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FRUIT ROT: RAIN, HEAT, HAIL AND OTHER FOUR-LETTER WORDS

Heavy rain and hot weather has plagued many areas in central Wisconsin, causing cranberry beds to flood along the ditches. Many growers are reporting that fruit remained under warm water for several hours and are now showing symptoms of scald and rot. In some cases, rotting berries are next to berries that still appear healthy. This raises the question: should you apply a fungicide to protect the healthy berries? Fortunately, I haven't heard hail horror stories from cranberry growers this year, but you're not out of the woods yet. If you get hit with hail, should you spray? My answer to spraying after scald or hail is "no" on both accounts. Here's why:

1. To the best of our knowledge, fruit rot develops from infections that occur during late bloom and early fruit set. These infections are from spores of several different fungi. The berries that are currently rotting as a result of scald may or may not have fungi in them, but they are not a source of spores—the fungus that may be present in the rotting berries is not in an infectious form. The cranberry situation in the field is not like when you see strawberries rotting in the grocery store. There are plenty of fungal spores present in a box of rotting strawberries—not the case for cranberry scald in the field.
2. We are beyond the window when fungicides are effective at controlling rot. See Peter Oudemans's rot article on p. 25 of the 1999 Wisconsin Cranberry School Proceedings: "Infection leading to fruit rot occurs during a 20-30 day period beginning at fruit set. Infections may occur following this period…but do not lead to fruit rot."
3. What would you spray if you sprayed? Bravo is the best rot fungicide but we're too close or even beyond the 50-day PHI. Mancozeb can be phytotoxic if applied after fruit are ¼ inch in diameter. Ferbam should not be applied later than 28 days after mid-bloom. Copper isn't very effective. That about covers your options.

Despite my opinion, I know some of you will still spray or maybe already have. I'm not offended—ultimately, it's your decision. But if you do spray, would you do me a favor? Leave a small portion unsprayed and let me know what happens. Researchers will probably never do a decent scald or hail experiment, because we plan our projects early in the season and cannot count on these events happening.

Upright Dieback and Stem Gall (Canker)

While you have the 1999 Cranberry School Proceeding out, turn to p. 29 to review upright dieback and p. 22 to review stem gall (canker). The hot weather we've had while fruit are sizing is ideal for the onset of upright dieback. But don't confuse upright dieback with another cause for uprights to die back: stem gall or "canker". Stem gall is easy to identify by the bumps, galls and cracks on uprights and/or runners. Vines generally recover, but it takes a few years to get back into production. To prevent further stem gall, do not overfertilize with nitrogen, minimize beater damage, and protect vines from winter injury.

Upright dieback is harder to nail down, but if you would like a diagnosis, take samples to your county Extension office or mail to: Plant Disease Clinic, 1630 Linden Drive, Madison, WI 53706. There is a fee, ranging from $10-20 depending on what needs to be done. Include any relevant details (when symptoms appeared, the pattern in the field, pesticides used, etc. Do NOT put my name on the package—if I am not here, nobody will open it!!!

Between plant pathology meetings, research, field days, and visiting in-laws, I will be out of the office August 6-16.

Patricia McManus
UW-Madison, Dept. Plant Pathology

Life is mostly froth and bubble,
Two things stand like stone,
Kindness in another's trouble,
Courage in your own.

Adam Lindsay Gordon

Editor's Note: A couple of years ago we did some hail simulation experiments where we bruised the berries and made a single small hole in individual cranberry fruits and then dipped them in either sterile water or ditch water. These fruit were then either sprayed with a fungicide (Bravo or Mancozeb) or water and maintained at room temperature or at a cold temperature.

We found that once there was a hole in the skin that fungicides were of no value in maintaining fruit integrity. Fruit held up much better at 40°F than at 72°F.

Admittedly, this was laboratory research, but the results were so striking that I believe they would also apply under field conditions. Hail storms can be devastating to a crop, but you can reduce your financial loss by saving the material and application expense of a fungicide treatment.

Teryl Roper

CRANBERRY CARBON BUDGET

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About this time every year I get the question "What fertilizer can I add to make the pinheads develop into large fruit?" This question makes the assumption that fertilizer is limiting to fruit growth. If you know that all of the major elements are in the adequate range (from regular tissue testing) you know that fertility is not the problem. If this is the case, adding more fertilizer **will not** make pinheads set!

Two factors have been identified as limiting to cranberry yields: the number of fruiting uprights per ground area and the number of fruit per upright. Lets take these in reverse order. The

number of fruit per upright is commonly known as fruit set. We could increase yields markedly if we could set only one more berry per fruiting upright. Several research projects have shown that there is competition between fruit on an upright for resources. That is one reason why lower early forming fruit are more likely to set than upper later forming fruit.

In my program we have investigatied how much carbohydrate is available for vegetative growth or fruit growth. We measured photosynthesis at intervals throughout the season and occasionally throughout an entire day. We then used this information to estimate how much carbon an individual upright can "fix" during a season. This amount is roughly the amount available for upright and fruit growth. We then compared this to the amount of carbon found in a typical fruit to see how many fruit could be supported by an average upright. For Stevens we found that a typical upright captures about 0.45 grams of carbon during the course of a year. Some of this carbon is used for respiration at night and some is used to create new leaves and stems. We'll estimate that is about 20%. That leaves about 0.36 grams of carbon available for fruit growth. A typical Stevens berry weighs about 1.5 grams. About 85% of that weight is water leaving about 0.225 g dry weight. Roughly 5% of the dry weight is the mineral fraction and the balance is lipid, protein and carbohydrate. This comes to about 0.214 g. Not all of what remains is carbon (some is hydrogen and oxygen). Some researchers have suggested multiplying this number by 0.45 to give grams carbon. That gives 0.09 grams of carbon per fruit. There is a respiratory cost associated with growing the fruit that we estimate is equal to the final carbon content giving a grand total of 0.18 grams of carbon per fruit.

Grams carbon fixed per upright	0.45
Loss to respiration & growth	(0.09)
Net carbon available per upright	0.36
Grams of carbon per mature fruit	0.09
Respiratory cost of growth	0.09
Total carbon cost per fruit	0.18

When the arithmetic is all done we can see that the amount of carbon available per upright compared to the amount of carbon required to grow a fruit allows for production of about 2 fruit per upright. The point of this exercise is to attempt to show that carbohydrates are likely the limiting factors for fruit set. A typical upright has enough carbon to support roughly two fruit. You should also understand that our estimates of photosynthesis are based on all clear sunny days with adequate temperatures. Our estimate of carbon available is likely too high. On the other hand our estimate of the respiratory cost to produce a fruit is likely too high, so the two may cancel each other out.

If our estimates are correct, can you increase yield and fruit set by adding fertilizer? **NO!** Once the tissue has adequate amounts of fertilizer, adding more is wasteful, not helpful. What can you do to increase photosynthesis? You can manage pests, keep weeds from competing (particularly early), make sure

your fertility program is adequate and you can hope for cooperative weather. Good overall management will provide maximum photosynthesis and optimum yield.

The other half of this story is what time of year carbohydrates are limiting. We did a variety of experiments to understand what time of year sufficient carbohydrates were most important for fruit set and development. Our experiments included shading studies where we would shade vines for various times, and leaf removal studies where new or old growth was removed at various times.

In all of these experiments we found that fruit set was very susceptible to carbohydrate limitation just after bloom. If we did anything to limit carbohydrates (removed leaves, shaded vines) at the period of fruit set, the number of berries and berry size were reduced. If we're trying to get those pinhead fruit to grow and develop in August, we're too late.

The next piece of the puzzle is where does the carbon come from for fruit set? The leaf removal studies suggested that the new growth above the developing flowers and fruit were most important. To be certain, we fed either new leaves above developing fruit or one-year-old leaves below developing fruit radioactive carbon dioxide. This CO2 was then incorporated into sugars and amino acids and we could follow where it went. We found that far more of the radioactivity ended up in fruit from the new leaves than from the old leaves.

Researchers at the University of Massachusetts have measured upright length and correlated that with fruit set and yield. They find that longer uprights (presumably with more leaves) have more fruit than shorter uprights. I speculate (this would be super hard to measure) that these longer more vigorous uprights would also have bigger caliper.

To some extent upright length and vigor is related to fertility. However, vigorous growth this year is also a result of nitrogen applied in 1998. Think of your fertility program year running from July to July rather than May to August. Nitrogen that you have applied already this year will have an effect on the vigor of the growth and the crop you'll harvest next year. Obviously, you can apply too much nitrogen, blow the buds, encourage field rots, and have rank vine growth. Walking that fine line between sufficient nitrogen and too much nitrogen takes experience and careful management.

In my opinion, it is too late to apply fertilizer in 1999 to make pinheads "blow up" into marketable fruit. Besides that, the limitation isn't having enough nutrition (N, P, K), it is having enough carbohydrates to feed competing demands.

Teryl Roper, UW-Madison, Extension Horticulturist

(Note: Much of the research cited in this article was supported by the Wisconsin Cranberry Board and Ocean Spray Cranberries, Inc.)

CRANBERRY FIELD DAY

The annual Wisconsin Cranberry Field day will be held on Wednesday August 11 at Cranberry Creek Cranberries, Inc. This marsh is owned and operated by the Hatch family.

The field day provides opportunities to visit with vendors and to see their latest products. The marsh tours this year will have a narration to describe some of what you are seeing. Lunch reservations should have already been made, but even if you don't stay for

lunch, please come and enjoy seeing a progressive marsh and your friends in the Wisconsin Industry.

The highest possible stage in moral culture is when we recognize that we ought to control our thoughts.

Charles Darwin

PRE-HARVEST INTERVALS

As we approach harvest it is time to pay close attention to pesticide pre-harvest intervals. The pre-harvest intervals are designed to allow residues to degrade before the product enters the food stream.

Pesticide	PHI (Days)
Bravo	50
Copper products	exempt
Diazinon	7
EBDC's	30
Ferbam	Apply no later than 28 days after mid bloom
Guthion	21
Lorsban	60
Nematodes	0
Orbit	Last application 7/31
Orthene	75
Poast	60
Pyrenone	0
Ridomil	45
Roundup	30
Sevin	7
Stinger	50
Weedar 64	NA

COOLING

A common fruit production technique is to cool the fruit and plants with water. Sprinkling with water for cooling is frequently used in tree fruit production, particularly in arid and hot regions. The principles are similar as for frost protection. As water changes from a liquid to a gas heat is consumed. As this heat is transferred to the water the plants are cooled.

The rate of cooling is a function of the water content of the air in relation to its ability to hold water. Warm air can hold more water than cool air. During a given day the water content of the air is relatively stable (unless a front moves through the area), but the relative humidity will fall as the air warms. Table 1 shows the change in relative humidity at a constant air water content of 50 grains per pound of air as the temperature increases.

Table 1. Change in relative humidity with constant moisture content of 50 grains

Air temperature (F)	Relative Humidity (%)
55	78
60	66
65	55
70	47
75	38
80	32
85	28
90	25

The difference in water content between the air and the vines actually drives the cooling process. As the air temperature increases during the day the cooling capacity also increases. During the last week of July the dew points were so high that little evaporative cooling would have occurred, but since the water temperature would likely have been cooler than the air temperature some cooling would have ensued.

One story related to sprinkling for evaporative cooling that I keep running into, not only from cranberry growers, but from other crops as well is that water droplets on the leaves act like little magnifying glasses that will concentrate sunlight on a small area and burn the leaves. This has no basis in fact. I know of no research data that supports this concept. Water droplets are not shaped like little magnifying glasses. Don't be afraid to use evaporative cooling for fear of "burning" your vines.

Teryl Roper, UW-Madison, Extension Horticulturist

The world has achieved brilliance without wisdom, power without conscience. Ours is a world of nuclear giants and ethical infants.

Omar Bradley

Weather

	Cranmoor			Warrens			Manitowish		
Date	Tmax	Tmin	Ddays	Tmax	Tmin	DDays	Tmax	Tmin	DDays
7/25	92	65	1879	93	69	2003	86	59	1619
7/26	84	64	1939	85	66	2066	82	54	1669
7/27	83	60	1965	87	62	2095	79	49	1688
7/28	86	65	1994	87	67	2126	81	66	1716
7/29	92	68	2026	94	69	2158	88	62	1745
7/30	97	66	2058	99	71	2191	95	61	1774
7/31	82	63	2085	83	65	2220	79	58	1797
8/1	75	56	2105	76	58	2242	71	55	1815
8/2	76	55	2125	78	56	2263	73	53	1833
8/3	74	58	2146	78	59	2286	69	55	1850

Hot temperatures last week really pushed the Degree-Day accumulation ahead. However, we are still slightly behind the 1998 accumulations.

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