Uganda Journal of Agricultural Sciences, 2004, 9:466- 469
ISSN 1026-0919

Restoration of degraded natural grasslands to enhance soil fertility, pasture and animal productivity

E. N. Sabiiti, D. Mpairwe, M. S. Rwakaikara, and S. Mugasi
Faculty of Agriculture, Makerere University, P.O Box 7062 Kampala, Uganda

Abstract

The natural grasslands of Uganda are regarded as a natural asset due to multiple uses in terms of providing cheap natural feeds/pasture to the over 5 million heads of cattle and about 6 million sheep and goats and in addition, support wild life and provide natural cover to the soils. Unfortunately, the grazing resources are facing serious degradation due to mismanagement, natural causes such as drought, weed invasion, frequent uncontrolled burning and overgrazing by cattle and wild life. There has been limited research to address the above constraints and the situation is becoming more serious because of reduced overall ecosystem productivity- animal productivity, reduced pasture productivity and loss of biodiversity. This downward trend is likely to affect the livelihoods of the majority of the people especially pastoralists who depend on these grasslands for animal production and herbal medicine. Limited research using forage/fodder legumes to restore or halt the declining trends indicate promising results over a period of six years on different farms in Mbarara District, Uganda. Introducing several improved legumes and grasses into these grasslands improved soil fertility, pasture and animal productivity with subsequent increase in food (milk) production and incomes. This paper presents data that has been generated from several studies on grassland research and other studies in the country that have developed appropriate technologies that have been adopted or are being adopted by the farmers to solve the problems of declining natural resources, food security and hence reduced poverty.

Key words: Animal, forages, grassland ecological productivity, legumes, degraded, animal, Kazo, Mbarara

Introduction

In Uganda, of the 20mha of land surface, 25% is covered by natural grassland and range (FAO, 1988). These natural grasslands are regarded as a natural asset due to multiple uses in terms of providing cheap natural feeds/pasture to the over 5 million heads of cattle and about 6 million sheep and goats and in addition, support wild life and provide natural cover to the soils. They also provide food, fibre, fuel wood, and medicine to the pastoral communities that utilize these grasslands and have significantly contributed to the economic development of the Country. Unfortunately, these grassland resources are facing serious degradation due to mismanagement, natural causes such as drought, weed invasion, frequent uncontrolled burning and overgrazing by cattle and wild life. The net effect has been a reduced ecosystem production in terms of pasture and animal production (Mugasi et al., 2000). This condition is also indirectly affecting the livelihoods of the pastoral communities (food security, income and health).

The limited research in Uganda to address the above constraints has indicated that bush clearing, use of improved legumes and grasses have enhanced productivity of the grasslands (Otim 1973, Mugasi et al., 1999, Sabiiti and Teka 2004). This paper presents data that has been generated by part of a six-year research in Kazo, Mbarara and other data from elsewhere that indicate promise on halting grassland degradation.

Methodology

The research in Kazo was done on farms of willing pastoralists who provided land and labour. Soils were sampled from these farms to determine nutrient status initially and there after treatments. A demonstration plot planted to several grasses and legumes was established first in 1996 to determine persistence of forages under these natural conditions and the most promising forages were later introduced on farms through over-sowing techniques (Sabiiti, 2003). The established grass/legume pastures on farm were grazed using lactating cows and during the grazing periods the farmers recorded milk production. Also the dry matter yields of the pastures were estimated and the chemical composition determined using the conventional methods. For species adaptability assessment a scoring scale system was used as and 0-3=poor adaptability, 4-6=moderate adaptability, 7-10=high adaptability.

Results and discussions

Persistence of improved grasses and legumes

The results in Table 1 indicate the most adapted forage species after two years of observation. These forage species attracted the attention of the pastoral communities since they remained green during the dry seasons.

Herbage dry matter yield, crude protein and animal production of natural pastures

As can be seen from Table 2, over-sowing forage legumes in natural pastures (improved) more than doubled the mean DM yield and mean CP yield. The farmers reported increased milk yield in cows that grazed these improved pastures. Many of them who had not sold milk before had started selling their milk and hence increased household incomes. The average milk yield on unimproved farms was 2.4 litres/cow/day compared to 3.8 litres/cow/day on improved farm and the differences could be contributed by the legumes, which contain high CP important for milk production. Studies at Serere (Table 3) further show that improved grass/legume mixtures in a similar ecological zone led to increased animal production in terms of live weight gains (Otim, 1973) suggesting that this technology has a potential for restoring the grasslands in Kazo.

Bush clearing on grassland productivity

Nearly all the farms in Kazo have been encroached by Acacia bushes and this has significantly reduced their productivity in terms of herbage yield and animal production (Sabiiti and Wein, 1991). The results in Table 4 clearly show that bush clearing more than doubled both DM and CP yields. Also it promoted the regeneration of natural legumes (*Neonotonia wightii*) in these pastures. Therefore, this approach when properly used will lead to the restoration of the degraded grasslands.

Soil fertility under natural pasture

Soil analysis studies on farms showed that there was an improvement in the nutrients status especially, %N upon using the improved pastures. Percent N ranged from 0.3 – 0.4 on improved pastures as compared to 0.1 – 0.2 on unimproved farms. However, the analysis was done after a year and this would not cause remarkable increases in N transfer. Table 5 shows that forage legumes certainly fix N and since some of these legumes were used in the study, it can be safely concluded that the increase was due to N fixed by the improved legumes.

Table 1. Highly adapted forage legumes and grasses in rangelands

Scientific Name	Common Name	Score
Legumes		
Macroptilium atropurpureum	Siratro	8
Centrosema pubescens	Centro	8
Cassia rutundifolia	Cassia	9
Lablab purpureus	Lablab	7
Desmodium intortum	Green leaf desmodium	7
Desmodium uncinatum	Silver leaf desmodium	7
Stylosanthes guianensis	Stylo	9
Gliricidia sepium	Gliricidia	10
Grasses		
Chloris gayana	Chloris	8
Brachiaria brizatha	Brachiaria	8

Scale:0-3= Poor adaptability; 4-6= Moderate adaptability; 7-10=High daptability

Table 2. Effect of over-sowing forage legumes in natural grass swards on dry matter yield and crude protein on farms in Kazo, Mbarara, Uganda

Farmer	Plots	Mean DM yield (kg/ha)	Mean % CP	Mean CP yield (kg/ha)
Kamaruka	Improved	4963	7.71	382
	Unimproved	2803	6.97	195
Katsigazi	Improved	4302	8.37	360
	Unimproved	1916	7.63	146
Kyambu	Improved	3202	8.53	273
	Unimproved	1032	8.21	85
Robinah	Improved	3744	9.49	355
	Unimproved	1911	8.59	164

Table 3. Animal production (live weight – gains) from grass/legume pastures in Serere, Uganda

	Panicum	Panicum + Stylo	Panicum + Siratro	Panicum + Centro	Panicum + Desmodium
Live weight gains in kg/ha/annum	510	675	658	694	744
Average daily gains in kg	0.38	0.51	0.49	0.52	0.56
% advantage of Grass-legume Pasture over pure Panicum in L.W.G./ha/annum		32.0	29.0	36.1	45.9

Adapted from Otim, 1973

Table 4. Mean herbage dry matter yield and chemical composition of pasture on two types of range condition in Kazo in 1998

	Cleared farms	Bushy farms
Dry Matter (kg/ha)	2,040	906
Crude Protein (kg/ha)	182	86
Crude Protein (%)	9.15	8.92
Neutral Detergent Fibre (NDF)	62.50	63.00
Dry Matter (%)	27.49	30.13
Legume Component (%)	7.35	2.27

Table 5. Some nitrogen fixation rates for tropical legumes in sub-Saharan Africa

Legume	Range (kg N/ha/yr)
Centrosema pubescens	84-396
Desmodium intortum	178
Leucaena leucocephala	110-600
Stylosanthes guianensis	94-290
Trifolium semipilosum	80

Source: Haque and Jutzi (1984)

Conclusions

The two technologies, namely; oversowing improved forage species and bush clearing of natural pastures have enhanced the degraded grasslands in terms of improved soil fertility, pasture herbage yield and chemical composition that led to increases in animal productivity (milk yield and growth rates). The generated incomes seem to be improving the livelihoods of the pastoral communities. It appears that the current decline in grassland productivity is likely to be reversed as more pastoralists adapt these technologies.

Acknowledgments

We wish to acknowledge Sida/SAREC for financing the research and the Organization for Social Science Research in Eastern and Southern Africa (OSSREA) for co-ordinating the overall regional Dryland Husbandry Project. The National steering and the field management committees are greatly appreciated for the smooth co-ordination of the project.

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