

MORPHOLOGICAL CHARACTERIZATION OF SWEET POTATO GENOTYPES

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ABSTRACT

Ten sweet potato germplasms were collected and characterized for their morphological characters. A large variation was observed in foliage and tuber characters. Vine growth habit ranged from compact and bushy type as in "S 30/25", "X-24" and "Tripti" to spreading type in "RS 47", "Local V9" and "Local V10". The local types exhibited comparatively longer vine to that of exotic as they showed spreading growth habit. Variation in tuber shape ranged from round as in "Kalmegh" to long elliptical in "RS 47". The skin color of tuber varied from white as in "S 30/21" and "Local V9" to red purple in "RS 47". Variation in flesh color from white as in "RS 47", "H82-2", "Local V9" and "Local V10" to dark yellow in "S 30/25" and "X-92" was observed among the ten genotypes. The dry matter content among the ten genotypes ranged from 13 per cent in "X-92" to 31 per cent in "Local V10". The germplasms were planted in winter and harvested at five months of maturity.

Key words: sweet potato, genotype, morphology, characterization

INTRODUCTION

Sweet potato (*Ipomoea batatas* Lam.) is cultivated throughout the tropical, subtropical and warm areas of the temperate region in the world. World's sweet potato production is 131,707 thousand metric tons, and China is the largest sweet potato producing country in the world (Kotecha and Kadam, 1998). China produces over 117 million tons of sweet potato (CIP, 1999), which is about 80 per cent of the world's sweet potato production (Huaman and Puente, 1988). In Nepal, sweet potato is grown throughout the middle hills and terai region, in kitchen gardens (Gautam, 1991) and as mixed crop with vegetables, corn and millet (Shah, 1991). It is grown throughout the country up to 1800 m above mean sea level (Shah, 1991; Gautam, 1998). Most of the middle hill districts including Kathmandu and the terai are the main sweet potato growing areas of the country (Lohani, 1981). From the production point of view, Nepal still lacks reliable statistics on area and production of sweet potato. As mentioned by Shah (1991) sweet potato is grown in approximately 7000 ha of land out of which some parts are river basin in terai and kitchen garden. He further reported that the average sweet potato productivity in Nepal is 8.948 t/ha. Nepalese agriculture has not given priority to sweet potato production. Hardly any research works and studies have been done in the area of germplasm collection, varietal improvement, varietal characterization, though we have different land races of sweet potatoes, which evolved due to the diverse agroecological conditions in the country (Pun, 1997). Due to lack of varietal improvement program, cultivars with high yielding traits have yet to be recommended. In view of the above limitations regarding the sweet potato production in Nepal, it was thought worthwhile to carry out experiments on sweet potato. So, this study was conducted to compare the exotic and local land races of sweet potato according to the morphology of their vegetative parts.

Generally, the sweet potato genotypes vary in morphological traits like vine and tuber characters. According to Ghosh *et al.* (1988) plant growth habit ranged from compact to spreading types and the leaves are of variable shape and size occasionally in the same plant. Morphologically, the mature sweet potato tuber may range in shape from spherical to nearly cylindrical or spindle shaped, in size from 0.2 to over 1 kg and in length from a few centimeters to over 30 cm (Onwueme, 1982). Iwanaga *et al.* (1989) examined dry matter content of forty-two hybrids and found variation ranging from 33 to 45 per cent with a mean of 40 per cent. Further they reported that about 40 per cent of dry matter has been regarded as the highest value in sweet potato cultivars. Joshep *et al.* (1989) studied the phenotypic variation in ten varieties for six characters like length of petiole, length of vine, tuber yield, weight of vine, number of tuber, number of leaves. The number of tubers, the length of petiole, and to a lesser extent the weight of vine exerting the greatest influences directly and indirectly upon tuber yield in sweet potato.

MATERIALS AND METHODS

The experiment was carried out at the Horticulture Farm, IAAS, Rampur located at 27°41' N latitude and 84°19' E longitude with an altitude of 228 m from the mean sea level. The soil of the experiment site was sandy loam, deep and well drained with 6.5 pH, which was well suited for sweet potato cultivation. Ten genotypes of sweet potato (seven from IARI, RAU, Bihar, India; one from BAU, Bangladesh; and two local from Rampur, Nepal) were grown in a Randomized Complete Block Design with four replications. The experiment was conducted during winter (7 November 2000 to 5 April 2001). The planting of vine cuttings 30-40 cm long (Wilson, 1988) was done in first week of November at a distance of 60 cm between the rows and 30 cm within the row (Onwueme, 1982). Manure and fertilizer in the experiment were applied as recommended by Ravindran and Nair (1994). FYM was applied @ 10 t/ha. The fertilizers were applied @ 37.5 kg N, 50 kg P₂O₅ and 37.5 kg K₂O per hectare. Nitrogen and potash were applied @ 37.5 kg per hectare as top-dressing 30 days after planting. First irrigation was given immediately after planting the vine cuttings and continued for 10-15 days. Subsequent irrigation was given at every ten days interval throughout the crop period. The crop was harvested at five months i.e. April 2001. To study the variation in morphological characters, four samples from each unit plots were selected from the middle row. The ten sweet potato genotypes were characterized according to the IBPGR descriptor (Huaman, 1987)

RESULTS AND DISCUSSIONS

Characterization of ten sweet potato genotypes has been summarized in the Appendix 1 and in the Appendix 2 for vine morphology and tuber morphology, respectively. Variation from compact plant type (S 30/25, X-24, Tripti) and spreading plant type (RS 47, Local V9, Local V10) among the ten varieties revealed the report of Ghosh *et al.* (1988). Long vine length with fast growth rate was observed in the local types (V9 and V10). Variation in tuber skin, red (X-92), red purple (RS 47), yellow (Kalmegh), pink (X-24), cream (H82-2, Tripti, V10), white (S 30/21 and V9) and orange (S 30/25) supported the finding of Iwanaga *et al.* (1989). Variation in several other characters like length of petiole, number of tubers, vine growth rate confirmed the earlier observation of Joshep *et al.* (1989). Variation was also observed in dry matter content among the ten genotypes. According to Huaman (1987) almost all genotypes showed lower dry matter content i. e. less than 30 per cent. However, two local types showed

medium i. e. between 30 to 40 per cent. Local V9 showed 30 per cent and V10 had 31 per cent which were the genotypes possessing high dry matter content among the ten genotypes. The exotic type S 30/25, X-92 showed very less dry matter content since these types had very moist texture and very watery consistency. The dry matter content was 16 and 13 per cent, respectively while Kalmegh had 18 per cent. The other genotypes showed dry matter content between 20 to 25 per cent. The dry matter content among these genotypes also showed very less in comparison to the earlier report of Iwanaga *et al.* (1989) where dry matter content ranged from 33 to 45 per cent among forty-two hybrids.

CONCLUSION

Large variation was observed among the ten genotypes in the vine and tuber morphological characters. Spreading type of growth habit was found in RS 47, Local V9 and Local V10. Variation in the morphological characteristics like compact growth habit (S 30/25, X-24, Tripti), semi compact (Kalmegh, X-92, S 30/21, H82-2), spreading (Local V9, Local V10, RS 47) were observed. The foliage color variation was from pigmented (Kalmegh, S 30/21, H82-2, Tripti) to green (Local V10, Local V9, RS 47, S 30/25, X-24, X-92) were noticed. Variation in tuber shape ranged from round (Kalmegh), obovate (X-92), elliptic (Local V9), thick elliptic (Tripti), long irregular (X-24 and Local V10), ovate (H82-2), round elliptic (S 30/25) were observed. Simultaneously, tuber skin color ranged from white (S 30/21, H82-2, Local V9); cream (Local V10), orange (S 30/25), yellow (Kalmegh), pink (X-24), red (X-92) to purple red (RS 47) were noticed. Similarly, simple (Tripti) to lanceolate (Local V10) leaves were characterized. The flesh color varied from milk white to pale yellow color. Even the boiled flesh varied in color, texture, consistency and sweetness. Yellow, very moist and watery flesh were observed in (S 30/25, X-92, Kalmegh and Tripti) and dry, hard and very sweet flesh were found in the varieties Local V10, Local V9, H82-2 and RS 47.

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Appendix 1: Characterization of vine morphology of ten sweet potato genotypes grown at Rampur during November 2000- April 2001

Genotypes	Description					
	Plant type	Vine growth rate	Vine diameter	Vine inter node length	Vine pigmentation	Vine tip pubescence
RS 47	Spreading	Fast	Very thin	Very short	Green	Absent
S 30/25	Compact	Slow	Intermediate	Short	Green, slightly pigmented nodes	Absent
Kalmegh	Semi compact	Slow	Thin	Very short	Totally purple	Heavy
X-24	Compact	Slow	Very thin	Very short	Green, slightly pigmented nodes	Sparsely
X-92	Semi compact	Intermediate	Very thin	Short	Green, slightly pigmented nodes	Absent
S 30/21	Semi compact	Intermediate	Thin	Short	Moderately purple	Absent
H82-2	Semi compact	Intermediate	Very thin	Very short	Totally purple	Moderate
Tripti	Compact	Slow	Thin	Intermediate	Totally purple	Heavy
Local V9	Spreading	Fast	Very thin	Intermediate	Green	Absent
Local V10	Spreading	Fast	Very thin	Intermediate	Green	absent
RS 47	Broad teeth	Small	Green	Yellow	Long	Green
S 30/25	Semi elliptical	Medium	Green	Pigmented spot on base of main rib	Very long	Green, pigmented close to leaf
Kalmegh	Semi circular	Medium	Green, moderately purple	partially pigmented main rib	Short	Partially pigmented throughout
X-24	Elliptical	Small	Yellow green pigmented edge	Pigmented spot on base of main rib	Very Short	Green
X-92	Elliptical	Small	Yellow green pigmented edge	Pigmented spot on several vines	Very Short	Green, pigmented close to leaf
S 30/21	Semi circular	Large	Green	Pigmented spot on several vines	Long	Partially pigmented throughout
H82-2	Semi circular	Large	Green	All the vines are partially pigmented	Intermediate	Totally pigmented
Tripti	Simple	Medium	Green, pigmented edge	Pigmented spot on several vines	Intermediate	Green, pigmented close to leaf
Local V9	Semi circular	Medium	Green, pigmented edge	Pigmented spot on several vines	Very long	Green
Local V10	Lanceolate	Medium	Green	Absent	Very short	Green

Vine growth rate (slow = <50cm, intermediate=50-100cm, fast = >100cm), Vine diameter (very thin = <4cm, intermediate = 7-9cm), Vine inter node length (very short = < 3cm, short = 3-5cm, intermediate = 6-9cm) Mature leaf size (small = <8cm, medium = 8-15cm, large = >14cm), Petiole length (very short = <10cm, short = 10-15cm, intermediate = 16-20cm, long = 21-25cm, very long = >25cm).

Appendix 2.A: Characterization of tuber morphology of ten sweet potato genotypes grown at Rampur during November 2000 to April 2001

Genotypes	Description					
	Tuber shape	Tuber skin col	Tuber flesh col.	Distribution of anthocyanin pigment	Tuber number plant ⁻¹	Tuber yield plant ⁻¹
RS 47	Long elliptical	Purple red	White	Absent	High	High
S 30/25	Round elliptic	Orange	Pale yellow	Absent	High	High
Kalmegh	Round	Yellow	Dark cream	Absent	High	High
X-24	Long irregular	Pink	White	Cortex and vascular cambium	High	High
X-92	Obovate	Red	Dark yellow	Absent	Medium	High
S 30/21	Long oblong	White	White	Vascular cambium and central parenchyma	High	High
H82-2	Ovate	Cream	White	Absent	High	High
Tripti	Thick elliptic	Cream	Pale orange	Board ring in the cortex	High	High
Local V9	Elliptical	White	White	Absent	Medium	High
Local V10	Long irregular	Cream	White	Absent	High	High

Number o.f tuber per plant (low = <2, medium = 2-4, high = >4), Tuber yield per plant (low = <100g, medium = 100-200g, high = >250g),

Appendix 2.B: Characterization of tuber morphology of ten sweet potato genotypes grown at Rampur during November 2000 to April 2001

Genotypes	Description						
	Dry matter content	Tuber surface *	Consistency of boiled flesh	Boiled flesh col.	Boiled flesh texture	Sweet ness	Fiber ness *
RS 47	Low (24 per cent)	Slightly ridged	Moderately hard	Grey	Intermediate	Very sweet	Moderate
S 30/25	Low (16 per cent)	Smooth	Watery	Yellow	Very moist	Sweet	Moderate
Kalmegh	Low (18 per cent)	Smooth	Soft	Grey	Moist	Slightly sweet	Absent
X-24	Low (24 per cent)	Slightly ridged	Very hard	Green and grey	Dry	Slightly sweet	Absent
X-92	Low (13 per cent)	Heavily ridge	Watery	Yellow	Very moist	Sweet	Absent
S 30/21	Low (23 per cent)	Smooth deep eyes	Soft	Grey	Intermediate	Slightly sweet	Absent
H82-2	Low (21 per cent)	Smooth	Hard	Cream	Dry	Sweet	Absent
Tripti	low (20 per cent)	Smooth	Soft	Yellow	Very moist	Moderately sweet	Absent
Local V9	Medium (30 per cent)	Heavily ridge	Very hard	Cream	Dry	Very sweet	Moderate
Local V10	Medium (31 per cent)	Slightly ridge	Very hard	Cream	Dry	Very sweet	Heavy

Dry matter content (Low = <30 per cent, medium = 30-40 per cent, high = >40 per cent)
 Characters with sign (*) were not included in the IBPGR descriptor (Huaman, 1987)