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Original Research Article

Genetic Variability for Tuber per Plant and Tuber Length in Different Flesh Colour of Sweet Potato (*Ipomoea batatas*) Germplasm

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Keywords

Sweet potato, Germplasm, Variability, Characterization

A B S T R A C T

Sweet Potato is an important tuber crops, especially in changing climate scenario. Dholi centre maintains regularly1152 germplasm (739 accessions + 413 strains + 8 varieties) keeping in view the importance of its nutritional quality having the reservoir of genes of tuber crops in India. They were characterized for storage root flesh colour and its intensity during 2008-09 and further grouped on the basis of storage root/plant and storage root length, enormous variability was reflected for storage root flesh colour intensity. With increase of number of root/plant the storage root length reflected good amount of variability in lower as well as higher direction but its increase from 6-8 tuber/plant, there was drastic reduction in storage root length in white fleshed varieties viz; RS-5, RS-47, Kalmegh and RS-43 (Check); whereas, 34 promising genotypes expressed yellow, orange, yellow-purple and purple-yellow flesh colour, which may reflect value added advantages of β carotene.

Introduction

Sweet potato is an important tuber crops grown in 111 countries including India all over the world. Asia accounts for 78.7 per cent of the area under Sweet potato is an important tuber crops grown in 111 countries including India all over the world. Asia accounts for 78.7 per cent of the area under cultivation of which (67.7%) is accounted by China. Germplasm is being a vast reservoir of exploitable genes, its conservation is of paramount improvement.

In India large number of germplasm are being maintained at T.C.A., Dholi (Bihar) are recently characterized for important descriptors provided by CTCRI, Thiruvananthapurum.

Materials and Methods

Dholi maintains 1152 (1144 accessions + 8 variety/cultivar) of sweet potato germplasm. In screening nursery all the accessions were planted at research farm T.C.A. Dholi (Bihar) during 2008-09 in 3.0 m2 plot size (2 x 1.5 m). Keeping plant and row spacing 30 x 15 cm during, Kharif season. Observation for number of storage root/plant (SR/Pl) and storage root length (cm) characters were recorded on the basis of number of tuber/plant 4(four) groups were made viz., 0-2, >2-4, >4-6 and >6-8 number of storage root/plant and each group were again divided into seven (7) sub group based on the length of tuber viz., 0-14 cm, >14-16 cm > 16-18 cm, >18-20 cm, > 20-22 cm,

>22-24 cm and > 24cm root length.

Storage root flesh colour characterization was done at harvest (growing stage) and at the same growth stage storage root flesh colour intensity was recorded using standard rating scores as given in descriptors booklet of AICRP on Tuber crops (other than Potato) as follows :

Score	**Colour**
1	White
2	Yellow
3.	Orange
4.	Purple
Storage root flesh colour intensity	
Score	**Intensity**
1	White
3	Pale
5	Intermediate
7	Dark

Results and Discussion

A perusal of table revealed that amongst total of 1152 accessions 793 white, 209 yellow followed by 41 orange and 7 accessions are of purple storage root flesh colour type. Remaining 90 accessions exhibited intermediate flesh colour (Varigated pattern) in eleven categories viz., white-purple (33), white-yellow (1), white-red (5), yellow-purple (21), yellow-orange (1), purple-yellow (14), purple-white (18), purple-spot (2), purple-orange (1), Orange-purple (2) and red-white (1).

These accessions were further sub grouped on the basis of storage root flesh colour intensity. Out of 793 white storage root flesh colour accessions 160 were of pale, 125 were intermediate and 508 accessions were of dark storage root flesh colour intensity. Similarly out of the 209 yellow storage root flesh colour intensity 124 genotypes were pale, 65 intermediate and 20 accessions were of dark intensity. Amongst 41 orange flesh colour accessions 10 exhibited pale, 8 intermediate and 23 dark flesh colour intensity, where as 7 purple flesh colour accessions exhibited pale (3 accessions) and dark (4 accessions) flesh colour intensity. Out of 99 intermediate flesh colour accessions, 33 accessions white-purple in nature out of these accession (17 accessions) were pale (10 accessions) were intermediate and (6 accessions) comprised dark intensity, the only one white-yellow flesh colour accessions exhibited intermediate intensity whereas 5 white-red accession exhibited pale (3 accessions) and intermediate (2 accessions) flesh colour intensity.

21 yellow-purple accessions exhibited all the three flesh colour intensities i.e. 13 pale, 4 each intermediate and dark. The only one yellow orange accessions exhibited pale intensity, 14 purple-yellow colour accession exhibited all the three intensity groups i.e. pale (1), intermediate (7) and dark (6).

Similarly 18 purple-white accessions exhibited (6) pale, (5) intermediate and (7) dark flesh colour intensity. 2 purple-spot accessions expressed dark intensity only. Similarly purple-orange colour accession exhibited intermediate colour intensity.

Out of 2 orange-purple accessions one each belonged to pale and dark intensity, whereas single red-white accession exhibited pale intensity.

This is quite evident (Fig. 1) from the above findings that the entire sweet potato gemrplasm expressed enormous variability for storage root flesh colour as well as storage root flesh colour intensity. The enlisted eleven different intermediate flesh colour accessions of studied sweet potato germplasm may be evolved naturally owing to crossing.

Storage root/plant and storage root length varied from a minimum of zero (no

tuber) for three accessions namely DOP 98-25, DOP 98-57 and DOP 98-124 to a maximum number of 8.0 (DOP 99-93) and maximum tuber length of 44.0 cm (DOP 99-39) respectively, which clearly reflected sizeable variability amongst 1152 acc. For these two most important descriptive characters. A perusal of table 2 revealed that 1st group with 553 accessions have upto 2 storage roots per plant and up to maximum of > 45.5 cm storage root length, second groups with 493 accessions has 2.10 to 4.00 storage root per plant with 4.66 to 34.66 cm storage root length, 3rd group with 98 accessions has 4.03 to 6.00 storage root per plant with 9.16 to 44 cm storage root length and the smallest group fourth with 8 accessions has 6.33 to 8.00 storage root per plant with 11.50 to 25.33 cm storage root length. Thus it is evident that with increase of number of storage root per plant the storage root length reflected good amount of variability in lower as well as higher direction. Interestingly when number of storage root per plant increased from more than 6.00 (From 6.00 to 8.00) the storage root length reflected drastic reduction. Wide rage of variability for these traits were also observed by Hossain *et al.* (2000); Choudhary *et al.* (2000) and Engida *et al.* (2007).

Table.1 Variability for storage root flesh colour and storage root flesh colour intensity in sweet potato germplasm

Storage root flesh colour intensity	Pale Score 3	Intermediate Score 5	Dark Score 7	Total
A. Storage root flesh colour				
White (Score 1)	160	125	508	793
Yellow (Score 2)	124	65	20	209
Orange (Score 3)	10	08	23	41
Purple (Score 4)	03	Nil	04	07
Sub Total (A)	**297**	**198**	**555**	**1050**
B. Intermediate flesh colour accessions				
White-purple	17	10	06	33
White-yellow	Nil	01	Nil	01
White-red	03	02	Nil	05
Yellow-purple	13	04	04	21
Yellow-orange	01	Nil	Nil	01
Purple-yellow	01	07	06	14
Purple-white	06	05	07	18
Purple-spot	Nil	Nil	02	02
Purple-orange	Nil	01	Nil	01
Orange-purple	01	Nil	01	02
Red-white	01	Nil	Nil	01
Sub Total (B)	**43**	**30**	**26**	**99**
Grand Total (A+B)	**340**	**228**	**581**	**1149+3* = 1152**

* Note : Three accessions. namely DOP 98-25, DOP-98-57, and DOP 98-124 did not formed tuber thus 1152-3 = 1149 tuber characterized

Table.2 Categorization of sweet potato accessions on storage root/plant and storage root length basis and promising ones

Group	Storage root/plant (SR/Pl)	Storage root length (cm) SRL	No. of accession	General mean (GM)		Checks/cultivars			Promising G.P.	
				SR/Pl	SRL(cm)	Name	SR/Pl	SRL (cm)	Max. SR/Pl	SRL (cm)
I	>0-2	0-14	553							
1.		0-14	421	1.48	9.58	RS-5(LC)	2.00	5.83	90	05
						Kalmegh(LC)	1.66	8.66	-	-
						RS-43(LC)	2.00	10.33	-	-
						RS-47(NC)	1.33	9.33	-	-
2.		>14-16	52	1.51	15.01	-	-	-	19	4
3.		>16-18	43	1.68	16.86	-	-	-	23	7
4.		>18-20	14	1.80	18.85	-	-	-	8	2
5.		>20-22	15	1.86	20.91	-	-	-	10	3
6.		>22-24	2	1.66	23.00	-	-	-	2	2
7.		>24	6	1.55	29.33	-	-	-	2	1
II	2.10-4.00	4.66-34.66	493							
8.		0-14	212	3.86	11.25	Cross-4 (Cultivar)	2.33	9.50	8	13
						RS-35(LC)	2.66	9.00	-	-
						RS-92(LC)	3.33	10.83	-	-
9.		>14-16	104	2.21	15.06	-	-	-	7	10
10.		>16-18	72	3.08	17.18	-	-	-	9	3
11.		>18-20	49	2.99	19.11	-	-	-	5	5
12.		>20-22	25	3.04	21.05	-	-	-	5	2
13.		>22-24	14	3.23	23.06	-	-	-	2	2
14.		>24	17	3.15	28.48	-	-	-	2	1
III	4.03-6.00	9.16-44.0	98							
15.		0-14	24	4.62	12.47	-	-	-	1	1
16.		>14-16	19	4.97	14.64	-	-	-	1	2
17.		>16-18	26	4.81	17.09	Sree Bhadra (LC)	5.00	16.16	2	4
18.		>18-20	13	4.84	18.80	-	-	-	2	1

19.		>20-22	3	4.77	21.33	-	-	-	1	2
20.		>22-24	5	4.73	23.53	-	-	-	1	2
21.		>24	8	4.46	30.81	-	-	-	1	1
IV	6.33-8.00	11.50-25.33	8							
22.		0-14	3	7.33	12.83	-	-	-	1	1
23.		>14-16	1	6.33	14.66	-	-	-	1	1
24.		>16-18	Nil	-	-	-	-	-	-	-
25.		>18-20	2	7.00	20.0	-	-	-	2	2
26.		>20-22	Nil	-	-	-	-	-	-	-
27.		>22-24	1	6.33	22.16	-	-	-	1	1
28.		>24	1	7.00	25.33	-	-	-	1	1
G. Total	**0-8**	**0-44**	**1152**	**μ=2.56**	**13.56 cm**					

Table.3 Promising germplasm of sweet potato

Sl. No.	SR/ Plant	SRL (cm)	Colour	Name of accession	Total No. of G.P.	Check flesh colour and Name
1.	0-2	0-14	Yellow	RNSP-3	1	White : RS-5(IC No.592468), RS-47(IC No.592485),Kalmegh (IC No.592475),RS-43(IC No.592532)
2.	0-2	>14-16	White	P-11, DOP-91-78(IC No.592570), DOP-92-87(IC No.592659), DOP-92-123 (IC No.592695), DOP-92-132(IC No.592704), DOP-92-146(IC No.592718), DOP Mix-93-13(IC No.592772), DOP Mix-93-15(IC No.592774), DOPMix-95-1(ICNo.592843), DOP-98-24(IC No.592956), DOP-98-77(IC No.593009), DOP-99-15.	12	
			Yellow	DOP-92-115(IC No.592687), DOP-98-65(IC No.592997), DOP-98-149, DOP-99-67.	4	
			Orange	DOP 99-28, 4410 27.	2	
			Purple	Nil	Nil	

			Y-Purple	DOP 98-58(IC No.592990)	1	
				Total	20	
3.	2.10-3.0	>14-16	White (Score 1)	87-x-45(IC No.592304), 87-x-54(IC No.592405), DOP 91-76, DOP 92-12(IC No.592584), DOP 92-27(IC No.592599), DOP 92-43(IC No.592615), DOP 92-67(IC No.592639), DOP 92-72(IC No.592644), DOP 92-81(IC No.592653), DOP 92-129(IC No.592701), DOP 92-139(IC No.592711), DOP 92-145(IC No.592717), DOP 92-148(IC No.592720), DOP 92-150(IC No.592722), DOP 92-184(IC No.592756), DOP Mix 93-7(IC No.592766), DOP Mix 93-8(IC No.592767), DOP Mix 93-10(IC No.592769), DOP Mix 94-4(IC No.592801), DOP Mix 94-10(IC No.592807), DOP Mix 94-16(IC No.592813), DOP 97-18(IC No.592815), DOP 97-25(IC No.592919), DOP 97-34(IC No.592928), DOP 98-8(IC No.592940), DOP 98-17(IC No.592949), DOP 98-23(IC No.592955), DOP 98-36(IC No.592968), DOP 98-42(IC No.592974), DOP 98-64(IC No.592996), DOP 98-100(IC No.593032), DOP 98-135, DOP 99-6, DOP 99-25, DOP 99-57, DOP 99-68, DOP 99-85, DOP 99-88, C-2-2003, IGSP-18.	40	
			Yellow (Score 2)	DOP 92-5(IC No.592577), DOP 92-22(IC No.592594), DOP-92-89(IC No.592661), DOP 92-156(IC No.592758), DOP 92-163(IC No.592735), DOP Mix 93-18(IC No.592777), DOP Mix 94-4(IC No.592801),DOP Mix 94-17(IC No.592814), DOP Mix 95-7(IC No.592849), DOP Mix 95-12(IC No.592854), DOP 95-25(IC No.592867), DOP 97-2(IC No.592896), DOP 98-31(IC No.592963), DOP 98-76(IC No.593008), DOP 98-118, DOP 98-139, DOP 99-65, IGSP-7, NDSP-9, C-3-2003, DOP 2005-8.	21	
			Orange (Score 3)	DOP 92-108(IC No.592580), DOP Mix 93-3(IC No.592762), SV-98.	3	
			Purple	Nil		
			White-Red	DOP 92-102(IC No.592674), DOP 92-128(IC No.592700).	2	
			Yellow-Purple	DOP 98-114.	1	
			Purple-White	DOP 92-101(IC No.592673), DOP 92-155(IC No.592727), DOP 98-132.	3	
			Purple-Yellow	DOP 98-145.	1	
				Total	**91**	

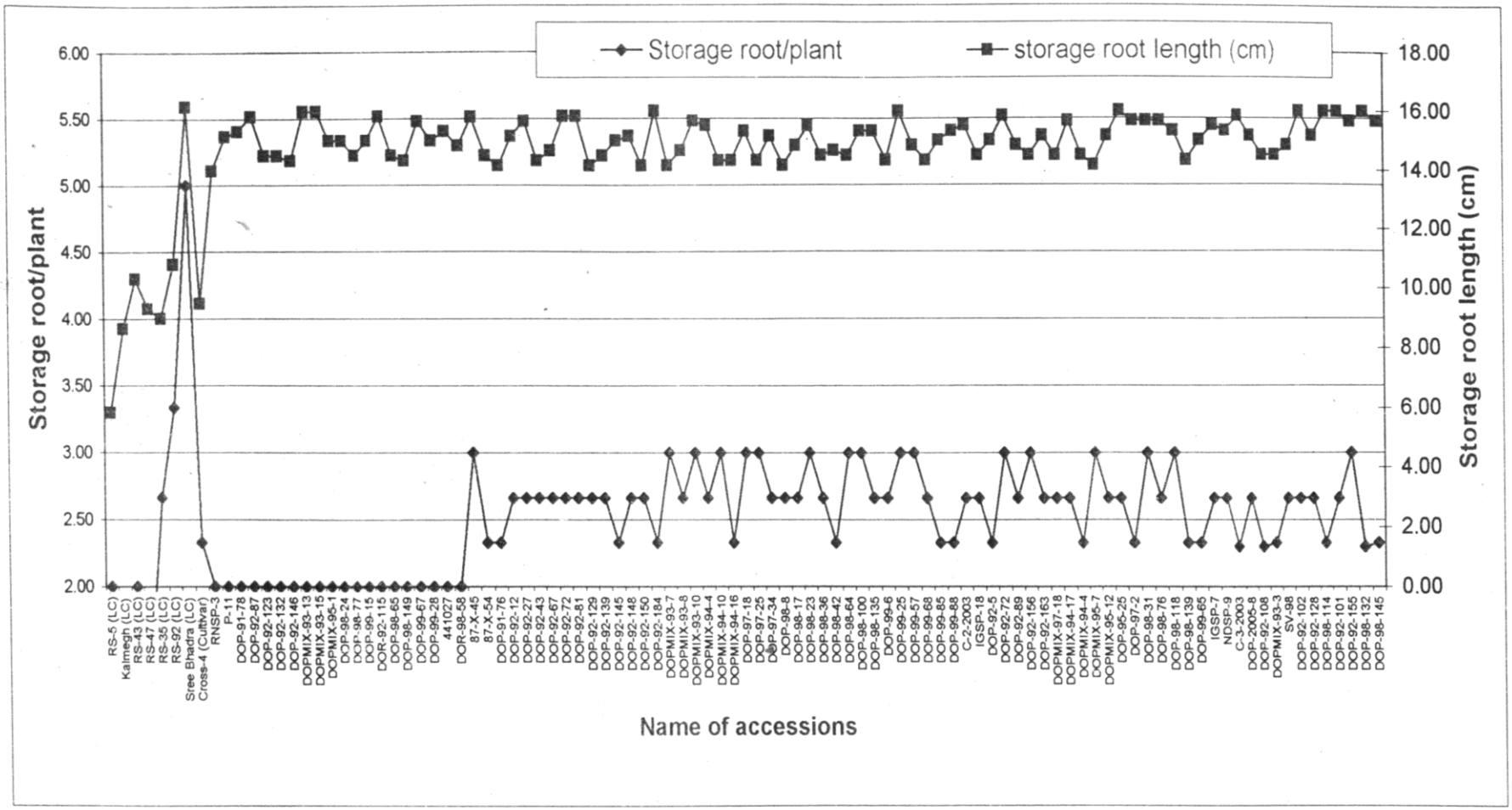

Fig. 2 : Categorization of sweet potato accessions on storage root/plant and storage root length.

The population mean of the germplasm exhibited average 2.56 storage root per plant and 13.56 cm storage root length. Out of the seven varieties, namely RS-47 (National check), R.S-92 (Local check), Kalmegh, RS-5, RS-35, RS-43 and Sree Bhadara and one popular cultivar cross-4 . All the four varieties including national check were found in the 1st group namely RS-47 (National check), Kalmegh, RS-5 and RS-43 were close to population mean for number of storage root per plant and close or below for storage root length. The two varieties (RS-35 and local check RS-92) along with cultivar cross-4 were placed in the second group and exhibited number of storage root per plant (2.33 to 3.33) and storage root length (9.50 to 10.83) their values are close to population mean of 2.56 for number of storage root per plant and 13.56 cm storage root length. Where as the only variety Sree Bhadra categorized in group three has double the number of storage root per plant (5.00) and slight higher (16.16 cm) storage root length than population mean. These findings indicated that careful manipulation of these characters is required, while designing the new genotypes. Optimization of these two important characters will be achieved probably through the selection for 2-3 storage roots/plant with optimum 14-16 cm storage root length. Based on this optimized requirement of these two characters promising accessions were identified, which may lead to improved genotypes of sweet potato in future, are presented in Table 3.Altogether, 91genotypes were promising which exhibited enormous variability for storage root flesh colour viz;white, yellow, orange, purple and intermediate types against the white fleshed checks namely RS-5, RS-47, Kalmegh and RS-43.The yellow purple and orange sweet potato accessions may provide value added advantage of beta carotene and alpha-tocopherol as pointed out by many researchers namely Okuno *et al.* 1998., Jaarsveld *et al.* 2005.

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