



## 2.3.3: Transformation of surplus waste tomato and capsicum – Stage 2 PROJECT SUMMARY

### The Problem

Australia produces around 480,000 tonnes of tomatoes and 76,000 tonnes of capsicums per annum of which Queensland contributes 50 - 65% of the total production. Bowen Gumlu Growers Association (BGGA) has a major contribution to the Australian horticulture industry with about \$190m worth of tomatoes and \$77m worth of capsicums produced per year. A significant portion (30-40%) of the produce amounting to about 150,000 tonnes of tomatoes and 23,000 tonnes of capsicums worth about \$300m are lost or wasted in the supply chain every year in Australia for various reasons. Hence, BGGA has decided to explore opportunities to value-add the produce.

### The Solution

BGGA partnered with the Fight Food Waste CRC and Queensland Department of Agriculture and Fisheries (QDAF) to explore ways to produce value added products including bioactive rich powders, liquid extracts and beverages to fully utilise the surplus produce. As a part of this, proof of concept protocols were developed and trialled in a Stage 1 study which was successfully completed in December 2020. After assessing the results from Stage 1, BGGA and QDAF commenced this Stage 2 project to further validate and compare the results with additional major varieties of tomatoes and capsicums grown in Australia in. The team trialled proof-of-concept methodologies for the extraction of major bioactives (lycopene from tomato powders and  $\beta$ -carotene from capsicum powders) and refined production of a probiotic tomato drink in the Stage 2 study.

### Project Objectives

The main objectives of Stage 2 project were to:

1. Process major varieties of tomatoes and red capsicums from different regions to produce dry powders and compare them for any changes in nutritional and key bioactive composition;
2. Develop and test concept methodologies to produce bioactive rich extracts (lycopene and  $\beta$ -carotene) from dry powders of tomato and red capsicum respectively;
3. Further develop and assess the probiotic tomato drink product from Stage 1 to enable potential commercialisation.

### Project Outputs

Three different varieties of tomatoes namely, Dobes, Mt Nutt and Trellis (200kg each) and one additional variety (Ducati) of red capsicum (~100kg) supplied by BGGA were used in the trials. The tomatoes and capsicums were processed to produce air- and freeze-dried powders and a clarified (free from suspended solids) probiotic tomato drink as per the methodologies developed in Stage 1. A commercial powder sample was produced in a drum drying unit using 10% (w/w) rice flour as a processing aid. Further, concept methodologies to extract lycopene from tomato powders and  $\beta$ -carotene from capsicum powders were also developed and trialled. Two different extraction methods namely, supercritical fluid extraction (SFE) and an edible oil-based extraction were used. The nutritional, antioxidant capacity (AOX) and total phenolic



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content (TPC) values were comparable to those obtained in Stage 1 study.

Commercially produced drum dried powders were found to have comparatively higher fat, carbohydrate, AOX and TPC values and lower fibre content which may be attributed to presence of high amounts of rice flour additive. The lycopene values for tomato powders in Stage 2 were found to be lower than in Stage 1 trials except for the Trellis variety. The main reasons for this could be varietal change, quality of the produce, storage conditions etc., as these were supplied in second grade condition. However, the analytical data for capsicums in both Stages 1 & 2 were comparable. The edible oil extracts of tomato and capsicum powders were found to have lower concentrations of lycopene and  $\beta$ -carotene respectively however, SFE samples showed high concentrations of these compounds. Further minor scale-up studies using 1-5kg of dried powders will be required to confirm these results.

The clarified tomato water probiotic beverage developed in Stage 2 was tested for *lactobacillus* probiotic counts at regular intervals (0, 7, 15, 30 and 60 days). The counts remained very high until day 60 and sensory evaluation indicated that the addition of probiotics to the tomato water improves the sensory quality of the products. A further product development with suitable flavour systems and optimisation is suggested to improve consumer acceptance. Overall, the Stage 1 & 2 studies successfully tested the concept processing methodologies and produced dried tomato and capsicum products on a pilot scale. Lycopene and  $\beta$ -carotene extraction

methods were trialled on a laboratory scale. Probiotic tomato beverages were successfully produced and assessed for shelf-life and sensorial characteristics.

#### **Commercialisation opportunities and next steps**

Following the completion of Stage 1 & 2 of the project, several value-added products were produced on both laboratory and pilot scale and presented to the industry client. The technologies and products developed from this research offer opportunities for commercialisation.

BGGA will assess the results, undertake techno-economic and market assessments prior to considering further scale-up and full-scale commercialisation of production of dried powders and probiotic tomato water. Extraction of lycopene and  $\beta$ -carotene needs further trials with minor scale up using 1-5kg dried powders.

BGGA has strong intent and capacity to commercialise the solutions developed through this project when fully explored.

#### **Project Impacts**

The research undertaken in Stages 1 & 2 of this project led to the development of a number of value-added products from the waste /surplus tomato and capsicum produce. If these technologies are successfully commercialised, this project is expected to help to reduce the waste in this sector by at least 70%. This will not only reduce the crop wastage but also saves resources and generates additional revenue for growers, making the industry more sustainable and enabling the creation of new regional industries and employment in the sector.



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Figure 1: Three different varieties of tomatoes (Dobes, Mt Nutt and Trellis) used in the processing



Figure 1: Red capsicum varieties, Warlock (used in Stage 1 trial) and Ducati (used in Stage 2 trial)



Figure 3: Lycopene oil extracts (left to right) from Dobes, Mt Nutt, Trellis and Sylviana variety tomato freeze dried powders



Figure 4:  $\beta$ -Carotene oil extracts (left to right) from Warlock and Ducati variety capsicum freeze dried powders