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PATH CO-EFFICIENT ANALYSIS FOR YIELD AND ITS COMPONENTS IN PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSP.]

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Abstract

Present investigation was carried out to examine path-coefficient analysis of the twenty genotypes of pigeonpea including check WRP-1 were received from Indian Institute of Pulse Research, Kanpur (U.P.), India. The trials were conducted in a randomized block design with two replications, during *kharif*-2012, 2013 and 2014 under irrigated condition at the Agricultural Research Station, Kalaburagi. On the basis of *per se* performance for seed yield per plant genotype RVK 275 (43.71 g), RVK 285 (42.71 g), JKM189 (42.58 g), BDN 2008-12 (41.67 g), AKT 9913 (40.59 g) were found promising as they showed high value for grain yield and its components. Path analysis revealed that pod length (0.378, 1.612), pod bearing length (0.493, 1.043), secondary branches (0.314, 0.935) and number of pods per plant (0.362, 0.539) had the highest positive direct effect on grain yield both at genotypic and phenotypic level. For maximizing the grain yield per plant emphasis should be given in selection of such characters for further improvement in pigeonpea.

Key words : Pigeonpea, path analysis, yield, randomized block design (RBD).

Introduction

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is an important grain legume that originated in the Indian sub-continent. It is now grown in many parts of the world including Southern Africa particularly the region encompassing Kenya, Mozambique, Malawi and Southern Tanzania (HoghJensen *et al*., 2007). This region is considered as a secondary centre of diversity for pigeonpea, it is a short lived perennial shrub in which plants may grow for about five years and turn into small trees.

Pigeonpea is an often cross pollinated (20-70%) (Saxena and Kumar, 2010) has diploid genome with 11 pairs of chromosomes (2n = 2x = 22) comprising a genome of 833.1 Mbp (Varshney *et al*., 2012). India is considered as the native of pigeonpea (Van der Maesen, 1980) because of its natural genetic variability available in the local germplasm and the presence of its wild relatives in the country.

It is cultivated in varied agro climatic conditions ranging from moisture stress and input starved conditions to irrigated conditions. Path coefficient analysis is an important tool for plant breeder in partitioning the correlation coefficients into direct and indirect effects of independent variables on dependent variable *i.e*. seed yield. Pigeonpea breeders look forward for widely adapted genotypes responsive to input intensive as well as input deficient agriculture in order to enhance production and productivity of the crop. With this back ground the present study was undertaken under irrigated situation in three locations to identify direct and indirect effects of pigeonpea for seed yield and its component traits.

Materials and Methods

The present experiment material comprised of 20 genotypes of pigeonpea including check WRP-1 received from Indian Institute of Pulse Research, Kanpur (U.P.), India. The trials were conducted in a randomized block design with two replications in three seasons *viz*., *kharif*-2012, 2013 and 2014 grown under irrigated condition, two protective irrigation were given at flowering and pod filling stage. The plot size of two rows each with 4m length was followed with spacing of 75 cm between rows and 25 cm between the plants. Observations were recorded on five randomly selected plants in each replication in each environment in respect of 12 different metric characters *viz*., days to flower initiation, days to 50 per

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Table 1 : Direct and indirect effects of quantitative characters on seed yield per plant at genotypic level.

Charcters		Days to flower intiation	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches	Secondary Branches	Pod bearing length (cm)	Number of seeds/ pod	Pod length (cm)	Number of pods/ plant	100 seed weight (g)
Days to flower intiation	Genotypic	**-0.081**	0.227	-0.1	0.076	0.067	0.007	-0.124	0.022	-0.032	0.114	0.1
Days to 50% flowering	Genotypic	-0.072	**0.256**	-0.099	0.089	0.085	0.009	-0.119	0.018	-0.027	0.179	0.067
Days to maturity	Genotypic	-0.072	0.226	**-0.112**	0.099	0.076	0.008	-0.027	0.015	-0.025	0.173	0.07
Plant height (cm	Genotypic	-0.043	0.16	-0.078	**0.142**	0.068	0.007	0.132	0.025	-0.037	0.17	0.078
Primary branches	Genotypic	-0.029	0.119	-0.047	0.053	**0.182**	0.008	-0.05	-0.024	0.012	0.256	-0.002
Secondary Branches	Genotypic	-0.037	0.16	-0.061	0.069	0.105	**0.314**	-0.059	-0.001	-0.007	0.262	0.046
Pod bearing length (cm)	Genotypic	0.02	-0.062	0.006	0.038	-0.018	-0.002	**0.493**	0.011	-0.008	0.062	-0.007
Number of seeds /pod	Genotypic	-0.021	0.054	-0.021	0.043	-0.053	0	0.063	**0.083**	-0.063	-0.055	0.067
Pod length (cm)	Genotypic	-0.032	0.089	-0.035	0.068	-0.027	0.001	0.049	0.067	**0.378**	-0.05	0.135
Number of pods/plant	Genotypic	-0.025	0.127	-0.053	0.067	0.129	0.01	0.085	-0.013	0.011	**0.362**	-0.037
100 seed weight (g)	Genotypic	-0.035	0.075	-0.034	0.048	-0.001	0.003	-0.016	0.024	-0.046	-0.059	**0.229**

Genotypic Residual = 0.270

Table 2 : Direct and indirect effects of quantitative characters on seed yield per plant at phenotypic level.

Charcters		Days to flower intiation	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches	Secondary Branches	Pod bearing length (cm)	Number of seeds/ pod	Pod length (cm)	Number of pods/ plant	100 seed weight (g)
Days to flower intiation	Phenotypic	**0.714**	-0.029	-0.413	0.002	0.073	0.484	-0.291	-0.471	0.698	-0.171	-0.297
Days to 50% flowering	Phenotypic	0.637	**-0.032**	-0.408	0.002	0.098	0.676	-0.304	-0.374	0.594	-0.275	-0.196
Days to maturity	Phenotypic	0.641	-0.028	**-0.46**	0.002	0.089	0.604	-0.085	-0.344	0.515	-0.268	-0.204
Plant height (cm	Phenotypic	0.398	-0.021	-0.335	**0.003**	0.065	0.475	0.292	-0.581	0.822	-0.26	-0.234
Primary branches	Phenotypic	0.335	-0.02	-0.266	0.001	**0.155**	0.596	-0.021	0.449	-0.153	-0.463	-0.013
Secondary Branches	Phenotypic	0.369	-0.023	-0.297	0.002	0.099	**0.935**	-0.267	0.051	0.237	-0.445	-0.142
Pod bearing length (cm)	Phenotypic	-0.199	0.009	0.038	0.001	-0.003	-0.24	**1.043**	-0.162	0.169	-0.115	0.038
Number of seeds /pod	Phenotypic	0.234	-0.008	-0.11	0.001	-0.048	-0.033	0.117	**-1.438**	1.626	0.101	-0.269
Pod length (cm)	Phenotypic	0.309	-0.012	-0.147	0.002	-0.015	0.138	0.109	-1.451	**1.612**	0.081	-0.433
Number of pods/plant	Phenotypic	0.226	-0.016	-0.229	0.002	0.133	0.772	0.222	0.269	-0.243	**0.539**	0.111
100 seed weight (g)	Phenotypic	0.315	-0.009	-0.14	0.001	0.003	0.197	-0.059	-0.575	1.037	0.089	**-0.674**

Phenotypic Residual = 0.250

Table 3 : *Per Se* performance of different quantitative characters in pigeonpea.

	Entries	Days to flower intiation	Days to 50% flowering	Days to maturity	Plant height (cm)	Primary branches	Secondary branches	Pod bearing length (cm)	Number of seeds/pod	Pod length (cm)	Number of pods/ plant	Seed yield per plant (g)	100 seed weight (g)
1	PUSA2001	78.67	79.67	138.50	115.83	7.61	1.08	30.33	4.67	4.92	78.28	19.24	9.53
2	JKM189	105.33	107.17	156.83	140.78	10.78	4.97	36.75	4.25	4.56	158.22	42.58	10.67
3	BDN-2008-1	105.50	104.50	155.67	131.78	10.17	3.11	38.58	4.81	5.33	129.78	35.16	9.54
4	JKM-7	114.17	116.67	169.33	144.06	9.35	3.26	31.89	4.57	4.69	130.43	33.93	9.45
5	WRP-1	94.50	89.50	147.50	102.39	8.72	0.54	39.71	4.22	4.36	93.94	35.89	9.93
6	ICP 11477	79.17	91.33	143.50	125.25	7.33	3.84	37.06	4.25	4.46	107.11	29.37	8.30
7	ICP 13579	114.50	119.17	166.83	131.28	10.33	6.58	28.16	4.61	4.83	163.00	34.42	8.24
8	ICP 995	103.00	104.50	156.00	131.67	10.39	4.89	26.70	4.31	4.48	148.72	35.20	8.07
9	ICP 4575	101.67	100.00	151.00	117.78	10.72	2.66	21.94	3.78	4.06	109.61	20.20	8.14
10	ICP 14471	89.67	87.17	150.17	120.33	8.81	3.53	33.89	4.28	4.38	117.89	29.01	8.95
11	AKT 9913	96.17	102.00	154.67	133.56	10.83	6.11	40.00	4.18	4.60	165.78	40.59	10.04
12	ICP 348	102.00	104.50	161.17	113.73	10.56	6.50	24.33	4.03	4.13	156.61	32.81	8.35
13	ICP 7366	82.17	92.17	138.33	103.28	8.72	2.28	26.39	4.14	4.24	113.61	19.00	8.05
14	ICP 8840	109.50	111.67	166.83	135.78	10.94	6.05	35.00	4.32	4.56	159.50	37.13	9.49
15	RVK 275	102.17	115.17	165.33	147.33	12.33	5.64	30.56	4.31	4.75	146.44	43.71	10.06
16	Bennur Local	85.67	92.50	142.17	120.44	11.44	5.27	32.31	4.25	4.38	162.17	40.14	10.00
17	RVK 285	103.83	100.17	161.83	150.00	9.11	3.94	41.33	4.49	4.90	136.33	42.71	11.43
18	BDN 2008-12	87.83	99.33	147.00	128.00	9.39	4.47	36.03	4.38	4.69	133.67	41.68	9.12
19	JSA 59	121.17	116.75	164.50	132.89	9.28	6.04	20.72	4.58	5.33	100.11	28.38	16.11
20	BDN 711	105.17	106.17	150.75	121.47	8.67	4.42	23.58	4.69	4.88	111.17	32.95	9.61
Mean		**99.09**	**102.00**	**154.40**	**127.38**	**9.77**	**4.26**	**31.76**	**4.36**	**4.63**	**131.12**	**33.71**	**9.65**
Range maximum		121.17	119.17	169.33	150.00	12.33	6.58	41.33	4.81	5.33	165.78	43.71	16.11
Range maximum		78.67	79.67	138.33	102.39	7.33	0.54	20.72	3.78	4.06	78.28	19.00	8.05

cent flowering, days to 80 per cent pod maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, pod bearing length, number of pods per plant, number of seeds per pod, pod length (cm), 100- seed weight (g) and seed yield per plant. Path coefficient analysis was carried out as per principle given by Dewey and Lu (1959).

Results and Discussion

The results of genotypic and phenotypic path coefficient analysis for twelve quantitative characters are presented in (tables 1 and 2). High rate (between 0.30 to 0.99) of positive direct effects were observed at genotypic and phenotypic level by means of the traits *viz.*, pod length (0.378 and 1.612), pod bearing length (0.493 and 1.043), secondary branches (0.314 and 0.935) and number of pods per plant (0.362 and 0.539). It indicates that, emphasis can be laid on these four characters during selection of genotypes for improvement of yield. The results are in conformity with reports of Baskaran and Muthiah (2007), Chandirakala and Subbaraman (2010) and Bhadru (2011). Eventhough low rate (0.10 to 0.19) of positive direct effect was observed for plant height (0.142 and 0.003) and primary branches (0.182 and 0.155) at genotypic and phenotypic level, it is also a important trait for yield improvement. The present findings are in agreement with results of Thanki and Sawargaonkar (2010) for pods per plant, Jaggal (2012) for days to 50% flowering observed direct contribution of branches per plant. Patel and Acharya (2011) obtained high positive direct effects on yield *via* number of pods per plant and low rate of positive direct effects through plant height, branches per plant and 100 seed weight. While days to flower intiation (-0.081) at genotypic level and days to 50% flowering (-0.032), number of seeds per pod (-1.438) and 100 seed weight (-0.674) at phenotypic level had negative direct effect on seed yield and days to maturity (-0.112 and -0.460) registered negative direct effects on yield both at genotypic and phenotypic level, indicating this trait is not the criteria for yield improvement. Bhadru (2011) observed negative direct effect of day's maturity.

The high indirect effects of pod length *via* number of seeds per pod, 100 seed weight, plant height and days to flower initiation at phenotypic level are the indication of its importance. Similar results were obtained by Salunke *et al.* (1995). Indirect contribution of pod length through number of seeds per pod, 100 seed weight, plant height and days to flower initiation was negative and of moderate magnitude. It clearly indicated that increase in the pod length resulted in decrease in the number of seeds per pod, 100 seed weight, plant height and days to flower initiation. Such findings were earlier reported by Salunke *et al*. (1995). In plant breeding, it is very difficult to have complete knowledge of all component traits of yield. The residual effect permits precise explanation about the pattern of interaction of other possible components of yield. In other words, residual effect measures the role of other possible independent variables were not included in the study on the dependant variable. Relatively moderate, positive residual values of R = 0.270 and 0.250 was observed at genotypic and phenotypic level, respectively. It indicates the moderate unexplained variation and characters included in the present study accounted for most of the variation.

From the present study, it can be concluded that on the basis *per se* performance for seed yield per plant, the genotype RVK 275, RVK 285, JKM189, BDN 2008-12, AKT 9913 were found promising as they showed high value for grain yield per plant and its components. Path analysis revealed that pod length, pod bearing length, secondary branches, number of pods per plant, primary branches and plant height showed highest positive direct effects on seed yield both at genotypic and phenotypic level. Hence, emphasis should be placed on these characters while breeding for high yield in pigeonpea.

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