

Perfecting Black Currant Production for Machine Harvest

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Introduction

Black currants are well suited for commercial production in the fruit growing region of Bayfield County, WI. With excellent winter-hardiness and frost tolerance, a robust crop can be expected every year. Cultivars with resistance to white pine blister rust, such as “Titania” and “Ben Sarek”, can be grown with no risk to adjacent white pine trees. Market demand for black currants is strong outside the USA, particularly in Europe, but is still limited in the USA. The excellent health properties of black currants and their use in value-added products, particularly beverages, may represent a market opportunity for growers in Bayfield.

Black currants grow as a multi-stemmed bush with asynchronous ripening of the fruit, which grow along the stems in clusters of 3-4 berries. Fruit is borne on 1-year old wood (and older) and, given the growth habit of the bush, tend to get buried toward the center of the bush under the current year’s growth. Heavily laden individual stems on the perimeter of the bush tend to bend and at fruit maturity are perpendicular to or on the ground.

Viable production depends on a cost-effective means of harvest, particularly if the fruit is sold to value-added processors at wholesale prices. Given the fruit presentation, hand-picking is labor intensive and has not proven cost-effective with the labor market in the Bayfield, WI region. Machine harvesting the black currants with a blueberry picker is possible, but has two main problems, the dense bushes and interior presentation of the fruit insulates the berries from the sway action of the harvester and the berries remain attached to the stems, and second, the heavily laden outer-canecan bend to the ground and fall beneath the catch plates of the harvester (Photo 2).

Given the potential for making beverages from Bayfield-grown black currants, it is important to understand fruit quality components such as total titratable acid (TTA) and brix and how they are affected by cultivar and harvest timing. Black currants are used for beverage making elsewhere in the world, but the fruit quality of black currants grown in the unique climate of the Bayfield area is unknown.

A series of black currant management trials were conducted from 2007 to 2010 to evaluate the affect of harvest timing on black currant brix and TTA, and pruning and trellising strategies on mechanical harvest efficiency.



Photo 1. Mechanical harvest of black currants is possible with a blueberry harvester shown here. On-going research is helping develop currants as a viable crop for Bayfield growers.



Photo 2. Black currant fruit is positioned the length of the cane and in large bushes can be buried in the interior of the bush, making machine and hand harvesting difficult.

Methods

Production

“Titania”, “Ben Sarek”, and an unnamed Scottish variety (D-16-6-64) of black currants are grown on approximately ½ acre near Bayfield, WI. The “Titania” and “Ben Sarek” plants were planted in 2005. The Scottish variety was planted in 2007. The planting is arranged in four rows of “Titania” with a fifth row of the Scottish variety. “Ben Sarek” is mixed with “Titania” as every seventh plant within each of the four rows. The plants are grown in sod culture with annual applications of mulch to the row with grass sod in the row-middles. The plants are drip-irrigated and are fertilized annually with 15 lbs of N per/acre. Renewal pruning is done annually to remove all 4 year old canes while retaining an even mix of 1, 2, and 3 year old canes. Mature bushes typically are thinned to 12-18 total canes.

Fruit Quality Trials

In 2007 and 2008, berries were harvested from the middle two inches from one randomly selected cane from a minimum of six randomly selected “Titania” bushes within each row. For “Ben Sarek” the berries were harvested from one randomly selected cane from each of a minimum of three randomly selected bushes within each row. The Scottish variety was sampled only in 2008. For each variety and row, a total of approximately 1 cup of berries was harvested for each sampling date. In each year, sampling began at veraison and continued up to two weeks after the main harvest. Harvest of the planting was done with a BEI blueberry harvester (Photo 1), once 95% of the berries had turned black, but before more than 5% had started to soften. The plants were then hand-picked to remove fruit missed by the machine. A minimum of three plants per row were left un-picked to accommodate fruit sampling after the main harvest.

For each sampling date, the berries were put in plastic sandwich bags, transported in a cooler, and frozen within one hour of harvesting. The berries were thawed at room temperature and pureed with a blender. The four samples (one for each row) were combined for each variety. Thus, despite true sub-sampling for the berry harvest, there is not replication in the Brix and TTA data for each sampling date. The juice was separated from the pulp using fine mesh poly-filter bags. To determine total titratable acid (TTA), a five mL sample of the juice was diluted with 50 mL of distilled water. pH of the diluted juice was measure with a pH meter. Phenolphaline was added to the diluted juice. The sample was titrated with 0.1N NaOH until color change. Brix of the undiluted juice sample was determined by using a refractometer.

Pruning and Trellising Trials

Beginning in 2008, each of the Titania-Ben Sarek rows received a pruning and trellising treatment. The flat fan system was trialed from 2008-2010. Three wires at 24, 36, and 54 inches from the ground were run the length of the row and the canes were tied to the wires. As with standard pruning, during the dormant season the 4 year old canes were removed and an even mix of 1-3 year old canes were retained with priority given to the most upright canes. Photo 3 shows the trellis wires and plants at the end of the growing season in October. The two-wire system was used from 2008-2010 and consisted of a single wire on each side of the



Photo 3. Flat fan trellis system with canes fastened to three wires 24, 36, and 54 inches from the ground.



Photo 4. Two-wire system with canes squeezed between two wires, one on each side of the plant. The system was more effective when the wire were 36” high instead of 12”



Photo 5. Ring system with the canes bunched together with a piece of twine to maintain a more upright growth form.

row tied to each other to squeeze the canes into a 6-12" space (Photo 4). The wires were 12" from the ground in 2008 and 2009 and 36" from the ground in 2010. The ring system was trialed in 2010 using twine or wire rings to encircle each plant and pull it tight to force all the canes in an upright position such that even with heavy crop loads, individual canes remain above the catch plates of the harvester. (Photo 5). In 2008 and 2009, a hedging system was trialed where the tops of each plant were headed to shorten the stature of the plant and reduce the chances of canes bending to the ground. In all three years, one row was managed with renewal pruning only, as the control.

Results and Discussion

Fruit Quality Trials

Figures 1 and 2 show the Brix and TTA for "Ben Sarek", "Titania" and the unnamed Scottish variety for 2008. For all three varieties the TTA and Brix varied considerably from one sampling date to the next, with no clear trend through the harvest period. The same was true for 2007 (data not shown). The variability may be due to sampling error, but could also be due to differences in cloud cover, temperature, or other weather variables that affect fruit quality from day-to-day.

It appears that varietal differences in Brix and TTA may be a more reliable and consistent way for wineries to obtain currants of given Brix and TTA. Figures 3 and 4 show the average TTA and Brix through the harvest window for "Titania", "Ben Sarek" and the unnamed Scottish variety for 2007 and 2008. In 2007 there were nine sampling dates and in 2008 there were ten dates. On average, "Ben Sarek" tended to have higher acidity and lower sugar content than "Titania". The Scottish variety tended to have a similar sugar content to "Titania" but with less acidity. Consistent with the averages, "Ben Sarek" tended to consistently have lower sugar content than "Titania". The Scottish variety consistently had a lower acidity than both "Ben Sarek" and "Titania" (Figures 1 and 2).

Pruning and Trellising Trials

Table 1 shows the black currant yields in pounds per row for each trellis system for each year. For the three years of the trials, the flat fan trellising system was most conducive for machine harvest with an average of 87.5% of the fruit harvested by machine. The reduced total yield from the flat fan system in 2008 compared to the control was likely due to the combination of aggressive pruning necessary in the first year to train the plants to the trellis and telegraphing of the sway action from the harvester down the row that dropped fruit ahead of the harvester. In 2009 and 2010, the flat fan system yielded as much as the control. The drawback for the system is the considerable labor and material expense to construct the trellis and fasten each cane to the three wires each year.

The two-wire trellis improved machine harvest efficiency in 2009 and 2010, especially when the wire was raised from 12" to 36" in 2010. The two-wire will require more refinement. Forcing the growth into a narrow space resulted in a portion of a row leaning into the row-middle. The ring system trialed in 2010, was also effective, and required only slightly more labor than the two-wire system.

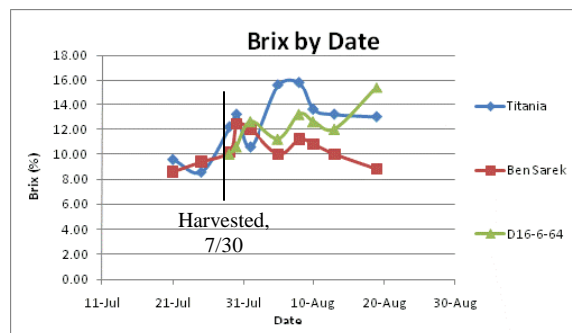


Figure 1. Brix for three black currant cultivars by sampling date in 2008.

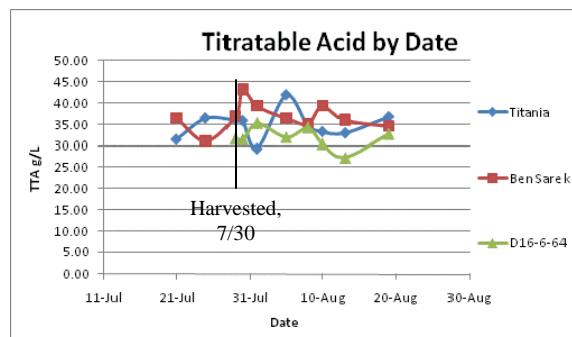


Figure 2. Total titratable acid for three black currant cultivars by sampling date in 2008.

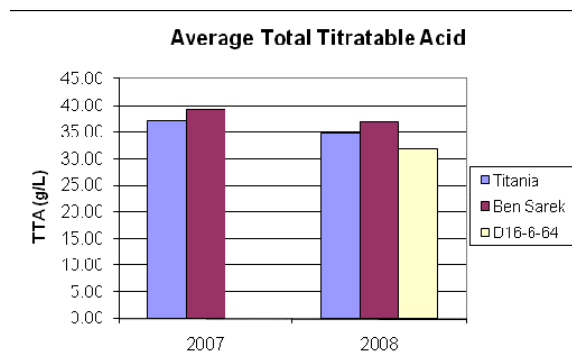


Figure 3. Total titratable acid for three black currant cultivars averaged across sampling dates in 2007 and 2008.

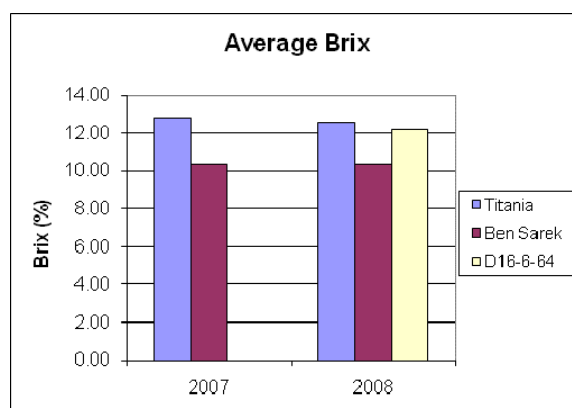


Figure 4. Black currant Brix for three cultivars averaged across sampling dates in 2007 and 2008.

The hedging system, although requiring no trellising reduced total yields compared to the control with no consistent improvement in machine harvest efficiency and, thus, was not continued in 2010.

This trial shows that putting the canes in a more upright position improves the efficiency of machine harvesting black currants. The ring system is currently the preferred method. Machine harvest efficiency is as good as the flat fan and two-wire systems. There is no telegraphing of the sway action from one plant to another such as in the flat fan system and there is no potential for the entire row to lean as in the two-wire system. Breeding plants with stronger, taller, and more upright canes could also achieve the same objective.

These trials have shown that up to 5000 lbs/ac of black currants with a brix between 10 and 13% and a TTA between 32 and 39 g/L can be produced in Bayfield.

System	2008			2009			2010		
	Machine	Hand	% Machine	Machine	Hand	% Machine	Machine	Hand	% Machine
Flat Fan	196	59	76.9	255	28	90.1	103	5	95.4
Two-Wire 12"	168	174	49.1	186	57	76.5	N/A	N/A	N/A
Two-Wire 36"	N/A	N/A	N/A	N/A	N/A	N/A	100	25	80.0
Ring	N/A	N/A	N/A	N/A	N/A	N/A	109	10	91.6
Hedge	125	61	67.2	150	82	64.7	N/A	N/A	N/A
Control	172	136	55.8	203	75	73.0	49	35	58.3

Table 1. Black currant yields in lbs per 300' row for each trellising system for the years 2008-2010.

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