Performance of Orange-fleshed sweetpotato genotypes in different agro-ecological regions of India

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Abstract

Orange-fleshed sweetpotatoes (OFSPs) are gaining importance in India due to their additional nutritive value. It is necessary to evaluate and select promising OFSP genotypes in the varied agro-ecological conditions of India and analyse important nutrient characteristics before releasing them as varieties. In a preliminary effort, five OFSP genotypes introduced from CIP-Lima, Peru and CIP-Bhubaneswar, India were evaluated in the Initial Evaluation Trial at 12 locations under the ICAR sponsored All India Coordinated Project on Tuber Crops in the main cropping season *(kharif)* for two consecutive years. The pooled data on tuber yields indicated that CIP 440038 recorded good yields at locations such as in Port Blair (33t/ha) and Kalyani (28 t/ha). CIP SWA- 2 recorded a maximum of 36 t/ha at Faizabad. CIP 440127 recorded highest yield at Ranchi (33t/ha) followed by Coimbatore (28t/ha) location while CIP 187017-1 recorded a yield 31 t/ha at Raipur. OFSP genotypes were further analyzed for total carotenoids, β carotene and dry matter content for three seasons namely Summer (March-May), Kharif (June-Sep) and Rabi (Oct-Feb) in the five genotypes raised at CTCRI, Trivandrum. The highest total carotenoids (8 mg/100 g fr.wt.) and β carotene (5.5 mg/100 g fr.wt.) were observed in CIP 440127. There was hardly any variation for the biochemical characters in the genotypes in different seasons. Overall this preliminary study indicated that two OFSP genotypes viz., CIP 440127 and CIP SWA-2 showed considerably wider adaptability compared to other OFSPs with reasonable potential yields and also higher quantities of β-carotene and carotenoids.

Keywords: orange-fleshed sweet potato (OFSP), agro-ecological regions.

Introduction

Sweet potato (*Ipomoea batatas* (L.) Lam) is a vegetatively and cross- pollinated crop. It is a short duration crop (3-4 months) cultivated for its edible tubers. It can produce highest energy (194Mj ha $^{-1}$ day^{-1}) and considerable yield with low inputs even in marginal lands (Woolfe,1992). The tubers and young leaves are used as a vegetable. The flesh colour of tubers of different sweet potato varieties vary from white to various shades of cream, yellow to dark orange colour depending on the carotenoid content with β- carotene as the major component. The leaves also possess high β- carotene content. The white- fleshed sweet potatoes are traditionally preferred by the local population all over India which however has no β- carotene content. The orange- fleshed sweet potato is an excellent source of β- carotene to control Vitamin A deficiency which affects millions of children in the developing countries. β- carotene is a precursor of vitamin A. The present study was under taken to asses the yield potential and carotene content of five orange-fleshed genotypes introduced from CIP, Lima, Peru and Bhubaneswar, India at different agro-climatic regions of India.

Materials and methods

The materials for the study comprised of five orange-fleshed genotypes CIP -187017-1, CIP-420027, CIP-440127, CIP-440038 and CIP-SWA -2 and the other orange- fleshed genotypes from the different co-ordinating centres. The trial was conducted at 12 centres on a Randomized Block Design in three replications for 2 consecutive years during the kharif season (June-September/October) under rainfed conditions following the recommended package of practices of each centre/location. The crop was harvested between 90 and 105 days after planting and the tuber yield was recorded. The biochemical analysis was carried out at CTCRI, Thiruvananthapuram for three seasons *ie* summer, kharif, and rabi. The tuber samples from each genotype raised at this location were analysed for carotenoids and dry matter content. The total carotene and β-carotene content were estimated

using the AOAC (1995) procedure. Dry matter content was determined by drying 100g of fresh tuber slices in an oven at 50^{0}C, till a constant weight was obtained. From the weight of dried sample the percentage of dry matter was calculated. The tuber yield data were pooled for two years for proper interpretation of the results obtained.

Results and discussion

The data on tuber yields are given in Table 1. Since most of the genotypes are not significantly varying in terms of yield across respective locations over two seasons, average yield was considered for each genotype across locations and seasons. The data indicated that the genotype CIP 440038 produced an yield of 21-28 t/ha at Thiruvananthapuram, Coimbatore, Kalyani, Raipur and Faizabad centres while CIP-440127 gave an yield of 28-33t/ha at three centers *viz*, Coimbatore, Kalyani and Ranchi. In CIP-187017-1, the yield 23 t/ha was observed at Kalyani and 31t/ha at Raipur. At Faizabad, CIP-SWA-2 recorded 36t/ha while at the other four centres (Thiruvananthapuram, Kalyani, Bhubaneswar and Jorhat) the yield was 16-18t/ha. The overall results showed that the genotypes CIP-440127 and CIP-SWA-2 had wider adaptability compared to the other genotypes. Grunberg et al,.(2005) reported that some high yielding genotypes had wider adaptability, while some genotypes had specific adaptation to medium to high yielding environments and low yielding environments. Haldavankar *et e*l (2009) also showed that some sweet potato cultivars had wider adaptability and produced stable yield at different environmental conditions in India.

Table 1. Tuber yield (t/ha) of CIP genotypes at different co-ordinating centres in India)

Centres/Locations	CIP -SWA- 2	CIP 187017-1	CIP 420027	CIP 440127	CIP 440038
Thiruvananthapuram, Kerala	16.17	6.04	2.16	15.04	20.82
Coimbatore, Tamil Nadu	13.69	20.94	2.42	27.90	21.16
Rajendra Nagar, A.P	8.52	6.65	10.42	10.91	12.04
Bhubaneswar Orissa	17.59	15.08	16.33	16.41	14.03
Kalyani,West Bengal	16.34	22.72	10.00	27.61	27.87
Ranchi, Jharkand	10.96	12.96	5.67	32.91	2.55
Dholi, Bihar	3.1	3.3	3.3	9.1	13.30
Port Blair, Andaman and Nicobar Islands	11.46	9.80	7.46	18.43	32.80
Raipur, chattisghar	-	31.02	27.49	-	27.99
Jorhat, Assam	17.66	14.57	8.58	-	-
Dapoli, Maharashtra	10.10	13.46	11.45	-	-
Faizabad, Uttar Pradesh (U.P)	35.94	-	27.67	-	26.83

The biochemical analysis of the orange-fleshed genotypes for the three seasons are given in Table 2. The data showed that the highest total carotenoids (7-8mg/100g.f.w.) and β-carotene (5-6mg/100g.f.w.) was observed in two genotypes CIP-440127 and CIP-SWA-2. The lowest total carotenoids (2mg/100g.f.w.) and β- carotene (1mg/100g.f.w.) was noticed in CIP-420027.The flesh colour and carotenoids were positively correlated. The depth of the orange flesh colour was mainly a function of the concentration of β-carotene (Simonne, *et al*; 1993) The genotypes included in the study showed different intensities of orange-flesh colour. The percentage of total carotenoids to β-carotene was 62-79%. Woolfe (1992) reported that the percentage of total carotenoids to β-carotene in the orange-fleshed sweet potato varied from 86-89%. Highest dry matter (28%) was found in CIP-SWA-2 followed by CIP-187017-1 (26%). The data for three seasons showed that there was not much difference in the total carotenoids and β-carotene between the seasons. Gruneberg, *et al.,* (2005) observed that the magnitude of genotypes and environment interaction for the nutritional traits in sweet potato was small. The genotype CIP-440127 and CIP-SWA-2 produced moderate yield with wider adaptability and possess moderate amount of total carotenoid and β- carotene content.

Table 2. Biochemical analysis of sweetpotato genotypes in different seasons

Genotype	Summer season				Kharif season				Rabi season			
	Total Carotenoids (mg/100g f.w.)	Carotene (mg/100g f.w.)	% of total carotenoids to carotene	DM (%)	Total Carot-noids (mg/100g f.w.)	Carotene (mg/100g f.w.)	% of total carotenoids to carotene	DM (%)	Total Carotenoids (mg/100g f.w.)	Carotene (mg/100g f.w.)	% of total carotenoids to carotene	DM (%)
CIP -187017-1	3.31	2.06	62.24	25.93	3.51	2.22	63.25	25.1	3.55	2.24	63.10	25.51
CIP- 420027	1.80	1.21	67.22	23.16	1.79	1.20	67.04	24.15	1.84	1.21	65.76	23.22
CIP- 440127	7.86	5.27	67.05	21.54	8.03	5.53	68.87	22.15	7.91	5.51	69.66	22.33
CIP- 440038	5.28	4.00	75.76	24.42	5.20	4.00	76.92	24.52	6.08	4.61	75.82	24.23
CIP- SWA -2	6.79	5.36	78.94	28.15	6.76	5.35	79.14	28.14	7.08	5.59	78.95	27.43

The people who are traditionally dependent on the consumption of white-fleshed local cultivars are unaware of the nutritive value of orange-fleshed sweet potato. Most of the consumers select varieties based on the best taste, flavour and texture, rather than those having a better nutrient profile (Chattopadhay et al, 2006). Introduction and evaluation of elite exotic genotypes with high β-carotene at different agro-climatic situations through the All India Co-ordinated Project enables to identify sweet potato genotypes having high yield and carotene content. The promotion of orange-fleshed genotypes in the house hold diets through nutrition programme could improve the vitamin A status.

Acknowledgement

The authors are grateful to all the scientists of the different coordinating centres for evaluating the orange-fleshed genotypes introduced from CIP, Lima, Peru and CIP Bhubaneswar, India

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