Red Currants and Gooseberries: Extended Season and Marketing Flexibility with Controlled Atmosphere Storage

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Ribes is the group of commercial berries that is most adaptable to long-term storage. Certain cultivars of gooseberries and red currants have been held for as long as three months at 0°C and the storage period can be increased with controlled atmosphere storage (CA). At present, the ribes industry is developing again in the US, and demand is growing. In spite of the growth, producers often experience a backlog of fruit during the peak production season in the Northeast, and lower prices due to excess inventory. Controlled atmosphere storage (CA) is a tool that can help to level out supply and prices and make currants and gooseberries available over an extended season.

Successful CA storage of currants and gooseberries is dependent on optimal cultural practices and acceptable weather during the growing season. Healthy berries (defined as full green strigs of disease-free red ripe berries) going in to CA will have a longer storage life with higher quality than berries that have been stressed or subject to pathogens before storage. This article will first focus on cultural practices and storage techniques as the key parameters that can be controlled by growers. The impact of weather during the growing season is considered, and then recommendations are made for storage practices that match the weather conditions encountered during the year.

Cultural Practices

Training and Pruning - Cordon training is recommended for getting into production quickly, and for growing the best quality fruit. One way to get rapid cordon development is to grow the plants for one year as a bush to develop the root system. The cordon branches are selected in the following year, and forced up the stake by taking advantage of the developed roots and providing plenty of water and nutrients. The goal is to keep the plants very vegetative so that roots will be nourished during the growing season in anticipation of pushing the next year's growth. These plants also have plenty of leaves to nourish developing fruit.

Most pruning is done during the summer. Spent branches that have produced fruit during the fruiting season are removed after harvest as well as any strong, upright branches coming from the base of the plant. Long branches are tipped in the greenhouse and the tip of any long fruiting branch growing outside can be cut back to four leaves to encourage new branches near where the fruit was borne in the current year. Winter pruning simply involves thinning out excess branches, leaving only two to three medium-sized branches per cordon. Summer and winter pruning regulate the size of the fruit crop and encourage vigorous vegetative growth to nourish the crop and roots. Light penetration is improved through proper pruning which improves fruit quality and keeps inner parts of the plant from dying out.

Finally, younger healthier plants produce fruit that can be stored longer. For example, in general terms, three-year-old plants might produce fruit of a quality that can be stored until April, while five-year-old plants produce fruit that can be stored until November. The more uniformly healthy a planting is kept, the higher the potential for longer CA storage of fruit from that block. Pruning practices help to keep plants young and uniform. Growers should be aware of the condition of each cordon, and should replace them if they stagnate. Blocks should be replanted as needed depending on their health and vigor.

Soil Quality - Choosing well-drained, friable soil is critical to having optimal root development. Freedom from excess water, and the presence of sufficient oxygen are necessary along with the availability of abundant nutrients, especially NPK.

Water - Preventing water stress on plants is critical for obtaining a quality crop. Remember that water is needed for

Figure 1. Trellised red currant in the greenhouse.

Figure 2. Harvested red currants

Figure 3. Packing red currants

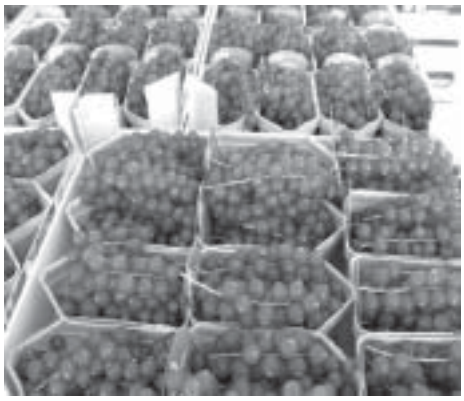

Figure 4. Packed red currants

Figure 5. Boxes of red currants in CA storage. Bag is sealed at base of pallet with sensing and gas-feed lines attached.

mineral transport, so a lack of water could also translate into a lack of nutrients. Water is particularly important during the first six weeks of crop development. Stress during these first weeks can cause early ripening, resulting in early seed development and fruit reddening with bigger fruits, and strigs that turn yellow. The result is fruit that has less potential for long-term CA storage. The optimum relative humidity for growing currants is 60-70%. Ideally the relative humidity would not drop below 40%

Weed Control - Weed control is important to help prevent water and nutrient stress in plants. In addition, good weed control helps improve air ventilation, and reduces disease potential.

Disease Control - Botrytis is the main disease that can cause fruit spoilage. A spray program should be considered if Botrytis has been or becomes a problem. The berries are most susceptible during flowering and become more resistant after flowering. The stem and flower end of the berry are most susceptible to infection. In Holland, it is assumed that 50% of the spray protection is lost after about 25 mm of rain, and another application of fungicide is made. When plastic roofs or greenhouses are used, much less spray is used.

Climate Control - The use of greenhouses is a way to control free water, humidity, light, temperature, and to some extent disease. The value of the crop must justify its use, and this is probably only possible in some cases for an early season crop. Plastic roof structures are a less expensive alternative that can have many of the same benefits as a greenhouse except for humidity and temperature control.

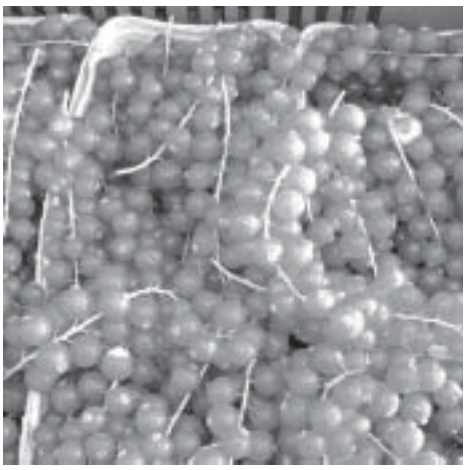

Figure 6. Botrytis causes some loss during storage.

Cultivar Choice - Certain cultivars such as Rovada have the genetic predisposition to long strigs of large-sized berries. Choosing a cultivar that has the genetic capability of producing the quality of fruit one wants is the first step to achieving quality. Cultural practices will help to optimize the potential available to the plant due to it s genetic make-up. Other considerations such as chill requirements, pest resistance, and winter cold resistance are also factors to weigh in cultivar selection.

Impact of Weather

Chill Periods - The proper cultivar must be chosen for the time of year production is desired, and for either greenhouse or outdoor production. This is because each cultivar has somewhat different chill requirements (from about

1,300 - 1,700 hours) which are critical for flower bud development. According to the Utah method, chill requirements are as follows: Junifer (the common greenhouse cultivar) 1500 hours; Rovada 1850 hours; and Jonkeer van Tets , more than 1850 hours. If greenhouse grown, the temperature should be kept between 2-7C (5C ideal) until the chill period has been satisfied. In outdoor production in the Northeast, these chill periods are normally satisfied naturally without problems.

Temperature - The flowering period would ideally have maximum temperatures of 22°C. A minimum of 17-20°C will help to insure better movement of bees. Wind also helps with the pollination process. Excessive heat can burn tender tissue and scar berries, and can also stress the plant. Shading or water sprayed overhead can prevent damage.

Rain - Top irrigation or rain normally help the development of better quality fruit than drip irrigation. If it were economically feasible, placing plastic roofs only for the flowering and ripening phases of production would be ideal. The roofs would be off during the rest of the season.

General CA Recommendations

Harvest and Handling - Unripe berries have a shorter CA storage life than ripe ones. A test can be done to determine the best point at which to harvest. Testing begins four weeks before harvest and is done every few days depending on how warm the temperature is. Twenty-five bushes are chosen to sample, and a cluster from the top, middle, and side of the bushes are picked. Clusters from all plants chosen in the same general location are grouped together (i.e. all tops, sides, middles). The first and last berries on the strigs are pulled and mixed together to get a juice sample to measure brix. The first reading is a baseline reading. Following readings are graphed, and when the brix reading from the last berries of a strig equals the reading of the first berries, and the readings from the inside of the bush stabilizes, fruit should be harvested. No wet berries should be picked, and care should be taken not to bruise or crush berries. Berries are often picked into one quart, cardboard pulp baskets for CA storage.

Placing Into CA Storage - Fruit should be cooled to 0°C with no condensation to begin. They are then placed into a large plastic bag which fits over a pallet that seals the bag on the bottom. Oxygen content is lowered to 2.5-3.0 % by replacing the air with nitrogen. The carbon dioxide level is raised to 20-25 %, and temperature maintained at -0.5 to -0.9 C. More carbon dioxide is used in a year where plants were stressed and strigs are a bit yellow. The cardboard baskets and boxes used help to absorb free water that might result from unwanted condensation. Avoiding rapid temperature changes will help prevent condensation. An RH of 93% is ideal. If plants have been stressed during the growing season, or the fruit is coming from an older or non-uniform block, storage life will be reduced.

Possible Problems

Pale Berries- Berries can lose their bright red color and become pale and appear water-soaked if oxygen levels are too low in CA storage. Picking too early causes the same appearance.

Yellow Strigs- The yellow color results when plants were stressed during their first phase of growth (May and June).

Botrytis- Infections normally take place during flowering, even though the fungus doesn't develop until berries ripen.

Short Strigs- (Last half of strig with no flowers) Short strigs are caused by a lack of chill period.

Berries Are Weak and Burst- Plants probably lacked water in the first growth phase (May-June), and had excess water in the last phase to ripening.

Last Berries Don't Ripen- If the last berries on the strig don't ripen, this is usually because the plant did not have enough leaf area. Pruning and water/fertilization can help improve this situation.

Gooseberries

The CA storage techniques for gooseberries are not as well tested and developed as for red currants. Some cultivars can be stored at 0°C for at least three months without CA if harvested at a green, mature stage. The berries will ripen off the plant at room temperature, and also over a more extended time period in cold storage. They are sensitive to ethylene, and ethylene will speed the ripening process. Two approaches could be taken with gooseberries. One would be to harvest at a green mature stage and place in CA conditions similar to red currants. Ethylene scrubbers could likely extend storage life. A second approach not yet tested might be to harvest at a 3/4 ripe stage and treat with MCP. Dutch researchers are planning to do further research with the second option.

Resources

A more complete guide to CA storage of Ribes will be available this spring from Cornell Cooperative Extension of Columbia County, 518-828-3346. A general book on Ribes production is also now available. *Currants, Gooseberries, and Jostaberries A Guide For Growers, Marketers, And Researchers In North America* by Danny L Barney, and Kim Hummer.