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EVALUATION OF SWEET POTATO VARIETIES BASED ON GROWTH AND YIELD

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Abstract

The research was conducted at Germplasm Centre of Agrotechnology Discipline, Khulna University, Khulna during the period from November 2021 to April 2022, to evaluate the growth and yield performance of selected six sweet potato varieties**.** The experiment consisted of six sweet potato varieties: BARI misti alu10, BARI misti alu11, BARI misti alu12, BARI misti alu14, BARI misti alu15 and local variety (check). The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The parameters measured included number of sprouts, plant height, number of branches, branch length, number of leaves, length of leaves, breadth of leaves, number of tubers, weight of tubers and yield (t ha^{-1}). The results of the study revealed that, BARI misti alu10 showed maximum yield (54.33 t ha^{-1}) followed by BARI misti alu14 (44.66 t ha^{-1}). Based on the findings of the experiment, BARI misti alu10 and BARI misti alu14 was found better in respect yield and yield contributing characters. The outcome of this study could be helpful in germplasm management, hybridization programs and crop improvement program.

Keywords: Evaluation, Growth, Sweet potato, Yield.

Introduction

Sweet Potato (*Ipomoea batatas* L.) belongs to family Convolvulaceae is one of the most important root crop and major food, feed, and vegetable crop in many tropical developing nations. In Bangladesh, it is known as " misti alu " (Mahmud *et al.,* 2021). The children in char and rural areas of Bangladesh are affected mainly by vitamin A deficiency which causes 88 children to become blind each day (Banglapedia, 2019) can be alleviated by sweet potato consumption. It also provides vitamin B complex, C, and E along with K, Mn, Cu, Fe, crude protein, β carotene, phenolic compounds, and beneficial fibers (Szalay, 2017; Sun *et al.,* 2019). Bangladesh's climate is favorable for the growth of sweet potatoes. In Bangladesh, sweet potato is grown in the riverbank areas. Currently, about 23,571 tons of sweet potato are being produced from an area of 23,014 hectares of land with an average yield of 10.25 t ha^{-1} (Alam *et al.,* 2023). Between 2000 to 2013, total sweet potato production of Bangladesh increased from 92,479 to 104,000 MT (FAOSTAT 2014). Despite the nutritional advantages and additional benefits of

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producing sweet potatoes, biotic and abiotic stress factors have a significant negative impact on their productivity (Guo *et al.*, 2006). In Bangladesh, the coastline region occupies 30% of the total area and about 0.83 million hectares of cultivable land of Bangladesh (Haque, 2006). Different levels of soil salinity have an impact on the cultivable regions in coastal districts. In the coastal region of Bangladesh, research experiment with sweet potato varieties is meager due to soil and climatic limitations so ensure better yield is a demand of time. So, the present study was carried out to evaluate the growth and yield of the selected potato varieties.

Materials and Methods

The field experiment was conducted at Germplasm Centre of Agro-technology Discipline, Khulna University, Khulna during the period from November 2021 to April 2022 to study the growth and yield performance of selected sweet potato varieties. The climate of the experimental area is sub-tropical in nature. It was carried out on a medium high land, fairly leveled, well drained silty loam soil. The treatments included six varieties (V_1 = BARI misti alu10, V_2 = BARI misti alu11, V_3 = BARI misti alu12, V_4 = BARI misti alu14, V_5 = BARI misti alu15 and V_6 = Local Variety). Sweet potato cuttings were used as planting material these were collected from BARI sub-station, Satkhira. The experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications. The unit plot was 4.8 m × 2.4 m in size and each plot contained 32 hills. Ridges and furrows were formed at 60 cm distance. The manures and fertilizers were used according the doses BARI, 2022. Intercultural operations and plant protections activities were done when it's necessary. Five plants were selected randomly from each unit plot. The number of sprouts hill^{-1} from the selected plants were counted and their average was recorded at 15 DAP. Plant height**,** number of leaves hill^{-1}, No of branches hill^{-1}, number of leaves, length of leaves (cm), and breadth of leaves (cm) was recorded at 15, 30, 45 and 60 DAP. Number of tuber hill^{-1}, number of tuber plot^{-1} weight of tuber hill^{-1}, weight of tuber plot^{-1} were taken using electric balance and their average was recorded in kg. The tuber yield plot^{-1} of sweet potato was converted into tha^{-1} by using the following formula:

$$\text{Yield (t/ha)} = \frac{\text{Yield/plot (kg)} \times 10000\ \text{m}^2}{\text{Area of plot (m}^2\text{)} \times 1000\ \text{kg}}$$

The collected data were statistically analysed for analysis of variance using computer software "Statistix-10". The means were compared by Duncan's Multiple Range Test (DMRT) at 5% and 1% levels of probability.

Results and Discussions

Number of sprouts

Statistically non-significant variation observed the number of sprouts hill^{-1} at 15 DAP. However, numerically the maximum number of sprouts hill^{-1} were observed in BARI misti alu14 (6.67) followed by BARI misti alu12 (6.33) and the local variety (6.33) whereas lowest (4.67) in BARI misti alu10 (Table 1).

Plant height

At 15 and 45 DAP, the varieties were not differed significantly for plant height. At 45 DAP, there were significant variation among the varieties in respect of plant height. The maximum plant height (61.33 cm) was observed in local variety followed by BARI misti alu15 (55.33 cm) and BARI misti alu12 (48.33 cm) while the shortest (47.67 cm) in BARI misti alu11 (Table 1). At 60 DAP, the plant height varied significantly among the varieties. The maximum height (77.33cm) was observed in the local variety followed by BARI misti alu12 (70.17cm) and BARI misti alu10 (60.5 cm) and that was the lowest (50 cm) in BARI misti alu11. There was tired to increase plant height with the advancement of date of planting (Table 1).

Table 1. Number of sprouts hill^{-1} and plant height of sweet potato varieties at different days after planting (DAP)

Variety	No. of sprouts/hill	Plant height (cm)			
		15 DAP	30 DAP	45 DAP	60 DAP
BARI misti alu10	4.67	19.67	26.67	44.33c	60.50b
BARI misti alu11	8.00	21.00	35.17	42.67c	50.00c
BARI misti alu12	6.33	20.00	33.50	48.33bc	70.17a
BARI misti alu14	6.67	21.50	34.50	48.00bc	57.00bc
BARI misti alu15	4.74	31.50	51.33	55.33ab	59.83b
Local (check)	6.33	17.33	37.50	61.33a	77.33a
$LSD_{(0.05)}$	NS	NS	NS	**	**

Means with common letters do not have any significant difference at 5% level of significance.
**Significant at 1% level of probability, LS: Level of significance, NS: Not significant

Number of branches

At 15, 30 and 45 DAP, there were no significant variation among the varieties in respect of number of branches. At 60 DAP, the number of branches varied significantly among the varieties. The maximum number of branches (7.00) were observed in BARI misti alu14 followed by BARI misti alu-10 (5.67) and the lowest number (4.33) were found in BARI misti alu11 followed by BARI misti alu12. (Table 2).

Length of branches

At 15 DAP, the varieties were differed significantly in respect of branch length. The maximum branch (20.67 cm) was found in BARI misti alu15 followed by BARI misti alu14 (17.16 cm) and BARI misti alu11 (16.67 cm) and that was the shortest (9.83 cm) in the local variety (Table 2). At 30 and 45 DAP, the length of branches was not varied significantly among the varieties. At 60 DAP, the branch length varied significantly among the varieties. The maximum length of branches was observed in the local variety (52.67 cm) followed by BARI misti alu10 (50.33 cm) and BARI misti alu14 (43.67 cm) and that was the lowest (31.5 cm) in BARI misti alu11 (Table 2).

Table 2. Number of branches and length of branches of sweet potato varieties at different days after planting (DAP)

Variety	Number of Branches				Branch length (cm)			
	15 DAP	30 DAP	45 DAP	60 DAP	15 DAP	30 DAP	45 DAP	60 DAP
BARI misti alu10	5.00	3.33	4.67	5.67ab	11.67ab	21.33	34.00	50.33ab
BARI misti alu11	4.00	3.67	4.00	4.33b	16.67ab	18.83	26.33	31.50d
BARI misti alu12	3.00	2.67	3.33	4.33b	14.50ab	27.67	30.17	36.33cd
BARI misti alu14	4.00	2.33	4.67	7.00a	17.16ab	25.33	36.50	43.67abc
BARI misti alu15	3.67	3.00	4.00	4.67b	20.67a	28.67	33.33	38.33bcd
Local Variety	2.67	2.67	3.67	4.67b	9.83b	15.33	37.33	52.67a
LSD $_{(0.05)}$	NS	NS	NS	*	*	NS	NS	*

Means with common letters do not have any significant difference at 5% level of significance by DMRT. *Significant at 5% level of probability and NS: Not significant

Number of leaves

At 15, 30, 45 and 60 DAP, the number of leaves were found statistically non-significant among the varieties. However, numerically the maximum number of leaves were observed in BARI misti alu10 and that was the minimum in BARI misti alu12 in all date of planting (Fig. 1).

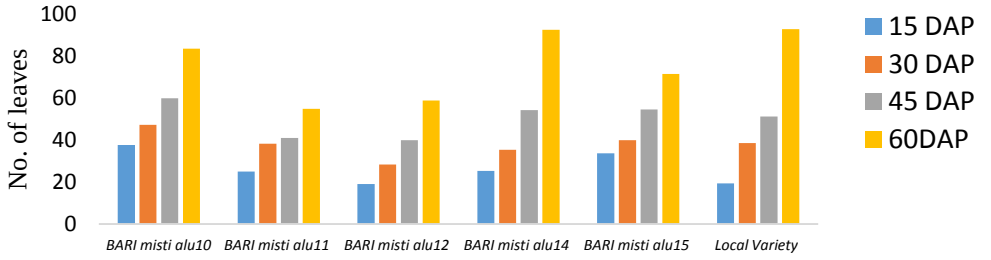

Fig. 1. Number of leaves of sweet potato varieties at different days after planting (DAP)

Length of leaves

At 15, 30 and 45 DAP, there were no significant difference among the varieties in respect of leaf length. However, numerically the maximum length of leaves were produced in BARI misti alu-15 and that was the minimum in the local variety in all date of planting (Fig. 2). At 60 DAP, there was significant variation among the varieties in respect of leaf length. The maximum length of leaves (11.2 cm) was observed in BARI misti alu15 followed by BARI misti alu12 (9.67cm) and BARI misti alu14 (9.50 cm) and that was the shortest (8.50 cm) in BARI misti alu10 (Fig. 2).

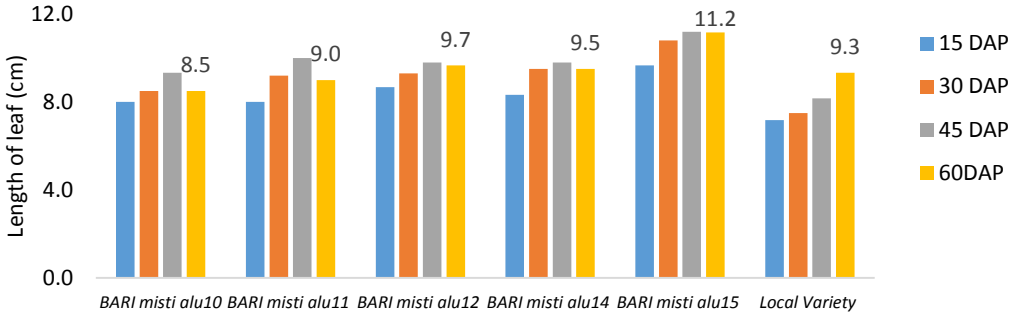

Fig. 2. Length of leaves of sweet potato varieties at different days after planting (DAP)

Breadth of leaves

At 15, 30 and 45 DAP, the varieties were not differed significantly for leaf breadth. However, numerically the broadest leaves were found in BARI misti alu15 and that was the narrowest in BARI misti alu11 in all date of planting (Fig. 3). Similar trend was recorded at 60 DAP, the varieties were not differed significantly for leaf breadth. However, numerically the broadest leaves were produced in BARI misti alu10 and that was the smallest in BARI misti alu12 (Fig. 3)

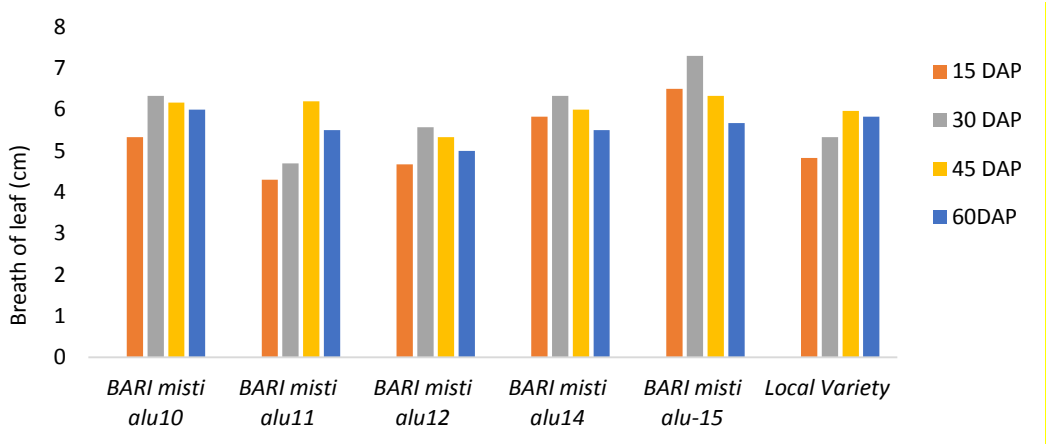

Fig. 3. Breadth of leaves of sweet potato varieties at different days after planting (DAP)

Number of tubers plot-1

The number of tubers of sweet potato varieties was found statistically significant. The maximum number of tubers per plot were obtained from BARI misti alu10 (405.33) followed by BARI misti alu14 (309.33) and BARI misti alu11 (202.67) and lowest number of tuber per plot (138.67) was found in the local variety (Table 3).

Weight of tuber plot^{-1}

Statistically significant variation found from weight of tubers of sweet potato varieties. The maximum weight of tubers per plot (28.52 kg) was obtained from BARI misti alu10 followed by BARI misti alu14 (23.45 kg) and local variety (23.24 kg) and the lowest (15.12 kg) in BARI misti alu12 (Table 3).

Tuber yield

The tuber yield of sweet potato was converted into per hectare and has been expressed in ton. Varietal difference in relation to yield was highly significant. The most productive variety was BARI misti alu10 (54.3 t ha^{-1}) followed by BARI misti alu14 (44.6 t ha^{-1}) and that was the lowest (28.8 t ha^{-1}) in BARI misti alu12 preceded by BARI misti alu15 (29.5 t ha^{-1}) (Table 3).

Table 3. Number of tubers, weight of tuber and tuber yield of sweet potato varieties

Variety	No. of tubers/plot	Wt. of tuber/plot (kg)	Tuber yield (t/ha)
BARI misti alu10	405.33a	28.520a	54.33a
BARI misti alu11	202.67c	17.301bcd	32.96bcd
BARI misti alu12	164.00c	15.139d	28.84d
BARI misti alu14	309.33b	23.445ab	44.66ab
BARI misti alu15	196.00c	15.496cd	29.51cd
Local Variety	138.67c	23.236abc	44.26abc
LSD $_{(0.05)}$	**	*	*

Means with common letters do not have any significant difference at 5% level of significance by DMRT. *Significant at 5% level of probability ** = Significant at 1% level, LS= level of significance.

Correlation

All the yield contributing characters of sweet potato varieties were positively correlated with yield. Among them, plant height, number of branches, number of leaves, length of branches, breadth of leaves and number of tuber hill^{-1} were correlated significantly with yield among the varieties. But the weight of tuber hill^{-1} was not significantly correlated with yield (Table 4.).

Table 4. Correlation coefficient of plant height, number of branches, length of branches, leaf number, breadth of leaf, no. of tuber and weight of tuber with yield

Yield contributing character	Tuber yield	Level of significance
Plant height	0.07	**
Number of branches	0.17	**
Length of branches	0.59	*

Yield contributing character	Tuber yield	Level of significance
Number of leaves	0.43	**
Breadth of leaves	0.16	**
Number of tuber/hill	0.56	*
Weight of tuber/hill	0.64	NS

*Significant at 5% level of probability, **Significant at 1% level of probability, NS-Not significant

Positive correlations exist between stem length and aboveground biomass yield, leaf number and biomass yield followed by tuber number and tuber yield (George *et al.*, 2002). BARI misti alu10 was the maximum branch producing variety at 15 DAP and 45 DAP and it was the highest yielder variety also. On the other hand, BARI misti alu14 was the second most branch producer variety and second higher yielder variety at the same time.

There are also positive and significant correlations between stem length and number of tubers, number of leaves and number of tubers, stem length and tuber yield, number of leaves, and tuber yield (Zelalem *et al*., 2009). This research study also agrees with those positive correlations. Here, the sweet potato varieties having longer stem, more branches, more and broader leaves gave more tuber and higher yield. There are direct relationships between the leaves and tubers of the plant. These relationships are indicated by strong positive correlations between the number of tubers and the number of leaves (Lahlou & Ledent, 2005). Correlation analysis of the present study also revealed the same relationship.

Conclusion

The experiment data revealed that, BARI misti alu14 was superior in number of sprouts. The longest plant and longest branch were observed in the local variety at 45 and 60 DAP. The longest leaf was observed in BARI misti alu15 in at all the DAP. BARI misti alu10 was the maximum leaf producer at 45 DAP, while it was the local variety at 60 DAP. In case of sweet potato tuber, the highest number of tubers, maximum weight of tubers and also the maximum yield BARI misti alu10 followed by BARI misti alu14. BARI misti alu10 and BARI misti alu14 found better in respect of growth, yield contributing characters and yield.

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Author's contribution

The authors confirm contribution to the paper as follows: study conception and design: M. A. Mannan, S. Nasrin; data collection, analysis and interpretation of results: S. I. Shorna, M. Rahman; draft manuscript preparation: S. Nasrin, K. Islam. All authors reviewed the results and approved the final version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Alam, M. J., Mahmud, A. A., Gaber, A., and Hossain, A. 2023. Energy efficiency and water use indices for sweet potato (*Ipomoea batatas* L.) production under subtropical climatic conditions of Bangladesh. *J. Water Climate Change*. 14(2):576-589. doi: https://doi.org/10.2166/wcc.2023.401.

Banglapedia. 2019. National Encyclopedia of Bangladesh. Night Blindness. Available online:http://en.banglapedia.org/index.Php.

FAOSTAT (Statistical Databases). 2014. Production Year Book. Food and Agriculture Organization of the United Nations, Rome, Italy. http://faostat.fao.org/site/567/ DesktopDefault.aspx?PageID=567.

FAOSTAT (Statistical Databases). 2020. Statistics division of Food and Agriculture Organization of the United Nations, Rome, Italy. http://www.fao.org/faostat/en/#data.

Guo, J. M., Liu, Q. C., Zhai, H., and Wang, Y. P. 2006. Regeneration of plants from *Ipomoea cairica* L. Protoplasts and Production of Somatic Hybrids between *I.cairica* L. and Sweet potato, *I. batatas* L. Lam. *Plant Cell Tissue Organ Cul.* 87:321-327.

Haque, S. A. 2006. Salinity problems and crop production in coastal regions of Bangladesh. *Pak. J. Bot.* 38(5):1359-1365. https://hdl.handle.net/10568/99442.

Lahlou, O., and Ledent, J. F. 2005. Root mass and depth, stolons and roots formed on stolons in four cultivars of potato under water stress. *European. J. Agro.* 22(2):159-173.

Mahmud, A. A., Alam, M. J., Heck, S., Grüneberg, W. J., Chanda, D., Rahaman, E. S., and Hossain, A. 2021. Assessing the productivity, quality and profitability of orange fleshed sweet potatoes grown in riverbank of the tista floodplain agro-ecological zone of Bangladesh. *Agro. J.* 11(10):2046. Doi: https://doi.org/10.3390/agronomy11102046.

Mahmud, A. A., Hassan, M. M., Alam, M. J., Molla, M. S. H., Ali, M. A., Mohanta, H. C., Alam, M. S., Islam, M. A., Talukder, M. A. H., and Ferdous, M. Z. 2021. Farmers' Preference.

Yield, and GGE-Biplot Analysis-Based Evaluation of Four Sweet Potato (*Ipomoea batatas* L.) Varieties Grown in Multiple Environments. Sustainability. 13:3730. https://doi.org/ 10.3390/su1 3073730

Sun, Y., Pan, Z., Yang, C., Jia, Z., and Guo, X. 2019. Comparative assessment of phenolic profiles, cellular antioxidant and antiproliferative activities in ten varieties of sweet potato (Ipomoea batatas) storage roots. *Molecules.* 24(24):4476. DOI: https://doi.org/10.3390/molecules24244476.

Szalay, J. 2017. Sweet Potatoes: Health Benefits, Risks & Nutrition Facts. Live Science. https://www.livescience.com/45838-potato-nutrition.html.

Zelalem, A., Tekalign, T., and Nigussie, D. 2009. Response of potato (*Solanum tuberosum* L.) to different rates of nitrogen and phosphorus fertilization on vertisols at Debre Berhan, in the central highlands of Ethiopia. *African J. Plant Sci*. 3(2):16-24.