ARTICLES

The role of Grassland in Ceylon's Agriculture

A. V. ANKER-LADEFOGED

ALTHOUGH LIVESTOCK, and especially cattle and buffaloes, have been raised in Ceylon for many centuries this aspect of farming is yet poorly developed and it does not play an important role in the country's agricultural economy except from the point of view of providing animals for draught. Many reasons have been given for this state of affairs and out of those the main one is, no doubt, that foods of animal origin have not until recently been in great demand and markets, therefore, poor. Nowadays, however, animal protein in some form or other is regarded as an essential component of a good diet, so much so that the average level of its daily consumption is considered by nutritionists as the most useful index for the quality of human nutrition. Milk, meat and eggs are considered among the most important protective foods. Here, where the livestock industry is undeveloped, the production of foods of animal origin is far too low to meet the requirement and large quantities are imported. To meet this situation and provide for the upward curve in human population, expansion and improvement of the animal industry must take place and such development should be based on a sound grassland policy. It is for us to develop sound systems of farming that will cater for the demands while at the same time keeping the soil intact and fertile. To this whole concept grassland farming is of fundamental importance.

Integration of crop and stock husbandry represents a definite advance towards a more stable system of agriculture and a greater assurance of a permanent food supply of high quality and therefore, if it is accepted, that livestock do fulfil a useful, indeed a vital role in both our agriculture as well as for our dietary needs, we must find methods by which to increase the economy of livestock production. Grass is without doubt the cheapest food for herbivorous stock and the cheapest way of feeding it is for them to help themselves; more and better grassland should therefore be given a prominent place in Ceylon's agriculture and be increasingly relied upon to bear the burden of the present and future livestock population. In this connection one should not think only in terms of simple pastoral practices but of a high level of managerial conditions. If such a marriage between crop and animal husbandry can be realised the purpose fulfilled will be three fold, viz., it will serve as a medium for maintaining and increasing the fertility in the soil; it will ensure that those portions of the crop which are inedible to man are not going waste; it will help to bring about a more stable economy for the farmer. As things stand to-day this aspect of the country's agricultural practice is hundreds of years behind when compared to some of the highly developed monocultures.

In the past when discussing the environment of tropical cattle a great deal of emphasis was placed on the climate. Important though this factor may be, it should not completely overshadow the other environmental factors such as vegetation and management practices. Management is in fact the most variable of all factors concerned with livestock production. Throughout the world successful animal husbandry is best built on a foundation of grassland, but here this was never so. Even today the bulk of the food, if considered on a digestible dry-matter basis, consumed by that portion of the stock which can be taken as economic producers, consists of concentrated foodstuff and not, as it should be, of fodder or pasture. Price relationship between foodstuff and animal products is at present such that this type of feeding no doubt is economic, but livestock are more useful in agriculture if they are more closely integrated with crop production. Cattle and buffaloes, being ruminant animals, have the ability to consume large quantities of bulky foods (grass, straw and other roughage) and to convert them into meat, milk and fat. This asset must be exploited to the fullest possible extent in order that the concentrates fed in addition are used to the best advantage. The feeding of the cow is a subject which has undergone much research and investigation both in laboratory and in the field. The balancing of rations in respect of proteins, starch, minerals etc. and the careful blending of raw-material to give the maximum yield is now the rule in advanced livestock farms with no detrimental effect to the animal. In the tropics these problems need much more investigation and experimentation. It is still usual to find feeding standards solely based on experiments carried out under cooler conditions applied to the rationing of cows in the tropics, although it is obvious that these standards require considerable modification. In Ceylon, experience from experimental livestock farms has made us realize that a fundamental investigation into the merits of indoor and outdoor feeding and management is a necessity. One thing is, however, certain in regard to feeding of stock in Ceylon, namely that fodder and pastures must be relied upon much more as a basis for feeding stock than has been the case hitherto.

Considering that grassland is so important to the increased production of livestock products and for maintaining soil fertility, particularly in areas where arable crops are grown, what are then the practical steps which should be undertaken to develop and utilize efficiently this potential source for increased food production? This problem is obviously two fold, production on the one hand and utilization on the other.

Natural Grasslands

In regard to production the present position is easy to appraise as only a small acreage of improved grassland exists in the country, the great majority of stock being fed on natural pasture lands. Introduced pastures and fodder areas cover only a fraction of Ceylon's agricultural area, and improved management practices are confined to a few farms and holdings, many of them being Government farms. In this brief account only general mention can be made about Ceylon's natural grasslands, which cover large tracts and are of very varying types ranging from the *patanas* in the highland region to the finer and more

palatable species in the dry-zone forest. Organised use of the natural grassland does not exist on any scale worth mentioning. Those made use of are far apart and often over-grazed. One cannot but regret this state of affairs when remembering that grassland is rightly credited with being second only to good forest cover in effecting soil and water conservation. Misused grassland, on the other hand, is one of the most powerful agents for soil destruction. Ceylon is relatively thinly populated with cattle and buffaloes, but still such misuses of grassland are common. Natural grasslands should be a matter of public concern because it is one of nature's most effective means of protecting against drought and flood hazards.

Although the use of introduced pastures and fodders are likely to provide the key to progressive grassland farming, the natural grasslands will always be an important factor in stock husbandry and steps should be taken to preserve a balance between utilization and deterioration. It should not be forgotten that the use of introduced pastures presupposes a standard of farming which provides for suitable management, and that it will take a long time before a radical change from existing primitive methods of utilization to a high standard of grassland use can be common practice in rural districts.

The natural grasslands in the highland districts are generally lacking in good species. There are only few plants from these which could be considered worthwhile using in improved pastures. Most of the grasses, as well as the non-graminaceous plants, are unpalatable and low yielding.

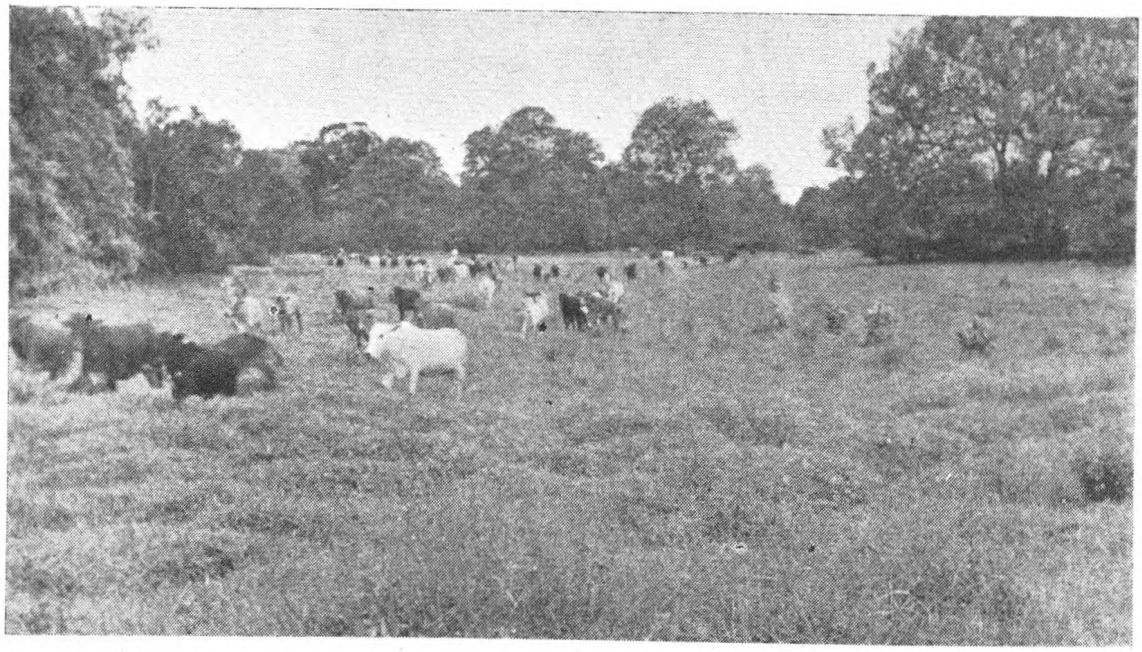
In up-country areas there is a gap in nature as far as pasture production is concerned, viz., the acidity of the soil caused by heavy rainfall and as a consequence thereof, leaching at a rapid rate. This situation is often aggravated by indiscriminate burning during the dry seasons. Soil acidity in the highlands is a very limiting factor for pasture development on a large scale due to the high cost of liming the lands which have to be a regular feature if satisfactory production both in regard to quality and quantity is the ultimate aim. Results obtained on Government livestock farms clearly indicate that a satisfactory sward cannot be maintained on the *patana* lands above 4,000 feet unless liberal amounts of artificial manure and lime are supplied regularly. This does not mean that there is no scope for pasture on such lands; but far from being so, it means that a good standard of management is a necessity for successful grassland farming. However, the areas above 4,000 feet covered by these special conditions is small and the scope for cattle farming very limited. Pasture plants from temperate zones have been successfully established at elevations above 5,000 feet and they produce well provided the level of pasture management is satisfactory.

The greatest hope for improvement and expansion lies in the low-country districts, particularly in the drier parts. There it can be safely assumed that the soils are quite capable of development to a level of good grassland value. The natural flora indicates this clearly. Conditions are also very good in the wet low-lands, but here grasslands will usually be maintained in direct and serious competition with crops grown for direct human consumption or various cash crops. Here again, grassland development is faced with the general problem of the small size of farm

units. Rotational fodder crops or permanent fodder crops maintained under a high manurial level are probably the answer under such conditions. There is, however, one great exception, viz., the vast acreage covered with coconut plantations. The approximate one million acres covered by this important industry could make a tremendous contribution towards the country's supply of animal food if the natural pastures which cover the ground under the palms are either improved by systematical management and grazing or replaced by introduced pastures of more productive species. Such a development is generally considered desirable also from the point of view of increased coconut production.

The dry-zones offer in many ways excellent prospects for extensive grassland development. Although the present extent of natural grassland is confined to roadsides, round tanks, under forest, park-lands and on river banks, it possesses enormous potentialities for livestock production, but to do so its utilization will have to be organised. At present some areas are badly ruined by overgrazing while others are not used at all. The problem of its proper utilization will have to be tackled with vision and vigour, or else no fruitful result can be expected. Many peasants regard natural grazing grounds as "waste land" and no attempts are made to use them in any organised way. One fine example of natural potentialities is the excellent natural pastures found along the Mahaweli and its branch rivers in the Tamankaduwa district. It is doubtful whether better natural pastures exist in any other part of the world. This gift of nature is far from being fully utilized; if properly utilized it may well be the basis for a scheme of milk production large enough to cater for more than half the Island's requirements.

On the whole it can be said that most natural pastures are what they are because of the peasant and his animals



Natural Pasture—Tamankaduwa

whenever grazing ground is left to itself the organised sword is gradually replaced by miscellaneous scrub etc., and given sufficient time it will revert eventually to scrub or forestland. Exceptions are pastures along rivers where annual floods control the situation and the hill *patanas* subject to periodical fires. The system of having communal pasture lands, or so-called reserves, as grazing grounds for a large group of small holders should be discontinued, as it always results in bad management and subsequent destruction of the sward. Such reserves could normally be more profitably used if they were divided among individuals. A policy entailing heavy expenditure of public funds on the development of grazing reserves for common use could be jutified only in those cases where there is evidence that there will be sufficient co-operation within the community to assure future maintenance. On natural pastures, as well as on introduced ones, the management of the grazing plays a direct part in the productivity, vigour and botanical composition of the sward. In tropical regions there is a very strong argument in favour of promoting a vegetative cover as dense as is possible to achieve under prevailing conditions and this can only take place if grassland is used systematically. With the ever increasing pressure of population in the country there is a constant tendency for cultivation to spread into the drier areas. This entails the risk of rapid destruction of the vegetative cover and the onset of soil erosion, unless a permanent, balanced system of farming is maintained. It is particularly under such conditions that pasture and livestock are indispensable for the farmer.

Introduced Pastures

Introduced pastures are artificially established grasslands in which productive and palatable species suitable to the area are grown. These pastures may either be permanent or temporary. The latter are those fitted into the cycle of crop-production. The establishment, utilization and management of introduced pastures demand a higher standard of farming skill than in the case of natural grassland, but it does not in any way call for more managerial skill than for instance the production of other crops. Extra efforts in connection with grassland farming are always well repaid by greater productivity and consequent improved soil structure. In general it can be said that the farmer who wants to maintain his grassland at the highest possible level of production year after year has to regard his grass sward as a major crop—a fact that is almost unheard of in Ceylon to-day.

During recent years more and more attention has been focussed on livestock keeping and pasture production. The vital necessity for a periodical soil cover in the crop rotation is being increasingly recognized. A soil cover would induce the recovery of soil structure and provide an opportunity for the accumulation of organic matter directly and also indirectly by the concentration of animals on the land. It would be most desirable if this aspect of farming is given more prominence when new land is opened up for cultivation. Grassland farming could, in fact, be introduced with great benefit as a preliminary step of land use in all new settlement schemes.

Success of Signal Grass

The Department of Agriculture has for several years conducted trials in order to find grasses and legumes well suited for the different zones of the Island. In the search for plants suitable for pastures the following factors are of great importance :—palatability, productivity, ability to provide a good soil cover and stand periodical drought, ease of eradication if required, ability to recover from intensive use and the ability to withstand special natural condition. Many valuable results have been obtained during years of trial, of which the success of *Brachiaria brizantha* or Signal grass is outstanding. The introduction of this grass has in fact revolutionized grassland farming in the country and it is sure to play a very important role in the future agricultural economy. It was only about 5 years ago that the Department introduced it starting with a single plant. This one plant has since by vegetative propagation been the basis for the establishment of some 10,000 acres. Prior to the arrival of Signal grass there was only a very small acreage which could be termed as improved-introduced pasture. The success of this grass has given considerable encouragement to grassland farming, and it has definitely helped to make many planters and farmers "pasture minded". Somehow this grass seems to have found a second and ideal home in Ceylon, it is not so outstanding in East Africa from where it originated.

The qualities that make Signal grass unique are as follows :—

(1) It is easy and cheap to establish (by cuttings).

(2) It competes easily with all types of weeds and does not need frequent weeding as do most other grasses and fodder plants hitherto in use.

(3) It is very resistant to drought, and can, if well managed, be lightly grazed during dry periods.

(4) Its mat-forming habit of growth makes it an excellent soil and water conservator and fertility builder.

(5) It is high yielding and relished by all types of stock. It can be used for pasture as well as soilage and makes excellent hay or silage.

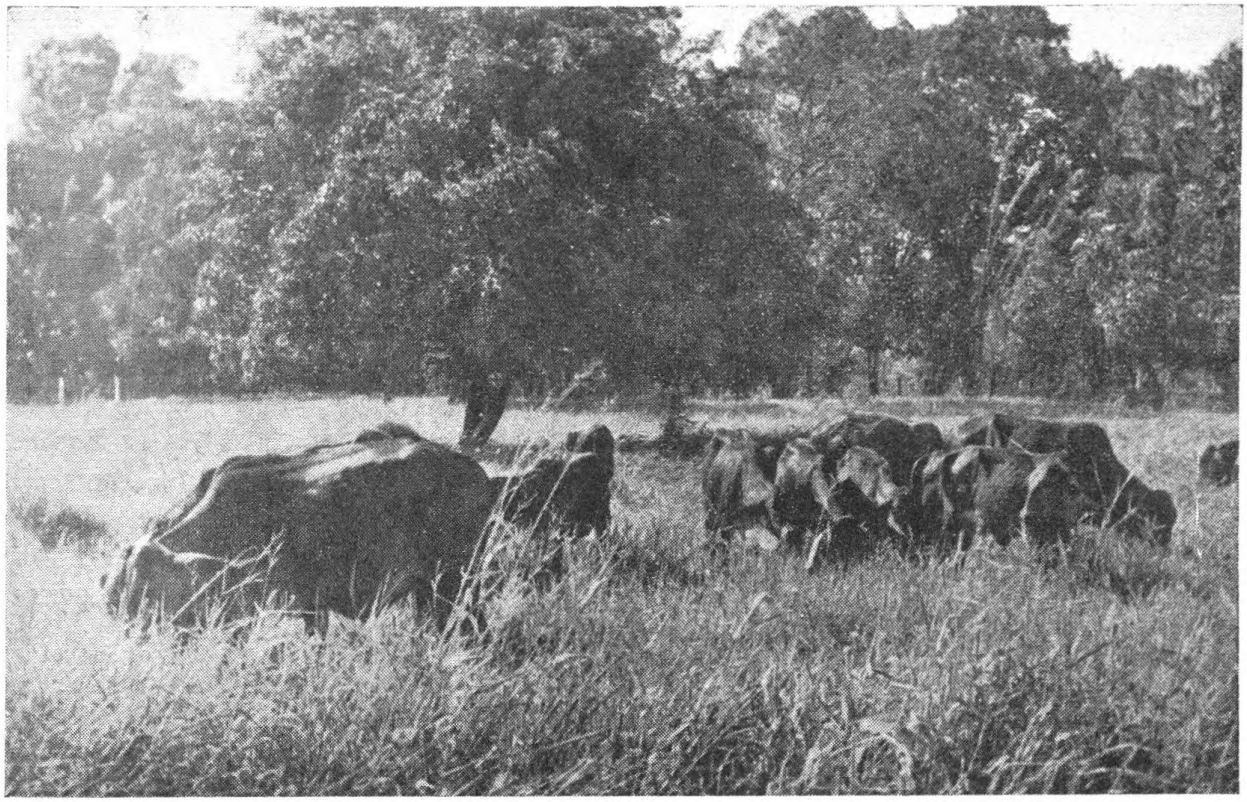
(6) It grows well under shade. This ability should be exploited in coconut lands and in the dry-zone forests.

(7) It can be grown under a wide range of climatic conditions and in different types of soil. It has been successfully grown in the dry-zone, wet-zone and up to an elevation of 4,000 feet. It does not tolerate water-logging.

Signal grass does not produce more than a very small percentage of viable seed, but its establishment by cuttings is easy and cheap, as it can be ploughed in by tractor or bullock drawn ploughs. In weed infested areas this method of establishment is usually more successful.

In *Brachiaria brizantha* and the well known Watergrass (*Brachiaria-mutica*) a solution has been found temporarily both for well drained lands and for waterlogged areas as far as grasses are concerned. While investigations will be continued in order to search for still better plants the farmers have got something in hand really worth while going ahead with.

Planting *Brachiaria brizantha* cuttings



Pasture of *Brachiaria brizantha* at Polonnaruwa Livestock Farm

Legumes in Pastures

But while a satisfactory solution has been found in respect of pasture grasses, what is the position in regard to legumes in pastures? The present position is, that while it has been easy to find legumes which mix well with grasses for a short period, it has been difficult to maintain a mixed sward of grasses and legumes over several years. Generally the maintenance of a stand of vigorous legumes in a sward is considered an important objective where farm animals are raised, so much so that some people have often considered it a " must ". But new developments within the field of grassland research seem to indicate that it is a point which has been overemphasized. In fact, there is evidence that a high level of production can be obtained from pastures without an intimate mixture of legumes. The greatest advantage of legumes is their ability to fix atmospheric nitrogen. Although this nitrogen is used primarily by the legumes, it also promotes a marked increase in the growth of the associated grasses. Legumes also increase the nutritive value of the forage by virtue of their high protein and mineral content. But against these advantages one must consider the following :—

(*a*) legumes are difficult to maintain in long leys, particularly during dry seasons.

(*b*) the inclusion of legumes in pasture swards calls for a comparatively high standard of managerial skill which is not yet commonly available in this country.

(c) grass-species are generally more productive than legumes.

(*d*) the resolution of the problem of using the legume or fertilizer as a source of nitrogen is one that will be influenced greatly by economic conditions.

(*e*) one way of supplementing the grass with nitrogen is to feed grazing stock on oilcakes ; this should be given considerable thought here where oilcake is a by-product of the coconut industry and is available very cheap.

(*f*) experiments carried out in other tropical and sub-tropical areas have indicated that cultivation of grasses and legumes separately offer good possibilities and call for less skill in management.

The whole question of the importance of legumes in pastures is however somewhat academic at it is not a question of one or the other, but only of how far this would influence the rate of pasture development here. There is no doubt that mixed swards will be as common here as in the temporate zone countries the moment suitable legumes are evolved, but until such time there are alternative approaches to the problem of maintaining and adequate supply of nitrogen for stock. Ceylon is comparatively rich in naturally occurring legumes, many of which are able to compete with the heavy sward of *Brachiaria brizantha,* and there are several introduced legumes which show great promise e.g. Tropical Kudzu (*Pueraria phaseoloides*), *Indigofera endechafylla, Stylosanthes gracilis, Desmodium scorpiurus* etc.: So the problem of growing mixed swards in Ceylon is not so bleak as it sometimes is made out to be.

Mention should also be made of the numerous fodder trees found in the country. Such trees can play an important part in livestock production especially during dry seasons. The

nutritive value of their leaves is high and they can be of great value also as shade trees in pastures.

Pasture Management

The productive capacity of pastures depends upon several factors, the most important being—soil and climate, species grown, type of animal and management. Optimum production is possible only when these factors are in equilibrium with each other. Of these factors, management is the most variable because it depends on the practical skill of the farmer. Grassland management should aim not only at maximum production and maintenance of the grass sward, but also at the best possible utilization of the forage once it has been grown. Management practices will, of course, have to differ considerably according to local conditions, but here are some general principles which are applicable to most parts of the country.

Rotational grazing of grassland—short periods of grazing followed by periods of recuperation—should be the rule because such controlled grazing, both on natural and introduced pastures results in better utilization than free range grazing. The purpose is to confine the animals to one area at a time so they will eat off the forage more evenly and with less waste by trampling and selective grazing.

Rotational grazing presupposes proper subdivision of existing grassland by fencing or the employment of herdsmen. But although this tends to add to the cost of the forage it is a system which pays good dividends because it almost certainly results in increased production and improved quality of the feed. The number of subdivisions required will depend on the type of stock, size of herd, and the productivity of the land with due regard to access to drinking water for stock.

In regard to *Brachiaria brizantha* pastures it has been found that a system of "high grazing" and frequent rotation of the grazing stock has proved very successful. By "high grazing" is meant that the herbage should not be grazed lower than 6 inches. By then the animals will have consumed the tender and highly nutritious growth. "High grazing" results in a more uniform production throughout the year, produces higher yields of nutritious forage and, above all, gives maximum soil protection thereby helping to conserve moisture during dry seasons.

On natural grassland the danger of over-grazing must always be kept in mind. Over-grazing results in favouring the less palatable and the low growing species at the expense of the better species and, if continued, will quickly deplete the sward and finally the soil will become almost useless for plant growth. On introduced pastures continued over-grazing results in the breakdown of the grass cover and replacement by weeds.

The utilization of grass is closely linked with its production. Many of the practical difficulties arising in connection with proper use of grass relate to seasonal growth and to the fact that the period of maximum growth coincides with the development of stem and consequent fall in nutritive value of the forage. This problem is of particular importance to grassland farming in the dry-zone. By good and well planned management, the grazing season in the dry-zone can be considerably extended, but the fact still

remains that approximately three-fourths of the forage is produced during the period from about October to May and this makes it impossible to obtain a close fit between the pattern of grass growth and the nutritional requirements of livestock unless part of the production during the season with lush growth is conserved as hay or silage. If conservation of surplus forage does not take place the stocking rate will have to be reduced thus resulting in lowered production per acre. It is on this basis that the farmer must arrive at some decision about livestock numbers in relation to the pasture supply. Of the managerial factors the stocking rate is perhaps the most important because the grazing animal itself can be of prime importance in building up fertility of land. If an increasing number of animals are carried on a pasture for a greater number of days more and more dung and urine are added to the soil. This, in turn, improves the soil and raises its cropping power. A gradual increase in stocking rate can only be achieved if pastures are well cared for, because, as in respect of other types of production, it is easy to plan for stagnation, but difficult to plan for progress. The tradition that keeping livestock always improve the fertility of the land is only relatively true because livestock do not return in the form of manure all that they have consumed. Land fertility is built up by livestock, however, in cases where the stock is fed supplementary feeds such as coconut cake and kept on well covered pastures so that very little of the value of their droppings is lost. Similarly in a system of mixed farming the fertility of cultivated fields can be improved by applying manure produced from pasture and cakes. In some areas, for instance in up-country *patana* lands, serious soil deficiencies exist which can only be overcome by a regular supply of fertilizers.

Management practices should always aim at maintaining a good soil cover throughout the year by adopting a correct grazing technique and ensuring good root development. There are two implements which are very useful in this connection, viz., the mower and disc-harrow. Mowing once or twice per year can help to keep the plants at a uniform stage of growth. Disc-harrowing helps to spread droppings from stock and to improve root-development.

Well maintained grassland and the associated animal husbandry (if given their proper place in Ceylon's agriculture) could indeed influence heavily the yield of arable crops. In fact grassland farming is adapted from nature's way of providing food and conserving the valuable top soil. In grassland farming therefore lies one of the country's greatest opportunities for expansion of food production.

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