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Performance of cowpea (*Vigna unguiculata*) genotypes in Kymore plateau and Satpura Hills of Madhya Pradesh

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Abstract

The experimental material comprised of fifteen genotypes of cowpea including two checks *viz.* Kashi Kanchn and Arka Garima received from AICRP on Vegetable Crops, IIVR, Varanasi. The objective of the experiment was to identify suitable genotypes to be used as cultivar in Kymore plateau and Satpura Hillsof Madhya Pradesh. The analysis of variance revealed significant differences between genotypes indicating presence of sufficient amount of variability in all the characters studied. Wide range of variability was observed for days to first flowering, days to 50% flowering, number of inflorescences per plant, number of pods per inflorescence, pod yield per plant, number of pods per plant and days to last pod harvest indicating the scope for selection of suitable initial breeding material for further improvement. On the basis of the mean performance of the genotypes among traits studied, the following were identified as promising lines for further crop improvement in cowpea viz., 2012/COPBVAR-6, 2014/COPBVAR-6 and 2014/COPBVAR-5. Among all the genotypes studied, genotype2012/COPBVAR-6 recorded the highest pod yield per plant and found suitable to the local agro-climatic conditions.

Key words: Cowpea, Genotypes, Variability, Mean performance, *Vignaunguiculata*

Introduction

Cowpea [*Vignaunguiculata* (L) Walp.] a legume, is one of the most ancient crops known to man. It belongs to the family Papilionaceae and sub family Fabaceae. Its primary center of origin is Africa. It is widely adopted and grown all over the world. Immature cowpea green

pods are commonly referred to as southern pea, black eye pea, crowder pea, lobia, niebe, caupi or frijole. The name "cowpea" probably derives from when, it was an important livestock feed for cows in the United States. Among the different pulses grown in the world, this crop can be grown in kharif and summer season in North India, while, in South India it is grown throughout the year. Cowpea is grown in small scale throughout the country for long green pods as a vegetable, seeds as pulses and foliage as fodder for animals. In India, the cowpea is grown in an area of about 3.9 million ha with a production of 2.2 million tonnes having a productivity of 564 kg seed ha^{-1} (Shivnandam 2005; Samadia 2016). In Madhya Pradesh it's covering area and production is very minor. Cowpea plant is herbaceous, warm season, annual requiring temperature of at least $18^{o}C$ thought all stage of development and having an optimal growing temperature about $28^{o}C$. Cowpea is rich in nutritional content as green pod of cowpea contains 85 g moisture, 3 g protein, 1 g minerals, 2.0 g fiber, 8.0 g carbohydrates, 72 mg calcium, 59 mg phosphorus, 2 mg iron, 0.09 mg riboflavin and 0.07 mg thiamin per 100 g of edible portion (Ananomus 2011).

The development of cultivars with early maturity, acceptable grain quality, resistance to some important diseases and pests has significantly increased the yield and cultivars area (Ehlers & Hall 1997).Yield being a complex trait, is influenced by many other important yield contributing characters controlled by polygene and also environment factors. So, in these characters, observed variability is the sum total of hereditary effects of concerned genes plus the influence of the environment. In any crop improvement program, basic information with respect to variability present in the crop is essential. There is no single variety/cultivar which has occupied a large area in Madhya Pradesh. Only local types, traditional farmer collections and cultivars are being cultivated. The consumer preference also varies with respect to pod size, shape and colour. The efforts of improving the crop by utilizing indigenous and exotic germplasm have been useful in breaking the yield barriers (Shivashankar et al. 1993) resulting in developing compact plant type with reduced duration and photo-insensitivity.There is great scope for genetic improvement in cowpea with regards to yield and quality. Keeping in view of the above point the present investigation was taken to evaluate and identify suitable genotypes of cowpea for Kymore plateau and Satpura Hills of Madhya Pradesh.

Materials and methods

The experiment was conducted at Horticulture complex, Department of Horticulture

J.N.K.V.V. Jabalpur (M.P.) during the Kharif season of 2014-15.Jabalpur is situated in "Kymore plateau and Satpura Hills" agro-climatic region of Madhya Pradesh. It falls on 23.9° North latitude and 79.58° East longitudes with an altitude of 411.8 meters above mean sea level. The tropic of cancer passes through the middle of the district. Jabalpur is situated in the semi-arid region having sub-tropical climate with cool winter and hot dry summer. The average annual rainfall is about 1375 mm, which is mainly distributed from the mid June to first week of October from South West monsoon, with occasional rainfall during winter. The mean relative humidity reaches up to 74 per cent during winter (November-February) with occasional frost. The average minimum and maximum temperature ranged from 6.8 °C to 46.6 °C. The experimental material for this study comprised of fifteen genotypes including two checks collected from different research institutes. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Each replication consisted of fifteengenotypes. All the genotypes were randomized separately in each replication. All the growth and yield parameters were recorded in each treatment from five randomly selected plants. The data based on the mean of individual plants selected for observation were statistically analyzed described by Panse and Sukhatme (1967) to find out overall total variability present in the material under study for each character and for all the populations.

Results and Discussion

During the investigation, out of the twelve characters under consideration, plant height, number of primary branches and number of secondary branches per plant are considered as growth attributes. Days to first flowering, days to 50 per cent flowering, days to first pod harvest and days to last pod harvest are the earliness attributes. Number of inflorescences per plant and number of pods per inflorescence are considered as flower attributes. Pod length, pod width, number of pods per plant and number of seeds per pod are regarded as pod attributes, while hundred seed weight and protein content are the seed attributes. Among the growth attributes, greater plant height and more number of secondary branches are preferable. Similarly, among the flower attributes, more number of inflorescences per plant and more number of pods per inflorescence are desirable (Verma et al. 2014). For earliness, lesser number of days to first flowering, days to 50 per cent flowering and days to first pod harvest are desirable, whereas more number of days to last pod harvest is preferable in cowpea for getting high yield. Among the pod attributes, lengthy pods with medium pod width, more number of seeds per pod and more number of pods per plant are preferable, while other attributes like more hundred seed weight and higher protein content are desirable for the consumer acceptance in cowpea. The estimates of mean sum of square due to genotypes were highly significant for all the characters, indicating the presence of genetic diversity in the existing material (Table 1). The findings of Rangaiah and Mahadevu (2000), Venkatesan et al.

(2003)**,** Girish et al. (2006), Lal et al. (2007), Eswaran et al. (2007), Bertini et al. (2009), Pandeyand Singh (2011), Manggoel et al. (2012) are similar to that of the present findings.

Table 1. Analysis of variance for eighteen quantitative traits in genotypes of cowpea

S. No.	Character	Mean sum of squares		
		Replications (df = 2)	Treatments (df = 14)	Error (df = 28)
1.	Days to 50% flowering	1.622	9.612**	1.717
2.	Number of flowers/cluster	0.067	1.776**	0.094
3.	Number of clusters/plant	22.427	343.897**	10.611
4.	Days to first harvest	5.403	17.229**	1.898
5.	Number of pods per cluster	0.206	1.049**	0.065
6.	Number of pods per plant	28.466	770.133**	21.585
7.	Pod length (cm)	1.931	86.974**	0.501
8.	Pod width (cm)	0.003	0.071**	0.002
9.	Pod weight (g)	27.755	379.89**	10.731
10.	Number of seeds/pod	0.962	5.165**	0.610
11.	Pod yield per plant (g)	173.422	2118.927**	295.565
12.	Pod yield per ha (q)	127.827	660.987**	83.183

** = significant at 5% level of significance

The mean performance of the genotypes (Table 2) revealed a wide range of variability for all the traits. The variation was highest for pod yield plant^{-1} (153 - 240 g), followed by pod yield ha^{-1} (85.13 - 134.39 q), number of pods plant^{-1} (29.33 - 77.00), number of flower cluster plant^{-1} (11.90 - 49.66), pod weight (28.33 - 63.0 g), pod length (14.87 - 33.28 cm), days to first picking (80.00 - 90.67 days), days to 50 per cent flowering (64.00 - 70.00 days), days to first flowering (55.33 - 59.33 days), number of flower cluster^{-1} (2.93 - 5.53), number of pods cluster^{-1}(1.53 - 3.46). The findings were quite similar to as reported by Kalaiyarasi et al. (2000) observed variability for number of pods plant^{-1}, number of seeds pod^{-1} and plant height. Bezerra et al. (2001) found wide range of variability for days to first flowering, number of pods plant^{-1}, pod length and number of seeds pod^{-1}. Pathak & Jamwal (2002) reported variation for pod yield plant^{-1}, number of days to 50 per cent flowering and plant height. It was low for number of days to first picking, pod length and average pod weight. Narayanankutty et al. (2003) found variation for pod yield and pods plant^{-1} and weight of pod. Nigude et al. (2004) reported that variation was higher for plant height and number of pods plant^{-1}. Malarvizhi et al. (2005) studied variability for days to 50 per cent flowering, plant height andnumber of branches plant^{-1}. Girish et al. (2006) studied wide range of variability

for number of pods plant^{-1} and plant height. Eswaran et al. (2007) revealed that high estimates of genetic variability were observed for plant height at the time of first flowering, plant height at the time of 50 per cent flowering and plant height at the time of 50 per cent maturity. Suganthi et al. (2008) reported that variation was higher for number of pods plant^{-1} and number of cluster plant^{-1}. Bertini et al. (2009) found that time to first flowering, number of pods plant^{-1}, total production ha^{-1} (q) and production plant^{-1} (g) in different cultivars showed high levels of genetic variability. Pandey and Singh (2011) reported that significant differences for days to first flowering, pods plant^{-1}, pod length and number of seeds pod^{-1}.Manggoel et al. (2012) observed significant variability for days to 50 per cent flowering, flowers plant^{-1} and pods plant^{-1}. Om vir & singh (2014) revealed highdegree of genetic variability for number of seeds pod^{-1}, number of pods plant^{-1}, number of pods cluster^{-1}, number of branches plant^{-1}, number of cluster plant^{-1}, plant height and number of days to 50 per cent flowering. Pal et al. (2014) reported high variation number of clusters plant^{-1} and pod length. It was low for traits days to flower initiation and days to 50 per cent flowering.

Out of fifteen genotypes, 2012/COPBVAR-6 recorded significantly the highest marketable pod yield per plant followed by 2014/COPBVAR-6 and 2014/COPBVAR-5 than the commercial checks Kashi Kanchan and Arka Garima. Other attributes like number of inflorescence per plant, number of pods per inflorescence, number of pods per plant, days to last pod harvest, pod width and hundred seed weight were also higher in the genotype. Hence these can be selected for further evaluation and directly released as a variety.Genotypes 2012/COPBVAR-6, 2014/COPBVAR-6, 2014/COPBVAR-5, 2014/COPBVAR-1 and Gomti recorded significantly better performance for marketable pod yield per plant than the checks and recorded the highest number of pods per plant. Hence, the genotypes 2012/COPBVAR-6, 2014/COPBVAR-6, 2014/COPBVAR-5, 2014/COPBVAR-1 can be selected for further improvement. Among the other genotypes, 2014/COPBVAR-3 and Kashi Kanchan were the earliest in flowering as well as in harvesting suggesting that these genotypes can be identified and used as a parent for developing early variety. Genotype 2012/COPBVAR-3 produced the highest seeds per pod, pod length, and average pod weight. Genotype 2014/COPBVAR-3 recorded significantly the highest number of flowers per cluster and pods per cluster. Hence, these genotypes can be used as donor parents for the respective characters (Verma et al. 2014).

Based on the findings of the present investigation, the conclusion drawn for further improvement of cowpea genotypes is that there is a need to evaluate these high yielding genotypes in large plots and over locations in Kymore plateau and Satpura Hills of Madhya Pradesh for their commercial utilization. A large number of pests and diseases affect the crop. There is a need to systematically test the genotypes for pest and disease reaction. They can be directly selected for general cultivation after confirming their performance in large plots across environments.

Table 2. Mean performance of growth and yield characters of cowpea

Genotype	Days to 50% flowering	Number of flowers/ cluster	Number of clusters/plant	Days to first harvesting	Pods Cluster^{-1}	Pods Plant^{-1}	Pod Length (cm)	Pod Width (cm)	Pod Weight (g)	Seeds Pod^{-1}	Pod Yield Plant^{-1} (g)	Yield ha^{-1} (q)
2011/COPBVAR-7	64.67	4.80	11.90	78.57	1.93	29.33	20.59	0.67	49.33	12.47	153.00	85.13
2012/COPBVAR-1	67.00	3.60	19.37	74.67	1.93	35.67	23.85	0.78	48.33	10.73	173.67	96.42
2012/COPBVAR-2	67.33	3.07	37.12	78.83	1.53	75.67	17.25	0.65	30.66	11.33	215.00	118.91
2012/COPBVAR-3	66.67	2.93	18.17	78.63	1.33	30.00	33.28	0.67	63.00	13.86	186.67	103.87
2012/COPBVAR-5	68.00	3.27	25.70	80.53	1.66	39.33	32.34	0.61	45.33	12.20	176.67	97.86
2012/C0PBVAR-6	66.67	3.07	49.66	77.67	1.53	77.00	26.05	0.55	42.33	10.13	240.00	134.38
2014/COPBVAR-1	66.67	3.87	32.35	80.33	2.33	56.00	15.45	0.71	28.33	10.33	218.67	121.87
2014/COPBVAR-2	68.33	4.27	28.17	78.17	2.40	67.67	14.87	0.79	28.33	8.80	206.67	115.16
2014/COPBVAR-3	64.00	5.53	13.53	74.50	3.47	47.00	22.99	0.85	45.00	10.00	211.67	116.82
2014/COPBVAR-4	65.67	5.07	13.88	78.90	3.20	44.00	21.54	0.77	40.67	9.40	180.00	99.94
2014/COPBVAR-5	69.33	4.13	14.43	81.43	2.73	39.33	19.57	1.04	57.33	10.93	226.67	125.85
2014/COPBVR-6	70.00	3.80	19.85	84.16	2.13	42.33	21.19	0.99	56.00	11.53	236.67	130.93
Gomti	68.00	3.33	19.35	77.87	2.33	45.00	22.30	0.82	48.33	11.07	216.67	120.29
Arka Garima (C)	68.00	3.73	16.40	78.07	2.47	31.00	21.83	1.07	62.67	11.07	183.33	101.91
Kashi Kanchan (C)	64.00	4.20	12.47	77.93	2.57	32.00	27.81	0.75	53.67	12.53	170.00	93.92
S.Em±	0.76	0.18	1.88	0.80	0.15	2.68	0.41	0.03	1.89	0.45	9.93	5.27
C.D. 5%	2.19	0.51	5.45	2.30	0.43	7.77	1.18	0.08	5.48	1.31	28.75	15.25

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