The Use of the CSM-CROPGRO-Peanut Model in Investigating the Dynamic of Genotype x Environment Interactions in Peanut

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Abstract

The relative importance of various components of genotype x environment (G x E) interaction, particularly the genotype x year (G x Y) and genotype x location (G x L) interactions, has significant implication on the testing strategy of crop breeding lines. This study was conducted to investigate the dynamic patterns of G x Y and G x L interactions for pod yield of peanut using the CSM-CROPGRO-Peanut model. Pod yields of 17 diverse peanut lines at 112 locations covering all peanut production areas in Thailand were simulated over 3 seasons (early-rainy, mid-rainy and dry seasons) and 30 years (1972-2002). Combined analyses of variance were done for individual seasons and for overall 3 seasons, with the number of year incrementally increasing from 2 to 30, starting from 4 different years. The relative contributions of the G x Y and G x L interactions were determined for the individual analyses. The results showed that, as the number of years in the combined analyses of variance increased, the relative magnitude of the G x Y interaction increased while that of the G x L interaction decreased. The contributions of G x Y and G x L interactions were grater and more fluctuated in the dry season than in the early-rainy and mid-rainy seasons, regardless of the starting year. However, notable increases in the relative contribution of G x Y interaction in the dry season were associated with certain years, making the time to reach the peak being varied from 5 to more than 10 years in the different starting years. A similar pattern was observed for the relative contribution of the G x Y interaction in the analyses over 3 seasons, but with a much lesser fluctuation. The decline in the relative contributions of the G x L interactions as the number of years increased was relatively smooth for all seasons, and became nearly stabilized in about 6 years. Although the magnitude of the G x Y interaction was much less than that of the G x L interaction, the 6 years required to capitalized most of the G x L interaction raises a question on the effectiveness of the strategy for using locations to replace years in varietal testing normally employed by breeders.

Keywords: Crop breeding; G x E interaction; Multi-environment trails; Crop simulation