

Organoleptic Properties of Harvested Water Melon (*Citrullus Lanatus Thumb*) Fruits Produced Under Different Planting Periods in Imo State, Nigeria

Ihenacho Linus Ugochukwu¹, Utazi Churchill Ogbonna², Iheanacho Rachael Akwaugo², Igbokwe Benson Ikechukwu³, Amadi Angelista Ojiugo⁴, and Chukwuemeka Vivian Ugochi⁴

1. Department of Agricultural Technology, Dr. B.U. Nzeribe State Polytechnic Awo-Omma, P.M.B 1472 Owerri Imo State, Nigeria

2. Department of Agricultural Management and Extension, Dr. B.U. Nzeribe State Polytechnic Awo-Omma, P.M.B. 1472 Owerri Imo State, Nigeria

3. Department of Computer Science Education, Benjamin Uwajimogu State College of Education, Ihitte Uboma, Imo State, Nigeria

4. Department of Science Laboratory Technology (Biochemistry), Dr. B.U. Nzeribe State Polytechnic Awo-Omma. P.M.B. 1472 Owerri Imo State, Nigeria

Abstract: This study was aimed at assessing the organoleptic properties of harvested water melon fruits produced under different planting periods Imo state, Nigeria. This experiment was carried out in two years, 2018 and 2019 respectively at the former Imo State polytechnic Umuagwo. In each of the years, samples were collected from water melon fruits produced under three different planting periods, February-April under total irrigation, April-June under rainfed planting and August-October under supplemental irrigation. A 9-point organoleptic evaluation parameter was used for the acceptance of watermelon flesh. Produced under different planting periods in Imo State, Nigeria. The tests were conducted with 10 panelists. The flesh quality was then evaluated based by the sensory characteristics of colour appearance, freshness, taste/sweetness, mouth feel, texture and overall acceptability. The result showed that the overall acceptability of fruits harvested from February-April (total irrigation) planting for 2018 was between 7.90-8.60 (very good). Also, the overall acceptability of fruits harvested from April-June varied between 7.50-8.20 (very good) while the overall acceptability of fruits harvested from August-October in the same year varied between 6.50-7.10 (moderately good). In 2019, fruits harvested from February-April had overall acceptability of between 7.90-8.70 (very good). Further, the overall acceptability of fruits harvested from April-June varied between 7.50-8.30 (very good) while the overall acceptability of fruits harvested from August-October in the same year varied between 6.60-7.20.

Key words: Organoleptic properties, harvested water melon fruits, different planting periods.

1. Introduction

Watermelon is a member of the cucurbit family (Cucurbitaceae) [1] and scientifically known as *Citrullus lanatus*, a tropical fruit popular among Nigerians and around the world. Watermelon is consumed for its pleasant flavour, aromatic aroma, sweet taste, appealing texture, and applied in the food and pharmaceutical industries [2]. Watermelon is

composed of 94% water [3] and contains simple sugars like sucrose, fructose, and glucose, with relatively low amounts of ascorbic acid [4]. United States Department of Agriculture [5] noted that matured watermelon contains high moisture content with 91% of the fruit's edible weight portion and may increase up to 93% upon ripening. Watermelon is a good source of dietary fibre and essential minerals including manganese, calcium, potassium, folate, and vitamins (C, B6, K, and A) [6]. Averagely, a watermelon weighs from 1.5 to 15 kilogrammes and is

Corresponding author: Nkwocha, Geoffrey Amanze, Ph.D., research fields: nutrition, biochemistry.

elongated, oval or round [7]. An average watermelon contains about 30% peel (also known as rind), 68% flesh and 2% seed [8]. Watermelon thrives more within the tropical regions and it is widely accepted for its aesthetic tastes and nutritional compositions [9]. Best flavour and texture of watermelon consumed is achieved when the fruit is harvested in the optimal maturity period; approximately 65 to 75 days after planting [10]. Matured watermelon has firm, symmetrical, fresh, and attractive waxy surface peel features [11]. Three to ten attributes have been used to assess watermelon and the types of qualities measured were generally non-specific, such as overall taste, appearance, aroma, sweetness, and texture [12]. Sensory analysis with trained panelists used a hedonic scale, an approach directed towards measuring liking of qualities as opposed to defining those qualities. Tarachiwin et al. [13] measured the attributes that were too broad to fully characterize watermelon (comprehensive, sweetness, and crispness) and did not provide definitions for the terms used in their study. Most of these studies were carried out in Asian countries with little being done in Nigeria especially in Imo State and moreover, the effects of the differences in planting periods of water melon on its organoleptic properties is yet to be determined in Imo State. This study therefore was aimed at assessing the organoleptic properties of harvested water melon fruits produced under different planting periods Imo state, Nigeria.

2. Materials and Method

2.1 Sample Collection and Storage

This experiment was carried out in two years, 2018 and 2019 respectively. In each of the years, samples were collected from fruits produced under three different planting periods, February-April under total irrigation, April-June under rainfed planting and August-October under supplemental irrigation.

Ten watermelons ranging from 2.0 to 3.0 kg (*Citrullus lanatus Thumb*) were obtained from the project site, former Imo State polytechnic Umuagwo.

Watermelons collection was carried out in the morning. The fruit selection was based on the similarity of size, maturity indication and colour. The damaged and unshaped fruit were removed from the sampling. Watermelon samples were kept in a dry place at 25 °C prior analysis.

2.2 Sample Preparation

The watermelons were washed and wiped with tissue paper. The watermelons were then peeled and their flesh cut into small portions of 15 g each. Watermelons flesh was prepared aseptically in clean and transparent disposable closed containers. Small portions of watermelons flesh as then served fresh to the panelists. During sample testing, panelists cleaned their mouths at time intervals with the provided plain water.

2.3 Organoleptic Evaluation

A 9-point organoleptic evaluation parameters was used for the acceptance of watermelon flesh produced under different planting periods in Imo State, Nigeria. The tests were conducted with 10 panelists from the former Imo State polytechnic Umuagwo comprising of 5 males and 5 females, with an age range of 18-30 years. The flesh quality was then evaluated based by the sensory characteristics of colour appearance, freshness, taste/sweetness, mouth feel, texture and overall acceptability by the evaluation scale of 1: extremely poor, 2: very poor, 3: moderately poor, 4: poor, 5: neither good nor poor, 6: good, 7: moderately good, 8: very good and 9: extremely good.

3. Result

The 9-point scale rating for the organoleptic properties of watermelon flesh produced under different planting periods in 2018 in the study area was calculated for all panelists and tabulated in Table 1.

3.1 Organoleptic Properties of Fruits Harvested from February-April (Total Irrigation) Planting for 2018

Table 1a showed the organoleptic properties of fruits harvested from February-April (total irrigation)

planting of 2018. The freshness varied from 7.30-7.90 (moderately good) for whole fruit and fruit juice. The colour ranged from 7.40-7.90 (moderately good) while fruit pulp had the least value of 7.40 (moderately good) on the colour. The sweetness varied from 7.80-8.40 (very good). Fruit juice had the highest value of 8.40 (very good) on sweetness followed by fruit pulp with 8.0 while whole fruit had the least value of 7.30 (moderately good) on sweetness. The mouth-feel varied between 7.30-7.90 (moderately good) for whole fruit and fruit pulp respectively. The texture ranged from 7.00-7.40 (moderately good), fruit pulp had the highest value of 7.40 (moderately good) on the texture while whole fruit and fruit juice had the same value of 7.0 (moderately good) on the texture. The overall acceptability varied between 7.90-8.60 (very good), fruit pulp had the highest value of 8.60 (very good) on the overall acceptability followed by fruit juice with 8.50 (very good) while whole fruit had the least value of 7.90 (moderately good) on the overall acceptability.

3.2 Organoleptic Properties of Fruits Harvested from April-June (Rainfed) Planting for 2018

Table 1b showed the organoleptic properties of fruits harvested from April-June (rainfed) planting of 2018. The freshness varied from 8.10-8.80 (very good). Fruit pulp had the highest value of 8.80 (very good) on freshness while whole fruit and fruit juice had the same value of 8.10 (very good) on the freshness. The colour ranged from 6.40-7.70 (good), Fruit pulp had the highest value of 7.70 (moderately good) on the colour, followed by whole fruit with 7.40 (moderately good) while the fruit juice had the least value of 6.90 (good) on the colour. The sweetness varied from 6.90-8.50 (very good). Fruit pulp had the highest value of 8.50 (very good) on sweetness followed by fruit juice with 7.20 (moderately good) while whole fruit had the least value of 6.90 (good) on sweetness. The mouth-feel varied between 6.40-8.30 for whole fruit and fruit pulp respectively. The texture ranged from 6.40-7.60. Fruit pulp had the highest value of 7.60 (moderately good)

Table 1 Organoleptic properties of watermelon (*C. lanatus Thumb*) fresh fruits harvested from 2018 planting.

February-April Planting (Total Irrigation)

Parameter	Freshness	Colour	Sweetness	Mouth-feel	Texture	Overall acceptability
Whole fruit	7.30	7.50	7.80	7.30	7.00	7.90
Fruit pulp	7.60	7.40	8.0	7.90	7.40	8.60
Fruit juice	7.90	7.90	8.40	7.50	7.00	8.50
Mean	7.60	7.60	8.07	7.57	7.13	8.33

April-June Planting (Rainfed) Planting

Parameter	Freshness	Colour	Sweetness	Mouth-feel	Texture	Overall acceptability
Whole fruit	8.10	7.40	6.90	6.50	6.40	7.50
Fruit pulp	8.80	7.70	8.50	8.30	7.60	8.20
Fruit juice	8.10	6.90	7.20	7.00	7.10	7.80
Mean	8.33	7.33	8.53	7.27	7.03	7.83

August-October Planting (Supplemental Irrigation)

Parameter	Freshness	Colour	Sweetness	Mouth-feel	Texture	Overall acceptability
Whole fruit	7.20	6.10	6.30	6.30	7.50	6.50
Fruit pulp	7.10	6.40	6.80	7.00	7.70	7.10
Fruit juice	6.90	7.70	6.50	7.20	6.70	6.60
Mean	7.07	6.73	6.53	6.83	7.30	6.73
Total	69.00	65.00	66.40	65.00	64.40	68.70
Mean	7.67	7.22	7.38	7.22	7.16	6.63
S.D	0.58	0.59	0.77	0.59	0.41	0.73

on the texture, followed by fruit juice with 7.10 (moderately good) while whole fruit had the least value of 6.40 (good) on the texture. The overall acceptability varied between 7.50-8.20. Fruit pulp had the highest value of 8.20 (very good) on the overall acceptability, followed by fruit juice with 7.80 (moderately good) while whole fruit had the least value of 7.50 (moderately good) on the overall acceptability.

3.3 Organoleptic Properties of Fruits Harvested from August-October (Supplemental Irrigation) Planting for 2018

Table 1c showed the organoleptic properties of fruits harvested from August-October (supplemental irrigation) planting period. The freshness varied from 6.90-7.20. Whole fruit had the highest value of 7.20 (moderately good) on the freshness while fruit juice had the least value of 6.90 (good) on the freshness. The colour ranged from 6.10-7.70. Fruit juice had the highest value of 7.70 (moderately good) followed by fruit pulp with 6.40 (good) while whole fruit had the least value of 6.10 (good) on colour. The sweetness varied from 6.30-6.80. Fruit pulp had the highest value of 6.80 (good) on sweetness, followed by fruit pulp with 6.50 (good) while whole fruit had the least value of 6.30 (good) on sweetness. The mouth-feel varied between 6.30-7.20 the values for whole fruit and fruit juice respectively. The texture ranged from 6.70-7.70 (moderately good). Fruit pulp had the highest value of 7.70 (moderately good) on the texture followed by whole fruit with 7.50 (moderately good) while fruit juice had the least value of 6.70 (good) on the texture. The overall acceptability varied between 6.50-7.10. Fruit pulp had the highest value of 7.10 (moderately good) on the overall acceptability, followed by fruit juice with 6.60 (good) while whole fruit had the least value of 6.50 (good) on the overall acceptability.

*3.4 Organoleptic Properties of Watermelon (*C. lanatus Thumb*) Fresh Fruits Harvested from 2019 Plantings*

The 9-point scale rating for the organoleptic

properties of watermelon flesh produced under different planting periods in 2018 in the study area was calculated for all panelists and tabulated in Table 2.

3.5 Organoleptic Properties of Fruits Harvested from February-April (Total Irrigation) Planting for 2019

Table 2a showed the organoleptic properties of fruits harvested from February-April (total irrigation) planting of 2019. The freshness varied from 7.40-7.80 for whole fruit and fruit juice. The colour ranged from 7.30-7.70. fruit juice had the highest value of 7.70 (moderately good) in colour, whole fruit 7.60 (moderately good) while fruit pulp had the least value of 7.30 (moderately good) in colour. The sweetness varied from 7.90-8.80, fruit juice had the highest value of 8.80 (extremely good) fruit pulp 8.70 (extremely good) while whole fruit had the least value of 7.90 (moderately good) on sweetness. The mouth-feel varied between 7.40-7.90 which were the exact values for whole fruit and fruit pulp respectively. The texture ranged from 7.10-7.50 The overall acceptability varied between 7.90-8.60, fruit pulp had the highest value of 8.70 (extremely good).

3.6 Organoleptic Properties of Fruits Harvested from April-June (Rainfed) Planting for 2019

The results of organoleptic properties of watermelon harvested from April-June (rainfed) planting of 2019 is presented in Table 2b. The freshness varied from 8.10-8.80. Fruit pulp had the highest value of 8.80 (very good) on freshness while whole fruit and fruit juice values were 8.20 (very good) and 8.10 (very good) respectively. The fruit colour ranged from 7.10-7.60. Fruit pulp had a colour value of 7.60 (moderately good) while whole fruit colour value was 7.50 (moderately good). The least colour value of 7.10 (moderately good) was on fruit juice. The sweetness rating varied from 7.00-8.70 (very good), fruit pulp had the highest value of 8.70 (very good), fruit juice 8.04 (very good) while whole fruit had the least rating of 7.00 (moderately good) on sweetness. The mouth-feel varied between

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6.50-8.40 these were the exact values for whole fruit and fruit pulp respectively. The texture ranged from 6.07-7.22. Fruit pulp had the highest value of 7.22 (moderately good), fruit juice with 7.90 (moderately good) while whole fruit had the least value of 6.07 (good) on the texture. The overall acceptability varied between 7.50-8.30. Fruit pulp had the highest value of 8.30 (very good) on the overall acceptability, fruit juice 7.70 (moderately good) while whole fruit had the least value of 7.50 (moderately good) on the overall acceptability.

3.7 Organoleptic Properties of Fruits Harvested from August-October (Supplementary Irrigation) Planting for 2019

Table 2c showed the organoleptic properties of fruits harvested from August-October (supplementary irrigation) planting period. The freshness varied from 7.00-7.30, whole fruit had the highest value of 7.30

(moderately good) on the freshness while fruit juice had the least value of 7.00 (moderately good). The colour ranged from 6.20-7.10. Fruit juice had the highest value of 7.10 (moderately good) on the colour, fruit pulp 6.50 (good) and whole fruit juice 6.20 (good) which was the least. The sweetness varied from 6.40-6.90. Fruit pulp has the highest value of 6.80 (good), while whole fruit had the least value of 6.40 (good) on sweetness. The mouth-feel varied between 6.50-7.30 the exact values for whole fruit and fruit juice respectively. The texture ranged from 6.60-7.80 (moderately good). Fruit pulp had the highest texture value of 7.80 (moderately good), whole fruit with 7.60 (moderately good), fruit juice had the least value of 6.80 (good) on texture. The overall acceptability varied between 6.60-7.20. Fruit pulp had the highest value of 7.20 (moderately good) on the overall acceptability, fruit juice with 6.70 (good) while whole fruit had the least value of 6.60.

Table 2 Organoleptic properties of watermelon (*C. lanatus Thumb*) fresh fruits harvested from 2019 plantings.

February-April Planting (Total Irrigation)

Parameter	Freshness	Colour	Sweetness	Mouth-feel	Texture	Overall acceptability
Whole fruit	7.30	7.60	7.90	7.40	7.10	7.90
Fruit pulp	7.50	7.30	8.70	7.90	7.50	8.70
Fruit juice	7.80	7.70	8.80	7.60	7.20	8.60
Mean	7.57	7.53	8.47	7.63	7.27	8.40

April-June Planting (Rained Planting)

Parameter	Freshness	Colour	Sweetness	Mouth-feel	Texture	Overall acceptability
Whole fruit	8.20	7.50	7.00	6.50	6.07	7.50
Fruit pulp	8.80	7.60	8.70	8.40	7.22	8.30
Fruit juice	8.10	7.01	8.04	7.20	7.09	7.70
Mean	8.37	7.37	7.91	7.37	6.79	7.83

August-October Planting (Supplemental Irrigation)

Parameter	Freshness	Colour	Sweetness	Mouth-feel	Texture	Overall acceptability
Whole fruit	7.30	6.20	6.40	6.50	7.60	6.60
Fruit pulp	7.20	6.50	6.90	7.10	7.80	7.20
Fruit juice	7.00	7.10	6.80	7.30	6.80	6.70
Mean	7.20	6.60	6.70	6.97	7.40	6.83
Total	69.30	64.51	69.24	66.00	64.38	69.20
Mean	7.70	7.17	7.69	7.33	7.15	7.69
S.D	0.64	0.57	0.78	0.76	0.54	0.78

4. Discussions

The watermelon fruits harvested from February-April has the highest value in overall acceptability. The fruit pulp and fruit juice rating were high. In terms of sweetness, the fruit pulp and juice were rated very good respectively. This confirmed the study of Yau *et al.* [14] which showed that watermelon contains a high amount of fructose content is in excellent condition since the degree of sweetness of fructose is 1.5 to 2.0 times higher than sucrose. Other attributes were moderately good. In April- June planting, fruits harvested this period were high in term of freshness both in whole fruit, fruit pulp and fruit juice respectively. The mouthfeel, fruit pulp and overall acceptability had high ratings of very good than other attributes that were rated moderately good.

The fruits harvested in August- October plantings had a rating moderately good and good in all the attributes. This trend was observed in both 2018 and 2019 planting periods. This is an indication that the organoleptic properties of fruits were affected by planting time. There was similarity in the colour among the fruits harvested at different planting time. This may be attributed to the lycopene content of the fruits that are responsible for the red colour in fruits. Soteriou *et al.* [15] noted that watermelon flesh colour is an important quality trait that is primarily determined by the synthesis and accumulation of carotenoid (lycopene) in chromoplast during ripening process. Soteriou *et al.* [15] further noted that lycopene, a red pigment carotenoid, is responsible and is found in greater quantities in watermelon than tomatoes. The overall acceptability observed in the harvested fruits in the February-April planting in terms of fruit juice, fruit pulp could be responsible for the attractive appearance due to high lycopene. The high lycopene content could be due the high quantum of lights reflected in the sun sunshine duration during

February-April planting. This is further collaborated the work of Valverde *et al.* [16] that lycopene is mainly responsible for the red colour of tomatoes fruits derived products. Furthermore, lycopene is responsible for the redness which is an indicative of attractive appearance or colour. The higher the quantum light, the more pronounced the pigmentation would be as a result of the strong influence of light intensity on the magnitude of pigmentation.

5. Conclusion

The organoleptic evaluation and determination of watermelon quality based on freshness, colour appearance, taste/sweetness, mouth feel, texture and overall acceptability were determined successfully by the evaluation of 10 panelists. The study showed that the organoleptic properties of water melon varied in different planting period in the two years of study. This implied that variations in the planting dates affected the organoleptic properties of water melon (*C. lanatus Thumb*) in Imo State, Nigeria.

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