

Research Application Summary

Morphological and genetic characterization of mango varieties in Mozambique

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Abstract

Mangoes are economically important for Mozambique because of adequate climatic conditions and international market opportunities. This study compare morphological and AFLP characterisation of 30 mango varieties from the Umbeluzi research station, including some commercial varieties. The total variation was lower using quantitative (89.4% similarity) than qualitative data (60% similarity). The combined quantitative and qualitative dendrogram had a total variation of 63% similarity and clustered varieties in three subgroups based on high fruit weight, high Brix content and low fruit weight. AFLP characterisation used seven primers combinations, generating 207 data points and detecting 74.9% polymorphisms with an average of 30 fragments per primer combination. The total variation was low (72.49% similarity) and the dendrogram showed five subgroups based on low fruit weight, dwarfness and low Brix content, commercial varieties, high fruit weight and roundish fruit shape. The combined morphological and AFLP dendrogram was more accurate in clustering varieties based on geographic origin within the country and from outside.

Key words: AFLP, mangoes, morphological

Résumé

Les mangues sont économiquement importantes pour le Mozambique en raison des bonnes conditions climatiques et les opportunités du marché international. Cette étude compare la caractérisation morphologique et AFLP de 30 variétés de mangues de la station de recherche Umbeluzi, incluant certaines variétés commerciales. La variation totale était inférieure en utilisant une quantitative (89,4% de similarité) que des données qualitatives (60% de similarité). Le dendrogramme combinés quantitative et qualitative a une variation totale de la similarité de 63% et variétés regroupées en trois sous-groupes en fonction du grand poids de fruits, de la haute teneur en Brix et du faible poids du fruit. La caractérisation AFLP a utilisé sept combinaisons d'amorces, produisant 207 points de données et détectant de polymorphismes de 74,9% avec une moyenne de 30 fragments par combinaison d'amorces. La variation totale était faible

(72,49% de similitude) et le dendrogramme a montré cinq sous-groupes en fonction du poids faible des fruits, de la petitesse de fruit et une faible teneur Brix, les variétés commerciales, le grands poids des fruits et la forme arrondie fruits. Le dendrogramme combinés morphologiques et AFLP a été plus précis en matière de regroupement des variétés en fonction de leur origine géographique dans le pays et à l'extérieur.

Mots clés: AFLP, mangues, morphologiques

Background

In Mozambique mango trees are extensively cultivated and are commonly planted in a scattered manner in fruit-gardens and forests. It is also found on small properties, where species not appreciated by the external markets characterised by the presence of fibre, a turpentine smell, small sized or often used by the local people (Ferrao, 1999). Fruit producers in Mozambique have received South African plantlets and overweight fruit and inadequate fruit colour are Tommy Atkins, Kent, Keitt and Heidi appear to be the most popular cultivars. The acceptance of these varieties seems to be associated with its eating quality (World Bank, 2006). Research on fruit growing in Mozambique is in the preliminary stage. More work is needed in continuity of the germplasm collection throughout the country, as well as the characterisation and evaluation of the germplasm for future improvement activities (Ferrao, 1999).

The main aim of this study was to describe and evaluate the main plant and fruit characteristics of 30 local varieties from Mozambique.

Literature Summary

The region of mango origin was most likely Indo-Burma. From here mangoes were probably exported to other countries and continents (Singh, 1968; Kostermans and Bompard, 1993). The worlds total mango production has increased over the years, from about 24.4 MT in 1999 (FAO, 2010) to 33.8 MT in 2008 (FAO, 2009). The major producers are Asia with about 74%, followed by Latin America and the Caribbean with 16%, Africa with 10% and less than 1% foEurope and Oceania (Galan Sauco, 2004; FAO, 2009). According to Krishna and Singh (2007) the phenomenon of allopolyploidy, out crosses and the different agro-climatic conditions in the mango growing areas has proportionate a high level of genetic diversity in mangoes. Confusion however exists in mango nomenclature due to different local names for the same varieties, thus making characterisation of germplasm important for better use of all genetic resources available.

Study Description

In morphological characterization the IPGRI descriptors for mangoes were used as a guide to collect data of the 30 selected varieties. These descriptors were used to assist with the identification of varieties and record characteristics marked as either highly heritable, such as fruit taste and type of embryony, or helping to assess abiotic and biotic stress susceptibility or independent of environmental influences, e.g. maturity period, fruit availability period etc.

For molecular characterization fresh leaves of 30 local varieties from Mozambique were collected from the research station at Umbeluzi, with three leaf samples per variety DNA extraction and all subsequent steps for molecular characterisation were done at the Plant Breeding molecular biology laboratory at the University of the Free State, Bloemfontein in South Africa.

AFLP analysis was done according to Vos et al. (1995) as modified by Herselman (2003). It was performed using *EcoRI* and *MseI* as well as *SbfI* enzymes, adapters and primer combinations. The process included double digestion and ligation of genomic DNA, pre-selective amplification reactions, selective amplification reactions and polyacrylamide gel electrophoresis and silver staining. After that data analysis was done where AFLP fragments were scored manually using binary unit characteristics for presence matrix was used to calculate the genetic similarity matrix using Dice similarity coefficient (Dice, 1945). The similarity matrix was subjected to UPGMA (Sneath and Sokal, 1973) (1) or absence (0) across the 30 varieties for the seven primer combinations utilised. The binary data clustering in the SAHN programme parameter and utilised to construct the dendrogram using the TREE programme of NTSYS-pc software, version 2.1 (Rohlf, 1993). The goodness of fit of clustering data matrices was calculated using COPH and MXCOMP programmes in NTSYSpc.

Research Application

All desired characteristics were not found in a unique variety, although some varieties showed potentially good characteristics for international markets including good Brix/acidity ratio, low content of fibre, good fruit weight, dwarfness, fruit shape and maturation period for different seasons. For processing products, varieties with characteristics for each purpose were identified. Some varieties presented high fruit juice content, for juice processing, high fruit weight for mango pulp and high acid content for mango pickles. Since domestic markets require availability of mango fruit throughout the year, the study provided different

varieties with different maturation periods but more work is needed to prolong the availability of mango fruit throughout the year through breeding programmes as well for international markets. Results indicated that it should be possible to obtain more adequate varieties to fulfill the market opportunity that Mozambique has in October and November and to improve fruit quality.

The lowest level of variation was detected using quantitative data (89.4% similarity) and qualitative data presented the highest (60% similarity).

Genetic characterisation gave significant and reliable results and the AFLP technique proved to be a powerful and suitable tool for identification of mango varieties. The origin of varieties played a significant role in clustering and led to clustering of varieties from India, commercial varieties from Florida and polyembryonic varieties from Thailand.

PCA indicated that fruit weight was the variable contributing most towards variation, and this confirmed the pattern of clustering in the morphological quantitative dendrogram, combined quantitative and qualitative as well as AFLP and combined AFLP and morphological dendrogram where varieties were mainly divided in clusters based on fruit weight. Other characteristics obtained in PCA that determined clustering in the dendrograms were tree height, Brix/TA ratio, TA and Brix.

Recommendation

It is recommended that future studies should include more varieties from the collection at Umbeluzi. Studies should also focus on morphological data taking into account pest and disease resistance as well as genetic and cytological analysis. Future studies should also include genotype x environment interaction over years.

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