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Genotype x environment interaction and yield stability of arabica coffee (*Coffea arabica* L.) genotypes

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Lack of suitable varieties that exhibit stable yield performances across wide ranges of environments because of significant Genotype x Environment Interaction (GEI) is the major factor among several production constraints contributing to low productivity of Arabica coffee in Ethiopia. In the present study, eleven advanced Limmu coffee genotypes were evaluated in eight environments (four locations over two years) to determine the existence of GEI and yield stability performances. The experiment was laid out in a randomized complete block design of two replications under all locations. Combined analysis of variance showed a highly significant effect of genotype by environment interaction indicating the differential yield response of genotypes across different environments. The major proportion of the variation explained by environments was 42.74% of the total variation. Nevertheless, the contribution of the genotypes to the total variance was much smaller than the environments and the genotype by environment interactions. This suggests that environmental variation, among other variance components was the major factor affecting the yield performance of coffee genotypes. To this effect, different stability models such as Additive Main effect and Multiplicative Interaction (AMMI), AMMI stability value, cultivar superiority index and yield stability index were used for the stability analysis. The first two Interaction Principal Component axis (IPCA) of AMMI exhibited a highly significant effect and cumulatively contributed about 63.21% of the total interaction sum of squares which was greater than half of the total. This indicated the capability of the first two principal component axis for cross-validated variation explained by the interaction effect. Subsequently, the two high yielding genotypes, namely; G3 (L52/2001) and G9 (L55/2001), on an average, showed stable performance across environments and on the other hand, the study also illustrated the presence of location specific high yielding coffee genotype such as L56/2001 as a result of significant interaction of the genotypes with the environments. Regarding to test environments, Gera 2015/16 (E5) regarded as a more stable site for coffee bean yield improvement over the rest environments due to the IPCA score nearer to zero which is having little interaction effect, while Agaro 2015/16 (E7) was considered to be the most interactive environment. Based on the result of this study, coffee breeders or farmers would be recommended for wisely selecting either for location specific or wider adaptable coffee genotypes leading to substantial yield increment under Limmu coffee growing areas.

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