

CUTTING Edge

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Lies, Damn Lies and Then Statistics



The Cutting Edge is a regular article written by Dr Jonathan Cutting for the New Zealand avocado industry magazine, AvoScene.

Yield – a fundamental concept for everyone involved in the avocado industry. However, there is little or no common perspective as to what exactly we mean and more importantly, how we calculate yield. Yield becomes really important when any form of grower comparison is undertaken. Grower comparison is the cornerstone of benchmarking. I thought it would be an interesting and useful exercise to explore meaningful ways of calculating avocado yield in order that our industry can develop this further and arrive at a yield calculation method that can become the New Zealand standard.

The issue of Hass yield is intriguing, both from an intelligence perspective as to how countries, regions and neighbours are doing, as well as the emotional perspective as to how “we” are doing. In discussions about yield with colleagues in the USA it appears that the national Californian 10 year yield average is approximately 4-5.5 tonnes per ha. The South African yield average varies depending on whom you talk to but estimates place national yield at 3.5-5 tonnes per ha. In Australia, yield figures are very hard to determine. Yield is often expressed as kg per tree. However, Graeme Thomas presented yield data at the Rotorua Conference in 1997 that showed the national 20-year yield trend

line to fluctuate between 4 and 6 tonnes per ha. Using data presented at the Joint Australian New Zealand Conference in Bundaberg earlier this year the average yield in the Bundaberg region is approximately 4 tonnes per ha.

We have presented the New Zealand national average yield in the annual report for the past two years. In New Zealand yields are slowly increasing (see table below). However the question we have to ask is - how accurate are the yield figures and is there a better way to calculate yield?

Industry Yields - June 1996 to June 2001

Year	Yield (tonnes per ha)
96/97	3.65
97/98	5.22
98/99	6.35
99/00	7.18
00/01	8.86

In terms of the New Zealand yield calculation the industry does have good data in relation to mass of crop harvested. This is especially so in the case of fruit that enters the export system. In relation to fruit sold domestically there is accurate monitoring of volume during the export season and an educated calculated estimate is made of crop not captured by the Avocado Industry monitoring system. This is verified against levy returns. The industry data in relation to acreage is less certain. As at 1 July last year the industry estimate of acreage was approximately 2,250 ha. The MAF census conducted last year showed acreage of almost 2,700 ha of land planted in avocados. One of the databases must have flawed or incorrect data. We will attempt to determine that this coming year. We therefore request that growers be patient

with the AIC as we go through the frustration of trying to determine the actual acreage of land planted in avocados in New Zealand.

The first issue to resolve is defining the calculating units that yield is expressed in as this largely determines how “portable” the yield data is. For example should yield be expressed as kgs, tray equivalents or tonnes. Different countries use different package masses e.g. California uses 25lb lugs, South Africa uses a 4 kg carton, New Zealand uses a 5.5 kg tray and Australia uses a six kg tray. I am firmly of the opinion that standard metric SI units (*System Internationale*) of kg and tonnes should be used.

The second issue and point of divergence is whether yield should be expressed as mass of fruit per unit area (tonnes per ha) or mass of fruit per tree (kg per tree). A great deal of the Australian avocado literature and science reporting expresses yield on a per tree basis. However, tree-thinning regimes change the number of trees per unit area and many growers have difficulty in knowing how many trees they have once a thinning regime has been implemented. I am of the opinion that all yields should be expressed as a function of land and therefore should be expressed as tonnes per ha.

A very common question is - what is a hectare? Should the area of land devoted to avocado orchard shelter be included in the calculation? Is there such a concept as a canopy ha for avocado? Should missing tree space be accommodated in the calculation of the acreage? These are questions that need to be resolved and consensus achieved before comparative yield benchmarking is undertaken. I suppose I have no firm opinion other than whatever is chosen should be consistently applied.

My suggestion is to use a simple, easily understood, formula based approach. My preference would be to use the following formula.

- Determine the number of trees in a block (for the purpose of this exercise say 467 trees)
- Determine the tree spacing in the block (for the purpose of this exercise say 7X8 m).
- Calculate the land covered by the trees in the block (for the purpose of this exercise say 7X8 (tree spacing) X 467 (number of trees) = 26,152 m². This is 2.61 ha.

Now determine the mass of fruit harvested from the block. We will use the following numbers for this exercise:

- 2,754 trays export fruit
- 1,117 trays local market fruit
- 890 kg processing grade avocados

This equates to 15,147 kg export fruit + 6,144 kg local market fruit + 890 kg processing fruit = 22,181 kg fruit = 22.18 tonnes of fruit

Divide the number of tonnes of fruit by the acreage in ha.

- 22.18 tonnes divided by 2.61 ha = 8.498 tonnes per ha.

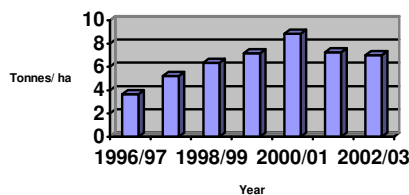
Hopefully this suggestion is useful. We would welcome any suggestions as to flaws or where simplicity and or accuracy can be increased. Hopefully our industry can have a universally implemented yield estimation system in place in the near future.

Yield is one of the key determinants of orchard profitability. It is therefore essential that all growers can accurately determine yield. This also identifies areas of your production system where improvements can be made and adds both depth and value to benchmarking orchards in programmes such as the Regional Discussion Groups comparative studies of orchards in the different regions.

Happy harvesting in the dry and try to get hold of a good calculator to calculate those yields next autumn!

Every year in May the AIC gathers information and data to be included in the Annual Report. One of the more interesting sets of data is annual yield expressed both in tonnes per hectare and total tonnage. Obviously the data is never quite perfect but we are confident enough in the information to publish it in the Annual Report. Anybody taking a strong interest in long-term trends and involved with the New Zealand avocado industry would be concerned with what is happening in terms of yield

National average yield from 1996 to 2003



The implications of falling yield and lower values will have serious impact on orchard gate returns, both nationally and at the individual grower level. The Bay of Plenty Regional Discussion Group has established a working party that is focussing on profitability. It has developed an exceedingly useful economic model to investigate orchard profitability and evaluate orchard costs. One of the more useful outcomes of this group has been an ability to focus on “*what growers should do or strive for*” to maximise profitability. The clear winner in the grower “holy trinity” of pack out, fruit size and yield is, undeniably, yield. Consider the table below.

Table 1. National and average Orchard Gate Returns

Year	National Orchard Gate Return	Average property Orchard gate return/ ha	*Elite (15 tonnes/ha) Orchard gate return/ ha
1999/00	\$ 22.101 M	\$ 17,709	\$ 36,996
2000/01	\$ 25.688 M	\$ 18,052	\$ 30,563
2001/02	\$ 23.306 M	\$ 14,176	\$ 29,371
2002/03	\$ 25.668 M	\$ 13,581	\$ 29,060

The calculation of “Orchard Gate Return” is based on industry gathered data for income, national average yield and national pack out. *The elite property represents the stated industry goal of 15 tonnes per ha average for the industry. There are a very small number of growers who are achieving yields above 25 tonnes per ha so as can be imagined their per hectare orchard gate returns are considerably higher than \$30,000.

If a grower achieved a yield of 25 tonnes per ha in 2002/3 and achieved industry average pack out and size distribution their orchard gate return increased to over \$48,000 per ha. Increasing pack out to 75% and improving one count size added a further \$6,000 per ha. If however the grower achieved 75% pack out and increased fruit size one count but only achieved the industry average yield, the per ha orchard gate return only increased from \$13,581 to \$15,203.

So what does this all mean? It means that growers need to seriously focus on yield. Only when they have upskilled themselves in terms of orchard husbandry and are achieving yields of above 15 tonnes per ha should their focus shift to the other two income drivers, export pack out and fruit size. In essence - yield must come first. Put another way, high export pack outs of large fruit without yield is not a survival strategy. I know, and can already hear, growers who have been in the industry many years being somewhat concerned at a strategy that sounds like the production of lots of local market fruit – not exactly what we need! And I agree with that sentiment. I accept those concerns are real and need to be addressed but I have to believe that all growers are in this business to make money – and money is primarily made through profitability and profitability is primarily achieved through yield. Export pack out and increased fruit size are the “icing on the cake” that turns a good business into an excellent business and should in reality separate our elite growers from the average. It is somewhat sad and disappointing when yield four times the national average is what separates our elite growers from the

average. Quite frankly a kiwifruit grower or a dairy farmer, producing **one quarter** of the yield of elite producers, would probably be evaluating their continued involvement in those industries.

I hear the cries blaming climate and the lamentings - "its two bad springs in a row" and "export pack outs are really low because of the year" etc. And yes, nationally our yields have dropped by almost 20% in the past two years, and the cause is largely climate (cool springs). However, there are still many orchards that have continued to crop well. In fact there are some record avocado crops around and in some cases right next to orchards that have done exceedingly poorly. There is obviously a lot more to this than climate alone.

So what can, and what should, we do? I have some ideas and industry participants are free to agree or differ with me. That is the wonder and privilege that is free speech. First, as an industry, and most definitely as individual growers, we need to embrace a scientific approach to growing avocados. There are many facets to this and I will discuss some of them in the next two **Cutting Edges**. A real concern that I have is the growing sense of "cult" within the provision of technical information to industry. You may ask what I mean by "cult" and I refer to the decision by growers or consultants to adopt a certain approach not because it is based on good science but because of a simple unsupported "I believe" approach – the end result is that we have lots of "believers" who do not follow a scientific approach. These same "believers" are convinced that silver bullets exist and that solutions to orchard problems do not rely on a particularly strong understanding of all the factors and inputs involved in orcharding. The really disturbing aspect of this is that that when orchard failure occurs it is almost impossible to identify the cause. I have seen this style of "knowledge transfer" creep into our industry at many forums stretching from certain beliefs around the "green" approach (and I am not "green" or organic

bashing here) to information provided to growers at field days and seminars.

The scientific approach is an important and underlying principle in modern agriculture. This requires participants to read and understand the literature and interpret the information in such a way that it becomes useful and adds value to a production system. In very simple terms the avocado tree is exposed to inputs; namely light, water and minerals (both gaseous and in solution). From these raw elements the tree produces photosynthates and uses photosynthates for respiration and growth. Temperature affects the rate at which these processes happen. Stated simply the production of photosynthetic products must exceed the use of the photosynthates for respiration and tree growth and maintenance. The surplus goes to fruit production and carbohydrate reserve storage. I accept this is an over simplification and that many subtleties determine how this happens. Our challenge, as growers and technical advisors, is to understand, modify and adapt the production system, based on sound scientific principles and knowledge, to perform better in terms of net photosynthetic gain. We harvest the benefits and effectiveness of our interventions in terms of regular and heavy cropping.

I know that the technical message needs to be simple. The KISS approach (keep it simple stupid) really should dominate. There are only two reasons if we are required to overly complicate the message:

- we don't really understand what we are doing or recommending and complicating the message looks good and professional
- we are busy "sweating the small stuff" and ignoring the really important foundations of good production.

To me there are two clear messages:

- Do it right the first time
- Do it at the right time

Both of these messages require that the grower has a certain suite of skills and understanding. The skill that is most lacking, and also happens to be the most important, is the ability to “read” trees. It is vital, for example, to determine when trees are losing leaf condition in autumn, so that properly timed intervention can avoid an alternate bearing situation arising 18 months out. Understanding is important so that the grower knows how to alter the situation, in this case leaf condition, with the correct input or suite of inputs. A very strong understanding of cause and effect is essential for avocado growers. This is the strength and elegance that is experience.

We need to put some meat onto this discussion by way of examples – and I will do that in the next two Cutting Edges. We will consider, first the issue of canopy management and tree size control versus leaf quality as the primary driver of carbohydrate accumulation and, second the importance of root mass, water use and irrigation in achieving regular cropping and high yields. We will consider these questions in terms of the literature and attempt to interpret empirical information in a useful way. After all, this is what innovation and the development of technologies is all about.

It is winter with not too much to do on the orchard. So during these cold evenings in front of the fire read and understand as much as you can about avocados. More importantly, never be constrained about questioning providers of technical information, be they other growers, consultants or scientists. Questioning, and the requiring of answers, is a key learning and understanding tool.