



# Evaluation of Agronomic Performance and Consumer Preference of Selected Watermelon Cultivars in Northern Sri Lanka

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**Abstract:** The Watermelon (*Citrullus lanatus*) is a highly demand fruit in dry zone of Sri Lanka. Identifying a best suitable cultivar for dry zone is essential. The objectives of the study were, to identify the suitable cultivars in northern Sri Lanka and to assess the consumer preference on different watermelon cultivars. A field trial was conducted at Sri Lanka School of Agriculture, Paranthan farm practice field between April to August in 2019 and twenty students from 2019/20 batch were selected for analyzing consumer preference. Four cultivars such as 'Sugarbaby', 'Thilini', 'Pilot-F<sub>1</sub>' and 'Manulla-F<sub>1</sub>' were selected. The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replicates. For growth performance, main vine length, number of vines, number of branches, number of leaves, leaf area per plant and for yield performance, days to flowering, sex ratio, number of fruits per plant and fruit weight were considered. Additionally, major pest and disease incidence and consumer preference were assessed based on the color, appearance, aroma, no of seeds and flavor of each cultivar by using "likert scale". The statistical analysis was done using Minitab statistical software (Version 18). Analysis of Variance (ANOVA) was declared significant at 5% level. Turkey grouping was used to separate the mean and linear correlation. Results were concluded that, no any significant difference between varieties and growth performance while there was a significant difference ( $p < 0.05$ ) in yield performance in terms of number of fruits per plant and fruit weight. Accordingly, mean number of fruits per plant from pilot-F<sub>1</sub>, thilini, sugarbaby and manulla-F<sub>1</sub> were 7.75, 7.0, 4.25 and 2.5 respectively. With respect to mean fruit weight, pilot-F<sub>1</sub>, thilini, sugarbaby and manulla-F<sub>1</sub> were 0.937 kg, 1.28 kg 1.78 kg, 0.981 kg and respectively. In accordance with consumer preference, thilini was not preferred because of undesirable color, flavor, aroma, more number of seeds and inner and outer appearance. Sugarbaby was highly preferred than the Thilini and Manulla-F<sub>1</sub> and which was recorded least percentage of pest and disease incidences. Therefore, 'Sugarbaby' showed its potential. The Pilot-F<sub>1</sub> emerged the better performer though it contained some desirable traits for fruit fly attack. Hence, since it contains more desirable than undesirable agronomic traits, it should be improved for production especially in Northern Sri Lanka and seed companies should make efforts of availing its seeds to growers.

**Keywords:** Agronomic performance, Consumer preference, Northern Sri Lanka, Watermelon

## 1. Introduction

Watermelon (*Citrullus lanatus*) is a warm, long-season crop (Ufoegbune *et al.*, 2014) which belongs to Cucurbitaceae family (Cane, 2002). The fruit is originated in the Kalahari Desert of Africa but the first recorded watermelon harvest occurred nearly 5,000 years ago in Egypt (Paris, 2015). The fruit contains 95% water, phosphorus (9 mg), ascorbic acid (8 mg), vitamins (0.64 g), calcium (8 mg), and carbohydrate (5 mg) per 100 g of edible portion and it is also rich in important substances such as lycopene and citrulline which helps to heart and liver functions (Perkins-Veazie, 2001). At present, it is grown in all tropical, subtropical, and arid regions of the globe (Georges, 1989), (Schippers, 2000). Basically, crop yield differs



from many factors like soil, climatic, variety, and farm management practices. Agro-ecological region of the study area is DL<sub>4</sub> (Panabokke, 1996), which is favorable for successful cultivation in terms of soil, climatic factors. Identifying the best cultivar is most important for farmers in the region, which helps to gain high profit for farmers without crop and marketing failure. The objectives of the study were, to identify the suitable cultivars in northern Sri Lanka and to assess the consumer preference on different watermelon cultivars.

## 2. Materials and Methods

A field trial was conducted at Sri Lanka School of Agriculture, Paranthan farm practice field between April to August in 2019 to assess the growth and yield performance of ‘Sugarbaby’, ‘Thilini’, ‘Pilot-F<sub>1</sub>’, and ‘Manulla-F<sub>1</sub>’. Thilini (local), Sugarbaby (exotic), Pilot-F<sub>1</sub> and Manulla-F<sub>1</sub> seeds were purchased from the local market of Killinochchi district in Sri Lanka. The average annual rainfall in this area is 1325 mm and the highest amount of rainfall is received during the period from December to February by the North-East monsoon periodical wind. The remaining period of the year is dry with the driest period being June to August. The average monthly temperature is 28.4 °C while maximum and minimum averages are 35 °C and 21.3°C. The average monthly temperature ranges from 25.6 °C to 30.0°C. The dominant soil type that can be found in the area is Solodized Slonetz (Mapa *et al.*, 2010).

The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replicates and three vines were tagged in each treatment plot for recording agronomic characteristics and growth performance. The recommendation of the department of Agriculture, Sri Lanka was adopted for establishment and management practices. The seeds were directly sown in the field on 22<sup>nd</sup> of May 2019, at a spacing of 1 m x 0.5 m. Three seeds were sowed per hole and were thinned to one seedling three-four weeks after sowing. Before sowing, organic manure and NPK basal fertilizer were applied in the planting holes at the recommended rate of 10 t/ha, 75 kg/ha, 200 Kg/ha, and 60 kg/ha respectively. Then two weeks and five weeks after seed sowing topdressing (Urea and MOP) one and two were applied with the rate of 75 kg/ha and 60 kg/ha. Other agronomic practices including irrigation and weeding were conducted uniformly as required in all plots. No chemicals or any other method of pest and disease control were employed.



The data were collected on agronomic characteristics, yield performance, pest and disease incident, and consumer preference. As a growth performance main vine length (cm, from the soil surface to the growing tip of the longest branch at first harvest), number of vines per plant (Time of first harvesting), number of branches per vine (Time of first harvesting) and number of leaves per main vine (Time of first harvesting). For yield performance, days to first flowering (First staminate flower appeared on one of the tagged vines as the days to first flowering from the date of sowing), days to first female flower (Number of days taken from the day of sowing to the onset of first female flower on any one of the tagged vine in each treatment), Sex ratio (The number of male and female flowers arising on the tagged vines), Average fruit weight (The average weight of fruits from the first harvest), number of fruits per plant. For major pest and disease incidents, powdery mildew (%), anthracnose (%), and fruit fly infestation (%) were accounted. The statistical analysis was done using Minitab statistical software (Version 18). Analysis of Variance (ANOVA) was done for all the characteristics of growth and yield performance and differences declared significant at 5% level. Turkey grouping was used to separate the mean and correlation to compare the relationship between variables. “Likert scale” was used to analyze the consumer preference of each variety based on the appearance, aroma, color, the number of seeds and flavor, for that, twenty students in the 2019/20 batch from Sri Lanka School of Agriculture, Paranthan were selected.

### 3. Results and Discussion

Seed emergence performance was calculated for all four cultivated watermelon varieties and which was showed non-uniform seed emergence. Seed emergence rate of Sugarbaby, Thilini, Manulla-F<sub>1</sub>, and Pilot-F<sub>1</sub> were 61.78%, 85%, 50%, and 50.7% respectively after eight days of seed sowing. Then which were followed 88.21%, 95%, 81%, and 82.5% respectively after eleven days of seed sown. Thilini showed a high seed emergence rate compared to the other three varieties in both two stages.

Flowering was found to start from the fifth week after seed sowing and the first flower to open was always a male flower. This result similar to the result of Gichimu *et al.*, (2008). However, their varieties not similar to the study except Sugarbaby variety (Gichimu *et al.*, 2008). ‘Sugarbaby’ took significantly ( $p < 0.05$ ) the shortest time (23days) to first male flower



while Manulla-F<sub>1</sub> took significantly ( $p < 0.05$ ) the longest time (29 days) to first male flower. Pilot-F<sub>1</sub> and Thilini took 27 and 25 days respectively. The opening of the first female flower occurred 3 to 6 days after the opening of the first male flower. 'Sugarbaby' recorded significantly ( $p < 0.05$ ) the shortest time to its first female flower (26 days), while the Manulla-F<sub>1</sub> recorded significantly ( $p < 0.05$ ) the longest time (35 days). Pilot-F<sub>1</sub> recorded 30 days while Thilini took 28 days to open their first female flower. Similar results were reported in Gichimu *et al.*, 2008 and according to their results, Sugarbaby took significantly shortest time to opening for both male and female flowers (Gichimu *et al.*, 2008). Wehner *et al* (2001) who were reported that first flower in all the watermelon varieties always a male flower which opened a few days to a few weeks earlier than the first female flower. With respect to Sex ratio (male: female flower), Manulla-F<sub>1</sub> had significantly ( $p < 0.05$ ) the highest sex ratio (more male flower) while Pilot-F<sub>1</sub> had significantly ( $p < 0.05$ ) least sex ratio (more female flower) and which mean value ranged from 3.6 to 0.24. There was no significant difference by means of the node to first flowering, the value ranged from Pilot-F<sub>1</sub> 3.75 to Manulla-F<sub>1</sub> 5.50.

There were significant ( $p < 0.05$ ) differences in the number of fruits per plant and fruit weight. The Pilot-F<sub>1</sub> emerged significantly the best yielder with 7.75 fruits/ plant but its fruits were lighter in weight (averaging 0.937 kg) compared to those of Sugarbaby averaged 1.775 kg (4.25 fruits/plant). The least production was recorded in Manulla-F<sub>1</sub> an average of 3.5 fruits/ plant with mean fruit weight 0.981kg. Thilini recorded an average fruit yield of 7.00 fruits/ plant averaging 1.275 kg in weight. There was a highly significant ( $p < 0.001$ ) and a negative correlation between the number of fruits and the sex ratio ( $R = - 0.725$ ) as shown in figure-1 (a). There was a highly significant ( $p < 0.001$ ) positive correlation ( $R = 0.818$ ) between the number of days to first flowering and the number of days to the opening of the first female flower as shown in figure-1 (b). Figure-1 (c) represented the sex ratio and days to first female flower had highly significant ( $p < 0.001$ ) positive correlation ( $R = 0.646$ ).

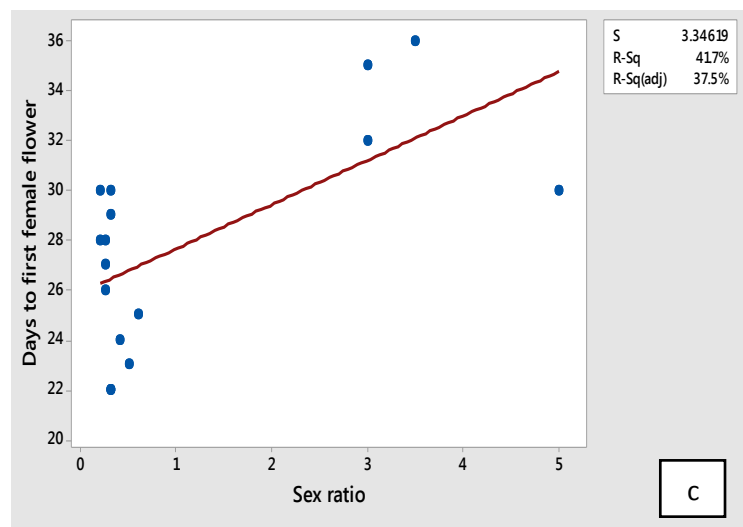
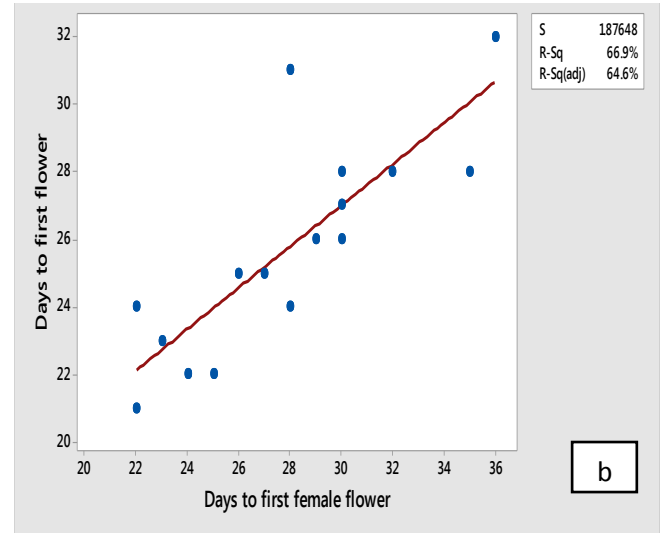
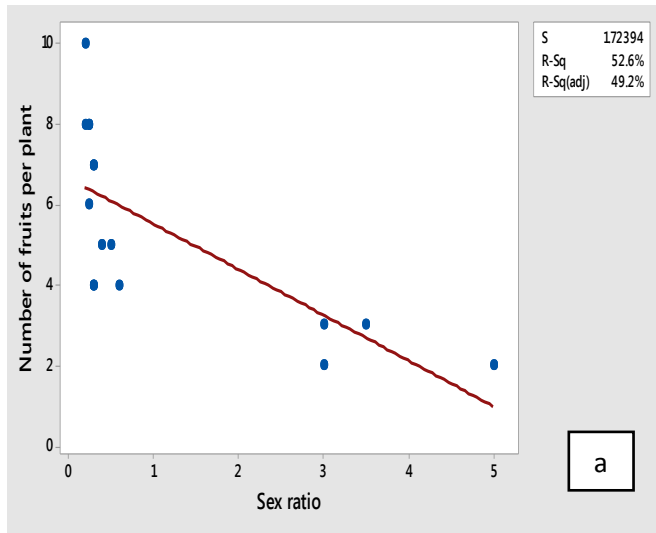


Figure 1: (a): Linear correlation between number of fruits per plant and sex ratio, (b): Linear correlation between days to first flower and days to first female flower, (c): Linear correlation between days to first female flower and sex ratio.

Other agronomic characters that were evaluated such as the number of branches on the main vine, number of leaf per main vine, length of the main vine, number of vine per plant and leaf



area. However, there was no significant difference ( $p>0.05$ ) in all the agronomic characters. The p values were 0.26, 0.105, 0.233, 0.873, and 0.674 respectively.

**Table: 01 Pest and Disease incidence**

	Sugar baby	Manulla F <sub>1</sub>	Thilini	Pilot
% of leaf affected by Powdery mildew	08%	10%	15%	08%
% of Anthracnose disease fruits	15%	10%	20%	10%
% of fruit infested by fruit fly	20%	35%	25%	30%

Two diseases were easily identifiable using their typical symptoms during the study. These were powdery mildew and anthracnose. On the other hand, fruits were infested by fruit fly. According to the percentage (%) of the leaf was affected by powdery mildew and percentage of fruit infested by fruit fly, categorized like immune (0%), resistant (1-10%), moderately resistant (11-25%), moderately susceptible (26-50%), susceptible (51-75%), highly susceptible (76-100%). The Sugar baby and Pilot-F<sub>1</sub> recorded least (8%) and concluded as a resistant for powdery mildew. Meanwhile, Manulla-F<sub>1</sub> was resistant (10%) and Thilini was moderately resistant (15%). Anthracnose, which is a fungal disease (*Colletotrichum lagenarium*) (Shivaprasad, 2013), especially in Sugar baby and Thilini reported as moderately resistant while Pilot and Manulla-F<sub>1</sub> were as resistant. Moreover, Sugar baby and Thilini were moderately resistant for infestation of fruit fly while pilot-F<sub>1</sub> and Manulla-F<sub>1</sub> were moderately susceptible. None of them recorded less than 10 % (resistant) infestation.

**Table: 02 Consumer preferences of watermelon varieties**

Criteria	Sugar baby	Manilla F <sub>1</sub>	Thiliny	Pilot F <sub>1</sub>
Mean of Aroma	4	4	3	4
Mean of Flavor	4	5	3	5
Mean of Color	4	4	3	5
Mean of Fleshy thickness	4	4	4	4
Mean of number of seeds	4	4	2	5



Mean of Appearance(Inner)	4	5	2	5
Mean of Appearance ( Outer)	3	4	3	5
<b>Overall Mean</b>	<b>4</b>	<b>4</b>	<b>3</b>	<b>5</b>

The Sri Lanka School of Agriculture, Paranthan students were selected for this study, where 37% of males and 63% females were with an age range from 21 to 25 years. Their decision to purchase the watermelon was based on the aroma, flavor, color, fleshy thickness, number of seeds, the inner and outer appearance of each variety. According to their level of preference, consumers scored from five to one. Which shows extremely like (5), like (4), acceptance (3), dislike (2), and extremely dislike (1) respectively.

The overall mean value proved that consumers extremely preferred to have Pilot-F<sub>1</sub> hybrid (5) and Sugar baby and Manulla-F<sub>1</sub> hybrid (4) scaled secondly as a category of like while consumers did not show their willingness to have Thilini variety (3). Conversely, in northern Sri Lanka consumers demanded especially for fruits seedless or less number of seeds watermelons and the similar results reported by Evans (2008). In Addition to that, the informal discussion was done with Fruit juice maker from the Traditional food court of the department of agriculture, Kilinochchi. They responded that consumer mostly preferred to have watermelon juice among mango, papaya, mixed, passion, and orange juice during dry periods, which was approximately 60% of the customers purchased watermelon juice every day.

#### 4. Conclusion

This study reports the most suitable watermelon varieties among Sugarbaby, Thilini, Manulla-F<sub>1</sub>, and Pilot-F<sub>1</sub> based on their growth, yield, pest and disease incidence and, consumer preference in Northern Sri Lanka. It was concluded that no significant difference between varieties in terms of growth performance while there was a significant difference in yield performance. Accordingly, the pilot- F<sub>1</sub> emerged the best performer though it contained some desirable traits for fruit fly attack. It should be improved for production especially in Northern Sri Lanka and seed companies should make efforts to availing its seeds to growers. Although Thilini is a local variety which is hardly known to many watermelon growers that it was not preferred by the consumer because of undesirable color, flavor, aroma, more number



of seeds, and inner and outer appearance. However, Thilini was moderately resistant to powdery mildew and anthracnose diseases. ‘Sugarbaby’ was a better performer than the latter two varieties namely, Thilini and Manulla-F<sub>1</sub> in response to yield performance, consumer preference, and least percentage of pest and disease incidences. Therefore, this showed its potential. This study was conducted one of the agro-ecological regions (DL<sub>4</sub>) in the northern part of Sri Lanka and findings represent to that particular region. Therefore, further studies are essential in the different agro-ecological region especially in the northern part of Sri Lanka to recommended better cultivar or cultivars for farmers.

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