Pasture Improvement Research in Eastern and Southern Africa

Proceedings of a workshop held in Harare, Zimbabwe, 17–21 September 1984
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Pasture Improvement Research in Eastern and Southern Africa

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Editor: Jackson A. Kategile

Cosponsored by the
Southern African Development Coordination Committee, Gaborone, Botswana,
and the
International Development Research Centre, Ottawa, Canada
Abstract: The proceedings contains reviews by national scientists on pasture research done primarily in Eastern and Southern Africa (Ethiopia, Kenya, Tanzania, Burundi, Zambia, Zimbabwe, 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.


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, Zambie, Zimbabwe, Soutzilandia, Lesotho, Botswana, Mozambique y Madagascar). Se destacaba 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, diseminación, introducción y evaluación de germoplasma; 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).
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PASTURE RESEARCH IN TANZANIA

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Abstract Pasture research started in the 1930s in Tanzania. Since then, investigations have continued in various aspects of pasture and range production, management and utilization, and pasture plant species introduction and evaluation. This paper briefly outlines these investigations with a note on the current organization and the main areas of pasture and range research.

With a total area of 939,701 km², Tanzania lies approximately between 1° and 12° South and 29° and 40° East. It is essentially a land of plains, valleys, plateaus, and mountains with the altitude varying from 0 m at sea level to well over 5,900 m on the snow-capped peak of Mount Kilimanjaro.

The climate, which is greatly influenced by altitude, varies from tropical subhumid to semi-arid. According to the ecological classification of Pratt and Gwynne (1977), 74% of the country's land surface receives 1500 mm or less annual rainfall, which is considered to be inadequate for the production of most agricultural crops in the absence of irrigation. Livestock production is, therefore, the main activity in these relatively dry areas. Variability in rainfall also influences the distribution of the human population: areas receiving more than 1,500 mm rainfall are, generally, more densely populated than those receiving 1,500 mm or less rainfall.
In 1978, the country had a human population of 17.5 x 10^6, of which about 94% lived in rural areas, and a livestock population of 12.1 x 10^6 cattle, 5.5 x 10^6 goats, and 3.6 x 10^6 sheep (Ministry of Agriculture 1979).

PASTURE RESEARCH

In Tanzania, pasture research dates back to the 1930s and was pioneered by such scientists as Staples (1937, 1938, 1945), Staples et al. (1942), French and Van Rensburg (1952, 1956, 1958), among others. Investigations that have been carried out since then have been reviewed (Mehta 1974) and the following account is only an overview of the investigations.

Range Ecology and Vegetation Surveys

Ecological and vegetation studies have been conducted in various parts of the country by many workers including Phillips (1930), Greenway (1933), Scott (1934), Pielou (1952), Walker (1974), and Kahurananga (1979). The results of some of these and other studies formed the basis for the production of various vegetation maps of Tanzania and East Africa as a whole (e.g., Gillman 1949; Heady 1960; Pratt and Gwynne 1977).

Range Management and Utilization

Studies on stocking rates have been carried out in various ecological zones in the country (Staples 1938; Walker and Scott 1968; Broatch 1970; Lugenja and Kajuni 1979). Grazing systems (rotational, continuous, and deferred and their combinations) have been evaluated in the subhumid to semi-arid areas (Staples 1937, 1945; Walker 1968; Walker and Scott 1968). Walker and Scott (1968) concluded that combinations of rotational and deferred grazing gave better results than any of the other systems used singly.

Considerable work has been done on the control of brush and weeds on rangeland using mixed herds of cattle and goats (Hornby and van Rensburg 1948), fire (Staples et al. 1942; van Rensburg 1952, 1958), and by mechanical means (Brzostowski 1960). However, most of
the results have not been published in widely circulated journals (for instance, a large amount of data is to be found in the Kongwa Pasture Research Biannual Reports 1962, 1968).

The use of mineral fertilizers on natural pasture has been shown to improve both the yield and the quality of forage in various parts of Tanzania (Evans and Mitchell 1962; Anderson 1965, 1968; Walker 1969b; Hendy 1975), but moisture stress reduces drastically the yield response in low rainfall areas (Lwoga 1981).

Introduction and Evaluation of Pasture Grasses and Legumes

The introduction, evaluation, and selection of pasture grasses and legumes have been undertaken for the humid to subhumid areas (Naveh 1966; Naveh and Anderson 1966; Anderson and Naveh 1967; Hopkinson 1979), subhumid to semi-arid areas (Walker 1969a; van Voorthuizen 1971), and semi-arid areas (Owen and Brzostowski 1967; Wigg 1973). The main evaluation criteria used in these investigations included persistence, dry matter production, resistance to grazing, drought resistance, and quality. Earlier studies evaluated the quality (mainly the chemical composition and in vivo digestibility) of various grass and legume species and their mixtures and browses (French 1939, 1941, 1945, 1950, 1957; van Rensburg 1956). Results of more recent evaluations (e.g., Lane and Lwoga 1978; Mukurasi 1978; Myoya 1980) are yet to be published in a form readily available to readers outside Tanzania. The results of some of these studies have been used for making tentative recommendations on the suitability of grasses and legumes for pasture establishment in the various ecological zones in the country (Table 1).

Pasture Establishment, Management, and Utilization

Rather little information is available on the suitability of different establishment methods for sown pastures, but several workers (Northwood and Macartney 1969; Lane and Lwoga 1978; Rukanda and Lwoga 1981) have proved the effectiveness of minimum cultivation techniques, with or without the use of herbicides, in introducing legumes on natural pasture in the subhumid areas.
Table 1. Suitability of grass and legume species for pasture establishment in Tanzania.

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Legumes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Humid to subhumid ecological zones</strong></td>
<td></td>
</tr>
<tr>
<td>Setaria splendida</td>
<td>Neonotonia wightii</td>
</tr>
<tr>
<td>Panicum maximum</td>
<td>Medicago sativa</td>
</tr>
<tr>
<td>Setaria anceps</td>
<td>Desmodium uncinatum</td>
</tr>
<tr>
<td>Chloris gayana</td>
<td>Desmodium sandwicense</td>
</tr>
<tr>
<td>Pennisetum purpureum</td>
<td>Desmodium intortum</td>
</tr>
<tr>
<td></td>
<td>Dolichos formosus</td>
</tr>
<tr>
<td><strong>Subhumid to semi-arid ecological zones</strong></td>
<td></td>
</tr>
<tr>
<td>Chloris gayana</td>
<td>Medicago sativa</td>
</tr>
<tr>
<td>Setaria anceps</td>
<td>Neonotonia wightii</td>
</tr>
<tr>
<td>Panicum coloratum</td>
<td>Clitoria ternatea</td>
</tr>
<tr>
<td>Panicum maximum</td>
<td>Dolichos formosus</td>
</tr>
<tr>
<td>Panicum antidotale</td>
<td>Rynchosia sennaarensis</td>
</tr>
<tr>
<td>Cenchrus ciliaris</td>
<td>Lotononis bainesii</td>
</tr>
<tr>
<td></td>
<td>Desmodium sandwicense</td>
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<td></td>
<td>Desmodium uncinatum</td>
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<tr>
<td></td>
<td>Desmodium intortum</td>
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<td></td>
<td>Stylosanthes guianensis</td>
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<tr>
<td></td>
<td>Centrosema pubescens</td>
</tr>
<tr>
<td></td>
<td>Macroptilium atropurpureum</td>
</tr>
<tr>
<td><strong>Semi-arid to arid ecological zones</strong></td>
<td></td>
</tr>
<tr>
<td>Cenchrus ciliaris</td>
<td>Clitoria ternatea</td>
</tr>
<tr>
<td>Cynodon plectostachyus</td>
<td>Centrosema pubescens</td>
</tr>
<tr>
<td>Chloris gayana</td>
<td>Stylosanthes scabra</td>
</tr>
<tr>
<td></td>
<td>Macroptilium atropurpureum</td>
</tr>
<tr>
<td></td>
<td>Rhynchosia sennaarensis</td>
</tr>
<tr>
<td></td>
<td>Stylosanthes humilis</td>
</tr>
</tbody>
</table>

Many experiments have shown the usefulness of applied fertilizers in improving both the yield and the quality of sown pastures where soil moisture supply is nonlimiting (Owen 1964; Owen and Mukurasi 1973; Marandu et al. 1975). Walker (1973) considered the use
of nitrogen fertilizer on sown grass pasture, in semi-arid north western Tanzania, uneconomic and recommended the use of legumes in mixed pastures as a practical way of increasing dry matter and protein yields.

Both the shortage and poor quality of forage during the dry season remain major constraints to livestock production in Tanzania. There have, however, been few studies on forage conservation and the utilization of conserved forages. Some early experiments (French 1938, 1939, 1956, 1957) evaluated the feeding value of various grass hays and silages but, recently, attention has been directed on the use of field crop residues in improving livestock nutrition during the dry season (Kategile 1979; Edelsten and Lijongwa 1981).

CURRENT PASTURE RESEARCH ORGANIZATION

Following the reorganization of agricultural research in 1981, pasture research is undertaken largely by the Tanzania Livestock Research Organization (TALIRO). Two other institutions, the Sokoine University of Agriculture and Uyole Agricultural Centre, also conduct research in various aspects of pastures.

The main areas of research include the following:

Range: Monitoring, improvement by sod seeding, grazing management, and bush control;

Sown pastures: Establishment methods, management, grazing systems, and conservation; and

Crop residues and other low-quality roughages: Nutritive value, methods of treatment, and utilization. In addition, small-scale seed production is undertaken at the various stations.

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