

Cranberry

Crop Management Newsletter

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TOBACCO STREAK VIRUS

Patty McManus and Lindsay Wells

UW-Extension and UW-Madison Plant Pathology

As published in last month's issue, berry scarring, believed to be caused by tobacco streak virus (TSV), is showing up on cranberries in Wisconsin. We have identified it on additional sites beyond the marshes that were affected in 2012. The attached document summarizes our work to date. Near the end are precautionary measures to prevent spread of the virus.

If you see berry scarring similar to what is shown in the photo and described in the following article, we would like to test it for TSV so that we can determine how widespread the problem is.

Put affected uprights in a labeled Ziploc-type bag, send it to me at the address below, and then call or email to let us know it's coming. We will not reveal the identity of growers

regardless of test results.

Be aware that if you have applied the fungicide chlorothalonil (brand names Bravo, Echo, Equus, Daconil), burn from that fungicide can resemble scarring associated with TSV. With fungicide burn, injury is most severe on exposed berry surfaces near the top of the plant canopy, and most berries in an area are affected. By contrast, scarring associated with TSV typically affects all or nearly all berries on an upright, and uprights with scarred berries are interspersed among healthy uprights.

To participate in the Tobacco Streak virus Survey, please submit your samples and outlined in last month's issue of the CCMN. The instructions are also included later in this newsletter. ❖❖❖



OBSERVATIONS FROM THE FIELD

Jayne Sojka

Lady Bug IPM, LLC

Fall is in the AIR! The Purple Martins have left – the hummingbirds are getting ready to head south as well. It is August but it sure feels like September!

We are seeing a fair amount of pinheads reddening off/abortion throughout all the counties this week. It seems that cool weather has slowed the plants down and now we are seeing all the seasons' stress. Yellow vine syndrome showed up several weeks ago and during that HOT HUMID stretch those areas grew. Actually the yellow is now a brown color and the fruit are small with some shriveling – almost dehydrated look.

We are seeing some areas of last year's leaves showing a red/brown color cast with a hint of new life on top. In some of those areas we are finding stem gall/Canker yet other areas are tough to diagnose. The stress could have been from spring pruning, casoron and then very wet conditions or it could date back to 2012 harvest as we saw wheel tracks in the spring. We are encouraging growers that see this now to make sure that particular bed is in a sanding program this winter.

Rose Chafer trapping, White Grub trapping and Japanese Beetle trapping is nearing an end. Some growers were amazed at the populations of Rose Chafers again this season; some traps were near 400 to 500 in a 7-day period! (Yes, we actually counted them - I use a grid work sticky trap to count that high.) We try to place traps in an area with the intent of pulling them away from the Cranberry Bed as

we have observed them feeding on the blossom and doing some damage. White Grub numbers surprised most trappers this year!

For the most part numbers were down; yet, I had one grower that peaked with 179 in one trap in a 7-day interval. We are seeing some damage in the cranberry beds already. In those areas, the vines pull back real easily as the grub has injured the root system. When you see bronzed uprights in your beds, check it out for white grub larvae.

Have a GREAT week everyone!



COST OF PRODUCTION SURVEY

UW-Extension is attempting to compile numbers of industry cost of production. You can help us provide better information by participating in this data collection effort. We have an Excel spreadsheet where you can enter your input numbers. Your sharing of this data will be kept strictly confidential. The spreadsheet can be found on the Wood County UW-Extension website. See Wood County-UW Extension website at www.wood.co.us/departments/UWEX/agriculture for Benchmarking Worksheets. Pooled results will be shared in future articles in the *Cranberry Crop Management Newsletter*. Individual specific numbers never will be shared. Please help out with this survey. Return completed spreadsheets to matthew.lippert@ces.uwex.edu or share with your trusted cooperating consultant that has the ability to forward this information to us without sharing your personal contact information.

UPDATE ON TOBACCO STREAK VIRUS ON CRANBERRY

Patty McManus and Lindsay Wells
UW-Extension and UW-Madison Plant Pathology

(This is a reprint of an article which appeared in the August 2013 Wisconsin State Cranberry Growers Association News.)

This document summarizes our current knowledge of *Tobacco streak virus* (TSV) on cranberry, based on work conducted in our lab and observations from the field. In brief, we have gathered evidence that suggests TSV is at least in part responsible for berry scarring (see photo) and possibly blossom blast and tip dieback. We also discuss what our results might mean based on current knowledge of TSV and related viruses on other plants. We conclude with some recommendations and sanitary measures that growers can follow to reduce the risk of spreading of TSV. The test used to detect TSV in the experiments described below is enzyme linked immunosorbant assay (ELISA), which is the same test used by Agdia, the commercial virus testing lab used by us and others in 2012.

TSV overwinters in cranberry beds. In late May and early June of 2013, we collected last year's leaves and leaves emerging from newly breaking buds in beds that showed scarring and tested positive for TSV in 2012. In 2013, we detected both scarring symptoms and TSV at the marshes where scarring was observed in 2012.

TSV was detected in pollen. We collected pollen from flowers on uprights that had scarring symptoms in 2012 and detected TSV in the pollen samples. In a subset of samples, pollen was washed, and the wash buffer was tested. In all but one case, the wash tested negative, suggesting that TSV is inside pollen and not loose on the surface. Pollen collected from flowers on TSV-negative plants from a distant site tested negative for TSV.

TSV was not transferred by hand pollination with infected pollen. We hand pollinated flowers on healthy, TSV-negative plants with TSV-infected pollen. Berries developed normally with no scarring, and they tested negative for TSV. This suggests that either TSV is not transferred via pollination, or that our healthy flowers "selfed," that is, pollinated themselves with their own healthy pollen. We noted that pollen from

TSV-infected plants was able to produce germ tubes in water, but we did not compare its vigor and ability to compete with healthy pollen. With a related virus of stone fruits, *Prunus Necrotic Ringspot Virus* (PNRSV), infected pollen is not as vigorous as healthy pollen. Thus, we cannot rule out transmission of TSV during pollination, but it is probably a rare occurrence. However, in the field even rare events could be significant, because there are millions of flowers in a cranberry bed.

Can TSV be transmitted through wounds and/or thrips feeding? We have experiments in progress in which we wounded fruit and then inoculated with sap from infected leaves or pollen presumed to be infected with TSV (came from infected plants). No results to report yet.

Thrips feed on pollen and get it on their bodies. In other plants, infection by TSV is believed to occur when thrips carrying TSV-infected pollen feed on uninfected plants. Thrips may in fact facilitate the initial infections in cranberry plants, but as described in the next section, we believe that TSV is causing berry scarring, and possibly blossom blast, leaf stippling, and tip dieback. We are considering experiments that include thrips for 2014.

TSV appears to enter plants during bloom and then later moves to leaves. In mid and late July, we found many cases in which scarred berries tested positive for TSV while leaves on those same uprights tested negative. In mid July we also noted that some berries, usually the lower (older) berries, showed scarring

Update on Tobacco Streak Virus, Continued on p. 4

*References to products in this publication are for your convenience and are not an endorsement of one product over similar products. You are responsible for using pesticides according to the manufacturer's current label directions. Follow directions exactly to protect the environment and people from pesticide exposure. **Failure to do so violates the law.***

UPDATE ON TOBACCO STREAK VIRUS ON CRANBERRY

(Continued from p. 3)

while the younger berries did not. However, the younger, apparently healthy berries did test positive for TSV. By late July, we generally were seeing scarring in every berry on an upright. From these data and observations, we hypothesize that TSV infects berries during bloom, possibly when thrips create wounds through which TSV-infected pollen enters. Infected flowers develop into scarred berries, and then the virus moves to younger berries on the upright, which are metabolic sinks. Finally, the virus moves into leaves. We predict that we will detect TSV in leaves on uprights with scarred berries sometime in August. Keep in mind, this scenario is our current hypothesis; data to support or refute it will come later.

Evidence that TSV is the cause of scarring. There are two main lines of evidence suggesting that TSV is at least in part responsible for berry scarring. First is the fact that when scarring occurs, typically every berry on an upright shows symptoms while other uprights nearby are not affected. Often several uprights on a runner are affected, while interspersed uprights from other plants remain healthy. This strongly suggests that a systemic factor is involved; in other plants, TSV and related viruses are systemic. While thrips might create the wound necessary for initial infection, it is unlikely that thrips would feed on every flower on a given upright, because they open over a period of several days. It is also unlikely that thrips would selectively choose to feed on flowers of uprights connected to the same runner, while skipping over interspersed uprights.

A second clue pointing toward TSV having a role in scarring is that we are observing what appears to be a “necrotic shock” reaction during the year of infection, followed by plant recovery the year after infection. A similar phenomenon is known to occur with *Blueberry shock ilarvirus* (BSIV) in blueberry and PNRV in stone fruits. None of the 2013 berries that developed on tagged uprights that had scarring (necrotic shock) in 2012 have scarring this year, although there are a lot of affected uprights in that same area of the bed. Although they are not showing symptoms, these plants are still infected with TSV, and their pollen is infected. This is exactly what we would expect if TSV in cranberry

behaves as related shock viruses behave.

Can we prove that TSV is the cause of scarring?

To prove that TSV is the sole cause of berry scarring would require that we inoculate plants with purified TSV particles. This is technically difficult. Instead, we are attempting to “mechanically” transmit TSV by wounding fruit and inoculating with sap from TSV-infected leaves and TSV-infected pollen. The difference between inoculating with contaminated sap/pollen and using purified TSV is that there is a possibility that another factor, such as another virus, in the plant sap contributes to symptoms. That said, we doubt that TSV-infected plants carry other plant viruses. In 2012, Bob Martin, a woody plant virologist with USDA, extracted dsRNA from affected uprights, and found no other RNA viruses (most plant viruses are RNA viruses). We also sent samples to Agdia, a commercial virus-testing lab, and none of 14 viruses often found on fruit crops were detected. Finally, Benham Lockhart at University of Minnesota looked at sap from infected leaves by electron microscopy and only found particles the size and shape of TSV. We note, however, that there are other viruses that are roughly the same size and shape of TSV.

Is TSV being detected at any sites other than the three that tested positive in 2012? We have just begun a survey and have confirmed TSV at new sites. We will have more information to report in the coming weeks.

Update on Tobacco Streak Virus, Continued on p. 5



UPDATE ON TOBACCO STREAK VIRUS ON CRANBERRY

(Continued from p. 4)

We are planning to test the effect of TSV on yield components. It is clear that scarred berries and blossom blast reduce yield on affected uprights. In the following year, it appears that plants do not show symptoms but do still carry the virus, at least based on our findings from 2012 to 2013. Does TSV infection affect yield if there is no berry scarring? To answer this, we will compare flower number, % berry set, berry number, and berry weight for uprights in three categories: i) TSV-positive with scarring; ii) TSV-positive without scarring; and iii) TSV-negative without scarring. We will also track re-bloom on these uprights in 2014 and possibly 2015. Tagging and tracking individual uprights is labor intensive, which will make it difficult to scale up our findings to the whole-bed level. But, we should be able to detect obvious effects. Also, this experiment will not account for many factors that affect yield, such as upright density, density of flowering uprights, winter hardiness, and overall plant vigor.

What are the long-term prospects for cranberry plant health and productivity? This is difficult to predict since we have just begun to study this problem. Assuming TSV on cranberry is similar to the necrotic shock viruses described above, we can look to those systems to predict how things might play out on cranberry. With BSIV and PNRV, initial necrotic shock symptoms sometimes appear on just one branch of the blueberry bush or cherry tree. Eventually, over a few years, all branches on the bush or tree experience necrotic shock symptoms—but usually just one or a few years for any given plant. After all branches have been through it, no more symptoms appear and plants go on to look normal, although they still test positive for virus and their pollen continues to be infected. BSIV is not believed to affect yield or plant health in blueberries after recovering from the initial necrotic shock. In stone fruits, PNRV does sometimes reduce yields in later years, but it's not always clear if it is acting on its own or in combination with other viruses.

In the case of cranberry, we have many more individual plants per acre than in a blueberry planting or stone fruit orchard. For this reason, we expect it would take several years for symptoms to run their course, but that in any given year, most plants would be

either not yet infected or have recovered from infection.

What can growers do about TSV? There is no spray or treatment that will cure plants in the field of viruses. If further research implicates thrips as a carrier of TSV-infected pollen, there may be treatments to control thrips populations. However, the risks of harming pollinators will have to be considered. New beds should not be established with vines known or suspected to be infected with TSV. Bearing in mind that we do not yet know all the different ways that TSV can be spread, **we recommend the following for the remainder of 2013:**

1. **Minimize traffic** in and out of cranberry beds, especially in beds where TSV is detected and especially if there is any lingering bloom. We expect the risk of new infections to diminish after there is no more pollen, but we cannot rule the possibility of transfer on feet, hands, or equipment.
2. **Sanitation.** Where TSV is known to be present, wear disposable plastic boot covers (available from Gempler's, Farm and Fleet, and similar outlets) and change before entering a new bed. Another option is to wash pollen and other plant material off boots between beds and then disinfest by spraying boots or stepping into 10% bleach, rubbing alcohol, or disinfectants such as Virex or Lysol. Wash hands between beds if plants are touched.
3. **Work in TSV-infected beds last,** if you must enter them at all. We suspect the risk of spreading TSV on harvest equipment is low, but where possible, harvest beds known to be infected last.
4. **Keep everything in perspective.** We are taking TSV seriously and believe growers should too, because there are many unknowns. But it is just one of dozens of production problems facing cranberry growers. Where TSV has been identified, most plants look healthy and beds produce well.



WSCGA SUMMER MEETING, FIELD DAY AND TRADE SHOW PROGRAM

Wednesday, August 14, 2013

Gardner Cranberry, Pittsville, WI

Parking and Logistics

The event is being held at Gardner Cranberry located at 7502 State Highway 73, Pittsville, WI, on Wednesday, August 14, 2013.

As you arrive, follow the signs to the parking area by turning north on County Highway E. Do not try to enter the grounds from Highway 73. Travelers should also be aware of a detour on Highway 73. The Yellow River Bridge is under construction on Highway 73. There is a posted detour to follow.

Trade Show

The Trade Show runs from 8:30 a.m. through 3:00 p.m. Indoor exhibits can be found in the new cold storage facility. Outdoor exhibits of heavy equipment can be found around the yard and buildings. A list of exhibitors will be available at registration.

Marsh Tours

Shuttle busses will depart on a regular schedule from a pickup point. The tour will take you through the marsh, to the processing facility which includes the production of concentrate and SDC's, and back to the meeting site. Check at registration for the location of the pickup site.

Mini Sessions

The WSCGA Education Committee and UW Extension Faculty will be conducting four mini sessions in the morning. They will be held in the lunch area. The topics for the sessions are:

10:00 a.m. Observations from the Field by the Crop Consultants

The session will be a general discussion of some of the management practices employed during the season that seemed to have had positive results, use of new products such as Altachlor, early season flooding strategies, and other topics that growers are observing in the growing season.

10:20 a.m. What's New in the Genetic Improvement Program?

Eric Zeldin and Juan Zalapa from the UW will update growers on new releases and progress to date in their research programs.

11:00 a.m. Using the Sun to Pump Your Water and the Latest in Soil Moisture Monitoring

Tod Planer has a pilot project that has developed a portable, solar-powered water pump. It also can be used to generate electricity for other uses. He will have it at the field day and demonstrate its use. Bill Bland will give an update

with new data on the project to evaluate tracking soil moisture.

Lunch

Meal tickets can be picked up at Registration beginning at 8:30 a.m. through 11:00 a.m. We previously asked that you purchase tickets in advance. The cost is \$15.00 each. There may be a limited number of tickets available the day of the event, but with the expected large crowd, we cannot guarantee that there will be tickets available the day of the meeting. The meal will be served in the cold storage facility. Please note the time on your ticket and get in line only during that time period. This will prevent long lines and allow everyone to enjoy the day on their own timetable. Contact the following to obtain meal tickets.

Wisconsin State Cranberry Growers Association

132 E. Grand Avenue, Suite 202

P.O. Box 365

Wisconsin Rapids, WI 54495-0365

P: 715-423-2070 F: 715-423-0275

E-mail: wiscran@wiscran.org

WSCGA Summer Business Meeting

The WSCGA Summer Business Meeting will be held at 1:30 p.m. in the lunch area. We will be updating growers on activities, presenting awards, introducing the individuals selected to participate in the Second Class of the Wisconsin Cranberry Leadership Development program and recognizing special guests. We encourage everyone to participate in the meeting.



Our Sponsors

This newsletter is produced by UW-Extension and is sponsored by a grant from the **Wisconsin Cranberry Board, Inc.** with further support from industry partners; **Clement Pappas & Co., Cott Corporation, Decas Cranberry Products, Inc., Mariani Packing Company, and Ocean Spray Cranberries, Inc.** Ten issues will be produced during the growing season and are available to anyone in the cranberry industry upon request either by US mail or by e-mail. If you would like to be added to our distribution, please contact

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2013 Tobacco Streak Virus Survey**Sample Collection Protocol**

Patty McManus, psm@plantpath.wisc.edu 608-265-2047 office, 608-692-8930 cell

Lindsay Wells, ldwells@wisc.edu 609-354-8645 cell

1. Collect 10 uprights from an area within a bed. This will be one sample. Place the 10 uprights into a plastic bag, and poke a few small holes in the bag for ventilation.
2. Repeat Step 1 in 2 to 3 additional areas within the same bed. This will give us 3 to 4 samples per bed (3 to 4 bags, each containing 10 uprights).
3. Label each sample bag with the following information using indelible marker:
 - a. Bed number or name
 - b. Variety
 - c. Sampling date
4. Send samples to: Lindsay Wells

Department of Plant Pathology

1630 Linden Drive

Madison, WI 53706
 - a. Provide your contact information, the nearest town/city or the county from which the samples were taken, approximate bed age, and any other relevant information.
 - b. If possible, send samples earlier in the week (M-W) to ensure timely shipping and processing of samples.
 - c. Whenever samples are sent, and especially if samples are sent later in the week, please call, text, or email Lindsay so that she can be ready for the samples.

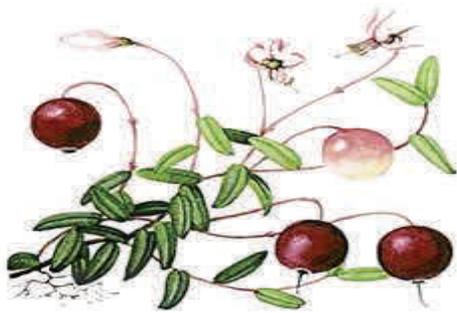
References to products in this publication are for your convenience and are not an endorsement of one product over similar products. You are responsible for using pesticides according to the manufacturer's current label directions. Follow directions exactly to protect the environment and people from pesticide exposure. Failure to do so violates the law.

Address Correction

If you have any address corrections, additions, or deletions, please let us know.

If you prefer to receive the CCMN newsletter by e-mail, please call 715-421-8440 or e-mail: mspencer@co.wood.wi.us

Thank you!



Self-Study Private Pesticide Applicator Certification

If someone missed the Pesticide Applicator's exam or you have someone new who wants to be certified, there is an option to obtain certification for Private Pest Applicators that is available year around to fit whenever it suits your schedule. It is called the Self-Study option. The UW-Extension Office can provide you with a DVD to view the same presentations as are provided at our training session held each year at cranberry school. You are required to purchase a Fruit Crops Manual (\$30) then and schedule an appointment to take your exam at the UW-Extension Office. Contact the **Wood Co. UWEX Office, 400 Market St. , PO Box 8095, Wisconsin Rapids, WI 54495, 715-421-8440, matthew.lippert@ces.uwex.edu or mspencer@co.wood.wi.us**

The exam is open book and multiple choice. The self-study option requires 70% correct answers as compared to 50% for those attending a pesticide applicator class. Not all counties will have the fruit crops exam, but they will be able to obtain one if you give them advance notice. A PAT certificate is required to purchase or mix or apply restricted use pesticides.

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