

Qualitative Characters and Sensory Test of Nutrient Treated on *Carica papaya* L. Fruits

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Abstract

The study was conducted in fruit and vegetable laboratory VFRDC (Vegetable and Fruit Research and Development Centre), Yemon Village, Hlegu Township and laboratory of Department of Botany, University of Yangon. The total number of fruits used in the experiment was 63. There were 7 treatments in the experiments. Each experiment had 9 fruits with 3 replicates. These fruits were arranged in complete Randomized Design (CRD) at room temperature (29-30 °C). The results of single fruit characteristics and sensory characteristics showed that T3(N20+B30 kg ha⁻¹) treated plants higher than the other treatment levels. These level results of the sweetest fruits (13.13°Brix) and the acid content were also highest (0.63%). Hence, T3 (N20+B30 kg ha⁻¹) should choose for the quality of fruits.

Keywords: single fruit characteristics, sensory characteristics, treatments levels and replication.

Introduction

The papaya (*Carica papaya* L.) is the most economically important fruit in the Caricaceae family. Its fruits, available through the year are very common food items in local markets (Purseglove, 1984). Sixty percent of the Papaya fruit is edible. The latter is an excellent source of vitamin C (ascorbic acid) a slice of which can meet on adult's daily requirement of 70 to 75 mg Vitamin C. Papaya is a fast growing crop which needs an abundant supply of nutrients at all times. To ensure good growth and high fruit yields, fertilizers should be applied of frequent intervals and at high rates it is particularly important in infertile soils (Philippines Team, 1984).

Measurements of skin color, pulp firmness, soluble solids, titratable acidity, ascorbic acid, respiration rate and ethylene production were made after harvest and daily during the storage period, whereas those of sensorial characteristics were performed when fruits reached full ripening (Nakasone and Paull, 1998). Typically, climacteric behavior was not verified for papaya fruit harvested at different maturity stages. Fruit harvested at a more advanced maturity stage showed reduced ethylene production during postharvest. Harvesting fruits at early ages is acceptable but lower sensory

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quality for consumption. The commercial success and increased productivity in papaya are due to the improved cultivars and production technology of the country (Medina, 1998).

Thus, the present study was conducted to know the single fruit characteristics in different treatment levels by the following objectives to observe the different treatment levels of qualitative characters of Papaya.

Materials and Methods

The study was conducted in fruit and vegetable laboratory VFRDC (Vegetable and fruit Research and Development Centre), Yemon village, Hlegu Township and laboratory of Department of Botany, University of Yangon, Yangon Region.

Experimental layout

The total number of fruits used in the experiment was 63. There were 7 treatments in the experiments. Each experiment had 9 fruits with 3 replicates. These fruits were arranged in complete Randomized Design (CRD) at room temperature (29 - 30 °C).

Data collection and statistical analysis

The following data were collected from single fruit characteristic; fruit length, fruit width, fruit weight, seed weight, peel weight, pulp weight, peel hardness, pulp hardness, total soluble solid (TSS), titratable acidity (TA), pH level and fruit temperature, respectively. Sensory characteristics of pulp intensity, characteristic papaya aroma, off-odor, pulp firmness, flavor general acceptability, sweetness, sourness, balance of sweetness and sourness, characteristics papaya flavor, off-flavor were immediately evaluated by tasting the prepared samples giving the sensory scoring sheets to the 9 number of trained and untrained panelists data were statistically analyzed using IRRISTAT software Program. All treatment means were compared using Least Significant Different (LSD) at 5 % level of significance.

Results

A. Single fruit characteristics

Fruit length, width, weight and seed weight

The result of the experiment showed that the maximum fruit length 23.00 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ and N20+B20+S40 kg ha⁻¹ 20.43 cm each, then N20+B20 kg ha⁻¹ 20.17 cm. Control had 16.83 cm and which was the least value among treatments. The statistical result of

fruit length treatment was significant at 0.01 % level. The maximum fruit width 36.67 cm was obtained from the treatments N20+B30 kg ha⁻¹, followed by N20+B30+S40 kg ha⁻¹ 36.17 cm and then N20+B40 kg ha⁻¹ 34.33 cm. Control had 28.33 cm and which was the least value among treatments. The maximum fruit weight 1133.67 g was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ 1050.00 g and then N20+B40+S60 kg ha⁻¹ 920.00 g. Control had 523.33 g and which was the least value among treatments. The maximum seed weight 16.95 g was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ 16.67 g and then N20+B20 kg ha⁻¹ 16.63 g. Control had 14.78 g and which was the least value among treatments. The statistical results of fruit length, fruit width, fruit weight and seed weight treatments were not significant (Table 1).

Table 1. Single fruit characteristic different level of nitrogen, borax and sulphur treated papaya

Treatment	Single fruit characteristic per plant			
	Fruit length per plant (cm)	Fruit width per plant (cm)	Fruit weight per plant (g)	Seeds weight per plant (g)
T ₁ (control)	16.83	28.33	523.33	14.78
T ₂ (N20+B20 kg ha ⁻¹)	20.17	32.73	873.33	16.63
T ₃ (N20+B30 kg ha ⁻¹)	23.00	36.67	1133.67	16.95
T ₄ (N20+B40 kg ha ⁻¹)	20.43	34.33	1050.00	16.67
T ₅ (N20+B20+S40 kg ha ⁻¹)	20.43	36.17	750.00	15.78
T ₆ (N20+B30+S50 kg ha ⁻¹)	18.17	31.50	830.00	15.37
T ₇ (N20+B40+S60 kg ha ⁻¹)	18.09	29.64	920.00	15.83
F test	**	ns	ns	Ns
5% LSD	8.12	10.87	256.87	1.77
cv%	23.30	18.60	16.60	6.30

*= highly significant ns= non-significant

B. Peel and pulp weight

The result of the experiment showed that the maximum peel weight 101.06 g was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B20 kg ha⁻¹ 91.82 g and then N20+B40 kg ha⁻¹ 78.47 g. Control had 61.07 g and which was the least value among treatments. The statistical result of peel weight treatment was not significant. The result of the experiment showed that the maximum pulp weight 925.75 g was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ 870.46 g and then N20+B40+S60 kg ha⁻¹ 824.10 g. Control had 426.89 g and which was the least value among treatments. The statistical result of pulp weight treatment was significant at 0.05 % level (Table 2).

C. Peel and pulp hardness

The result of the experiment showed that the maximum peel hardness 0.67 kg cm⁻² was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ 0.53 kg cm⁻² and then N20+B40+S60 kg ha⁻¹ 0.41 kg cm⁻². Control had 0.13 kg cm⁻² and which was the least value among treatments. The result of the experiment showed that the maximum pulp hardness 2.50 kg cm⁻² was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B20 kg ha⁻¹ 2.47 kg cm⁻² and then N20+BS40 kg ha⁻¹ 2.40 kg cm⁻². Control had 1.20 kg cm⁻² and which was the least value among treatments. The statistical result of peel and pulp hardness treatments was not significant (Table 2).

Table 2. Single fruit characteristic different level of nitrogen, borax and sulphur treated papaya

Treatment	Single fruit characteristic per plant			
	Peel weight(g)	Pulp weight(g)	Peel hardness (Kg cm ⁻²)	Pulp hardness (Kg cm ⁻²)
T ₁ (control)	61.07	426.89	0.13	1.20
T ₂ (N20+B20 kg ha ⁻¹)	91.82	714.90	0.20	2.47
T ₃ (N20+B30 kg ha ⁻¹)	101.06	925.75	0.67	2.50
T ₄ (N20+B40 kg ha ⁻¹)	78.47	870.46	0.53	2.40
T ₅ (N20+B20+S40 kg ha ⁻¹)	83.98	594.48	0.32	1.98
T ₆ (N20+B30+S50 kg ha ⁻¹)	61.68	699.15	0.12	1.98
T ₇ (N20+B40+S60 kg ha ⁻¹)	63.02	824.10	0.41	1.87
F test	ns	**	ns	Ns
5% LSD	43.52	198.00	0.46	1.37
cv%	31.70	15.40	103.00	37.6

*= highly significant ns= non-significant

D. Total soluble solid, fruit temperature and titratable acid content

The result of the experiment showed that the maximum TSS 13.13 °Brix was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ 12.60 °Brix and then N20+B20+S40 kg ha⁻¹ 12.23 °Brix. Control had 10.40 °Brix and which was the least value among treatments. The statistical result of TSS treatment was significant at 0.01 % level. The result of the experiment showed that the maximum fruit temperature 27.60 °C was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40+S60 kg ha⁻¹ 27.47 °C and then N20+B20 kg ha⁻¹ 27.40 °C. Control had 27.00 °C and which was the least value among treatments. The statistical result of fruit temperature treatment was not significant. The result of the experiment showed that the maximum TA 0.60 % was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B20+S40 kg ha⁻¹ and N20+B30+S50 kg ha⁻¹ 0.56 % each,

and then N20+B20 kg ha⁻¹, N20+B40 kg ha⁻¹ and N20+B40+S60 kg ha⁻¹ were 0.44 %. Control had 0.34 % and which was the least value among treatments. The statistical result of TA treatment was significant at 0.05 % level (Table 3).

Table 3. Single fruit characteristic different level of nitrogen, borax and sulphur treated papaya

Treatment	Single fruit characteristic per plant			
	Sweetness (°Brix)	Fruit temperature (°C)	pH	Acidity (%)
T ₁ (control)	10.40	27.00	5	0.34
T ₂ (N20+B20 kg ha ⁻¹)	11.77	27.40	6	0.44
T ₃ (N20+B30 kg ha ⁻¹)	13.13	27.60	6	0.60
T ₄ (N20+B40 kg ha ⁻¹)	12.60	27.07	6	0.44
T ₅ (N20+B20+S40 kg ha ⁻¹)	12.23	27.20	6	0.56
T ₆ (N20+B30+S50 kg ha ⁻¹)	11.07	27.07	6	0.56
T ₇ (N20+B40+S60 kg ha ⁻¹)	10.63	27.47	6	0.44
F test	**	ns	ns	*
5% LSD	1.59	0.95	0.67	0.45
cv%	7.60	2.00	6.5	52.80

*= highly significant *= significant ns= non-significant

E. Sensory evaluation on papaya fruits Pulp quality and aroma

Sensory evaluation on the quality of papaya fruits such as sweetness, sourness, aroma and flavor etc. of fruits were analyzed using the freshly harvested fruits from each treatment. The evaluation was done by the answers of a set of questionnaire from trained and untrained panels. The sensory characteristics of pulp color quality: pulp intensity and pulp firmness were shown as follows. The result of the experiment showed that the maximum pulp intensity 9.93 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B20 kg ha⁻¹ and N20+B40 kg ha⁻¹ 9.66 cm each, and then N20+B40+S60 kg ha⁻¹ 9.84 cm. The least value pulp intensity 9.36 cm was obtained from N20+B30+S50 kg ha⁻¹ treatments. The statistical result of pulp intensity treatment was not significant. The result of the experiment showed that the maximum papaya aroma 9.26 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ 9.21 cm and then N20+B30+S50 kg ha⁻¹ 8.66 cm. The least value papaya aroma 8.26 cm was obtained from N20+B20 kg ha⁻¹ treatments. The statistical result of papaya aroma treatment was significant at 0.05 % level. The result of the experiment showed that the maximum off-odor 9.95 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40+S60 kg ha⁻¹ 9.86 cm and then N20+B30+S50 kg ha⁻¹ 9.70 cm. The least value off-odor 9.64 cm

was obtained from N20+B20+S40 kg ha⁻¹ treatments. The statistical result of papaya aroma treatment was significant at 0.05 % level. The result of the experiment showed that the maximum pulp firmness 6.00 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B30+S50 kg ha⁻¹ 5.99 cm and then N20+B20+S40 kg ha⁻¹ 5.94 cm. Control had 2.74 cm and which was the least value among treatments. The statistical result of off-odor and pulp firmness treatment was not significant (Table 4).

Table 4. Sensory evaluation on different level of nitrogen, borax and sulphur treated papaya

Treatment	Pulp color quality	Aroma		Pulp firmness
	Intensity	Papaya aroma	Off-odor	
T ₁ (control)	9.42	8.42	8.26	2.74
T ₂ (N20+B20 kg ha ⁻¹)	9.66	8.26	8.07	4.91
T ₃ (N20+B30 kg ha ⁻¹)	9.93	9.26	9.95	6.00
T ₄ (N20+B40 kg ha ⁻¹)	9.66	9.21	9.24	3.69
T ₅ (N20+B20+S40 kg ha ⁻¹)	9.93	8.07	9.64	5.94
T ₆ (N20+B30+S50 kg ha ⁻¹)	9.36	8.66	9.70	5.99
T ₇ (N20+B40+S60 kg ha ⁻¹)	9.84	8.53	9.86	3.54
F test	ns	*	Ns	ns
5% LSD	0.87	1.06	0.53	3.16
cv%	5.2	7.00	3.30	42.2

*= significant ns= non-significant

Pulp intensity: < 5 cm = pale yellow, > 5 cm = orange-yellow;

Characteristics banana aroma: < 5 cm = hardly perceptible, > 5 cm = full;

Off-odor: < 5 cm = strong, > 5 cm = absent;

Pulp firmness: < 5 cm = watery and soft, > 5 cm = firm and crispy.

F. Flavor

The sensory characteristics of pulp color quality: pulp intensity and pulp firmness were shown as follows. The result of the experiment showed that the maximum general acceptability 7.65 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by control 7.56 cm each, and then N20+B30+S50 kg ha⁻¹ 7.04 cm. The least value general acceptability 6.41 cm was obtained from N20+B20+S40 kg ha⁻¹ treatments. The statistical result of general acceptability treatment was significant at 0.01 % level. The result of the experiment showed that the maximum sweetness 9.43 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by control 9.25 cm and then N20+B30+S50 kg ha⁻¹ 8.17 cm. The least value sweetness 7.21 cm was obtained from N20+B20 kg ha⁻¹ treatments. The statistical result of sweetness

treatment was not significant. The result of the experiment showed that the maximum sourness 10.00 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B20+S40 kg ha⁻¹ 9.93 cm and then N20+B20 kg ha⁻¹ 9.28 cm. Control had 9.08 cm and which was the least value among treatments.

The result of the experiment showed that the maximum balance of sweetness and sourness 8.88 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B40 kg ha⁻¹ 8.72 cm and then N20+B20 kg ha⁻¹ 7.86 cm. The least value sweetness 5.97 cm was obtained from N20+B30+S50 kg ha⁻¹ treatments. The statistical result of sourness and balance of sweetness and sourness treatment was significant at 0.01 % level. The result of the experiment showed that the maximum papaya flavor 9.82 cm was obtained from the treatments of N20+B30 kg ha⁻¹, followed by N20+B30 kg ha⁻¹ 9.80 cm each, and then N20+B40+S60 kg ha⁻¹ 8.92 cm. The least value papaya flavor 7.29 cm was obtained from N20+B30+S50 kg ha⁻¹ treatments. The statistical result of papaya flavor treatment was not significant. The result of the experiment showed that the maximum off- flavor 10.00 cm was obtained from the treatments of N20+B30 kg ha⁻¹ and N20+B30+S50 kg ha⁻¹ each, followed by N20+B40+S60 kg ha⁻¹ 9.75 cm and then N20+B20+S40 kg ha⁻¹ 9.52 cm. Control had 7.73 cm and which was the least value among treatments. The statistical result of off- flavor treatment was significant at 0.05 % level (Table 5).

Table 5. Sensory evaluation on different level of nitrogen, borax and sulphur treated papaya

Treatment	Flavor per plant (cm)					
	General acceptability	Sweetness	Sourness	Balance of Sweetness and Sourness	Papaya flavor	Off-flavor
T ₁ (control)	7.56	9.25	9.08	7.11	8.91	7.73
T ₂ (N20+B20 kg ha ⁻¹)	7.02	7.21	9.28	7.86	7.68	7.73
T ₃ (N20+B30 kg ha ⁻¹)	7.65	9.43	10.00	8.88	9.82	10.00
T ₄ (N20+B40 kg ha ⁻¹)	6.97	7.62	10.00	8.72	9.80	9.46
T ₅ (N20+B20+S40 kg ha ⁻¹)	6.41	7.74	9.93	6.52	8.87	9.52
T ₆ (N20+B30+S50 kg ha ⁻¹)	7.04	8.17	10.00	5.97	7.29	10.00
T ₇ (N20+B40+S60 kg ha ⁻¹)	6.91	8.08	10.00	8.40	8.92	9.75
F test	**	ns	**	**	ns	*
5% LSD	0.57	1.32	0.86	1.68	0.59	0.7
cv%	4.60	9.20	5.00	13.2	3.90	4.4

**=highly significant * = significant ns= non-significant

General acceptability: < 4 cm = dislike extremely, exactly 4 cm = neither like nor dislike, > 4 cm = like extremely;

Sweetness: < 5 cm = lack, exact 5 cm = fairly, > 5 cm = very sweet;
 Sourness: < 5 cm = extremely, > 5 cm = hardly perceptible;
 Balance of sweetness or sourness: < 5 cm = too sweet or sour, > 5 cm = very good blending;
 Papaya favor: < 5 cm = hardly perceptible, > 5 cm = full flavor;
 off-flavor: < 5 cm = strong, > 5 cm = absent.

Discussion and Conclusion

The results of the experiment showed that the single fruit characteristics such as maximum fruit length 23.00 cm, maximum fruit width 36.67 cm, maximum fruit weight 1133.67 g, maximum seed weight 16.95 g, maximum peel weight 101.06 g, maximum pulp weight 925.75 g, maximum peel hardness 0.67 kg cm⁻², maximum pulp hardness 2.50 kg cm⁻² were obtained from the treatments of N20+B30 kg ha⁻¹. So, the fruit length, width, weight, seed weight, peel and pulp weight, peel and pulp hardness, total soluble solid, fruit temperature and titratable acid content were obtained from N20+B30 kg ha⁻¹ treated plants higher than the other treatment. The sweetest fruits 13.13 °Brix and acid content of 0.60 %. (Medina, 1998) reported that minimum sugar content of papaya was 12 °Brix for export.

(Jain and Nema, 2010) found that the heaviest fruit (2.7 kg), highest TSS (10 °Brix), total sugar (9.2%), Vitamin C (58.8 mg/100 g) and acid ratio (0.50) were obtained from the fruits received 250g N, 500g P and 250g K/plant/ year. Therefore, it was assumed that the content of N20+B30 kg ha⁻¹ was lesser than the minimum requirement for export. The study was conducted to evaluate the sensory characteristics of N20+B30 kg ha⁻¹ treated plant, obtaining the highest orange yellow color of pulp intensity ± 9.93 cm, more pulp firm and crispy ± 46.00 cm, full characteristic of papaya aroma ± 9.26 cm, off-odor of papaya aroma 9.95 cm, general acceptability of papaya flavor 7.65 cm, more sweetness of papaya flavor 9.52 cm, sourness of hardly perceptible in papaya flavor 10.00 cm, more balance of sweetness and sourness in papaya taste 8.88 cm, full characteristic of papaya flavor 9.82 cm and off-flavor 10.00 cm.

According to the report of the recommendation of Philippines for papaya commodity team (Philippines Team, 1984), 20-40 g borax per tree is suggested for yield and fruit quality of papaya. Harvest time also has influence on fruit quality especially flavor and appearance measured by scores for sensorial evaluation. Measurements of pulp intensity, pulp firmness, papaya aroma and papaya flavor were made after harvest and daily during the storage period, whereas those of sensorial characteristics were

performed when fruits reach full ripening sensorial evaluation, portions containing two pieces of papaya were placed in a plastic recipient and offered to 40 untrained panelists. Fruit were evaluated for flavor, odor, firmness and appearance on a five points scale.

Therefore, these experiments result of single fruit characteristics and sensory characteristics showed that T3(N20+B30 kg ha⁻¹) treated plants are higher than the other treatment levels.

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References

- Jain P. and P. K. Nema. 2010. **Quality of guava and papaya fruit pulp as influenced by blending ratio storage period.** Am. J. Food Techno., 6: 507-512.
- Nakasone, H. Y. and R. E. Paull. 1998. **Tropical fruits.** CAB International, New York. 445 pp.
- Medina, J. D., G. V. Gutierrez and H. S. Garcia. 1998. **Important of the post-production system for Pawpaw in developing countries.** Institute Technologia De Alimentos.
- Purseglove, J. W. 1984. **Tropical Crops Dicotyledons.** Printed in Singapore by The Print House (Pte) Ltd.
- Shoji, K. and M. Matsumura. 1958. **Growth and Yield of Papaya in Relation to Fertilizer Applications.** HAES Progress Notes Station Prog. Report No. 118.
- The Philippines Teams. 1984. **The Philippines Recommends for PAPAYA.** Technical Bulletin Series No. 27.A, Philippine Council for Agriculture and resources research and development. National Science and Technology Authority Loss Banos, Laguna.
- Yadav, P. K. 2006. **Effect of integrated nutrient management on growth, yield and quality of papaya (*Carica papaya* L.) fruit.** PhD Thesis, C. S. A. University of Agriculture and Technology Kanpur (U. P.), India.