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Increasing cherry fruit size

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INTRODUCTION

Consumers are seeking bigger cherries and, according to market returns, the bigger the fruit the bigger the cheque from the agent. Although the consumer may still accept a 24 mm cherry, larger fruit brings higher returns—a factor that may determine the future viability of an orchard. For mid to late season fruit a 5 kg box of small 22 to 24 mm cherries sells for \$20 to \$25

whereas large 26 to 28 mm cherries sell for \$35 to \$40 per 5 kg box (gross). When production costs are taken into account the differences in net returns and profits are even greater. Assuming costs of about \$14 per box, net returns for small fruit are only \$5 to \$10 compared with \$20 to \$25 for large fruit.

However, larger fruit can come at a price, as the biological potential is equally as important

Moderate fruit set on a cherry tree on Colt rootstock. The fruit number, fruit size and leaf growth are well balanced.



as market returns. As with all fruit trees the cherry tree can only produce a specific quantity of fruit. This quantity can consist of either a large number of small fruit, a small number of large fruit or, preferably, a medium number of medium to large fruit. Achieving this optimum balance can be difficult, but the following suggestions can help to manipulate cherry trees into producing a desired fruit size range.

WHAT CAN CAUSE SMALL CHERRIES?

Small cherries are not inevitable (unless the wrong variety was chosen). Some of the main causes include:

- wrong variety / rootstock selection

- inadequate or inappropriate pruning
- too many fruit on smaller trees—lack of balance (i.e., too much fruit with too little leaf area)
- low tree vigour
- lack of water at critical times
- heat stress.

CROP LOADING—GETTING THE BALANCE RIGHT

Optimum crop loading is an achievable goal. Modern orchards are more uniform, healthier and more yield predictable than in the past. In addition, cherry orchardists are gaining more control over climatic factors with protective structures and treatments. While a pollination

Table 1. 15-year-old Ron’s trees at Young (2000–2001) after a moderate pruning.

Crop estimate	Light	Light–medium	medium
Tree size	Med–large	Med–large	Med–large
Yield per tree (kg)	14.9	17.3	20.3
% of fruit larger than 24 mm	53	31	19
Gross market return (\$ per tree)	82.44	81.02	89.71
Net return (\$ per tree assuming costs of \$14 per box)	44.28	38.30	31.11

Table 2. Four-year-old Sweetheart trees at Orange (Note: this is a specific/individual situation but it clearly shows the principles of crop loading)

Orchard production			
Crop estimate	light	optimum	heavy
Tree size	med	med–large	Small–med
Butt circumference (cm)	28	32	23
Trunk cross-sectional area (cm ²)	62.2	81.3	44.1
Yield per tree (kg)	6.2	18.9	16.8
Av. cherry size (g)	9.3	9.3	7.7
% fruit larger than 26 mm	80	70	23
Fruit number	667	2041	2194
Crop load model			
Crop load (number of fruit per cm butt circ.)	23.8	63.8	95.4
Crop load (number of fruit per cm ² TCSA)	10.7	25.1	49.8
Yield efficiency (kg per cm ²)	0.100	0.233	0.381
Economics			
Gross market return (\$ per tree)	58.88	167.90	120.25
Net return (\$ per tree assuming costs of \$14 per box)	40.68	113.20	70.85

failure, frost or unexpected heat wave will still disrupt cropping, cherry production is losing some of its uncertainties. The following two examples provide some insight into what can be achieved with accurate crop loading. In determining fruit size, Table 3 presents some useful comparisons.

With only a 30% difference between the highest and lowest crop loads, gross returns in these examples were very similar but net returns from the light cropped trees were 40% higher than for the heavy cropped trees.

These trees show some important principles in crop loading cherry trees:

- It is important to match the crop to the tree size.
- There is an upper limit for fruit size. Lighter crops will not further increase this size.
- An ideal for this variety/location interaction appears to be 25 cherries per cm² TCSA (trunk cross sectional area) and about 0.25 yield efficiency.
- Getting the right result does involve some counting and measuring. Some simpler methods using buds, spurs and branch length are being tested.

Table 3. Useful conversion from fruit diameter to fruit weight to the US packing row counts.

Fruit size diameter (mm)	Fruit weight (g)	US sales designation (row)
20.6	4.2–5.3	13 row
21.4	5.4–7.0	12 row
24.2	7.1–8.6	11 row
26.6	8.7–10.6	10 row
29.8	10.4+	9 row

Measuring crop load and tree canopy

It is critical for accurate crop loading to use a simple and meaningful measure of the amount of fruit that a cherry tree should and can size to an optimum pack-out for market. The following tree and fruit measures will assist in crop load decisions.

Tree butts

These (measured about 10 cm above the graft union and permanently marked with paint) are a simple and accurate measure of tree growth. Up until about 8 years old the continuing butt growth is keeping pace with fruit load. After

Heavy fruit set results in small to medium fruit on trees grown on Gisela 6 rootstock.



this age the butts will keep growing but fruit production will plateau.

Canopy volume (CV)

Maximum CV can be reached between 4 and 10 years of age depending on tree density. CV, in contrast to butt size, reaches a maximum at about 2 to 3 years before production plateaus. For older trees CV is a better bench mark for crop load. Calculations are based on simple geometric forms such as cones and 'boxes'.

Leaf area and number

These measures are physiologically accurate but more difficult to measure. Some rules of thumb in terms of visually assessing the leafy canopy are being developed.

Crop load (CL) and yield efficiency (YE)

Both CL and YE use butt circumference or butt area measurements to express the number of fruit (CL) or the weight of crop (YE) as a response to tree size. These measures are excellent for younger trees but canopy size is more accurate for older trees (more than 8 years old).

GETTING THE RIGHT START

Establishing the orchard with the right variety and rootstock in the right location and with the best practice orchard design is the essential first step.

Variety

Some varieties such as Lapins will produce large fruit and good yields. Other varieties such as Summit and Sunburst produce large fruit because of very light crops.

The critical points in choosing a variety are potential fruit size and cropping ability. Although climate and soil affect the variety performance some cropping characteristics are always present.

Van, Stella, Ron's, Chelan and Merchant can all over-crop with a drop in fruit size. Sir Tom, Tieton and Regina can under-crop although the larger fruit size can compensate.

It is important to note that many aspects of growing cherries such as pruning, rootstocks, pollination and irrigation can modify or overcome some of these varietal characteristics.

Fruit size is just one criteria to use in choosing a variety. Although the descriptor in nursery

catalogues, for example, 'large fruit for the time of season provided it is not over-cropped,' appears vague, it is often true when all the other factors are considered.

Rootstock

The choice of rootstock is part of the overall management package for a cherry orchard, fruit size being just one of the criteria. For a particular climate, soil, variety and training system the management inputs are designed to achieve good cropping levels with good sized fruit unless the wrong rootstock was chosen.

The interaction of rootstock and variety is critical. A good example is the propagation of shy varieties with precocious stocks and precocious varieties with more vigorous stocks.

Following are examples of how the choice of a particular rootstock impacts on cropping and fruit size:

- Gisela 5 and, to a lesser extent Gisela 6, will produce small over-cropped trees with small fruit if they are planted in a hotter, drier climate with limited irrigation and poorer soils.
- Mahaleb needs a deep, free draining soil that is free from *Phytophthora*, otherwise crops are heavier, the tree is small and fruit is small. (St Lucie 64 and 405 have more flexibility.)
- Colt produces a larger tree and cropping is usually precocious but fruit set will decrease as the tree ages. This prevents over-cropping and maintains good fruit size. Colt is still a good stock for many sites.
- The Geissen or GM series provides an interesting response as a dwarfing rootstock. Whereas most dwarfing rootstocks produce trees that will severely over-crop if not pruned well, Damil (GM 61) induces a reduced fruit set resulting in good fruit size.

Tree design

Tree shape and pruning regimes can affect crop load and fruit size. Vase and bush systems use more severe pruning to achieve their form. This encourages more vegetative growth and discourages flower buds. Central leader trees, spindles and trellised systems encourage early fruiting and spur development with an associated risk of over-cropping. Small fruit is inevitable if trees are not pruned adequately.

FRUIT DEVELOPMENT PERIOD (FDP)

Cherry production is characterised by rapid leaf development, rapid fruit development and a long post-harvest period. Without well-balanced crop loading fruit size is reduced. Critical periods include:

- 50 to 60 days from blossom to harvest for early to mid season varieties; and 100 days for late season varieties.
- 30 days after bud burst for full leaf development
- Shading occurs from 30 days after bud burst reaching a maximum at 60 days.
- 25% of final fruit weight is gained in the last week.

Leaves—the critical supporting act

Leaves, through photosynthesis, produce the structural carbohydrates and sugars that are critical for the growth of a cherry fruit. Not only do they produce the food but they also aid in mobilising nutrients and reserves from the rest of the tree and the soil. While leaves are recognised for their pivotal role in growing bigger and better cherries, growers will need to know if there are enough, whether they are healthy and that the leafy canopy of a cherry tree is not limited in its ability to size the fruit.

The leafy canopy can be viewed in a number of ways.

Light

Cherry leaves become photosynthetically 'competent' earlier in the season than other

species. This is what enables the cherry tree to size a mature crop in a very short growing season. This activity occurs despite a relatively small leaf area and cooler weather. The young fruit are fed by the spur leaves next to the fruit, other spur leaves, some of the newly emerged leaves and reserves in the root system and trunks.

Lack of light is very detrimental. Even a 10 to 15% reduction will reduce fruit set and fruit quality especially sugars and flavour. Although fruit size is not directly affected, there are two indirect effects. First, the reduced fruit set results in fewer fruit, which can reduce the number of small fruit. However, the second indirect effect can negate this size improvement. Orchard economics often demand a 'once over' harvest. Fruit in shaded areas will be picked at least five to seven days early and will not reach their full potential size or optimum sugars resulting in a tart or sour taste.

Note: 'Shade leaves' are larger and thinner. These are a good indicator of poor light, as are longer and thinner shoots. A dappled rather than a solid dense shadow under the trees indicates good light penetration.

Leaf:fruit balance

There is no absolute figure for this ratio in cherry trees but one study in Washington in 1987 showed that by increasing leaf area up to 100 cm² per fruit, fruit size continued to increase. In practical terms, that equates to two healthy leaves per fruit.

One useful orchard guide is the visibility of fruit. If you can see 20% of the crop among the leaves the balance is good but if most of the fruit is visible the tree is over-cropped and unbalanced and the cherries will not reach their full size potential.

Pruning—managing the leaf canopy

Regular pruning is essential. It not only develops the optimum canopy but it also thins potential fruit buds to maximise fruit size. The following pruning suggestions will help:

- Four-year-old spurs and older produce smaller fruit. Renewal pruning and removal of old spurs will improve fruit size.
- Remove shaded wood on the inside of the tree.
- Thin out two and three year old well-spurred branches.

ALWAYS READ THE LABEL

Users of agricultural or veterinary chemical products must always read the label and any Permit, before using the product, and strictly comply with the directions on the label and the conditions of any Permit. Users are not absolved from compliance with the directions on the label or the conditions of the Permit by reason of any statement made or omitted to be made in this publication.

DISCLAIMER

The information contained in this publication is based on knowledge and understanding at the time of writing in September 2004. However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up-to-date and to check the currency of the information with the appropriate officer of NSW Department of Primary Industries or the user's independent adviser.

- Summer tipping after harvest is worth trying.
- Head two- and three-year-old branches to reduce buds.

Cultural management

Establishing the right balance between leaves and fruit provides the potential for maximising fruit size. Managing water and nutrients will ensure the potential is fulfilled. Best practice principles are the foundation, with the following points being particularly relevant:

- Strategic water (such as deficit irrigation) can be used on later varieties in late districts. Summer rainfall can reduce the stress response but the strategy is still worthwhile.
- Fertilising after harvest will increase nutrition available to buds instead of leaves.
- Healthy flower buds produce larger flowers and potentially larger fruit.

Thinning

As with all stone fruit, basic crop thinning is achieved by pruning. In fact, in a commercial situation that is the only way cherries are thinned as the short growing season, small fruit size and large number of fruit per tree has stopped any thought of fruit thinning by hand. This may change with some developments in chemical thinning. Blossom dessicant chemicals used for other deciduous fruit crops may help in reducing crop load. Preliminary testing is promising particularly in removing fruit from around the growth ring at the base of the current season's growth.

GETTING IT ALL TOGETHER

The secrets to success in sizing cherries are:

1. Know your tree

- Select about 6 typical trees well within the block to study and monitor.
- Count and record fruit and measure butts (mark permanently about 10 cm above graft).
- Trees can be segmented into branch units to simplify counting.
- Look out for signs of shading (solid shadows, weak growth, thin leaves).

2. Manage your tree

- Fine tune irrigation scheduling.

- Delay fertilisers till after harvest.

3. Prune your tree

- Don't be afraid but keep the balance.
- Use summer tipping.
- Balance spurs and shoots.

4. Balance your tree

- Phase out old spurs.

5. Know your market

- Check market returns.
- Reassess economic data.

Getting the right crop load and producing the most sought after cherries is critical and very achievable. The concepts are basic and the management tasks are simple, cheap and very cost effective. As these concepts are continuing to be developed, growers may contact either the author or Department of Primary Industries district horticulturists at Orange and Young for further information.