EVALUATION OF ELITE BREEDING LINES OF FLUE-CURED TOBACCO FOR FIELD AND MARKET PERFORMANCE

OFFICE LOCARNO PIOUS MULEKANO

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A DISSERTATION SUBMITTED TO
THE FACULTY OF BIOLOGICAL AND AGRICULTURAL SCIENCES
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MAGISTER INSTITUTIONIS AGRARIAE
M.INST.AGRAR.
(SUSTAINABLE PLANT GENETIC RESOURCES MANAGEMENT)

PROMOTER: PROFESSOR CARL Z. ROUX
CO-PROMOTER: DR. TOM B. VORSTER

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To the late my father

You sustained severe sunburns in those cotton fields in pains-taking effort of setting me on this narrow path to the destination you foresaw!

Kwa malemu bambo wanga

Munazunzika ndi dzuwa lowamba koopsya m'minda ija ya thonje mkuyesetsa kolimba kundilozera kanjira aka ka masomphenya anu!

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Declaration

The work contained herein is original of the author. A part thereof or its entirety has not been submitted elsewhere for any course. The institutions, authorities, colleagues, friends and relatives acknowledged or quoted may not be held responsible for any clarifications that may be sought.

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Office Locarno Pious Mulekano

Promoter: Professor Carl Z. Roux (University of Pretoria, Department of Genetics)
Co-promoter: Dr. Tom B. Vorster (Agricultural Research Council-Tobacco and Cotton Research Institute).

Magister Institutionis Agrariae
(M.Inst.Agrar.)
Sustainable Plant Genetic Resources Management.

Abstract

Eleven elite breeding lines of flue-cured tobacco, OD1, OD2, ODT1, ODT8, ODT19, ODT82, ODT92, ODT100, OD313, OD490 and OD486B were evaluated for their field and market performance at the Tobacco and Cotton Research Institute in the 1998/99 growing season. The currently accepted cultivar, TL33, was used as a control.

Crop growth duration, photosynthetic competence, plant height at topping, number of leaves per plant, leaf area, and yield were investigated as parameters of field performance. Leaf quality, nicotine and reducing sugar concentrations and monetary returns per hectare were investigated as parameters of market performance.

The correlation analyses of the parameters of field performance showed that plant height at topping and whole-plant leaf area might be the most important

yield components of these elite breeding lines. Non-significant differences existed between any one of the elite breeding lines and TL33, in terms of cured leaf yields, concentrations of nicotine and reducing sugars in the leaves, cured leaf quality and market income. The Non-significant differences could be attributed to either the restricted genetic advance that is due to the common ancestry and the limited genetic base of *Nicotiana tabacum* or the inherent inaccuracy of one trial at a single locality.

A combined analysis of data from the trial at Rustenburg and other similar trials at Groblersdal, Potgietersrus and Vaalwater was conducted so that accurate information could be arrived at for meaningful conclusions.

The combined analysis showed significant differences among the localities and among the entries. ODT92, ODT82, OD2 and OD1 produced significantly higher yields than TL33 across the four localities. However, the four elite breeding lines were not significantly different from each other. ODT82, ODT92 and OD2 gave significantly higher market income per hectare than TL33, but the three elite breeding lines did not differ significantly. The interaction between the localities and the entries were non-significant.

The Additive Main effects and Multiplicative Interaction (AMMI) analysis showed that the first Interaction Principal Component Analysis (IPCA1) was non-significant. However, the AMMI analysis predicted that ODT82 and ODT92 would be the best-adapted genotypes at Groblersdal, Potgietersrus and Rustenburg while ODT92 and OD2 would be the best-adapted genotypes at Vaalwater in productivity and economic viability.

ODT82 and ODT92 were recommended for on-farm trials at Groblersdal, Potgietersrus and Rustenburg. ODT92 and OD2 were recommended for on-farm trials at Vaalwater. The three elite breeding lines would undergo the on-farm trials pending their release as commercial cultivars at their respective localities.

A holistic approach to crop improvement in multiple locality experiments with designs that maximise genetic effects might be a panacea to experimental irregularities and low producer income levels that prohibit investment.

Research programmes may need to have linkages with the concerned industry, have clear research objectives and adhere to the acceptable procedures of recommendation development.

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Illustrations

List of abbreviations

AMMI	Additive Main effects and Multiplicative Interaction
ARC	Agricultural Research Council
CV	Coefficient of variation
DT	Dry bulb thermometer reading
DTES	District Trial Evaluation System
DTPM	Days to physiological maturity
FLES	Fixed Location Evaluation System
GM	General mean
Ha	Hectare
HR	Hours
IPCA	Interaction Principal Component Analysis
IPCA1	First Interaction Principal Component Analysis
$IPCA1_G$	Genotype First Interaction Principal Component Analysis
$IPCA1_L$	Locality First Interaction Principal Component Analysis
Kg	Kilograms
LA	Leaf area
LAN	Limestone ammonium nitrate
LL	Leaf length
LSD	Least significant difference
LW_m	Maximum leaf width
M_g	Genotypic means
MKTV	Magaliesburg Tobacco Growers' Cooperative
M_l	Locality means
NLP	Number of leaves per plant
NS	Not significant
PHT	Plant height at topping
PTK	Potgietersrus Tobacco Growers' Cooperative
R	Rand (South African monetary unit)
Rep	Replication
RH	Relative humidity
SLA	Single leaf area
TCRI	Tobacco and Cotton Research Institute
TMV	Tobacco mosaic virus
WPLA	Whole plant leaf area
WT	Wet bulb thermometer reading
Y	Genotypic performance