"Pastures in the feeding of dairy cattle in Uganda, with particular reference to zero grazing"

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Cattle are the most important source of animal proteins available to man in Uganda. However, over the past 20 years the human population has grown at a higher rate than the cattle population. The cattle population is characterised by low levels of production of milk and meat. Several experimental projects are underway to intensify the system of husbandry through exploiting potentially high-yielding dairy and beef cattle, including improvement of fodder production through crop rotation systems. This paper introduces the Uganda Heifer Project International (HPI) and reports the baseline survey data collected in the period 1989–1992.

Uganda is 236,000 square kilometres in area. About 14 percent of this area is inland lakes, rivers and swamps. Forests comprise about 3 percent of the area while national parks and game reserves comprise about 7 percent of the total area. The rest of the area consists of cultivable land and marginal grazing areas. Over 80 percent of the land area is arable.

Development is a prime concern and aspiration of all nations, particularly so in the developing countries. Development involves human action on, and interference with, natural processes. However, there should be no conflict between environmental quality and development, if ecological and socioeconomic factors are considered together, and if short-term goals are conceived within the framework of long-term strategies. The ecological approach is one of the best tools for optimising the outcome of interaction between man and his environment, maximising the positive output of development and minimising its negative consequences.

Environmental issues are many and include for our purposes: increases in human and livestock populations, inequitable distribution of agricultural land, increases in numbers and varieties of epidemic and endemic pathogens and pests, nutritional deficiencies in man and animals and exhaustion of natural resources due to irrational exploitation. The carrying capacity of the environment varies according to the different types of biomass and also in relation to the socioeconomic aspects of the society.

Zero grazing is a relatively recent system of cattle husbandry which addresses an important socioeconomic issue of intensive cattle production through optimum utilisation of pastures incorporating sound technical inputs related to disease control, breeds and breeding.

Uganda's human and cattle populations and head of cattle per person for selected years are shown in Table 1.

It is clear that the human population has been growing at a higher rate than the cattle population over the last 20 years. Cattle are the most important source of animal proteins available to man in Uganda. This supply is mainly by means of dairy products, notably milk, and secondly through meat, particularly beef.

The cattle population in Uganda, however, is characterised by low levels of production of milk and meat. This is due to the combination of low genetic potential and poor methods of husbandry. Thus the milk yield of indigenous Zebu cattle, which form the majority, is of the order of 800 litres per annum assuming good husbandry practices.

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Table 1. *Uganda's human and cattle populations for selected years*

Year	Human population (million)	Cattle population (million)	Cattle per person
1931	3,536	2,104	0.60
1948	4,915	2,485	0.50
1959	6,456	3,590	0.55
1969	9,500	4,145	0.43
1980	12,500	4,500	0.30
1992 (estimates)	17,000	4,000	0.23

This is in contrast to the exotic Friesian dairy cattle which have been successfully introduced in the last 25 years. These cattle yield an average of 3000 litres in a 305 day lactation, on improved dairy farms. The indigenous Zebu cattle mature in 5 years and average 250 kilograms live weight. In contrast, exotic beef cattle introduced in the last 25 years and including the Angus, Hereford, Semmintal, and Cholalais mature in 2.5 years and have an average live weight of 500 kilograms, assuming sound management practices.

It is against this background that the system of zero grazing should be viewed: an intensive system of husbandry that exploits the potential of high-yielding dairy and beef cattle that are so critical in the supply of adequate quantities and quality of animal proteins to feed the ever-increasing human population shown in Table 1.

The earliest data on zero grazing from experimental stations in Uganda was from Mubuku UNDP/FAO/Uganda Irrigation Project (Froemert, 1969) and Kawanda Agricultural Research Station (Tiley, 1969).

Froemert (1969) in his FAO terminal report discussed the Mubuku Irrigation Project dairy unit. The project was sited in western Uganda. The location is 914.4m above sea level and experiences temperatures of 12–30°C and a rainfall of 889–1016 mm per annum. Irrigation land was allocated to 42 settlers during the years 1964–1969. The average area for each settler was 4.05 ha. The settlers grew fodder on their units and sold it to a centrally operated dairy unit. The unit was conceived as a farmers' dairy cooperative society. The farmers' role was production of fodder while the management of the dairy unit was the responsibility of Froemert, a FAO Animal Production Officer, assisted by a number of employees.

Fodder was one item in the settler's crop rotation system. An area of 0.40 ha. was set aside for growing lucerne (0.16 ha. for fresh feed and 0.24 ha. for hay) and 0.20 ha. was reserved for growing elephant grass. This legume and elephant grass fodder crop was estimated to be sufficient to feed three Friesian dairy cows. The 0.60 ha. area is equivalent to 1.5 acres, giving a stocking rate of one cow per 0.50 acre. Nineteen Friesian cows were purchased from Kenya in 1967. Three months after their arrival Froemert recorded the yields of these cows as averaging 12 litres per head per day. Twelve cows which completed their first lactation yielded 3,015 litres per head on average. Seven cows which required a longer period for adaptation to the Mubuku environment produced 3,374 litres in their first lactation.

Yields of fodder crops and legumes in the first year were as follows:

Lucerne	2,721.6 kg in 12 cuts during the year.
Forage maize	10,432 kg in 5 cuts during the year.
Elephant grass	7,711 kg. in 5 cuts during the year.

Table 2. *Recommended feeding regime**

Fodder	Chemical Composition (kg)			
	D.C.P.	S.E.	D.M.	C.F.
25 kg Elephant grass	0.250	1.750	6.250	1.950
11 kg Lucerne (fresh)	0.385	1.199	2.431	0.671
4 kg Lucerne (hay)	0.476	1.236	3.428	1.108
TOTAL	1.111	4.185	12.109	3.729

*Based on calculated nutritional requirements of 1.1 Kg D.C.P, 6.713 S.E. and 11 Kg. of D.M.

The calculated nutritional requirements were:
D.C.P. 1.100 kg
S.E. 6.713 kg
D.M. 11.000 kg (minimum)

Tiley (1969) described work on elephant grass in cutting and grazing regimes at Kawanda Agricultural Research Station in Mpigi District. This station is located in the fertile lake crescent of Uganda. The annual rainfall is 1016 mm and it is well distributed throughout the year with rarely any marked dry season. Humidity is high and temperatures relatively lower (16–27°C) than in the savannah areas of Uganda.

Elephant grass grows naturally and abundantly in this area. The yields of most varieties are satisfactory up to an altitude of 2,300m. Deep, medium-heavy, well drained loam soils with good moisture-retaining properties and moderate to high fertility levels produce the best growth of elephant grass.

Tiley (1969) gave the following data on cutting and grazing regimes of elephant grass.

Cutting: At a stocking rate of 2.5 Friesian cows per hectare and herbage yields of 12,500 Kg/cut, and with a cut made every 10 weeks, milk yields of 500 litres per month were obtained. Each cow's milk yield averaged 6.7 litres per day.

Grazing: At a stocking rate of 2.5 Friesian cows per hectare, and grazing in a 10-week rotation regime, returns were found to be the same as in a cutting regime. In both cases average milk yield per cow was 6.7 per day.

Comparing Mubuku's and Kawanda's stocking-rate equivalents under zero grazing, Mubuku irrigation project had twice the stocking rate and the cows yielded 9.8 litres of milk per day in the first lactation described above, as compared to Kawanda's milk yield of 6.7 litres per day. Notwithstanding possible genetic differences, the significant difference in milk yield can be attributed to the contribution of lucerne, a legume rich in protein and minerals.

Twenty years later in 1989, Namirembe Diocese of the Church of Uganda introduced a Heifer Project based on Friesian cattle imported from the United Kingdom under the "Send a Cow" subproject. The objective of the project was to investigate the income-generating potential of rearing dairy cows for needy women, such as widows, in the periurban areas of the capital, Kampala. Here, the demand for milk is high and the market has yet to be saturated.

Description of the Project Elements

Selection: The selection of women participants in the project is made by a committee which consists of veterinary professionals, churchmen and churchwomen. The minimum requirement for candidates is not based on educational background but possession of 0.50 ha. of land reserved for growing the basic fodder of elephant grass.

Training: Below is a syllabus for zero grazing in Uganda's Heifer Project International (HPI):

1. Introduction to zero grazing system:
   - –Description of zero grazing;
   - –Advantages of the zero grazing system including environmental protection;
   - –Disadvantages of zero grazing;
   - –Requirements of zero grazing: infrastructure, capital, skill, manpower farm layout.
2. Pasture
   - –a) Explanation of varieties of pasture including fodder trees emphasising the following:
   - –Grasses (Elephant grass [Napier], Guatemala)
   - –Legumes (Emphasis on legumes growing in each area e.g. Desmodium, Stylo, Siratro, Glycine, lucerne)
   - –Fodder trees (Leucaena, Gliricidia, Sesbania, Calliandra, Pigeon pea, etc.)
   - –Others (Potato vines, Banana stems, Groundnut tops)
   - –(b) Establishment of important varieties of pasture and fodder trees.
   - –(c) Fertilizer and manure application.
   - –(d) Spacing of the important varieties of pasture and fodder trees.
   - –(e) Stocking rate.
   - –(f) Diseases, pests, problems and control of the varieties of pasture and fodder trees.

Practicals: Visiting farms with various types of pasture and fodder trees in lines along contours depending on location of farms. Local fodder tree identification.

Preliminary results indicate that farmers confine themselves to growing the mandatory 0.50 ha. of elephant grass and hardly grow any legume pasture or fodder trees which would contribute protein and minerals to the diet. Purchased dairy meal supplements are used and these are likely to be more expensive than use of legume pastures such as lucerne. Lucerne can grow under rainfed agriculture in the described ecological area around Kampala–Kawanda, where the project is situated.

Milk yields recorded by the 70 women farmers in the project are of the order of 9 litres per cow per day. This production average is less than that obtained at Mubuku 20 years ago and may be attributed to poor feeding.

During the FAO/Uganda Dairy Development Project baseline survey data were collected and analysed during the period 1989–1992. Baseline surveys for seven pilot groups were completed but the analysis was available in tabular form for only five pilot groups, namely Kamuli, Mpigi, Mukono, Ibanda and Rubaare. The analysis was made by stratifying the farms into small, medium and large to avoid the great variations that existed between farms.

The appendix show tables obtained from the above project report showing livestock feeding regimes in Mukono, Ibanda, Mpigi and Rubaare, respectively.

The results show the dominant use of natural pastures in the feeding of dairy cattle. Average production per cow per day in Mpigi was 10.9 litres and 10.6 in Mukono. It is difficult to draw conclusions at this stage. However, the introduction of legume pasture species and fodder trees such as Leucaena would appear to promise significant improvements in the productivity of exotic dairy cattle with high genetic milk-producing potential, such as the Friesian which is the predominant breed in Uganda.

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Appendix: Livestock feeding regime

Source: FAO/Uganda Dairy Development Report, 1989–1992

Mukono Pilot Group

VARIABLES	Count	Mean	STD	Min	Max
Grazing (hrs/day), milking cows	96	18.0	5.3	3	24
Dairy meal (kg/day), milking cows	52	3.5	1.9	1	10
Dairy meal (kg/day), dry cows	14	2.6	0.9	1	4
Maize brand (kg/day), milking cows	30	3.2	2.5	1	12
Maize brand (kg/day), dry cows	13		1.1	1	4
Green fodder (kg/day), milking cows	46	18.1	21.0	1	112
Peelings (kg/day), milking cows	35	7.7	7.0	1	25
Peelings (kg/day), dry cows	18	4.9	3.9	1	18
Potato vines (kg/day), milking cows	9	2.4	1.0	1	4
Minerals (g/day), milking cows	100	75.9	213.6		1,600
Proteins (g/day), milking cows	100	5.0	50.0		500
Salt (g/day), milking cows	100	44.5	116.7		710
Water (l/day), milking cows	100	25.4	34.2		160

Ibanda Pilot Group

VARIABLES	Count	Mean	STD	Min	Max
Grazing (hrs/day), milking cows	119	16.3	5.9	3	24
Dairy meal (kg/day), milking cows	52	3.5	1.9	1	10
Dairy meal (kg/day), dry cows	14	2.6	0.9	1	4
Maize brand (kg/day), milking cows	30	3.2	2.5	1	12
Maize brand (kg/day), dry cows	13		1.1	1	4
Green fodder (kg/day), milking cows	46	18.1	21.0	1	112
Peelings (kg/day), milking cows	37	7.4	6.9	1	25
Peelings (kg/day), dry cows	18	4.9	3.9	1	18
Potato vines (kg/day), milking cows	9	2.4	1.0	1	4
Minerals (g/day), milking cows	100	75.9	213.6		1,600
Proteins (g/day), milking cows	100	5.0	50.0		500
Salt (g/day), milking cows	123	36.5	106.5		710
Water (l/day), milking cows	123	21.3	32.0		160

Mpigi Pilot Group

VARIABLES	Count	Mean	STD	Min	Max
Grazing (hrs/day), milking cows	11	8	1.8	4	10
Dairy meal (kg/day), milking cows	27	5.5	2.3	3	10
Dairy meal (kg/day), dry cows	2	1.8	0.4	2	2
Maize brand (kg/day), milking cows	26	4.9	2.4	1	9
Maize brand (kg/day), dry cows	4	2.8	0.6	2	4
Green fodder (kg/day), milking cows	37	57.7	31.9	12	192
Peelings (kg/day), milking cows	26	39.2	24.7	10	105
Peelings (kg/day), dry cows	5	33.0	36.7	5	90
Potato vines (kg/day), milking cows	12	20.8	32.6	2	90
Minerals (g/day), milking cows	48	135.8	24.4		800
Proteins (g/day), milking cows	48	154.8	342.3		1,750
Salt (g/day), milking cows	48	7.7	65.5		420
Water (l/day), milking cows	48	6.3	35.8		120

Rubaare Pilot Group

VARIABLES	Count	Mean	STD	Min	Max
Grazing (hrs/day), milking cows	120	12.1	1.7	7	24
Dairy meal (kg/day), milking cows					
Dairy meal (kg/day), dry cows					
Maize brand (kg/day), milking cows					
Maize brand (kg/day), dry cows					
Green fodder (kg/day), milking cows		4.0	1.4	3	5
Peelings (kg/day), milking cows	2				
Peelings (kg/day), dry cows					
Potato vines (kg/day), milking cows					
Minerals (g/day), milking cows					
Proteins (g/day), milking cows					
Salt (g/day), milking cows	108	2.1	1.4	1	5
Water (l/day), milking cows	119	1.3	0.6	1	5