

ALLEY CROPPING WITH LEUCAENA IN SEMI-ARID CONDITIONS

by

CHRISTELLE CHARLÉ BOTHA

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University of Pretoria
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To the memory of Dolly Pretorius, who would have been so proud.

1947 – 1999

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DECLARATION

I, Christelle Charlé Botha, hereby declare that this dissertation for the degree M.Sc.Agric.(Pasture Science) at the University of Pretoria, is my own work and has never before been submitted by myself for any degree at any other university.



C.C.Botha

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ABSTRACT

Alley cropping with leucaena in semi-arid conditions

by

Christelle Charlé Botha

STUDY LEADER : Prof. N.F.G. Rethman
CO-LEADER : Prof. W. A. van Niekerk
DEPARTMENT : Plant Production and Soil Science
DEGREE : M.Sc.Agric. (Pasture Science)

A study was conducted on the use of *Leucaena leucocephala* in alley cropping systems in semi-arid conditions. Leucaena is a well known multi-purpose leguminous fodder tree and has been used with success in alley cropping in the tropical and sub-tropical regions of the world. The purpose of this study was to simulate such a cropping system, compare different pruning treatments of leucaena, investigate the yields and quality of the crops grown in the alleys, investigate possible competitive effects between the trees and alley crops and monitor changes in soil quality due to the application of leucaena prunings as mulch.

It was concluded that yield and the contribution of yield components can be manipulated by using different pruning treatments. Pruning to a single-stemmed tree provided a long, straight stem that could be used as fence poles, for construction purposes or fuel wood. Crops could also be planted nearer to the trees. Hedgerow pruning is a labour-intensive operation, but is justified by the very high forage yield.

Yield of alley crops was suppressed in 3m alleys, confirming that this is not a viable option under local conditions. It became clear that cropping should not be attempted within 2m of tree rows, as yield was also suppressed. Crude protein concentration, NDF concentration and *in vitro* organic matter digestibility of the alley crops compared favourably with that of the fertilised control.

Row orientation and alley width played a definite role in competition for available moisture and light. It was found that an east-west row orientation provided a more evenly spaced distribution of sunlight. Soil water content increased from a distance of $\pm 1.5\text{m}$ from the trees.

The addition of prunings had a definite effect on the soil fertility status. The ideal, however, would be to monitor soil quality over a longer period, with and without the effect of nutrient removal by cropping, in order to make more accurate estimates of changes in soil chemical properties.

The use of leucaena in alley cropping systems definitely has potential in South Africa, especially in the semi-arid rural regions. It can provide much-needed fuel wood and forage, and also aid in ameliorating soils without the use of expensive inorganic fertilisers.

UITTREKSEL

Gangverbouing met *leucaena* onder semi-ariëde toestande

deur

Christelle Charlé Botha

STUDIELEIER : Prof. N.F.G. Rethman
MEDELEIER : Prof. W. A. van Niekerk
DEPARTEMENT : Plantproduksie en Grondkunde
GRAAD : M.Sc.Agric. (Weidingkunde)

Die gebruik van *Leucaena leucocephala* in gangverbouingstelsels onder semi-ariëde toestande is ondersoek. *Leucaena* is 'n bekende veeldoelige voerboom en is reeds met sukses in gangverbouingstelsels in die tropiese en subtropiese streke van die wêreld gebruik. Die doel van hierdie ondersoek was om 'n gangverbouingstelsel te simuleer, verskillende snoeibehandlings te vergelyk, die opbrengs en kwaliteit van aangeplante gewasse in die gang te ondersoek, moontlike kompetisie-effekte tussen die gewasse en bome te ondersoek en verskille in grondkwaliteit gevolg van die plasing van *leucaena*-materiaal as 'n deklaag te ondersoek.

Opbrengste en die bydraes van die onderskeie komponente tot die opbrengs kan gemanipuleer word deur verskillende snoeimetodes. Enkelstambome het 'n lang, reguit stam gelewer, wat aangewend kan word as heiningpale, vir konstruksiedoeleindes, sowel as vuurmaakhout. Gewasse kan ook nader aan die bome geplant word. Om tot 'n heining te snoei is arbeidsintensief, maar word regverdig deur die hoë voeropbrengste.

Die opbrengs van gewasse is onderdruk in die 3m gange, wat bevestig dat hierdie nie 'n volhoubare opsie onder plaaslike toestande is nie. Dit was duidelik dat gewasse nie binne 2m van die bome aangeplant moet word nie, omdat opbrengste onderdruk word. Die ruproteïëinhoud, neutraalbestande veselinhoud en *in vitro*

organiese materiaal verteerbaarheid van die gewasse het gunstig vergelyk met dié van die bemeste kontrole.

Ry-oriëntering en gangwydte speel definitief 'n rol in kompetisie vir beskikbare vog en lig. In 'n oos-wes oriëntasie was sonlig meer eweredig versprei. Grondwaterinhoud het toegeneem van 'n afstand van $\pm 1.5\text{m}$ van die boomry.

Die toevoeging van die snoei-opbrengs as 'n deklaag het die grondkwaliteit definitief beïnvloed. Dit sou egter ideaal wees om grondkwaliteit oor 'n langer periode te monitor, met en sonder die effek van nutriëntverwydering deur gewasverbouing, ten einde 'n meer akkurate beraming van veranderinge in grondkwaliteit te maak.

Die gebruik van leucaena in gangverbouingstelsels het definitief potensiaal in Suid-Afrika, veral in die semi-ariëde landelike gebiede. Dit kan voorsien in die noodsaaklike behoefte aan vuurmaakhout en voer, en kan aangewend word om grondkwaliteit te verbeter sonder die gebruik van duur anorganiese kunsmis.