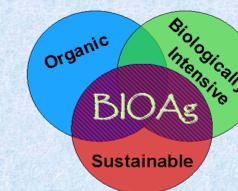


# INFLUENCE OF PROCESSING ON PHYTONUTRIENT CONTENT OF ORGANIC AND CONVENTIONAL RASPBERRIES AND BLUEBERRIES

Sablani, S. S., Andrews, P. K., Davies, N., Saez, H., Walters, T. W., Syamaladevi, R. M. and Mohekar, P. R.



## Abstract

- The phytonutrient of conventionally and organically grown blueberries and raspberries were measured.
- The influence of industrial processing methods i.e. air drying, freeze-drying, canning, freezing and fruit juice concentrate preparation on phytonutrient concentration was determined.
- The *long-term* goal of the research is to improve the shelf life and nutrient retention in organically grown berries by increasing our understanding of the mechanisms of nutrient destruction in processing methods.

## Introduction

- The market for organic foods has increased significantly during the last few years.
- Over the last decade the organic farm acreage in the State of Washington increased nine fold and is expected to grow further.
- Studies have shown that the nutritional quality of organically grown fruits and vegetables may be better than their conventionally grown counter parts in terms of macronutrients, vitamins, minerals, and phenolic compounds.
- A significant portion of organic produce needs to be processed in order to make them available throughout the year. Sometimes, processed fruits are desirable as ingredients in bakery and dairy products.
- The information on stability of these health-promoting components during storage and processing will be useful to the organic food processing industry in maintaining important nutritional attributes.

The specific objectives of the proposed study are:

- To study the influence of common processing such as canning, freezing, juice processing, and drying on phytonutrient content of blueberries and raspberries
- To quantify the retention of phenolics, ascorbic acid, and antioxidant activity in processed berries during storage at various temperatures.

## Materials and Methods

### Raspberries



**Variety:** Meeker  
**Harvesting:** Hand and Machine  
**Treatments:** Conventional and Organic

### Blueberries



**Varieties:** Duke and Reka  
**Harvesting:** Hand  
**Treatments:** Conventional and Organic

### Chemical Analysis

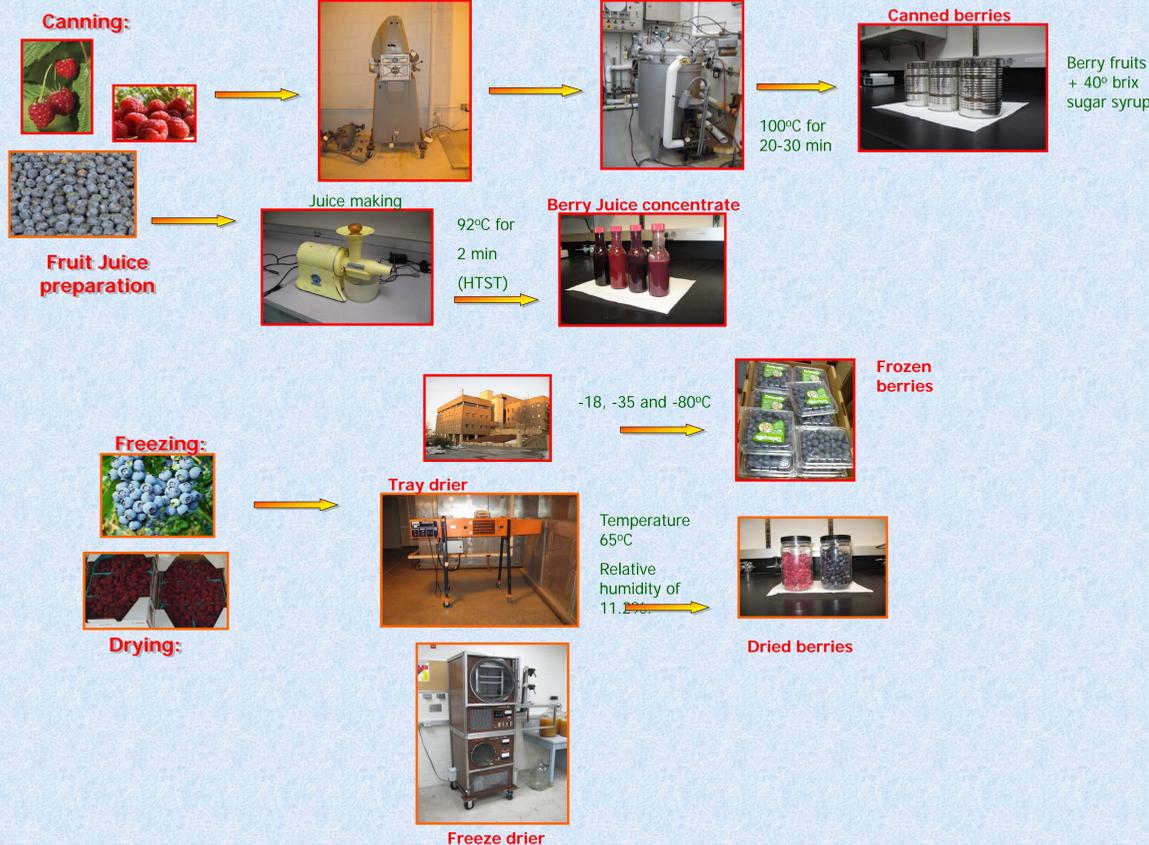
Anthocyanins: pH Differential Method

Polyphenolics: Folin-Ciocalteu assay Method

Flavonoids: HPLC method

Antioxidants: 2,2'-azino-bis-(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS)/hydrogen peroxide/peroxidase (Horseradish peroxidase, HRP, Type VI-A) method.

## Processing Methods:



## Results and Discussion

Table 1. Phytonutrients content in fresh raspberries and blueberries

Crop	Variety	Harvest	ID	Treatment	Total antioxidant activity (mmol Trolox equiv/ g FW)	Total phenolics (mg gallic acid equiv/g FW)	Total anthocyanins (mg Cyd-3-Soph-5-Glu* or Cyd-3-Glu**/g FW)
Raspberry	Meeker	Machine	RB-1	Conventional	14.2 (0.416) <sup>a</sup>	1.98 (0.002) <sup>i</sup>	1.22 (0.181) <sup>n</sup>
	Meeker	Machine	RB-1	Organic	19.1 (0.468) <sup>b</sup>	2.25 (0.080) <sup>j</sup>	1.24 (0.121) <sup>n</sup>
	Meeker	Hand	RB-2	Conventional	15.3 (0.495) <sup>c</sup>	1.92 (0.141) <sup>k</sup>	1.17 (0.099) <sup>o</sup>
	Meeker	Hand	RB-2	Organic	12.6 (0.600) <sup>d</sup>	1.95 (0.056) <sup>k</sup>	0.83 (0.054) <sup>o</sup>
Blueberry	Duke	Hand	BB-1	Conventional	14.3 (0.946) <sup>e</sup>	2.43 (0.100) <sup>l</sup>	1.86 (0.109) <sup>p</sup>
	Duke	Hand	BB-1	Organic	16.9 (0.793) <sup>f</sup>	2.59 (0.040) <sup>l</sup>	1.68 (0.063) <sup>p</sup>

Same superscript letter on the right side of the quantities indicate the means of the quantities are statistically similar  
\*Cyanidin-3-sophoroside-5-glucoside @ 524nm for raspberries  
\*\*Cyanidin-3-glucoside @ 530nm for blueberries

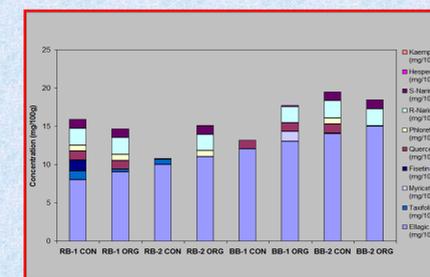


Fig 1. Flavonoids in fresh raspberries and blueberries (Aglycone and Glycoside)

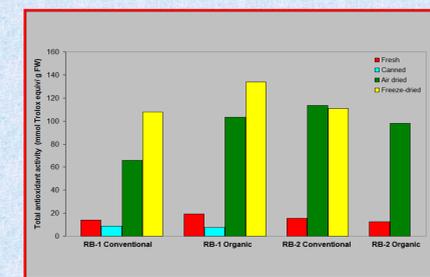


Fig 2. Total antioxidant activity in raspberries and blueberries

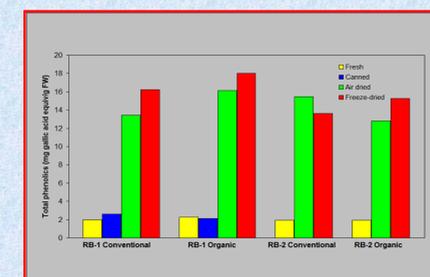


Fig 3. Total phenolic concentration in raspberries and blueberries

- Total phenolics concentration was significantly higher in organically produced berries (Table 1).
- The total antioxidant activity and total anthocyanins concentration in raspberries and blueberries depend on the cultivar and mode of harvesting (Table 1).
- A variety of different polyphenols in particular flavonoids were determined in blue berries and raspberries (Figure 1).
- In raspberries, ellagic acid predominates for aglycones and taxifolin glycoside predominates for glycosides, but in blueberries, fisetin and hesperidin predominate for glycosides and ellagic acid predominates for aglycones (Figure 1).
- Drying significantly increased the total phenolics concentration and the antioxidant activity in both raspberries and blueberries (Figures 2 and 3).
- Canning process did not influence the total phenolics concentration and the antioxidant activity in both raspberries and blueberries (Figures 2 and 3).
- Processing of berries can possibly improve availability of the phytonutrient content
- A definitive analysis of organic versus conventional treatments and flavonoids content is not yet possible.

## Acknowledgements

This research is funded with a BioAg program grant from The Center for Sustaining Agriculture and Natural Resources, the Washington State University

