



**RED SUN
HORTITECH**
PERFECT PLANTS™

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Selecting varieties for commercial macadamia orchards

Selecting varieties to plant in commercial orchards is a complicated and subjective challenge for growers and nurseries. There are many varieties to choose from. Performance varies according to the region where they are planted, there is no perfect variety for all climatic and management situations. This is according to Mark Hassenkamp (Managing Director of Red Sun Hortitech). In addition to having dedicated clonal mother blocks for propagation of all commercial South African Macadamia varieties, RedSun has been approved by CitroGold to propagate and distribute Australian Hidden Valley Macadamia Varieties to Southern African Growers.

When it comes to selecting the right variety, the experts at Red Sun Hortitech have a few suggestions on how to select varieties for commercial plantations.

Think in terms of first grade kernel per hectare

Many comparisons between varieties report yield of nut in shell (NIS) per tree, but this is in general a poor measure of tree performance. Growers are effectively paid for first grade kernel free of rejects. Yield of first grade kernel is the measure that is most closely related to income. Yield first grade kernel (kg) = Yield NIS (kg) x sound kernel recovery (SKR %) x first grade (%).

Secondly, tree yields can be misleading if taken in isolation, because in the end this is driven by income per hectare. A variety may have a high yield per tree, but if trees have a low spacing and are excessively large may still perform poorly when assessed on a per hectare basis. Equally, small trees planted on a wide spacing will also not achieve acceptable yields per hectare.

Yield first grade kernel per hectare (kg) = first grade kernel per tree (kg) x trees per hectare = first grade kernel per tree (kg) x 10 000 / between row width / within row width where trees will fit at nominated trees/ha

When making decisions about new orchards, all factors must be considered such as yield benchmarks, climate, management capacity, equipment, and then most importantly; yield, income, cost, profit etc. – must be managed and converted to a per hectare basis to drive decisions.

Decide on planting density

At Red Sun Hortitech they believe the first decision should be what tree density you intend to plant the orchard. This is led by climate and variety. There is an almost unlimited range to choose from. Some examples are:

- Low density – 10 m x 5 m (200 tree/ha)
- Medium density – 8 m x 4m (312 tree/ha)
- Medium-high density – 7 m x 3 m (476 tree/ha)
- High density – 5 m x 2 m (1 000 tree/ha)

Most new orchards are planted at medium densities (312 @ 8x4).

In general a low density orchard will take much longer to reach full production, because the trees will take many years to completely cover the otherwise open and non-productive orchard floor. Also, the large trees will then require larger equipment to manage them in the long term.

High density orchards have higher set up costs per hectare and will require more intensive management, such as pruning sooner in the life span of the orchard. However, it has the benefit of the orchard reaching full production much sooner. An orchard planted at 1 000 trees per hectare can achieve 5 tonnes per hectare in six to seven years, whereas a low density orchard that has 200 trees per hectare may take up to 20 years to achieve the same result. Low and high density orchards should achieve similar maximum yields per hectare, but there are still some questions as to whether high density orchards can maintain these yields in the long term. To get the full benefit of early returns from high density orchards, it is best to plant precocious varieties.

The planting density of a new orchard will influence the selection of varieties. It is unlikely that a semi-dwarfing, small, compact upright tree like A16 will fill the orchard at low densities, leaving a large area of the orchard unproductive with lower returns/ha. By the same token, planting a larger precocious variety such as 695, 842, and 849 at high densities would mean intensive management would be required to keep the orchard under control in later years.

Hidden Valley Macadamia Varieties (defined by an A prefix) are assessed on their ability to produce high first grade kernel yields per hectare. In general, according to Mark, they have been selected with a preference for medium to small size trees suitable for medium to high planting densities to improve total returns/ha.

Importance of various traits

When selecting varieties it is important to take all the different traits of each variety into account, rather than concentrating on one or two. To a degree the importance that is placed on various traits is a subjective decision and will also depend on the mix of climate and varieties being considered.

Some varieties are more heat stress susceptible: For example; another Australian selection; A4 is a very precocious tree that can produce commercial yields in three years. It has a medium spreading tree shape with an open willowy canopy susceptible to wind damage. It has excellent quality and size kernel with a mid-season nut drop. It is however more susceptible to stress from high temperatures but

performs well in milder regions, A4 needs extra fertilizer to compensate for its early cropping ability. In contrast; A16 is a slow growing and wind tolerant variety but a high yielder with excellent nut quality and would achieve high yields (and returns) per hectare if planted at higher densities.

Many growers consider it desirable to have all varieties ready for harvest at the same time, to achieve a short harvest window. Other growers prefer to spread the harvest out to reduce stress risk and minimise the need for large capital equipment to handle the harvest. Another important aspect to consider is to select varieties that are more or less the same tree size across orchards.

Mark says that while kernel characters are importance, in general, any variety that has been commercialised will have acceptable kernel qualities in terms of flavour and appearance. Although, there are some debates at the moment as to whether small or large kernels are more desirable. "Processors prefer large kernels, because they are less costly to handle, simply because there are less of them for any given weight". Others prefer small kernels for confectionary chocolate coating etc., If a growers chooses this this option, ensure that the variety has a larger percentage of wholes, rather than small halves which are more expensive for processors to sort," says Mark.

Pollen compatibilities have also gained prominence in recent years. However, there is still more work to be done before its importance can be quantified. The trials to date have been based on raceme by raceme tests, and designed to highlight different compatibilities. There is very limited data on actual orchard situations. For these reasons, this data should be given lower priority in selecting varieties, but a high priority when determining an orchard's design.

Design and plant the orchard according to polliniser compatibility

It is recommended selecting at least three varieties. This reduces the risk of varieties not performing up to expectations. It creates the potential to maximise pollination. It extends the flowering and harvest periods.

As mentioned previously, Mark says they do not believe that the producer should select varieties based on their pollen compatibilities. However, once varieties have been selected, the grower should design the orchard in a way that will maximise cross pollination – planting the most compatible combinations close to one another. Keep flowering periods in mind as well.

It is recommended that complete blocks of a certain variety are planted, rather than mixing the varieties in the row. While this may slightly reduce pollination, it will make orchards easier to manage.

Red Sun currently has two experimental varieties on controlled release. Firstly, A203 was selected in 1984 has a medium to large uneven sized nut with white kernels which drop mid-season. The tree is a medium sized upright tree with a slight willowing of branches. The kernel recovery lower at 34,43%. In Australia however it bears a very heavy crop and is precocious. The variety is hardy and may suit more marginal areas.

Secondly, A268 tree is a medium to large tree that has an open spreading canopy with a mid-season nut drop and very large, good quality nuts which have creamy, white kernels. The variety is performing well over a wide area of Australia from Bundaberg to New South Wales and also the Nelspruit, Mpumalanga region. It appears to be hardy and may do well in cooler regions, but there is no information at this stage regarding frost tolerance.

The following Australian yield and flowering spread summary is a useful illustration towards the planning of varieties within the farm layout.

Variety	Harvest	Flowering
A4	Mid-season	Late-season
A16	Late-season	Late-season
A203	Earl-season	Late-season
A268	Mid-season	Mid-season
814	Late-season	Mid-Late-season
816	Early-season	Late-season
842	Extended season	Extended-Mid-Late-season
849	Extended-Late-season	Late-season

Table 1. Cumulative sound kernel recovery at Winfield cultivar trial site for nine-year-old trees, with the same cultivars aged nine years at Burgershall for comparison.

Ranked varieties Winfield	Cumulative SK Winfield 2000-09 (kg/tree)	Cumulative SK Burgershall 1993-02 (kg/tree)
A268	40.11	
A422	39.11	
856	37.10	
842	35.73	
816	34.64	5.7
A16	34.22	11.8
814	33.74	7.9
246	32.70	
741	32.67	
344	31.79	5.5
A104	31.55	
A437	30.52	
783	30.22	
A38	29.09	
A423	28.78	
849	28.28	
Daddow	28.13	
A387	27.64	
A203	26.01	
A417	25.95	
A199	25.01	
705	23.93	
788	23.71	4.6
781	23.46	
853	22.75	
A4	21.72	12.4
835	16.26	

Mean rainfall and temperature

