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ASSESSMENT OF BIOCHEMICAL TRAITS IN ORANGE FLESHED SWEET POTATO (OFSP) GENOTYPES

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ABSTRACT

The present study was done to evaluate the biochemical characteristics of fourteen orange-fleshed sweet potato (*Ipomoea batatas* L.) genotypes during the *rabi* season of 2022–23 at Assam Agricultural University, Jorhat. The goal was to check how much variation exists in the nutritional attributes like total soluble solids (TSS), total carotenoids, starch content, total sugars, reducing sugars, non-reducing sugars, and shelf life. Overall, the findings showed noticeable differences ($p \leq 0.05$) among the genotypes for every trait that was measured. TSS was observed between 7.00 and 12.35 °Brix, and TSP 16-7 gave the best reading. Total carotenoid concentration ranged broadly from 1.06 to 14.31 mg/100 g, where PSP-1 had the maximum concentration. In the same way, starch content fluctuated from 10.15 to 22.75%. Moreover, Co-1 also had the highest total sugars (8.82%), as well as reducing sugars (7.79%), while Kiran showed the lowest total sugars (3.42%). For non-reducing sugars, the values stayed within 0.40 to 1.03%, and again Co-1 recorded the highest number. Shelf life varied from 17.50 up to 33.00 days, with Bhu Sona lasting the longest in storage. In short, the work confirms a fair amount of genetic variability, and this can be used to pick better lines that have improved nutritional quality, plus a stronger keeping quality too.

***Keywords* :** Orange-fleshed sweet potato, biochemical traits, carotenoids, sugars, starch, TSS, and shelf life.

Introduction

Sweet potato (*Ipomoea batatas* L.) is kind of a major starchy tuber crop that is grown and eaten widely in tropical, subtropical and warm temperate areas around the world. It comes under the family Convolvulaceae, and it is an herbaceous perennial vine, though in most cultivated situations people grow it like an annual crop which is sort of confusing but it works (Mukherjee, and Naskar, 2012). Many researchers believe it originated in Central America and today it is planted in more than 100 countries. It has an important effect on food and nutritional security, particularly in developing nations (Kar *et al*., 2022). In India, you will hear it as shakarkand, and in Assam it is commonly called Meeta aloo. Cytologically, sweet potato is a hexaploid species, with chromosome number of 2n = 6x = 90 (Jones, 1965).

At a global scale, sweet potato sits among the major food crops and it is also appreciated for its ability to fit into different agro-climatic conditions, needing relatively low inputs, and showing comparatively good productivity. In India, cultivation is largely focused in places like Odisha, Bihar, Uttar Pradesh and Madhya Pradesh. When you look at the different types, orange-fleshed sweet potato (OFSP) has become quite significant, mainly because it has a high β-carotene level, which is basically a precursor of vitamin A. So, OFSP is now considered a promising biofortified crop for reducing vitamin A deficiency and supporting nutritional security, especially for families with limited resources (Gurmu *et al*., 2017).

Sweet potato tubers tend to be loaded with carbohydrates, vitamins, minerals, and dietary fiber. Carbohydrate level are usually around 25 to 30 per cent, while the moisture content swings, anywhere from 58 to 72 per cent. Beyond that, these tubers are a solid source of vitamin C, vitamin E, potassium, calcium, and iron, plus moderate B-complex vitamins here and there. And apart from the nutritional part, sweet potatoes also work as a key raw material for different industrial products like starch, alcohol, and various processed foods (Sharma *et al*., 2019).

Some biochemical traits like total soluble solids (TSS), total carotenoids, starch level, total sugars, and their different fractions (the reducing and also non-reducing ones) are really important. They help decide how "good" the nutrition is, plus taste, processing suitability and even consumer acceptance (Badu *et al*., 2017). Shelf life, that one is also quite essential because it affects post-harvest handling, storage, and marketability. Since there is substantial variability in these biochemical parameters among different genotypes, it becomes possible to do selection and genetic improvement in a more effective way, (Mohanty *et al*., 2022).

Getting a clear idea of how much these biochemical traits vary, matters a lot for picking superior genotypes with improved nutritional quality, and also more reliable storage characters. So, the current study was done to look at the biochemical traits of orange-fleshed sweet potato genotypes, and to spot useful lines for nutritional upgradation, breeding programmes and also value-added applications (Oduro, 2013).

Materials and Methods

The present experiment was carried out in the *Rabi* season of 2022–23, at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat, Assam. The site is around 26°47′ N latitude, 94°12′ E longitude, with altitude near 86.8 m above mean sea level. Overall, the area has a humid subtropical climate, so relative humidity stays high, and temperatures range from about 5–7°C in winter to above 37°C in summer. The experimental plant material included fourteen genotypes of orange-fleshed sweet potato, specifically Bhu Ja, Dergaon Red, Gouri, TSP 16-3, CIPSWA-2, Kamala Sundari, PSP-1, TSP 16-7, S1156, Bhu Kanti, Bhu Sona, Kiran, Co-1 and TSP 16-9. These were brought from AICRP on Tuber Crops and ICAR-CTCRI.

The trial layout followed was Randomized Block Design with two replications. Each individual plot was 3.5 m × 2.1 m, with a spacing kept at 70 cm × 20 cm, allowing about 52 plants per plot. Planting was done using healthy vine cuttings, 20–30 cm length, 3–4 nodes each, set on ridges and furrows on 20th October 2022. The soil here was sandy loam, with fairly good drainage. Soil reaction was pH 5.50 and fertility status was moderate. Before sowing, well-decomposed farmyard manure was incorporated at 10 t ha^{-1}, and recommended N:P:K was added at 75:50:75 kg ha^{-1}. During the crop period, standard field routines were followed, like irrigation, weeding, earthing-up, and vine turning, just to keep everything in a good state.

For biochemical analysis, tuber samples were collected for lab assessment. Total soluble solids (TSS) were checked through a digital refractometer. Total carotenoids were measured spectrophotometrically at 452 nm. Starch content was determined by the anthrone method as described by McCready *et al.* (1950), and total as well as reducing sugars by Lane and Eynon method (AOAC, 1965) using Fehling's solution. Non reducing sugars, were worked out by doing a difference; meanwhile shelf life was kind of checked from how the sample behaved during storage, until it either started to sprout or, shrivel. The data that was recorded, then got statistically analyzed with analysis of variance, (ANOVA) done for a Randomized Block Design, and afterward the treatment means were compared using critical difference, at the 5% level of significance, (Panse, and Sukhatme, 1985).

Results and Discussion

Total Soluble Solids (°Brix)

The data about total soluble solids are shown in Table 1 and Fig. 1. There was a noticeable difference ($p \leq 0.05$) in total soluble solids among the different genotypes of OFSP, at the time of harvest. Out of all the genotypes, TSP 16-7 got the highest total soluble solids (12.35 °Brix), but Bhu Kanti had the lowest value, (7.00 °Brix). This kind of change in TSS across genotypes can be related to genetic differences, that affect sugar build-up and the carbohydrate metabolism pathway. In general, higher TSS lines up with a better taste and also easier consumer acceptance. Similar irregularities in TSS among sweet potato genotypes have been mentioned by previous studies, so it seems like there is a strong genetic effect in it (Badu *et al.*, 2017 and Pushpalata *et al*., 2011).

Total Carotenoids (mg/100g)

The total carotenoids are also presented in Table 1 and Fig. 1. A significant difference ($p \leq 0.05$) was seen in total carotenoids among the different OFSP genotypes at harvest. From all genotypes, PSP-1 showed the maximum total carotenoids (14.31 mg/100g), and Dergaon Red recorded the minimum (1.06 mg/100g). The broad spread in carotenoid level suggests that there is meaningful genetic diversity across the genotypes. A higher carotenoid amount is basically a good feature, because it supports vitamin A activity. Genotypes like PSP-1, can be viewed as rather promising for biofortification initiatives, especially those trying to address vitamin A deficiency (da Rocha Toroco *et al*., 2023).

Starch Content (%)

The data pertaining to starch content are presented in Table 1 and Fig. 2. A significant difference ($p \leq 0.05$) was observed in starch content among different genotypes of OFSP at the time of harvest, in other words it wasn't really uniform. Among all the genotypes, Co-1 recorded the maximum starch content (22.75%), while TSP 16-9 recorded the minimum starch content (10.15%). These starch level variations among the genotypes may be explained by differences in photosynthate partitioning and genetic makeup, perhaps one line is more efficient in distributing what is made during photosynthesis. Higher starch content is usually valued for industrial processing and energy value. Meanwhile, genotypes with lower starch, or "reduced starch accumulation" as some people say, may end up being preferred for direct consumption because the tubers can be softer, and that often matters to consumers (Ahoudou *et al*., 2025 and Gurmu *et al*., 2024).

Total Sugars (%)

The data pertaining to total sugars are presented in Table 1 and Fig. 2. A significant difference ($p \leq 0.05$) was observed in total sugars among different genotypes of OFSP at the time of harvest, again showing clear genotype effect. Among all the genotypes, Co-1 recorded the maximum total sugars (8.82%), whereas Kiran recorded the minimum total sugars (3.42%). Total sugar content plays a direct role in sweetness and general palatability of tubers. The variation noticed here may be linked to differences in enzymatic conversion, meaning starch doesn't get transformed the same way across genotypes. Genotypes showing more sugar are generally liked for table use and also for processing into sweet products, because that extra sugar tends to give better taste without extra adjustments (Badu, *et al*., 2017).

Reducing Sugars (%)

The data related to reducing sugars are set out in Table 1 and Fig. 2, a noteworthy difference ($p \leq 0.05$) was detected among the genotypes, at the moment of harvest. When all the genotypes are considered, Co-1 showed the highest reducing sugars, 7.79%, while CIPSWA-2 had the lowest value, 2.83%. Discussion: Reducing sugars are really important for the final taste, and for browning type reactions during cooking, processing too. The differences seen between genotypes can be linked to changes in carbohydrate metabolism and the level of enzymatic activity (Badu *et al*., 2017 and Ahoudou *et al.*, 2025).

Non-reducing Sugars (%)

The results concerning non-reducing sugars are shown in Table 1 and Fig-3. A significant difference ($p \leq 0.05$) emerged in non-reducing sugars across the different genotypes. Here, Co-1 again recorded the maximum non-reducing sugars (1.03%), whereas Kiran recorded the minimum non-reducing sugars (0.40%). Non-reducing sugars, mostly sucrose, support sweetness perception and also help storage stability. The genotype-to-genotype fluctuation might happen because sugar synthesis and accumulation follow different paths (Gurmu *et al*., 2017, and Gupta *et al*., 2017).

Shelf Life (days)

The data for shelf life are summarized in Table 1 and Fig. 3. A significant difference ($p \leq 0.05$) was observed in shelf life among the different genotypes of OFSP. Bhu Sona recorded the highest shelf life, 33.00 days, while TSP 16-3 recorded the shortest shelf life, 17.50 days. Differences in shelf life among genotypes could be explained by variations in physiological and biochemical makeup, moisture status and sugar level included. Genotypes with longer shelf life are simply more helpful for storage, for transportation, and for market acceptance (Bajrang, *et al*., 2022).

Table 1 : Performance of orange-fleshed sweet potato genotypes for various quality parameters

S. No.	Name of genotype	TSS (°Brix)	Total carotenoids (mg/100g)	Starch content (%)	Total sugars(%)	Reducing sugars (%)	Non-reducing sugars (%)	Shelf life (days)
1	Bhu Ja	7.78	5.37	17.60	4.18	3.74	0.44	20.50
2	Dergaon Red	10.35	1.06	18.00	6.53	6.08	0.46	21.50
3	Gouri	7.85	5.15	16.65	3.45	2.86	0.59	24.50
4	TSP 16-3	8.25	7.41	10.70	4.19	3.50	0.70	17.50
5	CIPSWA-2	7.93	2.76	22.20	3.51	2.83	0.68	27.00
6	Kamala Sundari	8.10	3.55	12.55	7.06	6.36	0.76	31.50
7	PSP-1	10.05	14.31	16.90	4.95	4.19	0.76	28.00
8	TSP 16-7	12.35	6.86	10.28	5.78	5.18	0.60	19.50
9	S1156	7.65	7.11	18.40	3.95	3.36	0.59	25.50
10	Bhu Kanti	7.00	11.07	17.36	4.63	4.06	0.57	20.00
11	Bhu Sona	10.10	11.01	16.65	3.73	3.16	0.57	33.00
12	Kiran	10.20	6.57	10.50	3.42	3.03	0.40	28.00
13	Co-1	9.75	3.46	22.75	8.82	7.79	1.03	29.00
14	TSP 16-9	8.00	11.10	10.15	5.28	4.58	0.70	18.50
Gm		**8.95**	**6.89**	**15.76**	**4.96**	**4.96**	**4.33**	**24.57**
SEm(±)		0.11	0.05	0.10	0.03	0.03	0.04	0.70
CD at 5%		0.35	0.16	0.33	0.10	0.10	0.11	2.15

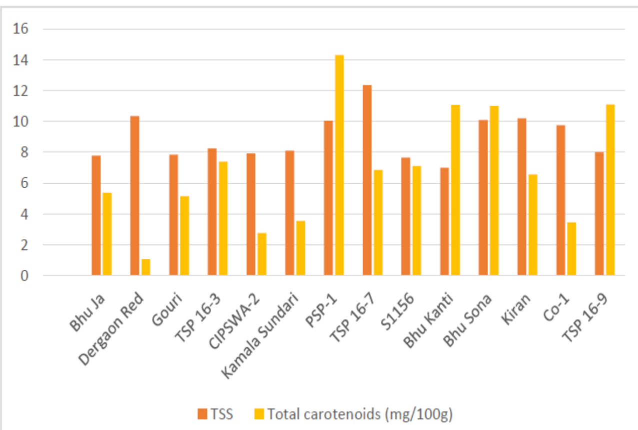

Fig. 1: Mean performance of orange fleshed sweet potato genotypes for TSS and total carotenoids (mg/100g) quality parameters

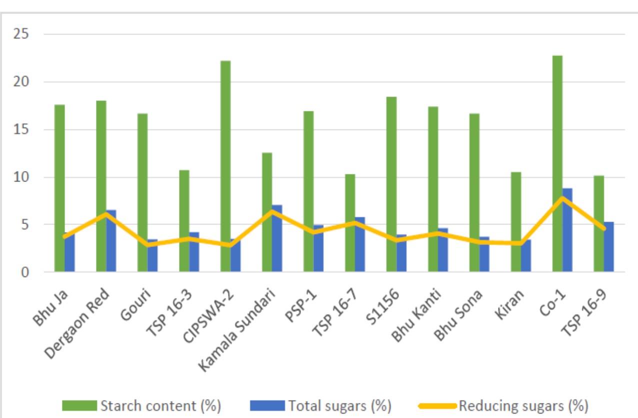

Fig. 2 : Mean performance of orange fleshed sweet potato genotypes for starch contents, total sugar and reducing sugar parameters

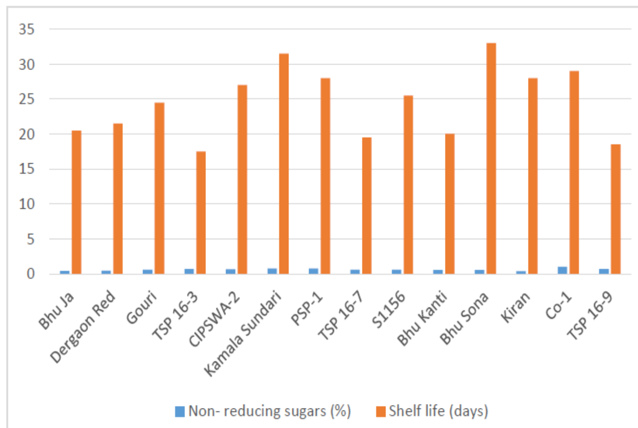

Fig. 3 : Mean performance of orange fleshed sweet potato genotypes for non-reducing sugar and shelf life parameters

Conclusion

In this present study, a lot of variability was observed among orange-fleshed sweet potato genotypes for several key biochemical traits. That points to strong genetic diversity, not just small differences. Some genotypes like PSP-1 had superior carotenoid levels, so it feels quite fitting for nutritional improvement efforts and biofortification programs. Co-1 turned out to be a promising option when you look at high starch and sugar content; it also suggests good potential for processing and value-added products, because that kind of composition is usually what industries want. TSP 16-7 recorded the highest TSS which in turn, may mean better consumer acceptability, mainly due to increased sweetness. Then Bhu Sona showed the longest shelf life, so it would be better aligned with storage needs and overall marketability, since keeping quality matters. Overall, the superior genotypes that were identified can be helpful in breeding programs, aiming at better nutritional quality as well as stronger post-harvest performance in sweet potato. So basically, these results give useful guidance for picking high-quality genotypes for cultivation and also for processing, and they can support future crop improvement programs as well.

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