Highlights
CIAT in Africa

Forages for intensive livestock systems in Uganda

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Tororo district is one of the poorest areas in Uganda with more than 60 percent of households falling below the absolute poverty line. A participatory diagnosis conducted in 2003 by the NGO, Africa 2000 Network (A2N), and CIAT, revealed the importance of feed availability for improved and cross-bred dairy cows and goats, especially during the second dry season which lasts from December to March. In 1997, a consortium of district-based research and development (R&D) organisations, called the Integrated Soil Productivity Initiative through Research and Education (INSPIRE), was formed to overcome food insecurity and poverty through improvement of soil fertility. Farmers initially evaluated the performance of several legume cover crops such as Mucuna and Canavalia using mainly agronomic criteria, but later on included the use of the legumes as animal feed as an additional criterion. In 2003, CIAT and A2N selected two interested farmer groups, Katamata and Umoja, to evaluate improved forages for their dairy cattle. Members of these groups were already receiving dairy cows on loan through an A2N dispersal scheme. The first objective of this study was to identify the most suitable forage species and varieties that would provide large amounts of high quality feed during the dry season using a combination of farmers' and scientists' criteria. The second objective was to develop an approach for participatory forage evaluation in Africa.

This study aimed to identify the most suitable forage species and varieties that would provide large amounts of high quality feed during the dry season.

Approach

Although farmers were familiar with tree forage species, such as Calliandra and Sesbania, and with Napier grass, they had limited knowledge about the use and management of herbaceous forages. Farmers and researchers agreed on the forage species and varieties to be tested (Table 1) and on a common design for each nursery plot. Farmers' criteria related to yield were: growth and vigour, plant height, fodder yield and drought resistance. They also mentioned germination, time of flowering, seed production, pest and disease resistance and palatability to livestock. It was agreed that farmer group members would collect most of the data (except fodder biomass data) and that after each growing season the data would be analysed and the data collection methods be reviewed together with the research facilitators. Researchers managed the collection of fodder biomass production data as they needed rigorous data to compare fodder production among species and accessions (Table 1).

Reflection and adjustments

During the first experimental cycle farmers learned about the appearance of the new forage plants, germination patterns and early growth. Quantitative data collection by group members using their own criteria proved to be a challenging exercise, especially as one of the groups experienced leadership irregularities. To ease the research process, the members reduced the number of parameters to be measured. With renewed enthusiasm, members conducted palatability tests. *Brachiaria* hybrid Mulato, *Brachiaria* var. Toledo,

Species or hybrid	Accession	Sept. 04	June 05	Total
Brachiaria hybrid	Mulato 1	36.6	19.6	56.2
Brachiaria brizantha	Var. Toledo	32.2	23.1	55.4
Panicum coloratum	ILRI 7153	6.0	5.3	11.3
Panicum maximum	ILRI 144	9.2	1.3	10.5
Centrosema macrocarpum	ILRI 12146	6.0	4.0	10.0
Centrosema pubescens	CIAT 15160	14.9	8.0	22.9
Chamaecrista rotundifolia	ILRI 9288	20.2	8.4	28.6
Desmodium heterocarpon	CIAT 13651	7.6	6.1	13.7
Macroptilium atropurpureum	ILRI 12391	9.7	2.0	11.7
Stylosanthes guianensis	CIAT 184	42.9	16.0	58.9

Table 1: Average fresh biomass production (t ha^{-1}) of forages planted in Tororo in April 2004, based on 2 subsequent harvests.

Panicum maximum and *P. coloratum* ranked the highest, in order of preference for local cattle, whereas improved dairy cattle ate all types without apparent preference. During the subsequent dry season, the two varieties of *Stylosanthes guianensis; Brachiaria* hybrid Mulato; *Brachiaria* var. Toledo and *Chamaecrista rotundifolia* showed their superior ability to stay green during drought.

Expansion and scaling out

Expansion of the forages from the nursery plots to other locations within the group members' farms happened slowly and on a small scale. For example, farmers used root splits of the grasses for this purpose to expand forage cultivation. Large variations in farmers' commitment to the experimentation process were found to be related to the dairy cow dispersal programme, where those who had received a cow were more committed. It is clear that selecting areas for experimentation on forages should depend on the level of development of dairy services in that area. In the absence of good dairy services, improved productivity could be achieved with local or cross-bred cattle, goats or sheep. The project has now scaled out to 11 other goat and dairy cattle groups in Tororo, where the *Brachiaria* variety and hybrid are cultivated in rows and plots on-farm.

Lessons learned

- The farmer groups were engaged in concurrent agricultural experiments for which they had developed participatory monitoring and evaluation plans. Integrating the forage experiments into these plans facilitated the research process.
- Internal group processes were an important factor for continuity and commitment to experimentation with forages. In the absence of group cohesion, management of plots work better on an individual basis.
- *Brachiaria* hybrid Mulato, *Brachiaria* var. Toledo, and *Stylosanthes* performed better than the other forages and compare well with known fodder yields of Napier grass. Under similar unfertilised conditions, Napier can produce up to 40 tonnes of fresh fodder (10 tonnes DM). The brachiarias are resistant to diseases such as smut and stunt that are a severe threat to Napier-based dairy production systems in east Africa. *Brachiaria*'s origin is in east Africa, but the superior variety and hybrid used in this experiment were screened and bred by CIAT and partners in Latin America. *Stylosanthes*, an exotic legume, provides cheap protein to supplement poor animal diets during the dry season.

Future direction

Although the research described is still at an early stage it has identified forages that are well adapted and can be scaled out to other similar areas. Once forages are integrated in the farming systems, there are clear benefits in terms of income generation, natural resource management (NRM), and other socio-economic benefits. For example, in smallholder systems in Southeast Asia forage technologies have increased household income from livestock by as much as 30 percent, resulting in increased manure production, and saved time and labour otherwise spent herding or in searching for fodder to cut and carry.

However, the use of forages can in many ways be more complex than other crops. The most likely way for forages to be adopted is when they are integrated among other crops rather than grown in sole plots. There is a large diversity in forage species and varieties, each with their specific environmental adaptation and management requirements. These inherent characteristics of forage technologies offer opportunities for, and indeed require smallholder farmers to experiment with "best bet" species and varieties and to invent local strategies to make forages profitable, sustainable, and compatible with other crops.

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