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Research Article

ASSESSMENT OF NUTRIENT COMPOSITION OF PAPAYA CULTIVARS GROWN UNDER PROTECTED CONDITIONS

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Abstract- Papaya is cultivated on a limited scale in Punjab and other north Indian states, due to climatic vagaries like extreme temperatures, frost injury and viral diseases. But, protected cultivation can alleviate these constraints to some extent. It can also improve the fruit quality and nutrient composition by providing nearly optimum environment. Thus, keeping this in view, the present study analysed five papaya varieties(Surya, Pusa Dwarf, Arka Prabhath, Madhu and Red Lady 786) for nutrient composition i.e. vitamin C, β carotene and mineral content. Significant variations were revealed in terms of vitamin C, β carotene and potassium content. Red Lady 786 recorded highest amount of vitamin C and β carotene. Among minerals, highest potassium content (2.50 g/100g) was found in Surya while calcium and magnesium content was at par in all the varieties. The overall results indicated that the variety Red Lady 786 was most superior in respect of nutrient composition.

Keywords- Nutrient, Mineral, Papaya, Protected, Red Lady 786

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Introduction

Papaya (*Carica papaya* L.) is an important fruit crop of tropical and sub-tropical regions of India. It has emerged as one of the choicest fruit crop due to its high yield potential and short gestation period. The ripe fruit of papaya possesses an immense nutritive value. It is low in calories (39 calories/100 g) and contains no cholesterol, but, is a rich source of antioxidants, vitamins, minerals (potassium, calcium and magnesium) and fibres. The papaya fruits are rich source of vitamin A (1094 IU/100 g) and flavonoids like β carotene having anti-oxidant properties. Fresh papaya is also a good source of potassium (257 mg/100 g) and calcium. India is the largest producer of papaya in the world with a production of 5381.7 thousand mt, [1]. However, in northern India, the systematic and accurate estimate of area and production of papaya is not available. This is mainly attributed to extreme temperatures, frost injuries, viral diseases, polygamous nature of plant etc.

Being a native of tropical environment, the papaya plants exhibit extreme sensitivity to low temperature. The existence of sub-optimal temperature during the growing period aggravates the incidence of carpelloidy, sex reversal and reduced pollen viability. The low temperatures below 20˚C may further accentuate the development of insipid fruits with low sugar content and poor nutrient value. These problems can be managed to some extent by selection of improved varieties and by growing plants under protected conditions.

Protected cultivation technology involves creation of nearly optimum environmental conditions for the sustainable growth of plants. It serves as an alternative to open-field cultivation. It improves the yield quantity as well as quality. In India, the commercial production through protected cultivation is still in its preliminary stage. Generally, vegetable and flower crops are raised under protected conditions in different parts of country. Among fruit crops mainly strawberry is grown under protected conditions. However, crops like papaya, banana and pineapple can also offer good potential. In India, limited information is available regarding the nutrient composition of papaya fruit raised under protected condition. Therefore, the present study was carried out for assessing the nutritional composition of different papaya cultivars, grown under protected conditions.

Materials and Methods

The present research was conducted at Fruit Research Farm, Department of Fruit science (Punjab Agricultural University), Ludhiana (Punjab) during 2012-13. The site is located at latitude of 30.9˚N, longitude of 75.85˚E and at altitude of 244 m above mean sea level. The plants of five papaya varieties namely Surya, Arka Prabhath, Pusa Dwarf, Red Lady 786 and Madhu were planted at a spacing of 6 ft × 6 ft, under poly net house. All the varieties were given recommended doses of fertilizers and other cultural practices for uniform growth. The fruits of these varieties were analysed for vitamin C, β carotene and mineral (K, Ca and Mg) content.

Method 1

The vitamin C content was estimated by reduction of 2,6-dichlorophenol indophenol dye by ascorbic acid according to the method of [2] .For this, 10 ml of juice was taken and final volume was made up to 100 ml with 3 per cent metaphosphoric acid and then 10 ml aliquot was titrated against standardized dye to obtain a pink colour which persisted for 15 seconds. Ascorbic acid was expressed in terms of mg per 100 g by using the following formula:

$$\text{Ascorbic acid (mg/100g)} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made up} \times 100}{\text{Aliquot of extract} \times \text{Weight of sample taken}}$$

Method 2

The β carotene was determined by the method of [3].In this method, 0.3 g of fruit pulp was weighed and crushed in a pestle and mortar. The yellow pigment was extracted using acetone and petroleum ether (1:1). After filtration, the entire extract was transferred to a separatory funnel wherein two layers were formed.

The upper layer with dissolved yellow compound (extract) was collected and the final volume was noted. The total carotene content was determined by recording its optical density at 445 nm wavelength using petroleum ether as blank. The results were expressed as β-carotene mg per 100 g of fruit pulp by applying the following formula:

$$\beta \text{ carotene} = \left(\frac{A \times y \times 1000}{A\,\% \times g} \right)$$

where, A = absorbance
y = final volume of extract
A % = Extinction coefficient (2500)
g = weight of sample (0.3 g)

Method 3

For determination of minerals *viz.* Potassium, Calcium and Magnesium, the fruit sample was digested by taking 0.5 g of dried pulp and 8-9 ml of di-acid mixture consisting of nitric acid (HNO_3) and per chloric acid ($HClO_4$) in the ratio of 4:1. Thereafter, the digests were filtered and the volume was made to 50 ml using double distilled water. These digests were used for the analysis of mineral nutrients. Among the minerals, potassium was determined through flame photometer method and calcium and magnesium were computed by Atomic Absorption spectrometer. The data was analysed by Least Square Design (LSD) using SAS (Statistical Analysis System) and significance level was determined at $P < 0.05$.

Results and Discussion

The assessment of current study revealed significant variations in the nutrient composition of different varieties. The perusal of data for vitamin C content of different varieties [Table-1] revealed that among all the cultivars, the variety Red Lady 786 was found to be superior with a vitamin C content of 73.20 mg/100g. It was followed by Madhu (65.06 mg/100g) and Pusa dwarf (62.44 mg/100g), while the variety Surya witnessed lowest vitamin C content (45.95 mg/100g). These results were in accordance with [4] who also witnessed higher vitamin C content in Red Lady 786. The genotypic variations might be ascribed to the differences in the vitamin C content of varieties. Also, the differential interaction of various genetic and environmental variables with metabolic processes can be responsible for the variations in ascorbic acid content of different varieties. The ascorbic acid level in fruit is also influenced by the availability of light to the crop and to individual fruits.Under poly net house, the plants received proper intensity of light which could have improved the ascorbic acid content in fruits compared to open condition. Similar results were worked out by [5].

Table-1 *Nutrient composition of different papaya varieties grown under protected conditions.*

Cultivar	Vitamin C (mg/100 g)	Vitamin A (β carotene) (mg/100g)	Potassium (g/100 g)	Calcium (g/100 g)	Magnesium (g/100 g)
Surya	45.953	5.37	2.50	0.14	0.15
Madhu	65.06	4.18	1.54	0.15	0.16
Pusa Dwarf	62.44	2.57	2.00	0.15	0.16
ArkaPrabhath	53.48	3.22	2.06	0.06	0.11
Red Lady 786	73.20	5.73	1.87	0.17	0.13
C D (0.05%)	9.45	1.41	0.93	NS	NS
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Further in the study, the highest level of β carotene (5.73 mg/100 g) was recorded in the fruits of Red Lady 786 followed by Surya (5.37 mg/100 g) and Madhu (4.18 mg/100 g). The former two varieties i.e. Red Lady 786 and Surya were at par with each other but statistically superior to remaining varieties, barring Madhu, which was significantly indifferent with Surya. Fruits of Pusa Dwarf expressed minimum vitamin A content (2.57 mg/100 g). As reported by[4], these variations among the varieties could be attributed to the genetic differences. [6] als ofurther confirmed that the cultivar-variety factor affects the carotenoid content of fruits. Carotenes are colour imparting pigments and the bright red colour pulp of variety Red Lady 786 and Surya also confirmed a higher level of β carotene.

The data pertaining to the mineral content of papaya varieties is also mentioned in [Table-1]. The perusal of data revealed no significant variation in calcium content of fruits. The calcium level in all the varieties was statistically at par with each other. But numerically, Red Lady 786 exhibited highest (0.17 g/100 g) calcium content while the lowest Calcium content (0.06 g/100 g) was found in fruits of Arka Prabhath. The magnesium content in all the varieties was also found as non significant. However, numerically Pusa Dwarf (0.16 g/100 g) recorded highest magnesium content and Arka Prabhath recorded lowest (0.11 g/100 g). These results were in agreement with [7] who also reported highest calcium and magnesium content (0.14 g/100 g) in Red Lady 786 grown under poly-house in Turkey conditions. In terms of potassium content, the varieties exhibited significant variations. Of all the varieties, the variety Surya exhibited highest potassium content of 2.50 g/100 g succeeded by Arka Prabhath (2.06 g/100 g) and Pusa Dwarf (2.0 g/100 g) while the variety Madhu exhibited lowest potassium content of 1.54 g/100 g. But, this data was found to be comparatively superior than reported by [7]. The soil and geographical variations could be attributed to such differences. Also, the soils of Punjab are rich in potassium which could have also resulted in its higher uptake and subsequently higher content in fruits. The variations among the cultivars in present study can also be due to their differential ability in withdrawing nutrients from soil and incorporating them into fruits.

Conclusion

Based on the overall study and analysis, the present investigation thus revealed that the nutritional value of cultivar Red Lady 786 is superior over other cultivars under protected conditions and thus is more acceptable for table purposes and processing from consumer's health point.

Conflict of Interest: On behalf of myself and my co-authors, I agree and accept that there is no conflict of interest.

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