Adaptation of short-season pigeonpea in multilocation yield trials

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Where ranking of lines or 'genotypes' alters with the test environment, an interaction of lines and environments is suggested. This source of overall variation can be relatively large compared with that due to the lines alone(1). For the efficient selection of lines, both in selection pressure and site(s) of early evaluation, the analysis of genotype x environment (GxE) effects on the adaptation of lines is important. Line selection in the Pigeonpea Improvement Project at the University of Queensland, involves initial discrimination on yield potential under favourable cultural conditions, followed by increasingly extensive multilocational testing. This paper reports an evaluation of this procedure.

Methods

Seed yield and other characters of 25 elite pigeonpea lines were determined in 11 environments in Queensland during 198[1]1/85 and 1985/86. The 25x11 data set was reduced to 13 line groups and 11 environments using cluster analysis(2). This represented a 48% reduction in matrix size, with 93% of the genotype and 85% of the GxE sums of squares retained in the reduced matrix.

Results and Discussion

At the 13 line group level, GxE variation was the main source of phenotypic variability for seed yield, accounting for 80% of total variance. Line effects represented only 20%. Most GxE variation for seed yield could be related to phenology and the initial separation of lines on seed yield (Fig. 1, groups 48, 117) resulted in groups differing in maturity. Later maturing lines (group 38, Fig. 1) failed to express yield potential in shorter season conditions characteristic of the lower yielding environments, but responded dramatically to longer season situations (Fig. 2, group 34 environment 11). The relationship between phenology and seed yield was less well defined in the clustering of the mid and early maturing lines and relatively large GxE effects for some of these groups emphasized the need for multilocational testing to discriminate between elite yielding lines.

Despite some very specific responses, the selection of high yielding and broadly adapted pigeonpea lines has been possible *as* the highest yielding lines performed at least as well as poorer lines in less productive environments (Fig 2). As evidence, discrimination was possible between old, new and proposed cultivars (Fig. 1 - groups 1, 33, 16 respectively) which suggests the efficacy of both the analyses and selection procedures involving initial discrimination and multilocation testing.

28. Byth, D.E. (1977). Proc. 3rd Int. Cong. SABRAO, Canberra 1977.

29. De Lacy, I.H. (1981). In 'Interpretation of Plant Response and Adaptation to Agricultural Environments' A.I.A.S. Refresher Training Course, Brisbane.

Figure1: Styalized dendogram of line classification in approximate order of mean yield.

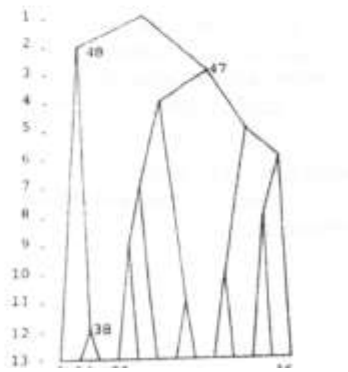

Figure 2: Comparison of adaptation responses of characteristic low (34), moderate (30) and high (16) yielding groups of pigeonpea lines in 11 environments. (Low yields of 16 at environment 3 resulted from poor stands)