

Improvement of the Maize Population "Elite Synthetic NT" for Soils with Low Nitrogen Content

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Abstract

The maize population 'Elite Synthetic NT' has been selected with the objective of improving its yield potential in soils with low nitrogen (N) availability. During the 1994/95 season, 144 half-sib families showing good male-female flowering synchrony were evaluated with and without N fertilizer at Sete Lagoas, MG. The experimental design utilized was a 12 x 12 lattice, with 5 m plots. The open-pollinated variety 'BR 106', selected in soils with high fertility, was used as a between block check. Mean ear weight for the selected families in N+ and N- environments averaged 4,511 kg/ha and 3,327 kg/ha, respectively. Yield reduction between environments averaged 27.14% for the selected families and 65.8% for BR 106. The results indicate that selection in N- environments is an efficient approach for developing genotypes with better performance in soils with low nitrogen content.

Nitrogen (N) availability is estimated to be the principal limiting factor in more than 20% of arable land (Lafitte and Edmeades, 1988). Nitrogen fertilizer application can overcome this limitation in many tropical regions, but the high risk resulting from high cost and uncertain economic return frequently deters farmers from using it. This has brought about an intensified search for technologies which can increase the efficiency of N use by plants (Furlani et al., 1985). For small-scale farmers in Brazil, improved N use efficiency is particularly important because there are no government fertilizer subsidies.

Increasing the N use efficiency of maize germplasm may reduce the effects of soil N deficiency on maize production. Superior genotypes may either be more efficient at N uptake or N utilization, or both. Traditional breeding programs commonly do not

select under low N conditions because higher environmental variation reduces the heritability of grain yield (Blum, 1988). It is not clear whether selection in N limited environments is a better strategy to improve N use efficiency (Clark and Duncan, 1991).

Genetic variability for N use efficiency under low N was found for inbred lines (Balko and Russell, 1980) and tropical cultivars (Thiraporn et al., 1987; Lafitte and Edmeades, 1994a,b). Moll et al. (1987) observed in temperate maize germplasm that materials selected for N use efficiency had good yields at high N levels, but they could not be distinguished from unselected materials at low N levels. It has been suggested that selection efficiency can be increased in environments with low N levels by selecting for secondary characteristics, provided they are correlated with grain yield and less

affected by the environment. For a breeding program, utilization of secondary characteristics is frequently limited due to the difficulty in measuring them with precision and rapidity (Beauchamp et al., 1976; Clark, 1982).

This study evaluates ear yield of half-sib families from Synthetic Elite NT under high and low N conditions and compares their performance with a commercial check entry. Synthetic Elite NT has been selected under low N conditions, whereas the check entry was developed in high fertility environments.

Material and Methods

Maize population Synthetic Elite NT was formed in 1987 from the 10 best inbred lines belonging to the breeding program of the National Center for Maize and Sorghum

