PASTURES IN SOUTH AFRICA

G F S HYAM AND K P ARCHIBALD,

Fertilizer Society of South Africa

Introduction

Millions of hectares of natural grazing (veld) are the source of feed for a large proportion of South Africa's livestock. In the areas of lower rainfall the veld grasses, in addition to their feed value in summer, retain much of their nutritive value in the winter months. This herbage is readily taken by stock. However, in the higher rainfall, sourveld areas in particular, the satisfactory feeding of livestock during the winter months presents problems. The grasses of the sourveld become unpalatable, have a low nutritional value and are subject to considerable variations in total dry matter (DM) production. These seasonal variations adversely affect dairy production. (Luitingh, 1978).

Throughout South Africa sown or planted pastures are playing an increasingly important and vital rôle in the cattle and sheep industry. (Booysen, 1970; Joubert, 1971; Luitingh and Hyam, 1976; Hermann, 1979; Luitingh and Rudert, 1981.) In a well planned system, pastures are a reliable, economic source of fodder of good quality and in sufficient quantity. Grazing is the most common — and usually the most economical — means of utilizing pastures. Pastures are also an important source of hay, foggage and, to a limited extent, silage. Silage, is often an essential component of the fodder flow in winter but sources and forms will not be dealt with, as such, in this paper. Suffice, at this stage, to state that good silage is an invaluable feed.

Pastures can be comprised of annuals or perennials. The component (or components) of the sward can be grass or grasses or a legume or legumes. There can be numerous combinations of these plants. Pastures can be rainfed or irrigated. They can be essentially summer growers or the pasture can consist of plants which produce best in the cooler seasons. Apart from sown or planted pastures as such, fertilized or fertilized, oversown, reinforced veld can, under specific circumstances, be a valuable source of forage. (Visser, 1966; Grunow, Pienaar and Breytenbach, 1970; Edwards and Booysen, 1972; Hyam, Penderis and Theron, 1977; Kruger 1981.) In addition to silage, various root crops such as Japanese radish, rape, turnips and swedes, can be worthwhile fodders.

Ruminants have the ability to economically utilise roughages and, therefore, offer little competition to man for available food supplies. Furthermore, many of the by-products derived from crops produced as food for man are a valuable feed for ruminants. (Mc Donald, 1971.) With proper planning, crop production and pasture production can, indeed, be complementary.

A grazed pasture, particularly when it comprises a number of species is a complex ecological system. Booysen (1980) stated that this ecosystem comprises "the abiotic physico-chemical environment together with the biotic assemblage of plants, animals and microbes. All these components of the ecosystem are both interdependent and interactive. The manipulation of any one has consequences upon the others and, thus, the whole."

For real success in farming, planning is essential. This should start with overall land-use planning. Scotney (1982) stressed vital factors which must be heeded. A primary consideration is that agricultural production must be on a sustained basis and, at the same time, resources must not be degraded. An inventory of resources must be compiled and an estimate made of production potential. Scotney summarised land use planning procedure under the following headings —

1. Survey
2. Assessment
3. Implementation
4. Evaluation

Much has been written and spoken about the importance of a multi-disciplinary approach in the planning of development in agriculture. By adopting this approach and linking it with the systems analysis technique progress has indeed been made. Harwin and Theron (1975) pointed out that systems analysis played an important rôle in the achievement of a multi-disciplinary approach. Jones (1978) wrote 'the systems approach means that decision-rich parts of any given system are considered quantitatively and in their proper context ... our systems approach has been concerned with the practical application of agricultural science and economics in decision-making at the farm level.'

Upon completion of the land-use plan the next step is to carefully plan the pasture programme. (Hyam, Rudert, Williams and Archibald, 1981.) Poor initial planning can result in dissatisfaction and, in some cases, failure of a pasture-based production system. Care should be taken with the important planning procedure. After deciding on the most suitable components for the pastures the next phase is that of establishment. Techniques have been described by many workers and details will not be dealt with in this paper. Suffice to state that seed-bed preparation must be of a high order, fertilizers must be applied as required and seed of good quality must be used.

Following the successful establishment of a pasture it is most important that subsequent management be of a high standard. Broom (1975) stated that management tended to be the limiting factor which affected a greater realization of the tremendous potential with regard to intensification for beef production which existed in the Natal Midlands. In addition to efficient livestock management it is essential that the pasture sward be correctly managed. Some of the main factors which have to be considered are adequate fertilization; a sufficient number of paddocks so as to ensure graze and rest periods best suited to the particular sward; in the case of irrigated pastures, evapotranspiration water losses must at least be replenished.

Some economic considerations

Well planned, efficiently managed pastures together with sound herd management make a profitable farming enterprise. Theron, Lesch and Mappledoram (1974) reported that the profitability of an enterprise was usually positively related to the intensity of pasture development. In 1976, Theron and Harwin stated that pastures brought about a highly significant increase in weaned calf mass per unit area. Furthermore, the

carrying capacity of an area was increased, and the ADG of the calves was greater than that obtained from less intensified areas. There were highly significant increases in cash returns per hectare. Stewart (1980) found that, for every Rand spent, pastures were twice as effective as concentrates in improving milk yield. He summed up by stating 'it may be true to say that farmers who were running large stable herds with excellent fertility, plenty of good quality home grown feeds and high milk yields made the greatest profit per cow.'

Officers of the Fertilizer Society of South Africa have been involved with fodder flow planning, in giving advice on the most suitable pasture components for a particular situation and on their establishment, fertilization and general management. During the course of the last three years particular attention has been paid to some sixteen selected farms with a view to obtaining economic data from practical farming situations. The pastures chiefly studied in these exercises have been Kikuyu (*Pennisetum clandestinum*); Star grass (*Cynodon aethiopicus*); Rye-grasses (*Lolium spp.*); Cocksfoot (*Dactylis glomerata*); and to a limited extent Coast Cross II (*Cynodon sp.*). Sound planning and efficient management have paid off. The gross margins obtained from a dairy enterprise in which six to eight lactating cows were grazed per hectare of irrigated Kikuyu pasture have been in the range R1 400 to R1 800 per hectare (for the lactating cows). The gross margins realised from irrigated Rye-grass pastures which were grazed in the cooler seasons has been equally encouraging. (Williams, 1982) An indication of the high yields and excellent quality which have been obtained from the pastures, which received on average 40 kg P and 350 to 450 kg N/ha/annum, is shown by the ranges given in Table 1.

TABLE 1: Crude Protein content and Dry Matter yields

	Annual Rye-grass (Midmar)	Perennial Rye-grass (Nui)	Cocksfoot (Hera)	Kikuyu	Star grass
Crude Protein %	21 - 27	21 - 26	19 - 24	17 - 24	18 - 24
DM yield t/ha	21	25	20 - 25	20 - 23	20 - 24

Development

In South Africa the area under pasturage has increased considerably during the last few years. Livestock farming systems are being better planned, pastures are more productive (both in quality and quantity due largely to better fertilization) and, in general, the standard of management has markedly improved. An example of the rate of development can be gauged by comparing the area under pastures in Natal as published in the 1976 report of the Department of Statistics with that reported by Fortheringham (1981) for the 1978/79 season. The area reported in 1976 was some 62 000 hectares. Within a few years the area under dryland and irrigated pastures in Natal exceeded 129 000 hectares. The area devoted to fodder crops, other than maize, was more than 65 000 hectares. If the area of the lands under maize which was grown for silage is added to the above figures it can be seen that the area required by the livestock industry in Natal alone is considerable.

Marginal soils

The considerable advancement which has been made during the last decade in the classification of soils is indeed encouraging. In South Africa a binomial system is in general use. (Dept Agric Tech Services, 1977). In the agronomic field, research findings have been energetically applied by leading farmers. The value of this approach is evident in the advancement which has been made in maize production during the past few years.

However an aspect which the authors believe requires urgent attention is to plan for the more economic utilization of soils considered marginal for crop production. Van Marle (1982) drew attention to this. He stated that livestock production could be integrated, not only into the more favourable rainfall areas, but also into the marginal grain producing areas of the west.

The authors aver that there are also large areas in other parts of South Africa which have been devoted to crop production even though conditions may be regarded as marginal from both an agronomic and economic standpoint. It is contended that not only the farmer but also the industry would benefit substantially if livestock production were to be encouraged on such land.

To illustrate the thrust of this argument let us consider the case of an hypothetical farmer living in the Western Transvaal who works the following areas of land:

60 ha	good arable land
180 ha	poor arable land
100 ha	veld
340 ha	Total

There are many and varied options available to him. Even if, for instance, it was decided to raise long yearlings there would be several variations. (Does he purchase the weaner or produce the animal on the farm? Does he buy the weaner before or after winter? Is it better to feed more or less lick thereby finishing the animal sooner or later?) Every individual case has its own requirements.

In this paper three systems are compared:

1) Producing maize grain from all arable land.

2) Producing weaners from poor arable land established to pastures.

3) Fattening long yearlings on poor arable land established to pastures.

Essentially the comparison which needs to be made is between the respective uses to which the poor land can be put. The gross margin of an enterprise is a measure of the contribution it makes towards covering common costs (ie overheads and financial costs) and the provision of ultimate net profit.

The gros margin of a 3 ton/ha crop of maize grain was estimated at R111. The total gross margin on poor land is thus: R111 x 180 ha = R19 980.

Weaner production on our hypothetical farm could involve a herd of the composition shown in Table 2.

TABLE 2: Herd composition

	August to April		May to August	
	head	MLU	head	MLU
Bulls	14	14	14	14
Cows	284	339	224	224
Replacements (0 - 1 yr)	275		75	25
Replacements (1 - 2 yr)	70	47	60	40
	643	400	373	303

Such a herd would generate the gross margin stated in Table 3.

TABLE 3: Gross Margin

Sale of stock	R79 840
Allocated costs (Digitaria aeriarlta pasture 100 ha; *Eragrostis curvula* pasture 80 ha; maize silage; licks; other costs)	50 141
Gross Margin	R29 699

Alternatively if one purchased weaners instead of breeding them and overwintered them on maize residues and veld, then on the hypothetical farm envisaged one could support the animal numbers given in Table 4.

TABLE 4: Number of animals

Month	head	MLU
May	575	190
October	568	284
April	560	420

This would produce the gross margin stated in Table 5.

TABLE 5: Gross Margin

Gross income	R234 024
Allocated costs (Purchase of weaners; hay; licks; other costs)	212 538
Gross Margin	R 21 486

Instead of growing maize silage on 20 hectares as was assumed in the previous example, this land was devoted to maize grain production, the residues of which were used by the cattle. The gross margin obtained on this land must be added to the beef gross margin so that all three systems may be fairly compared (see Table 6).

TABLE 6: Comparison of systems

		Total Gross Margin
1 Maize on 180 ha		R19 980
2 Weaner production 160 ha pastures 20 ha maize silage		R29 699
3 Long yearling production 160 ha pastures	R21 486	
20 ha maize grain	R2 2220	R23 706

In addition to the benefits accruing to the farmer there are also benefits accruing to the fertilizer industry. An example is given in Table 7.

TABLE 7: Comparison of fertilizer consumption

Option	Average consumption per hectare N	P	K (kilograms)	Value of Fertilizer Sales
1 Maize grain	45	32	5	R 71
2 Selling weaners	142	23	5,6	R136
3 Selling long yearling	150	22	0	R139

All the above calculations are of course based on assumptions and depending on what is assumed so the results would vary. But, even if the finer details change, it is difficult to dismiss the broad principle and the advantages flowing from them for both the farmer and the fertilizer industry. An added advantage for the country, and for posterity, is that lands which are established to perennial pastures are stable. Soil erosion is reduced to a minimum.

In conclusion we quote from the opening address given by the then Chief Director of Animal and Dairy Science, Dr W A Verbeek to the Grassland Society of Southern Africa in 1971 — "Die huidige stand van die veebedryf, die toestand van die veld in groot dele van die land en die ontwikkelingsbehoeftes in die hoë potensiaal gebiede vereis dat onkundigheid oor benutting en bestuur van die weidings nie langer 'n struikelblok mag wees nie ... bestuur van veld en aangeplante weidings bly steeds 'n uiters belangrike faset in die optimale benutting daarvan en om maksimum diereproduksie per hektaar oor die langtermyn te verwesenlik."

References

BOOYSEN, P. DE V., 1970. Populations and pastures in prospective. *Proc. Grassld Soc. sth. Afr.* 5, 14 - 16.

BOOYSEN, P. DE V., 1980. Pasture improvement possibilities in effective animal production systems. *S. Afr. J. Anim. Sci.* 10, 293 - 298.

BROOM, D.N., 1975. Economic considerations in beef intensification. *Proc. Grassld Soc. sth. Afr.* 10, 171 - 173.

DEPT. OF AGRIC. TECH. SERVICES 1977. Soil classification. Science Bulletin 390.

DEPT. OF STATISTICS, 1976. Report on agricultural and pastoral production. Report No. 06-01-13.

EDWARDS, P.J. & BOOYSEN P. DE V., 1972. The future for radical veld improvement in South Africa. *Proc. Grassld Soc. sth. Afr.* 7,61 - 66.

FOTHERINGHAM, P.J., 1981. Agriquest. Postal survey of agricultural land use. Dept. Agric. & Fisheries (Natal Region). Pub. N. 14/1981.

GRUNOW, J.O.; PIENAAR, A.J. & BREYTENBACH, 1970. Long term nitrogen application to veld in South Africa. *proc. Grassld Soc. sth. Afr.* 5,'75 - 90.

HARWIN, G.O. & THERON, E.P., 1975. Research on radical veld improvement. *Proc. Grassld Soc sth. Afr.* 10, 159 - 165.

HERMANN, M.N., 1979. A milk production strategy for Southern Africa. *S. Afr. J. Anim. Sci.* 9, 89 - 97.

HYAM, G.F.S.: PENDERIS, A.H. & THERON, E.P., 1977. Techniques for fertilizing, oversowing and sodseeding veld. *Proc. Grassld Soc. sth. Afr.* 12, 99 - 101.

HYAM, G.F.S.; RUDERT, C.P. WILLIMAS, F.R. & ARCHIBALD, K.P., 1981. Pasture Handbook. Fert. Soc. S.A. Pub. No. 78, 135 - 141.

JONES, R.I., 1978. The systems approach in agriculture. *Proc. Grassld Soc. sth. Afr.* 13, 21 - 25.

JOUBERT, D.M., 1971. Intensification of animal production in South Africa. *Fert. Soc. S. Afr. J.* 2, 7 - 10.

KRUGER, J.A., 1981. Milk production from radically improved old fallows in the Eastern Free State. *Proc. Grassld Soc. sth. Afr.* 16, 57 - 61.

LUITINGH, H.C. & HYAM, G.F.S., 1976. Aspects of increased beef production based on improved grasslands. Simmentaler Journal (World Congress).

LUITINGH, H.C., 1978. 'n Diereproduksie strategie vir Suid-Afrika. *S. Afr. Tydskr. Veek.* 8, 43 - 67.

LUITINGH, H.C. & RUDERT, C.P., 1981. Economic and biological priorities in livestock production int he RSA. *Fert. Soc. S. Afr. J.* 1, 11 - 16.

MC DONALD, I.W., 1971. Animal production: Quo Vadis? *S. Afr. J. Anim. Sci.* 1, 149 - 158.

SCOTNEY, D.M., 1982. Assessment of agricultural poetential (Presented at meeting of S.A. Institute of Ecologists, Sandton, Transvaal).

STEWART, P.G., 1980. Factors affecting profit in dairying: conclusions from Natal study group results. *S. Afr. J. Anim Sci.* 10, 283 - 285.

THERON, E.P.: LESCH, S.F. & MAPPLEDORAM, B.D., 1974. The potential in natal for the radical improvement of the veld and the fortification of established pastures. *Proc. Grassld Soc. sth. Afr.* 9, 175 - 178.

THERON, E.P. & HARWIN, G.O., 1976. The future role of improved pastures for beef cattle. *S. Afr. J. Anim. Sci.* 6, 139 - 146.

VAN MARLE, J., 1982. Omlyning van diereproduksiestrategie. *S. Afr. Tydskr. Veek.* 12 (in druk)

VERBEEK, W.A., 1971. The need to safeguard and extend the pasture resources for animal production in South Africa. *Proc. Grassld Soc. sth. Afr.* 6, 12 - 15.

VISSER, J.H., 1966. Bemesting van die veld. *hand. Weidingsveren. S. Afr.* 1, 41 - 48.

WILLIAMS, F.R., 1982. Personal communication.