Evaluation and Improvement of Natural Grassland (Patana) in the Hill Country Dry Zone of Sri Lanka for Economic Livestock Production

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(Based on research studies conducted at the MAB Project 3 Research Station — Bandarawela)

The dry patanas or the natural grasslands occurring in the hill country dry zone of Sri Lanka are situated on the Eastern slope of the Central massif and consist of about 67,000 hectares. About 25% or 16,000 hectares of patana are situated on gently sloping areas which is suitable for economic livestock production provided that this grassland is improved to carry additional stock than it is carrying now. Most of the land is found in the Upper Uva basin at an elevation of 800 — 1500 metres.2,3

The temperature is moderate by tropical standards and ranges from 18°C to 25°C with a diurnal variation of 5°C to 10°C. The mean annual rainfall is around 1500 mm of which about 1000 mm is received in the period October to January and the balance 500 mm in April and May.

The dry patana soil was characterised as “Red Yellow podzolic soil” 4 and described as being deep to very deep, well drained, with a variable A horizon depending on the erosion. The texture is moderately coarse to moderately fine, and the structure weak to moderate crumb. Soil reaction is acidic to strongly acidic with increase in rainfall. Organic matter and nitrogen are low to moderate; Phosphorus, Potassium, Magnesium and Calcium content is low. This shows that the soils are basically suitable for cultivation provided that the low fertility level could be corrected by proper fertilizer treatment and subsequent management.

About 75% to 90% of the plant population consists of grasses, and generally presents the appearance of a close cropped meadow land but composed of tussocky coarse grasses which have, both morphologically and physiologically progressed towards a xeromorphic habit and thus becomes less palatable except for tender shoots.2,5

The principal species of the grass complex are Themeda tremula, Arundinella villosa, Eleulalia phaeostaph, Cymbopogon polyneuros, Heteropogon contortus, Ischaemum ciliare. The tall mana grass Cymbopogon confertiflorus is dominant at lower elevation and often in association with Themeda in ravines and depressions. A small percentage of herbaceous species such as Hedyotis sp. Elephantopus scaber, Desmodium triflorum, Pteridium aquilum are also observed. Low shrubs like Knoxia platcarpa, Atlylosia trinervia and Osbeckia octandra are also common.

At present, the ruminant population in this area depend mainly on the natural grassland, consisting of grasses referred to earlier. The carrying capacity of this native sward was found to be extremely low. In a recent study, it has been observed that without application of any fertilizer the dry matter yield in the first year varied from 1000 — 2000 kg/ha, depending on the frequency of defoliation clipping. However, in the second year there were substantial reduction in the yields and the highest being when the sward was cut more frequently. Although application of nitrogen fertilizer increases the dry matter yield, the response was found to be very low, only about 7 kg of dry matter per kg of nitrogen applied compared to 25 kg of dry matter per kg of nitrogen reported for improved pasture under local conditions. Application of fertilizers to obtain higher dry matter yield from the native grass sward, therefore, could be a wasteful practice.

Based on the above, the carrying capacity of the native grassland would be in the region of one animal for every 3 hectares. But, even at such a low stocking rate there was a general reduction in the yield in the second year reducing the carrying capacity to about 5 hectares per animal.

There is very little scope of improved grassland production and management techniques based on native grasses of the dry patana for economic animal production. Therefore, it is imperative that these poor quality grasses with low rates of productivity be replaced with high yielding improved quality grasses and legumes to make animal production to be an economically viable proposition. However, replacing the native grasses with improved pasture would not be possible unless sufficient organic matter is incorporated into the soil in order to improve both the physical and chemical nature of the eroded infertile soil. Further, procuring sufficient organic manure in the region is not practicable because of high demand of farm yard manure for vegetable cultivation. Therefore, the only alternative would be to produce the organic matter on the
land itself in situ which can be achieved by the
cultivation of short duration crops, preferably legumes
to improve the fertility status of the land before
introducing the desired pasture species.
It has been demonstrated in various parts of the
world that the fertility status of soils can be improved
by a process of pioneer cropping by growing fertility
rebuilding crops, especially legumes.
This phenomenon was tested earlier and it was established
that soil fertility rebuilding pioneer cropping phase
over a period of one year before establishing improved
species resulted in a five fold increase in the
dry matter yield of the pasture during the establishment
year. However, the question
of economic returns from the pioneer crops during
the first year was investigated only recently and
it was established that growing maize in the Maha
season followed by a crop of horse gram in the Yala gives
the highest economic returns with the prevailing price
structure for these products.

The yields obtained from maize (grain) and horse gram
(seed) are 1167 and 1148 kg/hectare respectively.
Because of the variable nature of price for these products,
changes in the cost of production, and above all the
benefit accrued to the pasture established subsequently,
RO would be difficult to predict the actual cost-benefit
ratio of this operation. But, it would be reasonable to
assume that the expenses incurred can be recovered
without much difficulty. Another combination, but less
attractive under prevailing prices, is maize in Maha
and Kurukkan in Yala. The grain yield of Kurukkan
was estimated to be in the region of 800 kg/hectare.

The Paspalum dilatatum (Poir) pasture established after
pioneer cropping exceeded the control treatment without
pioneer cropping by 100 to 200% depending on the type
and to 200 to 300% in the second year.
The most interesting observation was that the treatment
without pioneer cropping or the control gave the
same dry matter yield both in the year of establishment
and in the second year. The yield was around
1200 kg/hectare/year which is comparable to the native
sward which it has replaced. However, unlike the native
sward the digestible organic matter (DOM) is around
55% and was neither affected by different pioneer
cropping treatments nor there is any difference
observed between the 1st and the 2nd year.
Another desirable feature observed was the number of
weeds in the treatment without pioneer cropping,
where four or five weedicings were required both in the
establishment and the second year while the number of
weeding required in the pioneer cropping treatments
was two and one respectively. This is due to the vigorous
growth of the pasture which kept the weeds under control.
This is a real advantage and minimises cost of establishment
and subsequent management due to infrequent weeding.

Management studies on improved pasture established
after one year of pioneer cropping were also
undertaken to evaluate the production potential of one
of the popular pasture grass that was identified
for dry pataana area namely Paspalum dilatatum (Poir).
This is a pasture grass exhibiting a low and
spreading habit, ideal for grazing, forms a dense
sward and prevents erosion on steeper slopes
and also has a very rapid recovery growth.

The two aspects that were studied are its response to
(1) Different nitrogen levels (2) Cutting frequencies.
The nitrogen levels were 0, 150, 225, 300 kg of
nitrogen/ha/year. The cutting frequencies were 30
days and 60 days. The parameters measured were,
dry matter and digestible organic matter (DOM).
by in vitro techniques.

From this experiment it may be concluded that:

1. There is an increase in both the dry matter
and digestible organic matter yield with increase in
the level of N and this was most significant when
the pasture was cut at 2 months interval.

2. Significantly higher dry matter yield for some
nitrogen treatment was observed when cut at two
months interval but at lower nitrogen levels
because of reduced digestibility, the total
digestible organic matter was not significant.

Another experiment was conducted to evaluate the animal production potential of Paspalum dilatatum
pasture. Two levels of nitrogen at 50 kg/ha and
100 kg/ha was applied in two split doses at the
commencement of the experiment and three months later.
South Down lambs (7-8 months old) at two stocking
intensities of 20 and 12.5 animals per hectare were
allowed to graze continuously. The experiment commen-
ced in January and continued for a period of 6 1/2
months. The experiment was discontinued when field
grazing was limited due to the onset of the dry
season in June/July and animals started losing weight.
No supplementary feeding except mineral mixture was
provided.

It may be concluded that at 50 kg nitrogen level and
at a stocking rate of 20 animals per hectare the daily
individual gain is depressed because of insufficient herbage
available for grazing. On the other hand individual
gains, as expected, reached maximum with high nitrogen
level and low stocking rate; and the other
two treatment fell within these two values.

Summary: The natural grassland or pataanas in the Hill
country dry zone of Sri Lanka hitherto received
very little attention because of its limited potential for
livestock activities. The dry matter production of the native grassland is between 1000—2000 kg/ha in the first year and less than 1000 kg/ha in the second year under a cutting management without any fertilizers. The response to inorganic nitrogen was only 7 kg of dry matter per kg of nitrogen applied. The Digestible Organic Matter (DOM) of the chief native grass species was lower than 30%. *Paspalum dilatatum* grass established after pioneer cropping the land for a period of one year produced a 200% increase in dry matter yield in the year of establishment and over 300% in the second year compared to that without pioneer cropping. It has been found that with 200 kg of nitrogen per hectare per year the dry matter yield exceeded 6000 kg and the potential of such a pasture produced a liveweight gain of one kg per hectare per day with growing South Down lambs.

References.


