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Studies on genetic variability of sweet potato under Bastar plateau of Chhattisgarh

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Abstract

An investigation was conducted at Research cum instructional Farm, K.D. college of Horticulture and research station, Jagdalpur, Bastar, Chhattisgarh to estimate correlation and path analysis among different characters of fifteen sweet potato genotypes during *rabi* 2024-25. The experiment was laid out in Randomized Block Design, with 15 genotypes of sweet potato to estimate the genetic parameter, character association and path coefficient for the character viz., vine length (cm), vine length of internode (cm), diameter of vine (mm), neck length of tuber (cm), tuber length (cm), tuber diameter (cm), number of tubers per plant, dry matter% of vine, dry matter% of tuber were recorded on five competitive random plants from each replication. Analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all the characters. Correlation revealed that tuber yield (t/ha) showed high significant positive correlation with tuber yield per plant at both phenotypic and genotypic level (0.969) and (0.988) followed by marketable tuber yield per plant, number of tubers per plant, diameter of vine and showed significant positive correlation with tuber diameter at genotypic level only. Path co-efficient analysis revealed maximum direct contribution towards tuber yield per plant showed maximum positive direct effect on tubers yield (0.594 t/ha) followed by number of tubers per plant, tuber diameter, vine length of internode, marketable tuber yield per plant, dry matter% of vine and neck length of tuber.

Keywords: Genetic parameter, correlation, path co-efficient analysis, character association, tuber yield

Introduction

Sweet potato [*Ipomoea batatas* (L.)] commonly known as “*Shakarkand*” is one of the most popular and important tuber crops in India and abroad because of its yield potential and high calorific value. It is a globally important tuber crop, ranked second most important tropical and subtropical staple tuber crop in area and production after cassava (FAOSTAT, 2014) ^[11]. In Chhattisgarh it is locally known as “Kalmal Kanda”, ‘Maati Kanda’ and ‘Kevat Kanda’ is one of the most popular and important tubers crops in India and abroad because of its yield potential and high calorific value. In India, it is grown in an area of 116 thousand ha and produces 1186 thousand MT with a productivity of 10.22 t/ha (Anon., 2020) ^[11]. In Chhattisgarh state, it is cultivated in an area of 4.65 thousand hectare area with the production of 54.19 thousand MT and productivity of 11.65 t/ha. In Chhattisgarh Balrampur is leading district in area and production of sweet potato, where productivity is 9.94 t/ha in Balrampur district (Anon., 2023) ^[12]. Sweet potato rich in vitamin A and potassium. The orange fleshed sweet potato rich in beta carotene whereas the purple-fleshed are richer in anthocyanin. Sweet potato tuber are rich in starch (20-28%), carbohydrates (28.2%) and vitamins (Dhaliwal, 2017) ^[9]. For fruitful breeding programme information about extends of genetic variability, correlation is basic requirement. In any crop improvement programme, evaluation of germplasm to assess the existing variability is a preliminary step.

Materials and Methods

The experiment was carried out during the year 2024-2025 at Instructional cum Research Farm of K.D. College of Horticulture and Research Station, Jagdalpur, Bastar. The experimental material comprised of fifteen genotypes along with two checks Indira Naveen as local check and Sree Bhadhara as national check. The experiment was laid out in a randomized block design with three replications at the spacing of 60 cm between rows and 20 cm between plants to plant.

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A net plot size of 3.6 m² was kept for each genotype. All the recommended cultural practices were taken to grow a healthy crop. Data were recorded on five randomly selected plants for thirteen characters viz., vine length (cm), vine length of internode (cm), diameter of vine (mm), neck length of tuber (cm), tuber length (cm), tuber diameter (cm),

number of tubers per plant, dry matter% of vine, dry matter% of tuber. Three important characters viz., tuber yield per plant tuber yield (t/ha), marketable tuber yield per plant and tuber yield per plant (g) were calculated on the basis of observed data.

Table 1: Analysis of variance for fruit yield and its component characters in sweet potato.

S. No.	Character (df)	Mean sum of squares (MSS)		
		Replication	Treatment	Error
		(2)	(14)	(28)
01	Vine length (cm)	1058.42	5128.21**	573.78
02	Vine length of internode (cm)	0.29	6.92**	0.18
03	Diameter of vine (mm)	0.3252	2.98**	0.50
04	Neck length of tuber (cm)	3.00	10.59**	1.06
05	Tuber length (cm)	6.82	54.23**	6.52
06	Tuber diameter (cm)	0.49	4.75**	0.59
07	Number of tubers per plant	0.36	1.85**	0.22
08	Tuber yield per plant (g)	2522.41	12581.61**	1144.51
09	Marketable tuber yield per plant (g)	446.10	9425.22**	261.73
10	Yield (t/ha)	15.08	90.54**	6.54
11	Dry matter% of vine	4.19	152.24**	10.96
12	Dry matter% of tuber	3.44	95.29**	11.22

Table 2: Genotypic and phenotypic correlation coefficient between tuber yield and its component characters in sweet potato

Characters		1. Vine length (cm)	2. Vine length of inter-node (cm)	3. Diameter of vine (mm)	4. Neck length of tuber (cm)	5. Tuber length (cm)	6. Tuber dia. (cm)	7. Dry matter% of vine	8. Dry matter% of tuber	9. No. of tubers per plant	10. Tuber yield per plant (g)	11. Marketable tuber yield per plant (g)	12. yield (t/ha)
Vine length (cm)	P	1.000	0.316*	0.138	0.127	0.249	0.311	0.043	0.624**	-0.102	0.129	0.020	0.114
	G	1.000	0.432**	0.032	0.176	0.341*	0.413**	0.065	0.768**	-0.073	0.164	0.028	0.144
Vine length of internode (cm)	P		1.000	-0.032	0.307*	-0.020	0.068	0.132	0.305*	-0.222	0.161	-0.254	0.135
	G		1.000	-0.025	0.368*	-0.042	0.086	0.137	0.413**	-0.276	0.169	-0.279	0.148
Diameter of vine (mm)	P			1.000	-0.398**	-0.239	0.156	-0.040	0.364*	0.355	0.255	0.541**	0.362*
	G			1.000	-0.653**	-0.325*	0.314*	0.040	0.473**	0.543**	0.381**	0.737**	0.525**
Neck length of tuber (cm)	P				1.000	0.260	-0.042	0.188	-0.081	0.517**	-0.309*	-0.345*	-0.358*
	G				1.000	0.409**	0.061	0.259	-0.132	-0.132	-0.401**	-0.412**	-0.462**
Tuber length (cm)	P					1.000	0.111	0.482**	0.020	-0.114	-0.301*	-0.084	-0.349*
	G					1.000	0.031	0.605**	-0.016	-0.213	-0.498**	-0.107	-0.515**
Tuber diameter (cm)	P						1.000	0.083	0.269	-0.212	0.306*	0.345*	0.330
	G						1.000	0.113	0.239	-0.242	0.406**	0.407**	0.430**
Dry matter% of vine	P							1.000	0.218	-0.225	-0.358*	-0.117	-0.374*
	G							1.000	0.249	-0.384**	-0.510**	-0.165	-0.485**
Dry matter% of tuber	P								1.000	0.195	0.164	0.279	0.238
	G								1.000	0.233	0.212	0.334*	0.286
No. of tubers per plant	P									1.000	0.433*	0.547**	0.433**
	G									1.000	0.516**	0.696**	0.590**
Tuber yield per plant (g)	P										1.000	0.441**	0.969**
	G										1.000	0.474**	0.988**
Tuber yield per plant (g)	P											1.000	0.556**
	G											1.000	0.627**
yield (t/ha)	P												1.000
	G												1.000

Table 3: Direct and indirect effect of component character on tuber yield and its components in sweet potato

Characters	1. Vine length (cm)	2. Vine length of internode (cm)	3. diameter of vine (mm)	4. Neck Length of tuber (cm)	5. Tuber length (cm)	6. Tuber diameter (cm)	7. Dry matter% of vine	8. Dry matter% of tuber	9. No. of tubers per plant	10. Tuber yield per plant (g)	11. Marketable tuber yield per plant (g)	12. Yield (t/h)
Vine length (cm)	-0.044	0.065	-0.002	0.002	-0.057	0.122	0.001	-0.016	-0.028	0.097	0.001	0.144
Vine length of internode (cm)	-0.019	0.152	0.001	0.006	0.007	0.025	0.004	-0.008	-0.107	0.100	-0.014	0.148
diameter of vine (mm)	-0.001	-0.003	-0.073	-0.011	0.054	0.092	0.001	-0.009	0.211	0.226	0.037	0.525
Neck Length of tuber (cm)	-0.007	0.056	0.047	0.017	-0.068	0.0179	0.007	0.002	-0.275	-0.238	-0.021	-0.462
Tuber length (cm)	-0.015	-0.006	0.023	0.006	-0.167	0.009	0.0180	0.000	-0.083	-0.296	-0.005	-0.515
Tuber dia. (cm)	-0.018	0.013	-0.022	0.001	-0.005	0.296	0.003	-0.005	-0.094	0.241	0.020	0.430
Dry matter% of vine	-0.002	0.020	-0.002	0.004	-0.101	0.033	0.030	-0.005	-0.150	-0.303	-0.008	-0.485
Dry matter% of tuber	-0.033	0.062	-0.034	-0.002	0.002	0.070	0.007	-0.021	0.090	0.125	0.017	0.286
No. of tubers per plant	0.003	-0.042	-0.039	-0.011	0.035	-0.071	-0.011	-0.004	0.390	0.306	0.035	0.590
Tuber yield per plant (g)	-0.007	0.025	-0.027	-0.006	0.083	0.120	-0.015	-0.004	0.201	0.594	0.024	0.988
Marketable tuber yield per plant (g)	-0.001	-0.042	-0.053	-0.006	0.017	0.120	-0.004	-0.007	0.271	0.281	0.051	0.627

Residual value: 0.128 Diagonal and bold figures show direct effect on tuber

Results and Discussion

The analysis of variance for tubers yield and its component characters indicated that mean sum of squares due to genotypes were highly significant for all the characters under study. Significant mean sum of squares due to tubers yield and attributing characters revealed existence of considerable variability in material studied for improvement of various traits. These findings were closely associated with the reports of Anshebo *et al* (2004) [3], Teshome *et al* (2004) [18], Chaurasiya (2012) [5], Mohanty (2013) [15], Dash *et al* (2014) [8], Bhadauriya *et al* (2018) [4]. In general, the genotypic correlations were observed to be higher than the corresponding phenotypic correlations for all the character combinations in present investigation, thus indicating the suppression of phenotypic expression under the influence of environmental factors (Table 2). Nedunzhiyan and Reddy (2000) [16], Choudhary *et al* (2000) [6] also found similar results in their studies on sweet potato.

Tuber yield

Tuber yield (t/ha) showed high significant positive correlation with tuber yield per plant at both phenotypic and genotypic level (0.969) and (0.988) followed by marketable tuber yield per plant (0.556) and (0.627), number of tubers per plant (0.433) and (0.590), diameter of vine (0.362) and (0.525), tuber diameter (0.430) at genotypic level only and significant negative correlation observed with dry matter% of vine (-0.374) and (-0.485) at both phenotypic and genotypic level followed by neck length of tuber (-0.358) and (-0.462), tuber length (-0.349) and (-0.515). Similar result had been also reported by Choudhary (2000) [6] for tuber yield, Hussain (2000) [12] for tuber weight, number of tuber per plant, Sahu (2003) [17] for tuber diameter and harvest index, Sahu (2005) [17] for diameter of tuber.

Path coefficient analysis

The path coefficient analysis which splits total correlation coefficient of different characters into direct and indirect effect of yield attributing characters on tubers yield (t/ha) was presented (Table 3). The data revealed that genotypic path, tuber yield per plant showed maximum positive direct effect on tuber yield tone per hectare (0.594) followed by number of tubers per plant (0.390), tuber diameter (0.296), vine length of internode (0.152), marketable tuber yield per plant (0.051), dry matter% of vine (0.030) and neck length

of tuber (0.017) which indicated that these are the main contributors to the tuber yield which is in consonance with the findings of Hossain *et al.* (2000) [12], Tirkey *et al.* (2011) [19], Bhadauriya *et al.* (2018) [4]. Whereas, tuber length showed maximum negative direct effect (-0.167) followed by diameter of vine (-0.073), vine length (-0.044), and dry matter% of tuber (-0.021).

Conclusion

In this present study the correlation between tuber yield and a character is due to direct effect of tuber yield per plant, number of tubers per plant, tuber diameter and marketable tuber yield per plant revealed true relationship between them and direct selection for this trait would be rewarding for yield improvement. Overall, in this study selection of genotypes having higher tuber yield or selection of tuber yield characters for further breeding program will improve the tuber yield per hectare. In genotypic path, tuber yield per plant showed maximum positive direct effect on tuber yield tone per hectare followed by number of tubers per plant, tuber diameter, vine length of internode, marketable tuber yield per plant, dry matter% of vine and neck length of tuber which indicated that these are the main contributor to the tuber yield.

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