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An Alternative Livestock Feeding Programme for Mahaweli System B and C

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ABSTRACT: One hundred and twenty eight farmers owning both crops and livestock in Mahaweli Systems B and C were surveyed with respect to livestock populations, compositions, productivities, feeds and feeding methods. The nutritive values of the feed materials found on the farms were evaluated.

More than 50% of cattle and 93% buffaloes in the study area belonged to indigenous types and produced 1.5 and 0.7 litres of milk per day, respectively. Low productivity of existing herds is partly because of their poor nutrition. About 92% of livestock farmers tether their animals without any shade to graze in native pastures which are poor both in nutritive value and dry matter yields. The water provided was inadequate and untimely.

An average farmer in the area annually harvested about 7.2 tonnes of paddy straw (4.5% CP, 43% IVDMD) from his 1.0 ha lowland. This is adequate to feed three cattle heads or buffaloes at a rate of 7 Kg/animal/day. The three commonly available tree legume species, namely, Glyricidia, Leucaena Erythrina, are nutritionally rich (20 – 24% CP, 60 – 67% IVDMD). A 200 m hedge of tree legumes would provide sufficient leguminous fodder for one cow year around. Every farmer could maintain 600 m long hedge of tree legumes in his 0.2 – 0.4 ha highland. Improved species of pasture and fodder, upland crop residues, and animal manure could also be used as animal feeds in small quantities.

Stall feeding with these feed resources would provide both the qualitative and quantitative requirements of three cattle heads of buffaloes in every farm. It would enable the farmer to enhance his productivity.

INTRODUCTION

Majority of Mahaweli farmers concentrate on crop production (Blauw, 1986). Farmers in Mahaweli systems B and C cultivate paddy in 1.0 ha of lowland and upland crops such as maize, cowpea, chillie and vegetables on the 2.0 ha of highland (Keerthipala, 1986). Therefore their sole income is derived from crops. Their nutritional requirements are not adequately satisfied; since they are highly dependent on starchy foods.

Mahaweli farmers mainly use tractors as farm power and use chemical fertilizers (Blauw, 1986). In such a farming system, there is idle farm labour in the off season (Rajaguru, 1986). Risk is always associated with this kind of farming system, because of the crop–monoculture (Emil *et al.*, 1980).

In order to increase the farm productivity, the existing farming system must be changed. The suggested alternative measure is, introducing livestock to the farming systems. It would improve the farm income and family nutrition, provide farm power and organic manure, exclude the risk associated with the crop–monoculture and increase the land and labour use efficiencies (Emil *et al.*, 1980).

However the farmers in the area are presently reluctant to introduce livestock into the farm because of two constraints:

* The majority of livestock are of indigenous origin and are less productive.

* Grasslands available for grazing are limited.

In order to popularise the livestock among the crop farmers, it is essential to rectify these existing farming problems.

Recently the Government livestock farms in the area have launched programmes to distribute more Indian breeds such as Tharpakar and Killari. But the traditional feeding systems presently practiced would reduce the productivity of these improved breeds too.

Therefore, it is essential to introduce an alternate type of feeding programme to achieve a higher animal production from the farms.

The objectives of this research are:

* to study the present productivity of livestock in Mahaweli systems B and C, and

* to propose an improved feeding programme for the livestock in the area.

MATERIALS AND METHODS

Study area

Mahaweli project system B is in the dry zone of Sri Lanka and covers an area of 130,000 ha. The major part of system B area lies within the administrative districts of Polonnaruwa and Batticaloe. A very small part of the area falls within the districts of Amparai (Acres International Lrd., 1979).

System C is on the dry–intermediate zone boundary, with a total land area of 69,150 ha; of which about 24,000 ha are irrigable. System C includes the districts of Badulla, Polonnaruwa and Amparai (Hunting Technical Services, 1979).

In system B there are six zones. Each zone contains a block. However the settlements are completed only in four blocks. They were selected for this study.

System C also has six zones. Activities in zone 1 are not governed by the Mahaweli Authority but by the Department of Agriculture, because this zone is already developed. The settlements in zones 5 and 6 are not completed yet, therefore the study was conducted in zones 2, 3 and 4 (there are two blocks in zone 2 and one each in 3 and 4).

Field survey

As the first step of the study, a field survey was conducted during March to May 1987 using 128 farmers from both systems. The following parameters were investigated in the field survey:

* Species, breeds and number of farm animals in a farm.

* Productivity of animals.
* Management and feeding methods practiced.
* Yields of crop and crop residue.
* Alternate feed stuffs available for supplementation.
* Farmers' knowledge and attitude on the improved feeding techniques.

The population surveyed comprised of all the farmers who owned both crops and livestock in system B and C. Sixty four farmers were chosen from each system, four units from each block and four farmers from each unit. Every selection was done randomly.

The data collected were first tabulated and then analyzed using Lotus 1-2-3 (spreadsheet package).

Laboratory experiments

Nutritive value of the following available feed stuffs were evaluated:

* Natural grasses (seven species).
* Paddy straw (five varieties).
* Other crop residues (nine crop varieties).
* Pasture and fodder legumes (seven species).
* Improved grasses (eight species).
* Animal excreta (cattle manure and poultry litter).

Each feed stuff was evaluated for: Dry matter, Crude protein, Ether extract, Crude fibre (AOAC, 1970) and In Vitro Dry Matter Digestibility (Tilley and Terry, 1963).

Field Experiments

The residue yields of different upland crop varieties were estimated in the fields of Aralaganwila and Girandurukotte regional agricultural research centres. The crop residues were collected from the plots which were cultivated according to the recommendations of the Department of Agriculture.

RESULTS AND DISCUSSION

Buffaloes predominated in system B (B) and cattle in system C (C). Many farmers kept poultry but only few kept goats and pigs (Table 1).

The majority of cattle in both systems were indigenous. However, Indian breeds and their crosses were also common. Whereas cattle belonging to European breeds were very few (Table 1).

Most of the buffaloes reared in this region were of indigenous breed. Few Murrah buffaloes were also reared. All the goats available in the area were of indigenous origin.

Since most dairy animals were indigenous, their milk production was low (1.5 in cattle, 0.75 in buffaloes and 0.23 L per day in goats). Draught power of the animals is correlated to the body weight (Cockril, 1974) and indigenous cattle and buffaloes having low body weights should provide less drought power. However the indigenous animals were preferred by the farmers, because they are acclimatised to the dry zone conditions and are adapted to perform well on the poor quality local grasses available in the area.

Indian cattle and buffaloes also thrive well under local conditions. Their average milk production and mature body weights were observed to be higher than those of indigenous animals. Indian drought breed "Killari" and the milk breed "Tharpakar" perform well in systems B and C. Therefore introduction of either Indian cattle and buffalo breeds or their crosses is essential to increase the milk production and the draught power.

The daily milk yield of Tharpakar in India is reported to be 12 litres (Kaura, 1957), while it was only 4.5 litres in system C. In both systems Killari bulls, Indian buffaloes and their crosses were observed to have lower weights than the standard. This may be due to both poor quality feed and inadequate quantity fed to animals. Breed effect is not the sole reason for the low productivity of indigenous animals; it is partly due to the poor nutrition. Therefore, improvements of the nutrition is essential to increase the productivity of animals.

Table 1. Livestock species and populations in systems B and C.

Class	Percentage farmers owning		Breed	Percentage	
	System B	System C		System B	System C
Cattle	38	81	Indigenous	52.0	50.0
			Indian	18.5	26.5
			Cross	28.3	20.7
			European	1.2	2.8
Buffalo	82	29	Indigenous	93.0	92.8
			Murrah	7.0	7.2
Goat	2	2	Indigenous	100.0	100.0
Poultry	24	14	Indigenous	35.6	63.6
			Rode Istand Red	54.0	18.1
			Leghorns	10.2	9.1
			New Hampshire	-	9.1
Pig	2	0	Crosses	100.0	100.0

Present system of animal feeding

No farmer had cultivated grasslands. Therefore road sides, channel banks and crown lands were the common sources of grass. Also farmers let their animals to graze the paddy stubble during the off season (Table 2). Tethering was the most common grazing practice followed by more than 92% farmers in both systems. Cut – and – carry system provided little better nutrition: 64% (B) and 82% (C) followed this system in the paddy cultivation season, however only few farmers followed the cut – and – carry system during dry season because of the shortage of grass [21% (B) and 45% (C)].

The present system of feeding is not satisfactory due to the following reasons:

i) *Native grasses are poor* both nutritionally and in dry matter yields (Table 3). The nutritive value of grasses like *Bracharia sudquadripera*, *Eleusina indica* (L) Gearth and *Dactylocatanium aegyptium* (L) Beauv found in this area were high. However, these grasses were observed to have poor dry matter yields. The most widespread fodder species with high growth rate in both systems is *Imperata cylindrica* (L) Beauv. When tender the nutritive value of this grass is high though the yield at this stage is low. This grass matures rapidly with a drastic drop in nutritive value.

ii) The animals graze in the sun and much energy is wasted in overcoming heat stress.

iii) Being tethered in one place for a long period reduces feed intake.

iv) Water provided is inadequate and untimely.

Alternative feed sources found in the area

Following were the alternate feed sources available:

* Crop residues
* Good quality grasses
* Browse and pasture legumes
* Animal excreta; and
* Concentrates.

Table 2. Livestock grazing in Mahaweli Systems B and C.

	% of farmers	
	System B	System C
Grazing place		
Common grass lands	13.0	7.8
Road sides	66.0	89.0
Scrub jungles	1.8	1.6
Channel beds/tank beds	21.0	26.6
Crown lands	24.0	32.8
Harvested paddy lands	94.0	92.0
Grazing type		
Managed grazing	5.6	3.2
Loose	1.8	3.2
Tethered	92.6	93.8

Table 3. Common native grasses and their nutritive values in systems B and C (% dry matter basis).

Grass species	CP %	CF %	EE %	ASH %	NFE %	IVDMD%
Bracharia subquadripera	14.1	31.6	3.8	13.3	37.3	62.1
Sporobolus diander Beauv	6.6	40.6	4.2	7.0	41.6	38.7
Chloris barbata SW (barberi)	9.3	35.7	3.1	11.6	40.4	44.1
Eleusina indica (L) Gaerth	10.7	31.8	3.2	12.2	42.1	65.9
Dactyloctanium aegyptium (L) Beauv	10.6	29.8	3.1	12.0	55.1	46.1
Imperata cylindrica (L) Beauv (tender)	7.5	24.4	3.3	11.2	53.7	39.5
Imperata cylindrica (L) Beauv (mature)	3.8	46.8	1.9	11.8	40.6	24.7

CP - Crude protein CF - Crude fibre EE - Ether extract
NFE - Nitrogen free extract IVDMD - Invitro dry matter digestibility.

Stall feeding with these feedstuffs is recommended. More labour is needed for stall feeding. However, this would not be a problem in farm families in Mahaweli systems B and C, because of the availability of idle labour.

Paddy straw

The most readily available source of livestock feed was paddy straw. A yield of about 7.2 t per farm per year is enough for three animals at the maximum achievable intake of 7 kg d^{-1} per animal. Paddy straw was low in protein, nitrogen-free extract and digestibility, and high in fibre (Table 4). Farmers recognise that straw is less palatable, especially when old. Farmers were not using any improved techniques of straw feeding, mainly due to lack of knowledge (Table 5).

It is recommended to:

* Conserve the full yield of 7.2 tonnes of paddy straw by using proper storage technique.

* Pretreat with urea and feed at a rate of 7 kg/animal per day. (Urea-pretreatment - Spray 4% urea solution on the straw and store in dark for 7 days before feeding. The water:straw 1:1).

Pasture and browse legumes

Four species of pasture legumes: *Macroptilium atropurpureum*, *Stylosanthus gracilis*, *Glycine javanica* and *Purarea phaseoloids* and three species of tree legumes: *Leucaena leucocephala*, *Gliricidia maculata* and *Erythrina indica* were available in the study area.

The CP levels of these feeds were higher than those of any other feed source available in the area. Furthermore, the high NFE, IVDMD and low CP contents improve the value of these feeds for ruminants (Table 6).

Gliricidia was the most common traditional tree legume in the area and Leucaena was also becoming popular among the farmers. One way to popularise the tree legumes is to plant them as live fences. Wherever the land is not utilized for crops, also could be planted with tree legumes. Also it is not difficult to maintain few rows of tree legumes inside the highland.

Table 4. Nutritive value of crop residues available in the Mahaweli systems B and C (Dry matter basis).

	CP%	CF %	EE %	IVDMD %	NFE %
Paddy straw					
BG 94-1	4.30	35.05	4.44	44.4	41.2
H-4	3.40	36.53	4.20	42.35	39.6
BG 379-2	4.83	36.48	4.30	42.78	38.4
BG 400-1	4.32	36.14	3.91	44.07	36.2
BG 380	5.56	33.67	4.56	41.93	39.2
Paddy husk	2.32	47.28	1.30	21.93	28.1
Other crop residues					
Black gram - stover	12.60	27.80	1.30	62.40	14.0
- husk	7.30	43.10	2.00	50.00	7.5
Green gram - stover	13.30	25.50	1.10	49.90	15.6
- husk	8.70	35.70	3.10	61.00	7.0
Cowpea (Arlington) - stover	10.90	32.90	5.70	74.20	14.8
- husk	4.70	42.60	1.00	52.10	6.0
Soybean - stover	11.60	42.10	3.60	64.20	7.0
- husk	12.50	23.90	0.90	64.00	8.6
Groundnut - stover	17.90	43.40	2.90	67.00	15.0
Maize (Bhadra) - stover	5.90	32.60	2.60	60.30	11.0
- cob	2.80	37.30	1.00	54.80	3.8
Maize (sweet) - stover	10.50	29.50	2.20	64.40	12.2
- cob	2.70	30.30	0.90	53.50	4.3
Banana - stem	10.40	42.10	2.30	63.20	10.4
- leaf	8.30	44.90	3.50	61.10	13.2

Table 5. Urea pretreatment or supplementation of straw for animal feeding.

	% farmers	
	System B	System C
Use		
Not known not used	62	34
Known but not used	38	66
Known and used	00	00
Reasons for not using		
Lack of knowledge	92	98
Lack of capital	26	25
Lack of storage facilities	16	18

Table 6. Nutritive value of improved grasses, pasture and fodder legumes and animal manure available in systems B and C. (Dry matter basis).

	CP	CF	EE	ASH	NFE	IVDMD
				%		
Grasses						
Panicum maximum	5.4	25.6	2.6	10.7	55.8	49.9
NB 21	5.9	36.6	1.5	10.0	46.0	44.7
Bana	5.4	36.0	4.0	11.1	43.5	43.5
Brachiaria brizantha	6.6	39.3	2.5	9.4	42.1	41.7
Brachiaria mutica	6.1	36.3	1.2	9.2	47.2	49.5
Brachiaria miliformis	6.2	37.5	1.3	10.3	44.7	42.1
Brachiaria ducumbans	5.6	38.3	1.5	7.1	47.5	41.1
Brachiaria ruzizensis	5.5	53.4	1.5	8.3	49.3	44.3
Tree legumes						
Leucaena leucocephala	20.8	17.1	4.0	10.7	47.3	58.7
Gliricidia maculata	42.3	18.2	2.9	9.7	44.9	66.5
Erythrina indica	19.7	19.5	2.4	10.3	48.2	60.2
Pasture legumes						
Puraria	15.4	42.7	2.9	11.0	28.1	67.7
Sirato	18.5	33.2	6.6	9.3	32.4	62.4
Stylosanthus	17.1	29.9	5.7	9.0	38.3	52.9
Glycine	13.6	39.8	4.4	8.4	33.8	52.0
Animal manure						
Cattle manure	18.8	43.5	7.5	13.3	16.9	49.0
Poultry litter	24.3	28.5	2.8	11.4	33.0	47.4

The legumes being the second most plentiful source of feed, it is recommended to feed up to one third of the animal's daily requirements. According to Emil *et al.*, (1980) the leguminous fodder requirement of an adult ruminant can be obtained from 200 m long live hedge.

Therefore, it is recommended to –

* take every step to maintain 600 m long fences and rows of tree legumes in the farm holdings.

* plant pasture legumes in the lands, wherever crops are not cultivated.

Other crop residues

These include stover and cob of maize; stubles and pod husks of cowpea, green gram, black gram, soybean and groundnut; the vines and other residues of sweet potato; and leaves and stems of cassava and banana. The crop residues mentioned here are nutritionally rich and could be obtained freely (Tables 6 and 7).

Unfortunately these feed stuffs cannot be stored. Hence there will be a pronounced peak production in late *Maha*; though at least the use of straw can be differed and regrowth of browse and other grazing can continue unhindered.

Improved grasses

Improved fodder species such as *Panicum maximum*, NB 21 Bana and pasture species such as *Brachiaria brizantha*, *B. mutica*, *B. miliformis*, *B. decumbens* and *B. ruziziensis* are observed to grow well in Mahaweli systems B and C. Because of the high IVDMD and NFE levels and low CF contents, these grasses possess good nutritive values, though they are not high in CP (Table 6). Farmers do not grow improved grasses due to limited available land. Therefore, it is recommended to plant improved grass in:

* lands unsuitable for crops, such as low lying water logged areas;
* road sides and unirrigated highlands;
* inter-row spaces of perennial crops as strips.

Table 7. Dry matter yields of crop residues in systems B and C. (*Maha* 1987/88).

Crop	Variety	Dry matter yield (Kg ha^{-1})	
Black gram	MI 81-1	1435	stover
Green gram		1322	"
Cowpea	MI - 35	778	"
	Arlington	923	"
Soybean	Boshier	1103	"
Groundnut		620	"
Maize	Bhadra	6420	"
		923	cobs
	Sweet corn	5140	tover

Animal excreta

Cattle manure and poultry litter are highly nutritious (Table 6). Pathirana (1986) showed that animal excreta may be supplemented with crop by products and could be included in rations up to 10%. Therefore, it is beneficial to induce the farmer to recycle animal manure as feed. These ingredients could be fed mixed with rice mill feed. They could also be used in the preparation of silage.

Knowledge of the farmer on importance and use of concentrates is poor. The available rice mill feed in the area is cheap (between Rs. 0.75 and 1.25 kg^{-1}) and rather good in quality (10.3% CP, 10.5% EE and 20.3% CF). If the farmer can provide a well balanced diet containing the feed stuffs discussed above, the necessity for concentrate feeding could be reduced.

The proposed feeding programme could fulfil both the quantitative and qualitative feed requirements of 3 heads of cattle (Table 8). This is based on the fact that 350 kg animal needs 10.5 kg DM containing 22.5 Mcal Digestable Energy, 577 g Digestible Crude Protein and 32.9 g of Ca (Ranawana, 1987).

Many farmers were willing to keep goats, but claimed inadequate feed-stuffs in farms and damages to the crops. Five or six goats can be raised in the place of a cow (Devendra and Burns, 1983). Goats can perform well on low quality feed and are able to use treated straw efficiently.

There is a possibility of raising few chicken in farms because of the availability of grains and by-products of rice, maize and pulses.

The carrying capacity of the farms under present cropping systems could be recommended as about three cattle or buffaloes, or fifteen goats and a few chicken. The proposed feeding programme evaluated in the study, would bring following benefits to the farmer by the increasing of the production of milk, eggs and saleable animals for meat and providing animal power and organic manure, leading to;

* Increased farm income.
* Improved family nutrition.
* Reduced the need for the expensive tractor power.
* Reduced the fertilizer cost.

Table 8.1. The quantities requirements and availability of animal food in the proposed integrated farm system.

	Kg DM/animal
Rice straw	7.0
Tree legumes	3.5
Improved grass/pasture legumes	1.0
Motive grasses	1.0
Animal excreta	–
Concentrates	–
Total available	12.5
Total feed requirement	10.5

Table 8.2. The quantitative requirements for each animal and, availabilities and surplus of different nutrient components.

	DE (Mca Kg^{-1})	DCP (g Kg^{-1})	Ca (g Kg^{-1})
Requirement	22.5	577	32.9
Available	23.4	597	80.3
Surplus	+0.9	+20	+53.4

* Increased the farm land and labour use efficiency; and
* Reduced the risk associated with crop – monoculture.

CONCLUSION

Many Mahaweli farmers are not keeping livestock due to the scarcity of land for fodder production, and the indigenous livestock reared are less productive. Present milk production is 1/3 to 1/8 of the maximum achievable and the draught power is about 1/2 the achievable.

The following are the recommendations for improving animal production in Mahaweli systems B and C.

* Conserving the full yield of 7.2 tonnes paddy straw.
* Treating the straw with urea and feeding 3 animals at the rate of 7 kg/animal /day.
* Feeding the small quantities of residue of maize, cowpea *etc.* direct as they become available.
* Growing 600 m live fence and rows that would produce year round supply of tree legumes for 3 animals (3 kg/animal/day).
* Incorporating animal manure at 10% supplement to feed (1 kg/animal/day).
* Planting improved grasses and pasture legumes in the lands unsuitable for crops.
* Practicing stall feeding with these feed – stuffs.

It is necessary to use improved breeds to achieve the full benefits of the advanced animal feeding programme. This would increase the milk yield by 3 to 8 fold and draught power by 2 fold.

If Mahaweli farmers were to use a feeding programme, as recommended in the study, the increased farm income, improved family nutrition, reduced fertilizer and tractor costs and increased land and labour use efficiencies would be achieved.

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