



# WISCONSIN CRANBERRY SCHOOL

## 2013 PROCEEDINGS

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## CRANBERRY ENTOMOLOGY IN WISCONSIN: SPOTTED WING DROSOPHILA (SWD), SPARGANOTHIS PHENOLOGY, AND THE BUG FLOODS

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In 2012, the USDA-ARS cranberry entomology program addressed a variety of issues: flea beetle biology and control (see Bosak et al. report in these Proceedings), pheromone-based mating disruption (see the Deutsch et al. report), the threat posed by a new invasive insect species (SWD), the biology of an age-old pest (Sparg), and the arthropod community removed during the spring floods. This report will focus on the latter three elements.

*Drosophila suzukii*, commonly known as SWD, is a recent arrival in the US (Hauser, 2011). It has been confirmed as a potential pest of the major fruit crops grown in the US (Lee et al., 2011). In anticipation of future infestations, management programs are being erected to combat this pest (Beers,

Van Steenwyk, Shearer, Coates, & Grant, 2011). One of the most troubling aspects of this fly is that it is attracted to and can penetrate unripe, hard fruit. This effectively broadens the window of fruit susceptibility, and allows the fly to “hitch a ride” within the food transportation system by hiding in ripening fruit. It has arrived in Wisconsin, has been detected in all major fruit-growing regions, and can be expected to be a regular visitor. While SWD has not been found in Wisconsin cranberries, one question has remained: is the cranberry a potential host for SWD?

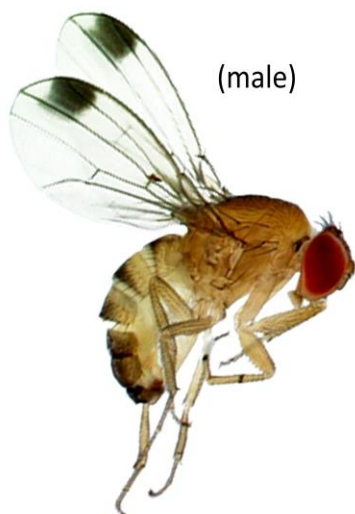


Photo courtesy C. Hammond, DATCP

females to cranberries in no-choice assays (the females had no choice as to what food source could serve as hosts for their eggs—only cranberries were offered). We found that SWD does not like cranberries very much. Following multiple replicated trials using ripe, under-ripe, and over-ripe organic Wisconsin cranberries, SWD females would not (or could not)

insert eggs into under-ripe or ripe cranberries. This suggests that healthy, current-year fruit should be safe from attack. Among the over-ripe, decaying cranberries (harvested, frozen, thawed, refrigerated)

We investigated this question by exposing gravid (mated)

Saw-like female ovipositor

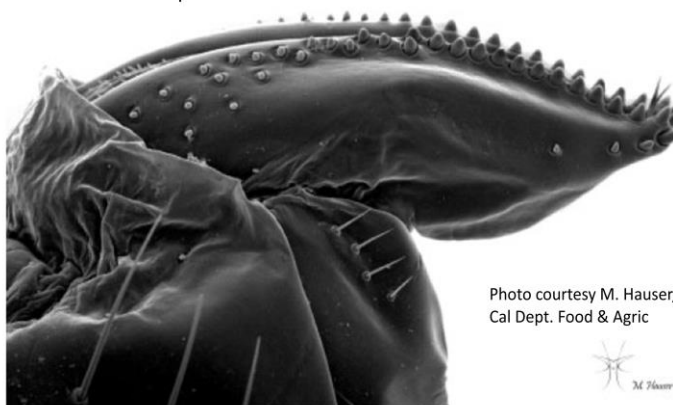


Photo courtesy M. Hauser, Cal Dept. Food & Agric



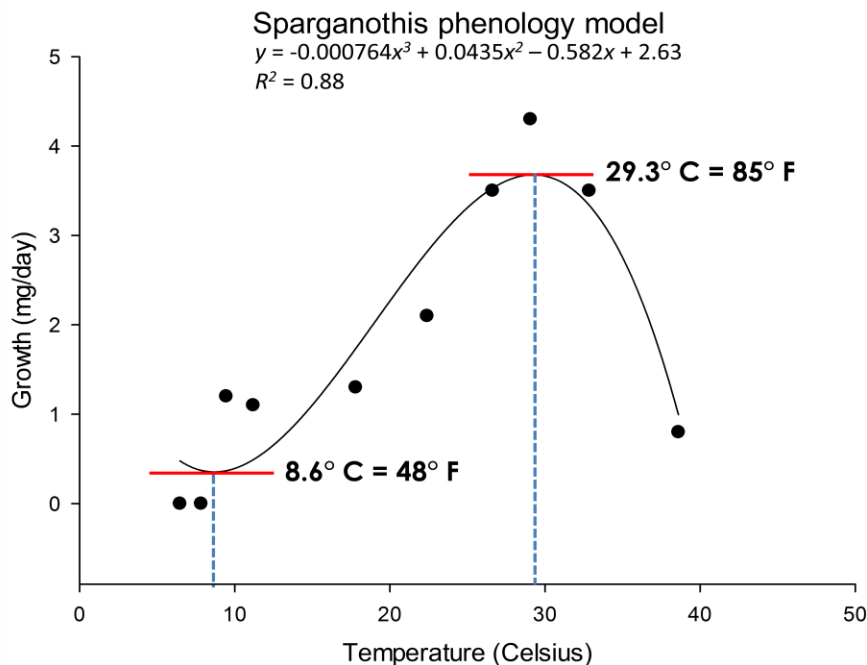
just two eggs were found among many berries, but no mature larvae were detected, and no adults emerged. Fortunately, rotten fruit usually do not make it into harvests because they generally do not float. While none of the SWD larvae in our study successfully developed within the highly acidic flesh of fresh cranberries, other studies using physically damaged cranberries have shown that SWD could reach adulthood. These berries represented wounded, decaying fruit, not the sort of berries that would get harvested. Again, current-year cranberries (that are not damaged or rotting) appear to be safe from SWD attack. Conversely, last-year's decaying bounty of unharvested cranberries may be vulnerable. SWD populations will likely be found each spring and summer in fruit-growing regions, but the risk to cranberry production seems minimal.

*Sparganothis phenology:*

Sparganothis fruitworm (SFW) has long been one of the more serious pests of cranberries (Eck, 1990), necessitating preventative pre-bloom sprays and subsequent "clean-up" sprays mid-season. A better understanding of its biology will sharpen our existing IPM toolbox by improving the timing of these sprays. We set out to uncover the development rates and degree-day (DD) accumulations associated with adult flight and egg-hatch.



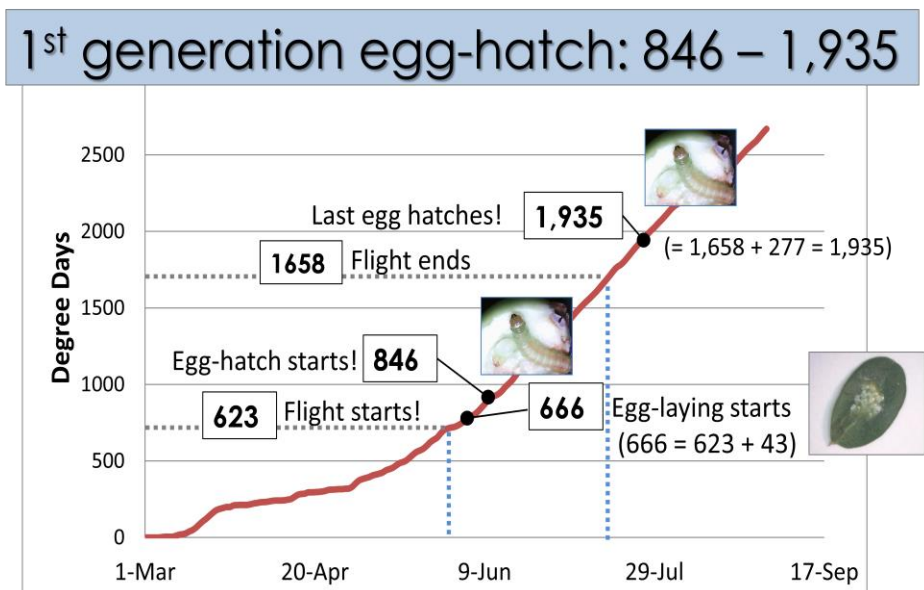




SFW larval growth rates were measured over a wide range of controlled temperatures (44-101°F). Growth rates were then plotted against temperature, and a model was fit to the dynamic. From this model, we were able to determine the lower (48°F) and upper (85°F) development thresholds of SFW larvae. The thresholds were used to generate

degree-day (DD) accumulations that were linked to developmental events, such as flight initiation and length, adult lifespan, pre-ovipositional period, ovipositional period, and egg gestation period. These DD accumulations represent key developmental benchmarks, helping to optimize pest management in the cranberry system.

Using the temperature thresholds from our growth rate trials (48°/85° F) and accumulating DD from March 1<sup>st</sup>, we found that the first males tended to fly around 623 DD, and the flight ended by 1,658 DD. We also determined that females tend to require 43 DD before they will begin laying eggs, which means that the first eggs will likely be laid by 666 DD (again, counting from March 1<sup>st</sup>). Given that each egg takes a minimum of 180 DD to hatch, the very earliest larvae can be expected to emerge by 846 DD. Ultimately, the larval emergence period can be estimated to last through 1,935 DD, and peak larval emergence (the 50% mark) should be around 1,390 DD.



### *The Bug Floods, re-visited:*

During the spring “trash flood,” a tremendous volume of plant material floats to the surface as water levels rise. This “trash” is removed from the beds by various means (e.g., by backhoe; Fig. 1) and is generally trucked away to other areas of the marsh. Since the trash floods are often used as a means of insect control, growers have been wondering if insect pests can be controlled by drowning as well as by physically removing the survivors from the bed. To address this question, we took samples of trash material from beds being flooded for insect control.

On average, the per-acre volume of plant material removed from any given bed was 0.51 yd<sup>3</sup> (cubic yard). On a 4-acre bed, for example, there were over 2 yd<sup>3</sup> of leaves, stems, berries, and various other “stuff” removed. We took our samples (2-liters/bed) and then sorted through them under microscopes to separate the arthropods. All arthropod specimens were curated in ethanol and identified. Based on our counts (per-liter), we could extrapolate how many arthropods were present per cubic yard, and thus how many arthropods per-acre were present in the trash.

Interestingly, the single most abundant organisms we found were not arthropods, but rather aquatic snails (2,892 specimens/acre). Among the arthropods, the most abundant group we found was the Coleoptera (beetles; Figs. 2-3), which were represented by 18 families (!) and totaled over 1,300/acre. Top among the beetles were the Staphylinidae (290/acre), Scarabaeidae (219/acre), Elateridae (141/acre), Carabidae (131/acre), and Curculionidae (51/acre). While the Scarabaeidae (white grubs and June beetles), Curculionidae (weevils), and Elateridae (wireworms/click-beetles) are significant pests and thus good to eliminate, the Staphylinidae and Carabidae are largely predaceous and probably eat many pests.

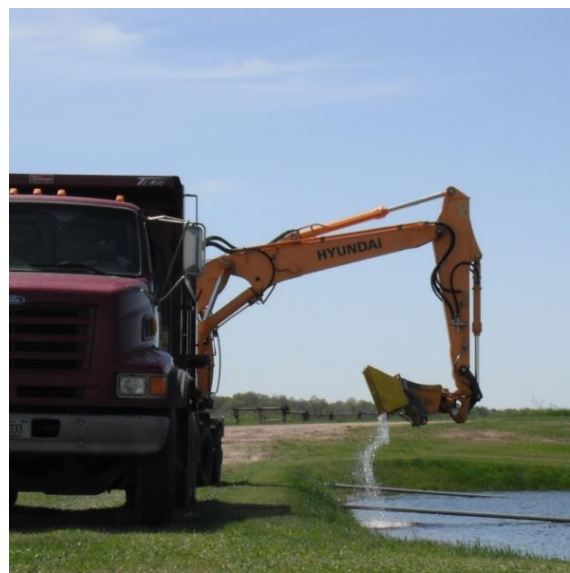


Figure 1. Removal of bed “trash.”

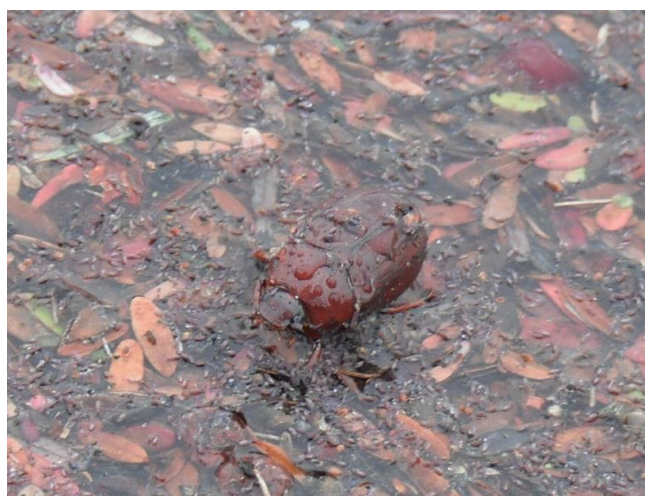


Figure 2. Adult scarab (June beetle/white grub) crawling on the surface of the trash during the floods.



Figure 3. Clockwise from top-left: Staphylinidae (rove beetles), Elateridae (click-beetles), Anthicidae (ant-like flower beetles), and Curculionidae (weevils).

This brings us to the second most abundant group: the spiders (Fig. 4). Over 121 spiders/acre were removed in the trash floods. Since spiders are absolute carnivores, it is possible that thousands of beneficial arthropods were removed in the trash. Ants, the third most abundant group (115/acre), vary widely in their ecological function, so it is difficult to characterize their role on the marsh. The fourth most commonly found arthropods were the Noctuidae (cutworms, loopers; Fig. 5), suggesting that these large caterpillars were readily floated out of the beds (78 cutworms per-acre).



Figure 4. Lycosidae (wolf spiders)





Figure 5. Noctuidae (cutworms, loopers).

Many other insect families were found, mostly from parasitic wasp families (e.g., Ichneumonidae, Pteromalidae), Hemipteran bugs (Piesmatidae, Miridae, and Pentatomidae) and various fly groups (syrphid flies, crane flies, marsh flies).

In all, there were at least 50 different *families* of insects documented within the Wisconsin marshes we studied. The total number of arthropods removed per-acre from the beds was approximately 2,127 specimens.

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Lee, J. C., Bruck, D. J., Curry, H., Edwards, D., Haviland, D. R., Van Steenwyk, R. A, & Yorgey, B. M. (2011). The susceptibility of small fruits and cherries to the spotted-wing drosophila, *Drosophila suzukii*. *Pest management science*, 67(11), 1358–67. doi:10.1002/ps.2225

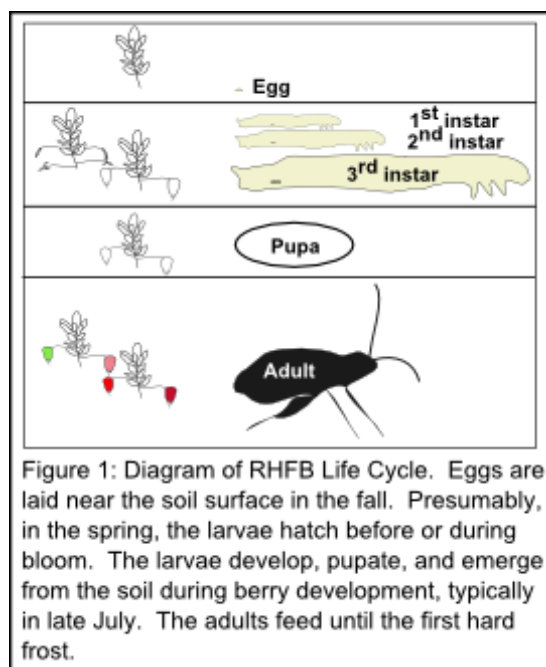
## TARGETING RED-HEADED FLEA BEETLE LARVAE

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### Introduction

Red-headed flea beetle (RHFB), *Systema frontalis*, feeds on cranberry roots during its larval stage and on tender leaf growth as an adult. Despite its recognition as a pest nearly 100 years ago, details of its life history and options for control remain largely unknown. Indeed, even its status as a pest is debated among growers. For marshes with multi-year infestations located in several beds or throughout the marsh, RHFB is a significant concern because of observations of abnormal vine growth after several years of infestation and the number of insecticide applications that are required for control.



RHFB has a single generation per year with four life stages: egg, larva, pupa, and adult (Fig. 1). In the fall, the eggs are laid near the soil surface, most likely in leaf litter (Scammell 1917). The egg or larval stage overwinters and in the spring, the larvae begin to feed on plant roots. The larval stage consists of three instars that progressively increase in size until reaching a length of 5.1 to 10.0 mm. After the third instar, the larva pupates in the soil and emerges as an adult, usually in mid- to late July. There are many species of flea beetles but the key identifiers for RHFB are a shiny, black body with a reddish-brown head.

Adult RHFB feed on a veritable buffet of plant species spanning many plant families (Clark, LeDoux et al. 2004). For a complete list of RHFB host plants, please see the table included at the end of this article. At least

twenty common weeds of cranberry are host plants for RHFB. Very little is known about their feeding preferences and reproductive capacity on different host plants. In a survey of RHFB in corn fields, RHFB were observed feeding on weeds in the fields or at the edges for 35 of 39 Iowa counties versus sightings on corn were limited to only 6 of 39 counties (Jacques 1969). On commercial cranberry marshes, RHFB are typically observed feeding on weeds on the dikes and in the cranberry bed. In addition, for marshes with severe infestations, areas of abnormal vine growth can be observed.

The research objectives for the summer of 2012 were:

1. Determine whether abnormal vine growth areas or hotspots, normal areas of vine growth, or the dikes were infested with RHFB larvae.
2. Locate the overwintering site of RHFB and identify adult feeding patterns.
3. Evaluate an insecticidal soil drench, targeting the larval stage, to reduce RHFB populations.

### 1. Sampling for larvae

Method:

To sample for RHFB larvae, soil cores were taken from the dikes, cranberry bed, and hotspots located at both sites. The cores were placed in plastic bags, transported in chilled coolers, and stored at 0°C until processing. Each core was washed through a series of sieves. Roots and detritus were transferred to Berlese funnels. Meanwhile, the material in the bottom sieve was transferred to a glass jar to which a concentrated Epsom salt solution was added. The jar was inverted to thoroughly mix the material, after settling, the surface layer was examined for any arthropods. Berlese funnels were inspected after the root material had thoroughly dried.

Results:

After processing 226 out of 656 soil samples, only one larva was recovered from the edge of a probable hotspot. Based on the adult emergence patterns, that are discussed in the next section, the population is highly variable and scattered throughout the bed reducing the effectiveness of this sampling method.

### 2. Emergence and feeding patterns

Method:

The overwintering study sites were located at two commercial cranberry marshes in Wisconsin. Emergence cages were placed either on the dike or in the cranberry bed after cranberry bloom, on June 22, 2012 and June 25, 2012. The cages were 15 ft. (4.6 m) in length by 3 ft. (0.9 m) in width by ft. (0.5 m) in height. Cages were supported by wire hoops and enclosed with a spun polyester fabric that has 90% light transmission. The fabric was secured at the soil surface using bio-degradable starch staples. Adult RHFB were collected weekly from the cages using a vacuum-based insect collection device. Collected beetles were transferred to a plastic bag and stored over ice until reaching the laboratory and subsequent stored at -20°C. Adult collections began on July 23, 2012 and ended on August 24, 2012.

Three commercial cranberry marshes were study sites for assessing the feeding distribution at the bed level. Ten sets of twenty sweeps were performed on the dikes, at the bed edges, and in the interior of the cranberry bed. The bed edges were defined by the outer fifteen feet (5 m). Sweep paths were in a zig-zag for the edges and interior. After each set of twenty sweeps, the net was visually inspected and the number of adult beetles recorded. Sweeps were performed in the morning at all locations.

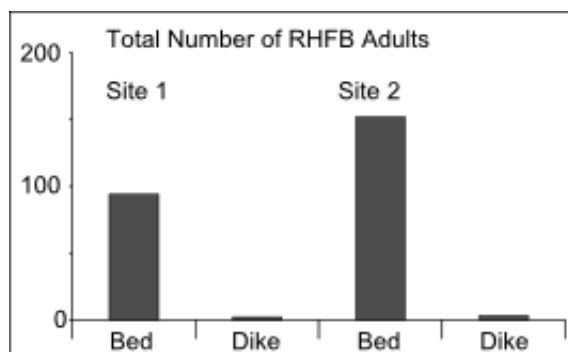


Figure 2: Total number of RHFB Adults recovered from emergence cages. Eight cages were placed in each location, bed or dike, at both sites. Adults were collected each week from July until August.

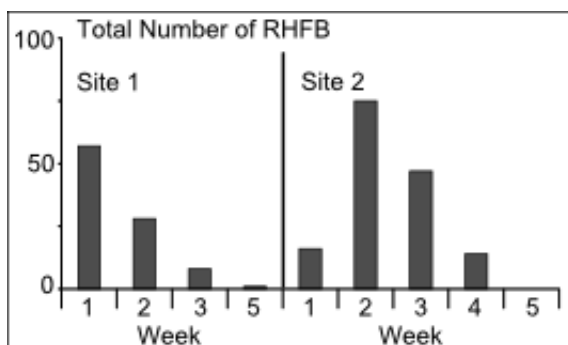


Figure 3: Weekly total of adult RHFB caught in emergence cages. This is another way to represent the data in Figure 2.

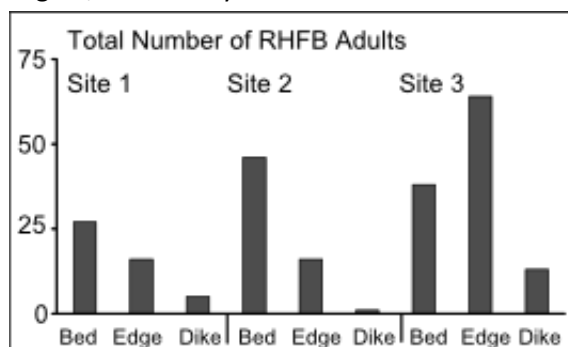


Figure 4: Feeding distribution of RHFB adults at three sites. The values reflect the total number of adults recovered in sweep nets during the 2012 growing season.

caged prior to bloom.

## Results:

From the emergence cages, most adult RHFB were caught from the bed compared to the dike, 246 individuals versus 5 individuals for the entire season at both marshes (Fig. 2). Most of the adults emerged during the first three weeks at both sites (Fig. 3). However, the highest number of RHFB adults was collected during the first week at Site 1 versus the second week at Site 2.

Sweep net sampling in the interior of the bed, at the edges, and on the dikes at three sites suggests that most of the RHFB adults are feeding in the bed (Fig. 4). However, it is important to note that for all three sites, the dikes were mown regularly. Mowing eliminates most of the leaf tissue from the broad-leaf weeds that could serve as food for the RHFB. The distribution of adults is likely to change depending on the availability of host plant species.

## 3. Insecticidal soil drench

### Method:

Three field sites were selected according to variety, region, and history of RHFB infestation. Insecticides were applied to the canopy and drenched into the soil with irrigation one week prior to bloom and one week following bloom to small plots within the cranberry bed. Each of the following treatments was applied to four plots per treatment: before bloom Altacor, Delegate, Belay, and NematacC, an entomopathogenic nematode product and after bloom, Belay. Control plots that received no insecticidal soil drench were included at each marsh. Emergence cages were installed over treated and control plots to contain any adults. Feeding damage and adult populations were monitored each week. Yield could not be estimated because the plots were



## Results:

The number of adults was not statistically different when comparing the soil drench treatments (Fig. 5). However, the post-bloom Belay soil drench had significantly less damaged uprights compared to the control and other pre-bloom applications (Fig. 6).

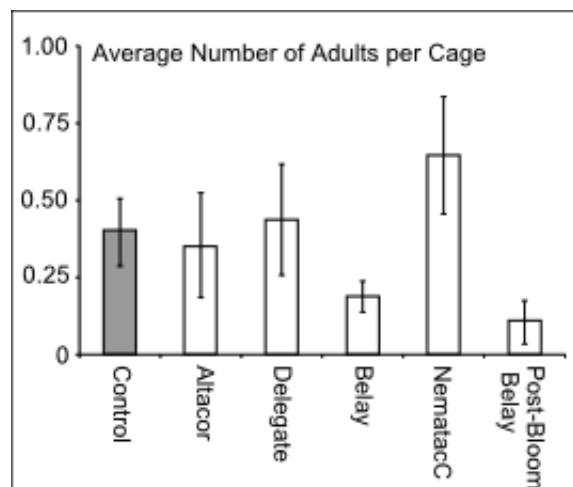


Figure 5: Comparison of Adult RHFB counts between soil drench treatments. Each plot was caged and sampled each week. A short ten second sampling with an insect vacuum was performed three times per cage. Very low numbers of adult RHFB were found with this method and were not statistically different. However, this trend is similar and significant for upright damage.

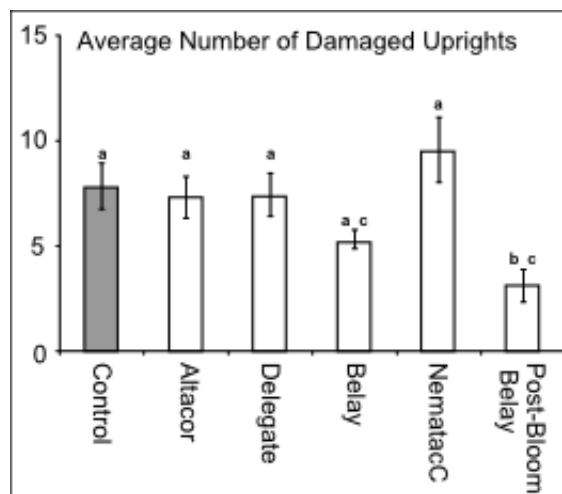


Figure 6: Comparison of upright damage levels between soil drench treatments. Altacor, Delegate, Belay, and NematacC were applied before bloom. After bloom, Belay was applied. Each treatment was replicated with four small plots at three commercial cranberry marshes. Treatments that share a letter, e. g. "a", are not statistically different. The post-bloom belay application is the only treatment different from the control.

## Acknowledgements

I'd like to thank the grower-cooperators who participated in these projects. Their help and flexibility were invaluable. Thank you to everyone from the Steffan Lab who helped with sampling. Also, thank you to Leroy Kummer and Hannah Gaines for their advice.

## List of Recorded Food Plants of RHFB Adults

Asterix (\*) indicate recognized weed in cranberry production; list was compiled with the following references: (Clark, LeDoux et al. 2004; Colquhoun, Roper et al. 2009), see <http://plants.usda.gov/java/> for images and more information.

Common Name	Scientific Name	Plant Family
American water-willow	<i>Justicia americana</i>	Acanthaceae
Redroot amaranth	<i>Amaranthus retroflexus</i>	Amaranthaceae
Poison oak	<i>Rhus toxicodendron</i>	Anacardiaceae
Carrot	<i>Daucus carota</i>	Apiaceae
Parsley	<i>Petroselinum crispum</i>	Apiaceae
Indian hemp	<i>Apocynum cannabinum</i>	Apocynaceae
Common winterberry	<i>Ilex verticillata</i>	Aquifoliaceae
*Common milkweed	<i>Asclepias syriaca</i>	Asclepiadaceae
*Common ragweed	<i>Ambrosia artemisiifolia</i> , <i>A. trifida</i>	Asteraceae
*Common burdock	<i>Arctium lappa</i> , <i>A. minus</i>	Asteraceae
*Aster, Bottomland aster	<i>Aster spp.</i>	Asteraceae
*Common beggarticks, devil's beggarticks	<i>Bidens frondosa</i>	Asteraceae
Nodding plumeless thistle	<i>Carduus nutans</i>	Asteraceae
Chrysanthemum	<i>Chrysanthemum</i>	Asteraceae
*Canada thistle	<i>Cirsium arvense</i>	Asteraceae
Dahlia	<i>Dahlia</i>	Asteraceae
*Burnweed	<i>Erechtites hieraciifolia</i>	Asteraceae
Joe pye weed	<i>Eupatorium purpureum</i>	Asteraceae
*Narrowleaf goldenrod, slenderleaf goldenrod	<i>Euthamia graminifolia</i>	Asteraceae
Sunflower	<i>Helianthus annuus</i>	Asteraceae
Strawflower	<i>Helichrysum</i>	Asteraceae
Canada lettuce	<i>Lactuca canadensis</i>	Asteraceae
Oxeye daisy	<i>Chrysanthemum leucanthemum</i>	Asteraceae
*Canada goldenrod	<i>Solidago spp.</i>	Asteraceae
cocklebur	<i>Xanthium sp.</i>	Asteraceae
*Jewelweed	<i>Impatiens capensis</i>	Balsaminaceae
Gray alder	<i>Alnus incana</i>	Betulaceae
Horseradish	<i>Armoracia rusticana</i>	Brassicaceae
Turnip	<i>Brassica oleracea</i>	Brassicaceae
Hops	<i>Humulus lupulus</i>	Cannabaceae
Bush honeysuckle	<i>Diervilla</i>	Caprifoliaceae
Japanese honeysuckle	<i>Lonicera japonica</i>	Caprifoliaceae
Weigelia (not in WI)	<i>Weigelia</i>	Caprifoliaceae
Beet	<i>Beta vulgaris</i>	Chenopodiaceae
*Common lambsquarters, goosefoot	<i>Chenopodium album</i>	Chenopodiaceae
*Virginia marsh St. Johnswort	<i>Hypericum virginicum</i>	Clusiaceae

Common Name	Scientific Name	Plant Family
Sweet potato	<i>Ipomoea batatas</i>	Convolvulaceae
Swamp azalea (not present in Wisconsin)	<i>Rhododendron viscosum</i>	Ericaceae
Blueberry, high bush	<i>Vaccinium corymbosum</i>	Ericaceae
Cranberry	<i>Vaccinium macrocarpon</i>	Ericaceae
Soybean	<i>Glycine max</i>	Fabaceae
Alfalfa	<i>Medicago sativa</i>	Fabaceae
Lima bean	<i>Phaseolus lunatus</i>	Fabaceae
Kidney bean	<i>Phaseolus vulgaris</i>	Fabaceae
*Clover, white and red	<i>Trifolium pratense, T. repens</i>	Fabaceae
Horse bean (not in WI)	<i>Vicia faba</i>	Fabaceae
Black currant	<i>Ribes nigrum</i>	Grossulariaceae
Gooseberry	<i>Ribes sp.</i>	Grossulariaceae
Carolina redroot (not in WI)	<i>Lachnanthes tinctoria</i>	Haemodoraceae
Harlequin blueflag	<i>Iris versicolor</i>	Iridaceae
*Wild mint, Germander	<i>Lycopus rubellus (Mentha, Teucrium)</i>	Lamiaceae
*Healall, selfheal	<i>Prunella vulgaris</i>	Lamiaceae
Flax	<i>Linum sp.</i>	Linaceae
Swamp loosestrife	<i>Decodon verticillatus</i>	Lythraceae
Crape myrtle (not in WI)	<i>Lagerstroemia indica</i>	Lythraceae
Okra	<i>Abelmoschus esculentus</i>	Malvaceae
Velvetleaf	<i>Abutilon theophrasti</i>	Malvaceae
Common marshmallow	<i>Althaea officinalis</i>	Malvaceae
Cotton (not in WI)	<i>Gossypium sp.</i>	Malvaceae
Rosemallow	<i>Hibiscus militaris</i>	Malvaceae
Sweetgale	<i>Myrica gale</i>	Myricaceae
Forsythia	<i>Forsythia</i>	Oleaceae
Willowherb	<i>Epilobium adenocaulon</i>	Onagraceae
*Evening-primrose	<i>Oenothera biennis</i>	Onagraceae
Royal fern	<i>Osmunda regalis</i>	Osmundaceae
Common plantain	<i>Plantago major</i>	Plantaginaceae
Rice	<i>Oryza sativa</i>	Poaceae
*Giant foxtail	<i>Setaria faberi</i>	Poaceae
Corn	<i>Zea mays</i>	Poaceae
Buckwheat	<i>Fagopyrum</i>	Polygonaceae
*Water smartweed	<i>Polygonum amphibium</i>	Polygonaceae
Black bindweed	<i>Polygonum convolvulus</i>	Polygonaceae
Marshpepper knotweed	<i>Polygonum hydropiper</i>	Polygonaceae
*Pale smartweed	<i>P. lapathifolium</i>	Polygonaceae
*Pennsylvania smartweed	<i>P. pennsylvanicum</i>	Polygonaceae
*Ladysthumb smartweed	<i>P. persicaria</i>	Polygonaceae
*Arrowleaf tearthumb	<i>P. sagittatum</i>	Polygonaceae
*Sheep sorrel	<i>Rumex acetosella</i>	Polygonaceae
*Swamp candles, swamp loosestrife	<i>Lysimachia terrestris</i>	Primulaceae
*Strawberry	<i>Fragaria spp.</i>	Rosaceae

Common Name	Scientific Name	Plant Family
Apple	<i>Malus sylvestris</i>	Rosaceae
Pear	<i>Pyrus communis</i>	Rosaceae
Carolina rose	<i>Rosa carolina</i>	Rosaceae
Shining rose (not in WI)	<i>Rosa nitida</i>	Rosaceae
*Blackberry, Raspberry, Swamp dewberry	<i>Rubus spp.</i>	Rosaceae
*Hardhack, Steeplebush	<i>Spiraea tomentosa</i>	Rosaceae
Buttonbush	<i>Cephalanthus occidentalis</i>	Rubiaceae
Poorjoe	<i>Diodia teres</i>	Rubiaceae
Virginia buttonweed (not in WI)	<i>Diodia virginiana</i>	Rubiaceae
Smooth false buttonweed (not in WI)	<i>Spermacoce glabra</i>	Rubiaceae
Heartleaf willow	<i>Salix cordata</i>	Salicaceae
Bebb willow	<i>Salix rostrata</i>	Salicaceae
Roundleaf greenbriar (not in WI)	<i>Smilax rotundifolia</i>	Smilacaceae
Eggplant	<i>Solanum melongena</i>	Solanaceae
Potato	<i>Solanum tuberosum</i>	Solanaceae
*Riverbank grape	<i>Vitis riparia</i>	Vitaceae

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# **PHEROMONE-BASED MATING DISRUPTION TO CONTROL THE HISTORICAL TOP THREE INSECT PESTS OF WISCONSIN CRANBERRIES**

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Alternative methods of pest control, specifically mating disruption (MD), have been investigated in many agricultural systems. MD has been used extensively in the US apple and pear industries for the last 20 years and is now a major component of orchard pest management in the Pacific Northwest. MD has also been tested in cranberry but there have always been drawbacks due to an inadequate carrier.

The premise of MD is that the air is saturated with the synthetic sex pheromone(s) of the target species, which impairs the male's ability to track the true female pheromone plume. If MD is successful, mating frequency drops significantly and many eggs remain unfertilized, thereby eliminating much of the subsequent generation. MD is most efficient in areas of moderate to low pest density, since in high pest areas there is a greater likelihood that males and females will find each other just by chance. A major consideration for implementing a MD program is that there is a method to release enough pheromone into the air during adult flight to adequately confuse the males. Two factors, the number of pheromone dispensers and the length of time that the pheromone is released, are key to ensure thorough coverage from a single application.

The need for a suitable pheromone carrier that provides high point-source densities, consistent pheromone release rates, and reduced labor costs, may be resolved with the SPLAT<sup>®</sup> technology. SPLAT<sup>®</sup> (Specialized Pheromone & Lure Application Technology) was developed by ISCA Technologies (Riverside, CA) and is a viscous, inert, food-grade wax emulsion that can be impregnated with synthetic pheromone(s). SPLAT<sup>®</sup> also has the potential for mechanical application, and once we have established that it works, we will be partnering with ISCA engineers to retrofit a tubing system that can deposit SPLAT<sup>®</sup> directly into the marsh using existing pesticide application equipment.

In our 2012 trial, we tested SPLAT<sup>®</sup> as a pheromone dispenser in the cranberry system. However, instead of targeting only one insect pest, we were attempting to disrupt the mating of three species: cranberry fruitworm (CFW), *Sparganothis* fruitworm (SFW), and black-headed fireworm (BHFw). There have been limited MD studies targeting multiple pests at once because it is not feasible in most agricultural systems. Cranberry has the potential because 1) all three of these major perennial pests have the main component(s) of their sex pheromone

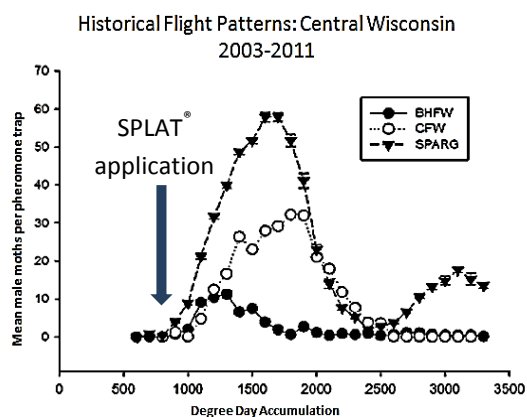


Figure 1. Trap count of CFW, SFW, and BHFw male moths from 2003-2011 across the major growing regions in Wisconsin. Degree days were calculated from a March 1 biofix using 41°F/85°F thresholds. The arrow indicates the correct time for a SPLAT<sup>®</sup> application.

commercially available, and 2) the adult flights are tightly correlated (Fig. 1). Thus, one application of SPLAT® right before the first adults emerge would be at the correct time to disrupt mating for all three species (Fig. 1).

## METHODS

SPLAT® was loaded with the synthetic pheromones at ISCA's facility and shipped in 250 ml caulking tubes. Unfortunately, due to production issues, ISCA could only supply 20 acres worth of the CFW pheromone, so the remaining SPLAT® contained just SFW and BHFWS pheromones. A total of 20 acres at two marshes were treated with the three species blend and a total of 29 acres at two other marshes were treated with the two species blend. There was a total of 59 acres of untreated control. We deposited SPLAT® by caulking gun in 3.2g dollops directly on the runners (Fig. 2). In each bed, SPLAT® was applied in 8 rows with 7-8 feet between dollops, totaling over 300 dollops per acre.



Figure 2. SPLAT® deposition within the canopy.

## RESULTS AND DISCUSSION

Our metrics of success were based on the number of male moths caught in pheromone-baited traps, female mating frequency, and larval densities in subsequent generations.

Pheromone-baited traps were set down the center of the inner most three beds of each block. We expected to see fewer male moths in our SPLAT® versus control traps, since adequate pheromone levels would prevent the males from locating the traps. At two of our marshes, we caught very low numbers of BHFWS and SFW moths in both our treatment and control blocks, so we were unable to determine the effect of SPLAT® at those locations. At Marsh 3 we caught fewer BHFWS and SFW moths in our SPLAT® versus control block (Fig. 3). At Marsh 4, we actually caught more SFW moths in our SPLAT® versus our control block but we discovered that there were inconsistencies in helicopter-applied insecticide from the previous season, resulting in a likely SFW hotspot in the SPLAT® treated beds. We did catch fewer BHFWS moths in our SPLAT® versus control block at this marsh, however, SPLAT® efficacy could not be assessed since our control and SPLAT® blocks did not have similar treatment histories. Regarding CFW, in the marshes treated with the three species blend, we caught similar numbers of moths in our control

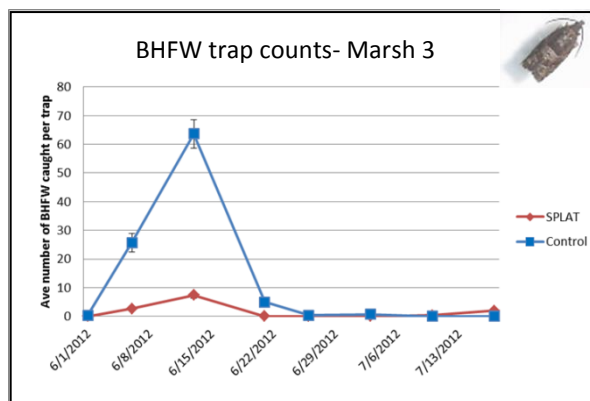
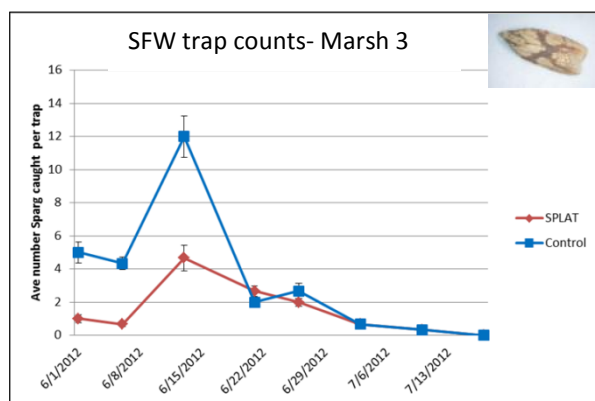


Figure 3. Average number of male moths caught per pheromone-baited trap at Marsh 3.

and SPLAT® treated beds. Previous studies have shown that CFW moths require two pheromone components to elicit any response, but the SPLAT® formulation from 2012 only contained one of the two pheromone components. Next season, ISCA will manufacture SPLAT® with both components of the CFW pheromone. Nevertheless, even with all these difficulties, insecticide applications were reduced by one spray in the SPLAT® beds at all four marshes.

To determine mating frequency, we attempted to collect female moths using a Dvac, a large insect vacuum. In previous seasons it had been successful as a low-impact sampling device, but last season it did not catch the moths that were needed, so we were unable to determine mating frequency. This coming summer we are planning to determine mating frequency using sentinel moths, which are virgin females that are set out in cages. These females can easily be collected and dissected to determine their mating status. Last summer we were also unable to determine any differences in larval densities since we only found CFW larvae, which we were effectively not treating for due to the incomplete CFW pheromone. Next season we will be adding timed visual scans, sweeping, and more berry scoring to increase our chances of finding larvae of all three species. On a positive note, both our collaborating growers and the Ocean Spray receiving station reported that they did not see any SPLAT® dollops coming in with the harvested berries.

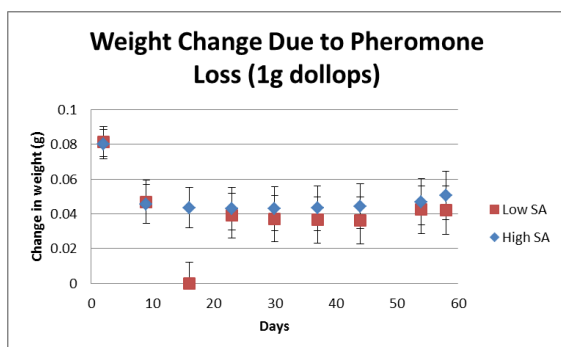


Figure 4. Volatilization pattern of the pheromone components from 1g SPLAT® dollops. Positive values indicate weight loss entirely due to pheromone release.

This first year we also performed a volatilization study to determine the effect of SPLAT® dollop size and shape on the pheromone release rate. Our experiment was set up as a two-way fully crossed factorial comparing size (1g vs. 3.2g) and shape (round, low surface area vs. cylindrical, high surface area). Blank SPLAT® was used as a positive control. We found that shape did not affect the release rate for the 1g dollops, but it did affect the release rate for the 3.2g

dollops. This indicates that we can use 1g dollops in the future without worrying about perfect uniformity in shape among the dollops. Regarding the release rate across time,

we discovered that, for the 1g dollops, there was a large initial release, but it quickly leveled off and remained low and constant for the rest of our study. This means that SPLAT® contains enough of the pheromones to last the full length of the adults' first flight (Fig. 4).

In conclusion, SPLAT® looks promising for multi-species MD in the cranberry system. In terms of the logistics of the program, we found that SPLAT® deposition within the cranberry canopy was feasible and the pheromone components were released in a low, uniform manner that lasted the full eight weeks of our study. As for the potential of MD using SPLAT®, where we had measurable moth populations and our experimental conditions were maintained, we caught fewer SFW and BFW moths in our SPLAT® versus control blocks. Additionally, we found that SPLAT® did not contaminate the berries at harvest. And, most importantly, even in this first season, SPLAT® replaced one insecticide application. Next season, as we increase the acreage treated with the three species blend and improve our sampling technique, we

hope to see high levels of MD for all three species, levels which, in the future, may no longer require insecticidal sprays for these pests.

#### **ACKNOWLEDGEMENTS**

We would like to thank ISCA technologies for supplying the SPLAT<sup>®</sup>. We gratefully acknowledge our collaborating growers and the help we had from the Steffan and Zalapa lab personnel. This project was funded by the USDA-ARS, Wisconsin Cranberry Board, and the Cranberry Institute.



## Meet our new entomologist

CHRISTELLE GUEDOT

UNIVERSITY OF WISCONSIN-MADISON, DEPARTMENT OF ENTOMOLOGY

Christelle is originally from Southern France where she obtained her B.S. in Cell Biology and Physiology and a Maîtrise in Neurobiology. In 1998, she moved to Logan, UT and in 2004 she obtained her Ph.D. from the Entomology Department at Utah State University. Her dissertation was on the nest location and nest recognition in two solitary cavity-nesting bees, the alfalfa leaf-cutting bee and the blue orchard bee, both important commercial pollinators.

One project addressed the effect of three dimension and color patterns on nest location and reproductive success of the alfalfa leaf-cutting bee, *Megachile rotundata*, in commercial alfalfa pollination. In commercial alfalfa seed production, where high bee densities are released, alfalfa leaf-cutting bee females may enter several nesting holes before locating their nests. Such levels of “wrong hole” visits lead to an increase in the time spent by females locating their own nests, thereby decreasing alfalfa pollination efficiency and possibly healthy brood production. The objectives of this study were to determine the effect of different nesting board configurations in commercial alfalfa leafcutting bee shelters (applying a three-dimensional pattern to the boards, applying a color contrast pattern, or applying a combination of three-dimensional and color contrast patterns) on nest location performance and on the incidence of chalkbrood disease. The three-dimensional pattern and the combined three-dimensional and color contrast pattern improved the ability of females to locate their nests compared with the uniform board (a standard configuration currently used commercially). The percentage of larvae infected with chalkbrood decreased by half in the three-dimensional board design, compared with the uniform board. These results have important implications for pollination efficiency and bee brood production.

Another study looked at the relationship between homing ability and body size in *Osmia*. The maximum homing ability of female bees, that is, their capacity to return to the nest after being displaced a certain distance, is considered to be an estimate of their maximum foraging distance. The homing ability of the blue orchard, *Osmia lignaria*, is 1,200m; beyond that distance females are not able to return to their nest. Homing ability and body weight for *Osmia lignaria* were combined with data for five other congeners, *O. rufa*, *O. cornuta*, *O. pedicornis*, *O. cornifrons*, and *O. emarginata*. Homing ability is positively and linearly related to body weight: the bigger the bee, the further it can fly and still be able to return to its nest. These results should be of use in selecting *Osmia* species as potential crop pollinators, distributing nesting shelters in orchards, and establishing adequate buffer distances around genetically modified crops.

In 2005, Christelle moved to Yakima, WA to conduct a post-doc at the USDA-ARS. There she worked on the basic biology, behavior, and chemical ecology of pest insects in fruit trees and vegetable crops. One of her many projects there was to identify a sex attractant pheromone for the pear psylla, *Cacopsylla pyricola*. The pear psylla is a major pest of pear, in that the nymphs produce honeydew that drips onto the fruit and get colonized by sooty mold fungus, making the fruit unmarketable for fresh

market. To isolate the pheromone, we washed whole insects, batches of 50 males or females, in a solvent and performed chemical analyses of these solvent washes. The chemical analyses revealed that males and females had very similar profiles but that females produced more of a particular chemical called 13-methylheptacosane (13-MeC27). This chemical was found to be attractive to males but not to females in Y-tube olfactometer choice tests and was also found to be as attractive to males as a solvent wash of females, suggesting that this chemical might be solely responsible for the male attraction to females. This chemical was then tested in field at different doses (0, 10, 100, 1000ug of 13-MeC27) on sticky traps. More males were caught on traps baited with the chemical (10, 100, 1000ug) than on control traps (0ug). Females were not attracted to 13-MeC27. We also tested different trap designs (our mesh trap, a clear mesh trap, a clear solid panel, and a delta trap) and found that the clear mesh trap was more efficient at catching psylla than the other types of traps. This is the first identification of a pheromone in any psyllid.

In October 2012, Christelle started at UW-Madison in the Entomology Department as the fruit crop entomologist and extension specialist. Her first research project at UW will address cranberry resistance to insect pests. She plans to hire a M.S. student in June that will work on this project to determine insect development rates, fecundity, and population densities in the field of blackheaded fireworm, sparganothis fruitworm, and cranberry fruitworm on six cultivars grown in Wisconsin to screen for cranberry resistance to insect-feeding damage.

# IRRIGATION AND SOIL MOISTURE MONITORING IN WI CRANBERRY BEDS

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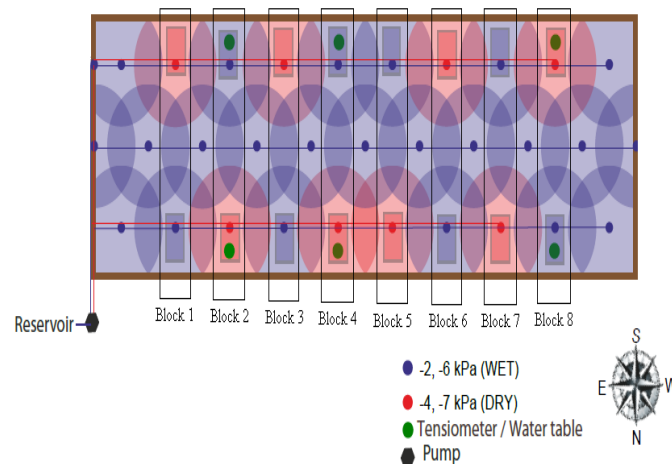
Water is an essential resource for cranberry production as it is used for irrigation, pest management, crop protection and harvest. Irrigation accounts for the largest amount of water consumption in cranberry production. A greater volume of water is used for management practices such as pest prevention, crop protection, and harvest however, unlike irrigation, the water used in pest management, crop protection, and harvest is recycled. Reducing water use in irrigation is critical due to both the consumption of water as well as the cost of fuel used to run the irrigation pumps. There are currently several soil moisture monitoring tools that are available to growers to provide additional information to help improve the efficiency of water use in cranberry production. This study was designed to evaluate the impact on crop productivity under two irrigation regimes based on two different tensiometer set points and evaluate the use of two types of soil moisture probes.

## Methods

### Setup and Experimental Design

This field study was conducted on a 5 acre cranberry bed of the cultivar ‘Stevens’ in Tomah, Wisconsin during the 2011 and 2012 growing season. The cranberry bed is divided into 8 blocks, and each block contains a wet and dry treatment area at either end of the bed (Figure 1). Tensiometers were located in blocks 2, 4 and 8 of the cranberry bed and volumetric water content probes were installed in Blocks 4 and 6 to record soil moisture levels daily.

**Figure 1.** Experimental design in cranberry bed. Each block contains a wet and dry treatment area, assigned randomly.



**Treatments.** Two soil moisture treatments were established through two independent irrigation lines using overhead sprinklers. The matric potentials for the treatments were maintained at -2 to -6 kPa (wet treatment) and -4 to -7.5 kPa (dry treatment). The wet treatment broadly corresponds to what producers regularly target in their fields (Table 1)

**Table 1.** Water applications for wet and dry treatments in 2011 and 2012

Year	Data collection Period	Treatment	Rain		Heat Protection		Irrigation		Other <sup>1</sup>		Total
			Inches	%	Inches	%	Inches	%	Inches	%	Inches
2011	6/20-8/31 (72 days)	Wet	7.44	36	0.08	0	12.72	62	0.20	1	20.43
		Dry	7.44	66	0.08	1	3.46	31	0.28	2	11.26
2012	6/1-9/7 (99 days)	Wet	8.87	25	0.0	0	26.09	75	0	0	35.0
		Dry	8.87	42	0.20	1	11.88	57	0	0	20.9

**Soil Moisture Measurements.** Soil moisture was continuously monitored by Hortau tensiometers and volumetric water content probes (Echo 5, Campbell Scientific, Inc.) throughout the growing season. Tensiometers measure soil water tension, or the force that is required to ‘pull’ water out of the soil matrix. This type of measurement provides an indication of how difficult it is for plant roots to extract water from the soil matrix. This type of probe can be used in many soil types however, it requires 24-48 hours to equilibrate with the soil matrix before measurements can be made.

Volumetric water content probe. This type of probe measures the % of the soil volume occupied by water. It does this by measuring the travel time of an electromagnetic wave along a waveguide (rods). The speed of the signal changes based on the volume of the soil occupied by water, so the value generated indicates the % volumetric water content. This value is not a direct measurement of soil moisture, but a calculation based on the electromagnetic wave, therefore the instrument must be calibrated to the specific soil type that it is being used in to generate accurate readings. A brief comparison of these two types of probes is listed in Table 2.

Table 2. Comparison of tensiometers and volumetric probes	
Tensiometer	Volumetric Probe
Measures tension required to ‘pull’ the water out of the soil matrix	Measures percent volume of water in the soil matrix
Does not need to be calibrated to specific soil	Must be calibrated to specific soil
Requires 24-48 hours to equilibrate before reading can be taken	Readings can be taken immediately
Must have proper contact with soil for proper readings	Must have proper contact with soil for proper readings
Maintain adequate water levels in the tensiometer and porous tip	Maintain electrical connections

#### *Plant Physiological Parameters*

**Photosynthetic capacity ( $A_{max}$ )** and stomatal conductance ( $g_s$ ) measurements were made on current season’s growth. After completing gas exchange measurements the portion of the upright measured inside the chamber was bagged for leaf area analysis so that photosynthetic rates per leaf area could be calculated. Leaf area was measured by scanning the leaves of each upright in reference to a ruler and using ImageJ to calculate the area.

**Xylem Potential** is a measure of the tension on the water column in the plant. The greater the water stress, the more negative the tension on the water column. Xylem potential was measured on

fruiting and non-fruiting uprights of the current season's growth throughout the growing season. This parameter was measured with a plant water status console or pressure bomb. Uprights were selected from each treatment and a fresh cut was made at the base of the stem prior to being placed in the sealed chamber. In the chamber samples were pressurized with nitrogen gas. The pressure is slowly increased until sap from the fresh cut stem is released.

*Chlorophyll fluorescence* was measured with a Handy PEA Chlorophyll Fluorometer (Hansatech Instruments Ltd.). These measurements were taken pre-dawn (23:30 HR to 01:00 HR) on healthy, current season's growth. Fv/Fm is a commonly used metric to measure plant stress by exposing dark adapted leaves to a super-saturating pulse of light and measuring the plants ability to utilize the light for photochemistry compared to dissipating the light as heat or fluorescence. Stressed plants have a lower capacity to convert incident light energy to photochemistry.

*Growth measurements and Yield Potential.* Vegetative and reproductive uprights were collected from the experimental blocks for both treatments and brought back to the lab for length measurements of current season's growth. Fresh weights were taken, and uprights were placed in drying oven for 24 hours prior to taking biomass measurements. Flower counts were conducted in late June while fruit set counts were made in the end of July and yield data was collected at harvest.

## Results and Discussion

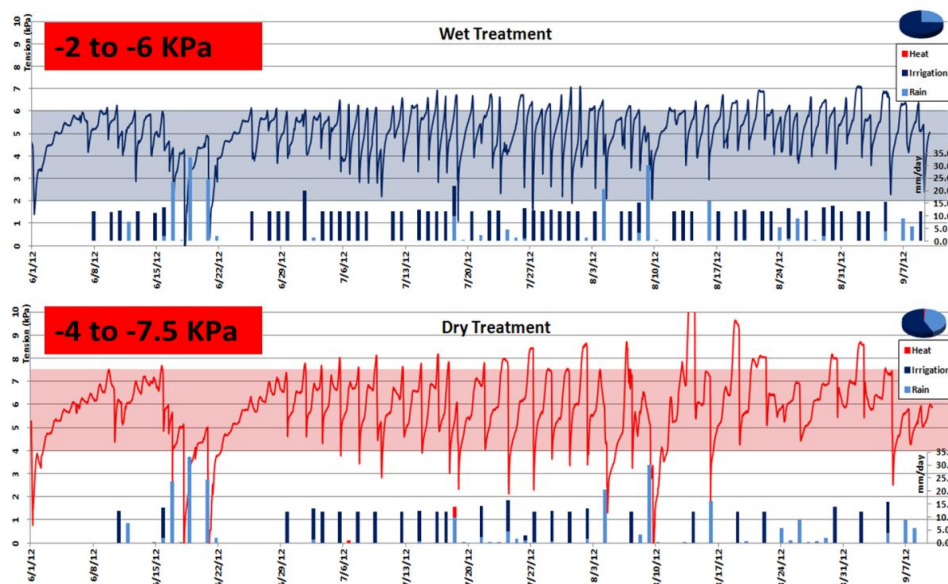
Soil moisture status was monitored throughout the growing season with two different probes. The irrigation treatments were applied based on the tensiometer set points and soil moisture was maintained within the limits of these set points throughout the season (Figure 2). The volumetric water content of the treatments ranged between approximately 12-15% for the dry treatment and 14-19% for the wet treatment during most of the season (Figure 3). The range of % soil moisture can not be used to inform irrigation set points for another field as the different soil textures will have different % water content in a saturated soil. The tension set points can be used in any soil texture and can therefore be used in different locations. Both probes provided consistent readings during the 2012 growing season. During late August and September, the soil moisture content was similar in both treatments due to increased precipitation events.

Results from photosynthetic capacity ( $A_{max}$ ) and chlorophyll fluorescence (Fv/Fm) measurements suggest that there was no difference in photosynthetic rates or fluorescence rates. Fv/Fm is a physiological parameter that is often used to measure plant stress. These results suggest that the dry treatment did not reduce the photosynthetic potential of the photosystems and that the plants are not experiencing physiological stress. Photosynthetic data can be a useful indicator of the plants ability to assimilate carbon, however it does not provide information about how the plant is utilizing the assimilated carbon. Therefore, this data provides evidence that the plants potential to assimilate carbon does not appear to be impacted by the reduced irrigation treatments but it is not an indication of how the carbon is allocated in the plant.

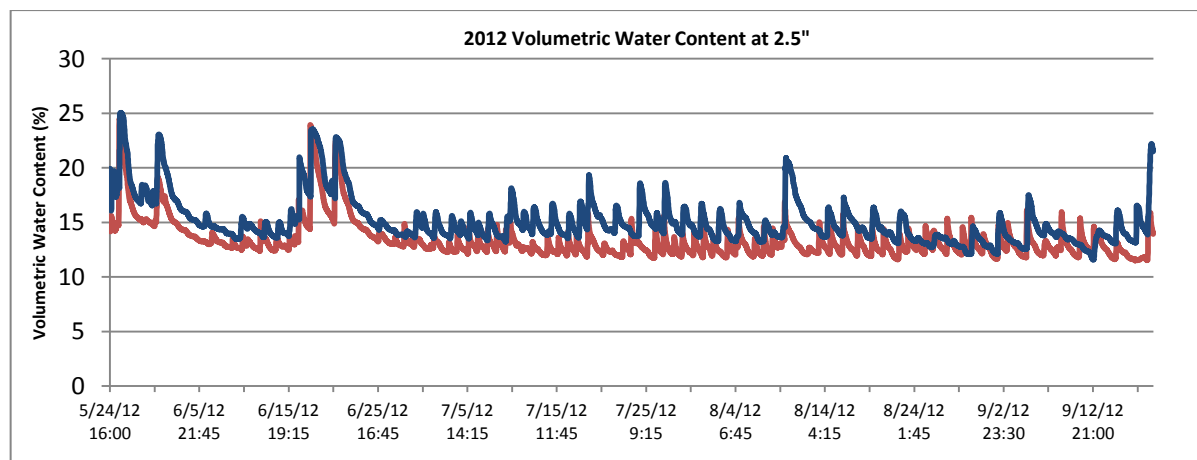
Xylem potential results from 2012 show that the dry treatment resulted in more negative xylem potential readings than that of the wet treatment, consistent with the reduced irrigation. As the 2012 season progressed and plants were further exposed to water stress there was a greater difference between the two treatments with less negative xylem potential in the wet treatment. Preliminary

results (2011) also determined that the dry treatment experienced more negative xylem water potentials. Collectively, these results for xylem potential suggest that the reduced irrigation directly affects the water status of the plants. However, the water stress did not seem to be extreme enough to impact physiological mechanisms that are typically affected by water stress as evidenced by the photosynthetic and chlorophyll fluorescence data.

Biomass measurements indicated that there was no difference in growth between the wet and dry treatment. There were differences between the vegetative and reproductive uprights however, this is expected as reproductive uprights allocate a significant amount of carbon to the developing fruit rather than to vegetative growth (Table 3).



**Figure 2:** Water tension was monitored throughout the 2012 growing season for both treatments. The dry treatment experienced a higher matric potential than the wet treatment



**Figure 3.** Volumetric water content of the Dry treatment (red line) and Wet treatment (blue line) measured throughout the 2012 growing season.

**Table 3:** Upright length of reproductive and vegetative uprights during 2012 season. There was not difference between wet and dry treatments in the vegetative or reproductive growth. Values followed by the same letter are not significantly different.

Structure	Upright length (cm)
Vegetative	11.511 a
Reproductive	6.623 b

**Table 4:** The overall biomass (vegetative and reproductive) for the wet and the dry treatment. Values followed by the same letter are not significantly different.

Treatment	Biomass (g)
Wet	3.304 a
Dry	3.39 a

Flower counts and fruit set results were consistent with general trends, where flower number is higher than fruit number because not all flowers set fruit (Figure 4). Fruit set counts were not statistically different between the wet and the dry treatment indicating there was no impact on yield potential by the dry irrigation treatment. Yield results also indicate that there was no impact on productivity by the reduced irrigation treatment (Table 5).



**Figure 4:** Flower and fruit set averages for the wet and dry treatment the bars indicate the standard error of the data collected. Overlapping bars indicate no significant difference in values.

**Table 5.** Yield parameters for the wet and dry irrigaiton treatment for 2011 and 2012.

Year	Treatment	Yield (lb/A)	Marketable Berry #/sqft	Marketable Berry Wt (g)	Unmarketable Berry #/sqft
2011	Wet	33,751	231	1.5	17.2
	Dry	34,382	240	1.5	21.7
2012	Wet	25,853	190	1.44	6.2
	Dry	27,673	200	1.45	6.8



## **Conclusions**

Cranberries are perennial crops and their yield potential is determined 14-15 months prior to harvest. It is currently thought that the fruit set of cranberry plants are limited by carbohydrate status, which is impacted by the plants ability to assimilate carbohydrates. The results of this study suggest that reduced irrigation rates did not adversely affect the photosynthetic capacity of the plants and did not lead to reduced productivity. With this being the second growing season that this study was conducted, it is encouraging that results are recurrent. A limitation of this study is that it is difficult to isolate the treatment effects to the area of data collection as the root system extends beyond the area of data collection. It is also difficult to determine the role of capillary rise of the water. Continued research and monitoring is needed to insure that these results are recurrent and accurately representing the current season's growth.

The results of this study indicate that it is possible to significantly reduce the amount of water applied through irrigation without detrimental crop effects. The use of soil moisture probes will allow growers to more accurately track soil moisture conditions and utilize these tools to manage application of water. Both the tensiometers and the volumetric water content probes provided soil moisture data that could be used to inform irrigation management decisions. However, in order to use these soil moisture monitoring tools, it is essential to understand the principles of how they work and their limitations. Factors that must be considered when developing an irrigation management plan include; uniformity of irrigation system, water dynamics in the beds being irrigated and an understanding of the technology. A moisture probe will only measure the moisture content of the small region immediately surrounding the probe and therefore it is important to have an understanding of the variability in water dynamics in the entire area being irrigated. It is also important to remember that if a bed has been heavily irrigated, the root system of the plant will be very shallow and therefore a transition to a reduced irrigation schedule may need to occur gradually in order to allow plants to develop deeper root systems.

The results of this study suggest that the amount of irrigation applied to a cranberry bed can be reduced without detrimental effects on the productivity of the crop. Soil moisture probes can be a valuable tool by providing information about soil moisture status that can be used to make irrigation management decisions.

## **Acknowledgments**

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## BERRY SCARRING ASSOCIATED WITH TOBACCO STREAK VIRUS

PATTY MCMANUS

*Department of Plant Pathology, University of Wisconsin, Madison*

Among the unusual observations in Wisconsin cranberry marshes in 2012 was a unique berry-scarring problem that showed up in early July. The worst affected beds were the Mullica Queen cultivar at three sites near Warrens. The scarring appeared as necrotic blemishes and cracks on berries, while leaves remained green and healthy in appearance (see photo). By September, some affected berries had dried up, while others were greatly distorted (see photo).



Necrotic scarring on fruit of Mullica Queen in July (left) and September (right).

Several factors were suggested as possible causes of the scarring. Toxicity from sprays was suggested, because some pesticides or combinations of products can burn berries, especially in hot weather. However, this idea was quickly dismissed because where the scarring occurred, it affected every berry on an upright while some other nearby uprights showed no symptoms at all. Superficially, the injury resembled damage caused by thrips insects on other fruit and vegetable crops. While populations of thrips were high on some other crops in the state, they are normally not a problem for cranberries, and cranberry scouts were not monitoring them closely in 2012. A third possibility that was suggested was Tobacco Streak Virus (TSV). The scarring on every berry on an upright would be consistent with systemic virus infection, and in fact, TSV has been described previously on cranberry, although until this year, it has never been associated with symptoms.

Three different tests were conducted to determine if TSV was present in plants with necrotic scarring and plants without symptoms. First, samples were sent to Agdia, a commercial laboratory that specializes in virus detection. The scarred berries and leaves from the uprights carrying scarred berries tested positive for TSV based on a test called enzyme-linked immunosorbent assay (ELISA). A diagnostic laboratory at the University of Minnesota found virus particles the size and shape that would be expected for TSV. The UM lab also did reverse-transcriptase polymerase chain reaction, a molecular test, and found further evidence for TSV. Thus, there was no question that we had TSV in cranberry, but the

question remained how widespread it was and whether it was the cause of scarring. As a next step, we tested several additional beds with a variety of symptoms on fruit and/or leaves.

Additional ELISA tests showed that in the affected Mullica Queen beds at three marshes near Warrens, 57 of 63 uprights with necrotic berries tested positive for TSV (see table). Plants with other types of symptoms such as ringspots, pinheads, or blossom blast from those same sites tested positive in 10 of 38 samples. Additional samples of symptomless uprights from the same Mullica Queen beds in which scarred berries tested positive for TSV were mostly negative; just 3 of 45 samples tested positive for TSV. It is not surprising to find TSV in a few uprights without symptoms, because viruses are often latent, or present without causing symptoms, in plants and animals. Samples with a variety of symptoms and healthy uprights from other areas turned up negative for TSV. Additionally, several samples were tested for a range of other common “berry” viruses, and all those results were negative.

#### **Summary of ELISA tests for Tobacco Streak Virus on cranberry in Wisconsin, 2012**

<b>Location</b>	<b>Symptom type</b>	<b>Fraction of samples positive for TSV</b>
Warrens (3 marshes, Mullica Queen)	Necrotic scar	57/63
	Pinhead, blossom blast, or ringspot	10/38
	No symptoms but collected from known TSV-positive bed	3/45
Manitowish Waters, Tomah, Mather (Stevens, GH1)	Necrotic scar, tie-dye, misc. ringspots, yellow mottled leaves	0/95
Babcock, Necedah, Tomah, Warrens (various cultivars, including Mullica Queen)	No symptoms	0/60

The data suggest an association between TSV and necrotic scarring in Mullica Queen beds near Warrens. However, to prove that TSV and/or thrips cause symptoms requires reproduction of those symptoms. While we will be attempting to do just that, we might not succeed. The unusual weather and growing conditions of 2012 may have contributed to symptom expression in a way that will be hard to mimic.

What threat does scarring and TSV pose? At the levels observed in 2012, berry scarring had a negligible impact on yield in affected beds. In isolated “hot spots,” however, many berries were aborted or so misshapen that they did not enlarge and mature. On a more widespread basis, the scarring would undoubtedly reduce yields. Another concern is that TSV is carried on pollen, and in other crops, thrips vector the virus. In certain viruses related to TSV, it is actually pollinators who spread the virus.

Obviously, you cannot spray an insecticide to kill the insect vector, if the insect is your pollinator! Finally, viruses are unpredictable. It might be the case that cranberries yield fine for years despite infection with TSV, but then under certain environmental conditions or when combined with another virus, problems arise. There is precedent for this in other crops, so we must take TSV seriously, even if it is currently not reducing yields or killing plants. In 2013, we intend to survey cranberry marshes in Wisconsin for TSV and intensively resample sites affected in 2012 to determine which tissues, including pollen grains, harbor the virus. If we can obtain enough diseased tissue, we will do a genetic analysis to determine whether it is similar to TSV that infects other crops in Wisconsin, or if we have a unique strain on cranberry.

## 2012 PESTICIDE SCREENING PROJECT UPDATE -

JACK PERRY, JED COLQUHOUN, P. MCMANUS AND C. WILLIAMSON

### 2012 Weather Review

Winter - open, mild; snow lacking

Spring - "jump start" in March; April – back to normal temps

Summer - May / all summer – warmer than normal with minimal rain

July / August - hot & drought

Summer summary - hot & dry

Effects of 2012 Weather on Friends and Foes

Everything – 2-3 weeks earlier than "normal"

Cranberry - early warmth caused early break in dormancy – lots of frost protection required

Weeds - broke dormancy or germinated early

Insects – arrived earlier; surprise 2<sup>nd</sup> generation when normally one generation

Insects – some 2<sup>nd</sup> generation Sparganothis found

Diseases – less disease than normal; lack of rain was not favorable for disease development;  
cranberry diseases don't do well in extreme heat

Projection for Summer of 2013

A quote from a USDA climatologist "Drought conditions have changed very little across the Plains and Midwest this winter and have increased concerns as to what this may mean for the upcoming summer growing season

While not an official forecast for this summer, the historical analogs that similarly match last year's heat and dryness do indicate that *odds are in favor of drier and warmer conditions again this summer.* "

### FUNGICIDES & DISEASES

Where have all the diseases gone? 2010 was a banner year for fruit rot. 2011 - 2012 not much fruit rot.

### 2012 Review

#### *2012 Fungicide Trials Objectives*

1. evaluate registered fungicides for early rot, fruit rot and cottonball control
2. evaluate 11 candidate products for early rot, fruit rot control and cottonball
3. is there any value in alternating fungicides?

#### *2012 Cranberry Fungicide Trials Materials & Methods*

Bravo WeatherStik 6L, Bravo Ultrex 82.5WDG, Evito 4SC

Dithane 75DF, Indar 2F, Abound 2.08SC

11 Experimental Fungicides

#### Six Locations

3 trials for fruit rot; 3 trials for early rot; 3 trials for cottonball

#### Treatments

18 products; 20 treatments

#### Application Schedules

Two applications/disease

Early Rot –two applications at 50% bloom & 10 days later

Fruit Rot – two applications at late bloom /early fruit set & 10 days later

Cottonball – two applications at 10% bloom & 25% bloom

#### Successes and Failures in the 2012 Disease Trials

3 early rot trials with good disease pressure in newer plantings

3 fruit rot trials – insufficient disease pressure (less than 5% disease)

3 cottonball trials – no disease

#### What worked for early rot control:

Bravo WatherStik, Bravo Ultrex, Abound, Abound + Indar use rate, Abound + Indar ½ use rates and Dithane and Evito provided 80 - 90% control of early rot; Indar – 60%; exp fungicide – 92%

both Bravo WeatherStik and Bravo Ultrex caused significant fruit scarring but the scarring was probably a factor of exceptionally high July temperatures

#### Value of mixing & matching fungicides

Bravo followed by (fb) Bravo, Abound fb Abound, Dithane fb Dithane, Bravo fb Abound, Abound fb Bravo, Bravo fb Dithane and Abound fb Dithane provided 84 – 89% control of earlyrot

#### 2012 Cranberry Fungicide Trials Summary

Good early rot disease pressure, in young plantings

Bravo, Dithane, Abound and Evito worked; Indar not so well

Efficacy of Bravo WS comparable to Bravo Ultrex

One of the eleven candidate fungicides one shows much promise

Is there value in alternating fungicides - from a performance standpoint – no

BUT from an IPM / resistance deterrent standpoint – it makes good sense

#### What to do in 2013

- 1) Continue early rot & fruit rot control trials
  - a) continue with registered products
  - b) more experimental fungicides
  - c) hone in on one candidate fungicide

2) Early rot trials in newer plantings – *need sites*

3) Do cottonball trials - *need sites*

## **INSECTICIDES & INSECTS**

### **2012 Objective**

Evaluate registered, newly registered and candidate insecticides for control of tipworms, fruitworms, fireworms, spanworms, flea beetles, leafhoppers and white grubs.

#### *Insecticides Tested:*

Actara 35WDG, Assail 30SG, Belay 2.1 SC, Delegate 25WG, Diazinon AG600, Imidan 70WP, Intrepid 2F, Confirm 2F, Knack 35WP, Lorsban 4EC, Rimon 0.8EC, Altacor 35WDG and 5 experimental insecticides

#### *Materials & Methods*

17 products, 20 treatments; 14 Trials in 2012, 2/pest; 1 or 2 applns/pest

#### *Altacor Introduction:*

New chemistry from Dupont; use rate 3 – 4.5 oz/acre = 3 applns/season; 9 oz max; 1 day PHI; broad spectrum of pests; safe on bees; systemic; lots of successful uses in 2012; a bit expensive.

Belay Update: Changes in progress *but not approved yet:* 1) Add rate range of 4-8 oz/appln; 2) Remove “apply post bloom” 3) Add “do not apply when bees are present”

To Make Imidan Work Best Know the pH; Imidan is most efficacious when the spray solution is slightly acidic (pH 6)

#### *New Insecticides Tested in 2012:*

5 candidate insecticides evaluated

4 had good activity on several of our insect pests

registrations for 3 of these are in-progress

#### *Flea Beetles*

Are we going to have to learn to live with them ? Yes - probably;

Why:-1) milder winter trend and 2) less use of OP insecticides; flea beetles are easily controlled; populations increase later in the season (August);

Effective products – Actara, Assail, Belay, Lorsban, Imidan, Diazinon, Orthene, Sevin

#### *2012 Insecticides Summary*

Registered products performed as expected, we have a good arsenal

Several experimental products showed good utility; 2 show great promise

Imidan has potential but must be pH adjusted to be effective

Need to learn to manage flea beetles



## **HERBICIDES & WEEDS**

### 2012 Objectives

1. Problem weed escapes
2. New post herbicides

Weed escapes include sweet vernal grass, creeping red fescue, cinquefoil, Solomon's plume, maples, willows, popples, oaks, dewberry, St Johnswort, leatherleaf.

### New POST Herbicides:

not many candidate products coming out - glyphosate resistant agronomic crops have degraded the market value of developing new herbicides

a lot of new products in the agronomic crops marketplace but most are package mixes of existing herbicides

two products have potentially pending cranberry registrations but both needs more work to find fit in WI

We anticipate a label for a new cranberry herbicide in 2013. This herbicide has demonstrated efficacy on dodder, yellow loosestrife, maples, golden rod and St. Johnswort

### **Status of Cranberry Pesticides Registrations**

2010:

- 1) Intrepid – improved use – restrictions removed;
- 2) Belay and Rimon insecticides registered;
- 3) 3) Evito fungicide registered;

2011- 2012 - Altacor insecticide registered

2013 - new herbicide label anticipated in cranberry

In Registration Processes – 1) 3 new insecticides, 2) expand Belay rate, 3) 2 new herbicides, 4) 2 new fungicides

Causes of Berry Damage in 2012 – 1) disease – early rot, TSV virus, 2) chemical – mostly chlorothalonil, 3) scald – exceptionally hot temperatures in July

## REFLECTING ON BUD APPEARANCE AND ITS ROLE IN YIELD PREDICTION

LISA WASKO DEVETTER, REBECCA HARBUT AND JED COLQUHOUN

*Department of Horticulture, University of Wisconsin – Madison*

### Introduction

External appearance of buds is a widely used method of yield prediction in cranberry. This qualitative approach considers big and round buds to be reproductive and thus containing flower initials that will contribute to next season's crop. Alternatively, small and narrow buds are considered to be vegetative and, consequently, lack flower initials. Despite its widespread use, the margin of error associated with this approach to yield prediction can be significantly large.

Research in our lab is attempting to create a more accurate and quantitative approach to yield prediction. Yet, creating an improved method of yield prediction necessitates an enhanced understanding of bud development and the role buds impart in determining yield. Studies on cranberry bud development date back to the early-to-mid 1900s. While valuable, these studies utilized small sample sizes, were conducted for only one growing season, and included cultivars that are no longer widely cultivated. Reports of "rebud," which circumvents biennial bearing, is also widespread among recently released cultivars and is not described in previous literature.

These observations have led us to question our current understanding of cranberry bud development and the role of external bud appearance in yield prediction. To address these issues, we undertook the following project with the overall objective of improving our knowledge of cranberry bud development. Specific sub-objectives of the project include:

- 1) Characterize bud development and flower initiation throughout two or more growing seasons.
- 2) Compare patterns of bud development and flower initiation across several cultivars, including recently released cultivars.
- 3) Evaluate the relationship between external appearance of buds and presence/absence of flower initials.

### Materials and Methods

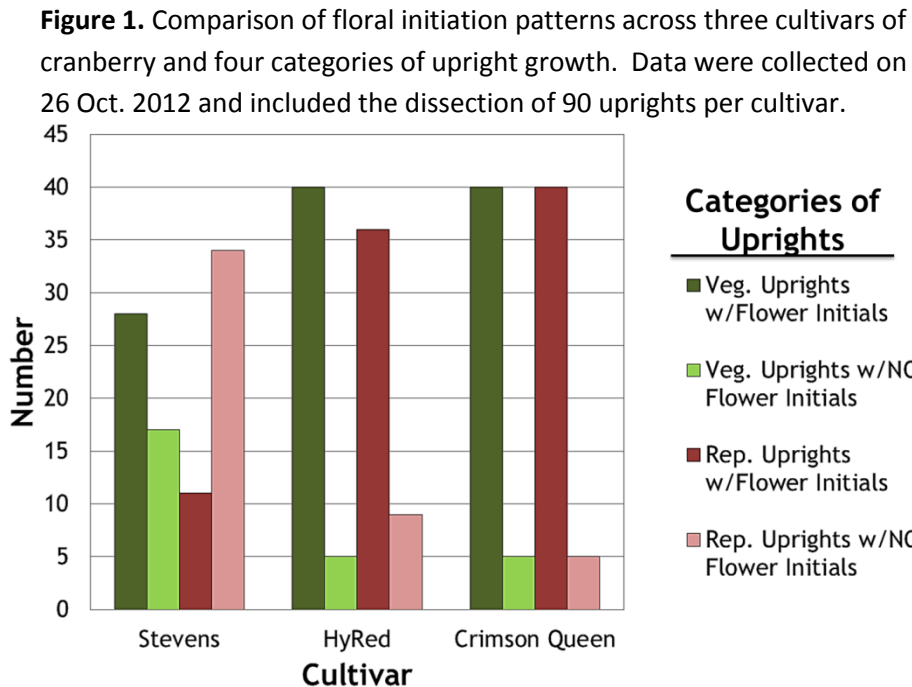
Uprights were randomly sampled from a marsh located in Wood County, Wisconsin. Cultivars sampled include Stevens and Searles, as well as the two recently released cultivars of HyRed and Crimson Queen. Approximately 100 uprights of each cultivar were collected at two week intervals from 5 March to 7 Dec. 2011. Based on the 2011 data, sampling was reduced to 70 uprights per cultivar in 2012 and statistical robustness was maintained. Collection of uprights in 2012 was concentrated during the projected floral initiation period and occurred twice per week from 5 July to 30 Aug. Additional uprights were collected on 14 Sept. & 26 Oct. 2012. These final two collection dates permitted assessment of bud fate after harvest and upon entrance into dormancy.

After each collection date, uprights were divided into two categories – vegetative (nonfruiting) and reproductive (fruiting). Length, width, and size ratio (width/length) of buds were recorded before dissection via light and scanning electron microscopy (SEM). Presence/absence of flower initials was noted after each dissection. Growth degree days (GDD) were also determined from a Watchdog 2465 Plant Growth Station (base temperature of 61°F; maximum temperature of 86 °F).

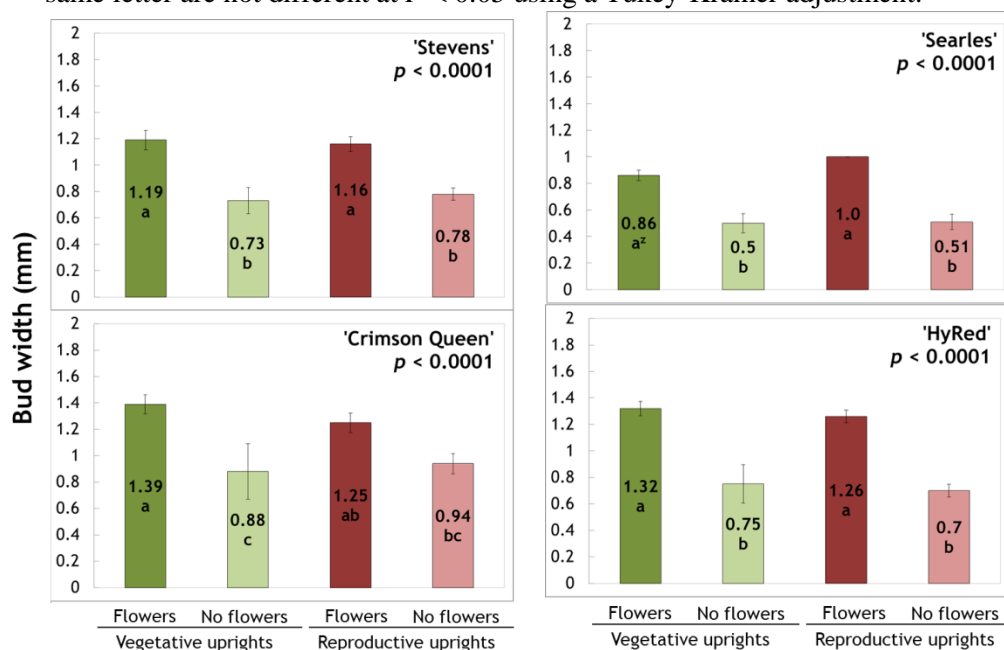
## Results

Excluding 'Searles,' flower initials were first observed across all cultivars on 29 July 2011 and 10 July 2012. These dates correspond to 290 and 332 GDD, respectively. Greater amounts of flower initials were observed within buds of vegetative uprights in 'Stevens,' whereas reproductive uprights had a tendency not to form flower initials (Fig. 1). This contrasts with 'HyRed' and 'Crimson Queen,' in which both vegetative and reproductive uprights had the capacity to form flower initials.

For convenience, only bud width data from 2011 are presented below (Fig. 2). However, results are consistent between 2011 and 2012. These data demonstrate that wider buds have a tendency to contain flower initials, regardless of an upright's fruiting status. Also noted was that the recently released cultivars of HyRed and Crimson Queen had a greater average bud width relative to Searles and Stevens. Few samples of 'Searles' could be included in the analyses due to an abundance of terminal bud death. Bud death within 'Searles' occurred during both growing seasons, despite no evidence of tipworm (*Dasineura oxycoccana*).



**Figure 2.** Relationship between bud width and presence/absence of flower initials across four cultivars and their respective categories of upright growth. Average bud widths (in boxes) were determined from 90 uprights per cultivar. Averages with the same letter are not different at  $P < 0.05$  using a Tukey-Kramer adjustment.



## Conclusions

- Flower initials were first observed in mid-late July during both growing seasons. Initiation appears to be determined primarily by time of year as opposed to accumulation of GDD. This suggests light and/or other physiological factors are involved in flower initiation within cranberry buds.
- The recently released cultivars of HyRed and Crimson Queen have a greater number of reproductive uprights that form reproductive buds. This observation is consistent with reports of these cultivars' ability to rebud and circumvent biennial bearing.
- Reproductive buds are wider relative to vegetative buds. Furthermore, buds of 'HyRed' and 'Crimson Queen' were, on average, wider than 'Searles' and 'Stevens.'
- Biennial bearing in cranberry is not consistent across all cultivars, particularly among the recently released cultivars included within this study.
- Given the variation of bud width across the sampled cultivars and qualitative nature of external bud evaluation, yield prediction models based on bud appearance may be in need of reevaluation.

## Acknowledgements

We would like to thank the following for their valued contributions to this project: Wisconsin cranberry growers, Wisconsin State Cranberry Growers Association (WSCGA), Biological & Biomaterials Preparation, Imaging, and Characterization Laboratory at the University of Wisconsin – Madison, and the Harbut Lab.

## 2013 CRANBERRY SCHOOL GROWER SURVEY RESULTS

During the 2013 Cranberry School, a live survey was conducted with the growers present in the room. The survey was carried out using Turning Point 5 (Turning Technologies, LLC) software and clicker hardware. Clickers were made available to attendees to allow for anonymous responses to be collected. Questions were displayed and respondents were allowed to select answers. After all responses were collected, the results of the survey were displayed. Results were not displayed until after the polling was closed and all responses were collected. The Percent column indicates the % of respondents and the count column indicates the number of growers that responded.

### 1) Did you raise the water level in the ditches after the harvest in 2011?

	Responses	
	Percent	Count
Yes- all beds were irrigated	32%	31
Yes- some beds received water	24%	24
No	44%	43
<b>Totals</b>	<b>100%</b>	<b>98</b>

### 2) Was your decision to raise water levels in ditches influenced by concern of having enough water for the winter flood?

	Responses	
	Percent	Count
No – I did not raise water levels because I did not feel it was necessary	39%	33
No - I raised ditch levels but was not concerned about water availability	49%	42
Yes – I did not raise ditch levels due to concern for available water	6%	5
Yes – I raised ditch levels, but not as much as I would have liked to due to water availability	6%	5
<b>Totals</b>	<b>100%</b>	<b>85</b>

### 3) What was the primary goal in raising ditch levels?

	Responses	
	Percent	Count
NA- Did no raise ditch levels	44%	45
Provide moisture to root zone	47%	48
late trash flood	3%	3
frost protection	2%	2
wind protection	4%	4
<b>Totals</b>	<b>100%</b>	<b>102</b>

4) Did you have a secondary goal in raising ditch levels in the fall?

	Responses	
	Percent	Count
NA - Did not raise ditch levels	41%	39
Provide moisture to root zone	5%	5
late trash flood	4%	4
frost protection	2%	2
wind protection	12%	11
no secondary reason only one primary reason	36%	34
<b>Totals</b>	<b>100%</b>	<b>95</b>

5) Do you feel that the vines were stressed going into the winter of 2011-2012?

	Responses	
	Percent	Count
Yes	21%	13
No	79%	50
<b>Totals</b>	<b>100%</b>	<b>63</b>

6) Do you feel that the vines were stressed going into the winter of 2011-2012?

	Responses	
	Percent	Count
Yes	18%	18
No	82%	84
<b>Totals</b>	<b>100%</b>	<b>102</b>

7) Was your timing of the winter flood application...

	Responses	
	Percent	Count
Optimal	62%	65
Too early	3%	3
some beds were optimal, some were too late	14%	15
all beds were flooded too late	21%	22
<b>Totals</b>	<b>100%</b>	<b>105</b>

8) Did poor ice cover result in any damage to the vines?

	Responses	
	Percent	Count
Yes	31%	33
No	69%	72
<b>Totals</b>	<b>100%</b>	<b>105</b>

9) Did you flood in April 2012 for frost protection?

	Responses	
	Percent	Count
Yes – all beds	67%	73
Yes – some beds	13%	14
No	20%	22
<b>Totals</b>	<b>100%</b>	<b>109</b>

10) If you did flood, how long did you hold the April flood?

	Responses	
	Percent	Count
1-2 days	2%	2
3-5 days	29%	28
6-10 days	59%	56
11-15	9%	9
<b>Totals</b>	<b>100%</b>	<b>95</b>

11) Did you use overhead irrigation for frost protection in April 2012?

	Responses	
	Percent	Count
Yes – all beds	82%	89
Yes – some beds	4%	4
No	14%	15
<b>Totals</b>	<b>100%</b>	<b>108</b>

12) Did you observe any damage to the vines that you would attribute to irrigating for frost protection?

	Responses	
	Percent	Count
Yes –all irrigated beds showed some damage	3%	3
Yes – some irrigate beds showed damage	25%	26
No	72%	76
<b>Totals</b>	<b>100%</b>	<b>105</b>

13) Did you observe typical bud break in spring 2012?

	Responses	
	Percent	Count
Yes, typical year	8%	8
No – all beds were delayed in breaking bud	2%	2
No - some beds were delayed in breaking bud	12%	13
Early, normal progress	40%	42
Early and fast	38%	40
<b>Totals</b>	<b>100%</b>	<b>105</b>





# WISCONSIN STATE CRANBERRY GROWERS

— *Association* —

1 2 5 <sup>th</sup> A N N I V E R S A R Y

2012 Annual Report

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## **ANNUAL MEETING**

### **January 22, 2013**

#### **Agenda**

- 1:00 PM      Call to Order  
Minutes from the 2012 Summer Meeting  
                • Jim Van Wychen, Secretary
- Election of Directors  
                • John Stauner, Chair, Nominating Committee
- Report of the President  
                • David Amundson
- Report of the Executive Director  
                • Tom Lochner
- Special Presentations
- Impacts of the Affordable Health Care Act on  
Cranberry Farming Operations  
                • Ron Kuehn, DeWitt, Ross and Stevens
- WSCGA Public Policy Program Strategies, Tactics and Action  
                • Jordan Lamb, DeWitt, Ross and Stevens
- WSCGA Communications Programs – Setting the Stage for  
a Positive Image for Cranberry Growing in Wisconsin  
                • Kris Naidl, Laughlin Constable
- WSCGA Public Policy Program – A review of 2012 and  
a Look Ahead at 2013 and Beyond  
                • Ron Kuehn, Dewitt, Ross and Stevens
- Report of Committees
- Other Business
- 2:30 PM      Adjourn



## WSCGA Summer Meeting – August 8, 2012

Owen Rock Cranberry, Hancock, WI

**Minutes:** The 2012 Wisconsin State Cranberry Growers Association Summer Meeting was called to order by President David Amundson on August 8, 2012 at 1:15 PM at Owen Rock Cranberry, Hancock, Wisconsin. A recognition plaque was presented to Mark Mahoney and Dave Billmeir of Owen Rock Cranberry for hosting the event.

**Secretary's Report:** Russ Rifleman moved and Mike Moss seconded a motion to waive the reading of the minutes from the January 2012 Winter Meeting and to approve the minutes as printed. Motion carried. The WSCGA Board of Directors were introduced and thanked for their work throughout the year.

**Special guests were introduced:** Noel Favia & Julie Specht from WDATCP Marketing Division; DATCP Deputy Secretary Jeff Lyon and the Warrens Cranberry Festival Royalty.

Executive Director, Tom Lochner, extended his thanks to the hosts of this year's event and to Jane Anderson her extra efforts in organizing and set up for this year's Field Day. Thanks were also extended to Bruce Anderson, Tod Planer, Leroy Kummer, Jack Perry, the WSCGA Education Committee, for their help with today's event. Updates were provided on governmental advocacy and the Heritage Campaign celebrating the 125th Anniversary of the WSCGA.

**Anniversary recognition was presented to:** Russ Rifleman of Ken Rezin Cranberry accepted a plaque in recognition of their farm for more than 125 years of production.

Greg Fanning, Chair of the Leadership Development Committee introduced the inaugural class of the program. They include: Rusty Schultz, Doug Rifleman, Benjamin Rezin, Mary Sawyer, Steven Bartling, Karen Doers, Greg Schwartz, Michael Gnewikow, Henry VanWyche, Benjamin Riker, Fawn Laack, Michael Bretl, and Jeff Hopkins.

Scott Soares, the Executive Director of the USDA Cranberry Marketing Committee, also presented comments on his new position, CMC planning efforts and encouraged growers to respond to an online questionnaire about CMC programs.

**Old Business:** None

**New Business:** None

### **Announcements:**

- Sporting Clay Shoot set for August 15.
- Growers were reminded to fill out the Sustainability Assessment that was sent out by Jed Colquhoun of UW Madison.

There being no further business, the meeting was adjourned.

Respectfully submitted,

*James Van Wyche* Secretary WSCGA





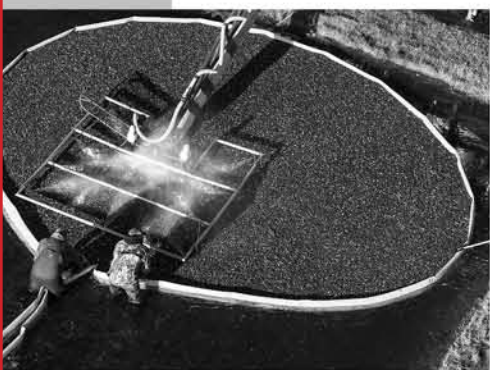
## President's Message – David Amundson

The year 2012 was highlighted by drought, price uncertainty, an election cycle that never ended, and fuel prices that did the rollercoaster ride. You pick how you would rank these; feel free to add more of your own. I would rank the seriousness of the drought at the top of the list; it rivaled the drought of '79 for impact on our marsh.

No matter what we saw individually as problems last year, the association stood up for the growers in 2012. Your organization worked on behalf of the growers with FEMA regarding floodplain zoning issues that would have impacted growers' ability to farm, with the DNR on a range of issues from high cap wells, impaired waters list that would affect every grower in the state, as well as elk reintroduction and many other issues. Ron Kuehn, Jordan Lamb and Tom Lochner were representing our interest based upon direction from the board and committees.

The scrutiny we face as growers today is like no other time. If we don't have a voice that stands for us, we will face these threats on our own. The association stands for us in this arena. As you review your dues for the coming year, think of the value vs. the money and the time you would spend on these issues -- you can't get a better deal. The association has been built by growers over many years to represent us. With longevity comes baggage. When you choose to pay your dues, think what the cranberry industry would look like if we didn't have the association; the choice should be easy. As growers, we board members try to guide the association for the benefit of all our grower members throughout the year. The board stands ready to do what the growers want of their association. Please call us if you have questions or input on how together we can improve the association.

The winter school and trade show look to be informative, and enjoyable; network with fellow growers, check out the Associate Member displays and learn something. Thank you all for coming.



## From the Executive Director – Tom Lochner

During the past year, we celebrated the 125th Anniversary of the Founding of the Association. We also made a transition in our staff team as Jane Anderson retired after 22 years of service to the organization. Obviously filling the position and finding someone who could perform to the standard that Jane set was a challenge to say the least. We were very fortunate to find Susan DeRouchey to step into the position of Executive Assistant. Since her start on October 1, she has hit the ground running. She was able to spend two weeks with Jane to learn the ropes, which enabled us to make a smooth and seamless transition.

Changes took place within the marketplace as well. Sales of major independent handlers to larger beverage and fruit companies created uncertainty in the market for those who sell their fruit on the independent market. Lower prices for concentrate and fruit created economic stress for growers. WSCGA did see a slight dip in membership renewals, which can be attributed to economic troubles. Some have expressed the sentiment that they cannot afford to support the organization. Others have expressed their belief that they cannot afford to be without the WSCGA to represent them, especially in difficult times. As an organization, we need to communicate that message to all growers and work to bring them into the only grower organization that has the prosperity of Wisconsin growers as its mission.

As you look through the annual report, you will see that we conduct a host of programs on your behalf. These programs are developed by growers for growers to meet grower needs. We have assembled the best team of staff, contractors, consultants and leaders to work on your behalf at the association. This takes financial resources.

The future faces severe challenges to your ability to farm. We anticipate more, not less efforts to regulate water use and quality. We expect more, not less regulations to be proposed and to be placed on farmers. Without a strong organization for all growers to unite under, these may come to pass. Those additional costs to your business could be staggering. Your Board has made the commitment to make sure they don't happen.

But it all starts with you, the member, writing a check to support the organization. The next step is to become active and involved by participating in the association through committees to make sure we meet your needs. Thank you to all who have supported the WSCGA this past year. Thank you to all of you who will continue to help us represent grower interests.



## **WSCGA Annual Report**

The Wisconsin State Cranberry Growers Association was formed in 1887 to serve the state's newly emerging cranberry industry. Some 125 years later, the organization continues to work to meet its mission of providing quality programs for members to enable the industry to prosper.

WSCGA is organized as a non profit, non stock corporation governed by a nine member Board of Directors. The board is advised by a number of committees and working groups on topics ranging from Public Policy to Promotion, Education and Fundraising. The association employs professional staff and consultants. The board, committees, staff and consultants work together as a team to develop and implement programs and policy for the organization.

### **THE TEAM -- WSCGA Board of Directors 2012**

#### ***David Amundson, President***

David's family operation Wisconsin Moss Company and Amundson Cranberry is located outside of Babcock, where he farms with his wife Jill. David was elected to the board in 2009, served as Vice President in 2011 and as President in 2012.

#### ***Mark Mahoney, Vice President***

Mark joined the board in 2011 and is part owner of Owen Rock Cranberries in Adams County, which served as the host site for the 2012 Summer Meeting, Field Day and Trade Show. He serves on the Public Policy and Environmental Affairs Committee, Administration Committee, Personnel Committee, Research Committee and as the WSCGA representative on the Cranberry Museum, Inc. Board of Directors. He was elected Vice President in 2012.

#### ***Jim Van Wychen, Secretary***

Jim and his family grow cranberries near Warrens, Wisconsin. Wetherby Cranberries has been producing cranberries for more than 100 years. Jim was first elected to the board in 2006 and as Secretary that same year. Jim serves on the Administration Committee, Personnel Committee and the Public Policy and Environmental Affairs Committee.

#### ***John Stauner, Treasurer***

John owns and operates James Lake Farm near Three Lakes, Wisconsin. John was elected to the board in 2008 and Treasurer in 2012. He chairs the Administration Committee and the Nominating Committee, while also serving on a number of working groups.

#### ***Tom Gardner***

Tom is part of Gardner Cranberry and Hay Creek Cranberry located near Pittsville, Wisconsin. Tom joined the board in 2012. He serves on the Public Policy and Environmental Affairs Committee.





## **WSCGA Board of Directors 2012 (continued)**

### ***Nicole Hansen***

Nicole is part of Cranberry Creek Cranberries in Juneau County. She was elected to the WSCGA Board in 2009. She served as Vice President in 2010. She chairs the Research Committee, serves on the Education Committee and represents the cranberry industry on the Board of Directors of the National Institute for Sustainable Agriculture.

### ***Mike Moss***

Mike, his wife Diane, and his family own and operate Elm Lake Cranberry, west of Wisconsin Rapids. Mike has served on the WSCGA board since 2007 and as President in 2010 and 2011. He serves as President of the Wisconsin Cranberry Research and Education Foundation and on the Administration, Personnel and Research Committees.

### ***Carl Salzwedel***

Carl and his family own and operate Salzwedel Cranberry near Warrens, Wisconsin. Carl was elected to the board in 2009. He is a member of the Research Committee and represents the WSCGA on the Cranberry Museum, Inc. Board of Directors.

### ***Tyler Walker***

Tyler works with his family at Walker Cranberry Company in the town of Cranmoor, west of Wisconsin Rapids. He was elected to the board in 2011. He serves on the Public Policy and Environmental Affairs Committee and the Nominating Committee. He also serves on the Wisconsin Cranberry Research and Education Foundation Cranberry Leadership Development Committee.

### ***Rebecca Harbut***

Rebecca holds the position of UW Extension Fruit Crops Specialist and is a member of the faculty in the Department of Horticulture at the UW Madison. She serves as an ex-officio member of the board. She assists with the Education and Research Committees, as well as setting up various workshops, field days and nutrient management training sessions.



## **WSCGA Committees**

### ***Public Policy and Environmental Affairs Committee***

The Committee is responsible for the development of recommendations on policy related to environmental issues, as well as other state and federal regulatory and legislative actions that arise as part of the public policy advocacy program. The committee also makes recommendation of disbursements from the restricted account for water and wetlands.

### ***Development Fund Committee***

The committee is responsible for efforts by the association to raise funds in support of important programs such as undergraduate scholarships, support of graduate students conducting research on cranberries, the establishment of an experiment station for cranberries in Wisconsin and the mission of the Wisconsin Cranberry Discovery Center. Since the committee held its first event in 1991, it has raised over \$240,000 in support of these programs.

### ***Administration Committee***

The committee advises the WSCGA Board on the internal operations of the association. Its major responsibility is development of a recommendation for an annual budget for the WSCGA.

### ***Education Committee***

The main emphasis of the WSCGA mission is education, both of growers and the general public on cranberry growing. A large portion of this responsibility is assigned to the Education Committee, making it one of the key committees in the association. The committee meets with UW Extension faculty and others during the year to review and plan the various education programs for the association including the Wisconsin Cranberry School, early season workshops, and the Summer Meeting and Field Day.

### ***Public Relations Committee***

The committee is responsible for generating a positive image of the industry in the state. That responsibility includes working with the media to tell the industry's story and working with other groups to help promote the state's largest fruit crop.

### ***Research Committee***

The Board of Directors established the Research Committee to provide growers with a forum to discuss research needs with University of Wisconsin research faculty and the cranberry research community, on a national basis. The committee works cooperatively with the Wisconsin Cranberry Board, Inc. (WCB), The Cranberry Institute (CI), and others to identify grower research needs, coordinate projects to avoid duplication, and to help establish priorities.



## WSCGA Staff

### ***Tom Lochner, Executive Director***

Tom Lochner was named as the first WSCGA Executive Director in 1988. Since then, the association has grown into a well-respected voice for the Wisconsin cranberry grower. The association has expanded its education, communications and public policy programs. It also took on the responsibility of providing administrative services to the Wisconsin Cranberry Board, Inc. to enable it to implement its research, education and promotion programs. In 2004, the WSCGA also assisted the Cranberry Museum, Inc. develop and operate the Wisconsin Cranberry Discovery Center in the Village of Warrens.

As the chief staff person, he represents WSCGA at various meetings, including everything from University Research and Extension, Federal, State and local governmental. He also is responsible to coordinate the activities of the staff and various consultants who assist with communications and public policy programs. He serves as a liaison with industry groups such as the Cranberry Institute and the USDA Cranberry Marketing Committee. He also serves as the lead spokesperson for the organization, giving presentations to groups across the state.

Over the course of his career, he has worked with the board and committees on growing the programs and membership of the association. He believes in a team approach to program planning and development. This approach has resulted in active committees, an engaged and high performing board and high grower participation in WSCGA programs.

### ***Susan DeRouchey***

Susan DeRouchey joined WSCGA in October of this past year. As Executive Assistant, she is responsible for keeping the office in Wisconsin Rapids up and running smoothly. She coordinates the Associate Member program and works with the Development Fund Committee to plan and hold the annual Cranberry Open Golf Outing and the Sporting Clay Shoot.

She is responsible for managing the Trade Shows for WSCGA, which are premier events in the industry. The Winter Trade Show has grown to over 100 exhibitors, generally selling out each year. At the Summer Trade Show, participation is also high on the part of exhibitors, approaching 100 indoor and outdoor booths.

Susan is also responsible for keeping the WSCGA website up to date and fresh. She also coordinates the publication of the WSCGA NEWS. And when growers call with a question, she is quick to find an answer or guide them to the right person to assist them.





### ***Crystal Johnston***

Cris joined the staff at WSCGA in 2005 as a part-time bookkeeper. Her main responsibility is to keep the financial records for the association. She also assists as a back-up for staff support and assists at meetings and WSCGA events. This past year, she took on additional responsibilities as Clerical Assistant. She now manages the databases for the membership, the assessment forms and filings for the Wisconsin Cranberry Board and serves as the office manager in purchasing supplies and managing the equipment needs of the association.

She also serves as the bookkeeper for the Cranberry Museum, Inc.

### ***Tod Planer, Farm Conservation Planning Coordinator***

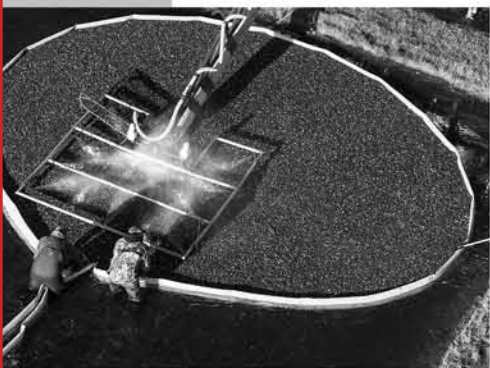
Upon his retirement as the Wood County Extension agent in 2002, Tod began a second career as a contractor for the WSCGA. In that role, he helped to develop and implement Whole Farm Conservation Plans for cranberry growers. Early efforts included tailwater recovery pilot projects and nutrient management. They evolved to evaluating a suite of conservation practices and their applicability to cranberry farms. Through these evaluations and pilots, Technical Standards were developed to allow growers to be eligible for NRCS cost-sharing programs.

In the past three years, Tod has been working on energy conservation and alternative energy generation on cranberry farms. This has resulted in support of pilot projects on wind, solar and hydro generation.

### ***Julie Ammel, USDA NRCS Cranberry Conservation Liaison***

While not an employee of the association, Julie works with WSCGA to assist growers with conservation programs. As a Natural Resource Conservation Service (NRCS) employee, she works for USDA NRCS with cranberry growers.

In this capacity, she helps growers apply for and receive cost-sharing for conservation practices. She also helps set up and conduct sessions to qualify growers to write their own nutrient management plans to meet state requirements. Under the agreement with NRCS, we have seen well over a million dollars in cost-sharing funds distributed to growers for everything from nutrient and pest management to irrigation system upgrades and tail water recovery.



## Association Consultants

**DeWitt**  
Ross & Stevens s.c. Law Firm

### Dewitt, Ross and Stevens, Legislative Counsel

DeWitt Ross & Stevens is a full-service law firm with experienced attorneys in virtually all areas of practice. Throughout the firm, there are attorneys who have developed expertise in niche areas but still understand the big picture.

The Government Relations team of DeWitt Ross & Stevens is the largest lobbying group in Wisconsin. Because they are located directly on Madison's Capitol Square, often times WSCGA strategize with Legislative Counsel Ron Kuehn and Jordan Lamb, and later head to the Capitol for meetings with legislators and other key policymakers.



**Ron Kuehn** began his career at DeWitt Ross & Stevens upon graduation from the University of Wisconsin Law School in 1971. Early in his career, he directed his practice into business law and, after a few years, expanded to government relations. Today, he exclusively works in state and federal government relations as the leader of the DeWitt Ross & Stevens, and Wisconsin's largest, government relations practice group. Ron has been representing WSCGA since 1988, when the industry faced the most significant challenge to the rights of growers to access water. During the years, Ron has worked for WSCGA on issues ranging from environmental to property taxes to transportation.

A key component of the ongoing governmental relations program is establishing relationships through regular communication with legislative and agency leadership, as well as with the grower community. These efforts over the past 20 plus years have positioned the industry so that it is able to respond to challenges, as well as initiate regulatory and legislative changes to help grower businesses.



**Jordan Lamb's** expertise in environmental regulation is a particular asset to WSCGA and our members as they navigate the interplay between state and federal regulations and running a successful business. Jordan was intimately involved with the creation and implementation of the Great Lakes Compact in Wisconsin, on behalf of Wisconsin agriculture. She also was a major voice for us in the development of the State non-point source pollution program and the rewrite of NR151 and ATCP50. She played a major role in the development of Wetland Reform Legislation in the last session of the Legislature and in developing protocol for dealing with floodplain issues with FEMA, DNR and county zoning offices.



## Key Issues in 2012

All Wisconsin residents are well aware of the turmoil that existed in Madison this past year. Even through the protests and political storm that accompanied Act 10, the budget and the recall elections, WSCGA continued to work on issues important to growers and had success in a number of areas.

- **Wetland Reform.** Governor Walker signed 2011 Wisconsin Act 118, the new wetland permitting reform statute into law. The new law provides the basis for the development of several important wetland general permits related to cranberry production. Most importantly, the statute directs the DNR to:

“In addition to the wetland general permits required under par. (a) [i.e., general permits for fills of less than 10,000 square feet], the department shall issue wetland general permits that are consistent with and correspond to, any general permits that are issued under 33 USC 1344 (e) and that regulate discharges other than those regulated under the required wetland general permits issued under par. (a).” Wis. Stat. § 281.36 (3g) (b) (emphasis added).

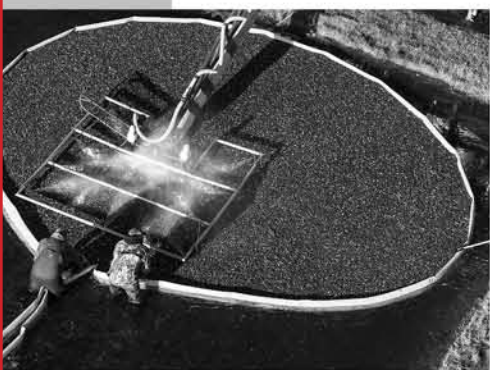
In short, this statute requires DNR to “issue” general permits that are consistent with Army Corps of Engineers GP 001, GP 002 and GP 014, which are critical for cranberry production in Wisconsin. Accordingly, we will be working with DNR on the creation of these state consistent and corresponding general permits as soon as possible.

- **FEMA Floodplain.** Wisconsin embarked on a revision to many of its county floodplain maps in response to concerns by FEMA about development in floodplains. Because of protections in place for Wisconsin cranberry growers under the Cranberry laws, and as a result of several Supreme Court cases, cranberry activities related to the maintenance and construction of dams, dikes and ditches are not subject to either state statutes or local ordinances. Rather, federal standards apply. In order to clarify the applicable standards and ensure uniform application of these standards for projects on cranberry farms, WSCGA is working with FEMA, DNR and the Wisconsin Counties Association on identifying practices on cranberry farms and clarifying a model ordinance to impose the federal floodplain standards on certain new construction activities.
- **DNR – WPDES Permits for Applications of Pesticides to Waters of the State.** After years of debate stemming from a 2009 federal court order in *National Cotton Council v. EPA*, the U.S. Environmental Protection Agency (EPA) and the Wisconsin Department of Natural Resources (DNR) released four final general permits regulating the use of pesticides in and near lakes, rivers and other navigable waters last fall. The general permit applies to pesticide applications to “waters of the state” and cranberry beds are not waters of the state; and the general permit maintains the Clean Water Act exemptions for agricultural non-point discharges from NPDES permit coverage.

WSCGA presented these arguments to the WDNR last December. Fortunately, in a letter signed by Secretary Cathy Stepp on February 1, 2012, the DNR agrees with our opinion. In her letter, Secretary Stepp writes, “While DNR staff generally agree with the arguments presented in your letter, we believe that decisions about the need for permit coverage should be made on a facility specific or case-by-case basis rather than across the board. If a cranberry grower does not wish to obtain coverage under one of the pesticide general permit, the grower must apply pesticides in a manner so that the pesticides remain on the bog. In other words, over spraying pesticides in such a way that they drift off of the bog and enter adjacent surface waters would require permit coverage.”

In short, growers applying pesticides to the beds themselves are exempt from any WPDES permitting requirement. However, applications to adjacent waters would require a permit. We recommend you ensure pesticides are not over-sprayed and do not drift over nearby waters.





- Impaired Waters.** In December, the Wisconsin DNR began its process to determine which waters it would recommend to EPA to be included on the impaired waters listing for 2012. Known as the 303d list, waters designated as impaired can be subject to DNR activity to address the particular impairment i.e. sediment, temperature, navigation, water quality, etc. The DNR made minor proposed recommendations to the list, based upon its methodology of determining if a water body was indeed impaired. In response, EPA directed DNR to add 99 water bodies that failed to meet the state numeric water quality standards for phosphorous, many of them in cranberry growing areas. DNR issued a public notice that it was going to expand the list by adding those 99 waters. WSCGA provided comments in opposition to the expanded list. We then worked with DNR and Members of the Wisconsin Congressional delegation to ask EPA to defer to the original DNR listing. In late 2012, the DNR told EPA that it was withdrawing its proposed list, except for one water body. As a result, these waters will not be subject to further regulation or the establishment of a TMDL (Total Maximum Daily Load), which could place restrictions on grower farming practices.
- Lake Beulah.** A unanimous Wisconsin Supreme Court decision directed DNR to use its broad authority when considering applications for high capacity wells. WSCGA joined other groups in analyzing the impacts of the decision on groundwater permits and other DNR permitting authority. If carried to the extreme, the decision could provide DNR with power well beyond that intended by the Legislature. WSCGA has been closely working with DNR and Members of the Legislature on this issue and expects an effort by the Legislature to address the Court Decision.
- Computing Phosphorous Loss from Cranberry Farms for Non Point Source Pollution Compliance.** WSCGA has initiated studies to develop alternative methods for cranberry growers to meet the non-point source pollution performance standards. Without this work, growers would have to meet the Phosphorous Index, a calculation which is not applicable to cranberry farming practices. The modeling development continued during 2012.

## Key Issues for 2013

- Wetland General Permits.** WSCGA will begin working on the development and issuance of General Permits for agriculture and cranberry farming activities in 2012. WSCGA is also going to seek clarification from the COE on guidance for activities that are subject to the exemptions in the Clean Water Act to provide a clear and better understanding for growers and agency personnel on how the exemptions apply to normal farming activities on cranberry farms.
- Water Access.** The success of cranberry farming is dependent upon access to abundant sources of water. WSCGA will continue to work to guarantee grower access to water provided under the Cranberry laws for surface water. We will also be closely tracking any legislation or rules related to access to groundwater.
- Water Quality.** Agencies will be reviewing standards for nutrient management plans and practices. WSCGA is active with Wisconsin DATCP, DNR and USDA NRCS to provide grower input into any proposed changes to these standards.
- Water Use Reporting.** Under the Great Lakes Compact, all high volume users of water are required to report their usage to DNR on an annual basis. WSCGA has developed a simplified reporting process. We are working with UW Madison faculty to refine the reporting to differentiate between use, reuse and withdrawal. WSCGA is also supporting reduction or elimination of registration fees.





# LAUGHLIN CONSTABLE

## Laughlin Constable Communications and Public Relations

Earlier this year, the public relations firm of Zeppos & Associates became part of Laughlin Constable, a multi-faceted and full-service agency. The team from Zeppos and Associates continues to provide services to WSCGA

through LC. The team is made up of a group of talented and creative public relations professionals with a wide variety of backgrounds. The consolidation with LC provides access to additional expertise for communications and public relations programs for WSCGA.



**Evan N. Zeppos, APR**, has more than three decades of professional achievement and experience as a public relations counselor. With experience in both the private and public sectors, he is recognized as a leading expert in public relations and has a unique blend of national, state and local involvement on major issues management and public relations challenges and opportunities. A Milwaukee Magazine survey of local public relations professionals ranked Zeppos as the top communications professional in the metropolitan Milwaukee area. He has also earned national accreditation from the Public Relations Society of America and is a member of its Counselors Academy.



**Kris Naidl** joined Zeppos in 1994 and began working with the WSCGA. Her work has been recognized through the receipt of 15 Paragon Awards from the Southeastern Wisconsin Chapter of the Public Relations Society of America (PRSA), including a Best of Show Award for her strategic communications work to affect change in state regulations.

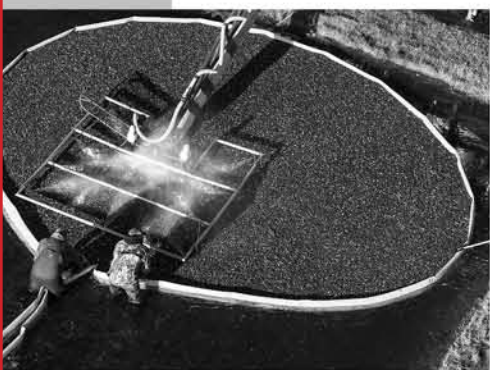
Prior to joining the firm, Naidl was the assistant director of community relations at the largest substance abuse prevention agency in Wisconsin. She has also held positions as a copy editor and writer at a southeastern Wisconsin magazine and worked for a state legislator.



**Laura Krinke** is responsible for a variety of client services, including writing, media outreach, community relations, special event planning, social media and more. She joined the team in 2010.

In her current position, Krinke coordinates media outreach for WSCGA. She has also helped create both e-commerce and educational websites for clients, and has led the implementation of several social media campaigns for clients.

A graduate of the University of Iowa, Krinke holds a bachelor's degree in communication studies.



## Communications Highlights from 2012

The WSCGA Communications program is developed as part of a team effort with the Public Relations Committee and the team at LC. The overall objective is to create a positive public perception of cranberry growing in Wisconsin. By developing a positive image of cranberry growing and public support for the needs of a prosperous industry, the WSCGA is able to achieve success in the public policy arena as well as securing support for research, extension and other programs.



### **Heritage Campaign**

2012 marked the 125th anniversary of the founding of the Wisconsin State Cranberry Growers Association. To celebrate the milestone, the organization conducted a multi-pronged campaign.

The first activity was to update the logo for WSCGA. The Public Relations Committee reviewed a number of concepts and selected two designs for a vertical and horizontal image. The images were developed in a format that makes them tremendously flexible and adaptable to today's digital world.

The anniversary celebration was a central theme to all of the communications effort in 2012. WSCGA launched an online sweepstakes. Utilizing Wisconsin Public Radio, WisPolitic.com, the industry partnership with the Milwaukee Brewer radio network and UW Badger Sports, the sweepstakes were promoted and winners received tickets to games, memorabilia, cranberry products and more. The effort allowed the association to build its social media database for further use and reach targeted audiences with messages about the importance of cranberry growing to state residents.



### **Paid Communications**

WSCGA uses grants for the Wisconsin Cranberry Board, Inc. for radio sponsorships with the Milwaukee Brewer radio network and UW Badger Football, Basketball and Hockey. The team at LC helps to coordinate the messages for the ads and helps to produce the scripts for them.

### **Cranberry Night at Miller Park**

To leverage WSCGA sponsorship with the Milwaukee Brewers, LC helps to coordinate Cranberry Night at Miller Park. As part of the special night, a WSCGA member is given the opportunity to throw out a ceremonial first pitch at Miller Park, special cranberry messages are prepared for both in stadium announcers and the radio broadcast. Cary Cranberry is also on hand to assist with the first pitch, meet and greet fans and assist with the sausage race.



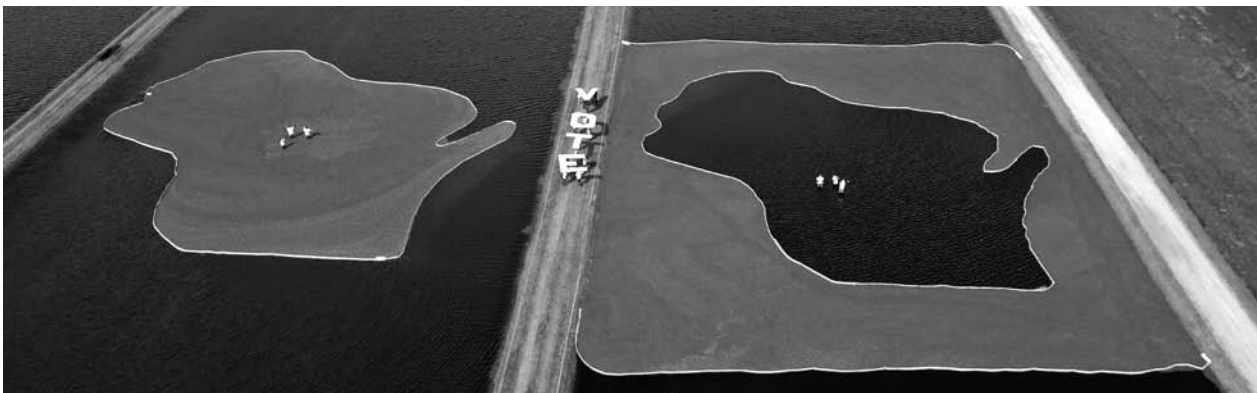


### **Wisconsin State Fair**

The WSCGA has coordinated media efforts around an educational and promotional booth at the State Fair. The cranberry promotion efforts include product drops at media outlets at the fair, promotion on State Fair materials and interstate billboard, and cooking demonstrations in cooperation with *We Energies* cooking stage. Interviews and appearances with media are also coordinated and arranged.

### **Web and Social Media**

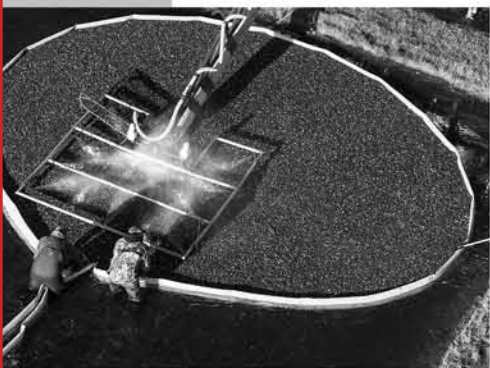
LC manages the WSCGA website and social media accounts including Facebook, YouTube and Twitter on an ongoing basis. This includes reviewing and updating website content to keep it fresh and interesting. LC also works to make sure there is consistently new content on the social media channels. LC has assisted the association in using these platforms as a way to communicate to the general public what is going on in the industry, as well as build and maintain relationships.



### **Fall Harvest Promotion**

Each year, LC assists the WSCGA media efforts surrounding the annual cranberry harvest. This year, the efforts began with the crop projections in August. That was followed up with a harvest media day event at Wetherby Cranberry in Warrens in October. To capitalize on the election, the WSCGA worked with the local Tomah High School Agriculture and Communications classes to encourage the public to "Pick Your Candidate."

The students worked with an engineer and GPS staking to create a blue and a red outline of the state of Wisconsin, utilizing floating fruit. The image at the right appeared in media across the country and resulted in hundreds of thousands of dollars in public relations value. Media were also able to interview growers and take helicopter rides to view and photograph harvest.



# BROYDRICK & ASSOCIATES



## **Broydrick and Associates Federal Legislative Counsel**

Founded in 1981 by Bill and Cynthia Broydrick, Broydrick & Associates is a premier lobbying firm today. The Broydrick Team consists of some of the best and brightest public affairs experts around, who bring experience from the private and public sector. With offices located in Washington D.C. and Milwaukee Wisconsin, they bring a unique blend of local, state and federal savvy to their clients.

**Bill Broydrick** served as former Congressman Les Aspin's press secretary, managed Congressman Robert Cornell's campaign and became former Wisconsin Governor Patrick Lucey's senior administrative assistant. In 1978, Bill was elected to the Wisconsin State Assembly and, in 1993, led the Office of Legislative Affairs, where he served as a consultant to the Department of Defense.

In 1981, Bill founded Broydrick & Associates, directing its rise to a nationally known firm with offices in Washington, D.C. and the Midwest. He has developed a vast network of contacts and offers outstanding strategic planning and grassroots organization.

Broydrick and Associates have been focused on assisting the WSCGA and the Cape Cod Cranberry Growers Association as we work to enhance cranberry research on a national basis. Their work secured funding for three USDA Agricultural Research Scientists who focus on cranberry. This funding has placed two programs at UW Madison to research cranberry insect pest problems and cranberry genetic improvement. Currently, they are assisting the organizations to secure funding for

improvements to research facilities in Massachusetts and Wisconsin.

## **WSCGA Service to Industry Awards -- Presented January 22, 2013**

The WSCGA Service to Industry Award is the highest recognition that the organization provides. It is given to groups or individuals who have provided exemplary service to the cranberry industry over the course of a career or on a one-time basis. In 2013, the board recognized two people for their career service to Wisconsin's cranberry growers.

### ***Jane Anderson***

Jane grew up on a small dairy farm in northeastern Wisconsin and after graduating from Peshtigo High School in 1970, worked in the purchasing department at Ansul Chemical Company.

In 1973, she married Bruce Anderson (her high school sweetheart) and they moved to East Lansing, MI where Jane worked for Michigan State University in the purchasing department while Bruce completed his engineering degree at MSU. They then moved to Milwaukee, where Jane worked for St. Luke's Hospital in personnel & nurse recruitment.

She moved to Wisconsin Rapids in 1979, and ventured into the legal world, working for the law firm of Crowns, Merklein, Midthun & Metcalf until 1990, when she answered a blind ad for an administrative assistant and began working for the WSCGA.

According to Jane, "that's when the fun started – organizing events, scheduling meetings, providing answers to questions about how cranberries are grown (I had to learn that too), making sure little "Susie" got materials for her 4th grade project and "Aunt Sara" got the cranberry relish recipe she had misplaced, scooping ice cream for the WDCD at festival time and setting up trade shows. Best of all was being able to work with some of the nicest people on the planet.

Following her retirement in November 2012, she and Bruce moved to Winchester, WI where they are settling in to life in the north woods.

In recognition of her 22 years of service to the association and growers, the WSCGA Board of Directors is pleased to present Jane Anderson with the Service to Industry Award.

### ***Jerry Bach***

Jerry was born and raised in Wisconsin Rapids and graduated from the University of Minnesota in 1965, with a degree in Forest Resources Mgmt. He married his high school sweetheart, Julie Jeffrey, in 1965, and they raised 3 children and are the proud grandparents of 7 grandchildren.

After graduation Jerry worked for the U.S. Forest Service in Utah and Colorado before accepting a position as Area Forester with Consolidated Papers, Inc. in northern Minnesota where he managed their timberlands and timber procurement programs .

In 1970, Jerry started a forest equipment operator training program at the Duluth Area Technical School and was named the Minnesota Technical Teacher of the Year in 1976. He enjoyed his years working in the timber industry but was always looking for an opportunity to get back home to Wisconsin Rapids.

In 1984, a friend informed Jerry that Ocean Spray was looking for a Plant Manager for their Babcock facility. This job was a perfect fit for the business management and equipment skills that Jerry possessed and he started with Ocean Spray in September of 1984. During his tenure at Ocean Spray, the Babcock plant went through two major plant upgrades, expanded into a year around operation and plans were laid for a new Receiving Facility at Tomah.

When Northland Cranberries left the Ocean Spray Coop, Jerry was hired to oversee the construction of their Receiving Facility and Freezer in Wisconsin Rapids, as well as to assemble a group of growers to supply fruit to the new Company. These early years presented some real challenges and changes to the Cranberry Industry. After leaving Northland Cranberries, Jerry served as Mayor of Wisconsin Rapids for 4 years and, during his tenure as Mayor, he had the opportunity to be involved in Ocean Spray's purchase of the Northland Facility and to welcome Ocean Spray to town as one of the City's major employers.

In 1999, Jerry served a term as President of the WSCGA, and during his tenure, the Cranberry Museum, Inc. was in transition to management by the WSCGA and moved to its present location in Warrens. Jerry has remained on the Cranberry Museum, Inc. Board since and today serves as the President of the Board of Directors. On behalf of the Board, Jerry would like to thank all of you for your continued support of this one-of-a-kind Cranberry Museum.

For his career of service the WSCGA is pleased to recognize Jerry Bach.





**WISCONSIN STATE  
CRANBERRY  
GROWERS**  
— Association —

## WSCGA Mission Statement

The mission of the Wisconsin State Cranberry Growers Association is to enable the cranberry industry in Wisconsin to prosper through the provision of grower information, responsible environmental stewardship, sound governmental policies and effective public communications.