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Short communication

Benchmarking study of quality parameters of Rivoli Bay selection of *Kunzea pomifera* (muntries): A new Indigenous crop from Australia

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ABSTRACT

New crops have played a significant role in the economic growth of countries around the world. Developing reliable information and knowledge of new crops is essential. Here we focus on one of 13 potential native food crops Indigenous to Australia, *Kunzea pomifera* L. (muntries, muntrie berries, family Myrtaceae). *K. pomifera* fruit is naturally sweet, palatable to "western" palates, has high levels of antioxidant compounds and has obtained high consumers' acceptance in a range of products. However, as this is a new crop, there is limited information about the horticultural production of *K. pomifera*. This study was conducted to develop methods and determine benchmark values for several fundamental fruit characteristics (size, total soluble solids, moisture content and total phenolic content), using a clonally propagated selection, "Rivoli Bay". Additionally, nutrient levels were determined and compared with three other Myrtaceae species *K. ericoides, Chamelaucium spp*. and *Leptospermum lanigerum*. Potassium and phosphorus levels in leaves sampled in 2015 were lower than in leaves sampled in November 2004 and January 2005 and the Myrtaceae species. Inadequate nutrition for these two key macronutrients may contribute to high variabilities of fruit size/100-berry weight and total phenolic content. The present study provides a critical reference point for the muntries industry regarding fruit characteristics (fruit size, total soluble solids, moisture content and total phenolic content) and macronutrients (potassium and phosphorus). The study highlights that optimal nutrition should be monitored as an integral part of new crop development to maximise potential at every step in the value chain.

1. Introduction

New crops species have provided significant benefits in terms of economic growth, vibrant communities, employment and new export opportunities for countries around the world. To achieve success, new crop industries must overcome many challenges including development of cultivars that satisfy all sectors of the value chain from growers, to processors and finally consumers.

Examples of global new crop development over the last 100 years include rapeseed/canola (*Brassica napus*) (Canola Council of Canada, 2015; FAOSTAT, 2015; Statistics Canada, 2015), macadamia nut (*Macadamia* spp.), originally from Australia but developed in Hawaii (Shigeura and Ooka, 1984; Australian Macadamia Society, 2016) and quinoa (*Chenopodium quinoa*) from Peru and Bolivia (Bhargava and Srivastava, 2013; Blare and Donovan, 2016). New crops have broad benefits on communities, including jobs (LMC International, 2013).

While the potential benefits of new crops are significant, the pathway to success for each new crop is different, and many problems need to be addressed. Crops, such as canola, quinoa and macadamia, that have a history of cultivation elsewhere, can be established with relative ease in a new environment such as Australia, because there is a body of knowledge readily available (Salvin et al., 2004; Bhargava and Srivastava, 2013). In comparison, establishing a completely new crop, such as an Indigenous crop, requires gaining reliable information on relatively basic characteristics such as plant growth, fruit/nut characteristics, yield and crop production requirements (Fletcher, 2002; Salvin et al., 2004). Ultimately, different cultivars need to be evaluated in a range of suitable growing regions to maximise all aspects of the value chain, producing new, high quality and yielding cultivars that satisfy the needs of processors and consumers.

In 2000, 13 Indigenous Australia plant species were identified as having high potential for the development of the Australian native food industry (Ahmed and Johnson, 2000). Of these, there is one stand-out success story, lemon myrtle (*Backhousia citriodora*, native to Queensland, Australia) which is sold as fresh and dried leaves and oil (Clarke, 2012). Although still a relatively small industry (average production is between 575 to 1,100 t per year and valued at AU$7

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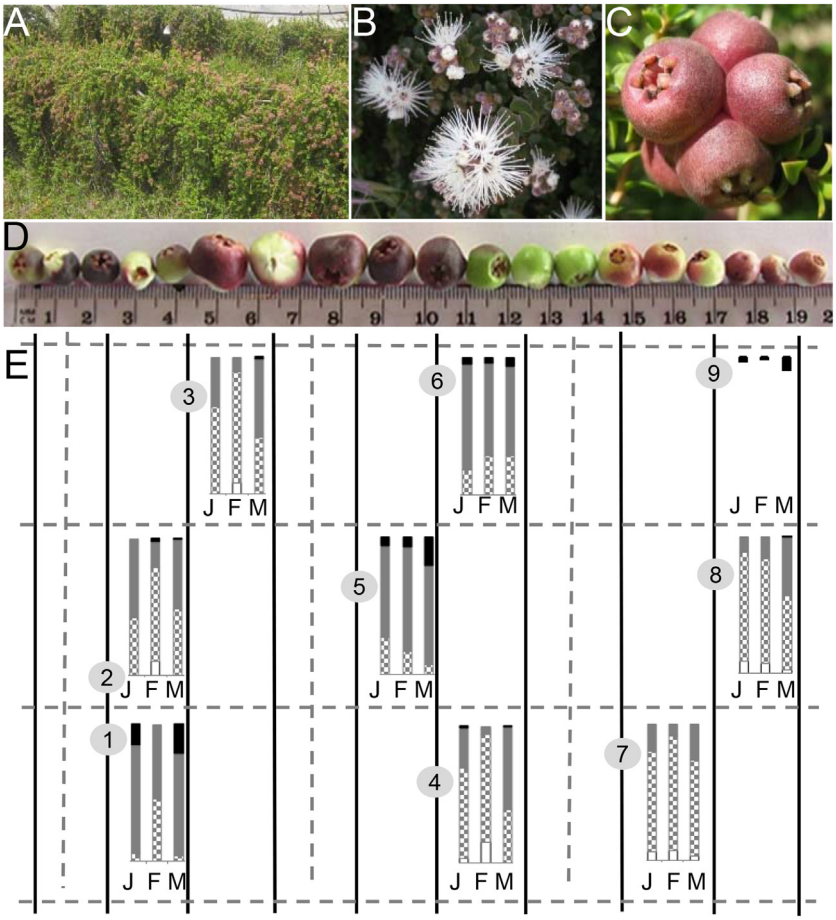

Fig. 1. *K. pomifera,* Rivoli Bay plants, on trellises (A), with flowers (B), and berries (C), muntrie berries of different sizes and colours (D), and a map of nine Rivoli Bay plants at Mt Pleasant (E). The map represents the position of the main stem of each plant (numbered, light grey circles) on the trellises (solid line). Data of berry sizes harvested in January (J), February (F) and March (M) 2015 (bar columns). Each bar represents 100%, consisting of percentage of extra-large- (black area), large- (grey area), medium- (checked area) and small- (white area) sized berries. Dash lines divide the orchard into nine quadrants.

to AU$23 million) (Clarke, 2012), lemon myrtle is now exported to Europe and USA (Clarke, 2012; Foster, 2014; Mazzorana and Mazzorana, 2016).

Here we focus on *Kunzea pomifera* (muntries) – one of the other 12 potential native food crops Indigenous to Australia (Clarke, 2013; Sultanbawa, 2016). *K. pomifera*, Myrtaceae family, grows naturally in parts of South Australia and Victoria, Australia, and its fruit was an important part of the diet and culture of Indigenous Australians (Hegarty et al., 2001). In cultivation, *K. pomifera* is trellised and stems of neighbouring plants weave together to form "a green wall" (Fig. 1A). *K. pomifera* flowers from September to January depending on regions and selections (Fig. 1B) (Ryder et al., 2008). Berries are harvested when they are ripe or turning purple-red (Fig. 1C and D) (Ryder et al., 2008). In the wild, berry size is approximately 1.0 cm diameter (Clarke, 2012; Ryder et al., 2008), but berries of some muntries selections are up to 1.6 cm in diameter (Fig. 1D).

Early consumers of new crops often pay a premium for these novel foods and high quality, premium-grade fruit of consistent quality is critical for success (Salvin et al., 2004). Quality assurance requires the establishment of benchmarks but only basic "produce quality information sheets" have been established for the Australian native food industry, including muntries (Ryder et al., 2008). Coefficient of variation% (CV%) is a useful and important parameter, especially for assessing the level of variability. For example, reviews on plant breeding suggest that CV% of <10% is desirable for most crop characteristics (Acquaah, 2012); however, other authors suggest that <20% is more realistic (Sahu, 2013; Ferreira et al., 2016). CV% has been used to assess highbush blueberry cultivar (*Vaccinium x corymbosum* L.), 'Herbert', (Litwińczuk et al., 2005) and grape cultivars (Martinez-Casasnovas et al., 2012). As new crops develop into established crops, CV% provides a way to assess year-to-year, cultivar and environmental variation reliably and easily.

The potential of muntries has not been realised, in part due to absence of reliable horticultural production information (Page, 2004; Ryder et al., 2008; Clarke, 2012). There is currently only one widely planted selection in cultivation, Rivoli Bay, but others are starting to be evaluated. Recently, fruit characteristics of muntries, Rivoli Bay, were reported in a preliminary paper with a small number of plants (Do et al., 2016). Clonal selection of plants for fruit colour and flavour has been identified as a key opportunity for growth of the muntries industry (Clarke, 2012). This current study was designed to (1) establish reference values for the Rivoli Bay selection, for fundamental fruit quality parameters (size, total soluble solids, moisture content and total phenolic content); (2) establish methods for assessment of fruit characteristics; and (3) investigate leaf nutrients to evaluate plant health.

2. Materials and methods

2.1. Plant materials and growth conditions

Nine healthy *K. pomifera* plants, selection Rivoli Bay, were chosen from a mature orchard (planted in 2000) at Mt Pleasant South