

Character Association and Path Analysis Study in Sweet Potato (*Ipomoea batata* L.)

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Abstract

Twelve genotypes of sweet potato were studied for six yield and yield attributing characters during 2007-08 and 2008-09. Out of six traits only for three traits genotype had shown significant difference viz., vine length (cm), number of tuber per plant and weight of tuber per plant. These character exhibited high heritability coupled with high genetic advance suggesting that preponderance of additive gene action. Number of tuber per plant exhibited significant and positive correlation with marketable tuber yield along with its high direct effect. It suggests that during selection this trait will be considered as prime trait to enhance marketable tuber yield.

Key words : Heritability, Genetic advance, Correlation, Sweet potato.

Sweet potato (*Ipomoea batatas* L.) is an important source of carbohydrate. In India, Sweet potato is grown in 0.14 m hectares with an annual production of 1.17 m tonnes with a productivity of 8.3 t/ha. But in Bihar its area, production and productivity are 300 hectares, 6,000 tonnes and 20 t/ha respectively. There are wide range of variability present in sweet potato, they may be white, orange, purple, white-purple flesh in color. Which are also comprising more medicinal and nutritive values in respect to white fleshed sweet potato. It is a future crop for sustainable agriculture after millets and pulses due to global warning/environmental changes.

Methods

The present experiment was carried out at the

research farm of Tirhut College of Agriculture, Dholi, Muzaffarpur during 2007-08 and 2008-09. The experimental material comprised 12 genotypes of sweet potato including the check RS-92 and RS-47. The experiments were conducted in randomized block design with three replications. Data of the five randomly selected plants were recorded of each of the characters viz., vine length (cm), number of tuber per plant, weight of tuber per plant, dry matter (%), harvest index (%) and marketable tuber yield (t/ha). The data were analyzed following the method given by Panse and Sukhatme (1) for ANOVA and correlation coefficient. The path was analyzed following the method given by Wright (2), Dewey and Lu (3).

Results and Discussion

Mean sum of square due to 12 genotypes were

Table 1. Range mean coefficient of variability and critical difference for six traits in sweet potato during 2007-08 and 2008-09.

Characters	Range		Mean		SE (\pm)		CD (t/ha) at (0.05)	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
1. Vine length (cm)	367.99—68.83	325.66—64.33	160.98	143.96	11.54	12.26	33.84	35.96
2. No. of tuber/plant	7.22—3.33	5.55—2.11	5.58	3.64	0.37	0.34	1.09	1.00
3. Weight of tuber/plant (kg)	0.41—0.18	0.48—0.11	0.26	0.30	0.02	0.01	0.06	0.05
4. Dry matter (%)	30.00—11.00	31.54—20.73	22.19	25.87	2.88	1.17	6.44	2.44
5. Harvest index (%)	81.56—61.11	80.47—33.25	74.76	69.66	7.89	5.09	17.60	10.57
6. Marketable tuber yield (t/ha)	23.70—9.62	33.33—9.95	16.47	24.24	2.64	0.89	5.89	1.85

Table 2. Genetic parameters of six characters of sweet potato during 2007-08 and 2008-09.

Characters	GCV (%)	PCV (%)	h ² (%)	GA	GA (%)	GCV (%)	PCV (%)	h ² (%)	GA	GA (%)
1. Vine length (cm)	52.97	54.41	94.79	171.03	106.24	51.62	53.69	92.45	147.20	102.25
2. No. of tuber/plant	19.71	22.88	74.23	1.95	34.98	31.51	35.47	78.88	2.09	57.63
3. Weight of tuber/plant (kg)	27.46	31.00	83.33	0.13	51.14	37.31	38.63	96.15	0.22	75.27
4. Dry matter (%)	22.61	27.67	66.78	8.45	38.07	29.79	30.30	96.61	15.60	60.31
5. Harvest index (%)	8.45	15.45	29.92	7.12	9.52	17.48	19.64	79.22	22.33	32.06
6. Marketable tuber yield (t/ha)	23.99	29.80	64.81	6.55	39.78	19.06	19.58	94.72	9.26	38.21

found to be highly significant for the traits viz., vine length (cm), number of tuber per plant and weight of tuber per plant in both the year during 2007-08 and 2008-09. But rest of the characters showed non-significant difference in both the year 2007-08 and 2008-09 except dry matter content which was found significant during 2007-08 (Table 1).

Low GCV was observed for harvest index. Moderate GCV was observed for number of tuber per plant, dry matter (%) and marketable tuber yield (t/ha), while high genotypic variability were observed for vine

length and weight of tuber per plant during 2007-08 (Table 2). It suggests that the expressions of characters viz., harvest index, number of tuber per plant, dry matter (%) and marketable tuber yield were influenced by environment. While the expression of vine length and weight of tuber per plant traits was governed by their genotypes as also observed by Kumar et al. (4), Hossain et al. (5), Tsegaye et al. (6).

In 2008-09 only two genotypes exhibited moderate GCV for the characters harvest index, and yield (t/ha) where as rest of the characters viz., vine length,

Table 3. Phenotypic (upper value) and Genotypic (lower value) correlation coefficient between different combination among six characters of sweet potato during (2007-08) and (2008-09).

Characters		Ch-1	Ch-2	Ch-3	Ch-4	Ch-5	Ch-6
2007-08							
1. Vine length (cm)	P	1.000	0.0811	0.0011	-0.1192	-0.1746	-0.0528
	G	1.000	0.1176	0.0003	-0.1507	-0.2386	-0.2237
2. No. of tuber/plant	P		1.0000	-0.1423	0.0984	-0.0979	0.6820*
	G		1.0000	-0.1997	0.0088	0.0683	0.7243
3. Weight of tuber/plant (kg)	P			1.0000	0.3577	-0.0425	0.3258
	G			1.0000	0.5443	-0.1162	0.9736
4. Dry matter (%)	P				1.0000	-0.1226	0.5085
	G				1.0000	-0.2644	0.7330
5. Harvest index (%)	P					1.0000	-0.0036
	G					1.0000	-0.1330
6. Marketable tuber yield (t/ha)	P						1.0000
	G						1.0000
2008-09							
1. Vine length (cm)	P	1.000	-0.4036	-0.4467	0.1057	-0.8248**	-0.4034
	G	1.000	-0.4257	-0.4727	0.1036	-0.9011	-0.6106
2. No. of tuber/plant	P		1.0000	0.6254*	0.0642	0.5538	0.6476*
	G		1.0000	0.6953	0.1276	0.6251	0.8349
3. Weight of tuber/plant (kg)	P			1.0000	0.0960	0.5462	0.5577
	G			1.0000	0.1000	0.5820	0.9833
4. Dry matter (%)	P				1.0000	0.2339	-0.0795
	G				1.0000	0.2192	0.1623
5. Harvest index (%)	P					1.0000	0.5118
	G					1.0000	0.9495
6. Marketable tuber yield (t/ha)	P						1.0000
	G						1.0000

Table 4. Phenotypic (upper value) and Genotypic (lower value) direct and indirect effect of six characters on marketable tuber yield of sweet potato during (2007-08) and (2008-09).

Characters	Ch-1		Ch-2		Ch-3		
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	
1. Vine length (cm)	P	-0.0225	0.2222	0.0315	-0.1572	0.0003	-0.0915
	G	-0.3319	3.5752	0.1163	0.3541	0.0003	-0.3498
2. No. of tuber/plant	P	-0.0018	-0.0897	0.3890	0.3894	-0.0349	0.1281
	G	-0.0370	-1.5220	0.9892	-0.8318	-0.2282	0.5145
3. Weight of tuber/plant (kg)	P	-0.0000	-0.0993	-0.0554	0.2435	0.2452	0.2048
	G	-0.0001	-1.6900	-0.1975	-0.5783	1.1427	0.7399
4. Dry matter (%)	P	0.0027	0.0235	0.0383	0.0250	0.0877	0.0197
	G	0.0500	0.3704	0.0087	-0.1061	0.6220	0.0740
5. Harvest index (%)	P	0.0039	0.1833	-0.0381	0.2156	-0.0104	0.1119
	G	0.0792	-3.2216	-0.0676	-0.5200	-0.1328	0.4306

Table 4. Continued.

Characters	Ch-4		Ch-5		Ch-6 (Corr)		
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	
1. Vine length (cm)	P	-0.0466	-0.0261	-0.0155	-0.3509	-0.0528	-0.4034
	G	-0.0080	-0.1208	-0.0005	-4.0694	-0.2237	-0.6106
2. No. of tuber/plant	P	0.0384	-0.0159	-0.0087	0.2356	0.6820*	0.6475*
	G	0.0005	-0.1488	-0.0001	2.8230	0.7243	0.8349
3. Weight of tuber/plant (kg)	P	0.1398	-0.0237	-0.0038	0.2324	0.3258	0.5577
	G	0.0288	-0.1166	-0.0002	2.6283	0.9736	0.9833
4. Dry matter (%)	P	0.3907	-0.2472	-0.0109	0.0995	0.5085	-0.0795
	G	0.0529	-1.1659	-0.0006	0.9899	0.7330	0.1623
5. Harvest index (%)	P	-0.0479	-0.0578	0.0889	0.4254	-0.0036	0.5118
	G	-0.0140	-0.2556	0.0021	4.5160	-0.1330	0.9495

number of tuber per plant, weight of tuber per plant and dry matter were obtained high genotypic variability. Similar findings were observed by Shashikanth et al. (7), Tsegaye et al. (6).

In 2007-08 only three characters exhibited high heritability viz., vine length, number of tuber per plant and weight of tuber per plant coupled with high genetic advance indicating the preponderance of additive gene action. While two characters dry matter and marketable tuber yield (t/ha) obtained moderate heritability with high genetic advance. In this case additive and non-additive type gene action is present suggesting that improvement may be done with the help of hybridization and selection should be done in latter generation. To have the higher genetic gain these characters may taken into consideration during course of selection to have the more productive genotype. Similar finding were also reported by Hossain et al. (5) and Shashikanth et al. (7).

In 2008-09 all the observed characters were exhibited high heritability coupled with high genetic

advance indicating the preponderance of additive type gene action suggesting that selection based on these traits would be effective. Similar findings were observed by Choudhary et al. (8), Tsegaye et al. (6), and Hossain et al. (5).

Genotypic and phenotypic correlation were worked for all the character combinations (Table 4). During 2007-08 positive correlation with weight of tuber per plant and number of tuber per plant; whereas vine length had shown negatively correlated with marketable tuber yield. The magnitude of genotypic correlation was bit higher than phenotypic correlation between number of tuber per plant and marketable tuber yield, weight of tuber per plant as well as dry matter content and marketable tuber yield. Which might be due to strong coupling linkage between those traits. High genotypic correlation than the phenotypic correlation may be due to the strong coupling linkage between these traits. Similar finding were also observed by Alam et al. (9).

In 2007-08 and 2008-09 number of tuber per plant

had shown significant and positive phenotypic correlation with weight of tuber per plant and marketable tuber yield. Most of the traits compound high genotypic correlation than phenotypic correlation. Vine length exhibited negative correlation with number of tuber per plant, weight of tuber per plant, harvest index and marketable tuber yield both at genotypic and phenotypic level of correlation.

Number of tuber per plant exhibited significant and positive correlation with marketable tuber yield due to high direct effect in both years and in 2008-09 due to high positive indirect effect of harvest index. It suggests that during selection this trait may be taken as prime trait to enhance marketable tuber yield. Similar results were also obtained by Hossain et al. (5), Kumar et al. (4).

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