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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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Postal Address: Box 8500, Ottawa, Canada K1G 3H9
Head Office: 60 Queen Street, Ottawa, Canada

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IDRC-237e

Pasture Improvement Research in Eastern and Southern Africa : proceedings of a workshop held in Harare, Zimbabwe, 17-21 Sept. 1984. Ottawa, Ont., IDRC, 1985. 508 p. : ill.

/Pastures/, /agricultural research/, /genetic improvement/, /forage crops/, /nutritional value/, /productivity/, /East Africa/, /Southern Africa/ - /research methods/, /research and development/, /information network/, /conference report/, /list of participants/.

UDC: 633.2.001.5(67:68)

ISBN: 0-88936-439-7

Microfiche edition available

Il existe également une édition française de cette publication

IDRC-237e

Pasture Improvement Research in Eastern and Southern Africa

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Editor: Jackson A. Kategile



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no. 4

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, 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).

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SURVEY OF PASTURE RESEARCH IN MADAGASCAR

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Abstract Malagasy are among the heaviest beef consumers in Africa. The major livestock are zebu cattle growing on native pasture and improved dairy cattle in the highlands. Seventy-two pasture species have been introduced; four extensively cultivated. Establishment of these pastures seems to be easier in pure stands than in mixtures. Trials show that animal production is high on grass pastures during the rainy season and on legume-based pastures as well in the first part of the dry season. Future areas of research will emphasize dairy small-scale farms and the pasture management of female and young zebu cattle.

The annual beef consumption in Madagascar is 14.65 kg per capita (MDRRA 1980). This means that on the one hand the Malagasy are among the heaviest beef consumers in Africa; on the other hand, this shows the importance of cattle raising based on the abundant native pasture, although it presents some prejudicial characteristics on the development of cattle breeding. Research has been carried out over the past 20 years to improve the ruminant fodders. This paper provides a survey of the results of experiments and suggests future research priority areas.

Madagascar is an island situated between 11° and 25° S latitude. Its total surface is about 587,000 km². The main beef-cattle-raising areas are in the western and southern parts of the island including the Highlands.

There are two climatic seasons: the rainy season, beginning in November, is followed by the dry season, which begins between April and June and lasts for 6-8 months. The annual rainfall ranges from 400 to 2,000 mm. Vegetation is dominated by grassland dotted with forests.

The major livestock in Madagascar is zebu cattle, which are estimated at 10,281,000 head. There are about 1,730,000 goats and 795,000 sheep (MPARA 1982). These animals are mostly meant to produce meat, apart from their important social role. There are 60,000 head of European-like dairy cattle in the Highlands and in the middle-western regions.

Malagasy natural grasslands are characterized by their wide surfaces. They can be divided into four different communities: (a) In the far-west grassland, the principal species are Hyparrhenia rufa, Heteropogon contortus, and Chrysopogon serrulatus. (b) Down south the communities are dominated by H. contortus and Cenchrus ciliaris. (c) In the region commonly called the middle-west, the typical species are H. rufa and H. contortus. (d) The Highland grasslands are dominated by Aristida rufescens, Ctenium concinnum, and Loudetia simplex.

The annual liveweight gain for zebu cattle on natural vegetation for grazing is around 40-70 kg (Granier et al. 1968; de Reviers 1970). The growing period coincides with the rainy season. The liveweight gain may reach 50-120 kg/head, but during the dry season, losses amount to about 20-60 kg/head and the young cattle are likely to die (de Reviers 1970).

Improved pastures are concentrated in the Highlands and the middle-west where dairy cattle are raised; milk production in these pastures varies from 1,300 to 3,500 L/lactation (Robert 1979).

PLANT INTRODUCTION

In the last 20 years, 72 pasture species have been introduced, 32 grasses, 32 legumes, and 8 cactus and browse species. These various species were tested in the four major pasture areas in Madagascar. Ten

species or so proved to be the most adapted and productive. Tall grasses like maize, Pennisetum purpureum and Tripsacum laxum produce 18-22 t dry matter (DM) per hectare. Smaller grasses yield from 7 to 16.4 t DM/ha. It is worth noticing that native pastures may produce 13 t DM/ha (Rasambainarivo et al. 1983).

The highest yielding legume is Stylosanthes guianensis (6 t DM/ha). More recently, Stylosanthes hamata has been introduced, which is regarded as one of the most promising legumes in many ecological areas of the Island. For the dry south, Stylosanthes humilis was tested and proved to be well adapted; on fresh, dry-season highlands, Desmodium species are more recommended.

Four plants are used extensively, three grasses and one legume. The grasses are P. purpureum, T. laxum, and Chloris gayana; the legume is S. guianensis.

ESTABLISHMENT

Generally speaking, from the experiments conducted to date, establishing grasses is easier than establishing legumes, but the research work consisted mainly in determining the most efficient and quickest way of establishing legumes. This led to the study of the factors involved in the improvement of the germination rate of seeds first and then those involved in land preparation.

Improvement of Seed Germination

In our studies, the germination rates of S. guianensis and S. humilis seeds are low (Rasambainarivo and Razafindratsita 1976), so chemical and mechanical treatments of seeds were tried. The results indicate that these treatments are quite profitable and the germination rate can be increased, e.g., the germination of untreated seed of S. guianensis is about 20%, but after treatment it is up to 80%.

Land Preparation

Comparison of two methods of land preparation was made in three different regions (Rasambainarivo and

Razafindratsita 1980). One involved the introduction of legumes in native pasture by the sod seeding technique. The other involved the fully cultivated seed bed using ploughing and disking. The results indicate that the introduction of legumes in the native pasture in this manner is bound to fail 3 or 4 years later, due essentially to competition between the existing vegetation and the legume seedlings. This competition may last 3 or 4 years and the legume yields decrease from year to year.

However, in the case of a fully prepared seed bed, the legume production is high even in the 1st year (S. guianensis: 4-6 t DM/ha) and it remains so more than 5 years after depending on the grazing management. We have only used fertilizer during the establishment period just before sowing. We also tested the pasture persistence under these conditions when there was no more fertilizer applied in the following years.

Research on seed pelleting with *Rhizobium* is not yet well documented and, in most cases, we worked with species whose *Rhizobium* belong to the "cowpea" group. In future, it will be necessary to try inoculation, because after a trial conducted in the western part of the island, we noticed that the growing rates of legumes were much higher when they are sown on a formerly groundnut field.

Grass establishment is easier by sowing or in a vegetative way. When comparing the plant density of maize we do not find any significant differences between 71,400 and 128,500 plants/ha (Rasambainarivo and Razafindratisita 1979). In the middle west region associations were tried. No differences were found on dry matter yields of grass alone (Chloris or Setaria) or their association with Stylosanthes and Siratro (Rasambainarivo and Razafindratsita 1978). The legume-grass ratio dry matter basis is growing from the rainy season to the dry season.

CHEMICAL COMPOSITIONS

Chemical analyses were performed to assess the quality of species. The main conclusions can be summarized as follows with clipped samples (Bigot and Razafindratsita 1975; Rasambainarivo et al. 1983).

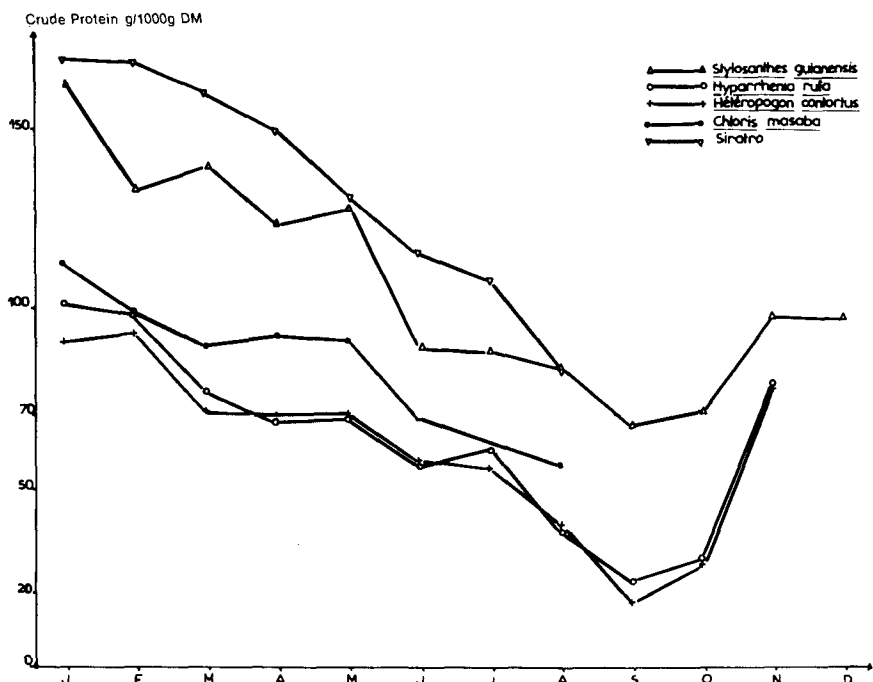


Fig. 1. Crude protein contents of pasture grasses and legumes.

Crude Protein (Fig. 1)

The crude protein content of the pastures decreases from January to September, after this it begins to rise. For grass species, the crude protein percentage is below the 7% level early in May for native pasture and 1 month later for *C. gayana*. It ranges from 10% in January to 2.4% in September for *H. rufa*. As for the legume species, their content does not show any important deficiency even in the dry season. Maximum percentage is reached in January at 16.8% with *Siratro*.

Phosphorus (Fig. 2)

For all the species, phosphorus content is less than 2% year round except for some samples of *Siratro* in the rainy season.

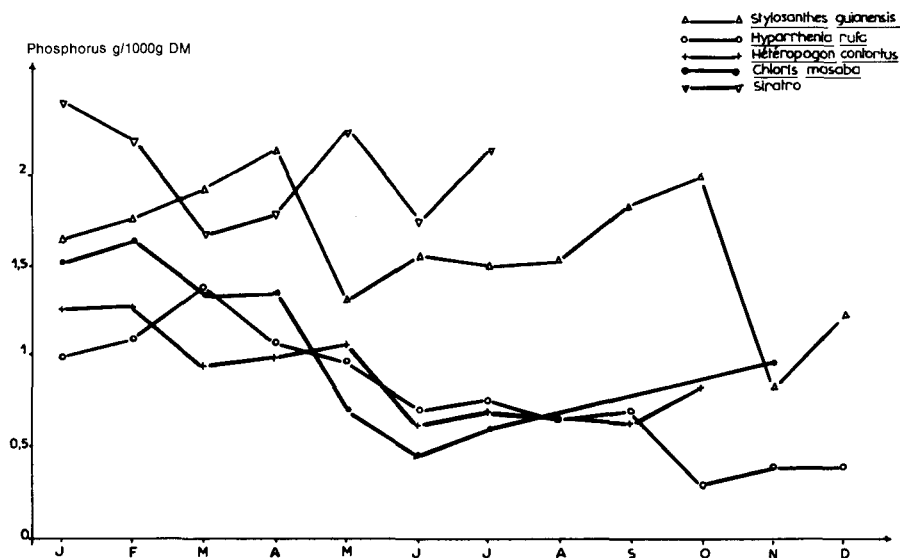


Fig. 2. Phosphorus contents of pasture grasses and legumes.

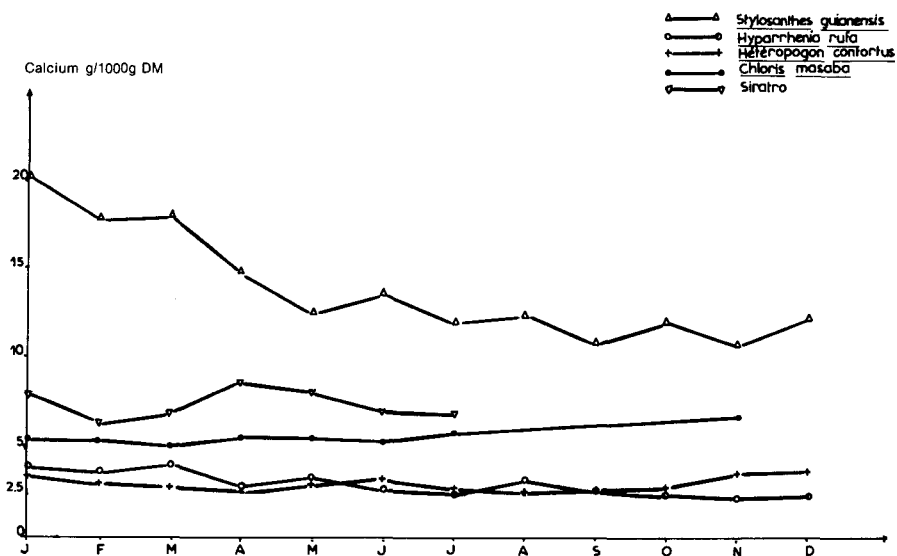


Fig. 3. Calcium contents of pasture grasses and legumes.

Calcium (Fig. 3)

The calcium amounts were considered sufficient to meet the animal requirements in the rainy and dry seasons. This content is usually constant at 2.8% for native species.

GRAZING MANAGEMENT AND ANIMAL PRODUCTION

The major cattle nutrition problem in Madagascar is experienced in the dry season. Pasture evaluation trials and traditional beef management practices indicate that the rainy season pasture is sufficient and has an adequate nutritive value for growth.

Experiments were undertaken to assess beef cattle production on pasture with different stocking rates. Usually, different fixed stocking rates were compared using the continuous grazing method. Six trials were conducted in three areas (Table 1). The main conclusions are that legume-based pasture may be stocked with from 1 to 11 animals/ha. The liveweight gains range from 0.136 to 0.430 kg/day (equivalent to 40 to 280 kg liveweight gains/ha). The main factors affecting animal production are stocking rates and the experimental season. So, by increasing the stocking rate we increased the animal output (Fig. 4). With 2 animals/ha, the gain is about 50 kg/ha but with 11 animals/ha the gain reached 200 kg/ha, even if the individual daily gain decreases from 0.220 to 0.180 kg. Trials, however, conducted in the western region show a very high liveweight gain on a grazed sorghum pasture. Daily individual gain reaches 0.688 kg and the liveweight gain per hectare is about 603 kg when stocked with 12 animals/ha (Fig. 5).

We have also tried the use of maize silage for zebu cattle fattening. The daily liveweight gain rose to 0.720 kg but the silage must be supplemented with 1 kg cotton seed-cake/animal/day (Rasambainarivo et al. 1978). Each hectare sown with maize forage permits a gain of about 1,100 kg liveweight.

All these results indicate that legume-based pastures are very promising during the rainy season and the first part of the dry season (until Septem-

Table 1. Liveweight gains from Zebu cattle grazing artificial pastures in Madagascar.

Pastures (cultivated areas)	Experimental management	Stocking rates (animals/ha)	Duration of experiments (days)	Results		References
				Daily mean gain (kg)	Gain/ha (kg)	
<u>Chloris gayana</u> + <u>Melinis minutiflora</u> + <u>Centrosema pubescens</u> + glycine + <u>Stylosanthes guianensis</u> (1 ha)	"Put and take"	4			286	Razakabaona (1969)
<u>Stylosanthes guianensis</u> + <u>Chloris gayana</u> (6 ha)	Continuous grazing	2 2 4 4	71 (May-Jul)	0.430 0.275 0.331 0.165	61 39 94 47	Rasambainarivo and Rakotozandrindrainy (1977)
<u>Stylosanthes guianensis</u> + <u>Siratro</u> (8 ha)	Continuous grazing	0.9 1.8 2.8	137 (Mar-Aug) 82 (Mar-Jun) 61 (Mar-May)	0.350 0.266 0.328	43 39 57	Rasambainarivo et al. (1983)
<u>Stylosanthes guianensis</u> + <u>Siratro</u>	Continuous grazing	3 6 9	125 (Feb-Jun)	0.245 0.136 0.174	81 100 197	Rasambainarivo et al. (1983)
<u>Stylosanthes guianensis</u> + <u>Siratro</u> + <u>Pennisetum purpureum</u>	Continuous grazing	4 7 11	125 (Feb-Jun)	0.180 0.202 0.204	78 177 282	Rasambainarivo et al. (1983)
<u>Sorghum</u> sp. (7.5 ha)	Continuous grazing	2.8 5.2 9.0 12.5	70 (Sep-Nov)	0.658 0.631 0.522 0.688	103 210 286 603	Rasambainarivo et al. (1983)

$$\begin{aligned}
 \text{Sorghum lowland pasture} &= A \begin{cases} Y = 4.19x + 650.33 \\ r = 0.74 \end{cases} \\
 \text{Grass — legume pasture} &= B \begin{cases} Y = -14.20x + 303.49 \\ r = -0.67 \end{cases} \\
 \text{Native pasture} &= C \begin{cases} Y = -14.43x + 9.64 \\ r = -0.93 \end{cases}
 \end{aligned}$$

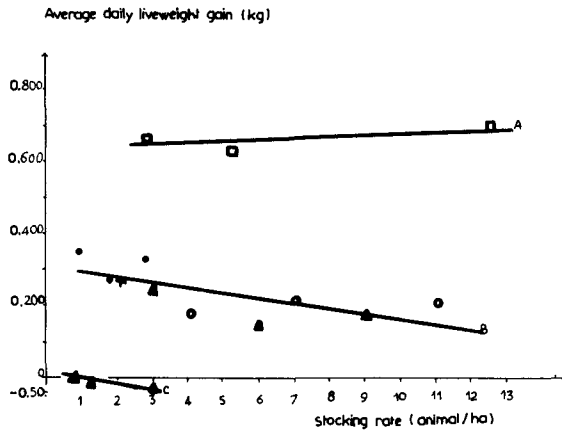


Fig. 4. The relationship between average daily live-weight gain and stocking rate for three pastures in the western region of Madagascar.

$$\begin{aligned}
 \text{Sorghum lowland pasture} &= A \begin{cases} Y = 52.02x - 50. \\ r = 0.99 \end{cases} \\
 \text{Grass — legume pasture} &= B \begin{cases} Y = 23.12x + 1.62 \\ r = 0.96 \end{cases} \\
 \text{Native pasture} &= C \begin{cases} Y = -1.31x + 0.74 \\ r = -0.64 \end{cases}
 \end{aligned}$$

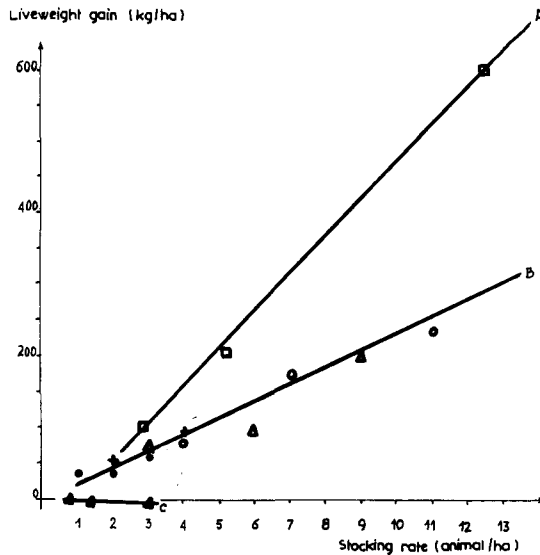


Fig. 5. The relationship between stocking rate and liveweight gain for three pastures in the western region of Madagascar.

ber). They permit some appreciable gains for zebu cattle, and the tall grass pasture, fresh or silage, may be used for beef fattening.

RESEARCH METHODOLOGY

The main purpose of a pasture is to provide food for grazing animals. Therefore, the final value of a pasture is to be expressed in terms of animal production. Our research methodology is then determined by this objective and the various local conditions. Because of a lack of qualified staff, a pasture research team was only formed after 1970.

The history of pasture research in Madagascar can be divided into three periods: from 1960 to 1973, studies were focused on native pastures, the way to improve them by management and plant introduction; from 1974 to 1977, plant introduction was carried on with establishment trials; and, finally, since 1978, we have undertaken some small regional screening trials along with the evaluation of pasture and silage through animal performance, measuring mainly liveweight gains. All these studies were performed in experimental stations and centres, and plant introduction is the result of interinstitution exchanges.

For clipping trials, the plot areas range from 24 to 50 m², where, as with grazing experiments, cultivated areas can reach 10 ha. In this case, management is in the form of continuous grazing with fixed stocking rates. The starting weight for zebu cattle is about 250 kg and experiments last 2-4 months.

FUTURE RESEARCH PRIORITIES

We have now some information on native pasture productivity and its limits and some data about introduced species that are well adapted. In the future, emphasis will be put on two areas: a better understanding of pastures and their management techniques for the dairy smallholdings, and the establishment and management of pastures to increase the female conception rate and encourage a more regular growth of young zebu cattle.

Research will be conducted in experimental stations and centres, but we are fully aware of the importance of on-farm trials. Sectorial and multidisciplinary research will be necessary at both the national and the international levels.

REFERENCES

- Bigot, A. and Razafindratsita, R. 1975. Etude la composition chimique de Stylosanthes guyanensis. Rapport annuel, Madagascar, Département de Recherche Zootechnique et Vétérinaire (DRZV).
- Granier, P. 1970. Productivité du pâturage naturel de bas-fonds dans le Moyen Ouest de Madagascar. Terre Malgache, 8, 166-178.
- Granier, P., Lahore, J., and Dubois, P. 1968. Etude du pâturage naturel de Madagascar. Productivité, Conséquence pratique. Rev. Elevage Med. Vét. Pays Trop. 21(2), 203-217.
- MDRRA (Ministère du Développement Rural et de la Reforme Agraire) 1980. Etude de la commercialisation du bétail et des prix de la viande à Madagascar. Madagascar, Ministère du Développement Rural et de la Reforme Agraire.
- MPARA (Ministère de la Production Agricole et de la Reforme Agraire) 1982. Statistique 1982. Madagascar, Ministère de la Production Agricole et de la Reforme Agraire.
- Rasambainarivo, J.H., Rakotoarivelo, J., and Rakotozandrindrainy, R. 1978. Utilisation de l'ensilage de maïs pour l'embouche du zébu malagasy en saison sèche. Communication présentée à la séance de l'Académie Malgache (Août 1978), 12 p.
- Rasambainarivo, J.H. and Rakotozandrindrainy, R. 1977. Essai de charge et mesure de la productivité animale sur pâturage de Stylosanthes guyanensis et Chloris gayana. Rapport interne, Département de Recherches Zootechniques et Vétérinaire (DRZV).

Rasambainarivo, J.H., Rakotozandrindrainy, R., and Rabehanitriniony, M. 1983. Productivité de quelques pâturages malgaches. Communication présentée à la séance des Sections Scientifiques Fondamentales et Appliquées de l'Académie Malgache (Mai 1983).

Rasambainarivo, J.H. and Razafindratsita, R. 1976. Etude de l'amélioration du pouvoir germinatif des graines de *Stylosanthes guyanensis* et *Stylosanthes humilis*. Rapport annuel, Département de Recherches Zootechniques et Vétérinaire (DRZV).

1978. Comparaison des productions en cultures pures ou associées de 3 légumineuses et 7 graminées fourragères. Rapport annuel, Département de Recherches Zootechniques et Vétérinaire (DRZV).

1979. Evolution du rendement et de la composition chimique de quatre variétés de maïs plantées à 3 densités. Rapport annuel, Département de Recherches Zootechniques et Vétérinaire (DRZV).

1980. Recherche sur l'alimentation fourragère des bovins dans le Faritany de Mahajanga. Résultats des essais de l'année 1980, Département de Recherches Zootechniques et Vétérinaire (DRZV).

Rasambainarivo, J.H., Razafindratsita, R., and Rakotozandrindrainy, R. 1981. Evaluation des productions bovines sur les pâturages à Sorgho des baibobo d'Anjiajia. Rapport annuel 1981, Département de Recherches Zootechniques et Vétérinaire (DRZV).

Razakabaona, F. 1969. Effects of legumes in the tanety grasslands of the Lac Alaotra Station. Madagascar, Rapport Institut de Recherche Agronomique à Madagascar.

de Reviers, B. 1970. Comportement de bovins d'élevage extensif soumis à l'action d'une saison sèche. Madagascar, Rapport Institut d'élevage et de Medecine Veterinaire des Pays Tropicaux.

Robert, J.P. 1979. Développement laitier à Madagascar.
Berne, Suisse, Direction de la Coopération au
Développement et de l'Aide humanitaire, 225 p.