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Growth and Yield Potential of Nine Selected Genotypes of Sweet Potato

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Abstract: The growth and yield potential of nine selected genotypes of sweet potato was studied. Length and weight of vines per plant, number of main stems per plant, number and weight of tubers per plant and weight, length, diameter and dry matter content of tuber varied significantly among the genotypes. The genotypes SP3 gave the highest yield 47.59 t ha^{-1} followed by SP4 (42.82 t ha^{-1}), SP16 (36.15 t ha^{-1}) and SP1 (35.89 t ha^{-1}). Tuber yield had significant and positive correlation with length and weight of vines per plant, number and weight of tubers per plant, average weight of tuber and diameter of tuber. Considering the associations into direct and indirect effects, weight of tubers per plant followed by average weight of tuber and number of tubers per plant found to contribute to the higher yield.

Key words: Sweet potato, genotypes, yield, correlation matrix and path analysis

Introduction

Sweet potato is an important root crop and extensively cultivated in tropical and sub-tropical areas including India, Bangladesh, Pakistan, China, Japan and Korea (Bose and Som, 1986). Nearly, 92% of the world's sweet potato production is in Asia (Villareal, 1982). Sweet potato requires low inputs and less management. The world average yield of sweet potato is 1.6 times higher than that of Bangladesh. Large number of sweet potato genotypes are cultivated in different parts of Bangladesh. Among them, some give high yield and have desirable characteristics for varietal improvement. Rashid (1990) stated that there was a great prospect to increase the production of sweet potato in Indo-Pak sub-continent. Selection of suitable genotypes from existing genotypes may be an important aspect for improvement of sweet potato in Bangladesh. Little attempts have so far been made for selection of superior mutants and introduction of improved sweet potato varieties (Wang, 1972). In present study, the growth and yield potential of nine selected indigenous genotypes have been investigated.

Materials and Methods

Nine selected sweet potato genotypes (collected from different parts of Bangladesh) were grown in randomized complete block design with 3 replications at the farm of Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh during November 1999 to August 2000. The unit plot size was 6.0 x 4.8 m^2 in which stem cutting of 30 cm size was planted keeping 60 x 30 cm^2 spacing. Manure and fertilizers were applied @ 10 tons cowdung, 140 kg urea, 100 kg TSP and 150 kg MP per hectare as per recommendations of Hossain and Siddique (1985). During final land preparation full dose of cowdung and TSP were applied. Urea and MP were side dressed in two equal installments after 35 and 60 days of planting respectively. Intercultural operations and plant protection measures were taken as and when required. Fifteen plants were selected randomly at maturity and data were recorded on length of vines per plant, number of main stems per plant, weight of vines per plant, number and weight of tubers per plant, average weight of tuber, length and diameter of tuber, dry matter percentage and yield of tuber per hectare. The means of all treatments were calculated and analysis of variances was performed by F- test and the significance of the differences between the pair of treatment means was evaluated by Duncan's Multiple Range Test (Gomez and Gomez, 1984). Correlation coefficients and path coefficients were estimated as described by Singh and Chaudhary (1985).

Results and Discussion

Significant variation was observed among the genotypes in length of vines per plant at harvest (Table 1). The length of vines per plant varied from 201.40 to 353.83 cm. The genotype SP1 produced maximum length of vines per plant (353.83cm) followed by SP16 (298.40cm), SP3 (297.45cm) and SP7 (242.90cm). The minimum length of vines per plant was recorded in genotype SP12 (201.40cm). The number of main stems per plant among nine sweet potato genotypes varied from 1.90 to 2.80. The highest number of main stems per plant was produced by genotype SP6 (2.80) followed by SP7 (2.72) and SP14 (2.50). The genotype SP12 produced the lowest number of main stems per plant (1.90). The weight of vines per plant showed remarkable variation in nine sweet potato genotypes (Table 1). The highest weight of vines per plant was recorded in genotype SP1 (1458.33g) followed by SP12 (1450.0g), SP3 (1410.0g) and SP6 (1310.67g). Genotype SP7 produced the lowest weight of vines per plant (1055.0g). This result was partially similar to that of Haque *et al.* (1999) where weight of vines per plant in thirty sweet potato genotypes varied from 780 to 1700g. The number of tubers per plant varied considerably from one genotype to another (Table 1). The maximum number of tubers per plant was observed in the genotype SP3 (4.95) followed by SP1 (3.98). The lowest number of tubers per plant was produced by SP7 (1.88). Rahman and Haque (1983) reported that the number of tubers per plant depends upon the variety. Siddique (1985) reported that the number of tubers per plant of different genotypes varied from 1.73 to 6.03. The average weight of tuber significantly varied among the genotypes ranging from 83.59 to 204.39g. The maximum average weight of tuber was recorded in SP6 (204.39g) followed by SP4 (195.51g). The lowest average weight per tuber was found in SP14 (83.59). The length and diameter of tuber varied significantly among nine genotypes ranging from 11.59 to14.36cm and 3.58 to 5.69cm, respectively. The maximum length and minimum diameter of tuber were recorded in the genotype SP14 (14.36 and 3.58cm respectively). The minimum length of tuber was observed in the genotype SP20 (11.59cm) and the maximum diameter of tuber in genotype SP6 (5.69cm). There was a little variation among the genotypes in per cent of dry matter content of tubers. The highest dry matter percentage was found in genotype SP1 (27.15%) followed by SP6 (26.65%) and SP20 (25.53%). Genotype SP12 gave the lowest dry matter percentage (19.26%). Anonymous (1991) reported that per cent dry matter content of eleven selected clones at harvest ranged from 22.76 to 31.83%. The weight of tubers per plant exhibited wide variation (Table 1). The weight of tubers per plant was significantly higher in SP3 (856.57g) than those of SP4 (770.80g), SP16 (666.67g) and SP1 (645.96g). The lowest weight of tubers per plant was observed in the genotype SP14 (204.92g). This result was in agreement with the findings of Siddique (1985) where the weight of tubers per plant of different genotypes ranged from 260.0 to 1120.g. The tuber yield of the nine sweet potato genotypes varied from 11.38 to 47.59 t ha^{-1} (Table 1). Genotype SP3 was found to be superior to rest of the genotypes and it produced 47.59t ha^{-1} followed by SP4 (42.82 t ha^{-1}), SP16

Table 1: Yield contributing characters and yield of 9 sweet potato genotypes

Genotypes	Length of vines /plant (cm)	Number of main stems/ plant	Wt. of vines/ plant (g)	Number of tubers/ plant	Average wt. of tuber (g)	Length of tuber (cm)	Diameter of tuber (cm)	Dry matter (%)	Wt. of tuber/ tubers/plant	Yield of tuber ha^{-1} (T)
SP1	353.83a	1.93b	1458.33a	3.98b	162.37c	12.85b	4.41bc	27.15a	645.96c	35.89c
SP3	297.45ab	2.21ab	1410.00ab	4.95a	172.97bc	13.06b	5.52a	22.26b	856.57a	47.59a
SP4	210.58c	2.27ab	1135.00c	3.94b	195.51a	13.20ab	5.08ab	22.60b	770.80b	42.82b
SP6	207.80c	2.80a	1311.67b	2.92c	204.39a	11.92bc	5.69a	26.65a	595.46d	33.10d
SP7	242.90bc	2.72a	1055.00c	1.88e	178.70b	12.48bc	4.09bc	22.35b	336.29f	18.68f
SP12	201.40c	1.90b	1450.00a	3.10c	147.69d	12.03bc	4.94ab	19.26b	457.50e	25.41e
SP14	224.62c	2.50ab	1310.00b	2.45d	83.59e	14.36a	3.58c	22.63b	204.92g	11.38g
SP16	298.40ab	2.45ab	1143.50c	3.71b	183.46b	12.34bc	5.21ab	22.82b	666.67c	36.15c
SP20	208.50c	2.31ab	1303.45d	2.04e	153.41d	11.59c	4.37bc	25.53a	308.56f	19.75f

In a column, values with common letter(s) do not differ significantly at 1% level and/ or 5% level.

Table 2: Correlation matrix among different plant parameters of sweet potato.

Parameters	No. of main stems /plant	Wt. of vines /plant	No. of tubers /plant	Wt. of tubers /plant	Average wt. /tuber	Length of tuber	Diameter of tuber	Dry matter (%)	Correlation with yield
Length of vines/plant	-0.249**	0.132NS	0.031NS	0.185*	0.186*	-0.048NS	0.158NS	-0.186*	0.179*
No. of main stems/plant		0.239**	-0.065NS	0.102NS	0.190*	-0.012NS	0.169NS	0.032NS	0.115NS
Wt. of vines/plant			-0.055NS	0.410**	0.499**	0.195*	0.499**	-0.086NS	0.409**
No. of tubers/plant				0.483**	-0.325**	-0.137NS	-0.181*	-0.144NS	0.483**
Wt. of tubers/plant					0.622**	0.157NS	0.625**	-0.412**	0.999**
Average wt./tuber						0.271**	0.844**	-0.298**	0.624**
Length of tuber							0.051NS	-0.016NS	0.152NS
Diameter of tuber								-0.341**	0.621**
Dry matter (%)									-0.404**

* and ** significant at 5% and 1% level of probability respectively, NS= Non Significant.

Table 3: Path-coefficient analysis showing the contrbution of component character of yield of sweet potato

Parameters	Length of vines/plant	No. of main stems /plant	Wt. of vines /plant	No. of tubers /plant	Wt. of tubers /plant	Average wt. /tuber	Length of tuber	Diameter of tuber	Dry matter (%)	Correlation with yield
Length of vines/plant	**-0.0038**	-0.0028	-0.0003	0.0005	0.1822	0.0078	0.0005	-0.0037	-0.0013	0.1791*
No. of main stems/plant	0.0009	**0.0111**	-0.0005	-0.0011	0.1005	0.0078	0.0001	-0.004	0.0002	0.1149NS
Wt. of vines/plant	-0.0005	0.0026	**-0.0024**	-0.0009	0.4038	0.0206	-0.0019	-0.0117	-0.0006	0.4090**
No. of tubers/plant	-0.0001	-0.0007	0.0001	**0.0168**	0.4757	-0.0134	0.0013	0.0043	-0.001	0.4830**
Wt. of tubers/plant	-0.0007	0.0011	-0.001	0.0081	**0.9849**	0.0256	-0.0015	-0.0147	-0.0029	0.9989**
Average wt./tuber	-0.0007	0.0021	-0.0012	-0.0055	0.6126	**0.0412**	-0.0026	-0.0198	-0.0021	0.6240**
Length of tuber	0.0002	-0.0001	-0.0005	-0.0023	0.1546	0.0112	**-0.0098**	-0.0012	-0.0001	0.1520NS
Diameter of tuber	-0.0006	0.0019	-0.0012	-0.003	0.6156	0.0348	-0.0005	**-0.0235**	-0.0024	0.6211**
Dry matter (%)	0.0007	0.0004	0.0002	-0.0024	-0.4058	-0.0123	0.0002	0.008	**0.0071**	-0.4039**

Residual effect (R) = 0.00153, Bold face denote direct effect , * and ** denote significant at 5% and 1% level of probability respectively, NS = Non significant.

(36.15 t ha^{-1}), SP1 (35.89 t ha^{-1}), SP6 (31.10 t ha^{-1}) and SP12 (25.41 t ha^{-1}). The lowest yield was recorded in genotype SP14 (11.38 t ha^{-1}). This result is in consonance with the findings of Haque *et al.* (1999) where the yield of thirty genotypes ranged from 5.18 to 48.33 t ha^{-1}. Anonymous (1992) obtained similar yield from 12 sweet potato genotypes ranging from 1.1 to 44.0 t ha^{-1}.

The correlation coefficient for different yield contributing characters are shown in Table 2. It was found that length and weight of vines per plant, number of tubers per plant, weight of tubers per plant, average weight of tuber and diameter of tuber had significant positive correlation with tuber yield. So, selection of any one of these characters would be lead simultaneous improvement of tuber yield. On the other hand, dry matter percentage of tuber was shown negative correlation with yield of tuber per hectare. Number of main stems per plant and length of tuber had no significant correlation with tuber yield.

The correlation coefficients were again partitioned into components of direct and indirect effects by path coefficient analysis (Table 3). Path coefficient analysis revealed that number of main stems per plant, number of tubers per plant, weight of tubers per plant, average weight of tuber and dry matter percentage had the direct positive effect on tuber yield of sweet potato. Among these, weight of tuber per plant had the highest positive effect on the tuber yield of sweet potato. On the contrary, length and weight of vines per plant, length of tuber and diameter of tuber had the indirect effect on sweet potato tuber yield. These results suggested that it would be wise to give stress on the genotypes with more weight of tubers per plant and average tuber weight. Negligible residual effect indicated that the characters chosen almost completely determined total genetic variability for tuber yield of sweet potato.

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