Journal of Root Crops, 2015, Vol. 41 No. 2, pp. 23-27
Indian Society for Root Crops
ISSN 0378-2409, ISSN 2454-9053 (online)

Field Performance of Two Orange-fleshed Sweet Potato Clones (CIP-440001 and CIP-440014) in Bangladesh

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Received: 5 January 2015 Accepted: 10 November 2015

Abstract

This article reports the performance in the regional and farmer's field trials of two orange-fleshed sweet potato (OFSP) genotypes *viz*., 'CIP-440001' and 'CIP-440014' introduced from the International Potato Centre (CIP), Lima, Peru and were released as 'BARI SP-12' and 'BARI SP-13' respectively by the National Seed Board (NSB), Ministry of Agriculture, Bangladesh in 2013. The leaf colour of BARI SP-12 is green when matured, with slightly purple young leaves, triangular and 3-5 very small leaf lobes, edge of leaf, leaf petiole and stem is slightly purple. Tuber is medium sized with purple-brown skin and deep orange flesh. The clone CIP 440001 (BARI SP-12) contains about 14,700 IU of β-carotene per 100g edible portion of tuber. The leaf of BARI SP-13 is green when matured, slightly purple young leaves, 5-7 deep lobes light green, leaf vine, petiole and stem light green. Tuber is medium sized with yellow brown skin and flesh colour is intermediate orange. The clone CIP 440014 (BARI SP-13) contains about 4,400 IU of β- carotene per 100g edible portion of tuber. The tuber yield of two varieties varied between 35 and 40 t ha^{-1} and was superior to previously released sweet potato varieties in Bangladesh.

Key words: Sweet potato varieties, Bangladesh

Introduction

Sweet potato (*Ipomoea batatus* L.) is a valuable tuber crop rich in carbohydrate, dietary fiber and phytonutrient specially β-carotene that is pro-vitamin-A and minerals. In Bangladesh, sweet potato is mainly cultivated by the marginal or subsistence farmers in a sporadic way in river belts, char lands, deltas and seasonally inundated flood plains with minimum labour, irrigation and chemical fertilizers (Ahmed *et al*., 1990). Sweet potato is grown in 56 thousand hectares which produces 7.0 lakh tones annually with an average yield of 12.5 t ha^{-1} (BBS, 2011). The average tuber yield of sweet potato was 12.5 t ha^{-1} (BBS, 2011), and it is very low as compared to many tropical and sub-tropical countries (Verma *et al*., 1994) due to continuous cultivation of local and poor quality indigenous sweet potato varieties. The present yield could be increased substantially by using high yielding varieties. To overcome the problems of low yield and vitamin-A deficiency among the rural population, efforts were made to develop varieties which are high yielding, with medium sized tubers and moderate carotene content.

Plant breeding is the technique to create variability over the existing ones to develop high yielding and good quality varieties in any crop. In view of these facts Tuber Crops

Research Centre (TCRC) of Bangladesh Agricultural Research Institute (BARI) developed 11 high yielding varieties of sweet potato since 1985 through introduction, selection and hybridization (Bhuiyan *et al*., 1996). Furthermore,TCRC has introduced 21 orange-fleshed sweet potato germplasm supplied by the International Potato Center (CIP), Peru. After several years of field trials with these exotic germplasm, two genotypes *viz*., CIP-440001 and CIP-440014 were identified with high yield potential and desirable qualities like high dry matter (28.93-29.78%) and β-carotene content (4400-14700 IU/100g). This paper reports the performance of recently released two varieties "BARI SP-12" and "BARI SP-13" in 5 different regions of Bangladesh.

Materials and Methods

The selected three genotypes CIP-440001, CIP-440014 and CIP-440024 collected from CIP were tested at five diverse locations *viz*., central (Joydebpur), west (Jessore), north (Bogra, Jamalpur) and east (Pahartali) at research and farmer's fields during 2009-10 to 2011-12. BARI SP-4 was used as check in the trials. The experiment was laid out in randomized complete block design with three replications. The unit plot size was 3.0 x 3.0 m each accommodating 50 plants in five rows at 60 x 30 cm spacing. The experiment was planted on mid-November and harvested on 2nd week of April in all the seasons. The crop was fertilized with 10 tons of FYM, 140 kg of urea, 80 kg of TSP and 150 kg of MP per hectare. These advanced clones were also evaluated in four on-farm trials at different locations *viz*., Jamalpur, Bogra, Jessore and Chittagong through farmer's participation. Data were recorded from 10 randomly selected plants from each plot. Disease and insect data were also collected from the trials. Organoleptic test was performed by a panel of sensory evaluators considering taste, sweetness, softness and physical appearance after boiling. Data were analyzed statistically using MSTAT C programme.

Results and Discussion

Performance at regional yield trial

The tuber yield of three genotypes and the check variety differed significantly at all the five locations (Table 1). At Joydebpur, Jamalpur and Bogra higher tuber yield (40.34, 43.30, 37.45 t ha^{-1} respectively) was obtained from CIP 440001. In case of CIP 440014, higher tuber yield was obtained at Joydebpur, Bogra, Jamalpur (39.43, 38.31 and 38.43 t ha^{-1} respectively). The mean tuber yield over the five locations revealed that CIP 440001 to be the highest yielder (38.48 t ha^{-1}) and it was second in CIP 440014 (37.64 t ha^{-1}) and these two genotypes were superior to the check variety BARI SP-4 (29.68 t ha^{-1}) and other varieties released and reported previously (25.0 -35.9 t ha^{-1}) in Bangladesh (Bhuiyan et al., 1996; Golder et al., 2007).

Yield performance across years

Year wise tuber yield of three genotypes and the check variety significantly differed at all the five locations (Table 2). During 2009-10 the highest tuber yield was recorded in CIP 440001 (38.21 t ha^{-1}) and the second being CIP 440014 (36.89 t ha^{-1}). These two genotypes produced higher yield than that of check variety. During 2010-11, the tuber yield of two genotypes yielded at par. During 2011-12, the highest tuber yield was recorded in CIP 440001 (39.76 t ha^{-1}) followed by CIP 440014 (38.26 t ha^{-1}). The mean tuber yield was highest in CIP 440001 (39.01 t ha^{-1}) followed by CIP 440014 (38.04 t ha^{-1}). The results are in agreement with the report of Bhuiyan *et al*., (2009) from Bangladesh.

Table 1. Tuber yield of four sweet potato genotypes in regional yield trial (Pooled data for 2009-10, 2010-11 and 2011-12)

Genotype	Location-wise tuber yield (t ha^{-1})					Mean
	Joydebpur	Jessore	Bogra	Jamalpur	Pahartali	
CIP 440001(BARI SP 12)	40.34 a	36.48 a	37.45 a	43.30 a	37.38 a	38.48
CIP 440014(BARI SP-13)	39.43 a	37.61 a	38.31 a	38.43 b	36.45 a	37.64
CIP 440024	31.56 b	29.62 b	30.71 b	30.46 c	31.42 b	30.08
BARI SP-4 (Check)	31.46 b	31.35 b	30.46 b	29.42 c	30.16 b	29.68
CV (%)	5.39	3.87	4.18	5.16	4.72	

Means followed by the same letter(s) do not differ significantly at 5% level by DMRT

Table 2. Year wise tuber yield of four sweet potato genotypes

Genotype	Year-wise tuber yield (t ha^{-1})			Mean
	2009-10	2010-11	2011-12	
CIP 440001(BARI SP 12)	38.21 a	37.48 a	39.76 a	39.01
CIP 440014(BARI SP-13)	36.89 b	37.78 a	38.26 a	38.04
CIP 440024	28.98 c	29.54 b	31.73 b	30.75
BARI SP-4 (Check)	29.25 c	30.64 b	29.16 c	30.57
CV (%)	4.61	5.03	4.17	

Means followed by the same letter(s) do not differ significantly at 5% level by DMRT

Table 3. Tuber yield of four sweet potato genotypes at farmer's field (Mean of 2009-10, 2010-11 and 2011-12)

Genotype	Location-wise tuber yield (t ha^{-1})				Mean
	Jamalpur	Bogra	Jessore	Chittagong	
CIP 440001(BARI SP 12)	41.34 a	38.61 a	42.15 a	39.81 b	40.47
CIP 440014(BARI SP-13)	40.16 a	39.73 a	41.46 a	42.31 a	40.91
CIP 440024	32.17 b	33.42 b	32.82 b	32.58 c	32.74
BARI SP-4 (Check)	31.71 b	30.43 c	32.93 b	31.87 c	31.73
CV (%)	4.18	2.11	4.29	5.20	

Means followed by the same letter(s) do not differ significantly at 5% level by DMRT

Yield performance at farmer's field

The tuber yield of three genotypes and the check variety significantly differed in the farmer's field at four locations (Table 3). At Jamalpur and Jessore CIP 440001 produced the highest yield (41.34 and 42.15 t ha^{-1}, respectively) whereas at Bogra, and Chittagong CIP 440014 produced the highest yield (39.73 and 42.31 t ha^{-1}, respectively). The mean highest tuber yield obtained from farmer's field was from CIP 440014 (40.91 t ha^{-1}) and it was second highest in CIP 440001 (40.47 t ha^{-1}) and these two genotypes were superior to the check variety BARI SP-4 (31.73 tha^{-1}) and other varieties reported previously in Bangladesh (25.0 -35.9 t ha^{-1}) (Bhuiyan et al., 1996; Golder et al., 2007). It was observed that all the tested genotypes produced higher tuber in farmers fields than on-station trials with similar trends (Table 1 & Table 3).

Pest and disease tolerance

Weevil infestation varied from 3.46 to 5.73 % which was remarkable (Table 4). Sweet potato feathery mottle virus (SPFMV) was lowest (2.21%) in CIP 440014, which was followed by CIP 440001 (4.55%). Mosaic or mild mottle virus was also lower in these two genotypes. There was no leaf curl virus observed in these two genotypes (CIP 440001 and CIP 440014) including BARI SP-4 (Table 5). Weevil infestation was very low in all the tested genotypes including check (3.46 to 5.73%).

The organoleptic characteristics of tubers of CIP-440001 and CIP-440014 as compared to other genotypes are indicated in Table 6. Significant variation was observed in tuber sweetness, dryness, fiber and general appearance through organoleptic test. Two genotypes CIP-440001 and CIP-440014 was found better than CIP-440024 which was similar with check variety except in general appearance.

Table 4. Length and diameter of four sweet potato genotypes

Genotype	Length of tuber (cm)	Diameter of tuber (cm)
CIP 440001(BARI SP 12)	14.53 a	5.89 a
CIP 440014(BARI SP-13)	14.69 a	5.48 a
CIP 440024	12.16 b	4.76 b
BARI SP-4 (Check)	15.68 a	4.89 b
CV (%)	1.65	0.90

Means followed by the same letter(s) do not differ significantly at 5% level by DMRT

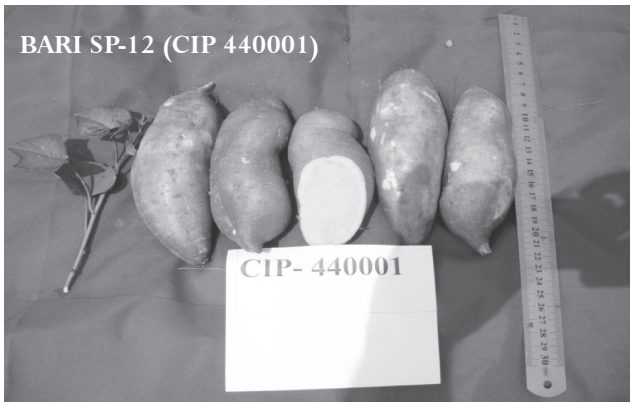

Fig.1. Tuber and leaves of BARI SP-12 (CIP 440001)

Fig.2. Tuber and leaves of BARI SP-13 (CIP 440014)

Table 5. Reaction of four sweet potato genotypes to different virus diseases at Joydebpur (Mean of 2009-10, 2010-11 and 2011-12 data)

Genotype	Virus infection (%)		
	SPFMV	Mosaic/Mild Mottle virus	Leaf curl
CIP 440001(BARI SP 12)	5.78	4.55	0.0
CIP 440014(BARI SP-13)	5.15	2.21	0.0
CIP 440024	11.25	6.87	6.24
BARI SP-4 (Check)	9.87	3.54	0.0
CV (%)	3.01	2.16	0.56

*SPFMV=Sweet potato feathery mottle virus

Table 6. Organoleptic characters of tubers of four sweet potato genotypes

Genotype	Sweetness	Dryness	Fibre	General appearance	Mean boiling index
CIP 440001(BARI SP 12)	6.8 a	8.2 a	6.7 a	7.1 a	6.7
CIP 440014(BARI SP-13)	7.3 a	8.6 a	6.1 a	7.9 a	7.5
CIP 440024	4.7 b	5.3 b	5.2 c	4.1 c	4.6
BARI SP-4 (Check)	6.0 a	7.2 a	7.0 a	6.0 b	7.3
CV (%)	2.1	1.5	1.1	1.4	

Means followed by the same letter(s) do not differ significantly at 5% level by DMRT

Note: Score on the basis of 0-10, 10 representing the maximum for each character; 0-4 poor, 4-6 medium and above 6 superior, 5 acceptable.

Conclusion

Considering tuber yield, quality parameters (higher dry matter and beta carotene content) and based on organoleptic test, two advanced clones CIP 440001 and CIP 440014 were selected and released as varieties in the name of BARI SP-12 and BARI SP-13, respectively by the National Seed Board (NSB), Ministry of Agriculture of Bangladesh in 2013 for commercial cultivation.

Acknowledgement

The authors are grateful to the International Potato Center (CIP) for germplasm supply and financial assistance for conducting the regional and farmer's field trials.

References

Ahmed, J. S., Elias, M., Mondal, N. I. and Ullah, M. M. 1990. Socioeconomic study of sweet potato cultivation in selected area of Bangladesh. *J. Root Crops*, **16**: 56-57.

BBS. 2011. Yearbook of Agricultural Statistics. Bangladesh Bureau of Statistics, Ministry of Planning, Dhaka, Bangladesh. 155 p.

Bhuiyan, M. K. R., Mannan, M. A., Ahmed, M. S., Dayal, T. R. and Ahmed, H. U. 1996. BARI SP-4 and BARI SP-5: Two improved sweet potato cultivars for Bangladesh. *J. Root Crops*, **22**(2): 93-100.

Bhuiyan, M. K. R., Hossain, M., Golder, P. C., Alam, M. S. and Attaluri, S. 2009. Performance of BARI SP-8 and BARI SP-9: the newly released high yielding sweet potato varieties from Bangladesh. *J. Root Crops*, **35** (2): 148-152.

Golder, P. C., Hossain, M., Bhuiyan, M. K. R., Ilangantileke, S and Attaluri, S. 2007. Performance of 'bari sp-6' and 'bari sp-7', the newly released high yielding sweet potato varieties from Bangladesh. *J. Root Crops*, **33**(1): 16-19.

Verma, V. S., Singh, K. P., Singh, N .K., Singh, J. R. P., Verma, S. P., Mishra, S., Sahu, M. P., Kumari, K. and Ray, R. 1994. Rajendra Shakarkand 35 and Rajendra Shakarkand 43: Two high yielding selections of sweet potato. *J. Root Crops*, **20** (1): 15-19.