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CONVERSION FROM CONVENTIONAL TO ORGANIC AVOCADO PRODUCTION

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ABSTRACT

The need to change the normal agricultural methods for growing avocados resulted in a conversion to organic production using vermiculture. Because this media had not been used and documented for avocados, techniques had to be developed and refined. This paper details some of hurdles that had to be overcome, techniques developed and results achieved.

Key Words: Australia, Avocado, Organic, Vermiculture, Worms, Vermicast.

INTRODUCTION

This is not a scientific paper. Instead, it relates the experiences of an avocado grower with some thirty years in the industry who took his orchard "Alston Vale" from being conventionally farmed to becoming Certified Organic. It was not all plain sailing and in fact this paper could well be titled: “From Triumph to Disaster and Back Again.”

In 1995 the account books for the avocado orchard clearly showed an increasing use of chemicals, their increasing cost and a reduction in both volume and sales receipts from the avocado crop. A change had to be made. After considerable research and discussion with other growers and scientific people and publications, the decision was made to change to organic production using vermiculture as the tool to replace conventional management practices.

WHY ORGANIC?

First, let us look behind the scenes to see what farming was and compare it with modern day farming.

In times past, man still used the traditional practices handed down from father to son, returning to the soil the left overs and manures from animal and human existence. All went well. Nature's program was observed, the basic organisms were retained and returned to the soil.

With the introduction of chemical and synthetic fertilisers Nature's design was turned upside down. Beneficial organisms were poisoned, natural immune systems were destroyed and pathogens ran amok. Sadly, this situation stimulated the production of further chemical poisons as supposed remedies. Endeavours to clean up the latest problems only compounded and aggravated the situation. So on it went like a snowball's progress down the hill; the problem just got bigger and bigger and the health of the soil became more and more degraded. The challenge now is to prevent further deterioration and destruction and rebuild our soils — it is the worlds greatest asset.

Research showed that the humble worm had the capacity to produce Nature's own specialists to feed and protect both soil and vegetation. Those powerful advocates of the worm, Sir Albert Howard, in his 'An Agricultural Testament' which outlines his historic and dramatic re-building of India's agriculture, Charles Darwin in his 'Darwin On Earthworms' and before them Aristotle, clearly stated their belief that the worm can do just that.

WORM FARMING

There are thousands of different species of worms throughout the world; however, they can be divided into two major types, soil-inhabiting earthworms and compost-inhabiting earthworms. The former live basically in the lower soil profile and are soil eaters. When they make their tunnels they aerate the soil, provide drainage and leave a thin coating of organism-rich mucus on the tunnel walls.

The compost-inhabiting worms live in the richer upper horizon of the soil profile and their diet is basically decaying vegetable matter. When the worms have re-cycled this vegetable matter, their excretion, which is called 'Vermicast,' becomes plant food and promotes the activity of soil micro-organisms. With the worm beds kept very moist, a leachate is also harvested from the beds. The worms are Nature's Garbage Collectors and Recyclers. These are the worms that are farmed at Alston Vale.

The leachate on analysis shows it to be of high bacterial content, which makes it such a valuable tool for controlling disease and insects when used as a foliar spray. The solid cast is highly fungal and is used as a soil dressing for correcting soil-based problems.

There are many different techniques used to farm and house house worms from small, plastic or wooden boxes, to 30 m long x 2 m wide worm 'factories.' The pilot plant at Alston Vale utilises an old nursery area and is a very low-key affair but plans have been made to develop worm farming to the 'factory' stage.

Worm husbandry has similar guidelines to other livestock. Care must be exercised with food, moisture, temperature and oxygen. Being an accredited organic grower, particular attention has to be paid to food. Like the computer axiom 'garbage in = garbage out,' the feed for worms determines the type and quality of the product they produce.

Only food with a vegetative background is used at Alston Vale. Not even the traditional manure from farm animals is used in case of contamination. A Carbon/Nitrogen ratio of 25/30:1 is the yardstick. The carbon is achieved by feeding cardboard, shredded paper and coarse hay. The Nitrogen

component comes from fresh green grass, sub-standard fruit rejected from packing sheds, fruit processors waste and use-by-date-expired fruit and vegetables. A wet bed with a temperature around 25°C yields the best results. Oxygen is essential because worms are living breathing creatures and an anaerobic environment can be fatal.

TO GO ORGANIC

To go organic meant that no more chemical fertilisers, insecticides, fungicides, or herbicides would be used in the orchard. The vermicast and leachate would take their place. However, in the early stages of Conversion there was serious apprehension that, without chemical controls, insects and fungal diseases would destroy the crop and the weeds, unchecked, would envelop the orchard. A compromise was struck and for the first year worm products were used as foliar sprays and chemicals were used for weed, insect and disease control. This was later found to be unnecessary. The combination of management changes and worm products achieved our goal without chemicals. Our organic status could have been achieved one year earlier.

Spraying Leachate

Leachate was originally applied as a foliar spray using a conventional tractor drawn power spray. In December 1999, due to a late flowering in some blocks there was a considerable amount of fruit of golf ball size on the top of the trees, some eight or more metres above the ground that were exposed to the sun. With the middle of summer only weeks away normally this fruit would be severely sunburnt and end up in the worms' food bin. Being too high for the ground rig to reach and not a proposition for hand spraying, the only thing left was to use a Helicopter. That spray provided THE major breakthrough.

The combination of very low flying, very fine nozzles that produced a heavy mist and the turbulence created by the rotors made for a perfect operation. Normally, with a ground rig it would have taken three and a half days to complete the task, the helicopter did the job in seventy minutes. In addition and even more importantly, using a helicopter was far more efficient in applying the spray. It thoroughly covered both surfaces of the leaves and was driven throughout the entire canopy, there was less spray drift and it was much cheaper than even using ones own staff and equipment.

Spraying Program

A spray program has been developed with the object of reducing stress on the tree and to control insect and disease attack. The first spray is carried out in July, about six weeks prior to blossoming (in this area of NSW) to cover that period of stress and also the stress incurred at fruit set. A second spray is applied immediately after completion of fruit set in September. This spray is vital for this is the time at which fruit size is determined by cell division and covers the first period of maximum fruit growth. It is also the first counter insect treatment. A third Spray is applied in mid December by which time the fruit has nearly completed its major sizing period. This is the time reinforcements are required on the fruit and leaves for insect control. There is evidence that this spray contributes to minimising the 'January' fruit fall. A fourth spray is generally dictated by local conditions, sometimes yes, sometimes no, sometimes February, sometimes later.

The present application rate is 300 mL of leachate plus 2.7 L of water per mature bearing tree. The water is really only a carrier. Smaller trees are sprayed to the 'run-off' stage using a ground rig with the same fine nozzles. Trials are still being carried out to 'fine-tune' the dose rate and the

times of application. Spraying has also to be coordinated with the period at which the micro-organisms, particularly the fungi, are most active.

The application of worm products in the orchard has been guided by the importance of the specific problem on hand. To date that importance has been in the control of insects and disease which could be checked with a foliar spray. It will be shown later in the paper how the vermicast solids really demonstrated their importance.

Weed Control

Right from the outset the weed growth was phenomenal. A new management procedure was required, one that combined the production of food for micro-organisms, benefited the insect population generally and also kept the orchard workable. The new weed control system adopted, achieves this objective. When our weeds reach 800 mm, alternate rows are slashed down to 300 mm then allowed to grow to 800 mm before slashing again. There is evidence that this practice protects the beneficial insects that keep their environment in balance and does not destroy their environment or food chain. With a side throw slasher mulch material is thrown under the trees where, when decayed, it provides food for the micro-organisms. This procedure associated with liberal applications of coarse mulch gives a degree of weed control as well as providing further nutrient for the micro-organisms and positive benefits to soil health and structure. A good coverage of inter row vegetation also reduces evaporation and stabilise soil temperatures.

Orchard Pests

The two main pests to contend with at Alston Vale are native insects endemic to most avocado growing areas on Australia's eastern seaboard. They are the fruitspotting bug *Amblypelta nitida* which "stings" the fruit and the redshouldered leaf beetle *Monolepta australis* which swarms on foliage and has the capacity to defoliate trees and mark the skin of the fruit to the extent it is not fit for market. Experience using leachate as a foliar spray suggests it has a repellent effect on insect pests. Apparently the detritus from the tree forms on the leaves, fruit and branches as an exudate which is attractive to many insects. The micro-organisms in the leachate consume this exudate and thus eliminate the food that attracts the pests.

Orchard Fungal Diseases

The main fungal diseases that can affect orchard production are phytophthora root rot *Phytophthora cinnamomi*, anthracnose *Glomerella cingulata,* and stem end rot *Dothiorella* sp.

Phytophthora cinnamomi was not a serious problem and was kept at bay organically with infrequent applications of liquid vermicast applied through the irrigation system. Anthracnose particularly in hot humid summers had been a problem for many years. With the foliar spraying of leachate it has been virtually eliminated. Stem end rot was always a problem prior to using leachate but the incidence of this disease has dropped considerably since the leachate spray program commenced.

RESULTS AS AT DECEMBER, 2000

The results from using vermicast and leachate indicated that organic production was possible, that pests and diseases could be controlled and the goal of a Certified Organic product could be achieved

• Despite the fact that some fruit was exposed for 12 weeks to the early and mid-summer sun they did not suffer from any sunburn.

• Anthracnose was virtually eliminated. This happening in a vintage year for that disease. Local packing sheds discarding up to 45% of consignments because of anthracnose damaged fruit.

• The annual January fruit drop did not take place.

• Insect damage had been reduced by 55%.

• The pH of the soil rose.

• Vermicast did not leach from the soil.

Other industries that have used worm leachate have reported:

• Plant Nurseries - Increased production of healthier plants with much better root systems and reduced insect and disease problems.

• Grape Growing and Wine Production - Increases in vine growth and health providing higher yields of superior quality wine.

• Sports Arenas and Playing Fields - Better quality and harder wearing grass even in shaded areas and reduced problems with compacted soil areas.

• Bowling Greens and Golf Course Greens - Easier to manage, fast, with reduced underlay thatch. Less water used and better soil structure

• Dramatic reduction in environmental pollution, pollution of water ways and sub-surface water.

DISASTER STRIKES

On a routine inspection in May 2001, the Orchard looked as if it had received the same treatment as did the Vietnam Jungles—an Agent Orange attack. Foliage had gone brown and was falling off; fruit was on the ground and the trees had scarecrow bare limbs—desolation. Despite the fact that this disaster occurred over a very short period, all the experts, independently consulted, had the same answer—*Phytophthora cinnamomi*. Their advice was unanimous, simple and positive. 'Sell Up–, Pull out all the Trees—Replant with a different crop.' Their advice was not followed. A decision was taken that an attempt would be made to organically turn DEFEAT into VICTORY. To make the problem worse, this disaster coincided with the commencement of the longest and severest drought Australia has experienced in recorded history. In the 23 months period of drought, water restrictions were imposed by the authorities who progressively reduced water allocations for irrigation until it was banned altogether.

THE ROAD TO RECOVERY

Despite the drought and no water the routine spray program was maintained throughout the orchard. Two small blocks of trees, the most severely damaged, received additional mulch and two soil applications of a 'high fungally dominant' mixture based on vermicast. Leachate was used purely to liquefy the solid cast for ease and effectiveness of applying as a liquid soil dressing. The drought finally broke in late February 2003. Within eight days of the commencement of the rain, leaves appeared on all the apparently dead trees within those two blocks. The leaves soon turned green and have continued to grow vigorously. The rest of the orchard is also recovering but not as fast as the blocks that received the solid vermicast. A dramatic indication that *Phytophthora cinnamomi* CAN be tamed, organically.

CONCLUSION

The change from normal avocado orchard management to organic, has been difficult and the learning curve rather steep. Nevertheless it has proved a most stimulating and exciting experience. Growing organic avocados is possible using vermiculture .

It has also shows production of higher quality fruit of greater flavour. Coupled with the new management procedures, has materially benefited soil structure and has made for greater absorption of rain. Natures own tireless workers have returned and are creating healthier soils. Vermiculture does control avocado pests and diseases. An old adage says It is far more effective to feed the soil than to feed the plant. Let the soil feed the plant—it does it better.

The Challenge to Prevent further Deterioration and Destruction has been accepted and we are confident that we are progresing in the Rebuilding of our Soils. It is commended to your attention.

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