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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

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

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, 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 utilies 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 Africa 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, 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 Africa Oriental y Meridional (RIPAOM).

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HIGHLIGHTS OF PASTURE RESEARCH IN MALAWI: 1975-84

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Abstract *This paper reviews highlights of pasture research in Malawi for the period covering the late 70s to the early 80s on species and cultivar introduction and evaluation, simple grass-legume mixtures, and animal production potential of planted improved pastures and that of legume reinforced natural grasslands. A statement of priorities for future research areas is also presented.*

The period during the late 60s and early 70s saw the beginnings of organized pasture and fodder-crops research in Malawi. The main emphasis was placed on germ-plasm introduction and evaluation in small plots for adaptation to local conditions. Alternative tropical forage grasses to Chloris gayana, the established commercial species, were sought to fit into grazing and stall-feeding enterprises. As a result of this work, a number of species and cultivars belonging to the genera Panicum, Chloris, Cynodon, and Cenchrus have shown good potential for forage.

The increasingly high costs of inorganic nitrogenous fertilizers have prompted a search for leguminous forage species in the genera Stylosanthes, Macroptilium, Macrotyloma, Neonotonia, Centrosema, Desmodium, and Leucaena as a source of cheap biologically fixed nitrogen. There is an ongoing evaluation program for all the germ-plasm accumulated to date. The evaluation program is geared toward fitting forage grasses and legumes to stall-feeding and grazing enterprises for beef and dairy production.

EVALUATION OF AVAILABLE GERM PLASM

Alternative Species to Rhodes Grass

Attempts to seek alternative grazing and stall feeding grasses to Rhodes grass (C. gayana) were initiated in the late 60s. Before this, Rhodes grass was and has continued to be the major commercialized species. Comparative studies to screen different alternative species to Rhodes grass indicated the potential of Panicum maximum cv. Ntchisi panic grass, a local ecotype collected from the wild and other ecotypes, and Cenchrus ciliaris (Table 1). Being a more robust panic grass, it was recommended for "cut and carry" purposes along with Pennisetum purpureum strains such as Gold Coast and Cameroons.

Evaluation of Rhodes Grass Strains

Since the early 50s there have been two documented Rhodes grass strains in Malawi (Dzowela 1984). These are Katambora from Zambia via Zimbabwe and Giant whose entry into Malawi from Tanzania was preceded by two strains, Teso and Mpwapwa, both of which were morphologically similar to Giant (Anonymous 1955, 1956, 1957, 1958, 1959, 1960, 1961). Katambora is a diploid that gained popularity because of its ability to suppress the nematode Meloidogyne javanica in cropping rotations in which tobacco is included, in spite of its relatively low-forage productivity. During the 1977/78 and 1979/80 period, an attempt was made to evaluate elite Rhodes grass cultivars in commercial use in the Central and Eastern African region to identify superior material for forage production over the conventional Katambora and Giant cultivars. Table 2 shows the forage and total crude protein (CP) productivity potential of the materials tested.

In all the years under discussion, the largest amount of forage and CP were produced by Pokot followed by Mbarara and Tanzanian local and then masaba. The latter, however, showed a good regrowth potential under proper cutting management (Dzowela 1984). Both Katambora and Giant, the two naturalized cultivars in Malawi, were inferior in both these respects. Katambora, the only diploid material in the group, produced the least amounts of forage and CP.

Table 1. Comparative forage productivity potential of different grass species and cultivars.

Cultivar	Total DM[a] production (Mt/ha)[c]	Total CP[b] production (Mt/ha)	Digestibility percentage of DM
Ntchisi panic grass	9.3	1.20	62
Hamil panic grass	6.6	0.81	61
Gatton panic grass	5.9	0.74	64
Common panic grass	6.2	0.74	63
Coloured panic grass	6.5	0.80	65
Cononaio panic grass	5.8	0.73	63
Rhodes grass	5.3	0.63	60
Sabi grass	5.0	0.64	61
Bambatsi-coloured panic grass	4.0	0.50	62
Biloela buffel grass	6.2	0.71	-
American buffel grass	4.6	0.57	-
Gayndah buffel grass	4.3	0.50	-

[a] DM = dry matter.
[b] CP = crude protein.
[c] MT = metric tonnes.

Table 2. Forage dry matter (DM) and crude protein yields (CP) of elite Rhodes grass cultivars from the Central and Eastern Africa region.

	Forage DM (Mt/ha)				CP yields (Mt/ha)			
Cultivar	1977/78	1978/79	1979/80	Mean	1977/78	1978/79	1979/80	Mean
Katambora, ex-Zimbabwe	8.52	9.85	9.43	9.27	0.69	0.81	0.69	0.73
Giant, ex-Kenya	9.62	12.21	15.78	12.60	0.85	1.07	0.73	0.88
Masaba, ex-Kenya	10.68	16.10	17.69	14.82	0.75	1.12	0.87	0.91
Pokot, ex-Kenya	12.20	17.71	18.20	16.04	0.74	1.39	0.95	1.03
Mbarara, ex-Udganda	11.19	14.90	17.75	14.61	0.65	1.34	0.87	0.95
Tanzania, local	12.88	15.31	16.93	14.93	0.85	1.09	0.87	0.94
Mean	10.88	14.22	15.91	13.71	0.74	1.14	0.83	0.91
Standard error	±1.97[a]	±1.03[a]	±1.23[a]	-	±0.07[b]	+0.05[a]	±0.02[a]	
Coefficient of variation (%)	26.6	10.2	10.9	-	13.6	8.4	5.4	

[a] Statistically significant at $P = 0.05$.
[b] Not significant.

Because Rhodes grass is an important grass in rotations involving tobacco in Malawi, it is necessary that the forage grass, apart from being easy to eradicate when cropping is anticipated (Booman 1977), suppress the nematode populations of Meloidogyne sp. in the soil. Table 3 shows the types of concentrations of nematodes harboured in the soil around the roots of the elite Rhodes grass cultivars tested.

The analysis showed no evidence of the presence of nematodes in the roots. It only showed the presence of nematodes in soil around the roots; notably the presence of Pratylenchus sp. in Pokot, Masaba, and Tanzanian Local. This nematode does attack tobacco and predisposes the plant to other pathogens such as Fusarium (Saka, personal communication). The other nematodes recorded do not pose a serious threat to the tobacco industry yet, but this fact must be considered and caution must be exercised when recommending some of the new cultivars. Presently, Masaba, because of its seeding qualities and good regrowth attributes, is being produced by the National Seed Company of Malawi.

Evaluation of Buffel Grass Cultivars

Between 1971 and 1975, buffel grass evaluation work (Anonymous 1975) indicated the superiority of this species in terms of forage and CP productivity and persistence over Rhodes grass. This evaluation considered the added advantage that unlike other alternative species, such as Panicum coloratum, cv Bushman mine and Cynodon nlemfuensis, buffel grass produces viable seed. After 1975, three elite cultivars of buffel grass were evaluated in two distinct agroecological zones: Chitala at 600 m altitude representing the low to medium rainfall (<850 mm) Lakeshore and Shire River Valley, and Chitedze at 1,100 m altitude representing the medium plateau areas that receive rainfall between 850 and 1,200 mm. The cultivars were evaluated in response to varying nitrogen (0, 40, and 80 kg N/ha) and phosphate (0, 38, and 76 kg P_2O_5/ha) fertilization rates. Attempts were also made to find suitable compatible tropical legumes at both sites. Data derived from this study are presented in Tables 4, 5, and 6.

At the Chitedze site, Biloela produced the largest amounts of forage followed by the morphologically

Table 3. Nematode recoveries from soil samples collected from the swards of elite Rhodes grass cultivars.

Rhodes grass cultivar	Replicate no.	Nematode identification	Concentration/ litre of soil
Katambora	I	No parasitic nematode	-
Katambora	II	No parasitic nematode	-
Giant	I	No parasitic nematode	-
Giant	II	No parasitic nematode	-
Masaba	I	*Scutellonema* sp.	600
		Pratylenchus sp.	1000
Masaba	II	*Tylenchorhynchus* sp.	200
Pokot	I	*Pratylenchus* sp.	200
Pokot	II	*Tylenchorhynchus* sp.	600
Mbarara	I	*Scutellonema* sp.	1600
Mbarara	II	*Scutellonema* sp.	200
Tanzanian local	I	*Scutellonema* sp.	4000
Tanzanian local	II	No parasitic nematode	-

Table 4. Forage dry matter (DM) yield (MT/ha) and total crude protein (CP) at Chitedze (MT/ha) for the years 1977/78, 1978/79, and 1979/80.

Treatments	1977/78 cultivars			1978/79 cultivars			1979/80 cultivars		
	Biloela	American	Molopo	Biloela	American	Molopo	Biloela	American	Molopo
Forage DM yield									
N-rates (kg/ha)									
0	3.9	3.9	4.1	9.2	9.3	9.3	6.5	7.0	8.0
40	6.5	3.9	4.7	10.1	9.4	10.5	10.3	7.5	9.6
80	5.9	4.7	4.4	11.7	11.6	11.4	12.7	8.6	10.3
P_2O_5 rates (kg/ha)									
0	4.9	2.7	4.2	10.2	9.0	10.0	10.3	8.2	8.9
38	5.3	4.5	3.7	10.9	10.1	11.1	10.3	7.7	9.7
76	6.2	4.7	5.2	9.9	11.1	10.1	8.8	7.2	9.3
Cultivar									
Mean	5.5	3.9	4.4	10.4	10.1	10.4	9.8	7.7	9.3
Standard error		±1.3[a]			±0.16[b]			±0.25[a]	
N-rates (kg/ha)	0	40	80	0	40	80	0	40	80
Mean	3.7	5.0	5.0	9.3	10.0	11.5	7.2	9.1	10.5
Standard error		±0.27[a]			±0.32[a]			±0.43[a]	
P_2O_5 rates (kg/ha)	0	38	76	0	38	76	0	38	76
Mean	3.9	5.0	5.4	9.8	10.7	10.4	9.1	9.3	8.4
Standard error		±0.36[b]			±0.41[b]			±0.62[b]	

(continued)

Table 4. Concluded.

Treatments	1977/78 cultivars			1978/79 cultivars			1979/80 cultivars		
	Biloela	American	Molopo	Biloela	American	Molopo	Biloela	American	Molopo
Total CP yield									
N-rates (kg/ha)									
0	0.45	0.35	0.35	0.84	1.03	0.84	0.28	0.34	0.36
40	0.78	0.38	0.42	1.05	1.02	1.07	0.48	0.39	0.45
80	0.75	0.46	0.43	1.20	1.37	1.28	0.66	0.56	0.52
P_2O_5 rates (kg/ha)									
0	0.59	0.29	0.39	0.77	1.14	1.36	0.50	0.45	0.42
38	0.60	0.45	0.37	1.01	1.02	1.33	0.50	0.39	0.47
76	0.79	0.44	0.45	0.92	0.99	1.17	0.43	0.46	0.43
Cultivar									
Mean	0.66	0.40	0.40	1.03	1.14	1.06	0.48	0.43	0.44
Standard error		±0.054[a]			±0.42[b]			±0.46[b]	
N-rates (kg/ha)	0	40	80	0	40	80	0	40	80
Mean	0.38	0.53	0.55	0.90	1.05	1.29	0.33	0.44	0.58
Standard error		±0.24[a]			±0.060[a]			±0.017[a]	
P_2O_5 rates (kg/ha)	0	38	76	0	38	76	0	38	76
Mean	0.42	0.47	0.56	1.09	1.12	1.29	0.46	0.45	0.44
Standard error		±0.031[a]			±0.059[b]			±0.042[b]	

[a] Significant at P = 0.05 level.
[b] Not significant.

Table 5. Forage dry matter (DM) yield (Mt/ha) and total crude protein (CP) (kg/ha) at Chitala (MT/ha) for the years 1977/78, 1978/79, and 1979/80.

Treatments	1977/78 cultivars			1978/79 cultivars			1979/80 cultivars		
	Biloela	American	Molopo	Biloela	American	Molopo	Biloela	American	Molopo
Forage DM yield									
N-rates (kg/ha)									
0	0.82	0.88	0.90	5.30	5.88	4.93	5.21	4.46	4.56
40	1.33	1.77	1.09	6.73	9.12	6.18	6.70	5.89	7.10
80	2.06	2.19	2.03	8.49	10.43	9.27	10.09	7.90	8.38
P_2O_5 rates (kg/ha)									
0	1.55	1.38	1.56	7.71	7.57	7.41	6.94	5.61	7.52
38	1.28	1.76	1.32	5.85	8.59	6.10	7.59	6.15	5.85
76	1.40	1.65	1.13	6.97	9.27	6.87	7.48	6.50	6.67
Cultivar									
Mean	1.41	1.59	1.34	6.84	8.48	6.79	7.33	6.09	6.68
Standard error		±0.17[b]			±0.34[a]			±0.36[b]	
N-rates (kg/ha)	0	40	80	0	40	80	0	40	80
Mean	0.87	1.38	2.09	5.37	7.34	9.40	4.75	6.56	8.79
Standard error		±0.15[a]			±0.52[a]			±0.23[a]	
P_2O_5 rates (kg/ha)	0	38	76	0	38	76	0	38	76
Mean	1.49	1.45	1.39	7.56	6.84	7.70	6.69	6.53	6.88
Standard error		±0.20[b]			±0.49[b]			±0.32[b]	

(continued)

Table 5. Concluded.

Treatments	1977/78 cultivars			1978/79 cultivars			1979/80 cultivars		
	Biloela	American	Molopo	Biloela	American	Molopo	Biloela	American	Molopo
Total CP yield									
N-rates (kg/ha)									
0	60	121	65	392	448	392	208	162	177
40	95	139	75	490	780	514	332	300	346
80	139	166	139	504	775	615	676	456	480
P_2O_5 rates (kg/ha)									
0	113	161	115	590	592	554	400	283	381
38	88	142	87	323	686	506	348	310	302
76	94	123	78	474	725	461	467	325	322
Cultivar									
Mean	98	142	93	462	668	507	405	306	335
Standard error		±4[a]			±61[b]			±25[b]	
N-rates (kg/ha)	0	40	80	0	40	80	0	40	80
Mean	82	103	148	411	595	631	182	326	538
Standard error		±11[a]			±33[a]			±19[a]	
P_2O_5 rates (kg/ha)	0	38	76	0	38	76	0	38	76
Mean	130	106	76	579	505	553	355	320	371
Standard error		±21[b]			±40[b]			±30[b]	

[a] Significant at $P = 0.05$ level.
[b] Not significant.

Table 6. Forage dry matter (DM) yield (Mt/ha) at Chitedze and Chitala.

	Chitedze	Chitala	
Treatments	1979/80	1978/79	1979/80
Buffel grass alone	5.22	3.80	2.53
Buffel grass in Siratro	2.59	4.92	2.69
Siratro in buffel grass	0.99	1.74	0.88
Buffel grass in Neonotonia	2.27	5.13	3.13
Neonotonia in buffel grass	0.96	0.37	0.08
Buffel grass in cook stylo	1.92	4.01	3.39
Cook stylo in buffel grass	0.52	1.92	0.06
Buffel grass in Centrosema (Hamata stylo)[b]	2.30	4.26	2.74
Centrosema (Hamata stylo)[b] in buffel grass	0.45	2.65	0.91
Siratro alone	1.94	4.13	1.32
Neonotonia alone	1.10	4.30	0.43
Cook stylo alone	0.90	5.59	0.77
Centrosema (Hamata stylo)[b] alone	0.65	6.33	2.85
Mean	1.68	3.83	1.67
Standard error	±0.21[a]	±0.65[a]	±0.40[a]

[a] Significant at P = 0.05 level.

[b] Hamata stylo was substituted for Centrosema at Chitala.

similar Molopo. There was a tendency for all cultivars to respond favourably to increasing nitrogen application rates. The forage productivity response to nitrogen application was significant in all years but the response to phosphate application was generally insignificant.

Crude protein yields were comparable among the three cultivars in all years except in the 1977/78 season when Biloela produced the largest amount of total CP. At Chitala, on the other hand, there was a tendency for the American variety to outyield the other cultivars. This was particularly evident in the first 2 years (Table 5). In the 3rd year there was a shift toward Biloela. This was attibuted to a 10% increase in the amount of rainfall at this site that year. All cultivars responded significantly to nitrogen fertilization rates, but there was no significant response to phosphorus application. At both Chitedze and Chitala, the soils have adequate amounts of available phosphates; this explains the lack of response (Matabwa, personal communication). It appears from this study that cv. Biloela does well in the subhumid environments whereas cv. American could be adapted to the drier near semi-arid areas. This fact was established in a separate study (Dzowela and Msiska 1984).

Growing buffel grass in association with tropical forage legumes benefits the grass component in the system. This fact was evident at Chitala where the forage production of the buffel grass increased as a result of a legume component. This increase could be either due to utilization of the nitrogen fixed by the legume or the smothering of weed species by the legume. At Chitedze, on the other hand, this advantage of the legume component was not very obvious (Table 6). The best association appeared to be that involving buffel grass/Hamata stylo followed by buffel grass/ Siratro and then buffel grass/Cook stylo at Chitala. For Chitedze, the best association was one involving buffel grass/Siratro followed by buffel grass/Neonotonia, buffel grass/Centrosema, and then buffel grass/Cook stylo.

ANIMAL PRODUCTIVITY OF IMPROVED PASTURES

Fertilized Grass Pastures vs. Legume-Based Pastures

A number of tropical forage grasses and legumes have been agronomically evaluated in Malawi. Of the Panicum species, the local strain, Ntchisi panic grass has shown greatest potential (Anonymous 1975). Its productivity potential in a cutting situation has been found to be three-fourths of that achievable by P. purpureum x P. typhoides (Dzowela 1978). Before this the Ntchisi panic grass was regarded as a grass suitable for "cut and carry" purposes. However, observations at Chitedze Agricultural Research Station have established that Ntchisi panic grass can persist for more than a decade in a grazing situation.

Of the newly introduced Rhodes grass cultivars from Kenya, the Masaba strain has shown good forage and regrowth characteristics (Dzowela 1984). It responds very well to inorganic nitrogen fertilizer, but with the current increased costs of this form of fertilizer, the option is to incorporate a tropical legume component in the pasture system. The legume component has the dual purpose of raising the nutrient status of the pasture system with respect to CP and calcium and phosphorus and of contributing biologically fixed nitrogen to the system to the benefit of the grass component as well (Thomas 1973). Earlier work conducted in Malawi has established the compatibility of Rhodes grass with Desmodium uncinatum cv. Silverleaf (Thomas 1976).

Attempts to seek more permanent pasture species for Malawi (Anonymous 1975) identified the C. nlemfuensis cultivar, Henderson No. 2 star grass, as a productive tropical grass. It produced good amounts of digestible forage and was able to support grazing animals through the wet season better than Rhodes grass.

A study comparing the performance of animals grazed on Ntchisi panic grass, Masaba Rhodes grass, and Henderson No. 2 star grass, a grazing trial was conducted at Chitedze Agricultural Research Station. The three pastures grown in pure stands receiving 40 kg of inorganic nitrogen application per hectare annually were compared with a Masaba Rhodes/Silverleaf desmodium mixed sward without the inorganic nitrogen application. Paddocks measuring 1.5 ha each were arranged in a randomized complete block design with three replicates. Each paddock was subdivided into four quarters to facilitate sequential rotational grazing by 2-year old Malawi Zebu heifers using the "put and take" grazing-management system (Mott 1960; Mott, personal communication). There were eight test animals permanently assigned to each pasture along with variable numbers of additional "graze" animals to use excess forage. Forages were sampled for dry matter (DM) before grazing. The animals were weighed on a 28-day interval throughout the wet season, which lasted for 5 months in 1982/83 and 1983/84.

The forage and animal productivity potential of Ntchisi panic grass is evident (Table 7). It produced significantly better average daily gains (ADG), total gains, and total forage than the other pastures, although ADG was not different from that achieved from Rhodes grass/Silverleaf pasture. Star grass supported the highest number of animals despite its relatively poor animal productivity. Intake and digestibility-related problems were suspected in the absence of chemical analytical data. In terms of forage productivity, the Rhodes grass pastures in pure and associated swards with Silverleaf desmodium were comparable; the better animal performance of the mixed pasture was attributed to higher nutrient intake afforded by the legume component in the mixture. In terms of ADG, the pure Rhodes grass pasture had similar production values to the Rhodes grass with Silverleaf in 1983/84 for some unknown reasons, while chemical analyses were being awaited.

Star grass, closely followed by Ntchisi panic grass, provided the most grazing days, although its forage production was lower than that of Ntchisi and comparable to that of the Pure Rhodes grass and Rhodes grass and Silverleaf desmodium. The fact that individual animal ADGs were lowest on star grass relative to the other pastures does confirm some intake and digestibility-related problems with this grass.

Legume Reinforced Natural Grassland

Preliminary investigations by the UNDP/FAO Project/75/020 indicated the value of introducing

Table 7. Average daily gains (ADG), total grazing days, total liveweight gains and dry matter (DM) forage offered

Pasture	ADG (kg/ha)	Grazing days (days/ha)[b]	Total gain (kg/ha)	Total seasonal forage DM (Mt/ha)
1983/83				
Star grass	0.42[a]	1628[a]	720[a]	11.45[a]
Ntchisi panic grass	0.67[b]	1451[ab]	916[b]	18.40[b]
Rhodes grass (pure)	0.49[a]	1340[b]	662[a]	11.33[a]
Rhodes grass + Silverleaf	0.62[b]	1184	669[a]	11.17[a]
1983/84				
Star grass	0.61[a]	1960[a]	911[a]	14.18[a]
Ntchisi panic grass	0.67[b]	1837[a]	950[a]	15.56[a]
Rhodes grass (pure)	0.70[b]	1177[b]	527[b]	14.61[a]
Rhodes grass + Silverleaf	0.70[b]	1165[b]	526[b]	14.71[a]

[a] Figures within a column with the same letter do not differ significantly, following Duncan's New Multiple Range Test.

[b] Product of length of grazing season in days and number of grazing animals (testers and grazers).

Table 8. Comparative liveweight gains of stylo-based and improved natural grasslands.

Treatments	Total gains in kg/animal from 26/6/79 to 18/8/79[a]	Mean daily gain in kg/animal
Stylosanthes-based grasslands	25.79	0.486
Unimproved	-3.56	-0.067

[a] Based on a group of 13, 2-year old steers.

Stylosanthes guianensis cv. Cook stylo as a means of improving the forage quantity and quality of extensive natural grazing areas, particularly in the dry season under the Western Mzimba ecological conditions in Northern Malawi. Liveweight gains of approximately 0.25 kg/day/animal were obtained between May and November when cattle generally lose weight (Van Empel, personal communication). An attempt, therefore, was made to determine the optimum stocking and productivity potential of these Stylosanthes-based grasslands (Table 8).

The potential of improving the natural grasslands by legumes cannot be overemphasized. The Cook stylo was capable of arresting liveweight losses at the time the group on unimproved grassland were losing weight. This was attributed to better intakes and digestibility of the legume-reinforced forage.

PRIORITIES FOR FUTURE RESEARCH AREAS

Although reliable research information has been generated, this type of research has primarily served the interest of the commercialized farmers who own only 4% of the national cattle herd of 0.87×10^6. The mixed smallholder farmer will be the main target of research efforts for the 80s. The need to develop a research technology that will be able to raise the standard of living of the smallholder through increased livestock productivity will be highlighted within the adaptive or farming systems research concept. An integration of improved pastures in the farming system of motivated dairy and beef farmers will take the first priority. Undersowing of improved pasture species in maize crops with the view to utilize crop residues better during the dry season will be the focal point of this work.

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