Improved fruit set and productivity in custard apple, Thailand, October 2007

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Australian Custard Apple Growers Association Inc (ACAGA)

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Australian Custard Apple Industry Thailand Study Report

Bruce Sloper, President Australian Custard Apple Growers Association and Roger Broadley, Project Team Member.

Summary

This study tour involved the President of the Australian Custard Apple Growers Association (ACAGA) and a technical adviser travelling to Thailand from the 28th October to the 3rd November 2007 to view production and handling systems for custard apple (particularly in the Pak Chong area where about 10 000 acres of custard apples are currently grown). Negotiations to access new improved germplasm from a Thai breeding program were conducted with Professor Chalonchai Babpraserth and Phacharavadee Paerattakul (Director, International Affairs Division) Kasetsart University.

In addition, time was spent with Chalermchai WONGS-AREE, Ph.D (Assistant Professor, Plant Molecular and Cell Biologist) and Sirichai Kanlayanarat, Ph.D (Associate Dean for Research Affairs) at the Prince Mongkut University. Discussions were had with the Prince Mongkut University post-harvest researchers investigating the latest results of custard apple post-harvest research and inspecting facilities and equipment at the University.

Two aspects of the Australian custard apple industry strategic plan which are seen as very important are in developing precocious and heavy natural setting varieties and developing dwarfing less vigorous rootstock. There is one Thai variety that produces large fruit, and sets naturally, and may be well suited to warmer growing districts in Queensland. The study tour provided the opportunity for negotiations on a face to face basis to access this fruiting variety. Although an agreement was not reached on this variety, negotiations continue.

The trip also provided us with the opportunity to acquire seeds of the Noi Nung (*Annona squamosa*) variety which meets the criteria of disease resistance dwarfing rootstock.

All necessary AQIS permits, inspections and approvals have been addressed correctly and seeds have been imported.

This study trip was supported by the Australian Government, Horticulture Australia Pty Ltd and ACAGA management committee.

Introduction

This trip aimed at assessing the Thai custard apple/sugar apple industry with a view to determining whether rootstocks and/or varieties were suitable for growing under Australian conditions.

Thailand custard apple/sugar apple industry

Like other Asian countries such as Taiwan, Thailand has the capacity to grow both sugar apple (*Annona squamosa*) and custard apple or atemoya (*Annona cherimola x*

Annona squamosa) types. Sugar apple is quite widely grown and is cheap, being about half the price of superior atemoya varieties. We suspect that sugar apple will be continued to be grown, as the local population earn approximately $2000-$3000 or less per annum, and they cannot afford to purchase dearer fruit lines. Sugar apple and custard apple, even though it was quite late in the season, were in abundance in roadside market stalls, along with fruit such as jackfruit, banana, grape, citrus, papaya, durian, sapote, and longan.

All roadside stalls, even though adjacent to each other, appeared to stock exactly the same range of fruit and vegetables, with little differentiation between them. Sugar apple and custard apple were prominently displayed at the front of each stall, suggesting that the local population deemed these two fruit types as being very popular. However the quality standard varied from stall to stall. There were large, medium and small custard apples of varying quality. The variety African Pride was not prominent, and fruit were small and not well presented. The reason for this is not clear – it may be that the variety is not well suited to hot, humid environments or was at the end of its harvest season. The African Pride fruit were the most poorly presented of all the sugar apple/custard apple types.

Phet Pak Chong Variety on sale and upfront at roadside stall

Prices for one variety called Phetpakchong was 80 Baht per kilogram, 30 Baht per kilogram for African Pride and 25 Baht per kilogram for sugar apple, which gives some indication of relative price and consumer preference. There are about 30 Baht to an Australian dollar.

Phet Pak Chong Variety on sale

Phet Pak Chong Variety Internal Quality

There are apparently two types of sugar apple grown in Thailand – Noi Nung and another type of sugar apple whose name we were not able to ascertain. Noi Nung has an aromatic or perfumed flesh, and there are about 25-30 seeds per 100 grams of fruit,

making this small fruit very seedy. It is used in ice cream where its perfumed aroma was obvious, even though little flesh was used in the ice cream. Noi Nung is apparently the preferred rootstock in an area about 150 km northeast of Bangkok, and we were able to obtain seed of this variety for testing in Australia. We were told that it has resistance to bacterial wilt.

Area planted to new custard apple varieties in the Pak Chong district, north east of Bangkok, appears to be about 2000 hectares. This has occurred with an eight year period.

There is some export of custard apple to Hong Kong and Singapore. Most fruit appears to be air-freighted, although reference was made to 18 tonne containers and modified atmosphere packaging. It is most likely that this will occur in the future, as the shelf life of fruit in this tropical environment appears to be 3-5 days. Some work has been conducted in the post-harvest area with polyethylene packaging, and reduced temperatures. It appears however that the lower temperatures account for extended post-harvest life up to 14 days.

Crop management

Thai labour costs about six dollars per day and is plentiful. Most work is done by hand.

Environment and soils

A considerable area of custard apple and sugar apple are grown in and around Pak Chong. The sugar apple tended to be less looked after than the custard apple, although there were some good blocks of sugar apple. Pak Chong itself is about 300 metres above sea level. Other nearby areas are 500 metres above sea level, and has fertile red-brown soil, which tends to promote tree vigour.

One grower had 100 hectares of custard apple and sugar apple.

Plant phenology

Trees grow continuously throughout the year, unlike in Australia. Consequently the trees can be manipulated to produce flowers at different times of the year. We were there late in the main season (late October), but there were plenty of fruit on sale on roadside stalls and in the main Bangkok wholesale markets.

Pruning occurs mostly in January. Flowering under normal conditions starts in February, and harvesting occurs from June to September. Fruit is exported in about August to October. Harvesting occurs 120 days after flowering.

Plant spacing

Plant spacing of 7 x 5 metres (286 trees per hectare) is recommended, but some growers are using 4 x 4 metre spacing for sugar apple. There is no mechanical pruning, and the custard apple trees are too close under this system.

Varieties

Major varieties include Phetpakchong (an atemoya), Mai Lee (another atemoya) African Pride, and a sugar apple (not named) and Noi Nung (another sugar apple). Phetpakchong has a yellowish skin when mature and can reach 1.49 kg in size. Most fruit are in the 400-800 gram range. There is an interest in custard apple with gold/yellow coloured skin in Thailand. Yield is supposed to be 50 kg per tree but we think it would be less than that. We thought this variety had significant calcium deficiency symptoms in the fruit.

In Thailand, African Pride cracks when mature, but this does not appear to be the case with Phetpakchong. Phetpakchong appears to reach about 22 degrees Brix, at least towards the end of the season. The first fruit tasted appeared a bit bland, but all of about six fruit tasted afterwards that had a firm texture and a more than acceptable flavour. When ready to eat the fruit was firm enough to be sliced in sections without collapsing. Phetpakchong is probably a cross between a cherimoya and Noi Nung, but this is yet to be confirmed. It is very similar in structure and taste to a Taiwanese squamosa variety.

Another variety called Mai Lee is apparently suited for older consumers. It can be broken in half by hand, it is yellow skinned, and not sticky. Yields are lower in this variety, supposedly being 30 kg per tree.

The variety Pinks Mammoth has been introduced from Australia by Professor Chalongchai, but it is low yielding and not performing well in Thailand.

Professor Chalonchai & Bruce Sloper

Rootstocks

Rootstocks appear to be mostly Noi Nung. *Annona glabra* and *Annona muricata* are used in wet conditions as rootstocks. *A. muricata* has some compatibility issues in Australia.

Pruning

Trees are managed into an open vase system, with a view to achieving 250 mm of growth after one year. However late in the season, there were many three metre canes filling the centre of the tree, and competition between fruit and leaves was probably causing the calcium deficiency symptoms seen in fruit (see earlier). This extensive shoot growth by October-November is quite unexpected, as the Noi Nung rootstock is supposed to be dwarfing. High temperatures, severe pruning, rich fertile soils and fertilisers applied, probably all contribute to the excessive growth. No mechanical pruning is used.

The variety African Pride appeared to be poorly pruned and probably poses more challenges than other varieties. We did see African Pride trees that were eight years old, and they were not too large, suggesting that the rootstock is causing some reduction in scion growth, and tree size.

Disease control

Disease is not seen to be a major issue. Chemicals used include mancozeb and carbendazim (active ingredients). Professor Chaloncha advised that Noi Nung rootstock did not have fungus problems and did not have problems with bacterial wilt.

Pest management

Fruit are all bagged for control of fruit fly with a special Dupont synthetic bag, called the Li Mai bag. This is one of the best bags that we have seen for control of fruit fly. No other pests were seen. No sightings of or evidence of damage from fruit spotting bugs was observed. This was surprising considering the density of canopy.

Protective Bags on fruit

Weed management

Weeds are a problem with fertile soils and rainfall of about 1300 mm per year. Hand cutting of weeds and cultivation between the rows are common, but we saw two people returning from weed spraying.

Irrigation

No underground irrigation was seen in many orchards. Flood irrigation is the main method of irrigating trees.

Grafting

Many trees are grafted in the field with a side graft technique. It is not certain, but the rootstock is probably placed in the tree on bamboo scaffolding, and a branch or shoots side grafted onto it. The branch is later cut and removed at the base.

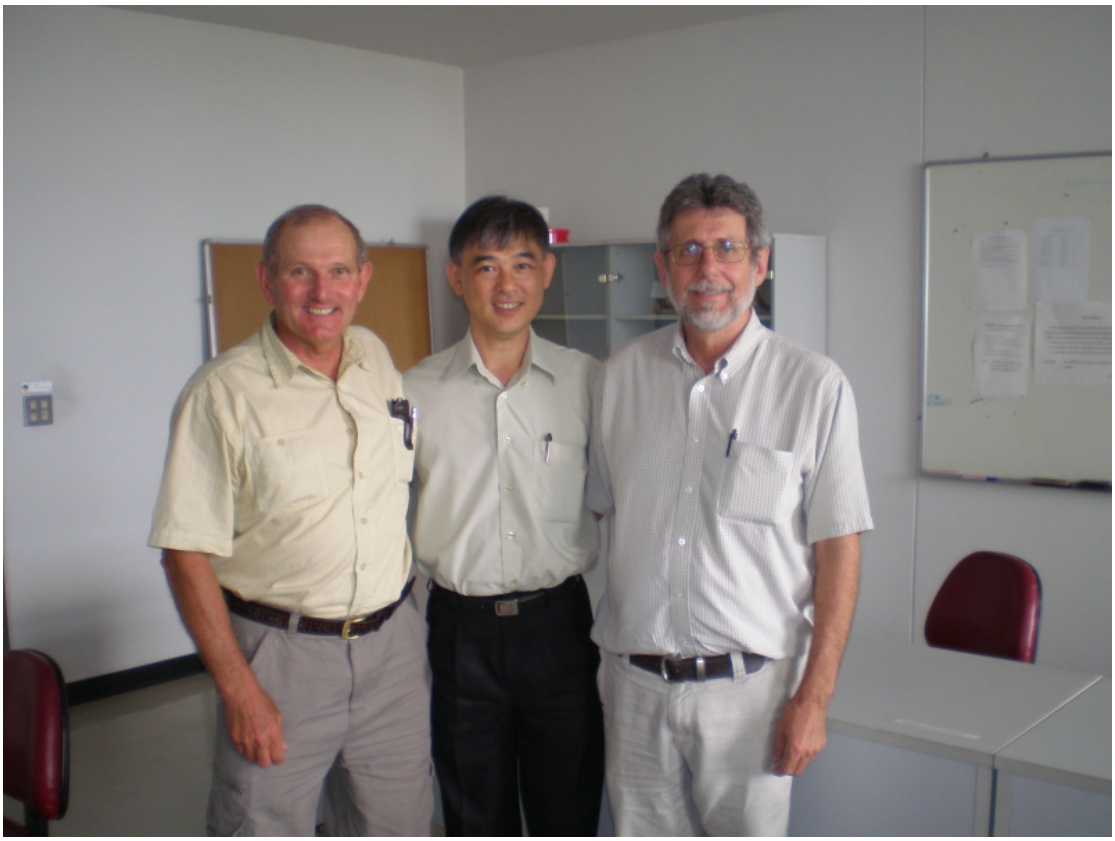
It appears that grafting can be done at any time of the year, but is commonly done from May to December. Bud wood is prepared by stripping leaves, but leaving three at the tip in each shoot. Grafting success is about 80-90%.

Harvesting

This is done by hand. It seems that fruit is sold in major wholesale markets, in 30 kilogram baskets. Fruit are protected by socks, but it appeared that the socks were used to hide skin imperfections rather than prevent bruising.

Post-harvest Research

Discussions were held with Dr Sirichai (Associate Dean for Research Affairs) and Dr Chalermchai (Assistant Professor, Plant Molecular and Cell Biologist) at the King Mongkut University. Some work had been done with chitosan coatings, different polyethylene plastic bags and low temperatures. Most work had been done with sugar apple, and shelf life extended from 3-5 days to 14 days. Chitosan did not work. The low temperatures used (13 degrees Celsius) appears to be the main factor in extending post-harvest life. Most fruit in Thailand are not transported by refrigerated trucks



Bruce Sloper, Professor Sirichai Kanlayanarat, Ph.D (Dean for Research Affairs, Prince Mongkut University), and Roger Broadley.

Value adding

Work was being conducted on preservation of colour and shape of dried flowers. At the time of our visit, no work was being done on value adding fruit as most of this work is done by private enterprise that have their own research laboratories and are very conscious of IP. King Mongkut's University has very impressive and up to date research facilities. In the value adding area, produce could be delivered by truck into cold rooms which were adjacent to and at the same level as well equipped laboratories. Some work had been done in the fresh cut and packaging of vegetables.

Acknowledgments

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