Integrated Cranberry Crop Management for Wisconsin

Cranberry

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YIELD COMPONENT ANALYSIS

In the first article in this series we explored environmental factors that can affect the rate of photosynthesis such as light, temperature, CO_2 concentration, mineral nutrients, and genetics. That sets the stage for this discussion of yield component analysis. Yield component analysis is a statistical procedure where various measurable or calculable factors can be assessed to see which have the greatest correlation with yield.

George Eaton and coworkers at the University of British Columbia performed yield component analysis of cranberry in the late 1970's (Eaton & Kyte 1978). In their study they collected all of the tissue growing in a square decimeter. This is about 4 x 4 inches or 16 square inches. Samples were collected from four properties in BC over two years. They counted the total number of uprights (U/dm2), the number of flowering uprights (Uf/dm2), number of flowers (F/dm2), number of berries (B/dm2), and the fresh weight of berries or yield (g/dm2). From these data they were further able to calculate floral induction (Uf/U), flowering (F/Uf), fruit set (B/F), and berry size (g/B). The resulting data were then subjected to statistical procedures to determine which factors were most important in determining yield.

They determined that two factors were most important in determining yield: floral induction (Uf/U) and fruit set (B/F). Floral induction is the proportion of fruiting uprights among the total number of uprights. The proportion of fruiting uprights was more important than the total upright density. Fruit set describes how many fruit set from the flowers that are present on a flowering upright. Since these two factors have been shown to be the most important factors determining yield researchers have spent much effort attempting to further describe them and to attempt to find ways to increase them. We'll deal first with floral induction.

Individual uprights in cranberry beds tend to produce flowers and fruit in alternate years. However, since there are millions of uprights per acre total yields can be more uniform, but grower data also shows the trend to a large crop one year followed by a smaller crop the subsequent year. This phenomenon is very common in other temperate fruit crops. In an effort to document the extent of biennial bearing in cranberry uprights researchers from MA, WI, NJ, and OR cooperated in a research project. In beds of Stevens, Ben Lear, and Crowley in each state

six-foot lines were set out in beds and 60 uprights that fruited in 1989 were tagged with vinyl tape after harvest but before the winter flood. Fruiting was determined by the presence of persistent pedicels from the fruit after harvest. In the late summer of 1990 fifty of the tagged uprights were cut and the presence of flowers and fruit was counted. The results of the study are shown in Figure 1.

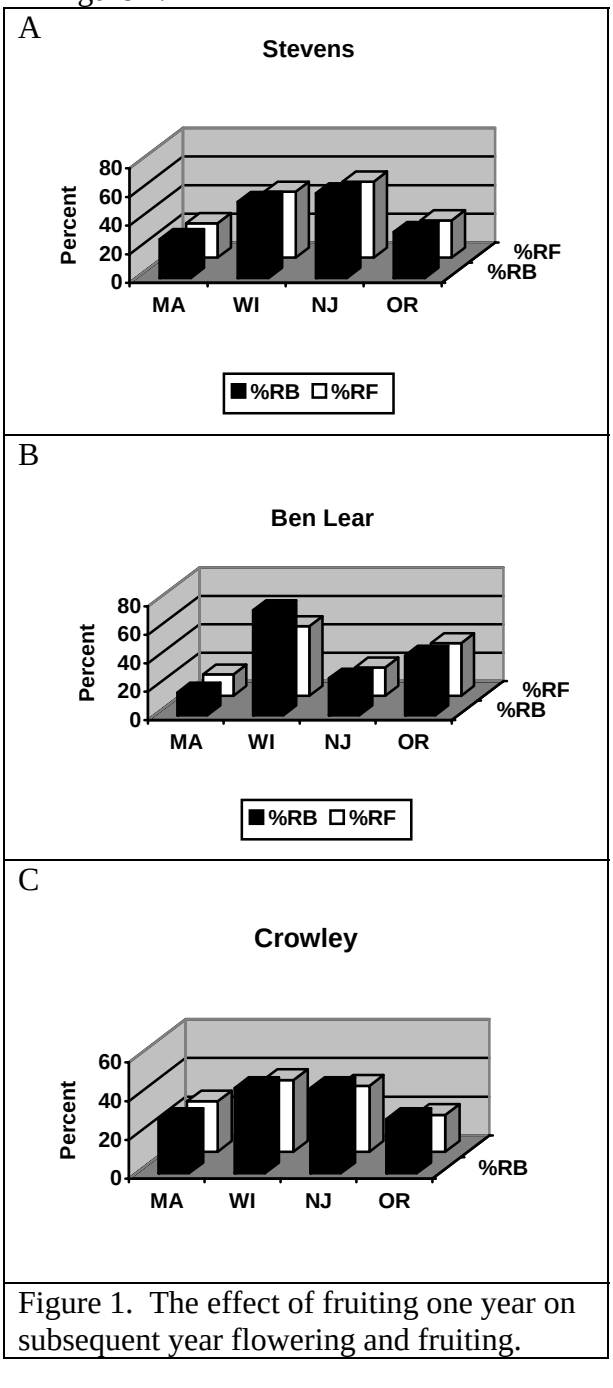

Figure 1. The effect of fruiting one year on subsequent year flowering and fruiting.

For uprights that fruited in 1989 the percent return bloom ranged from 74% for Ben Lear in Wisconsin to 16% for Ben Lear in Massachusetts (Fig 1B). Percent return fruit ranged from 49% for Ben Lear in Wisconsin to 15% for Ben Lear in Massachusetts (Fig. 1B). Most of the values for return fruit were between 25 and 50%. This suggests that individual uprights that produce fruit one year are unlikely to produce fruit the following year. In this study OR and MA were least likely to have return fruit set while WI and NJ were the most likely. That may have reflected environmental conditions during 1989 and 1990. Within each state cultivars behaved similarly suggesting that genetics was not significant, at least among cultivars tested in this trial.

A second study was instigated to look more closely at biennial bearing. Only two cultivars were used in this study, Stevens and Ben Lear. In each bed 60 uprights that fruited in 1990 were tagged with vinyl tape and 60 uprights that did not fruit were tagged. After fruit set in the summer of 1991 50 of the 60 tagged uprights were examined for the presence of at least one fruit. The results are shown in Figure 2. Uprights that fruited in 1990 were about half as likely to flower or produce fruit as those that did not for both Stevens and Ben Lear. For Stevens the percent fruit set was the same regardless of the upright condition in 1990 suggesting that other factors control fruit set. For Ben Lear percent fruit set was slightly higher for uprights that did not fruit in 1990 compared to those that did.

Life is always opening new and unexpected things for us. There is no monotony in living to him who walks with open and perceptive eyes. The monotony of life, if life is monotonous to you, is in you, not in the world.

Phillips Brooks

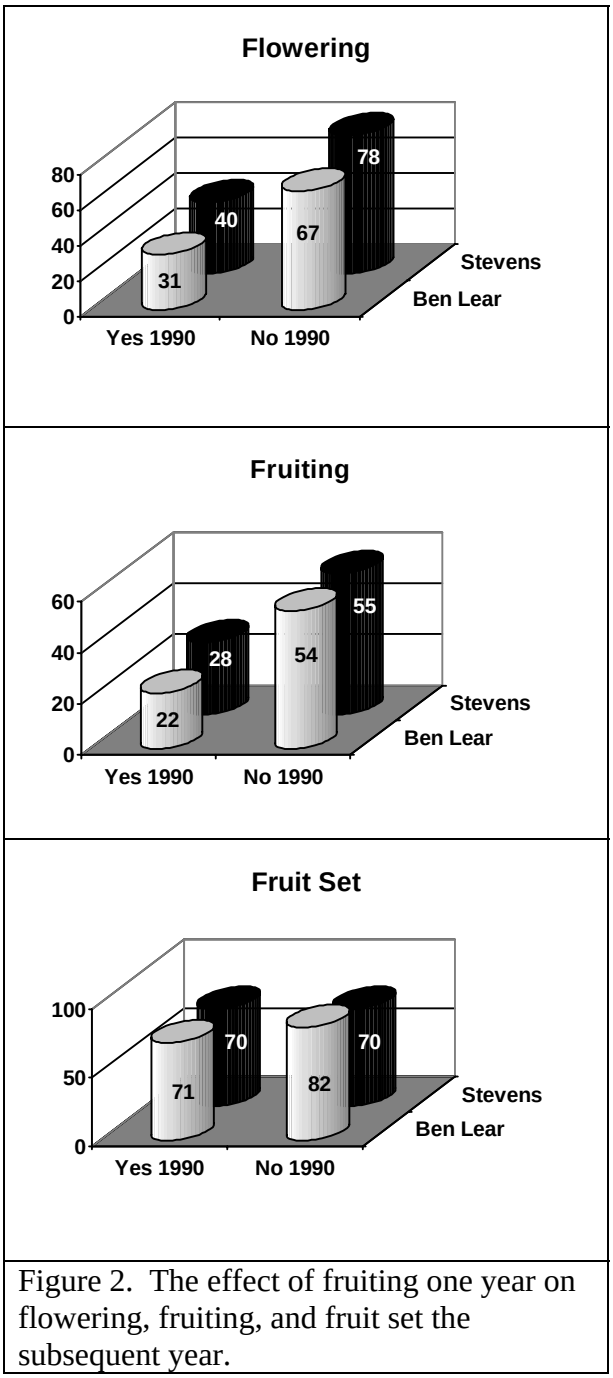

Figure 2. The effect of fruiting one year on flowering, fruiting, and fruit set the subsequent year.

One way growers manage upright density and thus indirectly the proportion of fruiting uprights is through sanding and pruning. Pruning is less common in Wisconsin than it is in other areas. In Oregon, Strik and Poole (1991, 1992) studied the severity and timing of pruning with a commercial mechanical pruner. They found that timing of pruning, December (early) or March (late), was not important. Severity of pruning was important. Moderate or heavy pruning resulted in greater fruit anthocyanin (color) but significantly reduced yields, particularly in the second year. Fruit set and the number of fruiting uprights (primary determinants of yield) was also reduced in the second year. After one year of not being pruned, yields increased substantially for all treatments except the control. So, for the best sustained yield OR growers are encouraged to prune lightly in alternate years.

Sanding is a more common Wisconsin practice. Leroy Kummer studied the effect of sanding and pruning on yields in cranberry (Kummer 1994). He found that sanding and pruning reduced yield the year following the practice, but that yields were enhanced in the subsequent two years. The decrease in yield was largely a result of fewer berries, not smaller berries. Unfortunately, the research didn't examine yield components so we could see what caused the changes in yield, both upwards and downwards.

Increasing the proportion of uprights that flower is a challenge. When upright density is too high yield declines. Individual uprights tend to flower every other year. We now know that there is a genetic component to biennial bearing. Some of the newer cultivars have a greater tendency to rebud than existing cultivars. However, these data are from immature plantings. Time will tell if the increased propensity to rebud will continue in mature plantings.

In this article we learned:

- The two most important components of yield are the proportion of flowering uprights and fruit set.
- Individual uprights tend to bear fruit every other year.

- Sanding and pruning can increase the proportion of fruiting uprights

The next couple of articles in this series will examine fruit set and research that shows what contributes to fruit set.

Teryl Roper, UW-Madison Extension Horticulturist

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ONE STEP FORWARD… TWO STEPS BACKWARDS?

A few weeks ago I learned that a nursery/greenhouse operation in Wisconsin was rearing transplants of a new cranberry variety developed in New Jersey. Some growers in Wisconsin have placed orders and will be planting large acreages to the New Jersey-bred variety. It is exciting to have new, high-performing varieties commercially available. However, as a plant pathologist, it is alarming to know that several acres in Wisconsin will be planted with material that originated in New Jersey, the hot bed of cranberry diseases. I am sure that breeders and propagators at every step of the process have done the utmost to ensure pest-free, healthy plants. However, the fact remains that there is no way to completely eliminate fungi and many other pests from woody propagation material. Most woody crops are at least certified free of viruses before being sold to consumers, but no such program is in place for cranberries. Although viruses are not currently known to cause problems in cranberries, we must not be smug about it. Viruses are nothing more than RNA or DNA (genetic code) coated in protein. They are famous for quickly mutating to increase their host range (this is why world health officials are up in arms about the virus that causes bird flu). Blueberries, which are grown in close proximity to cranberries in New Jersey, have several important virus problems. The cranberry industry has had amazing luck dodging viruses.

For the most part, they have the same slate of pathogens in New Jersey as we have in Wisconsin. Nevertheless, growers in New Jersey typically apply fungicides three to five times per year. Their hot summers exacerbate disease and mild winters allow the pathogens to persist. However, in addition to the warmer climate, two very important pathogens are common in New Jersey but rare or absent in Wisconsin: the fruit rot fungus *Phyllosticta vaccinii* and the root and runner rot water mold *Phytophthora cinnamomi*. I am quite concerned about introducing these pathogens to Wisconsin on cranberry transplants (and on vines, for that matter) and believe growers should share my concerns.

Although some plant diseases can be spread over hundreds of miles by wind (e.g, hurricanes are believed to have blown soybean rust spores from Brazil to the southern U.S.), the great majority of long-distance dispersal of diseases and other pests is by humans, usually through commerce. The cranberry industry has been trading vines across state lines for decades. So why am I now so concerned about the entry of plants from New Jersey? First, I have never liked the idea of trading vines across state lines. But transplants, in comparison to

cuttings, seem especially risky. In 2005, the disease early rot, caused by *Phyllosticta vaccinii,* was discovered at five cranberry marshes in Wisconsin. Plantings at four of these sites were established from greenhouse transplants of the Wisconsin variety HyRed, and at one site from greenhouse transplants of four New Jersey-bred varieties. Because these discoveries came late in the season, scouting of additional sites was on a haphazard basis. However, except for one leaf at one site, we did not find the pathogen at any other locations in Wisconsin. ***The common link among the affected sites is that they were established from greenhouse transplants.***

Why would greenhouse transplants be a source of problems? I do not know for certain, but I have a hypothesis. The chilling period for vines used to establish transplants in the greenhouse is generally many weeks shorter and not as cold as the long, formerly brutal Wisconsin winters. Thus, a pathogen like *Phyllosticta vaccinii* that probably is killed or greatly reduced by cold winters, might easily survive the short, mild chilling treatment used on cuttings to generate transplants. Greenhouse conditions vary, but in general potted woody plants find greenhouses more stressful than their natural environment outdoors. Such stress could predispose plants to pathogens. If just a small amount of *Phyllosticta vaccinii* were present, it might be enough to cause problems on plants while in the greenhouse or later in the field, especially during a hot summer like we had in 2005. Remember—plants can look perfectly healthy but still harbor pathogens. The same sort of logic holds for *Phytophthora cinnamomi*. This serious pathogen of many woody plants in the eastern and southern U.S. is apparently absent in Wisconsin because of our cold winters. But reduce or eliminate the winter, and you increase the risk of pathogen survival.

Okay, so even if the greenhouse transplants have these warm-climate pathogens lurking within them, won't the pathogens die during their first Wisconsin winter in the outdoors? One would hope so, but one must admit that winters have been mild in recent years. In fact, since 1960, the average winter temperature in Wisconsin has increased by six degrees Fahrenheit. This trend may or may not continue in the future. But if it does, and *Phyllosticta vaccinii*, *Phytophthora cinnamomi*, or some other germ we haven't thought of yet becomes part of the Wisconsin landscape, the fungicide bill will increase markedly. Conditions might not favor disease every summer, but you won't really know that until after the fungicides are needed. Therefore, fungicides will be applied "just in case." Nobody wants this—not the breeders, not the greenhouse managers, not the plant pathologists, and certainly not the growers!

With funds provided jointly by Wisconsin Cranberry Board and the UW cranberry breeding program, we will be scouting "at risk" acres in Wisconsin for signs of early rot. Some risk factors include: i) early rot was identified in the planting in 2005; (ii) the planting was established from greenhouse transplants; or (iii) the planting is new and under unusual heat stress. We will not be able to visit every site that meets one of these criteria. However, we will be distributing a scouting guide for early rot this summer. If you see symptoms that resemble the disease, we encourage you to submit a sample to the UW for analysis. More details will be forthcoming.

Patty McManus, UW-Madison.

No one should retire from work. If he does, he will shrivel up into a nuisance—talking to everybody about pains and pills and income tax. When I'm not working, I get tired of myself.

Herbert Hoover

CRANBERRY PEST MANAGEMENT BULLETIN

All copies of Extension Publication A3276 Cranberry Pest Management in Wisconsin were distributed at the 2006 Wisconsin Cranberry School. However, you can also view and print it on-line at: http://s142412519.onlinehome.us/uw/pdfs/A3276.PDF Every Wisconsin cranberry grower should have a copy of this publication and it should be replaced every year.

CRANBERRY FIELD DAY

The annual Wisconsin Cranberry Field Day will be held Wednesday August 9 at City Point Cranberries. Put this date on your calendar and plan to attend to visit with colleagues and to see a very well run marsh. This event is co-sponsored by the Wisconsin State Cranberry Growers Association and the University of Wisconsin-Extension.

SUNLIGHT PROTECTION

Sunglasses are not just a fashion accessory. Sunglasses offer excellent protection for your eyes. Like your skin, your eyes are at risk of damage and trauma if exposed to too much UV radiation or "UV."

When buying sunglasses, you can gauge their effectiveness by checking the swing tag on the sunglasses to ensure lenses block out 95% of UV. Polychromatic or colored glasses are less effective in blocking out UV. Polarizing lenses reduce glare substantially and are favored by many people for comfort, but polarization itself has little effect on the UV-absorbing properties of lenses.

Correct use of sunglasses should begin during childhood, but no one is too old to begin wearing them. If you wear corrective lenses, you should add UV-protective coating or obtain prescription sunglasses if you spend significant periods outside. You can buy protective shades to attach to your glasses or sunglasses that you can wear over your corrective lenses.