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STABILITY OF YIELD AND ITS COMPONENTS IN CHICKPEA (*CICER ARIETINUM* LINN) FOR CHHOTANAGPUR REGION

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ABSTRACT

Forty-two lines of chickpea (*Cicer arietinum* Linn) including two checks grown during winter season (rabi) for three years 1988-89, 1989-90 and 1990-91 in twelve environments were evaluated for stability parameters of Chhotanapur regions. Pooled analysis of variance revealed that the mean sum of squares due to genotypes and environment for primary branches/plant, secondary branches/plant and grain yield/plant (g) found highly significant (except primary branches /plant) indicating presence of high variability among the genotypes and environment. Environmental (Linear) was found highly significant for all the characters which indicated variation in weather condition of the location. The pooled deviation (non-Linear portion of the variance) was found highly significant for all the characters. The environment+ (Genotypes x environment) interaction were found highly significant, showing important role of environment and genotype x environment interaction to these characters. Considering all the characters the genotypes ICCL86309, ICC11141, ICCL84204, ICCL 85211, ICCL86211, ICCL87208, ICC5003, ICCL85307 having bi= 1 and S2 di = 0 found highly promising for average yielding environment. While genotypes ICCL 84303, ICC5003 having bi>1 and S^2 di= 0 found promising for richer environment. For poor environment genotypes ICCL 86226, ICCL87233 having bi<1 and S^2 di= 0 found promising.

Key words: Stability, Chickpea, Interaction

INTRODUCTION

Pulses occupy an unique position among field crops in Indian agriculture. They enrich the soil by fixing atmospheric nitrogen to the soil and utilise limited soil moisture. They play an important role in food economy of the country by virtue of having high protein content. Swaminathan and Jain (1972) reported protein content of bengal gram which ranges from 12.40 to 28.1 per cent with a mean of 19.5 per cent. During the year 1993-94, bengal gram was grown in an area of 6.76 million hectares having production of 5.56 million tons and productivity being 823 kg/ha (Anonymous, 1994) Low production level of bengal gram invites sincere and serious attentions of the scientists engaged in agricultural development programme.

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MATERIAL AND METHODS

The experimental material of the present investigation consisted of 42 genotypes of gram (Table-1) of diverse origin including two checks *viz.*, BR- 77 and H- 208 obtained from chickpea breeder, ICRISAT , Patancheru, Andhra Pradesh, India; Genotypes were sown for two dates of sowing November and December at two locations *viz* Kanke, (Ranchi) and Chianki (Palamu) for three years 1988-89, 1989-90, 1990-91 in a randomised block design with four replications in each environment under rain-fed condition. The plot size of each genotype was one row of 2.5 m long. Twenty five seeds of each genotype were sown in each row per replication. Row to row spacing maintained at 30 cm. and plant to plant distance at 10 cm. within the row. Recommended package of practices of bengal gram cultivation were followed. The land was a medium rice fallow. At maturity data were recorded on randomly selected five competitive plants from each genotype per replication. The data were computer analysed from Indostat services Hyderabad following Eberhart and Russell (1966) model.

RESULTS AND DISCUSSION

There exists a great agro-climatic variation in the plateau region of Chhotanagpur due to undulating topography, uneven rainfall distribution and variation in soil acidity. Such environmental variation play a significant role in (genotypes x environment) interaction. Normal recommended dates of sowing bengal gram in this region is first to fifteenth of November. But due to increase in cropping intensity, the sowing of bengal gram is delayed if it follows rice/potato pattern. So the framers are forced to go for seeding gram as late as December (late sown). Under such late sowing condition farmers do not get potential yield of gram. Hence, there is an urgent need to obtain stable genotypes which could give high and uniform yield of gram in these regions. The method advocated by Eberhart and Russell (1966) model was followed to evaluate genotypes based on stability parameters to obtain high and uniform yield of gram.

Pooled analysis of variance (Table- 2) showed highly significant genotype variation for secondary branches/plant, grain yield/plant (g) but non-significant for primary branches/ plant. Environmental linear found highly significant for all the characters indicating variation in weather condition of the location. The environment + (genotypes environment) interaction were found highly significant, showing important role of environment and genotype x environment interaction to these characters.

On the basis of stability parameters and mean value (Table - 3) (i) & (ii) have been classified into high, medium, and low mean bearing stable genotypes. For primary branches/plant genotypes having bi=1 and S^2di= 0 with high mean found in genotypes ICC 5003, ICC 11525, ICCL 86309, ICCL 86224, With medium mean value found in genotypes ICCL 85307, ICCL 84204, ICCL 85211, ICCL 86226, ICCL 86227, ICCL 88204 Genotypes with low mean value found in genotypes ICC 11141, ICCL 83128, ICCL87220, ICCL 87231, found stable for average yielding environment. For richer environment genotypes having bi>1, S^2 di=0 and high mean value found in genotypes ICCL 84303, ICCL 85311, ICCL 85314, ICCL 86301, ICCL 85316, ICCL 86334, ICCL 86333, ICC 5003, ICCL 85309, BR -77 (Check),- H-208 (check) found stable. For poor environment genotypes having bi<1, S^2di=0 and with low mean value found in genotypes ICC 4918, ICCL 84215, ICCL 83149, ICCL 86206, ICCL 87233, ICCL86221, ICCL 86211, ICCL 87208, ICCL 87211, ICCL 87232, found

Table 1 : Genotypes of chickpea, parentage and source.

Sr. No.	ICC/ICCL	Parentage	Source Experiment & Entry No.	Sl. No.	ICC/ICCL	Parentage	Source Experiment & Entry No.
1.	ICC 4918	Annigari	ICCT-DM 88-89 Ent#1	22.	ICCL 83277	JG 62 XNEC 108	ICCT-DS88-89ENT#8
2.	ICC 5003	K 850	ICCT-DM 88-89 Ent#2	23.	ICCL 86224	ICCC 30XP436-2	ICCT-DS88-89ENT#9
3.	ICC 11525	ICC VI	ICCT-DM 88-89 Ent#3	24.	ICCL 86226	Pant G - 114XT3	ICCT-DS88-89ENT#10
4.	ICCL 85333	Annigari X K 850	ICCT-DM 88-89 Ent#4	25.	ICCL 83128	P 5409XK850	ICCT-DS88-89ENT#11
5.	ICCL 84303	C 214 XBDN-9-3	ICCT-DM 88-89 Ent#5	26.	ICCL 86206	ICCL 78073 X BDN 9-3	ICCT-DS88-89ENT#13
6.	ICCL 85307	(Annigari XICCL 2) XICCI XK85)	ICCT-DM 88-89 Ent#6	27.	ICCL 86227	Pant G - 114 X T 3	ICCT-DS88-89ENT#14
7.	ICCL 85311	BG203X (WR315XBG203) XBG203	ICCT-DM 88-89 Ent#7	28.	ICCL 86209	ICCL78073XAnnigari	ICCT-DS88-89ENT#15
8.	ICCL 85314	P324XICCC 5	ICCT-DM 88-89 Ent#8	29.	ICCL 87233	ICCX -730170- F3XICC- 7300062- F3	ICSN-DS88-89ENT#1
9.	ICCL 86301	ICCL 78043 XK 850	ICCT-DM 88-89 Ent#9	30.	ICCL 86221	JG74XICCC9	ICSN-DS88-89ENT#2
10.	ICCL 85316	F 320 XICCC 5	ICCT-DM 88-89 Ent#10	31.	ICCL 86211	ICCL78073XBDN9-3	ICSN-DS88-89ENT#7
11.	ICCL 86334	(HMS 4HMS 13) Phule G-4	ICCT-DM 88-89 Ent#11	32.	ICCL 87208	K850XICCL 80074	ICSN-DS88-89ENT#14
12.	ICCL 86333	(HMS 4XHMS 5) BDN 9-3	ICCT-DM 88-89 Ent#12	33.	ICCL 87211	(Annigari XJG 74) XAnnigari	ICSN-DS88-89ENT#17
13.	ICCL 86309	P 127 XK 850	ICCT-DM 88-89 Ent#14	34.	ICCL 87220	ICCL 78004XBDN 9-3	ICSN-DS88-89ENT#23
14.	ICCL 86302	ICCL 78073 XBDN 9-3	ICCT-DM 88-89 Ent#15	35.	ICCL 87221	JG 78XBDN 9-3	ICSN-DS88-89ENT#24
15.	ICC 4918	Annigari	ICCT-DS 88-89 Ent#1	36.	ICCL 87231	ICCX-730089-2-3-B-BPXTI80-1	ICSN-DS88-89ENT#33
16.	ICC 5003	K 850	ICCT-DS 88-89 Ent#2	37.	ICCL 87232	AnnigariXI CCX-730041-8-1-B-BP	ICSN-DS88-89ENT#34
17.	ICC 11141	BDN 9-3	ICCT-DS 88-89 Ent#3	38.	ICCL 88204	ICCL 78021XICCC9	ICSN-DS88-89ENT#38
18.	ICCL 84204	P 2559XF5 (BN 10XNP 34)	ICCT-DS 88-89 Ent#4	39.	ICCL 85309	K4XNEC802	ICCT-DM88-89ENT#13
19.	ICCL 85211	(JG 62 XF 496) Chafa	ICCT-DS 88-89 Ent#5	40.	ICCL 87206	ICCC 22XPhule G-7	ICSN-DS88-89ENT#12
20.	ICCL 84215	ICCC 4X P436-2	ICCT-DS 88-89 Ent#6	41.	BR-77 (Check)	Selection Form Germ Plasm	Evolved from local material
21.	ICCL 83149	(G 130 XB 108) XNP 34 XGN 5/7	ICCT-DS 88-89 Ent#7	42.	H-208 (Check)	(S26XG24) XC235	

ICC - ICRISAT Chickpea cultivar, ICCL - ICRISAT Chickpea line stable. For secondary branches/ plant genotypes having bi=1 and S^2di= 0 with high mean value found in genotypes ICCL 86309, ICL 86302, while genotypes with medium mean value found in genotypes ICC 11141, ICCL 84204, ICCL 85211, ICCL 86206, ICCL 87233, ICCL 86211, ICL 87208, ICCL 87221, while genotypes with low mean value found in genotypes ICC 5003, ICCL 85307, ICCL 86334, ICCL 86333, ICC5003, ICCL84215, ICCL83149, ICCL 86209, Genotypes for richer environment having bi>1, S^2 di =0 and high mean value found in genotypes ICCL 84303, ICCL 86224, ICCL 86227, ICCL 87220, found stable. For poor environment genotypes having bi<1, S^2 di= 0 with low mean value found in genotypes ICCL85311, ICCL86301, ICCL 86226, ICCL 83128, ICCL85309, BR-77 (check) , H-208 (Check) found stable. For the character grain yield/plant (g) genotypes having bi= 1, S^2 di = 0 with high mean value found in genotypes ICCL85307, ICCL86221, ICCL86211, ICCL87208, ICCL 87211, ICCL 85309, BR-77 (check) , H- 208 (check) while genotypes with low mean value having bi-1, S^2 di=0 found in genotypes ICCL85333, ICCL84303, ICCL 85311, ICCL 85314, ICCL 86334, ICCL 86309, ICC 11141, ICCL 84204, ICCL 84215, ICCL 83149, ICCL 86224, ICCL86206, ICCL86227, ICCL86209, found stable. For richer environment genotypes having bi>1 , S^2 di= 0 and high mean value found in genotypes ICC 4918, ICC 5003, ICC 11525, ICCL86302, ICC4918, ICC 5003, ICCL 85211, ICCL 83128, found stable for poor environment genotypes having bi>1, S^2di=0 having low mean value found in genotypes ICCL 86301, ICCL85316, ICCL86333, ICCL86226, ICCL87233, ICCL87220, ICCL87221, ICCL87231, ICCL88204, ICCL87206, found stable.

Table 2 : Pooled analysis of variance for primary branches/plant and secondary branches/ plant.

Source of variation	d.f.	No. of primary branches/plant	No. of secondary branches/plant	Grain yield / plant (in Kg)
Genotypes	41	0.323	12.431 **	69.943 **
Env + (Gen X Env.)	462	0.545 **	14.371 **	4.440 **
Environment	11	19.284 **	453.142 **	133.770 **
Gen X Env.	451	0.08 **	3.670	1.286
Env. (lin)	4	212.127 **	4984.565 **	1471.475 **
Gen X Env (lin)	1	0.28 **	6.139 **	7.718 *
Pooled deviation	120	0.066 **	3.347 **	1.213 **
Pooled error	1512	0.06	2.558	2.936

* Significant at 5% level ; ** Significant at 1% level

Table 3(i) : Mean value of stability parameters of different genotypes for primary branch / plant, secondary branch / plant and grain yield / plant (g)

Sl. No.	Genotypes	Primary Branches / Plant			Secondary Branches / Plant			Grain Yield / Plant		
		Gen. Mean	bi = 1	$S^2d_1 = 0$	Gen. Mean	bi = 1	$S^2d_1 = 0$	Gen. Mean	bi = 1	$S^2d_1 = 0$
1.	ICC 4918	2.40	0.55**	0.02	9.44	1.03	149	15.83	1.28	0.20
2.	ICC 5003	2.36	1.00	-0.02	8.55	0.86	0.63	15.14	1.21	-2.27
3.	ICC 11525	2.49	1.06	0.01	11.02	1.19	1.00	14.57	1.25	-0.55
4.	ICCL 85333	2.66	1.15	0.09**	11.39	1.27	2.29*	15.36	0.90	-2.46
5.	ICCL 84303	2.27	1.15	-0.03	10.22	1.19	-1.13	14.42	0.95	-2.57
6.	ICCL 85307	2.22	0.96	-0.04	8.68	0.98	-1.88	17.00	1.08	-2.07
7.	ICCL 85311	2.22	1.31**	-0.05	8.06	0.83	-1.48	13.79	1.01	-1.09
8.	ICCL 85314	2.37	1.20	0.02	9.40	0.99	4.70**	14.55	1.06	-1.75
9.	ICCL 86301	2.23	1.16	0.02	8.29	0.69	0.99	12.44	0.81	-1.72
10.	ICCL 85316	2.32	1.23*	-0.01	9.85	0.81	1.96**	14.09	0.080	-1.48
11.	ICCL 86334	2.20	1.12	-0.05	7.60	0.86	-1.25	14.52	0.87	-1.53
12.	ICCL 86333	2.35	1.40**	-0.00	8.40	0.96	0.90	13.34	0.79	-1.60
13.	ICCL 86309	2.54	1.08	-0.00	10.57	1.12	-0.94	14.62	1.16	-1.02
14.	ICCL 86302	2.41	1.04	0.09	10.42	0.94	0.98	15.31	1.66**	-0.96
15.	ICC 4918	2.40	1.08	0.10**	10.33	0.93	2.21*	15.92	1.31	-2.43
16.	ICC 5003	2.41	1.36**	0.01	8.92	0.99	0.20	16.13	1.20	-2.38
17.	ICC 11141	2.17	1.00	-0.06	9.53	0.90	-0.53	14.62	0.99	-2.38
18.	ICCL 84204	2.25	0.91	-0.02	9.91	1.02	-1.27	14.33	1.14	-2.50
19.	ICCL 85211	2.28	1.05	-0.02	9.70	1.09	-1.26	17.09	1.20	-1.70
20.	ICCL 84215	2.12	0.76*	-0.04	9.02	1.14	-0.02	13.11	0.83	-2.51
21.	ICCL 83149	2.06	0.62**	-0.01	8.72	0.98	-1.02	13.67	1.10	-2.02

* Significant at 5% level ;** Significant at 1% level.

Table 3(ii) : Mean Value of Stability Parameters of different Genotypes for Primary Branch / Plant, Secondary Branch / Plant and Grain Yield / Plant (g)

Sl. No.	Genotypes	Primary branches / plant			Secondary branches / plant			Grain yield / plant		
		Gen. Mean	bi = 1	$S^2d_1 = 0$	Gen. Mean	bi = 1	$S^2d_1 = 0$	Gen. Mean	bi = 1	$S^2d_1 = 0$
22.	ICCL 83227	2.35	0.66**	0.07	10.23	1.49**	13.82**	19.37	1.16	1.14
23.	ICCL 86224	2.46	1.06	-0.02	12.20	1.60**	-1.40	12.80	1.16	-0.70
24.	ICCL 86226	2.32	0.91	-0.02	9.97	0.82	0.07	12.74	0.76	-2.40
25.	ICCL 83128	2.06	0.92	-0.05	8.82	0.80	-0.55	13.70	1.45**	-1.72
26.	ICCL 86206	2.13	0.79	-0.01	10.03	0.99	-1.73	14.27	1.01	-1.67
27.	ICCL 86007	2.25	1.03	-0.04	10.19	1.26	-1.60	14.75	1.13	-2.08
28.	ICCL 86209	2.03	0.68**	0.09**	9.09	0.55	0.22	14.68	0.84	-2.39
29.	ICCL 87233	2.19	0.84	-0.05	9.50	1.02	-0.95	12.79	0.70	-2.38
30.	ICCL 86221	2.19	0.70*	-0.02	11.19	1.10	8.90**	16.30	0.87	-2.36
31.	ICCL 86211	2.25	0.82	0.001	9.62	1.02	-1.08	17.47	0.98	-2.31
32.	ICCL 87208	2.21	0.76*	0-.009	9.59	1.03	-0.67	19.28	0.84	-2.14
33.	ICCL 87211	2.07	0.83	0.03	10.19	1.21	7.09**	18.74	0.90	-2.70
34.	ICCL 87220	220	0.95	-0.04	10.65	1.19	0.09	17.64	0.56*	-2.57
35.	ICCL 87221	2.52	1.10	0.06*	9.31	1.04	-1.43	17.22	0.77	-2.71
36.	ICCL 87231	2.10	0.92	0.01	10.69	1.47**	2.95*	17.27	0.72	-2.48
37.	ICCL 87232	1.98	0.65**	0.02	9.21	0.55**	1.24	17.89	1.11	1.65
38.	ICCL 88204	2.21	0.94	-0.04	10.85	0.87	2.08	15.41	0.76	-2.08
39.	ICCL 85309	2.52	1.57**	-0.01	8.34	0.67*	-0.05	18.08	0.85	-1.52
40.	ICCL 87206	2.04	0.76*	0.05*	7.98	0.77	2.53*	18.82	0.78	0.78
41.	BR-77(Cheek)	2.57	1.45**	-0.02	10.67	0.73	-1.10	22.68	0.95	-2.61
42.	H-208 (Cheek)	2.44	1.27*	-0.02	8.91	0.64*	-0.13	22.17	0.89	-2.37
Popn. Mean		2.28		9.65		15.81				
St. Err. Mean		0.07		0.55		0.33				
bi mean		1.00		1.00		1.00				
Se bi		0.11		0.16		0.18				

* Significant at 5% level ** Significant at 1% level

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