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Pasture Improvement Research in Eastern and Southern Africa

Proceedings of a workshop
held in Harare, Zimbabwe,
17-21 September 1984

Proceedings Series



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Cosponsored by the
Southern African Development Coordination Committee, Gaborone, Botswana,
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Abstract: The proceedings contains reviews by national scientists on pasture research done primarily in Eastern and Southern Africa (Ethiopia, Kenya, Tanzania, Burundi, Zambia, Zimbabwe, Swaziland, Lesotho, Botswana, Mozambique, and Madagascar). The application of the results obtained and lessons learned are highlighted and used in setting of national priorities for research areas for the future. Critical reviews on current pasture research methodologies are included in the proceedings. The research methods discussed are germ-plasm collection, storage, and dissemination; and germ-plasm introduction and evaluation, nutritive evaluation of pastures, grazing experiments, and range monitoring. Specific guidelines on methodologies are outlined and these are useful to pasture agronomists, animal nutritionists, and range-management scientists.

Two case studies of pasture-research regional networks in Asia and Latin America were presented and discussed. A strategy for future pasture research coordinated through a regional Pastures Network for Eastern and Southern Africa (PANESA) was discussed and agreed upon.

Résumé: Dans les actes ci-joints, des scientifiques de divers pays analysent la recherche entreprise sur les pâturages en Afrique orientale et australe (Éthiopie, Kenya, Tanzanie, Burundi, Zambie, Zimbabwe, Lesotho, Botswana, Mozambique et Madagascar). L'utilisation des résultats obtenus et les connaissances acquises sont mises en lumière, puis utilisées pour établir les priorités nationales en matière de recherche. Les actes comportent une analyse critique des méthodes de recherche actuelles sur les pâturages : rassemblement, entreposage et diffusion du matériel génétique; mise à l'essai et évaluation de ce matériel; expériences de pâturage; évaluation nutritive des pâturages et exploitation rationnelle de ceux-ci. On présente des lignes directrices précises sur les méthodes à suivre, qui seront utiles aux agronomes en charge des pâturages, aux spécialistes de la nutrition animale et aux scientifiques responsables de la gestion des pâturages.

Deux études de cas ont fait l'objet d'une présentation suivie d'une discussion : il s'agit des réseaux régionaux de recherche sur les pâturages en Asie et en Amérique latine. Après discussion, on a convenu d'une stratégie de la recherche sur les pâturages, dans les années à venir; la coordination de cette stratégie sera assurée par une section régionale du Pastures Network for Eastern and Southern Africa (PANESA).

Resumen: En las actas se recogen ponencias presentadas por científicos de diferentes países sobre las investigaciones en pastos que se han realizado principalmente en el África oriental y meridional (Etiopía, Kenia, Tanzania, Burundi, Zambia, Zimbabwe, Suazilandia, Lesotho, Botswana, Mozambique y Madagascar). Se destaca la aplicación de los resultados y experiencias obtenidos, muy útiles para determinar las prioridades de las investigaciones futuras en las diferentes naciones. En las actas se recogen también ponencias críticas sobre las metodologías empleadas actualmente en las investigaciones sobre pastos. Se analizan los siguientes métodos de investigación: recogida, almacenamiento, disseminación, introducción y evaluación de germoplasmas; evaluación del valor nutricional de los pastos; experimentos de pastoreo; y control de dehesas. Se resumen directrices y metodologías específicas de gran utilidad para agrónomos especializados en pastos, expertos en nutrición animal y científicos especializados en gestión de dehesas.

Se presentan y analizan dos estudios de casos de las redes regionales de investigación en Asia y Latinoamérica. Se discutió y aprobó una estrategia para realizar investigaciones sobre pastos en el futuro que serán coordinadas por la Red de Investigaciones sobre Pastos para África Oriental y Meridional (RIPAOM).

CONTENTS

Foreword	7
Participants	9
Keynote Address	15
Session I State of Research Work in Eastern and Southern Africa	23
Pasture Research in Zimbabwe: 1964-84 J.N. Clatworthy	25
Highlights of Pasture Research in Malawi: 1975-84 B.H. Dzowela	59
Pasture Research and Development in Ethiopia Lulseged Gebrehiwot and Alemu Tadesse	77
Pasture Research in Burundi Gaboryaheze Astère	92
Survey of Pasture Research in Madagascar J.H. Rasambainarivo, R. Razafindratsita, and M. Rabehanitriniony	102
Review of Range and Pasture Research in Botswana D.R. Chandler	115
Review of the Use of Improved Pasture Species in Mozambique Jonathan Timberlake and António Catalão Dionisio	143

Pastures in Lesotho	
C.J. Goebel, B. Motsamai, and V. Ramakhula	153
Pasture Research and Development in Zambia	
J. Kulich and E.M. Kaluba	163
Past and Current Trends of Pasture Research in Kenya	
Abdullah N. Said	180
Pasture Research in Tanzania	
A.B. Lwoga, M.M.S. Lugenda, and A.R. Kajuni	210
Forage Legumes in Agropastoral Production Systems within the Subhumid Zone of Nigeria	
M.A. Mohamed Saleem	222
Session II	
Pasture Research Methodologies and Regional Networks	245
Collection and Preliminary Forage Evaluation of Some Ethiopian Trifolium Species	
J. Kahurananga, L. Akundabweni, and S. Jutzi	247
Theory and Practice in Forage Germ-Plasm Collection	
J.R. Lazier	260
Germ-Plasm Storage and Dissemination	
Adolf Krauss	296
Tropical Pasture Germ-Plasm Evaluation: Strategy and Experimental Designs	
A.B. Lwoga	312
Introduction and Evaluation of Large Germ-Plasm Collections	
D.G. Cameron	334
Methods of Pasture Establishment	
P.J. Grant and J.N. Clatworthy	349

Animal Experiments as a Measurement of Pasture Productivity P.T. Spear	368
Commercial Seed Increase of New Pasture Cultivars: Organization and Practice D.S. Loch	392
Evaluation of the Nutritive Value of Forages Kassu Yilala and Abdullah N. Said	425
Range Monitoring Methodologies Moses O. Olang	452
Australian-Southeast Asian and Pacific Forage Research Network T.R. Evans	465
Network Approach in Pasture Research: Tropical American Experience J.M. Toledo, H.H. Li Pun, and E.A. Pizarro	475
Discussion Summary and Recommendations	499
Research Priorities and Future Strategies on Germ-Plasm Collection (Multiplication, Storage, and Dissemination)	499
Selection and Evaluation Methodologies	502
Establishment and Management	504
Research for Small-Scale/Small Producers Pasture Improvements	506
Organizational Aspects	507

REVIEW OF THE USE OF IMPROVED PASTURE SPECIES IN MOZAMBIQUE

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Abstract Mozambique, with an area of 779,500 km², encompasses a wide range of ecological conditions. It has a summer rainfall regime of 350 mm to 2,000 mm/year. The southern quarter of the country contains 80% of the total cattle population, much of it in the communal sector. State enterprises account for most of the rest.

Little research has been carried out into the use of improved pastures or pasture species, and most of our knowledge comes from successes or failures of their use on state farms.

Elephant grass is widely used as fresh fodder or for silage, and other large grasses also. Of the legumes leucaena and siratro show promise, as does Lablab purpureus to a lesser extent.

In the future it is hoped to utilize existing research station and state farm facilities in various ecological zones to observe management requirements and performance of selected pasture and fodder species. Emphasis will be placed on green and preserved fodders, and on seed production. Dual-purpose species that can also be used as food for humans will be looked at for use in the communal sector.

A major constraint will be the lack of technical agricultural personnel and practical managerial training will be a priority.

Mozambique covers an area of 779,500 km² from 11° to 27° S latitude and ranges in altitude from 1,600 m to sea level. Mean annual rainfall ranges from 350 mm near the South Africa-Zimbabwe-Mozambique border to 2,000 mm in the highlands of Zambezia Province. Consequently, the range of ecological zones is great, necessitating a flexible approach to pasture research.

There are three broad zones in Mozambique as regards cattle production -- south, central, and north. The south, consisting of the Provinces of Maputo, Gaza, and Inhambane, contains 80% of the national herd of 1.3×10^6 head. The zone is trypanosomiasis-free with the exception of small areas due to Glossina austeni, and this is probably the major reason why the vast majority of communally owned cattle are found here. The vegetation is mostly savanna, and much of the natural pasture is what is termed mixed veld and sweet veld consisting of Themeda triandra, Panicum maximum, and Urchloa mosambicensis along with Digitaria and Eragrostis species. Due to the reasonable summer rainfall (600-800 mm), the occasional dry-season rains, and virtually frost-free conditions in much of the zone coupled with fairly extensive areas of reasonably fertile soils, the potential for utilization of improved pasture species in beef and milk production is quite high. There is also good potential for irrigation along the major rivers.

The central zone is extremely varied and includes the alluvial plains of the Zambezi valley, the dry areas of Tete Province, the high rainfall forest areas of parts of Zambezia and Manica Provinces, and the extensive coastal plains of the Sofala and Zambezia. Some of this zone is covered with Miombo woodland. In most of the area, trypanosomiasis is important. Here, most cattle are found on larger enterprises, particularly in coconut plantations or on sugar farms. Angonia, on the border with Malawi, is exceptional in that it contains many cattle in the communal sector. In general, much of the area can be termed mixed veld, with sour veld in the higher areas and sweetveld in the drier areas of Tete. In this zone, there is also much potential for irrigation.

The northern zone, the Provinces of Niassa, Cabo Delgado, and Nampula, consist mostly of Miombo woodlands on poorer soils with a high incidence of trypanosomiasis. The few cattle found in this zone are predominantly in the state or private sectors, not in the communal sector. There is also little tradition here of cattle raising. Although rainfall is good, there is a long dry season and the grass is coarse and of poor quality for much of the year. Potential for irrigation is low.

USE OF IMPROVED PASTURE AND PASTURE SPECIES

Much of the pasture research that has been done in Mozambique concerns reconnaissance-detail surveys of botanical composition of natural pastures (Myre 1960, 1971, 1972; Lousa 1973) and was carried out in colonial times. More recently, research has been done into control of bush encroachment on natural rangelands (Sweet 1980), but there has been little research on improved pastures. Most of our knowledge has come from successes and failures in the use of these pastures on State Farms (Servoz 1982). Some research has been carried out at Mazeminhama (Myre 1969), and Namaacha and Umbeluzi in the south of Maputo Province on good basalt-derived soils, but has limited applicability to much of the rest of the country. In addition, some small trials are being carried out in Angonia near the Malawi border into suitability of various species for smallholder production (Centro Rural de Desenvolvimento 1984).

Some of the species tried in Mozambique are shown in Table 1 with indications as to their uses and success. In general:

Leuceana leucocephala has proved successful in many areas and is fed green to animals or grazed periodically in situ. Both plantations and row planting in natural pasture have been tried, using direct sowing or raising first in tubes in a nursery. Sufficient seed is collected for the country's present requirements. Mimosine poisoning has not been reported, but cattle have not been fed for long periods.

Siratro (Macroptilium atropurpureum) has been successfully grown and used under a wide range of

Table 1. Improved legumes and grasses used in Mozambique.

Species	Use/management	Success	Zone
<u>Legumes:</u>			
<u>Cajanus cajan</u>	<ul style="list-style-type: none"> Fodder and edible seed production 	<ul style="list-style-type: none"> Good in many areas as a human food crop; tall and open, so some weed problems 	South
<u>Centrosema pubescens</u>	<ul style="list-style-type: none"> Pasture under coconuts 		
<u>Desmodium uncinatum</u> cv. greenleaf cv. silverleaf	<ul style="list-style-type: none"> With elephant grass for fodder or silage Grown under irrigation with <u>Cynodon plectostachyus</u> for dairy fodder 	<ul style="list-style-type: none"> Used successfully 	Manica
<u>Lablab purpureus</u> local cvs	<ul style="list-style-type: none"> Fodder and edible seed production 	<ul style="list-style-type: none"> Good growth; low management requirements. Good seed and leaf production. Not yet tried under grazing 	Maputo
<u>Neonotonia wightii</u> cv. Cooper	<ul style="list-style-type: none"> With elephant grass for fodder and silage Reinforcing natural pastures 	<ul style="list-style-type: none"> Good results Reasonable results, but not persistent under grazing 	South South
cv. Tinaroo	<ul style="list-style-type: none"> Reinforcing natural pastures 	<ul style="list-style-type: none"> Some success; better in cool season 	South
<u>Leucaena leucocephala</u>	<ul style="list-style-type: none"> Reinforcing natural pastures; planted in rows improving fertility of old cotton fields Block planting for fodder; sometimes under irrigation Smallholder production for fodder 	<ul style="list-style-type: none"> Much success; recommended Grows well under dryland conditions 	South North Whole country
<u>Macroptilium atropurpureum</u>	<ul style="list-style-type: none"> Reinforcing natural pastures 	<ul style="list-style-type: none"> Successful; much potential 	Central, south
		<ul style="list-style-type: none"> Some success; tolerant of fire and drought, but expensive 	South

<u>Medicago sativa</u>	<ul style="list-style-type: none"> . With elephant grass for fodder or silage . Improving fertility of old cotton fields . Under irrigation for dairy fodder 	<ul style="list-style-type: none"> . Very successful; recommended; used for milk cattle and pigs . Very demanding in management and soil requirements; not recommended 	South, central North South
<u>Pueraria phaseoloides</u>	<ul style="list-style-type: none"> . Pasture under coconuts . Fodder 	<ul style="list-style-type: none"> . Some success at higher altitudes; can be planted from stolons 	Zambia central
<u>Mucuna</u>	<ul style="list-style-type: none"> . With sorghum and maize for silage under dryland conditions 	<ul style="list-style-type: none"> . Grows well 	South
<u>Stylosanthes guianensis</u> cv. fine stem oxley	<ul style="list-style-type: none"> . With <u>Cynodon plectostachys</u> under irrigation for dairy fodder . Reinforcing natural pastures 	<ul style="list-style-type: none"> . Successful; probably best species for this but does better if cut rather than grazed 	Manica South
cv. Cook	<ul style="list-style-type: none"> . Reinforcing natural pastures 		
<u>Stylosanthes hamata</u> cv. Verano	<ul style="list-style-type: none"> . Reinforcing natural pastures 		
<u>Stylosanthes humilis</u> cv. Townsville	<ul style="list-style-type: none"> . Reinforcing natural pastures 		
<u>Stylosanthes scabra</u> cv. Seca			
Grasses:			
<u>Cenchrus ciliaris</u> cv. Molopo	<ul style="list-style-type: none"> . Reinforcement of natural pastures mixed with Siratro Stylo cv. Cook, Stylo cv. Verano, Leucaena 	<ul style="list-style-type: none"> . Successful establishment but did not persist; better in drier areas 	South
<u>Chloris gayana</u>	<ul style="list-style-type: none"> . Reinforcement of natural pastures with Siratro 	<ul style="list-style-type: none"> . Good results 	(continued)

Table 1. Concluded.

Species	Use/management	Success	Zone
<u>Cynodon plectostachyus</u>	<ul style="list-style-type: none"> Under irrigation or good rainfall, with heavy fertilization for dairy fodder 	<ul style="list-style-type: none"> Good results 	Manica
<u>Melinis minutiflora</u>			
<u>Panicum maximum</u> cvs	<ul style="list-style-type: none"> Reinforcement of natural pastures mixed with Siratro, Glycine cv. Cooper, Leucaena Fodder or silage for beef and dairy cattle 	<ul style="list-style-type: none"> Good results, but stand needs replacing after 3 years; recommended 	South
<u>Pennisetum americanus</u> cv. Babala	<ul style="list-style-type: none"> For grazing or silage 	<ul style="list-style-type: none"> Good preliminary results; dual purpose crop as seed production good 	South
<u>Pennisetum clandestinum</u>	<ul style="list-style-type: none"> Hay making Lawn grass and soil stabilizer 	<ul style="list-style-type: none"> Good at higher altitudes but needs irrigation; production not high Widespread and good results 	Central, south Whole country
<u>Pennisetum polystachyon</u>	<ul style="list-style-type: none"> Fodder or silage for dairy herd 	<ul style="list-style-type: none"> Good preliminary results; drought and flood tolerant 	South
<u>Pennisetum purpureum</u>	<ul style="list-style-type: none"> Fodder for dairy and beef herds and pigs, with or without irrigation For silage alone or with Siratro, Desmodium, Glycine 	<ul style="list-style-type: none"> Very good results; widely used; recommended; best grass for dairy feeding, but needs irrigation Good results 	Whole country Whole country
<u>Setaria sphacelata</u>	<ul style="list-style-type: none"> Fodder for dairy herds 	<ul style="list-style-type: none"> Good production and palatable but needs plenty of water 	
<u>Setaria splendida</u>			
<u>Sorghum</u> spp.	<ul style="list-style-type: none"> Grown for silage under dryland conditions; sometimes with Stilojobium 	<ul style="list-style-type: none"> Successful; widely grown as food crop also 	South

Sources: Personal communication from various state farm managers and Tilak Viegas et al (1981); Tilak Viegas and Servoz (1981); Servoz (1982).

climatic conditions and is generally recommended for dairy production and reinforcement of natural pastures. It is also used green for pig feed. Although top growth was killed in many areas during the recent drought, siratro regrew well after the following rains.

Lablab purpureus local cvs. have shown much promise in the south. Management and fertilizer requirements are low and seed production is good. An added advantage is that the seeds can also be used for human consumption.

Elephant grass (Pennisetum purpureum) is widely grown, often under irrigation, as green feed or silage for dairy cattle and sometimes for pigs. But due to insufficient fertilizer and erratic irrigation, productivity is often low. Mixes with siratro and Glycine cv. Cooper have shown promise.

Cynodon plectostachyus has been used with success on some dairy farms under irrigation and with heavy application of fertilizer. Elsewhere it has been grown for hay. Good results have also been obtained under dryland conditions but under good rainfall.

Lucerne (Medicago sativa) was grown some years ago under irrigation to provide lucerne-meal to feed factories in the Limpopo valley. More recently, attempts to grow it in the south on alluvial soils under irrigation have been rather unsuccessful due to too large an area being cultivated and insufficient management. It is too demanding in its requirements.

On some State Farms normal or fodder sorghums (Sorghum alum, S. sudanese, S. vulgare) are grown to make silage, and on occasion maize (Zea mays) also. Sorghum growth with Stilozobium under dryland conditions has produced significant quantities of fodder for dairy herds.

Both methods of improving pastures -- cultivation of stands of improved species and oversowing of natural pastures -- have been tried. Oversowing or reinforcement of natural pastures (Themeda - P. maximum) has been done with Cenchrus ciliaris, siratro, Neonotonia wightii cv. Cooper, Stylosanthes guianensis cvs. Oxley and Cook, and Leucaena, but most have not persisted,

probably due to insufficient management. The rows of Leucaena have proved quite persistent, however. Establishment in many cases has been by using tractor-drawn disc harrows. It is hoped in the future to utilize animal traction more in the communal sector.

Although attempts have been made for Mozambique to become self-sufficient in seed, in particular for siratro, there is a great shortage (with the exception of Leucaena) in the country. The recent drought severely affected a pilot program of small-scale trials on many state farms in the south of the country (10) and seed collection was not possible. A few private dairy farmers are using improved pasture species, but in general all private and communal sector livestock are raised on natural pastures.

The Instituto Nacional de Investigações Agronómicas has recently set up a small Rhizobium culture facility. Most of the present production is for soybean inoculant, but there are facilities to grow various other strains of rhizobia on an experimental scale. It is hoped to expand these facilities in the future.

FUTURE RESEARCH PRIORITIES AND STRATEGIES

As so little pasture research has been carried out in Mozambique, we have no appropriate or successful research methodologies yet. At present, the emphasis is not on research as such but on utilization of established or reasonably successful species or practices.

However, the most promising and appropriate lines of inquiry for us would be the following: small-scale farm trials of promising new species and varieties in various ecological zones; to determine optimum methods, in the various zones, of establishment, fertilizer requirements, and management of siratro, Leucaena, elephant grass, and others under higher management levels on larger farms, both state and private; the same as above but for the lower management levels and low-risk requirements of the smallholder in the communal sector, for both milk production and selective dry-season feeding of animals; appropriate techniques for reinforcement of natural pastures with legumes such as Leucaena, Stylosanthes, Siratro, and Neotonia, for

either dairy ranching or beef production; appropriate fodder species, alone or in combination, for silage production; and appropriate grass/legume combinations for fodder production under irrigation.

A fruitful line of inquiry, which should also be more readily adopted by communal sector farmers, is the use of dual-purpose crops. These, for example L. purpureus, Cajanus cajan, sorghum, and millet, can be utilized for human food and the residues (or failed crop) used for animal fodder in the dry season.

It is hoped to initiate these investigations on various existing research stations covering the major ecological zones of the country, or on various state farms with the capacity to implement them. Research should also concentrate on economic aspects of pasture improvement. In addition emphasis will be placed on commercial seed production of selected species. A problem in the implementation of this program of investigations will undoubtedly be the shortage of technical agricultural personnel that can be allocated to it.

Much research work on improved pastures and fodder species has been carried out, particularly in Zimbabwe and Australia, that is appropriate for our conditions. The results of this research should be applied on a trial basis in Mozambique in our various ecological zones before being implemented on a production level.

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