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## Genetic variability assessment in vegetable cowpea [*Vigna unguiculata* (L.) Walp.] Genotypes

**Pratishtha Diwaker, MK Sharma, Ayush Diwaker, Pushendra Singh, Komal Bhadala and Suman Meena**

### Abstract

The present investigation was carried out to estimate genetic variability among 27 genotypes of vegetable cowpea for fifteen characters comprised of pod yield and its contributing characters. These genotypes were planted in Randomized Block Design with three replications during *Kharif*, 2016 -17 at Horticulture Farm, S.K.N. College of Agriculture, Jobner. Based on mean values with respect to characters, the highest yielder genotype is Kashi Nidhi followed by Kashi Kanchan, Kashi Shaymal and Kashi Unnati per plant basis. These genotypes might be utilized as potent parents in a breeding programme. Analysis of variance revealed highly significant differences among the genotypes for all the characters. The highest GCV and PCV were recorded for plant height at 45 days followed by pod length. High heritability along with high genetic gain was observed for plant height at 45 days, nitrogen content in pod, protein content in pod, pod length, number of pods per cluster, number of primary branches per plant, days to first pickings, pod yield quintal per hectare, pod yield per plant, number of clusters per plant, days to 50 per cent flowering and leaf area. Therefore, these characters can aid in selection programme.

**Keywords:** vegetable cowpea, variability, heritability and genetic advance

### Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is an annual, autogamous leguminous vegetable crop of India belongs to family leguminosae (Mackie and Smith, 1935) <sup>[1]</sup> with a chromosome number of  $2n=2x=22$  (Darlington and Wylie, 1955) <sup>[2]</sup>.

Its young leaves, pods and grains contain vitamins and minerals which have fuelled its usage for human consumption and animal feeding (Nielson *et al.*, 1997) <sup>[3]</sup>. It is considered as one of the oldest legumes and referred as "Poor man's meat" because of its high protein (20-25 %) source for human and livestock (Steele, 1972) <sup>[4]</sup>.

It has multipurpose use such as green pods for vegetable, seed as pulse and leaves and foliage for fodder purpose, that's why it is an important crop of the arid and humid tropics. It is a drought tolerant crop and thrives in warm weather (21- 35°C) and well adapted to the drier regions of the tropics, where other food legumes do not perform well.

The green tender pods contain moisture 84.6 per cent, protein 4.3 per cent, carbohydrate 8.0 per cent, fats 0.2 per cent and are also rich source of calcium, phosphorus and iron (Aykroyd, 1963) <sup>[5]</sup>. The area occupied by Kharif pulses in Rajasthan was (Kharif, 2016-2017) 41,00379 hectare, with the production and yield of 18,77389 tonnes and 458 kg per hectare, respectively, out of which the cowpea occupied 88,592 hectare area, producing 64,802 tonnes of dry seeds with a yield of 731 kg per hectare (Anonymous, 2016) <sup>[6]</sup>.

There are several diverse uses of cowpea due to which the varietal requirement in terms of plant type, pod type, maturity, pattern of use and growth are required to develop to suit the diverse regions of the country. Therefore, in cowpea selection and evaluation programme has become more complex and no single variety can be recommended to full fill all the objectives (Barrett, 1987) <sup>[7]</sup>. Thus, there is a growing need to develop suitable varieties for a specific region and or use. However, production is constrained by low and variable pod yield, pod quality, susceptibility to diseases and pests and the less availability of improved cultivars. Under such circumstances genetic diversity is of great importance and plays a crucial role in focusing crop improvement programme.

Thus, the present investigation aim to assess the genetic variability analysis in 27 genotypes of vegetable cowpea under study to achieve the target and provides a strong basis for selection of desirable genotypes for augmentation of yield and other yield attributing characters.

### Materials and Method.

The present investigation was carried out at Horticultre Farm, S.K.N College of Agriculture, Sri Karan Narendra Agriculute University, Jobner, Rajasthan during the *Kharif* season of the year 2016-17. The experimental material for the present study consisted of 27 promising genotypes of vegetable cowpea collected from different State Agricultural Universities, ICAR Research Institutes and the collection was maintained for study at S.K.N. College of Agriculture, Jobner, (Jaipur). The experiment was laid out in Randomized Block Design with three replications of each genotype. Layout of plan showed in plate 1. Two rows of each genotype were sown at spacing of 45x 15 cm in a plot of size is 3.0 x 0.9 m<sup>2</sup>.

### Results and Discussion

#### Mean performance

The mean performance and range of the 27 genotypes for all the fifteen characters are presented in the Table 1 and 2. Variation also depicted pictorially in plate 2,3 and 4.

#### Plant height at 45 days (cm)

The data pertaining to the plant height at 45 days have been depicted in Table 1. Plant height of different vegetable cowpea genotypes varied from 17.87 to 188.87 cm with an overall mean of 72.94 cm. The maximum plant height was recorded in genotype KVCP-16 (188.87 cm) followed by Arka Mangala (180.01 cm), Divya-1 (147.27 cm) and VRC-432 (141.20 cm) while the genotype VRC-436 (17.87 cm) exhibited minimum plant height.

#### Number of primary branches per plant

The data pertaining to number of primary branches per plant depicted in Table 1. Number of primary branches per plant ranged from 2.33 to 5.00 with an overall mean of 3.35. The maximum number of branches per plant were recorded in genotype RGC-1 (5.00) followed by KPC-3 (4.50), Divya-1 (4.4) and Kashi Kanchan (4.30) while, the genotype Kashi Unnati (2.33) exhibited minimum number of primary branches per plant.

#### Leaf area (cm<sup>2</sup>)

The data pertaining to leaf area depicted in Table 1. The results obtained from the present study indicated that leaf area of vegetable cowpea at 45 DAS varied from 56.02 to 23.85

cm<sup>2</sup> with an overall mean of 37.44 cm<sup>2</sup>. The maximum leaf area was recorded in genotype Cowpea-263 (56.02 cm<sup>2</sup>) followed by Arka Garima (53.73 cm<sup>2</sup>), Sailani (47.05 cm<sup>2</sup>) and VRC-437 (46.75 cm<sup>2</sup>) while, the genotype VRC-442 (23.85 cm<sup>2</sup>) exhibited minimum leaf area.

#### Days to 50 per cent flowering

The data pertaining to days to 50 per cent flowering depicted in Table 1. The days taken to 50 per cent flowering in different genotypes varied from 34.50 to 59.67 days with an overall mean of 43.09. Maximum days to 50 per cent flowering is exhibited by genotype IC-556636 (59.67) respectively followed by VRC-442 (55.00) and RGC-1 (55.00) whereas, earliest flowering is exhibited by Kashi Nidhi (34.50).

#### Days to first picking

The data pertaining to days to first picking depicted in Table 1. Days to first picking varied from 40 to 67.33 days with an overall mean of 50. Genotype Kashi Unnati was the earliest in producing pods for first picking in (40.00) days followed by Kashi Nidhi (40.33) and Divya-1 (41.67). However genotype IC-556636 resulted in late picking (67.33).

#### Number of pickings

The data pertaining to number of pickings depicted in Table 1. The number of pickings ranged from 6.83 to 9.83 with an overall mean value of 7.94. The maximum number of pickings were recorded in genotype Divya-1(9.83) followed by Arka Mangala (9.33), Kashi Nidhi (9.33), Kashi Gauri (9.33) wheareas minimum number of pickings were recorded in AVCP-1(6.83) and Kashi Kanchan (6.83).

#### Number of clusters per plant

The data pertaining to number of cluster per plant depicted in Table 1. The number of clusters per plant ranged from 6.3 to 16.9 with an overall mean of 12.18. The genotype Kashi Unnati showed maximum number of clusters per plant (16.9) followed by Kashi Gauri (16.6) and Kashi Kanchan (16.5) while genotype Sailani exhibited lowest number of clusters (6.3).

#### Number of pods per cluster

The data pertaining to number of pods per cluster depicted in Table 1. Number of pods per cluster varied from 1.02 to 2.84 with an overall mean 1.59. The maximum number of pods per clusters were recorded in genotype Sailani (2.84) followed by Pant lobiya (2.64), RGC-1 (2.33) and minimum were noted in Kashi Nidhi (1.02).

**Table 1:** Mean values for yield attributing traits in vegetable cowpea

S. No	Genotypes	Plant height at 45 days (cm)	Number of primary branches/ plant	Leaf area(cm <sup>2</sup> )	Days to 50% flowering	Days to first picking	Number of picking	Number of clusters/plant	Number of pods cluster
1	AVCP-1	48.73	3.20	36.00	47.50	54.00	6.83	9.90	1.95
2	Baramasi	27.23	2.80	37.07	44.67	51.00	7.67	11.70	1.83
3	Arka Suman	44.13	3.47	37.46	47.93	56.00	7.83	11.82	1.59
4	Arka Mangala	180.00	2.40	41.97	48.50	55.00	9.33	14.05	1.40
5	Arka Garima	80.75	2.80	53.73	49.00	56.33	8.17	12.70	1.54
6	Sailani	116.07	3.13	47.05	43.50	51.00	8.33	6.30	2.84
7	Cowpea -263	50.47	3.27	56.02	36.40	44.67	7.17	12.60	1.40
8	Kashi Nidhi	55.53	3.16	35.95	34.50	40.33	9.33	15.73	1.02
9	Kashi Kanchan	52.00	4.30	44.92	36.00	43.00	6.83	16.50	1.03
10	Kashi	50.47	3.07	37.47	36.00	44.67	8.33	14.60	1.20

	Shaymal								
11	Kashi Unnati	32.47	2.33	31.67	34.53	40.00	7.17	16.90	1.11
12	Kashi Gauri	22.00	2.80	28.52	42.67	48.00	9.33	16.60	1.16
13	Pant lobiya	29.27	2.73	36.67	41.67	48.33	7.83	7.20	2.64
14	Pusa Komal	34.27	2.73	24.72	39.50	46.00	7.67	8.79	2.14
15	VRC-436	17.87	2.60	32.74	38.33	45.00	7.17	8.10	2.29
16	KVCP-16	188.87	4.00	29.42	49.83	55.67	7.33	12.60	1.31
17	IC-556636	39.87	3.60	34.71	59.67	67.33	7.17	13.50	1.17
18	VRC-442	36.00	3.47	23.85	55.00	62.00	7.67	13.50	1.44
19	KPC-3	45.13	4.50	37.21	42.00	49.00	7.83	10.47	1.24
20	VRC-432	141.20	3.40	28.20	38.00	46.00	8.33	14.40	1.18
21	NDCP-8	23.20	3.73	38.71	38.00	44.00	8.17	8.10	1.95
22	RGC-1	28.80	5.00	37.72	55.00	62.67	7.33	8.10	2.33
23	KVCP-70	112.00	2.40	31.49	40.00	47.33	7.00	14.20	1.12
24	VRC-431	137.27	4.07	33.91	40.00	46.00	8.00	12.60	1.52
25	VRC-437	131.80	4.20	46.75	42.00	49.00	8.50	11.70	1.59
26	KPC-8	96.60	2.80	46.17	48.00	56.00	8.33	11.70	1.64
27	Divya-1	147.27	4.40	40.74	35.33	41.67	9.83	14.40	1.29
	GM	72.94	3.35	37.44	43.09	50.00	7.94	12.18	1.59

### Number of pods per plant

The data pertaining to number of pods per plant depicted in Table 2. Number of pods per plant varied from 21.45 to 12.98 with an overall mean of 18.03. Maximum number of pods per plant recorded in Baramasi (21.45) followed by Arka Mangala (19.77) and Arka Garima (19.46) while minimum number of pods per plant were exhibited by KPC-3 (12.98).

### Pod length (cm)

The data pertaining to pod length depicted in Table 2. The pod length of different genotypes recorded in the range of 9.63 to 36.24 cm with an overall mean of 18.12. The maximum length of pod recorded in genotype Kashi Nidhi (36.24 cm) followed by Kashi Kanchan (29.83 cm) and Kashi Shyamal (29.49 cm) whereas, genotype Sailani, KPC-3 and KVCP-70 recorded minimum pod length (9.63 cm).

### Pod yield per plant (g)

The data pertaining to pod yield per plant depicted in Table 2. Among the tested genotypes pod yield per plant varied between 46.02 to 111.39 g with an overall mean of 80.51. The maximum green pod yield recorded in genotype Kashi Nidhi (111.39 g) followed by Kashi Kanchan (105.02 g), Kashi Shaymal (101.48 g) and Kashi Unnati (101.48 g) while minimum pod yield per plant recorded in KPC-3 (46.02 g).

### Pod yield quintal per hectare

The data pertaining to pod yield quintal per hectare depicted in Table 2. Among the tested genotypes pod yield (q/ha) varied between 68.17 to 165.03 quintal per hectare with an overall mean of 119.27. The maximum green pod yield recorded in genotype Kashi Nidhi (165.03 q/ha) followed by

Kashi Kanchan (155.58 q/ha), Kashi Shaymal (150.33 q/ha) and Kashi Unnati (150.33 q/ha). Whereas, minimum yield quintal per hectare was recorded in KPC-3 (68.17 q/ha).

### TSS content in pods (%)

The data pertaining to TSS content in pods depicted in Table 2. The TSS content in pods ranged from 5.33 to 3.33 % with an overall mean of 4.37. The maximum TSS content was recorded in genotype VRC-436 (5.33 %). However, minimum TSS content in pod recorded in genotype Arka Suman (3.33%), Arka Mangala (3.33%), Kashi Gauri (3.33%) and VRC-442 (3.33%).

### Nitrogen content in pod (%)

The data pertaining to nitrogen content in pods depicted in Table 2. The nitrogen content in pod ranged from 0.38 to 0.69 per cent with an overall mean of 0.46. The maximum nitrogen content recorded in genotype IC-556636 (0.69 %) followed by VRC-436 (0.67 %), Arka Mangala (0.66 %) and KVCP-16 (0.65 %), whereas minimum nitrogen content in genotype AVCP-1 (0.38 %), KPC-3 (0.38 %), VRC-432 (0.38 %) and KPC-8 (0.38 %).

### Protein content in pod (%)

The data pertaining to protein content in pod depicted in Table 2. The protein content in pod varied from 2.40 to 4.29 per cent with an overall mean of 2.85. The maximum protein content was recorded in genotype IC-556636 (4.29 %) followed by VRC-436 (4.19 %), Arka Mangala (4.11 %) and KVCP-16 (4.03 %) whereas, minimum protein content recorded in genotype AVCP-1 (2.40 %), KPC-3 (2.40 %), VRC-432 (2.40 %) and KPC-8 (2.40 %).

**Table 2:** Mean values for pod yield and quality attributing traits in vegetable cowpea

S. No	Genotypes	Number of pods/plant	Pod length (cm)	Pod yield/plant (g)	Pod yield q/ha	TSS (%)	Nitrogen content in pod (%)	Protein content in pod (%)
1	AVCP-1	19.29	16.56	82.01	121.50	4.33	0.38	2.40
2	Baramasi	21.45	26.50	100.89	149.46	4.00	0.60	3.73
3	Arka Suman	18.72	17.50	82.01	121.49	3.33	0.61	3.83
4	Arka Mangala	19.77	15.30	81.42	120.62	3.33	0.66	4.11
5	Arka Garima	19.46	21.00	88.26	130.75	5.00	0.64	4.02
6	Sailani	17.93	9.63	60.77	90.03	4.67	0.41	2.55
7	Cowpea -263	17.53	9.72	60.77	90.02	4.00	0.49	3.04
8	Kashi Nidhi	16.04	36.24	111.39	165.03	5.00	0.64	3.98
9	Kashi Kanchan	16.99	29.83	105.02	155.58	4.00	0.42	2.60
10	Kashi	17.52	29.49	101.48	150.33	4.33	0.56	3.52

	Shaymal							
11	Kashi Unnati	18.78	28.47	101.48	150.33	4.00	0.64	3.97
12	Kashi Gauri	19.25	25.40	99.59	147.54	3.33	0.54	3.35
13	Pant lobiya	18.98	20.53	83.78	124.12	4.33	0.42	2.65
14	Pusa Komal	18.85	20.00	83.78	124.11	4.67	0.45	2.80
15	VRC-436	18.56	18.88	82.60	122.37	5.33	0.67	4.19
16	KVCP-16	16.51	12.92	68.44	101.40	4.67	0.65	4.03
17	IC-556636	15.80	10.58	64.90	96.15	4.33	0.69	4.29
18	VRC-442	19.42	15.26	80.24	118.88	3.33	0.39	2.45
19	KPC-3	12.98	9.63	46.02	68.17	4.33	0.38	2.40
20	VRC-432	16.99	12.92	69.62	103.14	4.67	0.38	2.40
21	NDCP-8	15.80	10.58	63.72	94.40	5.00	0.39	2.45
22	RGC-1	18.84	15.26	79.06	117.13	4.67	0.39	2.45
23	KVCP-70	15.95	9.63	53.69	79.54	4.67	0.42	2.60
24	VRC-431	19.15	16.33	80.01	118.53	5.00	0.43	2.70
25	VRC-437	18.64	15.00	77.88	115.37	4.33	0.63	3.92
26	KPC-8	19.19	23.18	88.26	130.75	5.00	0.38	2.40
27	Divya-1	18.55	12.92	76.70	113.63	4.33	0.48	3.00
	GM	18.03	18.12	80.51	119.27	4.37	0.46	2.85



Plate :- 1 General view of experimental field



Plate :- 2 Variation in pod colour and length of vegetable cowpea genotypes



Plate :- 3 Variation in seed colour of vegetable cowpea genotypes

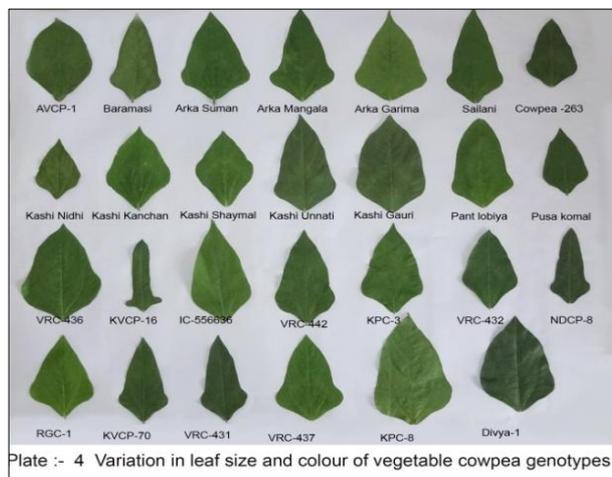


Plate :- 4 Variation in leaf size and colour of vegetable cowpea genotypes

### Parameters of genetic variability

The range, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability, genetic advance and genetic gain are given in Table 3.

### Genotypic Coefficient of Variation (GCV)

The highest genotypic coefficient of variation (more than 20) recorded for plant height at 45 days (71.23) followed by pod length (40.24), number of pods per cluster (31.20), number of clusters per plant (24.16), nitrogen content in pod (22.23), protein content in pod (22.23), number of primary branches per plant (21.38), leaf area (20.71), pod yield per plant (20.00), pod yield per hectare (20.00) and moderate (between 10 to 20) for days to 50 per cent flowering (15.52) days to first picking (13.96), TSS content in pod (11.27) and low

genotypic coefficient of variation (less than 10) recorded for number of pickings (9.53) and number of pods per plant (8.29). These results are in broad conformity to earlier researchers Pathak and Jamwal (2002) [8] and Venkatesan *et al.* (2003) [9].

### Phenotypic Coefficient of Variation (PCV)

The PCV ranged from 71.38 to 11.49 and recorded high (more than 20%) for plant height at 45 days (71.38) followed by pod length (40.56), number of pods per cluster (31.75), number of clusters per plant (24.99), nitrogen content in pod (22.34), protein content in pod (22.34), leaf area (22.30), number of primary branches per plant (21.81), pod yield per plant (20.53), pod yield per hectare (20.53), and moderate (between 10 to 20) for days to 50 per cent flowering (16.27), TSS content in pods (15.72), days to first picking (14.28), number of pods per plant (11.68), and number of pickings (11.49). These results are in broad conformity to earlier researchers Nigude *et al.* [10] and Pal *et al.* (2003) [11].

### Heritability ( $h^2$ )

A wide range of heritability (50.39 to 99.58 %) observed for the characters under study. High values of heritability (more than 60 %) observed for plant height at 45 days (99.58 %) followed by nitrogen content in pod (99.03 %), protein content in pod (99.03 %), pod length (98.43 %), number of pods per cluster (96.55 %), number of primary branches per plant (96.13 %), days to first pickings (95.56 %), pod yield (94.91 %), pod yield per plant (94.91 %) number of clusters per plant (93.49), days to 50 per cent flowering (91.04 %), leaf area (86.30 %), number of pickings (68.81 %), whereas moderate heritability (between 30 to 60 %) was obtained for TSS content in pod (51.41%) and number of pods per plant (50.39 %). Similar findings were reported by Borah and Khan (2000) [12] and Sapara *et al.* [13].

### Genetic Advance

The high value of genetic advance (more than 20) was recorded for the characters plant height at 45 days after sowing (106.79), pod yield (47.88), pod yield per plant (32.32) and moderate (between 10 to 20) exhibited by pod length (14.90), leaf area (14.84), days to first picking (14.05), days to 50 per cent flowering (13.15) and low genetic advance (less than 10) exhibited by number of clusters per plant (5.86), number of pods per plant (2.18), number of primary branches per plant (1.44), protein content in pod (1.44), number of pickings (1.29), number of pods per cluster (1.00), TSS (0.73), nitrogen content in pod (0.23). Similar findings were reported by Santosh *et al.* (2002) [14].

### Genetic gain

The high value of genetic gain (more than 20 %) was recorded for the characters plant height at 45 days (146.43 %), pod length (82.25 %), number of pods per cluster (63.16 %), number of clusters per plant (48.14 %), protein content of pod (45.58 %), nitrogen content in pod (45.58 %), number of primary branches per plant (43.19 %), pod yield per plant (40.15 %), pod yield per hectare (40.15 %), leaf area (39.64 %), days to 50 per cent flowering (30.51 %), days to first picking (28.14 %), TSS content in pod (16.65 %), and number of pickings (16.28 %) and number of pods per plant (12.13 %). Similar findings were reported by Idahosa *et al.* (2010) [15].

**Table 3:** Variability parameters for different characters of vegetable cowpea

S. No	Characters	Range	Mean	GCV	PCV	h <sup>2</sup>	GA	GG
1	Plant height at 45 days (cm)	118.87-17.87	72.94	71.23	71.38	99.58	106.79	146.43
2	Number of primary branches/ plant	5.0-2.33	3.35	21.38	21.81	96.13	1.44	43.19
3	Leaf area (cm <sup>2</sup> )	56.02-23.85	37.44	20.71	22.30	86.30	14.84	39.64
4	Days to 50% flowering	59.67-34.5	43.09	15.52	16.27	91.04	13.15	30.51
5	Days to first pickings	67.33-40.0	50.00	13.96	14.28	95.56	14.05	28.10
6	Number of pickings	9.83-6.83	7.94	9.53	11.49	68.81	1.29	16.28
7	Number of clusters/ plant	16.9-6.3	12.18	24.16	24.99	93.49	5.86	48.14
8	Number of pods/ cluster	2.84-1.02	1.59	31.20	31.75	96.55	1.00	63.16
9	Number of pods/ plant	21.45-12.98	18.03	8.29	11.68	50.39	2.18	12.13
10	Pod length (cm)	36.24-9.63	18.12	40.24	40.56	98.43	14.90	82.25
11	Pod yield/ plant (g)	111.39-46.02	80.51	20.00	20.53	94.91	32.32	40.15
12	Pod yield (q/ha)	165.03-68.17	119.27	20.00	20.53	94.91	47.88	40.15
13	TSS (%)	5.33-3.33	4.37	11.27	15.72	51.41	0.73	16.650
14	Nitrogen content in pod (%)	0.69-0.38	0.46	22.23	22.34	99.03	0.23	45.58
15	Protein content in pod (%)	4.2-2.4	2.85	22.23	22.34	99.03	1.44	45.58

### Conclusion

Analysis of variance revealed highly significant differences among the genotypes for all the characters showing thereby considerable amount of genetic variability for all the characters and were amenable to improvement. High heritability along with high genetic gain was observed for plant height at 45 days, nitrogen content in pod, protein content in pod, pod length, number of pods per cluster, number of primary branches per plant, days to first pickings, pod yield quintal per hectare, pod yield per plant, number of clusters per plant, days to 50 per cent flowering and leaf area. Therefore, these characters can aid in selection programme.

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