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Research Article

Stability analysis for grain yield and yield components in chick pea (C*icer arietinum* l.)

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Abstract:
Twenty one advanced breeding lines selected from All India Coordinated trials and one local popular variety "annegiri' were studied over three years to identify high yielding stable genotypes. Genotype , environment and G x E interaction variance found to be significant. Genotypic variance over environments was significant for grain yield , pods/plant and 100 seed weight. Both linear and non linear components were found to be important for the traits studied. Significant non linear component for grain yield indicated the predictability of the trait. Of all the genotypes C-506 and C-527 were found to be stable.

Key words
Chickpea, stability, G x E interaction, Regression coefficient

Introduction

Chickpea (*Cicer arietinum* L.) is an important pulse crop in India and well adapted to drought prone semi arid tropical regions. In Andhra Pradesh it is cultivated in an area of 4 lakh ha. Moisture limitation is the critical factor due to temperature fluctuations during crop growth which results in forced maturity and poor yields/low productivity. Hence, genotypes overcoming moisture stress and having high adaptation to temperature fluctuations were the objectives. In the present study about 21 advanced breeding lines selected from coordinated trials and one locally popular variety Annegiri were studied during *rabi* 2006-07, 2007-08 and 2008-09 to identify high yielding stable genotypes of chickpea.

Material and Methods

The experiment was laid out in a randomized block design with three replications. Each genotype was sown in four rows plot of 4 meter length. The net plot size was 7.2 sq.m at 30 x 10 cm spacing between rows and plants respectively. Ten plants were randomly selected in each replication and observation on plant height, number of primary branches, number of secondary branches, 100-seed weight and number of pods per plant were recorded. The characters days to flowering, days to maturity and grain yield was recorded on whole plot basis.

Results and Discussion

Stability parameters and G x E interaction components for number of pods per plant, 100 seed weight and grain yield were computed as per Eberhart and Russel (1966) model. The significance of regression coefficient (bi) from unity and deviation from regression (S^2di) for each genotype was tested using t-test and F-test respectively. Significance of variance (Table-1) arising from genotype, environment and genotype x environment marks the adequacy of analysis of the measure of stability. The mean sum of squares for genotypes was also significant over the environments for grain yield and yield contributing traits like pods per plant and 100 seed weight revealing the presence of genetic variability among the genotypes. Significant mean sum of squares due to genotype x environment (G x E) interactions indicated that the genotypes interacted considerably with the environment conditions. Both linear and non linear components of G x E interactions were significant showing the importance of linear and nonlinear components in expression of all the traits under study. For grain yield non linear portion was non significant indicating predictability of the trait across the environments.

For grain yield per plant, stability parameters indicated , of 22 genotypes 12 exhibited non significant S^2di indicating their predictable performance (Table-2) Out of these 12 genotypes, six genotypes viz; C-506, 510, 519, 521, 527 and Annegiri were average performers with bi around unity. Two genotypes C-506 and C-527 manifested high mean performance as compared to grand mean along with regression coefficient around unity and non significant S^2di value for grain yield. This implies that they were stable performers across different environmental conditions for grain yield. Genotypes C-520 and C-516 recorded high *per se* performance and identified as suitable genotypes for favourable environments as indicated by its high regression coefficient (bi >1) value with non significant S^2di Similar results were reported by several workers (Khorgade *et al*. 2001 and Prakash. 2006).

Taking into account all the parameters of stability it can be inferred that overall the experiment has resulted into identification of two stable chickpea genotypes C-506 and C-527 . Significantly, both the genotypes C-506 and C-527 are early types (78 and 84 days respectively) than Annegiri (94 days). Thus the earliness over local variety had further added advantage to the genotypes C-506 and C-527 to over come the moisture stress and temperature fluctuations. Thus the genotypes can be directly introduced as cultivars and also used as parents for stability and earliness for chickpea improvement.

References

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Table1.Joint regression analysis of variance for three characters in chickpea

Source of variation	d.f	Number of Pods / plant	100 seed weight (g)	Grain yield (kg/ha)
Genotypes	21	133.65 **	35.87**	2456895.33**
Environments	2	6678.67 **	0.92	40468812.0**
G x E	42	87.53 **	1.54**	1196918.11*
Environment + (G x E)	44	391.18 **	1.42**	41525876.00**
Environment (linear)	1	12988.10**	1.88**	40649855.00**
G x E (Linear)	21	66.89 **	1.08**	842529.64
Pooled deviation (non-linear)	22	108.77**	1.88**	420002.57
Pooled error	126	20.87	0.02	804288.25

Table-2. Stability parameters for number of pods, 100-seed weight and grain yield in chick pea

Genotype	No. of pods per plant			100 seed weight			Grain yield (kg/ha)		
	X	b	S^2d	X	b	S^2d	X	b	S^2d
C-501	50.56	1.17	113.80*	14.0	1.88	2.28*	1503.78	0.89**	-2019
C-502	52.00	1.34**	-19.00	13.8	2.22	0.11*	1402.44	1.05**	1026.7
C-505	49.89	0.50	41.00*	18.4	3.8	0.72*	1400.12	1.08**	28102*
C-506	60.67	1.01	65.82*	13.8	0.75	0.44*	1785.63	1.03**	-3720.5
C-507	50.44	1.53*	-10.86	17.0	2.23	0.09*	1326.45	1.07**	10267.3*
C-510	54.56	1.25**	-16.51	17.2	2.07	1.09*	1274.60	1.04**	-4432.0
C-511	50.00	1.40**	-11.89	19.3	-0.66	1.55*	1336.74	1.07**	10967.3*
C-512	58.29	0.74**	7.05	10.1	-0.09	0.06*	1520.71	1.02**	10327.9*
C-516	60.89	0.85**	6.10	20.2	0.69	0.75*	1374.60	1.32**	-4712.2
C-517	54.56	1.01**	-15.96	18.8	0.76	0.44*	1581.48	1.15**	5392.0*
C-518	48.33	0.43	62.00*	20.5	9.82	11.06*	1215.70	0.90**	72209.9*
C-519	50.56	1.21**	-19.70	16.0	3.04	0.19*	1393.45	1.04**	-5940.3
C-520	49.56	1.11**	-13.92	19.0	4.63	1.87*	1614.14	1.13**	2816.4
C-521	58.00	1.21**	75.80*	19.2	0.03	7.66*	1393.45	1.04**	-5940.3
C-522	63.00	0.53	230.42*	19.1	-4.84	0.08*	1646.99	0.78**	32103.1*
C-523	56.67	0.99	106.21*	17.2	4.92	2.19*	1193.75	0.69**	-3530.6
C-524	49.33	0.43	62.08*	19.8	9.84	11.08*	1315.82	0.92**	72209.9*
C-525	59.56	1.21**	-19.72	19.1	4.66	1.87*	1614.14	1.05**	-2816.3
C-526	63.00	1.09**	65.83*	13.7	1.83	2.28*	1551.85	0.87**	1028.7
C-527	61.56	0.80**	-6.98	18.7	-3.63	0.85*	1671.69	1.03**	10329.9
C-528	58.26	1.11**	-13.92	17.0	4.99	2.19*	1215.28	0.91**	72206.0*
Annegiri	40.22	0.61**	-4.16	13.8	9.83	11.08*	1347.19	1.32**	3768.0*

*,** significant at 0.05 & 0.01 probability levels, respectively