



GEM™ Avocados in New Zealand

By Jonathan Dixon, PhD
Chief Technical Officer, Seeka Ltd

Why GEM?

Unlike other high value fruit crops (e.g. apples, kiwifruit, berries, nuts), average avocado yields are much the same as 20-30 years ago. This means the costs to grow avocado fruit have increased while yields have stagnated, squeezing profitability. There are new innovations being used such as high density plantings and plant growth regulators, however, change is happening very slowly.

The most commonly grown (greater than 95 percent) and traded avocado variety in New Zealand is Hass as it has good taste and ships well. Unfortunately, in New Zealand Hass is also high vigour, alternate bearing and tends to produce low yields if not managed well. Having a new variety that is low vigour, low alternate bearing and high yielding is highly desirable to improve the profitability of avocado groves.

Additionally, for the New Zealand avocado industry to rely on one variety is very risky as a new pest or disease can appear that could effectively destroy many groves. The New Zealand kiwifruit industry experienced a devastating bacterial disease commonly known as PSA (*Pseudomonas syringae* pv. *Actinidi-ae*) in 2010. At the time, there were two main commercial kiwifruit varieties, Hayward and Hort16A. The highly profitable

Hort16A was eliminated by PSA causing severe disruption to the industry. With the New Zealand avocado industry almost totally reliant on Hass it is strategically at high risk of collapse should a new pest or disease like PSA become established.

GEM is a variety that has a lot of modest improvements over Hass and is distinctively different from Hass. The only common attribute is the fruit go black when they ripen. In particular, GEM:

- Has a growth habit well suited to high density and does not need plant growth regulators
- Is relatively low vigour compared to Hass
- Has a compact growth habit – it doesn't spread sideways
- Tolerates temperature extremes – both heat and cold
- Is very precocious
- Is low alternate bearing
- Has later maturity
- Hangs well on the tree
- Has thicker, smoother skins
- Ships well
- Is an attractive fruit and has, most importantly, excellent taste

The New Zealand GEM

GEM avocado trees are grown and marketed in New Zealand through a grower club type arrangement where members pay a license fee. Around 16,000 GEM trees, about 100 acres, have been planted starting in December 2017 (summer in New Zealand) through November 2019 (spring in New Zealand). Typical tree spacing is 13 feet by 19.5 feet or 160 trees per acre (400 trees per hectare at 6m x 4m). Initial plantings of the GEM trees were in December 2017 to April 2018 (fall), and 66 percent were on clonal Dusa rootstock, 10 percent on clonal Bounty rootstock and 25 percent seedling Zutano rootstock across 13 sites. Other trees were planted from October 2018 to April 2019.

There is a very enthusiastic community of early adopter GEM growers and the demand for trees far exceeds the numbers of trees being propagated each year. The first GEM tree in New Zealand was planted around 1999 with three copies made in 2003. Tree numbers have been slow to increase as all the budwood had come from these four trees in the New Zealand Avocado geneblock in Te Puke. Additional budwood trees have been created since 2014, and this budwood bottleneck has now been overcome and tree supply is increasing each year.

Learning to grow GEM in New Zealand

Being at the start of the commercial development of a new avocado variety is something of a privilege and an opportunity to learn as much as possible as the trees are planted. A number of research trials have been initiated, and a system is in place to maintain records of detailed observations on the trees' growth and development. The most important finding has been that GEM has a unique growth habit and fruit characteristics distinct from Hass. As a result, researchers have modified or avoided some of the common tree management practices used for Hass when managing GEM.

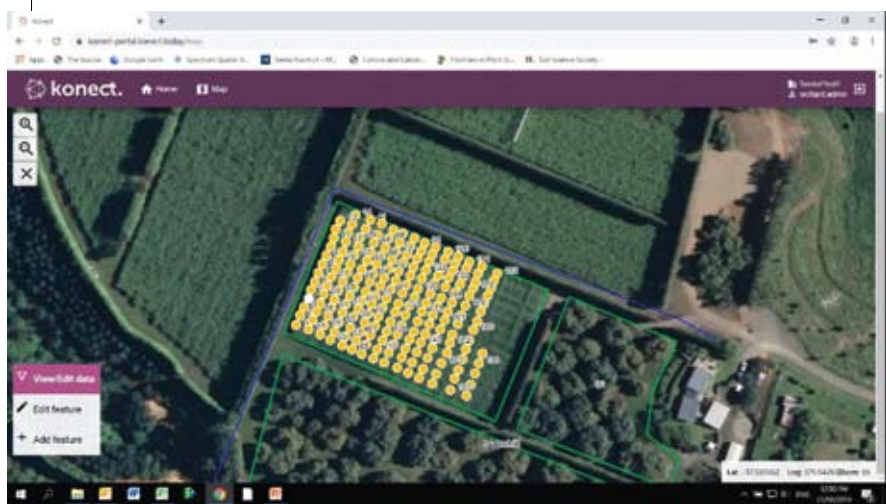
Commercial GEM plantings in New Zealand are only a cou-



ple of years old and the first lessons have been around best practices for planting. This includes evaluating rootstocks, planting month and structures to support the trees. Trials are underway for two different tree spacings and sheltering trees from wind.

With the first plantings we have observed tree decline when the trees were planted using the same method as planting Hass trees for the same rootstocks. This tree decline was worst in the first spring after planting and characterized by excessive flowering and defoliation, followed by tree death for about 20 percent of trees. The decline was very unusual as the symptoms were similar to Hass trees when their roots die and was largely confined to trees on the Dusa rootstock. While the GEM scions had poor health, the roots were very healthy and robust lacking any disease symptoms.

To learn as much as we could, growers were surveyed for their management practices. About 4,800 individual trees were mapped by GPS location to be individually assessed for tree health every few weeks. Attention was paid to the best type of foliar fertilizer applications used by growers.



We identified three main factors in the tree decline:

- Planting method – possible overwatering of the trees (the Dusa rootstock is known to be sensitive to over watering during establishment)
- Month of planting – trees planted in summer and fall had more tree deaths
- Negative rootstock to scion interactions

In addition, it was noted that trees exposed to wind established poorly compared to trees well protected from wind.

In the second spring, very few newly-planted and second-year trees have gone into decline and tree death numbers have been very small. Trees still defoliated and flowered excessively, but then responded with plenty of bud break and shoot flush. GEM trees in New Zealand flower very heavily every season; we speculate this is due to the relatively cold winter temperatures compared to California. The three and four-year-old trees in our research blocks have had low amounts of leaf drop and the defoliation we see may just be a feature of newly planted or young trees in New Zealand conditions that disappear as the trees age. Trees planted into “shelter cages” have had very little leaf drop and excessive flowering and may have been less stressed than the trees fully exposed to wind.

As a result of what we have learned during the first sea-

son, we have developed the following GEM tree management practices: avoid over-watering the trees; conduct two weekly foliar fertilizer applications of nitrogen; remove flowers from stressed trees as the flower buds break; and develop and increase shelter from wind for newly planted trees.

As the trees get older new challenges will occur. There are two issues that will need management when the trees have reached their mature height and are crowding onto each other. They are minimizing wind scarring of the skin and pruning to maintain productivity.

We will continue to carefully observe the GEM trees as the groves are planted and the trees age. There are long-term research trials underway with monitoring of flowering and fruit set, maturity and postharvest quality, rootstocks and tree spacing as well as growing GEM trees on trellises to explore ultra-high density canopy management methods. The acreage of GEM is forecast to keep increasing over the next five years to reach 400 - 500 acres. The main markets for New Zealand grown GEM fruit look to be winter New Zealand and Asian markets where the attractive appearance and excellent taste of the fruit will be well received. We see the future of GEM as a useful addition to reduce reliance on Hass, allowing the New Zealand avocado industry to have greater resilience to unexpected negative events.

