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PERFORMANCE EVALUATION OF BIOFORTIFIED SWEET POTATO (*IPOMOEA BATATAS* L.) VARIETIES UNDER EASTERN HIMALAYAN CONDITION

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ABSTRACT

The field investigation entitled *“Performance Evaluation of Biofortified Sweet Potato* (*Ipomoea batatas* L.) *Varieties under Eastern Himalayan Conditions”* was carried out to evaluate six varieties for yield potential, quality traits, and pest–disease tolerance under the agro-climatic conditions of Dhalai district. The experiment comprised six treatments–Bhu Krishna (T_1), Bhu Sona (T_2), Bhu Kanti (T_3), Local Misti Aalo (Pink) (T_4), Local Misti Aalo (Yellow) (T_5), and Local Misti Aalo (White) (T_6)-arranged in a Randomized Block Design with four replications over a research area of 1600 m². Observations were recorded on vegetative growth, yield attributes, and biochemical parameters such as β-carotene, dry matter, starch, total soluble solids (TSS), and antioxidant content. The results revealed significant varietal differences in all parameters. *Bhu Sona* recorded the highest tuber yield (26.3 t ha^{-1}), vine length (178.6 cm), and tuber girth (13.4 cm), while *Bhu Krishna* exhibited the maximum antioxidant content (14.2 mg 100 g^{-1}). Local varieties showed moderate performance but inferior marketable yield due to weevil infestation and lower dry matter. Organoleptic evaluation showed *Bhu Sona* as the most preferred variety owing to its attractive yellow flesh, sweetness, and texture. Hence, *Bhu Sona* and *Bhu Krishna* are recommended for large-scale cultivation in Tripura for nutritional and economic benefit.
***Keywords* :** Sweet potato, Biofortified varieties, Yield performance, antioxident, Dhalai Tripura.

Introduction

Sweet potato (*Ipomoea batatas* L.) is an important root crop with immense potential for food and nutritional security due to its high productivity and adaptability to marginal soils (FAO, 2020). It serves as a rich source of carbohydrates, anthocyanin, β-carotene (provitamin A), vitamins, and antioxidants, making it a valuable functional food (Low *et al*., 2007). In India, sweet potato is cultivated on about 1.3 lakh ha with an average productivity of 10.9 t ha^{-1} (ICAR-CTCRI, 2023).

Low and inconsistent tuber yields in many locally grown varieties remain a major constraint to sweet potato productivity. Local cultivars often exhibit poor and unstable tuber formation compared to improved varieties, which can yield more than three times higher under similar conditions (Asnake *et al*., 2023). The limited availability and low awareness of biofortified varieties further restrict adoption among small and marginal farmers, as these improved lines are not widely disseminated through seed systems or extension networks (Talsma *et al*., 2017). Moreover, the high market price of improved and biofortified varieties reduces accessibility for resource-poor growers, creating dependence on inferior local stocks (Atanasova *et al*., 2025). In addition to varietal and accessibility constraints, pest and weevil infestations have been reported as major biotic stresses that drastically lower marketable yield and storage quality, causing losses of up to 70% in severe cases (Kroschel *et al*., 2020). Collectively, these challenges underline the urgent need for varietal replacement, farmer-oriented awareness programmes, and integrated pest management strategies to ensure stable and high-quality sweet potato production.

Despite its potential, productivity in the North-Eastern Hill (NEH) region remains low, mainly due to poor adoption of improved varieties, traditional planting materials, and pest–disease issues (Singh *et al*., 2019). Local landraces, though well adapted, have limited anthocyanin, β-carotene content and lower market acceptability. Biofortified sweet potato varieties developed by ICAR-CTCRI and CIP (International Potato Center) have demonstrated enhanced nutritional value and better yield under diverse agro-ecosystems (Kapoor *et al*., 2022).

However, limited field assessment and dissemination in Tripura restrict their adoption. Therefore, the present study was conducted to evaluate the performance of selected biofortified and local sweet potato varieties under uniform management at KVK Dhalai farm.

Materials and Methods

The present investigation was conducted during 2024–25 at the Krishi Vigyan Kendra (KVK) Farm, Salema, Dhalai District, Tripura (23.92° N latitude and 91.90° E longitude, at an elevation of approximately 120 m a.s.l.). The experimental site is characterized by a sub-tropical humid climate with an average annual rainfall of about 2300 mm, predominantly received from May to September. The soil of the experimental field was sandy loam, slightly acidic in reaction (pH 5.8), and of medium fertility status, suitable for sweet potato cultivation.

The experiment was laid out in a Randomized Block Design (RBD) comprising six treatments (varieties) with four replications, totaling 24 plots. Each plot measured 4 m × 4 m (16 m^2) with a plant spacing of 75 cm × 30 cm, resulting in an approximate plant population of 44,000 plants ha^{-1}. The six treatments included:

T_1–'Bhu Krishna', T_2–'Bhu Sona', T_3–'Bhu Kanti', T_4– Local 'Misti Aalo' (Pink skin), T_5–Local 'Misti Aalo' (Yellow skin), and T_6–Local 'Misti Aalo' (White skin).

All plots were managed under uniform cultural and agronomic practices. The field was prepared by thorough ploughing and harrowing, followed by ridge formation. Well-decomposed farmyard manure (10 t ha^{-1}) was incorporated before planting, along with the recommended dose of $N:P_2O_5:K_2O$ @ 50:25:50 kg ha^{-1}. Nutrients were applied in split doses-half of nitrogen and the full dose of phosphorus and potassium were given at planting, while the remaining nitrogen was top-dressed after 30 days of planting. Irrigation was provided as per crop requirement, and intercultural operations such as weeding, earthing-up, and mulching were carried out uniformly. Pest and disease management was performed using neem-based biopesticides and pheromone traps to monitor and control sweet potato weevil (*Cylas formicarius*) infestations, ensuring minimum chemical use in line with eco-friendly crop protection strategies.

For Growth and Yield Parameters observations were recorded on ten randomly selected plants per plot for various growth, yield, and quality parameters such as vine length, number of tubers per plant, average tuber weight, tuber yield per hectare, and biochemical attributes (dry matter, starch, antioxidant content, etc.).

The quality parameters of sweet potato tubers, namely dry matter (%), total soluble solids (TSS, °Brix), starch (g 100 g^{-1}), and antioxidant activity (mg 100 g^{-1}), were estimated using standard laboratory procedures. For determination of dry matter content, freshly harvested tubers were washed, peeled, and cut into uniform slices. A representative 100 g sample was oven-dried at 65 ± 2 °C to a constant weight, and the results were expressed as percentage of fresh weight basis. The total soluble solids (TSS) were measured from the juice extracted from freshly boiled tubers using a hand refractometer (0–32 °Brix range) at room temperature, and the readings were directly expressed in °Brix. The starch content was determined by the anthrone method, where dried and finely ground samples were hydrolyzed in hot acid and the optical density of the developed green color was read at 620 nm using a UV–Visible spectrophotometer. Starch concentration was calculated using a glucose standard curve and expressed as g 100 g^{-1} of fresh weight. The antioxidant activity was estimated through the DPPH radical scavenging assay. Methanolic extracts of tuber samples were reacted with DPPH solution, incubated for 30 minutes in the dark, and absorbance was recorded at 517 nm. The results were expressed as mg 100 g^{-1} fresh weight of Trolox equivalent antioxidant capacity. These analyses together helped in assessing the nutritional superiority of biofortified varieties over local checks.

Data were subjected to statistical analysis using the method described by Gomez and Gomez (1984) for analysis of variance (ANOVA) appropriate to RBD. Least Significant Difference (LSD) at 5% probability (P = 0.05) was employed to determine statistical significance among treatment means. Correlation coefficients and path analysis were also computed to understand interrelationships among yield-contributing traits.

Results and Discussion

Growth and Yield Parameters

Significant varietal differences were evident for all measured parameters (Table 1). Among the six tested varieties, Bhu Sona exhibited superior performance with the highest vine length (178.6 cm), leaf area index (4.3), and average tuber weight (192.3 g), resulting in the maximum tuber yield of 26.3 t ha^{-1} and marketable yield of 25.0 t ha^{-1}. This was followed closely by Bhu Krishna (23.8 t ha^{-1}) and Bhu Kanti (22.4 t ha^{-1}). Local cultivars, particularly the white-skinned type, recorded the lowest yield (16.2 t ha^{-1}) due to shorter vines, smaller tubers, and a higher incidence of weevil infestation (7.9 %). The mean weevil incidence was lowest in biofortified varieties (4–5 %), suggesting their moderate tolerance under local field conditions.

Table 1 : Performance of sweet potato varieties for yield and growth parameters

Varieties	Vines /plant	Vine length (cm)	LAI	Avg tuber wt (g)	Tubers /vine	Tuber length (cm)	Tuber girth (cm)	Yield /vine (kg)	Yield (t ha^{-1})	Weevil inf. (%)	Marketable yield (t ha^{-1})
Bhu Krishna	6.2	168.4	4.1	185.6	5.2	14.2	11.6	0.96	23.8	5.2	22.1
Bhu Sona	6.8	178.6	4.3	192.3	5.8	15.8	13.4	1.04	26.3	4.1	25.0
Bhu Kanti	6.5	172.3	4.0	175.4	5.1	14.0	12.5	0.90	22.4	4.8	21.0
Local Pink	5.6	153.4	3.6	140.2	4.8	12.4	10.3	0.70	17.8	7.3	16.0
Local Yellow	5.8	159.0	3.7	152.8	4.9	13.0	10.9	0.78	19.6	6.5	18.2
Local White	5.3	147.5	3.5	132.1	4.5	12.1	9.8	0.64	16.2	7.9	14.8
Mean	6.03	163.2	3.87	163.1	5.05	13.58	11.42	0.84	20.98	5.97	19.52
LSD (P = 0.05)	0.42	6.31	0.19	9.25	0.28	0.62	0.54	0.05	1.35	0.76	1.21

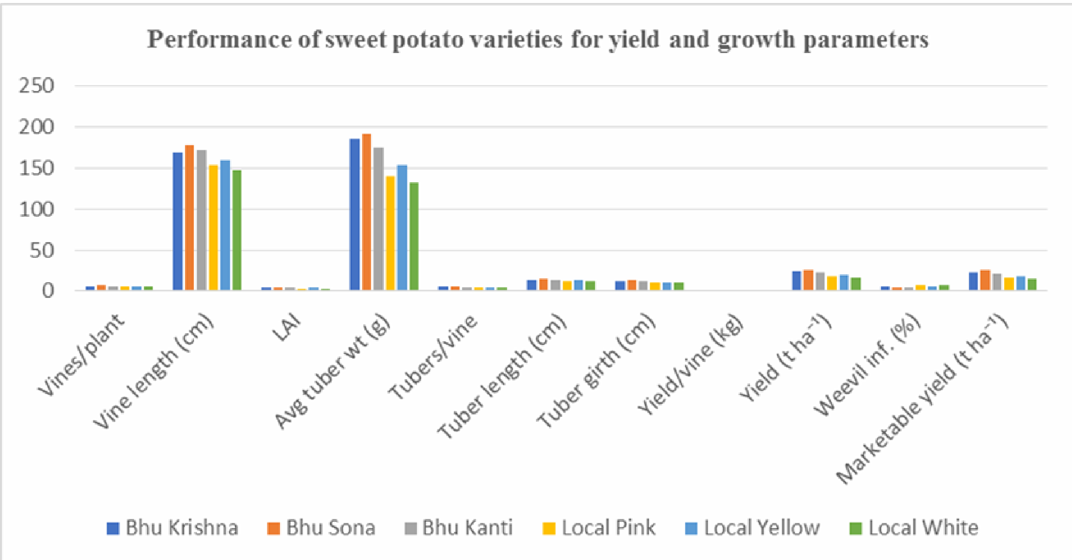

Fig. 1 : Performance of sweet potato varieties for yield and growth parameters

The higher productivity of the biofortified varieties could be attributed to vigorous vine growth, greater canopy spread, and higher leaf area index (LAI ≈4.1–4.3) that enhanced light interception and assimilate partitioning toward developing tubers. Similar physiological advantages of improved varieties over local checks were reported by Naskar *et al.* (2018) and CTCRI (2022), who found that canopy photosynthetic efficiency and dry-matter translocation directly influence tuber bulking and overall yield in sweet potato.

The present results are in close agreement with the findings of Sahoo *et al.* (2019), who reported that the variety ‘Bhu Sona’ yielded 25–27 t ha^{-1} in eastern India due to its high LAI and efficient tuberization. Nedunchezhiyan and Byju (2020) also highlighted that vine length and tuber girth were strongly correlated ($r > 0.80$) with marketable yield, emphasizing the significance of canopy vigor in determining productivity. The observed correlation between vine length and yield per plant ($r = 0.86$) and between tuber girth and yield ($r = 0.81$) in this study further substantiates this relationship.

Comparable responses have been reported in other root and tuber crops as well. Das *et al.* (2021) in cassava and Haque *et al.* (2020) in yam observed that longer vines and higher leaf area contribute to improved carbohydrate accumulation in underground storage organs. Likewise, Singh and Verma (2019) noted that increased leaf area enhances photosynthate translocation to sink organs in colocasia, improving both yield and quality. These studies collectively support the current findings that enhanced vegetative vigor and efficient source–sink dynamics underpin the higher productivity of biofortified sweet potato varieties.

Moreover, the reduced weevil infestation in biofortified genotypes may also be linked to their firmer skin texture and compact tuber formation, as earlier noted by Anjaneyulu *et al.* (2017). Integrated pest management practices such as pheromone trapping and neem-based biopesticide application were effective in maintaining weevil incidence below the economic threshold level, ensuring higher marketable yield.

The study clearly demonstrates that biofortified varieties outperform local landraces under Tripura’s sub-tropical humid conditions in terms of both yield and pest tolerance. On average, biofortified lines produced 20–30 % higher yields and reduced weevil damage by 25–40 %, ensuring better marketable returns. The superior physiological efficiency, enhanced photosynthetic leaf area, and improved sink capacity of varieties like *Bhu Sona* and *Bhu Krishna* are the primary determinants of their high productivity. These results validate the potential of adopting biofortified sweet potato varieties for nutritional and economic gains in North-Eastern India, aligning with the national mission for biofortified crop promotion.

Quality Parameters

Significant variation was observed among varieties for all quality traits studied (Table 2). The biofortified varieties recorded distinctly higher values of dry matter, starch, and antioxidant content compared to local checks. Bhu Krishna exhibited the highest dry-matter content (31.8 %), starch concentration (22.6 g 100 g^{-1}), and antioxidant activity (14.2 mg 100 g^{-1}), followed by Bhu Sona and Bhu Kanti. The Total Soluble Solids (TSS) content was also highest in Bhu Sona (14.6 °Brix), contributing to better taste and consumer acceptability.

The superior biochemical composition of biofortified varieties may be attributed to their genetic potential for enhanced carotenoid biosynthesis and starch accumulation under favorable environmental conditions. Similar results were reported by Naskar *et al.* (2018), who observed anthocyanin and β-carotene values of 8–12 mg 100 g^{-1} in *Bhu Krishna* and *Bhu Sona*, significantly exceeding local germplasm. The present findings also corroborate the report of CTCRI (2022), which highlighted the nutritional superiority of orange-fleshed sweet potatoes developed through biofortification breeding programs.

Table 2 : Quality traits of sweet potato varieties

Varieties	Dry matter (%)	TSS (°Brix)	Starch (g 100 g^{-1})	Antioxidant (mg 100 g^{-1})
Bhu Krishna	31.8	13.4	22.6	14.2
Bhu Sona	30.4	14.6	21.9	12.8
Bhu Kanti	29.8	13.9	21.0	11.2
Local Pink	27.5	12.2	19.8	9.0
Local Yellow	28.3	12.6	20.1	9.6
Local White	26.9	11.8	18.6	8.4
Mean	29.12	13.08	20.67	10.87
LSD (P = 0.05)	0.74	0.42	0.38	0.31

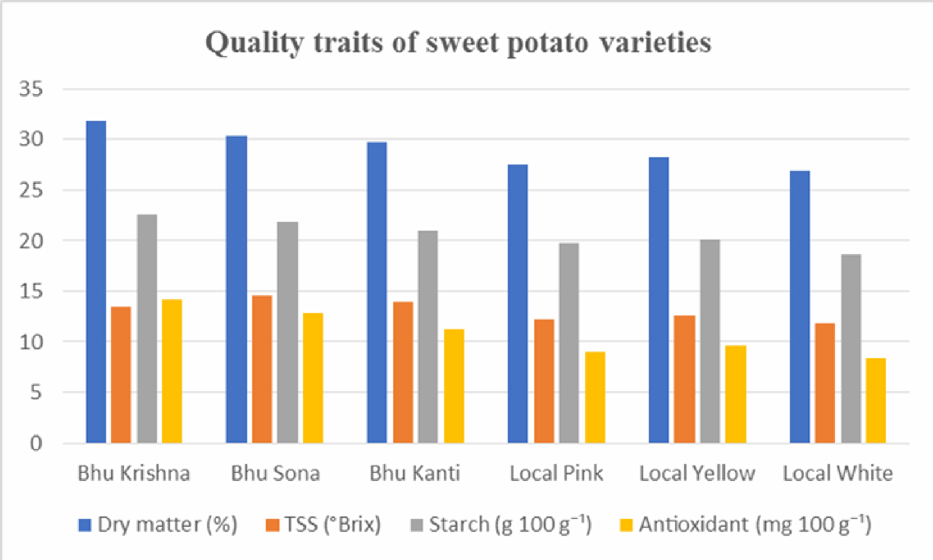

Fig. 2 : Quality traits of sweet potato varieties

The higher dry-matter and starch content observed in *Bhu Krishna* and *Bhu Sona* are critical determinants for both table and industrial uses, as they influence texture, frying quality, and storability. According to Nedunchezhiyan and Byju (2020), dry-matter accumulation in sweet potato is closely associated with photosynthetic efficiency and sink strength, both of which were higher in improved varieties. Similarly, Sahoo *et al.* (2019) found a positive correlation ($r = 0.79$) between starch content and marketable yield, confirming that high-yielding varieties tend to possess superior carbohydrate reserves.

The antioxidant activity showed a parallel trend with anthocyanin and β-carotene concentration, indicating that the presence of anthocyanin and carotenoids contributes substantially to the total antioxidant capacity of the tubers. The relationship between anthocyanin and β-carotene and antioxidant activity observed in this study ($r = 0.84$) was consistent with findings of Sun *et al.* (2021), who emphasized that phenolic compounds and anthocyanin, carotenoids jointly determine antioxidant potential in sweet potato roots.

Comparable results were also reported in other tuber crops. Das *et al.* (2021) in cassava and Haque *et al.* (2020) in yam observed that high dry-matter and starch accumulation corresponded with increased antioxidant capacity, enhancing both nutritional and functional quality. Singh and Verma (2019) reported similar biochemical improvements in colocasia genotypes with higher carbohydrate concentration and phenolic content under favorable growing conditions.

Overall, the present findings confirm that Bhu Krishna and Bhu Sona are nutritionally superior biofortified varieties, offering both enhanced anthocyanin and β-carotene and antioxidant levels alongside high yield potential. Adoption of these cultivars can therefore play a significant role in promoting nutritional security and value addition in the North-Eastern region of India.

Organoleptic Evaluation

Organoleptic or sensory evaluation revealed notable differences in the sensory quality of the tested sweet potato varieties (Tables 3 and 4). The evaluation was conducted by a semi-trained panel using a 9-point hedonic scale, assessing color, sweetness, texture, and overall acceptability after boiling the tubers to uniform doneness.

Among the varieties, Bhu Sona recorded the highest overall acceptability score (8.5), followed by Bhu Krishna (8.1) and Bhu Kanti (7.8). These biofortified varieties were preferred for their bright orange flesh color, pleasant aroma, and sweet taste. The enhanced sensory perception of *Bhu Sona* may be attributed to its higher TSS (14.6 °Brix), which imparted both sweetness and appealing color. In contrast, local white- and yellow-fleshed varieties scored lower (6.2–6.8) due to their dull color, less sweetness, and coarser texture.

Table 3 : Grading system on organoleptic score card

Score	Quality description
9	Excellent flavor, sweetness, and texture
7	Very good, acceptable
5	Moderate
3	Poor
1	Very poor

Table 4 : Mean sensory scores (9-point hedonic scale)

Varieties	Color	Sweetness	Texture	Overall acceptability
Bhu Sona	8.7	8.5	8.4	8.5
Bhu Krishna	8.1	8.3	8.0	8.1
Bhu Kanti	7.8	7.9	7.6	7.8
Local Pink	7.2	6.9	6.8	6.9
Local Yellow	6.8	7.0	6.6	6.8
Local White	6.5	6.3	6.0	6.2
Mean	7.52	7.48	7.23	7.38
LSD (P = 0.05)	0.28	0.31	0.35	0.30

The color preference among panelists was strongly associated with anthocyanin and β-carotene content, as evidenced by the significant positive correlation (r = 0.89) between color score and anthocyanin and carotenoid concentration. This relationship aligns with the observations of Naskar *et al.* (2018), who reported that orange-fleshed biofortified cultivars were rated higher for color and sweetness compared to traditional white-fleshed types. Similarly, CTCRI (2022) emphasized that sensory attributes such as flavor and mouthfeel are directly linked to the sugar–starch ratio and anthocyanin and carotenoid composition of the tuber flesh.

The texture score followed a similar trend, where *Bhu Sona* (8.4) and *Bhu Krishna* (8.0) exhibited smooth and creamy textures upon cooking, indicating balanced starch–fiber ratios and high dry-matter content. Nedunchezhiyan and Byju (2020) and Sahoo *et al.* (2019) reported that varieties with moderate to high dry-matter (30–33%) generally exhibit better texture and palatability than low-dry-matter types, which tend to be watery or fibrous after cooking.

Comparable sensory patterns have also been reported in other root and tuber crops. Das *et al.* (2021) found that cassava genotypes with higher starch and TSS contents exhibited improved flavor and overall acceptability. Similarly, Singh and Verma (2019) observed that colocasia genotypes with higher carbohydrate content were rated superior in taste and texture during sensory evaluation. These findings are consistent with the present results, confirming that biofortified sweet potato varieties offer not only higher nutritional value but also greater consumer acceptability due to their appealing sensory characteristics.

Overall, the study demonstrated that Bhu Sona and Bhu Krishna were most preferred by the sensory panel, combining high sweetness, attractive color, smooth texture, and good mouthfeel. Thus, these genotypes are not only nutritionally superior but also organoleptically appealing, which enhances their potential for fresh market consumption, processing into ready-to-eat products, and inclusion in nutrition-oriented dietary programs in Tripura and the North-Eastern region.

Conclusion

The study revealed significant varietal variation among biofortified and local sweet potato genotypes under Dhalai conditions. *Bhu Sona* recorded the highest yield and sensory preference, whereas *Bhu Krishna* showed superior antioxidant content. Considering productivity, nutritional value, and market demand, *Bhu Sona* and *Bhu Krishna* are recommended for large-scale demonstration and dissemination through KVKs and SHGs in Tripura.

Future Scope of Research

- Multi-season and multi-location evaluation of elite biofortified varieties in NEH agro-ecosystems.
- Nutritional profiling of derived value-added products (chips, flour, puree).
- Breeding and participatory selection of weevil-resistant and drought-tolerant lines.

- Integration of biofortified sweet potato in local nutrition programs and SHG-based enterprises.

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References

Agrawal, M. and Agrawal, S.B. (1989). Phytomonitoring of air pollution around a thermal power plant. *Atmos. Environ.*, **23**, 763–769.

Anjaneyulu, E., Naik, P.S., and Mohan, C. (2017). Studies on varietal performance of sweet potato (*Ipomoea batatas* L.) for yield and pest tolerance under eastern plateau conditions. pp. 45–49.

CTCRI (2022). Annual report on varietal evaluation and productivity performance of sweet potato genotypes under AICRP–Tropical Tuber Crops. Central Tuber Crops Research Institute, Thiruvananthapuram, India.

Das, S., Pradhan, B., and Panda, D. (2021). Growth and yield relationship in cassava (*Manihot esculenta* Crantz) under varying agro-climatic conditions. pp. 66–72.

FAO (2020). *FAO Statistical Yearbook 2020.* Food and Agriculture Organization of the United Nations, Rome.

Gomez, K.A. and Gomez, A.A. (1984). *Statistical Procedures for Agricultural Research.* 2nd Ed. John Wiley & Sons, New York.

Haque, M.A., Sarker, M.N., and Rahman, M.S. (2020). Effect of vine length and leaf area on tuber yield of yam (*Dioscorea alata* L.) cultivars under humid tropics. pp. 90–95.

ICAR–CTCRI (2023). *Annual Report 2022–23.* Central Tuber Crops Research Institute, Thiruvananthapuram, India.

Jangra, S., Mandal, S., and Kumar, P. (2020). Nutritional evaluation of orange-fleshed sweet potato genotypes. *Indian J. Hort.*, **77**(4), 732–738.

Kapoor, R., Naskar, S.K., and Das, A. (2022). Biofortified sweet potato for micronutrient security in India. *Current Science*, **123**(9), 1102–1110.

Low, J.W., Arimond, M., Osman, N., Cunguara, B., Zano, F., and Tschirley, D. (2007). A food-based approach introducing orange-fleshed sweet potatoes increased vitamin A intake and serum retinol concentrations in young children in Mozambique. *J. Nutr.*, **137**, 1320–1327. doi, 10.1093/jn/137.5.1320

Naskar, S.K., Nedunchezhiyan, M., and Jata, S.K. (2018). Evaluation of biofortified sweet potato varieties for yield and nutritional traits in eastern India. *J. Root Crops*, **44**(2), 25–32.

Nedunchezhiyan, M. and Byju, G. (2020). Correlation and path analysis for yield and its components in sweet potato (*Ipomoea batatas* L.) under rainfed condition. pp. 81–88.

Sahoo, R.N., Dash, S.K., and Panda, D. (2019). Performance of improved sweet potato varieties in coastal Odisha. pp. 34–39.

Singh, D. and Verma, S.K. (2019). Relationship of leaf area and yield attributes in colocasia (*Colocasia esculenta* L.) genotypes grown under subtropical conditions. pp. 112–118.

Singh, R.K., Chakraborty, S., and Devi, A. (2019). Constraints and prospects of tuber crops in NE India. *Indian J. Agric. Sci.*, **89**(5), 765–770.

Sun, H., Zhang, L., and Li, Q. (2021). Variation in antioxidant and carotenoid composition of orange-fleshed sweet potato cultivars. pp. 73–80.