

Analysis of Phenotypic Stability in Ten Cassava Genotypes in Three West African Countries

I. K. Asante¹ and A. G. O. Dixon²

1. Department of Botany, University of Ghana, P. O. Box 55, Legon, Ghana

2. International Institute of Tropical Agriculture, Ibadan, Nigeria

Abstract

Ten cassava (*Manihot esculenta*, Crantz) genotypes were assessed for phenotypic fresh tuber yield stability for 2 years in nine locations in three West African countries (Nigeria, Ghana and Benin). From a combined analysis of variance for fresh yield, all main effects were significant. First order interaction genotype \times year was not significant, while genotype and location interaction was significant. By Finlay and Wilkinson's b-value of stability statistic genotype 82/00058 was considered high yielding with average stability and may perform well in any of the three agroecologies. Genotypes 4(2)1425 and 50395 would be adapted to any favourable agroecology by Finlay and Wilkinson's stability statistic. By Shukula's stability statistic, genotype 30572 ranked the most highly stable. The three stability statistics, Finlay and Wilkinson's, Shukula's and the rank sum method agreed in classifying genotypes 82/00661, 30572, 82/00942 and 82/00058 as high yielding and stable. A plot of environmental mean yields against coefficient of variation (CV) per cent judged genotype 82/00942 as having phenotypic yield stability for the environments considered, while genotype 50395 was judged less stable but high yielding, and, therefore, can be targeted to a specific agroecology.

Introduction

Crop varieties may not produce uniform yields across different environment as a result of the existence of Genotype-Environment ($G \times E$) interactions. Stability to resistance of any sort is one of the most complex problems in the field of resistance breeding. For instance, yield of a crop variety with vertical resistance, i.e. complete resistance, to a particular pest/disease may be stable over time, but generally not sustainable although vertical resistance is dependent on the genetic potential of the crop variety. Sometimes, there is partial or horizontal resistance which is of polygenic, additive nature. Though this type of resistance is likely to be durable, it cannot be sustainable. Generally, these two types of resistance are not sustainable due to fluctuation and continual changes in the population of pest and pathogen. This complicates the selection of lines for release as commercial varieties and recommen-

dations of cultivars for particular environments. It has, therefore, been imperative for the breeder to incorporate stability analyses in the selection of crop varieties that are under the influence of a reasonable level of $G \times E$ interaction.

Three concepts of stability are widely recognized (Lin *et al.*, 1985). Type A stability purports that a genotype is considered to be stable if its among-environment variance is small (Finlay & Wilkinson, 1963; Francis & Kannenberg, 1978). For type B stability, a genotype is considered stable if its response to environments is parallel to the mean response of the genotypes in the trial (Plasteid & Peterson, 1959; Plasteid, 1960; Shukula, 1972), while type C stability states that a genotype is stable if the residual mean square from the regression model on the environmental index is small (Eberhart & Russel, 1966; Lin & Binns, 1988; Kang & Gorman, 1989; Crossa *et al.*, 1991). However, the method commonly used by