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**Address Correction**

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Thank you!

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# Cranberry Crop Management Journal

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## Unmanned aerial vehicles (UAVs) in pest management: Progress in the development of a UAV-deployed mating disruption system for Wisconsin cranberries

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Unmanned aerial vehicles (UAVs) represent a powerful new tool for agriculture.

Currently, UAVs are used almost exclusively as crop reconnaissance devices (“eyes in the sky”), not as pest control delivery systems. Research in Wisconsin cranberries is taking UAVs in a new direction. The Steffan and Luck Laboratories are working to convert UAVs into delivery systems for pest control products. Specifically, this research collaboration is looking to build upon the successes of the Wisconsin mating disruption program by retrofitting UAVs to fly over marshes and deliver SPLAT® (ISCA Technologies, Inc., Riverside, CA).

This work represents a significant new application of UAV technology, and should re-frame how UAVs can be used in agriculture.

The overarching goal of this collaboration is to scale up the deployment of mating disruption (MD) in Wisconsin cranberries, facilitating the integration of MD into current pest management programs. Scaling up the MD system will necessitate the use of UAVs because these units can rapidly, precisely deliver SPLAT® throughout a bed.



Early design of a retrofitted UAV. This prototype involves an octocopter platform with GPS-navigation system. Artwork courtesy of Cullen Winebar, University of Wisconsin.

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Using GPS-guided flight plans and retrofitted UAVs, the SPLAT<sup>®</sup> materials will be deposited at prescribed spatial distributions on Wisconsin cranberry marshes. This work will allow growers to manage their worst insect pests using MD, which should afford Wisconsin growers a competitive advantage in the cranberry marketplace.

Not only will this work create the first viable multi-species MD system in cranberries, but it will also be easily tailored to any given marsh size, bed layout, or locality. MD is not a new technology and indeed has become a well-established pillar of many integrated pest management (IPM) programs. Our project significantly advances the science of MD, and even pest management technology more broadly, by using fleets of UAVs to deploy pest management materials.



UAVs can be retrofitted to transport pheromone-loaded “wax soup” (SPLAT<sup>®</sup>) across the marsh, depositing the wax according to a pre-set flight plan. This research represents a public-private collaboration between the Steffan (Entomology) and Luck (Biological Systems Engineering) laboratories at UW-Madison, as well as the private company, ISCA Technologies, Inc. (Riverside, CA). Photo courtesy Joan Fischer, University of Wisconsin.

The eventual deliverable technology associated with this work will be a new tool for Wisconsin cranberry growers. Further, given that MD is a certified organic technology, it also represents a critical tool in the organic toolbox. Across the entire cranberry industry, MD systems will provide growers with an effective pesticide alternative or a reliable supplementary pest control tactic.

## **Grower Update**

**David Bartling**  
**Manitowish Cranberry Co., Inc.**

With harvest complete and all berries sent down the road, we finally know the size of our crop: not a bumper crop but still quite large. I am quite pleased when I see our hard work and efforts throughout the growing season pay off during harvest.

We had the pleasure of hosting a South Korean film crew during harvest that is filming its second season of a food documentary where the host travels the world finding foods that are very specific to certain parts of the world and the culture surrounding them. The show will be featured on Korean Broadcasting Station next year, the Korean version of Wisconsin Public Television. Our Korean speaking skills, or lack there of, did not help the difficult language barrier but, it was quite fun to have such an energetic group of foreigners so excited to put on waders and experience cranberry harvest.

This year we had an abnormal amount of leaf piles left in the bed where our berry pump suction box sits, so with some man power and a leaf vacuum, we have removed the majority of the piles. We are looking into a proactive solution to preventing the piles or removing them during harvest. The easiest solution we have found is using a light, mesh mat placed underneath the suction box that will catch all leaves that fall, then carry the mat out of the bed after it is harvested. We have a few other tweaks and updates on our harvest equipment that we will tackle this winter as well.

Our other post-harvest projects include renovating two, three acre beds (both were Bain MacFarlin variety), one of which we just finished hauling off eight inches of peat. The other we will haul off as soon as the dikes dry out again after the recent rains. We will haul in twelve inches of sand over the ice once we have our winter flood on.

Our other project that is near completion is installing an underground mainline on our 45 acre parcel, replacing the aged, above ground, aluminum mainline. We are now waiting on a part to fuse the final connection and then the trench can be back filled and fresh gravel spread over the top. It seems things have not slowed down much since harvest was finished!

David Bartling  
Manitowish Cranberry Co., Inc.

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## Soil, Tissue and Water Tests

Matt Lippert, Wood County UW-Extension Agriculture Agent

**During times of low margins, one should probably spend more money on nutrient analysis.** With harvest nearly complete, it soon will be time to look forward to next year and plan for crop inputs. Tissue tests taken last August will be a yardstick combined with soil tests, yield records and observations of plant health in the marsh to determine fertility needs for 2016.

**Compared to the possible savings from fertilizer reduction, or alternatively, yield response due to extra inputs, nutrient tests are very inexpensive.**

Enter your soil and tissue tests results onto a spreadsheet. Determine if there are trends occurring over time. How do your tests compare to industry benchmarks? Do any levels seem inadequate or excessive? Can you explain any of these changes due to plant maturity not being what is typical on your normal sampling period, overgrowth, or some known stress? In addition to tracking trends over time, review the variability of your results. If you have a standard program for your entire marsh, but your beds vary in organic matter content, yield potential of varieties, water source, water use, age of bed or other factors; you may find beds deviating apart due to these factors that affect nutrient uptake and use.

Do you work with the same lab; use the same sampling protocols, possibly marking sampling locations with GPS?

If you already customize fertility programs for specific beds, do you do it mainly on in season observation, or do you look at trends in your nutrient tests to confirm what you are seeing in plant growth? While the most recent tests are the most important, **the cumulative record of trends of averages and variability combined with yield information are more powerful than any single test.**

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Many growers are aware of the classic differences in water sources and how water may be a source of higher pH trends or nitrogen causes more and more variable vine growth. Are you tracking through testing what is happening with your water? During a drought year is there more well water or ditch water? Does the nutrient profile of the ditch water vary seasonally or year by year? If I have expanded my acreage have I changed the amount of water used from varying sources?

Determining nutrient requirements for a perennial plant such as cranberries can be complicated. Much of the nutrient pool is in the plant itself. In cranberry production the ability of the soil to cycle nutrients varies considerably depending on sand, peat and old cranberry tissue in the soil profile. The profile changes as a bed matures.

If you have found the results of these tests conflicting or confusing, be patient, you are building a record. The value of your test information compounds as you save results and do analysis over time.

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