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Planting Decisions from the New Zealand Perspective

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The rootstock, planting distances, site vigor and cultivar factors are up for discussion at early stages in the planning program. Unfortunately, there is no recipe which can be followed so each of these factors needs to be carefully considered when designing the new orchard planting. The skill lies in integrating all these factors and then adopting management policies which fit the situation.

Whatever planting system is chosen, the final result will be totally dependent on how well the trees fill their allotted space with balanced growth and strong healthy fruit bud. Its long-term future will depend on how well you maintain the optimum vigor/cropping/light interception balance throughout the life cycle of the block. For financial success, the main focus needs to be sustainable production of high quality fruit at maximum yield.

Relative to the benefits of maximizing income through high orchard performance, any benefit which can be obtained by shaving costs is minimal. This does not mean spending extravagantly on exceptionally high tree densities or fancy trellis systems. But it does mean spending what is necessary to get the basics right.

PLANTING DISTANCES

This is a controversial question at any time. Largely it depends on the likely vigor of trees planted in a particular site. Vigor varies with rootstock/interstock, scion, topsoil depth and whether or not the site is a replant one. A certain amount of vigor manipulation is possible so each rootstock/scion combination has a range of tree density over which it can be managed reasonably successfully.

Between-row spacing also has to take machinery access into account as well as tree vigor. With the present standard New Zealand bin of 1.07 x 1.5 m (3.5 x 5 feet), spacings below 4 m (13 feet) between rows become very difficult and, if you want an easy life as a tractor driver, 4.5 m (14.7 feet) between-row spacing becomes about the minimum acceptable distance when orchard access is taken into account. If you want narrow rows, you need to adopt a smaller bin. In-row spacing, as far as I can see, should not be less than twice the distance of 2 years' extension growth. At twice 2 years' extension growth, the side branches along the row from adjacent trees will be touching at the end of their second growing season in the orchard and therefore filling their allotted space. As a rule, you do not carry good fruit bud until the wood is 2 years old which means that it will be in the third leaf before sufficient crop load can be applied to bring vigor under control.

ROW DIRECTION

Row orientation also affects in-row spacing. Where row direction is more or less north/south, in-row spacing can be close because each side of the row gets equal levels of light. Once rows approach east/west direction, the south (north in the northern hemisphere) side of the tree becomes very shaded and produces poor quality fruit unless there is sufficient gap between the trees to allow good light to get through to the shaded side of the row. The best way to achieve this is by having greater in-row distance to give light access to the shaded side of the tree. If you do not, it is likely that most of the fruit will be carried on the sunny side of the tree where it has a high risk of becoming sunburned.

To minimize sunburn problems a row orientation that allows the sun in the early afternoon, which is the hottest part of the day, to shine straight down the rows will give the least amount of problem from sunburn. A stake or post will cast a shadow which can be used to check row orientation. In the winter the shadow cast between 1:30 p.m. and 2:00 p.m. will give the optimum row direction to minimize sunburn problems. During the daylight saving period, look at the shadow between 2:30 p.m. and 3:00 p.m. for optimum row direction.

TREE HEIGHT

With tree height you need to compromise between yield efficiency and ease of working and spraying. There are a number of studies which indicate that for optimum yield the ratio between tree height and between-row spacing should be in the range of 0.8:1 to 1:1. With high light levels and relatively low latitude in New Zealand compared to northern Europe, ratios of 1:1 are more suited to our situation if yield is to be maximized. In fact if you have badly misjudged tree vigor, it may be necessary to exceed the 1:1 ratio to obtain satisfactory balance between vegetative growth and cropping.

Trees to about 4.5 m (14.7 feet) height are relatively easily worked from 8-rung ladders which means that, in terms of tree height, 4.5 m between-row spacing is about right. With dwarf rootstocks, between-row spacing needs to be less if tree height to between-row ratios of 0.8:1 or 1:1 is to be achieved, otherwise too much of the orchard is devoted to tractor access.

For New Zealand conditions the optimum tree dimension, if we had the right rootstock range (generally MM.106 in New Zealand) and sufficient knowledge of behavior of the scion/rootstock combination under the conditions at which they are going to be grown, would be 2 to 2.5 m (6.6 to 8.2 feet) spread and 4 to 4.5 m (13 to 14.7 feet) height. These trees would be grown in the range of 890 to 1250 trees/hectare (350 to 500 trees/acre).

Where excess vigor is likely to be a problem, e.g., MM.106 on new soil, M.793 on fertile replant sites, we need to think more conservatively on tree spacings and here 5 x 3 m (16.4 x 9.8 feet) is possibly the safest option.

With dwarfing rootstocks, particularly Mark and M.9, tree densities need to be in the range of 1500 to 2000 trees/hectare (607 to 810 trees/acre), i.e., 1.65 x 4 m (5.4 x 13.1 feet) to 1.45 x 3.5 m (4.7 x 11.4 feet) in order to fill their allotted space efficiently. Once you drop below 4 m between rows, we are committed to narrow equipment, including bins. Also with dwarf trees, you drive between rather than under the trees because it is difficult to get sufficient tree height to pass under the lower branches.

EARLY YIELDS CRITICAL

With any new development, or a replant situation, early yields are critical to the financial success of the venture. There are a number of ways of cracking this nut. Up to a point planting higher density orchards will achieve this objective but it can be expensive. Also as the orchard matures, high densities may lead to real orchard management problems if vigor cannot be controlled and shadeout from overcrowding occurs.

In my opinion moderate density orchards, if well managed, can match higher density orchards for production and, when mature, are much easier to manage. This path also enables us to stay with woolly apple aphid tolerant rootstocks rather than turn the clock back 100 years and move back to rootstocks which lack woolly apple aphid resistance. (Editor's note: All MM. rootstocks are resistant; root infestations with susceptible rootstocks are not generally a problem in North America.)

The first step in obtaining high performance from a moderate density orchard is to plant a large, well-grown tree. I am aware of a number of blocks which have been planted with 2-year-old scion trees. These trees already have a good lower branch structure in place. When planted they will go about three-quarters of the way toward filling their "in-row" space with fruiting wood if placed around 2 m (6.5 feet) apart in the row. The transplanting shock also tends to reduce tree vigor and encourages flower development with those varieties that are tardy at producing flower buds. With this type of tree I have seen about half a box of fruit taken in the first growing season without compromising tree development. In the second growing season, yield can be around 1 to 1.5 boxes and I suspect, by year three, 2.5 boxes a tree would not be impossible.

If you planted at 2 x 4.5 m (6.5 x 14.8 feet), the first year production would be 550 boxes per hectare, with 1650 boxes per hectare in the second year and somewhat above the national average at 2775 boxes in the third leaf.

The key is to plant a big tree and keep it growing. Early planting is preferable, by mid-July (midwinter in New Zealand) if soil conditions permit. However, I have seen high growth performance from September/October (spring) planted trees where satisfactory irrigation management has been practiced.

WEED, PEST AND DISEASE CONTROL ABSOLUTELY VITAL

Apart from early season water stress, there are two other factors which stop young tree growth stone dead in its tracks. These are weed competition and foliage loss due to pests, diseases or misguided summer pruning. Weed control in the young orchard has to be immaculate to optimize early production. In replant blocks or near established orchards in New Zealand, apple leaf curling midge will devastate new growth if left uncontrolled. Black spot (scab) and powdery mildew are capable of doing a similar job if not controlled. As young tree growth extends well into the autumn, the growth is at risk from leaf curling midge, black spot and powdery mildew until it ceases and the terminal leaves become mature.

At a rough guess, getting the weed and pest and disease control right for the first year in a new planting will probably cost only about NZ $1000 per hectare (US $500 per acre), but will probably more than double tree growth. This means that, in terms of yield performance, well-looked-after trees will more than compensate for going to much higher densities. If good pest, disease and weed control costs only about NZ $1000 per hectare, this amount will buy you only

about another 100 trees which is not going to give you anything like the production advantage possible from properly looking after a smaller number.

PEST AND DISEASE RESISTANCE WHEN CHOOSING ROOTSTOCKS

With the industry movement toward integrated pest management, it is vital that we stay with woolly apple aphid resistant rootstocks. At present, most of our orchard plantings are on tolerant rootstocks. This means that the small proportion planted on susceptible rootstocks such as M.9, M.26 and Mark are not under heavy infection pressure, thus making woolly apple aphid control relatively easy. If the proportion of susceptible rootstocks increased markedly, we can anticipate substantially more difficulty with woolly apple aphid infestation of susceptible rootstocks.

New dwarfing and semi-dwarfing rootstocks with woolly apple aphid resistance are under development. Until these rootstocks become commercially available, I believe trees propagated using M.9 or Mark interstock on our standard rootstocks are our best option.

There are now a number of interstock blocks planted and they are beginning to look pretty spectacular. A word of warning about fire blight infection of M.26. Over the years we have heard stories from the USA of M.26 trees being killed by fire blight at the bud union as a result of systemic infection travelling down the tree from a strike in the scion. This season I came across this type of fire blight infection here. It appears as if it may become a problem where susceptible varieties such as Gala are grown on M.26 in warmer districts which favor fire blight activity. We, therefore, need to be very diligent about fire blight control for orchards planted on this rootstock.

M.9 and MM.106 are both reported from the US to be susceptible to fire blight as well but, to date, I have not come across reports of problems with tree deaths due to fire blight infection to the union. Until we have something better, these M.9 or Mark interstocks with either MM.106 or M.793 rootstocks look to be our best options.