



Thesis Abstract

Performance and Stability of Grain Maize Genotypes in Peninsular Malaysia

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In plant breeding programs, potential genotypes are usually evaluated in different environments (locations and years) before desirable ones are selected. Genotype and environment (G x E) interaction is associated with the differential performance of materials tested at different locations in different years, and influences selection and recommendation of cultivars. Highly stable genotypes are desirable. Furthermore, spatial variability on soil properties and crop yield has been one of the major objectives in investigations related to agriculture production. Performance and stability of grain maize (*Zea mays* L.) genotypes were evaluated in four locations in Peninsular Malaysia, namely: Padang Rengas (Perak), Rhu Tapai (Terengganu), Sungai Udang (Melaka), and UPM, Serdang, Selangor, in two years.

The objectives of the study were to: 1) determine the performance of 14 grain maize genotypes for grain yield and yield components at the four locations in two years; 2) evaluate the G x E interaction effects; 3) identify high-yielding genotypes at each location and their stability by using different stability parameters; 4) evaluate the spatial variability of soil nitrogen (N), phosphorus (P), and potassium (K); plant N, P, and K; and their influence on grain yield; and 5) investigate the relationship among grain yield and soil and plant nutrient variables.

The experiments at the locations were arranged in a randomized complete block design (RCBD) with four replications. Recommended agronomic practices were used at each location. Evaluations were conducted from June 2000 to March 2002. Genotypes and G x E interaction effects were highly significant, indicating high variability among genotypes, and genotypes responded differently to the changing environments. Among the 14 genotypes evaluated, GxA. Selected GxA, SC-2, Putra J-58, and TWC-4 showed high performance and have good potential to be used as source populations for future breeding programs. Comparing performance of genotypes for grain yield and yield components, Selected GxA was found to have the highest grain yield (5,726 kg/ha⁻¹), shelling percentage (84.9%), 100-grain weight (25.5 g) and ear weight per plant (149.5 g), earliest in flowering (50.6 days to tasseling and 53.2 days to silking) and longest ears (15.5 cm). TWC-2 was found to be earliest to mature. SC-3 showed the shortest plants, while Suwan 1 was the tallest and was late in maturity. The highest ear diameter was observed on SC-1. Terengganu in 2000 was found to be the most favorable environment, as shown by its highest environmental index.

Different methods of stability analyses (i.e., comparison of mean values, regression coefficient, deviation from regression, coefficient of determination, environmental variance, Wricke's ecovalance, Shukla's stability variance, and genotype grouping involving coefficients of variation) were used and they were consistent with each other in revealing the stability of the genotypes. Selected GxA was identified as having the highest grain yield and most stable in performance, followed by DC-1, while SC-2 was the lowest yielding and most unstable genotype. Some genotypes showed specific adaptability to specific locations. This experiment led to the identification and possible release of a new, high-yielding and stable grain maize synthetic variety, Selected GxA.

Broad-sense heritability estimates on the genotypes were moderate for grain yield in the year 2001 evaluation and years combined, and also for ear length, ear diameter, and number of kernel rows per ear in each year and years combined. These indicate that genetic factors had moderate effects on the control of grain yield, ear length, ear diameter, and number of kernel rows per ear in the population of genotypes.

In addition to the evaluation on genetic stability, spatial variability for grain yield and leaf and soil chemical properties were also evaluated at the four locations, where different patterns of spatial variability for grain yield variation was associated with soil N, P, K, and leaf P contents. Grain yield was particularly positively correlated with soil P and K contents.

The results also indicate the effectiveness of site-specific soil management such as reduced fertilizer applications to increase grain yield through minimizing yield variation in grain maize fields.