

# **Production of the High Anthocyanin Plum Variety, Queen Garnet, as a New Ingredient for the Functional Food Market**

R Berecny  
The Good Rich Fruit Co  
Warroo Station  
Inglewood, Qld. 4387  
Australia

**Keywords:** antioxidant plum, Good Rich Fruit

## **Abstract**

**The Good Rich Fruit Co is aiming at the large scale commercial production of the high anthocyanin, Queensland bred plum, the Queen Garnet. Amongst other beneficial nutrients, this plum has anthocyanin 3-20 times higher than commercial plum varieties currently available. It is only matched by a few berries. Anthocyanins are being linked to many natural preventative health benefits. The strategy is to produce a high value, high anthocyanin product for the functional foods and health food markets. This can be a fresh or processed product. Potential markets include fresh fruit, juice and juice blends, powders, additives to other products and colourings.**

## **INTRODUCTION**

The Queen Garnet was bred, and is owned by the Queensland government. It is licensed to Nutrafruit Pty Ltd, and is being grown by The Good Rich Fruit Co under contract to Nutrafruit.

The plum has a very dark flesh and skin, with anthocyanin levels of 150-280mg/100g (Netzel et al 2012; Fanning et al 2013, Bobrich et al 2014). Most commercial plum varieties are in the 5-30mg/100g range (Fanning et al 2014).

Amongst other things, the strategy is to supply branded product into the anthocyanin / antioxidant market at a per unit price more competitive than other competing fruits and vegetables. This is attributed to the high per gram percentage, and production advantages of these plums over the relatively high anthocyanin berries targeting the market.

## **QUEEN GARNET PLUM**

The Queen Garnet is a result of a plum breeding program carried out by Dr Bruce Topp and Dougal Russell of the Queensland DPI. The selection was made in 2001, and commercialisation occurred after a period of testing.

It is a very dark fleshed, dark skinned fruit. It is medium chilled (approx. 650 hours) and matures in late January, early February in SE Queensland. Testing has shown that the anthocyanin levels in the plum are far higher than commercial varieties currently in production. The anthocyanins are the chemicals responsible for the dark colouring.

The anthocyanin levels have been consistently measured at 150-280mg/100g. The majority of plum varieties currently under production measure in the 5-30mg/100g range. See Figure 1. The only variety shown to have near comparable levels is the Black Diamond line, which is being marketed as “The High Antioxidant Plum”. In a recent study, Queen Garnet fruit had double the anthocyanin content of Black Diamond, as well as three times greater quercetin glycoside content (Bohrich et al 2014).

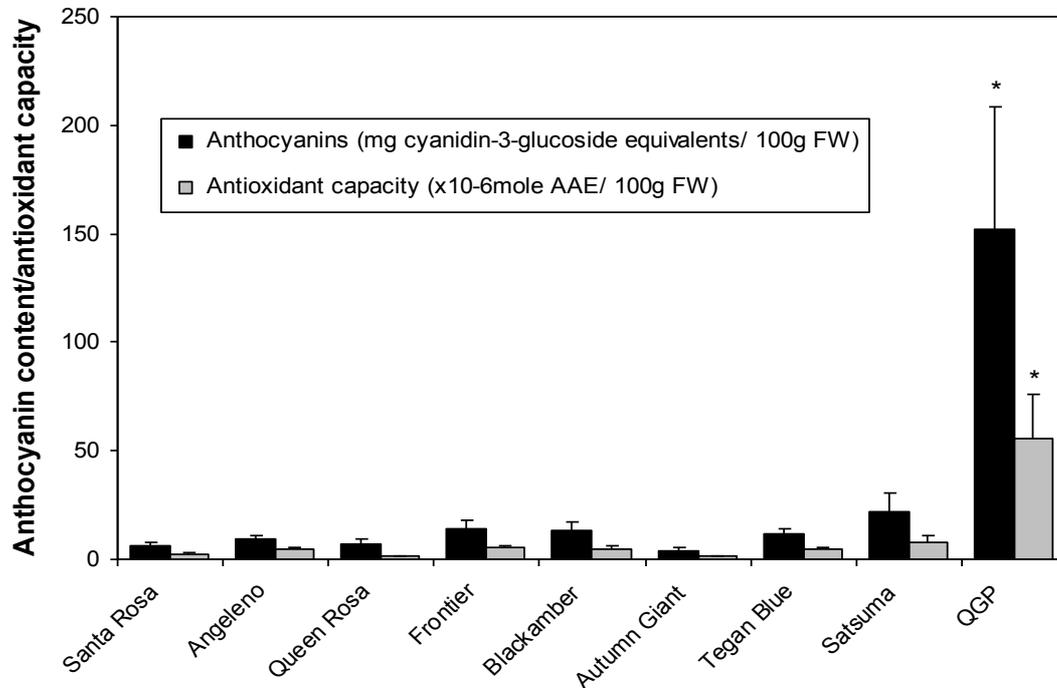


Figure 1: Comparison with other plums (Netzel et al 2012)

On examination of the USDA Database for flavonoid content of selected foods, the only fruits shown to match the highest levels of the Queen Garnet have been members of the berry family, such as elder berries, choke berries, as well as black currants. These tend not to be sweet, and are not as readily consumed as the plum.

The pomegranate and blueberry industries are making serious attempts to capture a portion of the anthocyanin/antioxidant market. The plum will be in direct competition to these products. Figure 2 compares the values of anthocyanin / antioxidant capacity of juices of these and other products being marketed as antioxidant rich juices against the Queen Garnet plum juice (QGPJ).

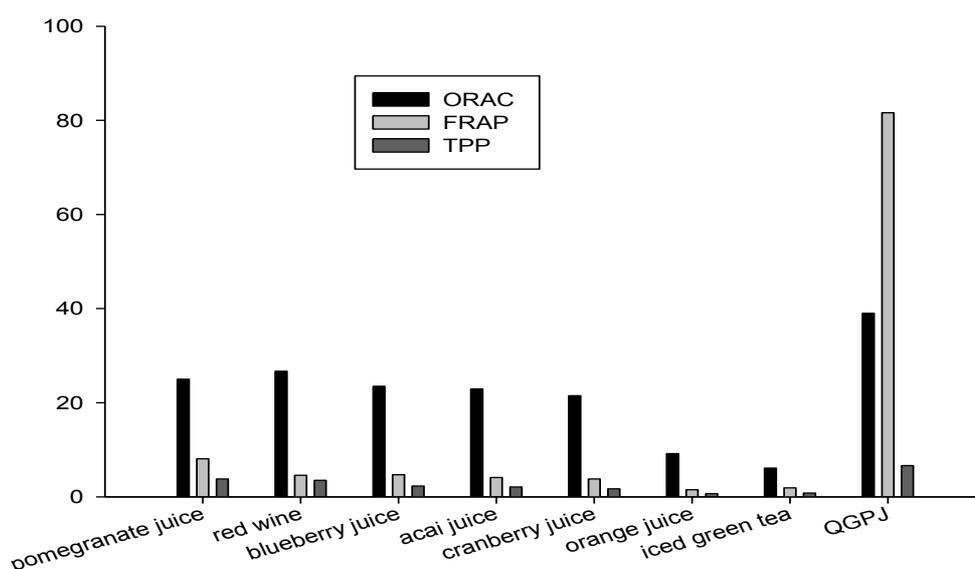


Figure 2: Comparison of antioxidant capacity and polyphenol content of QGPJ versus commercial beverages (all data except for QGPJ sourced from Seeram et al 2008); results are expressed as  $\mu\text{mol}$  trolox equivalents/ml (ORAC assay),  $\mu\text{mol}$  ferric equivalents/ml (FRAP assay), and mg gallic acid equivalents/ml (TPP = total polyphenols by Folin-Ciocalteu method) (Fanning 2012)

## HEALTH BENEFIT RESEARCH

A series of studies have been and are being carried out looking into potential health benefits of the Queen Garnet juice.

- Bioavailability and metabolism study of Queen Garnet anthocyanins/polyphenols (in humans), undertaken by Dr Michael Netzel, QAAFI, Brisbane. Two trials (one published [Netzel et al 2012] and one being formulated for submission) have been undertaken showing the urinary excretion profile of anthocyanins and metabolites following ingestion of QGPJ. Urinary malondialdehyde content, a marker of oxidative stress, was significantly reduced following QGPJ, compared to control (water).
- Examination of the effects of ingestion of Queen Garnet plum juice in metabolic syndrome rat model by Prof Lindsay Brown, University of Southern Queensland (being prepared for publication).  
This work showed the excellent capacity for the Queen Garnet plum juice to significantly reduce blood pressure, fat deposits, heart muscle stiffness, and body weight in rats being fed a high fat, high carbohydrate diet, similar in many ways to that being consumed by a large portion of the human population. It is now important to repeat this as a human trial.
- Examination of the anti-thrombotic activity of Queen Garnet plum juice (in humans) by Dr Indu Singh, Griffith University (has been submitted for publication). This research gave a positive response showing inhibition of platelet aggregation.

- Investigating the ability of Queen Garnet plum juice to improve cognitive health in humans, University of Wollongong. This project is due to commence in October 2014.

## **THE GOOD RICH FRUIT COMPANY**

The Good Rich Fruit Company orchard is located in the Inglewood region, SW of Brisbane, Australia. The orchard was planted in 2010 - 2011 and currently has 75,000 Queen Garnet, plus polliniser plum trees.

The orchard is in early stage production. Approximately 170 tonne of fruit was harvested in February 2014. This is expected to build to 2,500+ tonne over the next 3-4 years.

The long term strategy is for this fruit to be mechanically harvested, with a predominantly processing market absorbing the product.

The orchard has been laid out using GPS precision techniques to allow easy hands-free directed use of machinery.

The trees are being grown with the aim of maximising nutrient density in the final plum product. Sunlight improves anthocyanin levels therefore netting has not been used. There is been no use of artificial chemical fertilisers. Soil and tree nutrition has been achieved through the use of natural products such as purpose built composts, lime, rock dust and mulches. This is boosted through the addition of biology, emulsified fish, kelp, humates, etc.

This combined with a foliar program based around calcium, kelp and trichoderma, has meant almost no disease or insect issues. The only cover sprays required for disease and insect control have been oil and copper during winter. There has not been the requirement for other chemical cover sprays. As the fruit is being aimed at a health food market, a serious attempt is being made to reduce chemical exposure.

Queensland fruit fly is a major endemic pest in SE Queensland. A major trial is being carried with the aim of controlling this pest using SIT (Sterile Insect Technique). This encompasses the weekly mass release of sterile flies aimed at rendering the wild fly population unable to reproduce. This is combined with the removal of host plants in the immediate area, the placement of MAT's (male annihilation pads) baiting, and trapping for monitoring purposes. This is showing a lot of promise.

Mulch and herbicide are employed for weed control. Ground cover supplied by the mulch, and the use of "Weedseeker" technology has meant herbicide application is kept to a bare minimum and reducing.

### **Marketing - Fresh**

While the long term strategy is for The Good Rich Fruit Co to be supplying a processing product, the fresh market is also being used to give the plum a profile in the market. The initial fresh sales occurred in February 2014. The colour, flavour, Brix (20+) and potential health benefit meant a very good premium (40%+) on the domestic market, over competing plums in the timeslot.

Trial shipments were also sent to the Singapore market with an equally positive response.

These markets will be expanded in 2015 with increasing fruit volume available and a low level marketing program employed.

Growers in southern Australian regions are planting trees to extend the marketing season for fresh fruit. It is anticipated that with the spread of supplying regions, and the use of MAP fruit can be supplied to the market for up to 12 weeks. This becomes a very attractive proposition for the major sellers.

Research is currently under way (Dr Kent Fanning, DAFF, Qld) to determine optimum harvest timing criteria, plus longer term storage.

Planting material has been sent to the USA, South Africa and Spain for trial with a view to market extension.

### **Marketing - Processing**

The anthocyanin content, combined with the flavour and colour are seen as the keys to obtaining share in the functional food, antioxidant market.

Research has been carried out (Dr Kent Fanning, DAFF, Qld) into extracting the maximum anthocyanin content from the processing of the fruit. This information is being employed to aid potential processors with the setting up of their lines.

The rich, dark coloured juice has a very attractive flavour as a straight 100% juice. It is envisaged that the major juice market will be both 100% and as an additive to other juices to give them a health (antioxidant) boost, plus added colour.

The plum juice is also being looked at as an ingredient in products such as dairy, pastes and ciders.

Trials have also been carried out on dehydrating the juice to form puree and powders with a view to direct access to the health food supplement market.

The health / functional food market is a very large, rapidly expanding worldwide market.

Please note that starting in 2015, the control and related marketing of the Queen Garnet will be under the registered name “Purple Heart” to achieve the best long term returns and protect participants in the ongoing program.

### **ACKNOWLEDGEMENTS**

Mr Bim Goodrich – The Good Rich Fruit Co., Inglewood, Qld

Dr Kent Fanning – Dept Agriculture, Forestry and Fisheries, Qld

Mr Hugh Macintosh – Nutrafruit, Qld

Mr Bill Hatton – Nutrafruit, NSW

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