Moringa oleifera Lam. Flowering and Fruiting under Sub-optimal Conditions and effects of Starch Storage

Daniel M. Manduwa, Elsa S. du Toit and Hannes Robbertse
Elsa.dutoit@up.ac.za
Department of Plant and Soil Sciences, Faculty of Natural and Agricultural Sciences, University of Pretoria, Private Bag X20, Hatfield, 0028, Pretoria, South Africa

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi

Introduction

Moringa oleifera Lam. (miracle tree) is a fast growing, drought tolerant tree with numerous beneficial uses, such as for nutritious food, animal forage, green manure, water purification, traditional medicine and biofuel (Cordier *et al*., 2013) and in high demand in South Africa. Flowering and fruiting patterns of *M. oleifera* vary in different countries and are unknown for sub-optimal (subtropical) conditions (Gauteng region) in South Africa. Also, *M. oleifera* showed irregular bearing which needed to be investigated.

Figure 1. A flowering and fruiting branch of *M. oleifera*.

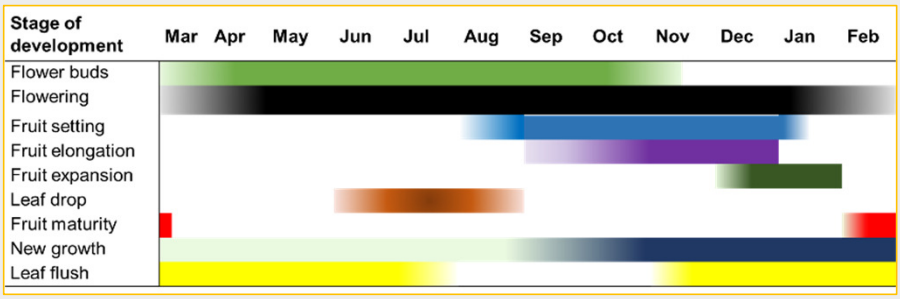

Figure 2. A timeline chart to demonstrate different phenological stages for *M. oleifera* trees at their peak under sub-optimal conditions in South Africa.

Materials and Methods

Research was conducted at the University of Pretoria Experimental Farm (25°45'08.6"S, 28°15'30.5"E) in Gauteng. An eight year old orchard with trees spaced at 2m X 2m under drip irrigation was studied **(Figure 1)**. Each tree was supplemented with 5ℓ water on a weekly basis when the trees received barely any rainfall from May to August. Flowering and fruit set trends were monitored **(Figure 2)**. Changes in starch concentrations for different plant parts (root, branch, shoot, leaf, fruit and seed) were also monitored between 16 flowering trees (control) and 16 deflowered trees. Deflowering was carried out at the onset of the flowering cycle and continued throughout the trial period. Sampling for starch content was done for the above mentioned plant parts at four different phenological stages of the trees, namely: flower development, fruit elongation, fruit filling and fruit maturity. Starch analyses were done according to a modified AOAC 996.11 method (Megazyme, 2011).

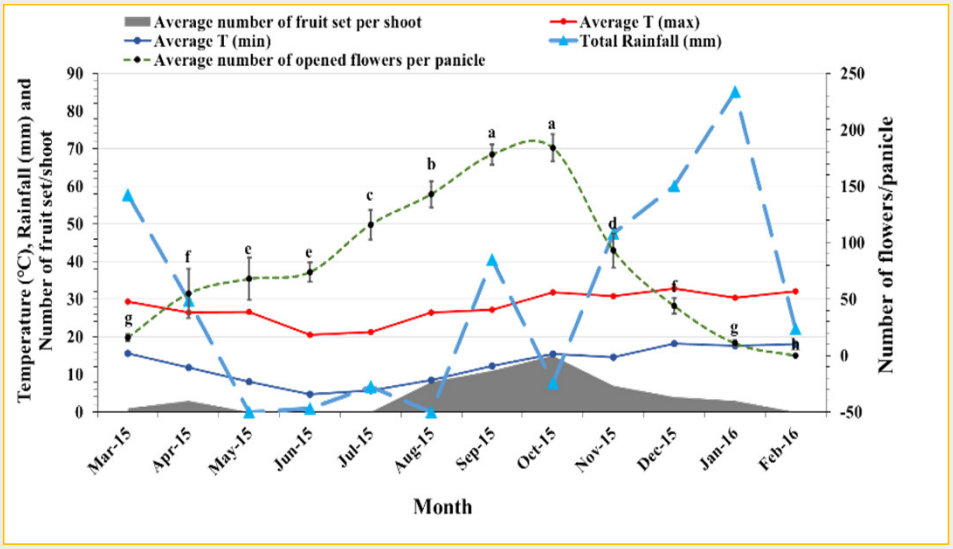

Figure 3. Average flower production per panicle and fruit set per shoot for *M. oleifera* in relation to average maximum and minimum temperatures for 2015/2016 season. Means followed by different letters are significantly different according to Fisher's LSD post hoc analyses (p≤0.05).

Results and Discussion

Flowering was almost all year round **(Figure 2)**. Flower numbers per panicle and fruit set reached a peak during September and October (spring season) with almost no fruit set during June and July (winter season) **(Figure 3)**. Rainfall during the study period was lower (358.3mm) than normally (annual rainfall of 640mm) expected in Pretoria **(Figure 3)**.

There were significant differences in starch reserves between the flowering and deflowered trees (p≤0.05). Also an interaction effect in starch between deflowering treatment (flowering and deflowering) and stage (flowering, fruit elongation, fruit filling and fruit maturity) during development of flowering trees were observed **(Figure 4)**. The effect of deflowering was more significant during fruit filling and fruit maturity stage.

There were no significant differences in flowering and fruiting between flowering and deflowered trees in the following season (year) (p≤ 0.1731) which means that the relationship between starch reserves and fruiting in *M. oleifera* could not be established.

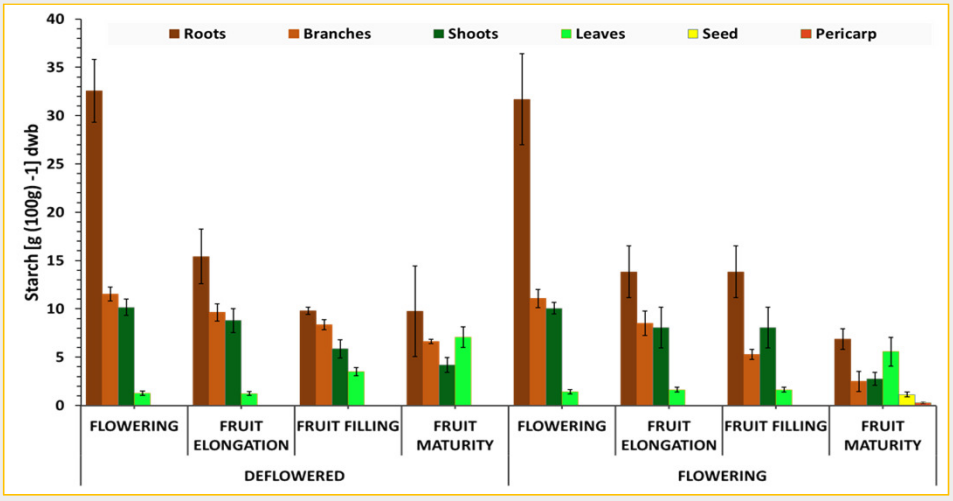

Figure 4. Changes in concentration of starch (g/100g dry weight basis) in different parts of deflowered and flowering trees during the reproductive stage of *M. oleifera*.

Conclusions

Although there is a sink/source relationship in different plant parts, starch cannot be singled out as the only factor for irregular bearing of *M. oleifera* trees under sub-optimal conditions. Extreme weather conditions such as temperature and rainfall may also play a role. Deflowering shows promise to increase starch reserves in the plants for fruit development.

References

Cordier, W., Du Toit, E.S. & Steenkamp, V., 2013. *Moringa oleifera*: Benefits in Nutrition and Health. Botanical Research and Practices. In: Plant Extracts. Nova Science Publishers, New York. p 87-118.

Megazyme 2011. Total starch assay procedure (Amyloglucosidase/ α-amylase method) AOAC Method 996.11 AACC Method 76.13 (and improvements)

Megazyme International Ireland.

NRF National Research Foundation
BHEARD Borlaug Higher Education for Agricultural Research and Development