

Performance of Chickpea (*Cicer arietinum* L.) Genotypes in Kolhapur Region

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Abstract

The mean performance and analysis of variance (ANOVA) was studied in a set of 40 genotypes on chickpea (*Cicer arietinum* L.). The experiment was carried out in a randomized block design with three replications during Rabi 2013-14 at Post Graduate Research Farm, College of Agriculture, Kolhapur. It is of great interest to consider the *per se* performance of different genotypes in respect of different quantitative characters of economic importance particularly earliness, number of secondary branches per plant, number of pods per plant, number of seeds per pod, 100-seed weight and grain yield. The genotype IC-83429 and IC-83327 were found to be the earliest to flower. For secondary branches per plant IC-83340, Vijay, IC-83465 and Vishal had the maximum number of branches. The genotypes which had born the maximum number of pods per plant were IC-83429, IC-83321, Vishal and IC-83348. Highest yielding genotypes were Vijay, Vishal, IC-83429, IC-83348 and IC-83391. The analysis of variance for all the characters of forty genotypes revealed highly significant differences among the genotypes studied, indicating sufficient amount of variability present among the material genotypes tested.

Highlights

- On the basis of mean performance observed in the present study the six genotypes *viz.*, IC-83429, Vishal, Vijay, IC-83340, IC-83372 and IC-83523 were found to be superior genotypes for further breeding programme.

Keywords: Chickpea, mean performance, ANOVA, characters, genotypes

Chickpea (*Cicer arietinum* L.) commonly known as chana, gram or Bengal gram, is an important and unique food legume. It is an important pulse crop of the world occupying third position amongst pulses. It is an important legume extensively cultivated in the arid and semiarid regions of India as a pulse crop. It is an important source of protein to the predominating vegetarian population of the country and used in variety of food products like snake food, sweets, condiments and vegetables. Among a dozen of different grain legumes under cultivation in India, gram is the leading crop and is

grown in Rabi season. Indian subcontinent accounts for 67% of total production of gram in the world. India is largest producer (25%), importer (20%) and consumer (27%) of Pulses in the world. In Pulses, chickpea accommodates third position in the world. In India the area under chickpea was 8.75 million ha. Production was 8.25 million tons and productivity 943 kg/ha.

Chickpea (2n=16) belongs to the sub-family papilionadeae of family *leguminosae* (Baldev 1988). It is known to be originated in Western Asia and then dispersed in two diverse directions. Large



seeded chickpea, referred to as Kabuli type, are well adapted to spring sowing from Afghanistan westwards into Middle East, Southern Europe and North Africa. Small seeded cultivars of different colours are known as desi types and are mostly planted in winter from Pakistan, eastward and also in Ethiopia, Sudan, Mexico and Chile (Aukland and Singh 1977). India is the world's biggest producer of the pulses occupying an area of 23.89 million hectares under different agro-ecological regions with an average production of 15.12 million tonnes and productivity of 638 kg per ha, which is comparatively very low to the average pulses yield (857 kg/ha) of the world.

Improvement in yield and quality of crop is the primary objective of a plant breeder. Selection of superior plants is the basis of crop improvement. The efficiency of selection depends on the identification of genetic variability from the phenotypic expression of the characters. Variability means difference among the individuals of a same or different species. The variability may be due to environment or genotypes or interaction of both the components.

Materials and methods

The present investigation entitled, "Performance of chickpea (*Cicer arietinum* L.) genotypes in Kolhapur region" was conducted at Post Graduate Research Farm, College of Agriculture, Kolhapur during *Rabi* season of 2013-14. The details of the material used, methods adopted and statistical analysis followed during the investigation are described below.

The experimental material used for study consisted of 40 genotypes of chickpea which were obtained from the Pulses Improvement Project, M.P.K.V., Rahuri. The list of genotypes is given in Table 1.

Experimental design

During *Rabi* 2013-14, 40 genotypes of chickpea were evaluated in a Randomized Block Design with three replications. Each genotype was sown in double row of 4.00 m length with spacing 30 cm between row and 10 cm within rows.

Preparation of land

A uniform piece of land was selected for laying out the experiment. The land was brought to the fine tilth by ploughing and harrowing.

Sowing and cultural practices

The land selected for the experiment was medium black which was brought to fine tilth. The fertilizer @ 25 kg N/ha in the form of urea and 50 kg P₂O₅/ha in the form of single super phosphate were applied as a basal dose at the time of sowing. In order to facilitate easy and better germination, a light irrigation was given after sowing.

The operations like thinning, weeding, hoeing and plant protection measures were carried out regularly to ensure satisfactory crop growth.

Observations

Observations on following 10 quantitative characters were recorded on five randomly selected plants from each plot in each replication. These plants were tagged before flowering. The data were recorded on days to 50 per cent flowering, days to maturity, height of the plant (cm), number of primary branches, number of secondary branches, number of pods/plant, number of seeds/pod, 100 seed weight (g), seed yield/plant (g) and protein content (%).

Statistical Analysis

Analysis of variance (ANOVA)

The analysis of variance was done as suggested by Panse and Sukhatme(1967) in following form

Sources of variation	DF	MSS	Expected mean square
Replication	(r-1)	MS _r	$\sigma_e^2 + t \sigma_r^2$
Treatment	(t-1)	MS _t	$\sigma_e^2 + r \sigma_r^2$
Error	(r-1) (t-1)	MS _e	σ_e^2
Total	(rt-1)		

Where,

r = number of replication

t = number of treatments

Results and discussion

The mean values of the genotypes for different characters studied are given in Table 1.

Days to 50 per cent flowering

The population mean for this character was 63.15 days. The variation in days to 50 per cent flowering

Table 1: Mean performance of 10 different characters in 40 genotypes of chickpea

Sr. No.	Name of genotypes	Days to 50% flowering	Days to maturity	Height of the plant (cm)	No. of primary branches	No. of secondary branches	No. of pods per plant	No. of seeds per pod	100 seed weight (g)	Seed yield per plant (g)	Protein content (%)
1	IC- 83319	55.67	109.67	53.67	4.07	11.6	60.47	1.04	15.26	10.47	21.57
2	IC- 83321	55.00	121.67	40.03	3.53	12.87	83.67	1.24	13.10	8.20	20.47
3	IC- 83327	51.67	107.67	43.97	4.00	12.47	77.33	1.12	15.50	8.55	19.91
4	IC- 83329	71.00	116.00	47.73	4.40	11.60	42.67	1.48	10.74	6.27	19.07
5	IC- 83335	57.33	112.33	34.20	3.73	14.60	55.80	1.72	11.25	7.82	22.34
6	IC- 83338	64.00	119.33	35.63	4.80	11.13	53.57	1.17	12.41	7.58	23.15
7	IC- 83340	75.00	121.33	46.87	3.87	18.67	57.53	1.36	18.98	10.12	18.25
8	IC- 83343	58.00	113.33	40.89	4.00	9.93	55.47	1.47	14.52	8.47	21.52
9	IC- 83345	67.33	111.67	40.43	4.07	12.00	53.07	1.35	16.22	5.87	19.63
10	IC- 83346	68.00	123.00	48.87	3.13	13.40	62.07	1.24	12.17	7.02	21.42
11	IC- 83348	57.33	118.33	45.57	3.27	13.07	81.67	1.35	15.45	11.33	21.70
12	IC- 83353	63.33	113.33	38.73	4.60	9.87	55.40	1.48	14.30	6.60	21.00
13	IC- 83357	68.00	113.67	37.53	4.53	11.40	48.73	1.32	12.80	4.08	21.29
14	IC- 83360	59.67	116.33	52.47	3.87	13.47	68.67	1.56	11.98	9.42	22.49
15	IC- 83367	69.00	115.33	36.00	4.67	9.80	47.93	1.43	12.03	5.82	18.93
16	IC- 83368	55.00	106.33	46.37	3.87	15.27	55.73	1.37	11.21	7.62	21.54
17	IC- 83370	56.67	116.00	41.13	4.20	8.67	42.40	1.53	12.33	7.20	22.97
18	IC- 83372	56.33	105.00	36.20	3.87	11.73	48.60	1.48	10.91	10.11	20.63
19	IC- 83374	54.33	109.33	39.63	3.53	10.67	51.10	1.43	11.33	6.79	19.93
20	IC- 83383	54.67	110.67	43.43	3.47	11.47	50.60	1.68	10.67	7.56	18.33
21	IC- 83391	76.00	116.00	44.03	3.73	11.53	55.33	1.55	10.37	10.49	22.41
22	IC- 83397	82.67	123.00	41.23	4.60	10.53	35.07	1.39	17.93	8.42	18.42
23	IC- 83406	67.33	109.67	40.53	3.47	15.07	53.93	1.60	11.22	6.47	21.33
24	IC- 83411	75.33	116.00	35.77	3.87	10.60	36.67	1.48	11.93	5.56	21.51
25	IC- 83415	53.33	112.67	49.40	3.87	10.07	74.93	1.16	16.21	9.66	23.59
26	IC- 83428	53.00	118.33	39.70	4.07	10.13	50.73	1.25	14.17	8.52	20.83
27	IC- 83429	51.67	121.00	48.03	3.73	11.93	118.00	1.09	14.75	15.52	23.03
28	IC- 83435	54.00	110.00	45.50	3.93	13.00	57.53	1.20	11.96	8.00	22.44
29	IC- 83443	56.00	109.00	38.48	4.07	11.87	63.60	1.21	14.93	9.77	19.75
30	IC- 83452	62.00	116.67	42.87	3.67	14.47	47.60	1.60	16.75	7.83	22.67
31	IC- 83465	74.33	117.67	42.83	3.40	17.13	60.53	1.63	9.93	6.73	20.93
32	IC- 83466	69.33	114.33	38.20	3.33	9.80	45.73	1.27	11.67	6.86	23.67
33	IC- 83486	59.67	113.67	44.50	4.27	10.53	54.40	1.64	16.34	7.86	20.12
34	IC- 83510	75.33	121.33	46.60	3.73	13.80	48.80	1.45	10.45	8.60	21.03
35	IC- 83523	70.67	118.33	49.83	3.80	11.40	54.67	1.79	10.66	8.00	20.35
36	IC- 83524	77.33	116.00	43.07	3.53	12.73	51.87	1.33	7.61	5.59	19.08
37	IC- 83563	58.00	112.00	36.10	3.87	9.40	51.67	1.53	11.96	7.01	18.47
38	IC- 83565	69.33	116.00	46.73	2.93	12.60	55.93	1.28	12.15	6.40	19.50
39	Vijay	66.00	118.33	46.97	4.73	17.73	76.13	1.12	17.65	20.74	19.34
40	Vishal	57.33	116.33	56.60	4.13	15.33	83.40	1.23	26.99	20.49	23.51
	Mean	63.15	114.92	43.16	3.90	12.33	58.22	1.39	13.47	8.64	20.95
	S.E.	1.83	2.05	2.58	0.24	0.58	2.05	0.07	0.18	0.45	0.81
	C.D. 5%	5.15	5.78	7.28	0.67	1.63	5.78	0.20	0.497	1.26	2.28
	C.D.1%	6.84	7.67	9.65	0.89	2.16	7.67	0.27	0.66	1.67	3.02
	C.V.	5.02	3.09	10.37	10.52	8.14	6.11	9.03	2.27	8.95	6.69

Table 2. Analysis of variance (ANOVA) for ten characters studied in chickpea.

Source of variation	D.F.	Days to 50% flowering	Days to maturity	Height of the plant (cm)	No. of primary branches	No. of secondary branches	No. of pods/plant	No. of seeds/pod	100 seed weight (g)	Seed yield/plant (g)	Protein content (%)
Replication	2	290.80	74.06	109.16	1.11	18.51	282.29	0.16	1.01	5.95	10.76
Treatment	39	218.03**	62.39**	85.89**	0.58**	16.05**	696.64**	0.10**	33.68**	34.94**	7.49**
Error	78	10.06	12.66	20.05	0.17	1.01	12.65	0.02	0.09	0.59	1.97



Fig. 1: Difference among individuals for plant height in chickpea

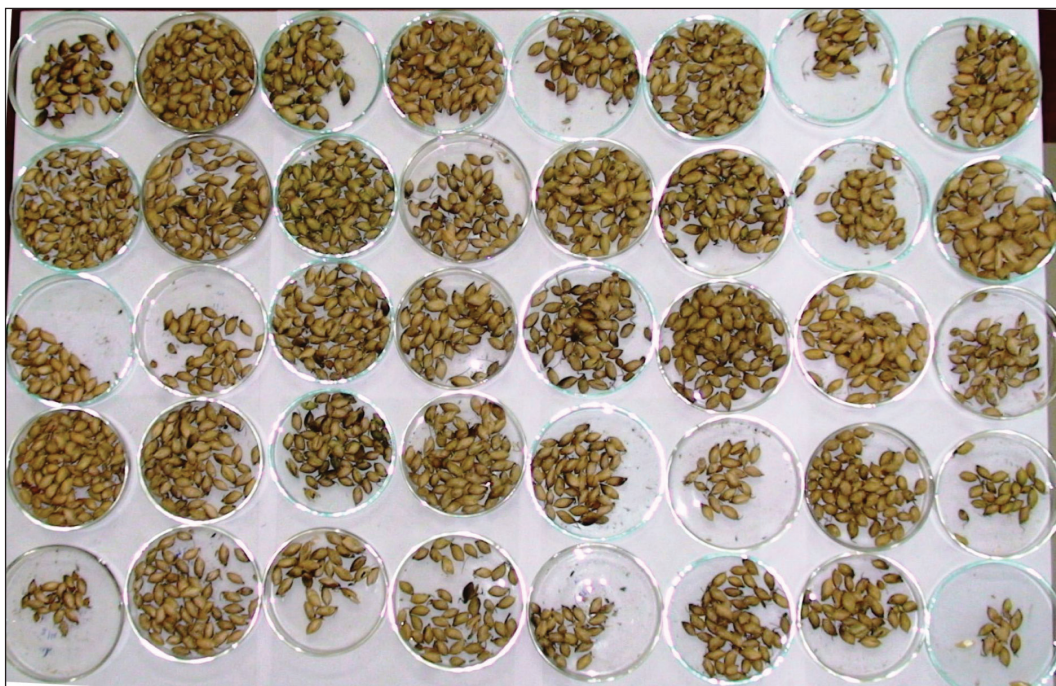


Fig. 2: Difference among individuals for number of pods per plant in chickpea

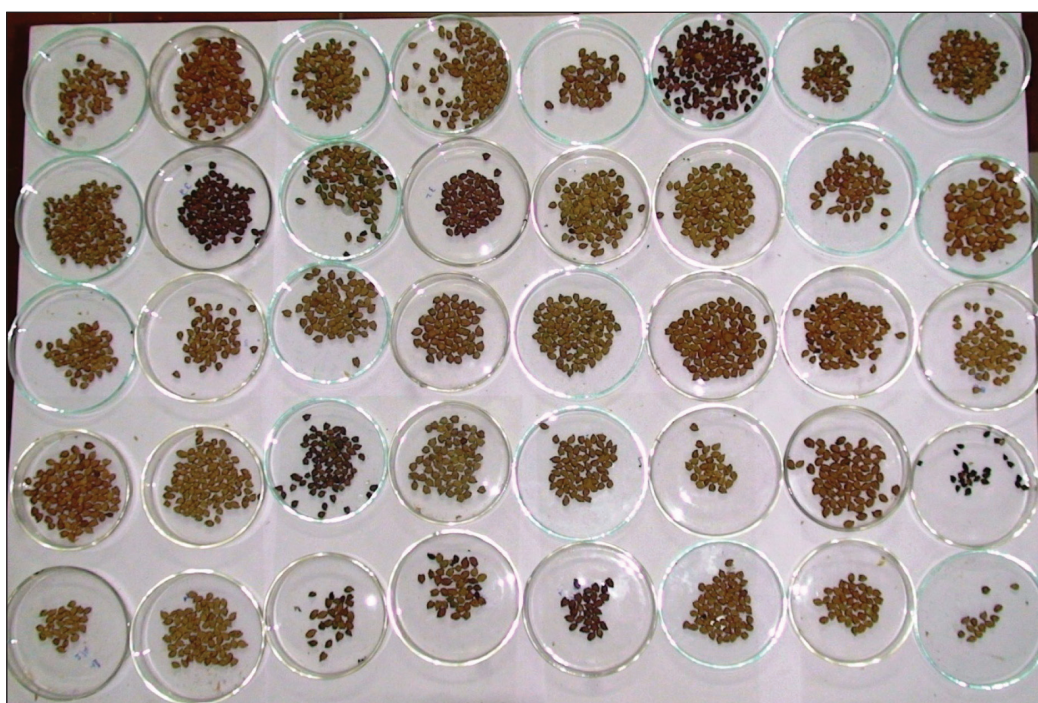


Fig. 3: Difference among individuals for seed yield per plant & seed colour in chickpea

ranged from 51.67 to 82.67 days. Genotype IC-83327 and IC-83429 took least days while highest days were taken by IC-83397. Twenty one out of forty genotypes were significantly superior for days to 50 per cent flowering than population mean.

Days to maturity

Eighteen out of forty genotypes showed significantly superior for maturity when compared with population mean of 114.92 days. The variation in days to maturity ranged from 105.00 to 123.00 days. Genotype IC-83372 matured in least number of days (105.00) followed by IC-83368 (106.33), IC-83327 (107.66) and IC-83443 (109.00) while IC-83346 and IC-83397 matured very late (123.00) days.

Height of the plant (cm)

The population mean for this character was 43.16 cm. The plant height (Fig. 1) was maximum in case of Vishal (check) while it was minimum in case of IC-83335. The value recorded for maximum height was 56.60 cm while minimum height was 34.20 cm. Nineteen out of forty genotypes were significantly superior height of the plant than population mean.

Number of primary branches

The population mean for this character was 3.90. Number of primary branches per plant ranged from

2.93 (IC-83565) to 4.80 (IC-83338). The genotype IC-83338 showed the highest number of primary branches followed by Vijay (4.73) and IC-83367 (4.67). Seventeen genotypes recorded significantly superior number of primary branches than the mean performance.

Number of secondary branches

Seventeen out of forty genotypes showed significantly superior number of secondary branches per plant when compared with population mean of 12.33. The variation for number of secondary branches ranged between 8.67 to 18.67 days. The genotype IC-83340 showed the highest number of secondary branches followed by Vijay (17.73), IC-83465 (17.13) and Vishal (15.33). Genotype IC-83370 showed least number of secondary branches per plant.

Number of pods per plant

Number of pods per plant (Fig. 2) ranged from 35.07 to 118.00. Genotype IC-83397 recorded lowest, while IC-83429 had maximum number of pods per plant followed by IC-83321 (83.67), Vishal (83.40) and IC-83348 (81.67). Twelve genotypes recorded significantly superior number of pods per plant than the mean performance (58.22).



Number of seeds per pod

Nineteen out of forty genotypes showed significantly superior number of seeds per pod when compared with population mean of 1.39. The variation for number of seeds per pod ranged from 1.04 to 1.79. The genotype IC-83523 showed the highest number of seeds per pod followed by IC-83335 (1.72) and IC-83383 (1.68). Genotype IC-83319 showed least number of seeds per pod.

100 seed weight (g)

Sixteen out of forty genotypes recorded significantly higher 100 seed weight than the population mean of 13.47 g. The variation for 100 seed weight ranged between 7.61 g to 26.99 g. The genotype Vishal showed the highest 100 seed weight followed by IC-83340 (18.98), IC-83397 (17.93), Vijay (17.64) and IC-83452 (16.75). Genotype IC-83524 showed least 100 seed weight.

Seed yield per plant (g)

The variation for seed yield per plant (Fig. 3) was ranged from 4.08 g to 20.74 g. The genotype IC-83357 had minimum seed yield per plant while the check variety Vijay produced maximum seed yield per plant followed by another Vishal (20.49), IC-83429 (15.52), IC-83348 (11.33) and IC-83391 (10.49). The population mean for this character was 8.64 g. Eleven out of forty genotypes showed significantly high seed yield per plant when compared with population mean.

Protein content (%)

The variation for protein content (%) ranged between 18.25 to 23.67 per cent. The lowest protein content was recorded by the genotype IC-83340 while maximum by the genotype IC-83466 followed by IC-83415 (23.59%) and Vishal (23.51%). Twenty one genotypes recorded significantly high protein content than the mean performance (20.95%).

The present study revealed the wide range of variability (Table 1). The results are in accordance with that for earliness by Sood and Kumari (2000) and Farshadfar and Farshadfar (2008); Number of primary branches per plant by Ali *et al.* (2008), Muhammad *et al.* (2008) and Sharma and Saini (2010); Number of secondary branches per plant by Sable *et al.* (2000), Muhammad *et al.* (2008) and Borate *et al.* (2010); Number of pods per plant by Farshadfar and Farshadfar (2008) and Borate *et al.*

(2010); Number of seeds per pod by Farshadfar and Farshadfar (2008); 100-seed weight by Arora *et al.* (1991), Meena *et al.* (2006) and Farshadfar and Farshadfar (2008); Seed yield per plant by Sood and Kumari (2000), Sable *et al.* (2000), Meena *et al.* (2006), Ali *et al.* (2008), Muhammad *et al.* (2008) and Alwawi *et al.* (2010); protein content by Alwawi *et al.* (2010) and plant height by Ali *et al.* (2008), Farshadfar and Farshadfar (2008) and Muhammad *et al.* (2008).

According to the Table 1 the characters number of primary branches showed highest CV (10.52) followed by height of the plant (10.37), number of seeds per pod (9.03), seed yield per plant (8.95), number of secondary branches (8.14), protein content (6.69), number of pods per plant (6.11), days to 50 per cent flowering (5.02) and days to maturity (3.09) while the character 100 seed weight had least CV (2.27). The character height of the plant showed highest C.D. (7.28) followed by days to maturity and number of pods per plant (5.78,) days to 50 per cent flowering (5.15), protein content (2.28), number of secondary branches (1.63), seed yield per plant (1.26), number of primary branches (0.67) and 100 seed weight (0.49) while the character number of seeds per pod had least C.D. (0.20).

Analysis of variance

The analysis of variance (Table 2) revealed highly significant differences among genotypes under study, showing variations for all ten characters in forty genotypes of chickpea.

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