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Validation of correlation based response parameter as stability criterion for varietal promotion in chickpea coordinated yield trials

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ABSTRACT

A parameter based on correlation coefficient between deviation of yields of a variety from corresponding mean yields recorded at several locations and the estimates of similar deviations for a check variety was used to estimate response of each of the 13 varieties included in AVT 1 coordinated trial of chickpea in central zone of India during 1999-2000. Three well established standard check varieties were included in the trial for comparison. The deviations in the yields of test entries from their mean yield and the checks were computed for each location. The correlations between deviations of the yields of a variety and those of each of the checks were treated as measures of sensitivity or response. Significant positive correlation was taken as a measure of similarity between a variety and a check included in the pair while recommending variety for promotion or identification. Analysis of the data showed that BGD 109, IG 338, CSJD 901 and BGD 98 could have been promoted to AVT 2 on being statistically identical in sensitivity with standard check GCP 101. Similarly, GCP 9516, GCP 9504 and Phule G 93009 could have been promoted to AVT 2 as these varieties showed significant correlation with standard check Vijay.

Key words: Chickpea, Correlation, Stability analysis

Promising genotypes of chickpea (*Cicer arietinum* L.) emanating from different breeding programmes in the country are evaluated in multi-location yield trials of All India Coordinated Research Project (AICRP) on Chickpea in order to assess their yield performance before releasing them for commercial cultivation. In the coordinated trials, grain yield and disease reaction play profound role in varietal promotion to the next tier of testing, though other characteristics such as seed size, crop duration, *etc.*, are also considered to cater to the need of specific market and production niches. However, varietal sensitivity to varying environments, which is equally important and the major objective of the coordinated trials, is not given due consideration while promoting test entries. Efforts are hardly made to obtain direct estimate of environmental sensitivity of test entries in these trials except indirect estimates in terms of yield rank, disease reaction and phenology over the locations. There is, thus, need to obtain direct measure of environmental sensitivity of test entries, which can provide combined effect of the environmental factors on grain yield in addition to their yield performance and disease reaction. In order to validate the approach adopted by Singh (5), correlation between yield deviation of test entries and standard checks from environmental mean (pair-wise) at different locations is applied for assessing environmental sensitivity of test entries included in the Advance Varietal Trial (AVT 1) of chickpea.

MATERIALS AND METHODS

Thirteen promising lines of chickpea promoted from Initial Varietal Trial along with three checks (C 235, Vijay and GCP 101) were evaluated in randomized block design with three replications at 10 locations in Central Zone of India during 1999-2000 under the AICRP on Chickpea. For all the 10 locations, yield potential was quantified by taking a simple average of yield of all the 16 entries, which was used as potential of the location similar to the ranks obtained in Eberhart & Russel (2) and Perkins & Jinks (3). Further, deviation in yield from respective location mean for newly developed lines under trial as well as for well-established check varieties were obtained for each of the location. Finally, Pearson's correlation coefficients were computed between 13 test entries and three check varieties for their deviation in yield from respective location mean. Significant positive correlations between deviations in yields suggested similar response of the variety and the check following the method proposed by Singh (4, 5).

RESULTS AND DISCUSSION

The detailed yield data obtained from the coordinated trial are given in the progress report 1999-2000 of All India Coordinated Research Project on Chickpea, IIPR, Kanpur (1). Correlation coefficients between each of the 13 test entries and each of the 3 standard check varieties for their deviations in yield from respective location mean are given pair-wise in Table 1 along with mean yield (kg/ha) and yield ranks.

Out of the 39 correlations examined, seven correlations were significantly positive (negative correlations were not of interest in the present context). For example, GCP 9504, GCP 9516 and Phule G 93009 had significant positive correlation with the check variety, Vijay, indicating that these newly developed test entries expressed similarity in response with the well-established old variety Vijay. Therefore, on being at par or acceptable in yield and other characteristics, these genotypes could have been promoted for further testing in the areas suitable for cultivation of Vijay. These genotypes perhaps shared the common gene pool and, therefore, expressed similar response pattern over a diversified range of agro-ecological conditions in the country. Four test entries BGD 109, IG 338, CSJD 901 and BGD 98 in the trial were similar

Table 1. Correlation coefficients between 13 test entries and 3 standard check varieties for their deviations of yield from respective location mean

Promising line	Average yield (kg/ha)	Rank	Correlation coefficient with check		
			C 235	Vijay	GCP 101
BGD 109	2008	2	-0.536	0.448	0.666*
GCP 9516	1839	5	-0.183	0.786**	0.565
IG 338	1750	7	-0.465	0.504	0.650*
CSJD 901	1834	6	-0.516	0.369	0.701*
GCP 9504	1899	4	0.053	0.682**	0.248
RSG 895	1665	9	-0.09	0.181	0.314
Phule G 93009	1947	3	-0.361	0.767**	0.629
BGM 524	1529	11	-0.345	-0.155	0.213
FG 712	1719	8	0.541	-0.315	-0.438
KGDM 1180	1465	12	0.576	-0.28	-0.707*
H 95-122	1363	13	0.601	-0.624	-0.686*
H 95-123	1602	10	0.427	-0.582	-0.582
BGD 98	2056	1	-0.846**	0.506	0.932**

*, ** Significant at 5% and 1% level of significance

in response to the check variety GCP 101. Among these four varieties, two varieties namely, BGD 109 and BGD 98 have emanated from the same breeding programmes and are likely to have the common parentage. Therefore, on being at par or acceptable in yield and other characteristics, these genotypes could have been promoted for further testing in the areas suitable for cultivation of GCP 101. Likewise, other pairs of varieties with significant positive correlations could be explained for response patterns but only those varieties, which are good in yield, will have commercial utility and, therefore could be acceptable to the farmers.

Sensitivity of a variety comprises influence of varying effects of several biotic and abiotic factors observed in phenotypic expressions over a series of locations/ environments. Generally, it is conceived in terms of yield, *i.e.*, how the productivity of a variety is influenced over a range of locations. It is expressed as the sum effects of counteractions of several yield-influencing factors predominant at locations. Several mathematical devices are available for assessing different aspects of the complexities of varietal response. However, no perfect measure of response is available so far. A generalized assessment of similarity or dissimilarity in response of two varieties can also be obtained by estimating correlation between actual yield of both the varieties at respective locations. In this case, it is assumed that both varieties of the pair with significant positive correlation for their yield at different locations give similar response to all the factors influencing the yield at respective locations. In the present study, a simple correlation base method proposed by Singh (5) is applied to visualize varietal response to environmental factors. Correlation coefficients are estimated between newly developed lines under trial and a well-established check variety for their deviations in yield from respective location mean. Location mean was measured by taking simple arithmetic mean of yields of all the varieties under testing in order to quantify the potential of the location. Location potential could also be measured in terms of absolute yield values on the basis of other observations. The mean yield as location potential is used for estimation of correlation coefficient between deviations from mean, which is considered as a measure of response. A generalized assessment of similarity or dissimilarity in response could also be obtained by estimating correlation between actual yield of both the varieties at respective locations. It was assumed that both the varieties of the pair with significant positive correlation for their yield at different locations are expected to be equally responding to all the factors influencing the yield at respective locations. When deviations in yield of both the varieties of the pair from respective location means are used for estimating correlations, a more precise measurement of similarity/ dissimilarity in response between both the varieties of the pair could be obtained, specifically both in rich (above average yield potential) and poor (below average yield potential) environments.

The correlation coefficient as above provides additional information about commercial value for a variety. It could be possible to develop a sensitivity map of the varieties in the country while genotypes are being evaluated in All India Coordinated System. Such information should be considered in addition to yield, disease reaction and other parameters already used for promotion/identification of the varieties. Therefore, correlation coefficient estimated as above will help recommend a variety for cultivation in the area where the concerned check varieties is suitable for cultivation. Varieties released using such information will last longer in cultivation.

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