A PLEA FOR PASTURES AND THEIR IMPROVEMENT

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I must at the outset apologise for disagreeing with the Hon. Sir H. Marcus Fernando's view that the breeding of cattle by stall feeding is practicable and that this practice should be more generally adopted. In support of my view I quote Dr. J. B. Orr, Director of the Rowett Research Institute, Aberdeen. In an Empire Marketing Board Publication (No. 18, 1929, p. 13, entitled "The Composition of Pastures") he says: "Modern improved breeds of cattle with a rapid rate of growth have been evolved in districts with improved cultivated pastures. The improvement of the breed and the pastures have gone hand in hand and are closely connected. But in developing animal husbandry in new countries, sires of improved breeds have been imported to 'grade up' native cattle without any 'grading up' of the pastures. The common result has been that as the 'grading up' process proceeds, mortality increases. The natural herbage which is able to support in health slower growing native cattle, which have evolved on this herbage, is too poor in constructive material to support more rapidly growing animals. The equilibrium between the grazing animal and the herbage is upset, and the resulting mortality and sterility are really part of a natural process tending to the elimination of a type whose rate of growth and of production is greater than the herbage can support." If further evidence of the truth of Dr. Orr's pronouncement is needed one has only to look through the history of the development of German agriculture during the latter half of the last century. With the increase of population and its movement towards the large towns arable farming and stock raising were intensified and this meant an increase of nutritive substances for both plants and animals. This marked the beginning and rapid development of artificial fertilisers for plants and artificial nourishment by way of concentrated feeds very rich in protein and for the most part imported. At first all seemed well with this method but later when German agriculture passed through critical times, this type of feeding became too dear and rendered stock raising uneconomic and unremunerative. It was, however, not till the outbreak of the great war that Germany

realised that for stock feeding the most practical, most natural, and most economic method consisted in intensifying the forage production on the grassland, the pastures, and in the rotation of crops.

I must, nevertheless, admit that even where a high level of forage production has been reached, a considerable use of concentrated foods will still be lucrative, because maximum yields can only be obtained by this means combined with the use of good forage. Have we in Ceylon come to that stage of stock development and pasture improvement when we have to call in the aid of expensive concentrates, like gingelly, cotton, or coconut poonac which are naturally lacking in mineral matter and which have in the process of their manufacture lost their vitamins? Should we not get into stride with other parts of the Empire and the rest of the agricultural world and devote more attention to pastures which Mr. Amery, the late Secretary of State for the Colonies, in the preface to "A record of concerted endeavour to foster the better exploitation of the Empire's Grasslands" says is a subject pre-eminently worthy of intensive research on an Empire basis.

Before coming to the question of the improvement of pastures let us convince ourselves that pastures are the most natural, most practical, and most economic raw material for the formation of milk, meat, mutton, hide and other products of live-stock. In Ceylon, except with capitalist breeders, it is the only raw material because the poor villager cannot afford anything else. It is universally admitted that good pasture is the best feeding stuff for herbivora. The reason is apparent when we compare the composition of good pasture with that of other food-stuffs.

The following table (from the Empire Marketing Board's Publication 18, p. 8.) shows the fairly close correspondence in the mineral and protein content of good pasture to those in cow milk:

	CaO	P_2O_5	Na_2O	K_2O	Cl	Protein
Cow's milk	2·38	3·43	0·81	3·21	1·4	52·00
Good pasture	3·64	2·75	0·94	11·54	3·5	65·00
Maize	0·03	1·83	0·13	1·36	0·001	29·00
Decorticated cotton cake	1·22	11·26	0·24	8·05	0·11	164·50

The resemblance shown in this table is undoubtedly a very important factor in determining the high nutritive value of good pasture not merely in promoting growth but chiefly in maintaining health in stock. What better evidence of the practicability of pastures for the production of meat is needed than the fattening qualities of the pastures of the Tamankaduwa area of the Anuradhapura district? Its cheapness is also sufficiently obvious.

Sufficient, I trust, has been said to convince even the most sceptical of the value of pastures to the agricultural and economic welfare of the Island. Let us now enquire whether Ceylon pastures are in need of improvement. Can we conceive a tea or coconut plantation which is regularly cropped but receiving no attention whatever by way of cultivation or manuring ? What attention have we given our pastures which are cropped, *i.e.*, grazed in and out of season, and the productivity of which is taxed beyond their normal. Can we fail to recognise that there is a slow invisible flow of soil fertility with every herd of live-stock that is grazed on our pastures without any compensating return to the soil ? Depletion is inevitable and is hastened by drought. As depletion proceeds on an impoverished soil the vegetation tends to disappear and the pasture responds less readily to whatever rainfall there is and any existing vegetation is literally eaten out. A barren soil denuded of pasture is the inevitable result. In all parts of Ceylon, pastures in various stages of deterioration can be seen by the most casual observer.

How then can our pastures be improved ? Only a very careful study of our pastures can provide a definite answer to this question and this answer I am not in a position to give. I may, however, indicate in very broad terms such methods of improvement to which some of the pastures that have come under my notice are sure to respond.

Drainage.—A well-aerated healthy soil is just as necessary to grassland as it is to arable land. Water-logged pastures are invariably overrun with useless weeds, especially the *Cyperaceae*, and *Eriocanloneae*. The vegetation of any land is a very good guide as to whether drainage is needed or not. The need for drainage is obvious in lands which were once under rice but are now for some reason or other abandoned. Nothing but prompt and thorough drainage can save those lands from reverting to useless waste lands. On well-drained land the grass has a better chance of growing and establishing itself in a competition with such weeds as thrive on water-logged soils.

Irrigation.—In earlier centuries irrigation of grasslands was carried out on a large scale in European countries and this practice has been revived and is on the increase. Spray irrigation of pastures has proved very beneficial in advanced countries. Everywhere it has been found that irrigation of pastures has increased their yield. The phosphorus, potassium and magnesium content of pasture was found to rise with irrigation while the calcium content fell. Where flooding is not practicable for reasons of an insufficient water supply a system of channels, while serving the dual purpose of watering the animals and the pastures, will also help to keep the land from getting water-logged in wet weather.

Water meadows in Ceylon are not known to me but their possibilities are evident alongside the banks of rivers and streams which are subjected to occasional flooding. Could not the occasional flooding of the Mahaweli Ganga which then overflows its banks in the Tamankaduwa district partly account for the productivity of its pastures ?

Clearing.—The need for this is very evident in paddy lands which have been abandoned sufficiently long ago and which have now reverted to scrub. Nothing short of a thorough freeing of this land of the scrub together with draining is needed for its improvement.

Land which has been reclaimed from varying stages of deterioration by one or more of the above methods, will then need further attention and fencing should be one of the first steps towards the maintenance of the pastures in good condition and towards our goal, their increased exploitation. Judicious grazing is just as important as correct manuring and grazing cannot be controlled without fences. The position of the fence must be determined by the convenience of working the land and the uniformity of the grazing. The size of the enclosure has to be determined by such conditions as climate, soil, and extent of the grazing herd.

Grasslands will certainly need manuring. What manures should be applied investigation only can reveal. Manuring should, however, be preceded by mechanical treatment. Some pastures have been so regularly grazed that every possibility of adventitious growth has been reduced to a minimum and only a mat of roots is left. No amount of manures can be expected to break through such a mat and reach the soil. Rejuvenation of that type of soil is necessary by breaking up the mat. Such coarse grasses as *Chrysopogon aciculatus*, *Setaria glauca*, *Aristidia setacea*, which are due either to insufficient grazing or other unexplained reasons act as a serious check on good herbage plants. They have to be removed, often by drastic burning. The fire should pass quickly over the herbage so that any of the finer plants which may be struggling for an existence may not be unduly injured. Burning should be followed by harrowing before manures are applied.

Chief among the factors affecting the composition and, therefore, the utility of pastures, are the several species of plants with their seasonal variation and degree of growth under varying conditions of climate and soil. The introduction of desirable grasses and legumes as *Axonopus compressus*, *Desmodium* spp., *Paspalum conjugatum*, *Alyssicarpus*, *Pannicum fluitans*, *P. colonum*, *P. pilicatum*, *Stenotaphrum complanatum*, *Cynodon dactylon*, *Setaria sulcata*, may be first steps towards improvement after such preliminaries as draining, fencing, and burning where necessary.

Qualities of grasses suited for grazing are either those with a creeping habit or those with the capacity of producing numerous small leaf shoots as well as the large flowering shoots. These plants must also be able to maintain themselves under the influence of the grazing animals. *Ipomea*, *Commelinia* and *Mikania*, have been found to be useful species for grazing although they are not grasses.

Shade trees are a very necessary adjunct to pasture lands as they protect both the cattle and the grass in the very hot weather which is aggravated by a period of drought. Such trees as *Poinciana regia* and *Leucaena glauca* affording a light feathery shade are more suitable than dense shade. Such trees as *Mimusops hexandra*, *Acacia* spp., the pods of seeds of which are readily eaten, should be planted up.

Manuring can now follow. It is not possible for me to say with certainty what manures should be applied but I may mention such elements of plant food which are indispensable.

Liming will undoubtedly be helpful although as a general rule grassland will stand a higher degree of acidity than arable crops. Liming influences the quality of pasture. Joachim (*The Tropical Agriculturist*, LXVIII, 1927 pp. 269-271) has amply proved the poverty of Ceylon *cultivated* pasture grasses in minerals especially. We can from that gauge the quality of uncultivated pastures. Crawford (*ibid* p. 279.), while admitting that, "Manuring the soil with phosphatic manures and calcium is obviously the most direct method of attack" says "it has the drawback of being expensive. It is more suited to mixed farming than to grazing." He favours "Supplementing the grazing by foodstuffs known to be rich in the deficient minerals, especially as regards calcium content." German experience cited above has proved that better grazing is not only more practical but also more economical. Before deciding the question of cost and feasibility one must take into consideration the train of subsidiary effects liming has both on the soil and on the pasture. We must not lose sight of the fact that grazing does not mean merely grass but anything which is palatable, non-poisonous, and of nutritive value. Liming encourages the growth of leguminous plants of the type of *Desmodiums*, etc., which cattle eat readily and which are rich in calcium. It has also been proved that one can take more liberties with the grazing on limed soils without permanent damage to the pasture. Lime also serves as a preparation for such other manures as phosphates by promoting the more rapid disappearance of coarse and badly grazed herbage.

Phosphatic manures are by far the most important for grazing land although there are some lands which do not respond easily to phosphates. Here too as in the case of the manuring of other crops considerations of soil and climate should determine whether phosphates should be applied and, if so, in what form. The phosphorus content of herbage has been shown to fall during drought. In South Australia the indication is that soil moisture can be conserved by enriching the soil. This result, if confirmed, will be of great economic importance to pasture lands in dry districts. It may here be mentioned that in Ceylon water seems to be the limiting factor to the productivity of pastures. Phosphates act on grassland by inducing tillering and the development of lateral and fibrous roots, cause a bottom growth of legumes which act as a wet blanket keeping the temperature down, keeps grass from growing too sappy, and enriches pastures.

On poor grazing land potash by itself does not seem to be effective and it should only be used either in conjunction or on land previously treated with phosphate. Kainit is usually applied because the common salt in these fertilisers makes coarse herbage more palatable to stock which pull it off and help in cleaning up rough patches.

The nitrogenous manures on grassland is either on an intensive or extensive scale and as no definite results are available under Ceylon conditions no useful purpose will be served in this paper by any comparison of, or reference to, either of the methods. It is a subject which had better be left for experience to decide. Nitrogenous manures help to maintain the "freshness" of a pasture over a longer period and the herbage known as "May" grass can be produced in England as late as July or even August by their use. Under extensive grazing systems farmyard manure should be both available and the best source of nitrogen. It should not, however, be left to be about as it induces rank growth and coarseness of the herbage.

All attempts at the improvement and maintenance of grassland by mechanical and manurial treatment will be of no avail if the grazing is not controlled. Experience alone can teach us at what stage of the growth of a pasture the maximum yield can be obtained by grazing and the extent to which the pasture could be safely grazed down before it is rested. Rotational or intermittent grazing of pastures has proved to be more economic and profitable in England. The ideal method is to tether the animal—a practice regularly followed on permanent pastures over considerable areas and on large farms in the south of Sweden. Its possibilities are greater in Ceylon because of the more favourable conditions for growth of plants throughout the greater part of the year. Intensity of grazing will have to be reduced with the

advent of dry weather and care will be needed that the pasture is grazed to a nicety so that neither too rank a growth is left to be parched up by a drought nor too little left for recovery when better weather sets in. The art of grassland management involves the manipulation of a number of factors.

One may be inclined to deride all the suggestions for improvement of pastures put forward in this paper on the score of cost. What the actual cost will be, it is not possible for me to say but communal labour and a levy on each head of cattle that is grazed ought to be able to meet the expenditure a great way. If only on an experimental scale, it is a trial worth making when one remembers that it is an attempt to not only assist paddy cultivation which everyone looks upon as a national industry but also to improve our live-stock of which just now we have every reason to be ashamed. Besides the methods of improvement mentioned in this paper there are several other points on which research is needed, *e.g.*, the question of mowing *versus* grazing in districts where growth is more luxuriant. Research alone can show the adaptability and applicability in local conditions of methods, the results of which so far achieved in other countries, have proved remunerative.