Vegetable Science (2016) 43 (2) : 271-273

Short Communication

Combining ability studies in cowpea (*Vigna unguiculata* L.Walp)

DB Kajale*, Y Ravindrababu, DB Prajapati and AA Khule

Received: October 2015 / Accepted: July 2016

Cowpea (*Vigna unguiculata* (L.) Walp) being one of the important sources of cheap and high quality vegetable protein is mainly grown for tender pods as vegetable. Cowpea as a crop has many uses such as pulse fodder, cover crop and green manure. It can fix atmosphere nitrogen in the soil by symbiotic bacteria to a range of 6-131 kg/ha per year (Ayanaba and Dart., 1997). To increase the green pod yield of cowpea, knowledge of combining ability effect and variance have paramount significance in deciding the selection of parents and breeding method for obtaining new recombinants for desirable type.

The parental material consisted of nine lines of cowpea *viz.*, Pusa Falguni, GC-4, CGD-340, CGD-362, CGD-118, CGD-77, CGD-402, CGD-340 and CGD-25 were crossed in all possible combinations (excluding reciprocals). Thirty six hybrids along with nine parents were grown at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *Kharif* 2008. The entries were grown in a randomized block design (RBD) with 3 replications. Seed were dibbed at a distance of 45 cm between row and 10 cm between plants. Observation are recorded on parents and hybrids for days to 50% flowering, days to first picking, plant height (cm), number of primary branches per plant, number of pods per plant, pod length (cm), number of seeds per pod, green pod yield per plant (g), protein content (%) and crude fiber content (%) The statistical analysis was done by employing method 2, model-1 of Griffing (1956).

The estimate of gca effects revealed that, none of the parent was found to be consistently good general combiners for all characters (Table 1). The parent Pusa Falguni was good general combiner for most of the character viz, days to 50% flowering, day to first picking, plant height, pod length, number of seeds per pod, number of branches per plant, green pod yield per plant and crude fiber content. The GC-4 and GCD-370 were also observed good general combiner for pod yield and other related character in the derived direction. For days to first picking, Pusa Falguni, CGD-352 and CGD-118 recorded as good general combiner. The estimate of gca effects revealed that none of the parent was found to consistently good general combiner for all the characters (Buhecha, 1981 and Sawant, 1995). CGD-352 was also good for days to 50% flowering, days to first picking, number of seed per pod, protein content (%) and crude fiber content (%). CGD-370 and GC-4 appeared to be good general combiner for green pod yield (g) and other related character in the desired direction. The parent CGD-402 and CGD-77 had good gca effect for number of pods per plant and pod length. An overall appraisal of gca effect indicated Pusa Falguni, GC-4 and CGD-370 appeared to be good gca for green pod yield and other contributing characters and high gca effects are related to additive gene and additive x additive interaction effect (Griffing, 1956) which fixable genetic component of variation. The parent with high gca effect for a particular component breeding programme, seeking improvement in yield through that particular component (Patil and Shete, 1986).

The estimates of SCA effects revealed that none of the crosses were consistently superior for all the characters (Table 2). Similar findings were also reported by Patil and Bhapkar (1986) and Thiyagarajan *et al.* (1993). The cross GC-4 x CGD-25 possessed highest sca effect for green pod yield per plant (g), number of branches per plant, number of seeds per pod and number of pods per plant followed by Pusa Falguni x CGD-352 and CGD-370 x CGD-25 for green pod yield. The cross CGD-77 x CGD-340 showed high negative sca effect for days to 50% flowering and first picking, cross CGD-118 x CGD-402, Pusa Falguni x CGD 402 and Pusa Falguni x CGD-

Dept. of Genetics and Plant Breeding, CP College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar-385506, Gujarat
*Corresponding author, email: kajaledilip2010@gmail.com

Table 1: Estimation of general combining ability (gca) effects of parents in cowpea

S. No.	Parents	Days to 50 % flowering	Days to first picking	Plant height (cm)	No. of branches per plant	Pod length (cm)	No. of seeds per pod	No. of pods per plant	Green pod yield per plant (g)	Protein content (%)	Crude fiber (%)
1.	Pusa Falguni	-1.08*	-1.44*	-2.56*	-0.10	0.53*	0.28*	4.41*	21.67*	-0.09	0.22*
2.	CD-4	0.05	0.181	1.95*	0.02	0.01	-0.01	3.41*	10.63*	0.09	0.23*
3.	CGD-370	0.86*	0.89*	-0.75*	0.12	0.19	0.65*	-0.67	2.72*	0.46*	0.04*
3.	CGD-370	0.86*	0.89*	-0.75*	0.12	0.19	0.65*	-0.67	2.72*	0.46*	0.04*
4.	CGD-352	-0.59*	-0.66*	-0.67	0.23*	0.37*	0.48*	-3.02*	-7.55*	0.44*	0.14*
5.	CGD-118	-1.15*	-1.25*	0.82*	0.09	0.19	0.34*	-0.21	-3.02*	-0.08	0.005
6.	CGD-77	1.23*	1.39*	3.56*	-0.18*	0.34*	-0.13	-6.14*	-3.89*	-0.02	-0.11*
7.	CGD-402	0.13	0.27	-2.68*	-0.17	-0.11	0.02	2.16*	1.61	-0.71*	-0.23*
8.	CGD-340	0.52	0.65*	-0.75	-0.02	-0.69*	-0.74*	0.63	-13.59*	0.06	-0.21*
9.	CGD-25	0.016	-0.03	1.09*	0.01	-0.83*	-0.89*	-0.56	-8.59*	-0.13*	-0.09*
	$S.E._{(gi)}$ ±	0.27	0.29	0.37	0.08	0.12	0.12	0.38	1.24	0.05	0.02

* and ** are significant at P = 0.05 and P = 0.01 levels, respectively.

Table 2: Estimation of specific combining ability (sca) effects of hybrids in cowpea

Hybrids	Days to 50 % flowering	Days to first picking	Plant height (cm)	No. of branches per plant	Pod length (cm)	Number of seeds per pod	Pod per plant	Green Pod yield per plant (g)	Protein content (%)	Crude fiber content (%)
Pusa Falguni x GC-4	0.57	0.42	10.30**	-0.52	-2.54	-0.56	-0.25*	0.44	2.63**	0.83**
Pusa Falguni x CGD-370	0.16	0.57	-1.21	-0.72*	2.31	2.40**	3.76**	26.72**	-1.63**	-0.59**
Pusa Falguni x CGD-352	-0.60	-2.27*	-0.42	-0.10	0.93*	1.17**	2.97*	32.20**	1.42**	0.18**
Pusa Falguni x CGD-118	0.45	1.18	-4.99**	0.27	1.04**	2.34**	4.40**	23.14**	0.94**	0.29**
Pusa Falguni x CGD-77	2.46**	3.07**	-4.80**	1.21**	2.49**	0.35	0.46	5.14	-2.04**	0.31**
Pusa Falguni x CGD-402	-1.4	-2.87**	3.58**	-0.09	1.74**	3.46**	-1.44	24.79**	-2.50**	-0.39**
Pusa Falguni x CGD-340	2.40**	2.58**	-5.88**	0.45	-0.86*	0.10	-11.17**	-34.65**	-0.09	-0.38**
Pusa Falguni x CGD-25	3.71**	3.80**	-1.69	-0.24	-1.19**	-1.77**	12..62**	-12.79**	-0.98**	-0.35**
GC-4 x CGD-370	-2.27*	-3.61**	-6.07**	0.71*	2.16**	0.16	-6.20**	-12.37**	0.25	0.47**
GC-4 x CGD-352	-0.44	0.13	4.44**	-0.20	3.18**	0.94*	8.74**	0.44	1.33**	0.08
GC-4 x CGD-118	-0.62	-0.43	-11.21**	-0.42	-2.36**	-1.55**	9.14**	11.24**	-2.24**	-0.50**
GC-4 x CGD-77	2.08*	2.07*	-8.19**	0.46	2.28**	1.88**	-5.86**	-13.85**	-4.21**	-0.50**
GC-4 x CGD-402	-0.33	0.09	-1.33	-0.19	0.53	-0.47	11.69**	10.50**	-1.54**	.034**
GC-4 x CGD-340	-0.3	0.22	0.08	0.99**	0.72	2.27**	8.09**	14.58**	-0.29	-0.46**
GC-4 x CGD-25	0.64	0.57	-2.78*	1.42**	-0.00	1.51**	5.75**	47.57**	0.81**	-0.61**
CGD-370 x CGD-352	-0.32	-0.10	-4.23**	1.03**	2.17**	2.20**	-1.30	16.41**	1.89**	0.91**
CGD-370 x CGD-118	-3.66**	-2.31*	-8.09**	1.44**	-1.61**	-0.12	10.15**	0.85	-0.51**	-0.25**
CGD-370 x CGD-77	4.31**	3.80**	-6.77**	0.78**	1.70**	3.21**	0.68	18.62**	0.25	-0.34**

Conti....

Hybrids	Days to 50 % flowering	Days to first picking	Plant height (cm)	No. of branches per plant	Pod length (cm)	Number of seeds per pod	Pod per plant	Green Pod yield per plant (g)	Protein content (%)	Crude fiber content (%)
CGD-370 x CGD-402	-2.28*	-0.71	-2.19	-0.02	-0.30	-2.54**	-5.42**	-2.75	1.06**	0.78**
CGD-370 x CGD-340	5.25**	2.97**	6.43**	-0.37	-1.78**	-0.32	8.87**	22.62**	-0.68**	-0.23**
CGD-370 x CGD-25	-1.63	-0.83	6.66**	0.69*	1.11**	-0.45	9.84**	29.65**	1.48**	0.66**
CGD-352 x CGD-118	0.16	-0.63	4.75**	1.43**	-2.32**	0.51	-1.64	-7.39	-0.47**	-0.62**
CGD-352 x CGD-77	5.30**	5.68**	-0.25	-0.73*	-0.84*	-2.37**	0.82	-4.39	1.20	0.44**
CGD-352 x CGD-402	-1.92*	-2.39*	8.09	-0.33	0.81*	-0.63	-0.27	14.22**	-1.91**	0.28**
CGD-352 x CGD-340	0.21	1.03	-4.07**	0.14	-0.10	-1.99**	-5.34**	-2.96	-0.61**	-0.22**
CGD-352 x CGD-25	-1.73	-1.14	-5.18**	0.54	-1.76**	1.95**	-0.94	-7.83	1.42*	0.40**
CGD-118 x CGD-77	-0.93	-1.12	13.14**	0.28	-0.49	2.10**	1.89	-4.05	0.70**	0.63**
CGD-118 x CGD-402	4.57**	4.13**	-5.99**	-0.72*	3.65**	1.63**	-9.28**	-24.26**	-1.3**	-0.43**
CGD-118 x CGD-340	-2.55**	-2.51**	-7.17**	0.89**	0.94*	-0.05	-4.68**	-14.89**	0.18	-0.05
CGD-118 x CGD-25	-0.38	-0.75	-0.94	0.55	0.08	-1.57**	-0.28	-20.89**	1**	0.31**
CGD-77 x CGD-402	-0.75	0.65	-7.57**	-1.11**	-2.52**	1.24**	-2.02	-1.56	1.63**	0.09
CGD-77 x CGD-340	-4.88**	-4.29**	-7.38**	-0.2	0.69	-1.24**	0.87	-1.35	2.74**	0.79**
CGD-77 x CGD-25	-2.53**	-2.97**	0.84	0.03	0.76	-0.69	-1.02	8.44*	-0.2	-0.38**
CGD-402 x CGD-340	3.25*	1.85*	1.27	0.59*	0.61	2.22**	12.40**	21.70**	2.49**	0.30**
CGD-402 x CGD-25	-2.07*	-2.38*	0.46	-0.11	-1.45**	0.04	1.80	-0.30	-2.4**	-0.07
CGD-340 x CGD-25	1.07	0.70	4.32**	0.90**	1.30**	0.18	-7.79**	-11.92**	0.86**	0.93**
S.Em.(±)	0.89	0.93	1.21	0.28	0.39	0.39	1.24	4.00	0.17	0.06

425 showed high sca effect for number of pods per plant. The crosses exhibited high positive and negative sca effects involved either good x good, good x average, good x poor, average x average combining parent. In a situation where predominance of additive and non-additive gene effect has been observed for most of the traits, it is better to advocate the biparental mating and diallel selective mating to exploit both additive and non-additive gene effects. Jatasara (1979) and Aravindhan and Vijendra Das (1996) suggested that it would be desirable to follow cyclic method of breeding for combining superior recombinants which will simultaneously exploit additive and non additive gene effect for evolving the desirable genotypes of cowpea with superior quality.

Reference

Aravindhan S and Vijendra Das LD (1996) Heterosis and combining ability in fodder cowpea for green fodder and seed yield. Madras Agric J 83(1): 11-14.

Ayanaba A and Dart DT (1997) Biological nitrogen fixation in farming system of the tropics. John Willey and Sons, New York, pp 209.

Buhecha KV (1981) A genetics study of yield and its components in cowpea. M.Sc. (Agri.) Thesis, Submitted to Gujarat Agricultural University, Sardarkrushinagar.

Jatasara ML (1979) Combining ability for green and dry matter yield in cowpea [*Vigna unguiculata* (L.) Walp.]. Forage Res 5: 165-168.

Griffing B (1956) The concept of general and specific combining ability in relation to diallel crossing system. Assiut J Agric Sci 9: 463-493.

Patil RB and Bhapkar DG (1986) Combining ability in cowpea. J Maharashtra Agric Univ 11(3): 303-306.

Patil RB and Shete MM (1986) Combining ability analysis in cowpea [*Vigna unguiculata* (L.) Walp.]. J Maharashtra Agric Univ 11(3): 293-295.

Sawant DS (1995) Combining ability studies in cowpea. Anna Agric Res 16(2): 206-211.

Thiyagarajan K, Natrajan C, Rathnaswamy R and Rejasekaran S (1993) Combining ability for yield and its components in cowpea. Madras Agric J 80(3): 124-129.