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Parameters of genetic variability, correlation and path coefficient analysis for yield and yield components in round fruited Brinjal (*Solanum melongena* L.)

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Abstract

The present investigation entitled "Parameters of genetic variability, correlation and path coefficient analysis for yield and yield components in round fruited brinjal (*Solanum melongena* L.)" was conducted during *late Kharif* season during year 2019-2020 at Horticultural Research cum Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The study consisted of nineteen genotype of Brinjal and out laid in Randomized Block Design (RBD) with three replications. The data be determined to work out the genetic variability, correlation coefficient and analysis of path for the traits *viz.*, plant height (cm), plant spread, number of primary branches, days to first flowering, days to 50 per cent flowering, days to first fruit harvesting, number of fruits per plant, number of fruits per cluster, fruit length (cm), fruit girth (cm), average fruit weight (g), stalk length (cm), yield per plot (kg) and yield per hectare (q).

The maximum genotypic and phenotypic coefficient of variation was noted for Number of fruits per plant, yield per hectare, fruit weight, number of fruits per cluster and fruit girth. The phenotypic coefficient of variation (PCV) was greater than the genotypic coefficient of variation (GCV). Maximum heritability was observed for the traits plant height, days to 50 percent flowering, fruit girth, number of fruits per plant, stalk length, total soluble solid fruit weight, yield per plot and yield per hectare. Maximum heritability coupled with higher genetic advance was recorded for number of fruits per plant, yield per hectare, yield per plot, fruit weight and fruit girth.

Keywords: Genetic variability, path analysis, correlation, round fruited brinjal

Introduction

Brinjal (*Solanum melongena* L. $2n = 24$), one of the important nutritive vegetable crops, belongs to the family Solanaceae referred by various other names *viz.* Eggplant, Aubergine (French), Baingan (Hindi), Badanekai (Kannada), Vangi (Marathi), Vankai (Telugu), Katharikai (Tamil) etc. According to Vavilov (1928)^[6], primary centre of origin of brinjal is the Indo-Burma region, whereas China is the considered as the secondary centre of origin. As per Isshiki *et al.* (1994), the centre of diversity and genetic variability of brinjal is assumed of the area of Bangladesh and Myanmar (former India-Burma border). In largest germplasm sample from India, his findings were based on isoenzyme and morphological variation noted.

In India, brinjal is a major vegetable crop and is cultivated throughout the year. However, in both temperate and tropical area of the globe, it is usually growing for major importance its immature fruits as regular use vegetables (Rai *et al.*, 1995), while in the temperate regions it is more cultivated during the warm season. It is often referred to as poor man's crop on the basis of its highest production capacity and market availability of the commodity and brinjal is also referred to as the "King of vegetables" because of its versatility use in Indian cuisine. Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh are grown in India for commercial purposes.

Planning of a breeding programme is successful for certain traits depends upon the nature and magnitude of variability, which exist in the available material and parts played by the environment with a view to scan out the germplasm for yield contributing characters,

the present study is undertaken at the department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). With following objectives: 1-To study of genetic variability in round fruited brinjal for fruit yield and its contributing characters. 2-To find out the correlation among the yield and its contributing characters in round fruited brinjal. 3-To work out path coefficient analysis for fruit yield and its traits in round fruited brinjal.

Material and Method

The present experiment was conducted on the experimental field of AICRP on Vegetable Crop under the Department of vegetable Science at Research cum Instructional Farm, Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG) on the basis of above investigation, of nineteen genotypes of differing in morphological attributes were chosen for detailed analysis, which carried out during late

kharif season of 2019-20. This chapter deals with description of the material used and methodology adapted during the course of investigation.

Experimental material

Nineteen genotypes of brinjal were grown in a randomized complete block design with three replications. The transplanting of experimental material was done on 13th September 2019. The seedlings of brinjal genotypes were transplanted in field at the distance of 60 cm for row to row and 50 cm plant to plant Recommended dose of fertilizers and other cultural package of practices were adopted for better crop growth. Five competition plants were selected randomly from each plot to record observation on various characters. The average value of each character was calculated on the idea of five plants for every genotype in each replication with plot wise character observation.

Table 1: List of brinjal genotypes studied along with their sources of availability

	Genotypes	10	BRRGENO 10
1	BRRGENO 1	11	BRRGENO 11
2	BRRGENO 2	12	BRRGENO 12
3	BRRGENO 3	13	BRRGENO 13
4	BRRGENO 4	14	BRRGENO 14
5	BRRGENO 5	15	BRRGENO 15
6	BRRGENO 6	16	BRRGENO 16
7	BRRGENO 7	17	BRRGENO 17
8	BRRGENO 8	18	BRRGENO 18
9	BRRGENO 9	19	Swarna Mani*

Source: AICRP on vegetable crops, IIVR, Varanasi

Results and Discussion

The analysis of variance for fruit yield and its contributing characteristics for brinjal during late Kharif 2019 (Table 1). The average number of squares for genotypes was considered to be important for its all characteristics, i.e. plant height (cm), plant spread (cm), number of primary branches, days to first flowering, days to 50 percent flowering, days to first fruit harvest, stalk length (cm), number of fruits per cluster, number of fruits per plant, fruit length (cm), fruit girth (cm), fruit weight (g), mean number of square.

Genotypic and phenotypic variance coefficients are basic variability statistics, and this method is widely used to test variability. The phenotypic variation coefficient was slightly higher than the equivalent genotypic variation coefficient,

suggesting the effect of the context on the character production being measured. As shown by Sivasubramanian and Madhavamenon (1973), the genotypic variation coefficient (GCV) and phenotypic variation coefficient (PCV) are classified as low (less than 10 percent), moderate (10-20 percent) and high (more than 20 percent). Table 3 presents genotypic and phenotypic heterogeneity coefficients in various characters.

For characters, viz., a high degree of genotypic and phenotypic coefficient of variation has been documented. Number of fruits per plant (46.31 and 50.69), yield per hectare (44.60 and 47.42) fruit weight (37.32 and 44.52), number of fruits per cluster (26.96 and 38.28) and fruit girth (25.40 and 26.57).

Table 2: Mean performances of brinjal genotypes for yield and its component characters

Genotype	1	2		3	4	5	6	7	8	10	11	12	13	14	15	
		N-S	R-III													
BRRGENO 1	52.33	62.90	63.00	3.33	35.00	60.66	62.78	1.00	13.39	9.46	9.65	365.16	3.33	3.86	33.25	277.08
BRRGENO 2	69.33	66.83	66.83	633	39.00	70.00	59.25	1.00	41.11	9.10	1121	19220	6.33	3.66	55.79	464.91
BRRGENO 3	68.33	70.82	71.32	6.00	40.33	71.66	57.13	1.33	38.73	10.03	9.42	80.46	3.66	4.10	20.64	172.08
BRRGENO 4	57.33	66.35	68.54	4.00	3333	65.00	63.38	1.66	15.43	12.43	7.85	17320	4.30	4.43	17.60	146.71
BRRGENO 5	47.33	62.66	64.00	3.66	4133	72.33	64.40	1.00	16.60	9.36	9.61	14736	3.66	4.10	16.30	135.86
BRRGENO 6	53.33	70.00	70.16	4.00	40.66	78.66	66.60	1.00	1839	9.50	11.48	20736	3.66	4.16	27.05	225.46
BRRGENO 7	59.66	72.03	72.66	5.00	36.66	78.66	73.00	1.33	10.18	11.46	9.62	250.66	3.63	4.06	12.71	105.96
BRRGENO 8	71.00	72.68	72.33	6.66	45.00	8333	66.91	1.00	21.45	10.53	7.04	125.46	3.80	4.33	18.99	15825
BRRGENO 9	51.00	64.2A	66.24	4.33	42.66	75.66	65.33	1.00	8.65	10.00	9.51	31223	3.30	4.30	11.31	94.25
BRRGENO 10	57.00	66.16	65.66	6.00	4433	77.66	69.66	1.00	1835	10.26	9.41	211.80	4.16	4.23	27.79	231.58
BRRGENO 11	57.33	72.33	72.33	5.66	40.66	7733	73.22	2.33	33.57	6.76	530	84.50	4.06	4.16	44.13	39232
BRRGENO 12	62.00	66.67	66.67	633	4033	71.66	70.46	2.00	14.85	10.93	6.79	234.00	4.13	4.16	33.07	293.98
BRRGENO 13	61.66	71.85	73.99	533	3833	65.66	67.07	1.66	993	10.20	6.01	14299	3.50	4.10	13.91	123.70
BRRGENO 14	65.00	63.64	63.14	6.66	32.66	7133	71.52	1.00	2138	7.66	7.70	182.00	3.46	4.03	38.01	337.92
BRRGENO 15	67.66	74.00	73.99	5.66	38.00	77.66	73.70	1.00	1534	9.93	721	17530	3.83	4.13	26.62	236.65
BRRGENO 16	40.33	62.72	62.72	4.66	40.66	8133	75.30	1.33	19.46	9.83	5.08	123.49	3.46	4.30	21.25	188.96
BRRGENO 17	58.66	64.67	65.05	4.66	4233	73.66	79.67	1.00	15.62	12.53	5.88	117.00	3.53	4.13	16.05	142.69

BRRGENO 18	52.66	62.00	62.35	5.66	42.66	69.00	77.79	1.33	17.86	12.66	5.58	169.00	3.56	4.13	28.90	19022
Swarna Mani	54.00	63.99	64.55	5.00	40.33	71.33	69.49	1.00	12.72	9.20	5.74	272.99	3.80	4.23	33.77	30823
Mean	58.21	62.90	64.55	5.21	39.7	73.29	68.77	1.26	19.11	10.1	7.9	187.77	3.85	4.14	26.16	22246
C.D.	4.225	3.684	4.460	1.325	4.755	2.437	7.077	0.571	6.556	1.897	1.028	75.841	0.495	0.163	6.832	59.585
SE(m)	1.467	1.225	1.483	0.46	1.651	0.863	2.457	0.198	2.276	0.659	0.357	26.335	0.172	0.057	2.39	20.69
SE(d)	2.075	1.732	2.097	0.651	2.335	1.221	3.475	0.28	3.219	0.932	0.505	37.244	0.243	0.08	3.38	29.261
C.V.	4.365	2.571	3.097	15.299	7.203	2.04	6.189	27.187	20.634	11.299	7.826	24.292	7.721	2.369	15.813	16.109

- Plant height (cm)
- Plant spread (cm)
- Number of primary branches
- Days to first flowering (days)
- Days to 50% flowering (days)
- Days to first fruit harvest (days)
- Number of fruits per cluster
- Number of fruits per plant
- Fruit length (cm)
- Fruit girth (cm)
- Fruit weight (g)
- Stalk length (cm)
- Total soluble solid (%)
- Yield per plot (kg)
- Yield per hectare (q)

Table 3: Genetic parameter of variation for fruit yield and its components in round fruited brinjal

S. No.	Character	Mean	Range		Coefficient of variation (%)		Heritability (%)	Genetic advance as % of mean
			Minimum	Maximum	GCV	PCV		
1	Plant height (cm)	58.21	40.33	71.00	13.52	14.21	90.55	26.5
2	Plant spread (cm)	64.55	61.33	75.66	5.84	7.14	66.95	9.85
3	Number of primary branches	5.21	3.33	6.66	17.59	23.31	56.93	27.34
4	Days to first flowering (days)	39.7	32.66	45.00	7.47	10.37	51.81	11.07
5	Days to 50% flowering (days)	73.29	60.66	83.33	7.87	8.13	93.7	15.7
6	Days to first fruit harvest (days)	68.77	57.13	77.79	7.97	10.09	62.38	12.97
7	Number of fruits per cluster	1.26	1.00	2.33	26.96	38.28	49.58	39.11
8	Number of fruits per plant	19.11	8.65	41.11	46.31	50.69	83.43	87.14
9	Fruit length (cm)	10.1	6.76	12.66	13.44	17.56	58.59	21.19
10	Fruit girth (cm)	7.9	5.08	11.48	25.4	26.57	91.33	50.01
11	Fruit weight (g)	157.77	80.46	365.16	37.32	44.52	70.23	64.43
12	Stalk length (cm)	3.85	3.30	6.33	16.62	18.32	82.24	31.04
13	Total soluble solid (%)	4.14	3.66	4.43	3.85	4.52	72.56	6.75
14	Yield per plot (kg)	26.17	11.31	55.79	43.53	46.32	88.33	84.28
15	Yield per hectare (q)	222.46	94.25	464.91	44.6	47.42	88.46	86.41

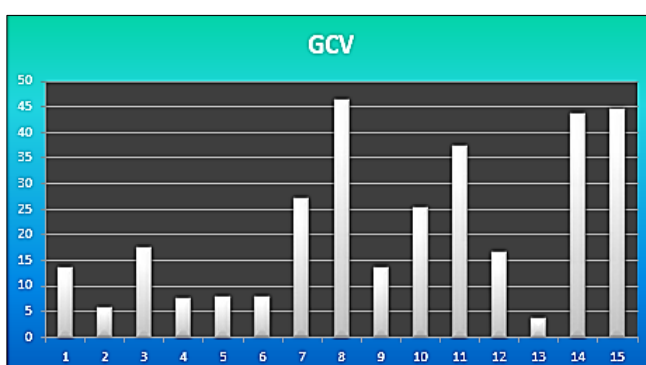


Fig 1: Graphic representation of the genotypic coefficient of variation (GCV) of yield and yield contributing of brinjal

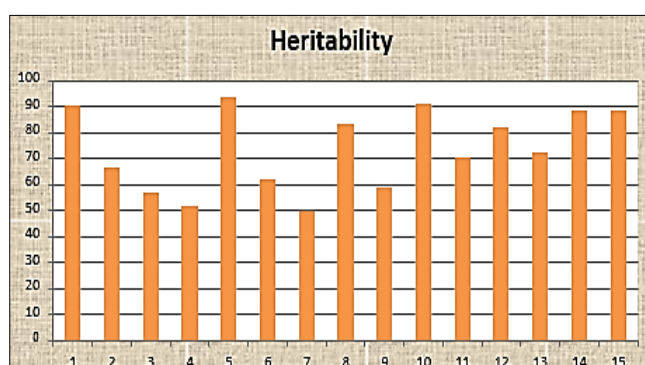


Fig 3: Graphic representation of the heritability (h²) of yield and yield contributing of brinjal

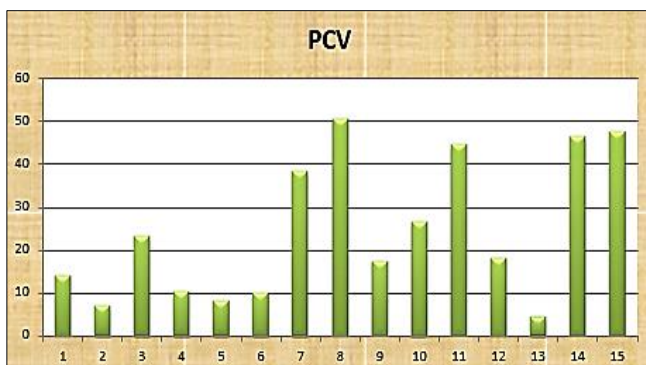


Fig 2: Graphic representation of the phenotypic coefficient of variation (PCV) of yield and yield contributing of brinjal

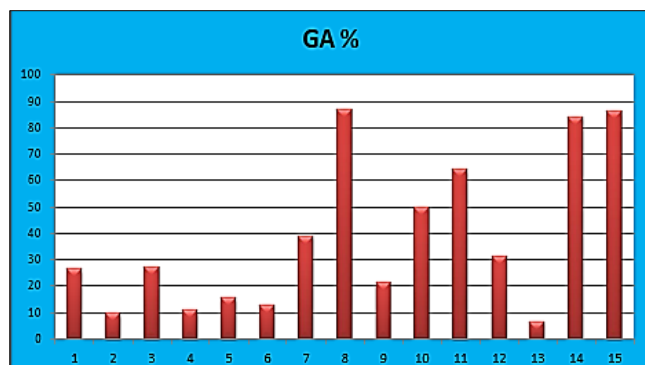


Fig 4: Graphic representation of GA% of yield and yield contributing of brinjal

The essential genetic criteria for the selection of a genotype that make for higher selection efficiency are heritability and genetic progression by isolating the environmental effect from

the overall variability. The association between parents and their descendants was governed by heritability, while genetic progress provides knowledge of future gain for a particular

character after selection. In the current analysis, as indicated by Robinson (1966), attempts were made to measure heritability in a large sense and ranked as low (< 50 percent), moderate (50 - 70 percent) and high (> 70 percent).

Highest magnitude of broad sense heritability was reported in days to 50 percent flowering (93.70%), fruit girth (91.33%), plant height (90.88%), yield per hectare (88.46%), yield per plot (88.33%), number of fruits per plant (83.43%), stalk length (82.24%), total soluble solid (72.56%) and fruit weight (70.23).

While moderate value for heritability was reported in plant spread (66.95%) days to first fruit harvest (62.38%), fruit length (58.59%), number of primary branches (56.93%) and days to first flowering (51.81%). The lowest heritability was reported in number of fruits per cluster (49.58%).

Correlation specifies the degree and direction of association between the two or more variables under study. It measures the extent of the relationship between different characters and depends on which genetic improvement of the dependent variable should be chosen depending on the characters of component. In all possible variations, the relationship between fruit yield and its component characters has been determined at phenotypic (P) and genotypic (G) stages, and the outcomes are showed in Table 4.

There was a strongly significant positive association of yield per plot (0.990), stalk length (0.675), number of fruits per plant (0.0.592), number of primary branches (0.475) and plant height (0.276) at the genotypic level of total fruit yield per hectare. It also has a strongly important positive association at the phenotypic stage with yield per plot (0.983), stalk length (0.540), number of fruits per plant (0.0.578), number of primary branches (0.303). There is also a strongly important negative association between total soluble solids (-0.614 and -0.439) and fruit lengths (-0.703 and -0.508) at genotypic and phenotypic stages.

Taking the overall fruit yield per hectare as a dependent variable and other attributes, genotypic path analysis was carried out. As an independent variable, plant height, plant spread, number of primary branches, days of first flowering, days of 50 percent flowering, days of first fruit harvest, number of fruits per cluster, number of fruits per plant, fruit length, fruit girth, fruit weight, stalk length and total soluble solids. There are two paths for each attribute, i.e. direct and indirect influence, which are given in Table 4.5.

Good direct results of fruit yield per plot (0.487), day to 50 percent flowering (0.332), stalk length (0.268), number of fruits per cluster (0.134), number of primary branches (0.132), fruit length (0.074), and plant height (0.003) were recorded by the genotypic path coefficient. Total soluble solids (-0.331), fruit girth (-0.291), fruit length (-0.222), plant spread (-0.199), days to first fruit harvest (-0.170), days first flowering (-0.164) and number of fruits per plant (- 0.156) have a detrimental direct impact.

Conclusion

- The variance analysis revealed that there was significant variability among the genotypes for most of the traits that revealed potential for more genetic improvement.
- For the plant height, days to 50 percent flowering, fruit girth, no. fruits per plant, stalk length, total soluble solid fruit weight, yield per plot and yield per hectare, of crop recorded high level of heritability was observed.
- Correlation studied revealed that fruit yield (kg/ha) showed positive and significant correlation with yield per plot, stalk length, number fruits per plant and primary

branch per plant at both genotypic and phenotypic levels, but only at, but only at genotypic level with plant height.

- In path coefficient analysis fruit yield showed high level of positive and direct effect on fruit yield per plot (0.487) followed by days to 50 percent flowering (0.332), stalk length (0.268), number of fruits per cluster (0.133), primary branch per plant (0.132), fruit length (0.078) and plant height (0.002).
- The genetic improvement of plant quantitative and qualitative character is the main interest of the plant breeder. In order to do this, it is necessary to quantify the genotypic and phenotypic variation available for various characters of plant economic importance and their inter relationship.

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