (**PHI**): 30 day*
- Do not exceed a total of 12 oz. AI per acre per year
- Rate of use per acre: 2.0 – 4.0 oz.
- Minimum interval between applications is 7 days

Actara may be applied by ground equipment and should be used with at least 10 GPA for ground applications. Some restrictions apply for chemigation and sprinkler irrigation and Actara cannot be applied by air in cranberry. For more information on mixing, spraying, and all other considerations, please see the product label.

Actara is highly toxic to bees exposed to direct treatment on blooming plants and cannot be applied when bees are foraging and until flowering is complete. It is also not recommended to spray this product before bloom as the active ingredient can be found during bloom in the flower nectar and pollen. Actara is toxic to wildlife and highly toxic to aquatic invertebrates and must not be applied directly to water or to areas where surface water is present. A surface-water advisory warns that this product may affect surface water quality from spray drift and runoff. Specifically under cranberry, the label states to not apply within 25 feet of bodies of water. Please check the label for more information on these warnings.

Please check with your handlers before using any product as PHIs may vary from the one stated in the label*. Some handlers are applying a 45 day PHI on Actara in 2021. As always, make sure to read the label before using any pesticide. You can find the label of Actara at the following link: https://www.syngenta-us.com/current-label/actara

Happy growing season!

Ericoid Mycorrhizal Fungi & Cranberry: Mutualisms with Potential

By Becca Honeyball & Amaya Atucha

Mycorrhizal fungi are everywhere. These symbiotic organisms, a group of highly specialized root fungi, are naturally present in most every soil. In broad terms, mycorrhizae are the associations formed when mycorrhizal fungi colonize the roots of host plants, facilitating host plants' uptake of water and nutrients (especially phosphorus, zinc, and copper) that otherwise may have not been accessible [8]. Mycorrhizae do this by acting as extensions of the plant's existing root system, expanding upon the existing root zone by penetrating plant cells and tissues and increasing their connections to the soil. This increases the root system surface area that's available for absorption, often resulting in improvements to plant growth and vigor, particularly in an environment of moisture stress and low nutrient availability. In return for these benefits, the host plant provides its mycorrhizal fungi with fuel in the form of sugars.

There are several distinct categories of mycorrhizal fungi, with different infection styles across mycorrhizal groups (detailed in Figure 1), and all of them share this feature of forming mutually beneficial associations (mutualisms) with host roots. Soil scientists estimate that about 80-90% of all terrestrial plant species experience some form of mycorrhizal symbiosis, and that mycorrhizal fungi comprise approximately 30% of all soil-borne organisms [8].

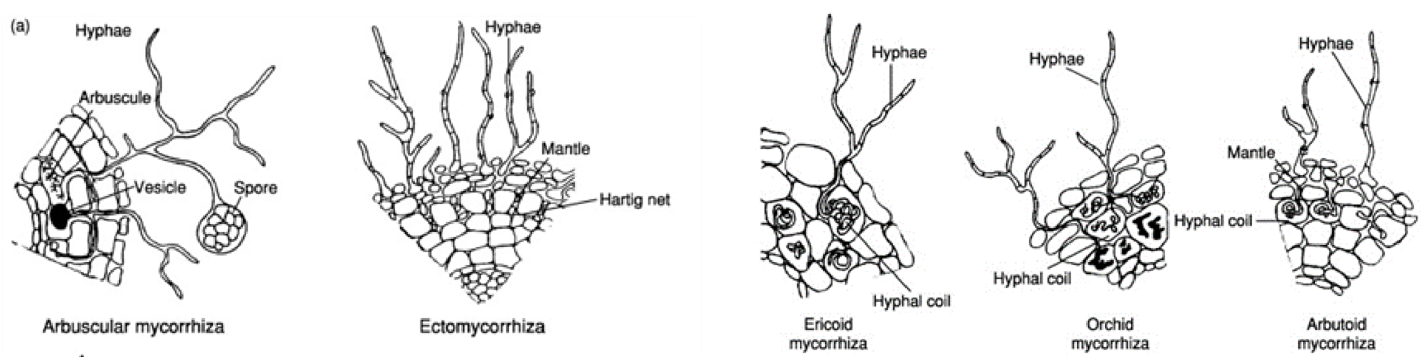

Figure 1. Differential relationships between fungal and plant structures for each of the main types of mycorrhizal associations; *originally printed in Selosse et al. (1998) "Trends in Ecology and Evolution", vol. 13: 15-20. Retrieved from Egerton-Warburton et al (2005) via Elsevier [10].*

There has been research on mycorrhizal fungi and their beneficial plant interactions, which has resulted in the commercialization of many products containing mycorrhizal inoculants that promote increased plant health and productivity. However, these products are typically ineffective for cranberries. This is because species of mycorrhizal fungi that bond with cranberry roots, referred to as Ericoid mycorrhizal fungi (ErMF), are a unique and highly specialized group of mycorrhizal fungi that are not included in these products. ErMF that inoculate cranberry vines are "arguably the least researched and perhaps also the least understood type of mycorrhizal symbiosis[9]." Because of this, their development for use as an agricultural tool will take time.

ErMF are endophytes, meaning that the mycorrhizal association formed between plant and fungus remains inside the skin cells of cranberry's thinnest roots, rather than producing any external structures.

The mycorrhizae connect to one another through long, branching filaments called fungal hyphae (shown in Fig. 2a). ErMF hyphae form the mycorrhizae by inserting themselves into the fine root cells, developing a tightly packed hyphal "coil" inside the cell, resulting in root volumes that are up to 80 percent fungal [7]. Examples of these hyphal coils can be seen stained blue in Figure 2b. The hyphae form a loose network around the root system and have an extremely high surface area, which is what facilitates uptake of otherwise unavailable nutrients [3].

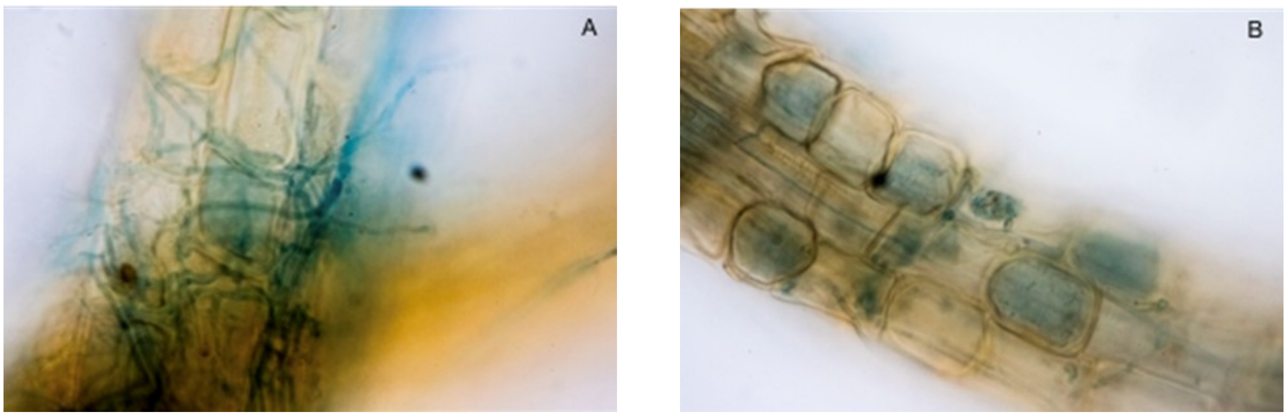

Figure 2. (a) Hyphal network and (b) fungal coils. *2a shows the network of hyphae that surround the thinnest root. 2b depicts several instances of the hyphal coils that infect rhizodermal cells. Both images taken at 600–960× magnification on an Olympus BX60 microscope and Martin Microscope attachment for Canon camera.*

Ericoid mycorrhizae, just as other types of mycorrhizae, increase the uptake of P, Zn, and Cu from the soil by the host plant—but in the case of ErMF it can also increase the uptake of N from the soil (Figure 3). A study in cranberry testing the *Rhizoscyphus ericae* species of ErMF (since renamed *Hyaloscypha hepaticicola*) demonstrated an increase in uptake of nitrate (NO_3-) by cranberry vines when inoculated [1, 3, 9].

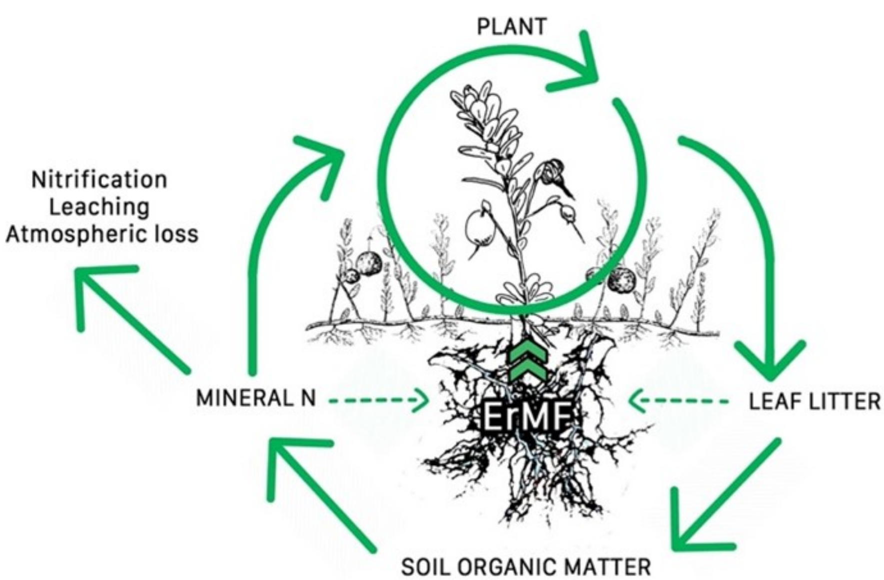

Figure 3. N pathways in the cranberry agroecosystem.
*The **solid arrows** indicate the standard N cycling pathway, which has a tendency towards N loss from through nitrification, leaching, and atmospheric loss. The cycle around the shoot system indicates resorption of N from leaves during the aging process and leaf fall. Because of this, cranberry leaf litter tends to be low quality, with a high C:N ratio. Leaf litter breaks down to become a part of the soil organic matter and to then be mineralized to ammonium and thus accessible to plants. **Dotted arrows** represent the pathways of ErMF symbiosis, where plants can directly take up N from fertilizers, mineralization, or even organic N. Figure concept adapted from Stackpoole et al (2012) and central illustration sourced from Kim Patten via Davenport et al (1994) [11, 12].*

This assist in nitrate uptake may allow for lower nitrogen usage by growers while maintaining the same yield results. Indeed, multiple promising studies in other fruiting ericaceous plants support the notion of ErMF inoculation expanding tolerance of drought and nutrient stress [3, 5, 6], which bodes well for analogous studies in cranberry.

Mycorrhizal associations have historically been a rather mysterious factor in plant health, even more so with the less common groups like ErMF. As we learn more about ErMF and the role they play in nutrient cycling and stress mitigation, it's plausible that we can adjust management practices to encourage these mutualisms and thereby afford crops another level of protection against environmental stress.

References

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High Soil pH: Understanding Plant Nutrition in Cranberries

By Senay Ugur, Emily Hahn, Jyostna Devi Mura

In 2020, we conducted a preliminary study and found a significant effect of high soil pH (pH~ 7.2) both on plant nutrient absorption and on fruit size. A 40 to 60% fruit size reduction was observed in high soil pH (pH ~ 7.2) plots compared to optimum soil pH (pH ~5.0) beds. The fruit sampled from high soil pH plots had increased calcium (Ca) levels, and substantially decreased sodium (Na), iron (Fe), manganese (Mn), and zinc (Zn) levels compared to fruits from optimum soil pH beds. A similar trend in nutrient content was observed in leaves and stems. These preliminary results suggest that the cranberries under high soil pH are unable to take up some micronutrients from the soil, such as Na, Fe, Mn, and Zn—resulting in a significant decrease in fruit size.

Soil pH influences many soil characteristics such as microorganism activity, nutrient availability, and nutrient absorption. Most microorganisms have an optimum pH range for survival and function. Organic matter mineralization slows or stops at very acid or alkaline pH levels because of poor microbial activity related to bacteria. **The availability and absorption of some plant nutrients are affected by soil pH, as shown in Figure 1. Soil pH has little impact on the availability of nitrogen (N), sulfur (S), and potassium (K). However, N stays as ammonium ($NH4^+$) form at pH 4.2-5.5, which is ideal for cranberry growth. Under high soil pH, $NH4^+$ is converted to nitrate (NO3-) form**

that is not as bioavailable as ammonium for cranberry to absorb.

On the other hand, phosphorus (P) is directly affected by soil pH. For example, phosphate tends to react with calcium (Ca) and magnesium (Mg) at alkaline pH. In acidic soil, it reacts with aluminum (Al) and iron (Fe) and becomes less soluble. As soil pH increases, many nutrients, like magnesium Mg and Ca, become increasingly available, disturbing the nutrient balance and causing toxicity.

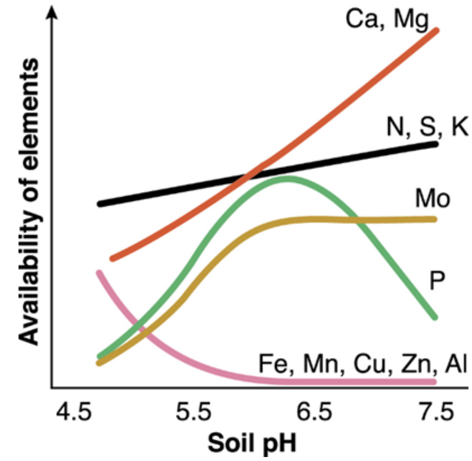


Figure 1. *Soil pH and availability of the elements (**Source: agric.wa.gov.au**)*

Soil pH can be adjusted for optimum cranberry growth. Soil pH is a measure of soil acidity or alkalinity. It depends on the hydrogen (H+) ion concentration in the soil solution; as H^+ ions in the soil increase, the soil pH decreases. The pH of soil ranges from 0 to 14, with pH 7 being the neutral point. *Soils* with *pH* levels greater than *7* are considered *alkaline*, and those with pH less than 7 are referred to as acidic. Cranberries are best adapted to soils with pH between 4 and 6.

High pH (i.e. pH > 6) in a bed can be lowered by the application of elemental sulfur. Cranberry plants are adapted to tolerate high sulfur levels in the soil. Sulfur combines with water and oxygen to form sulfuric acid ($H_2SO_4^-$) that has H^+ ions which are released into the soil solution, thus lowering the pH. This process is time consuming since it involves a bacterium named *Thiobacillus thiooxidans*. This specific bacterium is always present in the soil at low levels. However, it takes time for the population to increase, depending on environmental conditions, for sufficient sulfur conversion to occur to lower soil pH. Alternatively, if the pH of a bed is very acidic (i.e. pH < 4), calcium (lime) can be used to raise the pH.

Recent visual observations this year have indicated that bud development in high pH soils is approximately 3 to 6 days behind that of optimum soils. Buds from optimum pH soils were at the hook stage (Image 1), while buds from high pH soils were either at bud elongation or early hook stage (Image 2) on June 4, 2021.

June 4, 2021

Image 1. *Optimum soil pH bud development*

June 4, 2021

Image 2. *High soil pH bud development*

(Photo credits: Emily Hahn)

This year, we are conducting a study to replace micronutrient deficiencies in high pH soils by applying micronutrients as a foliar spray. We plan to evaluate the effect of foliar micronutrient application on cranberry fruit size both in high soil pH and optimum soil pH plants. Two distinct phases (hook and early fruit stage) were selected for foliar treatments. Soil, upright, and fruit nutrient data will be collected and compared before and after foliar application across pH treatments. In addition to foliar spray, we are studying soil microbiome amendments (bacteria and mycorrhizae) that can help maintain optimum pH in cranberry soils and nutrient absorption.

These studies will be conducted for two years, and we are looking forward to offering growers insight into whether the effects of extreme soil pH can be mitigated with foliar sprays.

Progress on the 2021 Pesticide Screening Program

By Allison Jonjak, Christelle Guedot, Jed Colquhoun, and Leslie Holland

As disease treatment windows close and we start counting insect number, continue degree day accumulation, and prepare to assess fruit set percentages, we wanted to give growers an update on the status of the 2021 pesticide trial program.

The first trial of the season tests a variety of pre-emerge herbicides, along with growth regulator hormones. Jed took the opportunity to teach me to measure and stake trial plots, and to familiarize me with the CO_2 backpack sprayer used to make applications at 20 gallons per acre in our treatment blocks. Walking speed and boom height are critical for even applications. We applied all the products at the same timing, at the Wisconsin Cranberry Research Station.

The next trial to be applied was the pre-bloom portion of a leafhopper control trial. We are screening 8 chemistries for control of the blunt-nosed leafhopper, as well as other leafhopper species present on cranberry marshes. Each product was applied pre-bloom in one plot to assess their efficacy at controlling leafhopper nymphs, and products will also be applied post-bloom in a second plot to screen insecticides that could control leafhopper adults. Finding a site for this trial involved lots of helpers—since BNLH are only present at some marshes, IPM scouts kept in constant contact to identify marshes that could host timely trials. Thanks to all involved!

Then a heat wave brought us suddenly quickly through bloom! Three fungicide trials were applied to marshes with a history of fruit rot pressure.

The Candidate Fungicide Trial screens 9 chemistries for protection against fruit rot. The Reduced Risk Candidate Fungicide Trial screens 6 products, including OMRI-certified and biological products, for protection against fruit rot. In each trial, each product was applied at 20% bloom and at 80% bloom. The Use Patterns Trial is focusing on effectiveness of various application timings. Four fruit rot prevention tank mixes are tested in each of two timing plans – plan 1 is two applications made during bloom at 20% and 80% bloom, and plan 2 is with single application made during bloom at 50% bloom.

Figure 1: *Trial plan for the Use Patterns Trial, generated by ARM software [1]. Each treatment is a combination of the product used and the application timing.*

Degree Days have been accumulated to determine the egg hatch window for sparganothis fruitworm based on previous research (Steffan et al). The Wisconsin Cranberry Research Station has enough lepidopteran pressure to host this trial, in which we evaluate the effectiveness of Altacor sprays at 10% of egg hatch, 25% of egg hatch, and 40% of egg hatch, based the DD model benchmarks. The 10% egg hatch window arrived just as the fungicide trial window was closing, so these applications were made on the same day.

Still to be applied are the post-bloom portion of the post-emerge herbicide trial, the post-bloom portion of the leafhopper trial, the 40% egg hatch phase of the sparganothis/cranberry fruitworm trial, and the flea beetle trial, which will assess 6 products, including 3 unregistered products.

A hearty thanks to all operations who are hosting trials, or have offered to host trials this year! I look forward to sharing the results with everyone after we take the crop to yield.

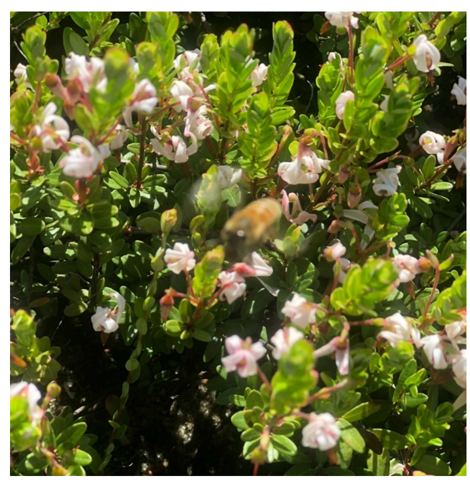
Figure 2: *A trial location, after all applications have been made and before flags are placed at the trial corners.*

[1] https://gdmdata.com/Products/ARM/?ref=quick

Grower Updates

Flying Dollar Cranberry

By Seth Rice



Here in central Wisconsin our bloom progressed rapidly. It is nothing to see 10% a day! Some growers were calling their beekeepers to bring them even earlier as planned.

With the fast bloom comes everything else that comes our way during the growing season. Both with our fungicide and insecticide applications are getting even closer together. Switching to fungicide to insecticide applications back and forth can be exhausting but necessary.

We have had some BHFW pressure on some marshes as well as fruit worm across the region. Everybody is still on the lookout for that Blunt-nosed leafhopper and our IPM programs that are in place is doing a great job!

We can see pinheads on our hybrids already with our Stevens not too far behind.

Last week some growers around a Wisconsin Rapids got hit pretty hard with hail. We were lucky enough to be spared this round. I have always heard the saying that “Farmers are the biggest gamblers”. The older I get and the more time I spend in the agriculture industry, I realize how true that really is.

Also, we have got some relief from the heat wave with some rain that not just the cranberry industry needed but all agriculture needed.

Fertilizer applications are starting to take place with pinheads showing. With some growers taking a hit with the hail, fertilizer plans may change accordingly. Try to make the most of it!

Cranberry Lake

By Karl Pippenger

Ben Lear and early varieties are about 25% pollinated, with Stevens slightly behind at 15-20%. Some growers are beginning nitrogen applications on early varieties. Vines are comparable in stage to 2016.

Timing for fruitworm applications will likely be late next week on early varieties and early the following week on Stevens. Make sure anything applied is approved by your beekeeper and is considered “bee safe”. For heavy fruitworm pressure, consider a second application after the bees are gone. If you are using a product such as Confirm, it needs to be applied a few days earlier than contact killers.

Also, make sure you understand “full bloom” when talking to your scouts and other growers. Some scouts (and I believe the UW) consider full bloom to be when the maximum amount of bloom is open. Others (myself included) consider full bloom to be the time when the number of pollinated flowers equals the number of unopened flowers, which is a few days later than the former method. It doesn’t matter, as long as you understand what it means concerning timing of crop amendments.

This upright contains one hook and four flowers, three of which are “receptive”. Receptive means the flower is mature enough to be pollinated. The flower in the top left is not receptive, as the pistil is not visible. On the other three flowers, the pistil is extended beyond the stamen.

Once flowers are receptive, it usually isn’t long until they’re pollinated. One method—the method I use—to time a fruitworm application is wait until 3-5 days after 50% fruit set for Stevens and 7 days after 50% fruit set for Ben Lear. Others use flight trapping, and current research is looking at calculating egg hatch by GDDs.

It is likely this upright will only have mature fruit on the three receptive flowers. With a little luck we may set the fourth flower.

Research Station Update

By Wade Brockman

Things here are moving very fast as the hybrid varieties are out of blossom and I would expect my Steven's to be out by next week. Weather had been about perfect until the last 5 days in which we received 6 1/2" of rain. Hopefully dry weather is in our future.