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REPORT
for the
CHURCHILL FELLOWSHIP
by Duncan Woodhead

In 1988 I was awarded a Churchill fellowship to study and evaluate the methods used to produce, package and market subtropical stone fruit and exotic citrus. I visited California, Texas, Florida, Italy, Amsterdam and Britain.

I would like to sincerely thank the Churchill Foundation for without their generous support, I would certainly not have been able to undertake this study tour of our industry.

My report can be most clearly described as having two sections; firstly, looking at the production of the various crops and secondly, looking at the marketing and how it varies in these different countries. I have made comparison throughout this report to the Far North coast of New South Wales where I am presently farming 17 acres. This comprises 3500 sub-tropical stone fruit trees and 800 citrus trees, mainly Tangelos and cumquats.

SECTION 1

PRODUCTION TECHNIQUES

CALIFORNIA

Stone Fruit

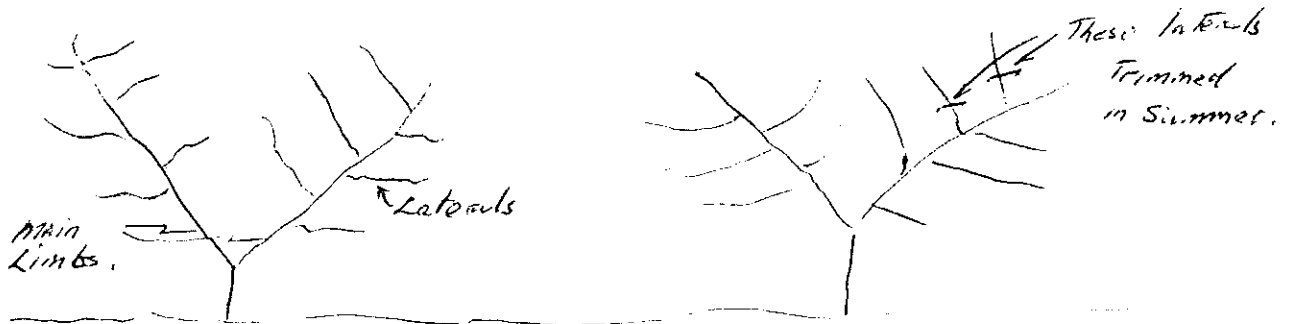
I started my tour with a visit to one of the largest producers of stone fruit in the world. They are known as Superior Farming Co.

In California they farm 30,000 acres of which 20,000 is under stone fruit and grapes, approximately a 50/50 split. They are an interesting company as they are one of the few private companies which have their own grape and stone fruit breeding programs, their own residue testing labs, soil and leaf analysis facilities, packing and marketing sections.

The stone fruit breeding program is led by Dr. Carlos Fear. Their aim is to breed peaches, nectarines and plums for specific sections of the market. Specifically the section of the market which gives the best returns e.g. early fruit, or very late fruit. Once they have bred a variety they will then hold the patent not allowing any other grower to compete with them in that market segment. Because of their size they are able to offer a large shipments of these specifically bred varieties which are sold under the Superior Stamp.

Their farms are generally 500 - 1000 acres units managed by individuals responsible for that farms performance. These managers are assisted with weed and spray schedules by an Area Manager and also specialists.

Superior farms are one of the few farms I visited that use a palmette training system in California; although it varied from the traditional three pronged system using only 2 prongs similar to a tatura trellis but in the perpendicular plane e.g.



The centre is cleaned out after harvest to allow new growth.

This system may have potential for varieties such as Florida Prince which tend to have poor buds on older wood.

Generally in California most trees are pruned in the traditional vase shape. This has become the accepted system. Although there has been quite a bit of work done on improving production per hectare using different pruning systems and closer spacing, most orchardists had resisted change for a number of reasons. Firstly they use Mexican labour extensively who are extremely confident at pruning vase shaped trees, but are not confident at pruning the new systems. Secondly many plantings are in production for up to 20 years thus any changes of system are very slow. The new plantings are tending to be a closer planted vase system; instead of 20 x 20 ft., they are going to 18 x 10 ft.

Trees in California are generally supplied bare rooted to growers. They are budded in large field nurseries and the price varies according to the royalties due on that particular variety and the circumference of the tree measured 6" above the ground. The most popular size is 3/4 - 1" which sells for approximately US \$5; \$2 of which being royalties. These trees are usually delivered from the nursery in late winter and the aim is to plant them prior to bud break, trees are then aged using the terminology:- 1st leaf, 2nd leaf eg 1st leaf= 1 year growth from the time of planting, 2nd leaf= 2 years from the time of planting.

Irrigation is very important in California as the rainfall is extremely low, 5 - 6 inches per year. There is plenty of water supplied from the Rocky mountains but it is expensive. Most of their irrigation is by flood irrigation, again this is motivated mainly by tradition although the newer plantings are changing over to drip systems. The new drip system is far more economical with the available water and allows the use of fertigation. People I spoke to who had not changed to the drip said that it was capital cost which was a factor in not changing the system.

Girdling is commonly used in California. They use a specialized knife with a U shape blade, cutting either a 1/2, 1/4 or 1/8 inch wide strip of the outer bark down to the cambium layer. Either a complete circle or spiral (ending an inch above) is cut around either the main trunk or individual structural limbs. It is normally carried out approximately six weeks after the buds break when the fruit is thumb nail size. This may have to be varied for low chill stone fruit.

There are several advantages and disadvantages to girdling:-

Advantages:

Earlier fruit

Larger fruit

Can be used as a management tool to spread the picking time of a particular variety. e.g. girdling half the variety and leaving the other half, making approximately 4 days difference in the picking time.

Disadvantages:

Increased number of split stones

If too deep it can kill the tree

If too shallow it will have no effect

Shorter tree life due to excessive stress on the tree.

Although girdling can be used for the reasons listed above I think that in our area where we have high rain fall and high humidity a trees life may be drastically reduced. Although this must be weighed against the potential increase in fruit size and the time of maturity.

Thinning is done when the fruit is approximately thumb nail size. They thin very heavily on palmette trees, leaving only 30 fruit on a 3 year old tree, and 180 fruit on a seven year old tree. Picking begins in early April with Florida Prince which has recently been planted in Southern California very near the Mexican border. Currently there are five growers growing about a thousand acres, with one grower growing about 600 acres. Several other varieties are being trialed but no commercial plantings yet! The fruit is generally picked into picking bags then into half ton bins which are generally padded. The exception being the grower of the early Florida Prince who was picking into shallow trays to lower the incidence of bruising. The fruit is picked very green to allow for the fairly rough handling it receives once in the shed. Although there is a trend to pick what they call tree ripened fruit meaning leaving the fruit on the tree slightly longer and allowing a fruit to develop a yellow background but not to soften before picking. This allows the fruit to gain a higher sugar content and therefore more flavour.

I visited several packing sheds in California. Nearly all of them hydro cool their fruit as soon as it arrives in the packing shed. It was then either packed or stored in cool rooms held at 1 or 2 degrees centigrade. Hydro cooling takes out the field heat very quickly getting the fruit down to three to four degrees within 20 - 30 minutes. This allows the fruit to be handled with less chance of bruising and have a longer shelf life. This system of cooling the fruit early would be very useful in our area as it is far faster than the standard cool room which can take anything up to 24 hours to reduce the core temperature to 2 to 4 degrees centigrade.

There were three types of packing sheds which I will discuss in relation to their rate of production e.g. the amount of trays per 8 hour day in relation to the number of people in the shed. Firstly there is the very simple system where the fruit is picked into lugs, usually 18 litre size. These lugs are placed on a tilted rack and the packers pack the fruit directly from the lug to the tray ready for transportation to the market, then placed in the cool room. With this process 8 persons can pack a thousand trays a day.

The second system commonly used in California is a continuous belt system. In this system the fruit comes up onto a belt 600 mm wide, 20 metres long. The packers stand beside the belt picking

the fruit off the belt as it goes past them. Each packer concentrating on packing one size. Any fruit that is missed returns on another belt to the start. In one of the shed which had this system any marked or bruised fruit was sent into a continuous flowing trough of water and up an elevator into a bin ready for dumping. An efficient way of automatically moving fruit around. This system with eight packers could pack 3000 trays in one day.

From the previous simple system we move up to the really complex system used by companies like Superior Farming and other large packing shed operations. This system basically uses a computerized weight and colour grader. The fruit is often defuzzed and waxed, then gently rolled directly into the tray. These systems are often run sequentially and are capable of handling a hundred thousand double layer trays a day. Probably these systems are not relevant for this area at present.

I think the most relevant system is the second system which is very similar to the circular table. This system is cheap to manufacture and install and is capable of handling reasonably high volumes efficiently.

Citrus

I visited several citrus orchards with most orchards producing Valencias or Washington Navels. The production was on a large scale and most orchards were only concerned with the growing of the fruit. All the fruit is packed through large packing sheds which generally handle the marketing of the fruit as well. I did visit a couple of Pomelo, Grapefruit, Cumquat and Lime orchards. The Pomelo orchards like the other exotic citrus were generally a very small part of the large citrus orchards, the average size was around a thousand acres.

The pomelo varieties used were Clander, Shaddie (a white flesh variety) and mellow yellow a new variety which seemed to have a lot of potential. Their main concern with pomelos was to get large well coloured fruit. By large I mean 2 fruit per 18 litre box. To this end they used several techniques which again could be quite useful in this area.

Firstly they pruned the centre out of the trees to make them into a tight vase shape. This allowed for more light to penetrate into the dense foliage and more air circulation through the trees, thus reducing the pest problem by making the spraying programmes more effective.

Secondly they thinned the fruit out to gain size removing all doubles, and any fruit hanging too low. Therefore allowing plenty of air circulation around each fruit. The thinning was done in the autumn when the fruit was slightly smaller than a golf ball. They also controlled the tree's height by hedging the tree to eight foot in the spring.

As the main market for most of the exotic citrus was leading up to January 27, the start of the Chinese New Year, they used sprays of 24D and GA extensively to hold the fruit on the trees in order to extend their harvest date to nearer the end of January.

The trees were spaced at 20 X 20 feet intervals, approximately 100 trees per acre.

The plantings of grapefruit were small. Although there was interest in Ruby Red due to its good colour and taste as opposed to the traditional white flesh variety.

Cumquats were grown in only one area in California, just east of San Diego, approximately 20 acres being the total planting. They were using the variety Nagami and packing the fruit into 4 kilogram boxes. The fruit is sized using a converted cherry grader, into large and medium size. They are sold mainly to the Chinese once again for the New Year celebration. The fruit was also being exported to Europe but for marginal prices.

TEXAS

From California I moved onto Texas to meet up with Professor Wayne Sherman, Dr. Bob Rouse - Texas, Dr. David Byrne - Texas and Bruce Topp from Queensland. The southern Texas stone fruit industry started around 1981 and it is based around McCallum in the Rio Grande valley.

The industry here is largely due to the efforts of Dr. Bob Rouse who started to trial some of Professor Sherman's varieties at the Texas A and M Experimental Station in Weslaco. The initial variety trials were Earli Grande, Florida Prince and Florida Grande. They are now growing and naming such varieties such as Tropic Sweet and Tropic Beauty. In the Rio Grande, which is predominately the citrus growing area, there are five main growers who have planted approximately 600 acres of low chill stone fruit. They have formed a co-op to pack and market their fruit. The fruit is picked into half bushel boxes, the main sizes, ~~between~~ ^{between} 3/4 and 2 inches. The boxes are volume filled by weight, a very quick system but it does not allow for good presentation of the fruit.

Unfortunately when I visited Texas and Florida they had both been hit by severe late frost which had destroyed their 1989 crops and made variety evaluation impossible. Texas has major problems in getting skilled labor which in turn led to poor pruning and thinning. The growers were keen to expand the industry but after losing all their 1989 crop they had basically decided to hold off expanding the planting for another year. The prediction was that if everything went well they would plant around five thousand acres between the five growers. Although good soil with an acceptable PH is fairly limited in southern Texas.

FLORIDA

Florida is the home of low chill stone fruit and I was lucky enough to stay with the 'father' of this industry, Professor Wayne Sherman. Unfortunately due to the severe freeze there was no stone fruit to evaluate. This had also set back Professor Sherman's breeding program by one year. His breeding program is based on cross breeding varieties of favorable characteristics and then selecting from these high bred plants for further testing and evaluation. Firstly by himself and then by selected peach growers for industry acceptance.

His breeding programme is now aimed at producing a firm non-melting flesh peach with good keeping qualities. This would alleviate the problem of growers packing fruit too early and the fruit having no flavour. One of these peaches is already available in Australia, called 9-20C.

Professor Sherman is also looking at Male Sterile varieties for our Australian conditions where excessive fruit set causes very high labour input due to the amount of manual thinning. By selecting varieties that need to be cross pollinated you can control the fruit by varying the number of pollinating trees within an orchard. There are some varieties already available in Australia such as:

Nectarines - 82-25N, 8-13N, 84-14N, 84-23N
Peaches - 82-12, 5-58P, 86-7, 86-26

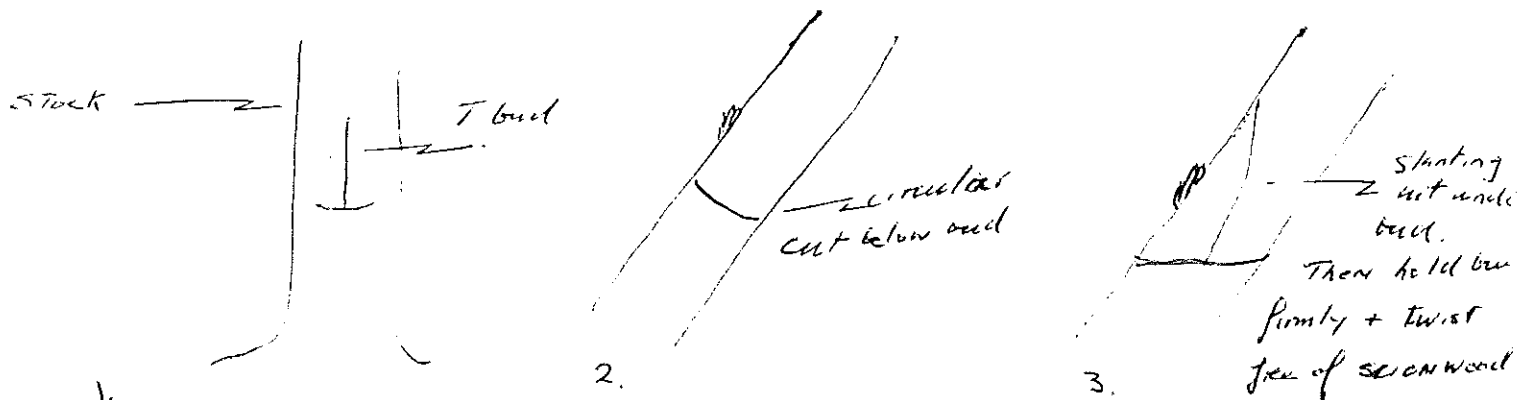
As a method of controlling our abundant fruit set this method has good long term benefits. During my stay with Professor Sherman we also discussed the technique he uses firstly for seed propagation and secondly for propagation of his new high bred varieties.

Seed propagation with regard to cost of seed and especially virus tested seed material. It is therefore important to get a high strike rate. The seed is firstly cracked open using a pair of secateurs which actually cuts the seed in half by snipping the protruding edge of the seed. This operation although time consuming is worth while as depending on the variety there is often a high percentage of doubles within the one kernel. Also it allows for better germination of the seed. The seed is then soaked in water for three days changing the water every 24 hours. Then vermiculite is dusted with a fungicide e.g. Benlate and dampened, and then the seed is placed in a bag with the moist vermiculite and put in a fridge at 5 to 6 degrees and checked for germination regularly. Once the seed has germinated, the germinated individual seed is placed in a jiffy pot or planted directly in the field in nursery rows. These trees are grown in the nursery row until late spring when they are approximately two foot high with pencil thick butts and then budded. Professor Sherman uses a T budding technique which is very quick. Firstly the leaves are removed in the section that is going to be budded. This is usually about six to ten inches above the ground. Then a T section is cut in the bark, cutting through to the cambium layer. The top section of the T is opened with the back of the knife. Then holding the bud stick firmly a circular cut is made below the

bud. Then a slanting cut is made to join up with the cut below the bud. Then holding the bud firmly, give a twist which will free the bud from the stick.

eg

Then SCION.



This bud chip is then slipped into the already prepared stock. The bud is then wrapped above and below the bud using a pre-cut rubber band which are obtainable within Australia. It is a very fast way to wrap the bud and assures a tight hold due to its elasticity. After ten days the top of the stock is removed leaving the leaves below the bud until the bud starts to shoot then they too are removed. The major benefit of this procedure is firstly the speed of the operation and secondly the rubber band is biodegradable and therefore does not need to be cut off as with the plastic tape.

I would like to at this point, thank Professor Wayne Sherman and his wife Etoyle for their considerable assistance and for welcoming me into their home.

ITALY

My stay in Italy was extremely brief although I did manage to get to a couple of research stations. Most Italian orchards are fairly small ranging in size from 5 to 20 acres. Their fruit is generally packed by a centralized shed for consignment to one of the major European centres. Most of the stone fruit is grown on a three pronged palmette system with a spacing of 2.5 X 4 metres; a fairly intense system. There were not many low chill varieties in use. Their earliest fruit being Early Crest, May Lady and Spring Lady - all Californian varieties.

Research in Italy is currently aimed at breeding a dwarf tree to reduce such costs as pruning and picking. There has also been limited work done on growing stone fruit in a hot house situation in an attempt to get earlier fruit. Unfortunately the cost of the hot house and controlling tree vigour seem to be the main limiting factors with this system. Their breeding program has had limited

success. They now have a dwarf peach tree but the fruit quality still has to be improved to be competitive against existing varieties. We are probably looking at a five year time lag before these dwarf varieties are commercially available.

CONCLUSIONS

Generally Australian standards of fruit production compare favorably with overseas fruit production. However, the varieties contained in many of our orchards do need to be updated to maintain the high standards which are necessary to receive a reasonable return on capital invested and compete favourably with other countries.

SECTION 2

MARKETING TECHNIQUES

CALIFORNIA

In California the majority of the fruit is marketed through a brokerage system which is generally run by the large packing sheds. The fruit is generally packed for the grower at a set price. Contained within this price is a fixed amount for selling the fruit. A price is reached and agreed between the seller (packer/broker) and the buyer e.g. a large supermarket, an exporter or possibly even another broker. The price is generally ex the packing shed door with the buyer paying the freight (FOB), although this is negotiable. The quality and size of the fruit required are agreed upon and the fruit is then sent. It must arrive in the condition stated or the contract is not valid. Superior Farm company sell their fruit on a similar basis although they had their own brokerage system and generally exported their fruit direct from their shed. Whereas small packing operators would sell their fruit to specialized exporters who pooled their fruit with fruit from other sheds of similar quality. Generally, the fruit quality in California is of a very high standard.

In conclusion it must be stressed that often the brokers never saw the fruit personally and just arranged transportation to the final purchaser. Thus reducing much of the double handling involved in our antiquated system and improving the quality of the product at the point of consumption.

TEXAS / FLORIDA

A similar system operates here although the quality of the fruit is generally poorer. The fruit is small and often picked very green to avoid bruising during packing. Unfortunately the fruit has little or no flavour. In Texas the average size was 1 3/4 - 2 inches, 2 1/2 inches being considered very large. The fruit was extremely poorly presented in half bushel boxes allowing for large volumes to be processed very quickly but not allowing for any attention to presentation which is a major factor in extracting a good price in an over supplied market.

EUROPE

Italian fruit is marketed on a similar system to Australia, with the fruit being sent on consignment to a broker. The broker then 'on-sells' the fruit direct to the supermarket, or places the fruit on the market to be bought by the smaller vendors for sale to the public. The broker usually works on a 11% commission. The exception to this system is the Dutch auction system, where the fruit and vegetables are brought into a large centralized shed; the produce is checked on arrival for soundness and for conformity to the grade standard; placed in cool storage and auctioned the following day. In Holland the auction houses have preset times to auction each product; for example, grade 1 tomatoes for export are

auctioned throughout all the 31 auction houses at 8.50 am each day. The buyers sit in front of a clock, and may stop the clock as the price drops. Whoever stops the clock first may buy as many boxes as he requires. The clock is then reset for the remainder of that line. The fruit is then distributed directly to the buyer's stores and trucks. This system considerably reduces handling of the fruit and vegetables. The auction house generally take a 3 3/4% commission, made up of 3% for the auction house, 1/4% for grower study groups, 1/4% for research and 1/4% to the central bureau who advertises the products and guarantees the growers a minimum price for their produce and supplies and sets the price for the standardized packaging for each product. This system has many advantages and is an extremely fair way to sell produce, which Australia could do well to copy. Firstly the product is maintained in excellent condition due to minimal handling, secondly the grade standards are strictly enforced prior to sale as the buyer needs to know and trust that grade 1 fruit is indeed grade 1 fruit. Thirdly the commission is small due to efficient handling for the fruit, and because of the central bureau levies, the basic price for each commodity is guaranteed. The level of support is reduced if a glut situation remains for a substantial period of time, thus allowing growers time to change over to a new crop.

Although Holland is not a big importer of stone fruit or citrus, there are a few agents who specialize in exotic fruit. One of the more progressive names being Bud Imports in Delft, who were importing a large range of exotic fruits and were very interested in Australia as an 'out of season' source. They do not work on an auction house system, generally taking fruit on consignment, although they were willing to pre-buy fruit of a guaranteed quality. Again they told me that Australia has a poor reputation for supplying consistently good quality fruit.

BRITAIN

My visit to Britain was mainly concerned with looking at the retail side of the stone fruit and citrus industry, but I did also visit the I.C.I. and the East Malling research stations, where I made the following observations.

Neither institute had a direct involvement with stone fruit or citrus, but both had been involved with the development of several chemicals used in both industries, notably Cultar, a substance made to chemically dwarf a tree, which I.C.I. is now marketing around the world. I had long talks with them about this chemical and its properties. East Malling is turning its research towards the development of dwarf trees, rather than chemically controlling the tree. This coincidentally, is also the direction being taken by the Italian research stations, where they now have a dwarfing variety but with dubious fruit quality. However in a few years time they should have improvised the fruit quality (due to selective breeding) and have a commercially viable dwarf variety. This will allow much more efficient fruit production, as most operations will be able to be carried out from ground level. I.C.I. is now putting extensive research into plant development, looking for better varieties of cereals etc. and this may reflect

a world wide trend against excessive use of chemicals and more towards naturally grown crops.

Retailing of fruit in the U.K.

I visited Marks and Spencers and the Waitrose group of retail stores, and also British and Brazilian, a major pre-packer for Safeway, Marks and Spencers, Waitrose, Sainsbury, Tesco and the Co-op which are the major supermarkets in the U.K.

Marks and Spencers and Waitrose have a similar marketing strategy. Both aim at the top end of the market providing a product of very high standard, packaged in a convenient take-home pack which is pre-priced and bar coded, and an expiry date, (which it is strictly adhered to) Their market strategy has turned fruit and vegetables into a 'convenience food'. It is packaged as a complete meal e.g. avocados pre-ripened, packaged with some lettuce, tomato and a container of salad dressing, or a complete salad with several different types of lettuce, ready to eat, only needing to be tipped out of the bag and the provided salad dressing added. The stone fruit was pre-packed in 2, 4 and 8 fruit containers. The packaging reduces the chance of the fruit being bruised by the consumer, thus ensuring consumer satisfaction when they eat the fruit and reduces the percentage of waste. To this end the aforementioned companies not only pre-pack their fruit, but also carry out tests to ensure the highest standards are maintained.

Stone fruit which comes mainly from Spain and Italy in the period May to September, is bought either direct from the farm packing sheds in these countries or bought through the English wholesale market. On arrival at the pre-packing factory each consignment is tested for sugar content, ripeness, amount of split stone, percentage of blemish and residual levels of chemicals in the fruit. Each supermarket chain sets its own predetermined standards which the fruit must meet; these standards vary between the different groups.

If necessary the fruit is ripened in ripening rooms using ethylene gas, or else packed directly into the correct sized packaging to the appropriate supermarket. A sample of each consignment is retained to check on the ripening period and fruit quality when ripe. Random testing for illegal chemicals is also carried out by most supermarkets. The increasing consumer awareness about the presence of chemicals in agriculture and the growing demand for organically grown food has made supermarkets such as Safeways promote a high profile of selling healthy fruit and vegetables and to this end they give away large volumes of high quality health and nutritional advice pamphlets, promoting their products.

The regular testing and surveillance of products is becoming more and more common. It is a factor that Australian growers and exporters are going to have to become aware, as some chemicals which are acceptable in this country, are not acceptable in Europe e.g. post harvest treatment of stone fruit with a fungicide.

Marketing of Australian fruit in Europe

Supermarkets in the U.K. are now looking at specific products and want to ensure a constant supply of these to their shops. With this in mind there is a definite gap in the supply of stone fruit between the end of the European season in late September and the beginning of the Chilian season in early December. Currently both areas are supplying a very high quality fruit to the market, so for Australia to compete favorably the fruit exported must be of equally high standard with good colour and firm enough to withstand the travelling time involved. Fruit arriving at this time of year, could expect a return of between £9 and £14 per tray landed in the U.K.

Nectarines would probably be the most acceptable fruit, as nectarine sales in Europe continue to rise, as opposed to peaches which have remained static. However there is still a larger volume of peaches sold.

In conclusion I would like to thank the Churchill Foundation for giving me this marvellous opportunity to study my vocation overseas, and I believe that I can use this knowledge to the benefit of both Australia and myself.