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Kamal Sundari: A High Yielding Orange-Fleshed Sweet Potato for Konkan Region of Maharashtra

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Abstract

Among the tropical tuber crops, sweet potato (*Ipomoea batatas* L. Lam) produces more edible energy even on marginal lands than any other major food crop. It plays an important role in the economy of poor households. Some cultivars having orange-fleshed tubers are rich source of β carotene, which is a precursor of vitamin A. In order to identify a suitable cultivar of orange-fleshed sweet potato for Konkan region, an experiment was conducted during *kharif* (rainy) season for four consecutive years (2008 – 2011) at Central Experiment Station, Wakawali. The experiment was laid out in randomized block design with four replications. The pooled results of four consecutive years revealed that among the five entries of sweet potato, Kamal Sundari produced significantly highest tuber yield (15.67 t ha^{-1}). Kamal Sundari also produced the highest marketable tuber yield of 11.93 t ha^{-1}, which was significantly superior over the rest. The average marketable weight of tuber was 155 g. The net returns and B:C ratio was found to be the highest in the case of the Kamal Sundari (` 77, 238 ha^{-1} and 1.47, respectively). Multi-locational trials conducted at five locations also indicated the superiority of Kamal Sundari (12.53 t ha^{-1}).

Key words: Sweet potato, genotypes, tuber yield, yield parameters, economics

Introduction

In India, majority of farmers cultivate root and tuber crops as a subsistence crop, mainly as intercrops in homestead. Among the tropical tuber crops, sweet potato (*Ipomoea batatas* L. Lam) produces more edible energy even on marginal lands than any other major food crop (Woolfe, 1992). It plays an important role in the economy of poor households and acts as a major source of subsistence and cash income to farmers in agro-climatically disadvantageous regions (Rajib Nath et al., 2007). In India, sweet potato cultivation is approximately in an area of 1 lakh ha with a production of 9 lakh tonnes. In Maharashtra, sweet potato is grown in an area of 4700 ha. In Konkan region of Maharashtra, 200 ha are under sweet potato cultivation with an average productivity of 13.5 t ha^{-1} (James George et al., 2012). Sweet potato is a versatile crop utilized for human consumption, animal feed and as raw material for industry. The tubers are usually eaten boiled or baked. They also have industrial value and are rich sources of carbohydrates, sugar and vitamin A (Nedunchezhiyan et al., 2007). The young tender tops and leaves are used as leafy vegetable. The vines are widely used as a fodder for cattle and pigs and as a fish feed. Some cultivars having orange-fleshed tubers are rich source of β carotene, which is a precursor of vitamin A. Tubers of yellow/orange-fleshed cultivars contain high amounts of carotenes up to 45 – 100 µg g^{-1} (Ravi et al., 2009). Sweet potato is an important tuber crop in Konkan region. This crop is well suited to small and marginal holdings due to its flexible planting and harvesting times, low requirement of inputs and management. Presently the farmers of Konkan region cultivate Konkan Ashwini and some local sweet potato entries. But the productivity of these entries is very low.

The objective of the present study was to identify a suitable cultivar of sweet potato for Konkan region.

Materials and Methods

The field experiment was conducted in South Konkan Coastal Zone of Maharashtra at Central Experimental Station, Wakawali, Maharashtra. The soil of this zone was lateritic in nature with pH in the range of 5.6 to 6.5. The climate is warm and humid with average rainfall of 3500 mm occurring during monsoon season (June to September). The experimental site is located at 17°40' N latitude and at 73°16' E longitude at an altitude of 167 to 234 m above mean sea level. The experiment was laid out in randomized block design with four replications during the *kharif* seasons of 2008 - 2011. Five entries of sweet potato viz., Kamal Sundari, SV – 98, 362/7, CIPSWA - 2 and Konkan Ashwini were evaluated under rainfed situation. The entry Konkan Ashwini was used as check for this experiment. Apical vine cuttings of 20 cm length were planted at a spacing of 60 x 20 cm in plots of 3.0 x 2.4 m size accommodating 60 plants per plot. FYM @ 12.5 t ha^{-1} and chemical fertilizers to supply NPK @ 75:50:75 kg ha^{-1} were applied. Half N and full P and K were given as basal and the rest were applied at 30 days after planting. The entries were harvested at 120 days after planting. Plant protection and weeding was done as per package of practices recommendation. The same set of experiments were conducted at five regional stations as multi-locational trials during *kharif* seasons of 2010 and 2011. The data of yield attributing characters and marketable, nonmarketable and total tuber yield were recorded and analyzed statistically (Gomez and Gomez, 1984). The per cent of weevil damage was computed on weight basis. Fresh vine yield per hectare was calculated on the basis of per plot data.

Results and Discussion

Tuber yield

The total tuber yield of different entries of orange-fleshed sweet potatoes were significant during the individual experimental years as well as in pooled results (Table 1). Kamal Sundari produced the highest total tuber yield over the rest of the entries in individual years, except during *kharif* 2009. Kamal Sundari was significantly superior to the rest of entries during *kharif* 2008, whereas on par with 362/7 during *kharif* 2010 and with SV-98 during *kharif* 2011 at Wakawali Station. The pooled tuber yield data of four consecutive years revealed that among the five entries of sweet potato, Kamal Sundari produced the highest tuber yield of 15.67 t ha^{-1}, which was significantly superior to the rest of the entries. The tuber yield increased by 76.06% in Kamal Sundari over the check, Konkan Ashwini. The variation in tuber yield among the genotypes/cultivars may be due to their inherent genetic potential and adaptability to specific environment. The maximum tuber yield of 26.96 t ha^{-1} and 20.39 t ha^{-1} were reported in Kamal Sundari at Kalyani in West Bengal and Jorhat in Assam, respectively (AICRP, 2010) and also at Bagalkot in Karnataka (28.95 t ha^{-1}) (AICRP, 2011).

The entry Kamal Sundari produced significantly highest marketable tuber yield of 13.71 t ha^{-1} and 10.15 t ha^{-1} during *kharif* 2010 and *kharif* 2011, respectively (Table 2). The average of two years data revealed that, significantly highest marketable yield of 11.93 t ha^{-1} was produced by Kamal Sundari. The results are in agreement with the

Table 1. Tuber yield of sweet potato entries

Entries	Tuber yield (t ha^{-1})							% yield increase over Konkan Ashwini (check)
	2008	2009	2010	2011	MLT 2010	MLT 2011	Pooled	
Konkan Ashwini	12.79	10.22	9.59	7.09	7.24	7.94	8.90	—
CIPSWA-2	18.40	19.88	9.05	7.85	8.52	6.59	10.34	16.18
Kamal Sundari	23.97	19.34	18.75	12.12	11.86	12.36	15.67	76.06
362/7	18.93	18.85	17.32	10.04	10.63	8.79	13.47	51.33
SV-98	16.48	12.01	13.69	11.30	9.21	8.54	11.47	28.82
CD (0.05)	3.64	4.05	2.30	1.71	1.76	1.07	0.60	—

MLT: Multi-locational trial

Table 2. Marketable and nonmarketable tuber yield of the orange-fleshed sweet potato entries

Entries	Marketable yield (t ha^{-1})			Nonmarketable yield (t ha^{-1})			Average marketable tuber weight (g)
	2010	2011	Average	2010	2011	Average	
Konkan Ashwini	5.89	4.94	5.41	0.70	1.43	1.06	71
CIPSWA-2	7.14	5.62	6.38	0.44	1.20	0.82	89
Kamal Sundari	13.71	10.15	11.93	0.22	0.98	0.60	155
362/7	8.37	7.54	7.96	1.93	0.89	1.41	67
SV-98	10.13	8.73	9.43	0.82	1.23	1.03	75
CD (0.05)	1.24	1.27	0.87	0.25	NS	0.18	9.90

results reported by AICRP (2009) at Jorhat, Assam. The nonmarketable tuber yield was significantly lowest in Kamal Sundari (0.22 t ha^{-1}) during *kharif* 2010. However, it was not significant during *kharif* 2011. The average nonmarketable tuber yield of 0.60 t ha^{-1} was observed in Kamal Sundari, which was significantly lowest than the rest of the entries.

Yield attributes

The average weight of marketable tuber (155 g) was observed in Kamal Sundari, which was significantly superior over the rest of the entries, followed by CIPSWA-2 (89 g). Kamal Sundari produced marketable tuber yield of more than 15 t ha^{-1} and maximum weight of marketable tuber of 320 g at Jhargram in West Bengal (Rajib Nath et al. 2007). The length of tuber was maximum in the entry Konkan Ashwini (14.79 cm) followed by 362/7 (11.45 cm). The diameter of the tuber was greatest in the entry SV-98 (12.35 cm), but statistically on par with 362/7 and Kamal Sundari (Table 3). Maximum marketable tuber yield and average marketable tuber weight was reported earlier in Kamal Sundari (Rajib Nath et al., 2007)

Weevil infestation

The data presented in Table 3 revealed that the per cent weevil infestation was maximum in the entry 362/7 (15.41%). The per cent weevil damage was lowest in Kamal Sundari (7.98%). This is may be the reason for the highest marketable tuber yield in Kamal Sundari.

Fresh and dry vine yield and length of vine

Average data of two years indicated that maximum fresh vine yield of 24.52 t ha^{-1} was produced by CIPSWA-2, which was on par with Kamal Sundari and significantly superior over the rest of the entries (Table 4). The same trend was observed in the case of dry vine yield during *kharif* 2010. However it was not significant during *kharif* 2011. The average of two years' data revealed that the entry CIPSWA – 2 produced the maximum average dry vine yield of 7.82 t ha^{-1} and was statistically on par with Kamal Sundari and 362/7. The length of vine was not statistically significant among the entries.

Performance under multi-locational trial

The average yield performance during *kharif* 2010 and 2011 of different entries of sweet potato at five locations under multi-locational trial is presented in Table 5. Kamal Sundari produced significantly highest average tuber yield of 12.53 t ha^{-1} over the rest of the entries. The entry 362/7 (10.18 t ha^{-1}) ranked second. Yield variation by sweet potato genotypes at different locations has been reported by Golder et al (2007). This is in agreement with the results obtained at Kalyani, West Bengal and Dholi, Bihar (AICRP, 2011).

Economics

The net return was found to be the maximum in the case of Kamal Sundari (` 77, 238 ha^{-1}). The entry 362/7

Table 3. Weevil damage and tuber characters of the sweet potato entries during *kharif* 2011

Entries	Weevil damage (%)	Tuber length (cm)	Tuber diameter (cm)
Konkan Ashwini	10.30(18.64)*	14.79	6.96
CIPSWA-2	13.45(21.42)*	10.55	7.70
Kamal Sundari	7.98(16.19)*	9.98	11.33
362/7	15.41(22.82)*	11.45	11.75
SV-98	11.38(18.97)*	9.15	12.35
CD (0.05)	NS	1.13	1.60

* Figures in parentheses indicates arcin value

Table 4. Fresh and dry vine yield of the sweet potato entries

Entries	Fresh vine yield (t ha^{-1})			Dry vine yield (t ha^{-1})			Length of vine (cm)
	2010	2011	Average	2010	2011	Average	
Konkan Ashwini	18.86	24.05	21.45	6.06	7.32	6.69	102.50
CIPSWA-2	24.43	24.62	24.52	7.88	7.76	7.82	128.33
Kamal Sundari	22.90	24.26	23.58	7.43	7.69	7.56	132.50
362/7	20.73	22.94	21.83	6.67	7.36	7.02	125.00
SV-98	22.47	20.85	21.66	7.25	6.62	6.93	124.17
CD (0.05)	3.00	2.01	2.31	1.03	NS	0.84	NS

Table 5. Performance of sweet potato entries under multi-locational trial (mean of two years)

Entry	Total tuber yield (t ha^{-1})					Mean tuber yield (t ha^{-1})
	ARS, Palghar (Thane)	RARS, Karjat (Raigad)	ARS, Awashi (Ratnagiri)	RFRS, Vengurla (Sindhudurg)	ARS, Mulde (Sindhudurg)	
	R I	R II	R III	R IV	R V	
Konkan Ashwini	6.66	7.57	8.23	6.68	9.51	7.73
CIPSWA-2	5.36	6.41	6.77	9.71	9.13	7.47
Kamal Sundari	8.95	12.64	14.22	9.93	16.92	12.53
362/7	7.24	10.83	11.70	6.11	15.02	10.18
SV-98	7.24	6.59	10.15	9.12	12.21	9.06
CD (0.05)			1.01			

(` 49, 289 ha^{-1}) was the second best (Table 6). The returns per rupee invested (B:C ratio) was maximum in the case of the entry Kamal Sundari (1.47), while the entry 362/7 (1.31) was the second best.

Conclusion

From the pooled tuber yield data of four years, the entry Kamal Sundari produced significantly highest tuber yield of 15.67 t ha^{-1} compared to the rest of the entries. The highest net returns of ` 77, 238 ha^{-1} and B:C ratio of 1.47 was observed in the entry Kamal Sundari. The sweet potato entry Kamal Sundari is recommended for cultivation in Konkan region of Maharashtra for higher yield.

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Table 6. Cost–benefit analysis of cultivation of sweet potato entries (mean of four years)

Entry	Pooled yield (t ha^{-1})	Gross monitory returns (` ha^{-1})	Total cost of cultivation (` ha^{-1})	Net returns (` ha^{-1})	B:C ratio
Konkan Ashwini	8.90	133500	147851	-7916	0.95
CIPSWA-2	10.34	155100	151604	10852	1.07
Kamal Sundari	15.67	235045	164881	77238	1.47
362/7	13.47	202031	159291	49289	1.31
SV-98	11.47	171977	154274	24201	1.16

Cost of inputs: FYM: ` 1800 t$^{-1}$; Planting material: ` 0.50 cutting^{-1}; Labour cost: ` 120 day$^{-1}$; Selling price of tuber: ` 15 kg^{-1}; Selling price of vine: ` 0.30$^{-1}$; Urea: ` 5.60 kg^{-1}; Single super phosphate: ` 3.60 kg$^{-1}$; Muriate of potash: ` 5.20 kg^{-1}

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