THE ROLE OF FERTILIZERS IN LIVESTOCK PRODUCTION IN SOUTH AFRICA

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Introduction

The role and importance of fertilizers in livestock production in South Africa in the coming years is going to be influenced by many factors which are often confounded and nearly always confusing. For the technologist the temptation to concentrate on scientific data, which might be applied under a variety of economic and political conditions, is great **BUT** those involved in advising the producer should take these factors into consideration and attempt to place them in perspective.

Those farmers concerned with the production of dairy products, red meat or animal fibres are all involved in relatively long term project which make frequent changes impractical and uneconomic. Decisions on production systems and marketing policy must be taken with due regard to factors such as: protectionist or free market policies; inflation of input costs; the demand in the market place as influenced by population growth and standard of living; the availability and price of alternative products; the possibilities of export; the price and size of production units; ecological stability as the basis of sustained productivity; to name but a few. In the final analysis, although livestock production from both natural and planted pastures might be a great way of life, the producer who is going to make it a profitable way of life is the one who produces most efficiently and by dint of positive marketing ensures a good turnover. A market orientated approach should entail not only producing the right product at the right price but, especially in the South African context, also developing the market, ie the people of this nation.

The approach to long term planning of livestock enterprizes will vary dependent on the enterprize and the agro-ecological area involved. The basic principle that production systems must be adapted to local conditions, to ensure sustained production from well conserved natural resources, is still valid. This discussion will thus be based on production systems in the major agro-ecological zones.

Karoo

This area is characterized by sweetveld with a low grazing capacity which is pre-eminently suited to large farming units utilized on an extensive basis with little or no alternative pasturage. However, poor veld condition and relatively small units make the utilization of irrigable soils for planted pasture, and the planting of drought-tolerant species such as saltbush and spineless cactus desirable, in order to relieve the grazing pressure on the veld during critical growth periods and also to increase the carrying capacity - and hence turnover - of producion units.

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Of some 75 000 ha under irrigation in this area approximately 85% is established to planted pasture. The major crop on these soils is lucerne which has a potential yield in excess of 20 t/ha. At these levels of production, where circulation of nutrients via the grazing animal is limited, the high rates of removal of P and K will necessitate emphasis on these nutrients.

Under dryland conditions there is a large unrealized potential for drought tolerant crops. Whereas there is a potential for 2 500 000 ha of saltbush only 50 000 ha is established at this stage (Steynberg & De Kock, 1986). With respect to potential fertilizer usage, however, the prospects are limited by the fact that this crop requires little or no fertilizer. Successful establishment and production is more closely linked with the availability of moisture.

Savanna

These bushveld areas vary from low rainfall sweetveld areas, in the Valley Bushveld of the east coast, the Kalahari Thornveld of the Northern Cape and the Sweet Bushveld of the Northern Transvaal, to mixed and sourbushveld areas of the Central and Eastern Transvaal. In the **sweetbushveld** areas there is a very definite need for planted pastures which can be utilized to create a fodder bank to act as a buffer against drought periods. At the same time such pastures would be invaluable in reducing the grazing pressure on the veld and thus encouraging more rapid veld recovery after decades of degrading misuse. This concept of encouraging the establishment of pastures to eliminate the need for stock reduction schemes, while at the same time promoting improvement in veld condition, is one strongly supported by the National Grazing Strategy, which has re-generated interest in the necessity of promoting the ecological stability of our pastoral resources. This has coincided with the growing realization that cropping in these low rainfall areas is a high risk enterprize and that such arable lands can be used for planted pastures.

In the northern savanna areas emphasis has been placed on beef production in the past, but with the growing realization of the importance of the balance between bush and grass - between browsers and grazers - goat enterprizes are becoming more common. Many units have also been converted into game farming units, and whereas the objectives of striving for a balanced utilization of such vegetation with a spectrum of adapted wild life is highly laudable it must be recognized that many of these game farming units are too small to be ecologically sound. Planted pastures - of indigenous adapted species - can, therefore, make an important contribution to stabilizing such units. This is particularly true of those units incorporating arable land, which if permitted to revert to an "old land" situation will have an extremely low productivity for decades.

In the Valley Bushveld the contribution of browsers is dominant and grazers play a very minor role. Even on ir-

rigated pastures the emphasis is on intensive mohair production with lucerne playing a very important role.

Under dryland conditions species which are most widely used are *Anthephora* and *Cenchrus* although species such as *Panicum, Digitaria* and *Eragrostis* also offer considerable promise. Each species has its own niche but at present only grasses are used. With the low and erratic rainfall and eutrophic soils so characteristic of these areas the rate of fertilization is generally very low - recommendations varying from 0-50 kg N/ha. The current emphasis on grass pastures might change in the future if the search for adapted forage legumes should prove successful and this would have a direct effect on fertilizer usage.

In the **sour bushveld** areas, characterized by a higher rainfall (500 mm p.a. +), the need for planted pastures and the range of alternatives is even greater. As the name (sour) implies veld in these areas is deficient in nutrients for at least part of the year. Apart from pastures being used to produce a fodder bank, or to relieve the grazing pressure on veld, they are needed to supply feed during the dormant winter months, when veld cannot meet the nutritional requirements of livestock. In areas such as the Springbok Flats, which have been largely ploughed, pastures can also fulfill an important role in stabilizing farms by means of diversification and shifting the emphasis from a high risk cropping system to a more stable mixed farming system.

The range of species utilized in the sour bushveld, especially where supplementary irrigation is available, includes not only perennial grass pastures such as *Cenchrus, Digitaria, Chloris, Cynodon* and *Pennisetum* but annual species such as babala, fodder sorghum, grazing vetch and ryegrass. Most notable is the potential of tropical legumes in the warmer areas. Legumes such as *Desmodium, Glycine,* Siratro and *Leucaena,* which have already revolutionized livestock production in many tropical countries, all offer considerable promise in our sub-tropical Lowveld and coastal belt.

Whereas the present emphasis is on grass pastures receiving 100-150 kg N/ha, together with P and K on deficient soils, under dryland conditions and 250-350 kg N/ha under irrigation, if and when the emphasis shifts to legume-based pastures the market for N is likely to decline. It is unlikely, however, that pure grass pastures will disappear entirely for the reason that climatic, edaphic and management limitations are often critical to the persistence of the legume, whereas grass pastures usually have a wider range of adaptation and are more tolerant of mismanagement. It is for this reason that advisory services almost always place the emphasis on grass pastures in the initial planning phase and only recommend legumes for the experienced grassland farmer.

Although Karoo and Savanna cover more than two thirds of the Republic it is in the remaining areas - Western Highveld, Eastern Highveld, Escarpment, Southern and South Western Cape - that a great potential for planted pastures and intensification of livestock production lies.

The **Western Highveld,** including the most intensively cropped areas of the OFS and Transvaal, has been identified as the main target area for the Conversion Scheme, ("Omskakelingskema") whereby it is hoped that in the short term 1 000 000 hectares of marginal arable land will be established to perennial pastures. This scheme had its origin in the artificially high grain prices which encouraged farmers to cultivate marginal soils in a marginal rainfall area. The objectives of planting pastures on such marginal soils are to protect the resources and at the same time create a more stable diversified production system with crops on the better soils - subject to lower risk - and livestock enterprizes to stabilize income.

Given the poor condition and limited areas of veld on the Western Highveld such pastures are needed to provide summer grazing and at the same time have good foggaging (or hay) qualities. Alternative pastures during the summer, especially the early summer period, are essential if viable livestock enterprizes are to be built up as a stable economic alternative to cropping. At the same time resting of veld during this period should have a dramatic effect on veld recuperation. During the late summer such planted pastures may be rested to provide foggage (or hay) for the winter period when the reduced availability of crop residues may become a limiting factor on some production units.

Digitaria is by far the most popular grass pasture on the Western Highveld - making up more than 50% of all new plantings. It has been particularly favoured because of its high palatability, and because of the reasonable quality of foggage. Other species include *Eragrostis, Cenchrus, Anthephora, Panicum, Chloris, Sorghum, Cynodon* and *Pennisetum.* The general emphasis with these grass pastures on the poorer soils in relatively low rainfall conditions has been on minimum costs. Although it is conceded that **HIGH** fertilization levels are not warranted under such marginal conditions the emphasis on **MINIMUM** costs is not justifiable. Granted that the grain farmers of this area have a heavy debt load and they must be cautious not to overcapitalize (with pasture establishment you literally buy the land twice over) in livestock enterprizes which render a relatively slow return. The emphasis on **OPTIMIZATION** of **LOW INPUT** pastures is therefore logical. What is a **LOW INPUT** pasture? The ideal pasture is cheap to establish, is high yielding and palatable, needs no fertilizer and even less management and gives good animal performance - **A WONDER CROP!!**

No single crop satisfies all these requirements. If a pasture crop should meet these specifications it will be so popular that the price of seed will mitigate against large scale implementation. Secondly, experience has demonstrated repeatedly that so-called **SAVINGS** during establishment with respect to seedbed preparation, seed quality, seeding rate and fertilization result in **INFERIOR** pastures. Whilst it is logical and commendable to select pasture species and cultivars which are palatable, and which ensure good intake, to expect high production without fertility is totally impractical. The production of any pasture being determined primarily by the availability of moisture and plant nutrients. It is also necessary to differentiate between grass and legume based pastures. Whereas grass pastures may be

established relatively cheaply, legumes - in this area lucerne has proved to be the best adapted - invariably have higher input at establishment. Conversely annual fertilization costs will be much lower on lucerne than on grass pastures. Advice to farmers establishing perennial pastures in this - and any other agro-ecological - area should, therefore, place emphasis on the correct choice of crop for their particular conditions and requirements and a good establishment followed by an optimal management programme. This includes fertilization, which in principle is determined by the inherent requirements of the crop, the nutrients supplied by the soil, the management of the crop and the limitations of the environment. Yield prediction models for pasture grasses have identified moisture (rainfall, soil depth, soil texture) as the most important environmental factor limiting production. The same factor determines potential fertilizer usage. Where the majority of pastures are established on poorer soils it must be recognized that production potential and hence fertilizer usage will be relatively lower. The other factor which might effect the level of fertilization of pastures is the relatively high level of fertility built up during the "golden years of maize production". Until such time as these levels become depleted it is difficult to motivate the maintenance of such levels, especially as the saving on costs during the interim period whilst the livestock enterprizes come into full production, can make or break a farmer who is overextended. The important point is that the fertility status of the soil established to pasture should be as intensively monitored as for any cash crop, to ascertain the rate of depletion and determine when additional fertilizer is required.

When discussing the **OPTIMIZATION** of fertilization, management must be very clear as to relative importance of different limiting factors. Dependent on the areas available, land prices, the price of fertilizer and the prices of different livestock products or the cost of alternative pasture or fodder, the optimum level is likely to differ considerably.

The **Eastern Highveld** of the Transvaal and OFS has long been recognized as a stable mixed farming area characterized by the intergration and interdependence of cropping and livestock enterprizes. Although the rainfall is higher than on the Western Highveld many soils have both chemical and physical limitations and even the so-called high potential cropping soils are characterized by high production costs, making the use of such soils for livestock production an attractive alternative. At the same time it is recognized that in these sourveld areas crop residues play an invaluable role in providing a cheap source of roughage in the winter feeding period. Planted pastures do, however, play an important role on marginal cropping soils and in rotation with cash crops to supply summer grazing, for those enterprizes requiring high quality grazing, and winter foggage or fodder. The tendency, at this stage, is to utilize pastures to balance fodder programmes and hence improve efficiency of production.

There is, however, a tremendous potential for intensification of livestock production in these areas. This applies to the replacement of veld, where 40-60% of the veld with a production potential of 40-50 kg red meat/ha could be replaced with planted pastures with the productive capacity of 400-500 kg red meat/ha, and to the incorporation of pastures into cropping systems. For example it has been calculated that, if only 25% of the area currently planted to maize were replaced by dryland lucerne, the number of woolled sheep in this area (currently one of the more important wool producing areas of the country) could be increased by over 200%. Apart from the increase in numbers the improvement in reproductive efficiency, animal performance and advantages of N-fixation and circulation should all be noted. Where there is the potential for legume based pasture this should be developed although the particular requirements of such crops in terms of soil acidity, P, K, Ca, Mg and trace element supply need to be measured up against the saving in N. It is particularly true of lucerne that although the annual cost of fertilization is relatively low, the cost of establishment on the leached acid soils of the Eastern Highveld, where the weed problem also increases expenses, is very high.

The other factor to consider when incorporating legumes into production systems is the level of management required to minimize problems with frothy bloat and to ensure persistence of the legume. In a mixed farming area many farmers still opt for the easier **GRASS** option and in these areas apart from the annuals such as teff, sorghum, babala, millets and cereals there is a range of adapted species including *Eragrostis, Pennisetum, Digitaria* and *Paspalum* which might be used under dryland conditions. With rainfall in excess of 600 mm the optimum level of N is often much higher than on the Western Highveld (200-300 kg N/ha), and P and K deficiencies are much more common. Where irrigation is available the range of species, the level of fertilization and the productive capacity is much higher. Unfortunately the availability of water may become a serious problem in the future despite this area being one of the major catchment areas in the RSA. The demands of the Lowveld vegetable and sub-tropical fruit producers and the thirsty urban, industrial giant of the PWV area will probably receive priority.

East of the Escarpment in the Eastern Transvaal, Natal, and Eastern Cape there is a similar situation. With a good rainfall the potential for pastures is good and in many areas is already being realized with species such as *Festuca, Dactylis, Trifolium, Acroceras* and *Cynodon* being added to the list of dryland crops. Under irrigation the temperate species play a notable role with a tendency for producers to concentrate on grasses initially and as they become more experienced to introduce legumes. With the exception of Northern Natal, where crop residues play a significant role in over-wintering strategies, most farmers are conditioned to produce fodder for the winter months when the natural veld cannot meet the requirements of livestock. As a result planted pastures have long been a feature of these areas, and the farming community accepts that success is dependent on a reasonable level of fertilization and management.

In the cooler areas the potential for pastures is not always realized because of the rapid expansion of forestry enterprizes. Forestry also extends down into the coastal areas but here competition for land is also with sugar cane and sub-tropical fruits. Where both of these latter alternatives are particularly susceptible to the vagaries of the export market there is a potential for tropical pastures, including both grasses and legumes,

which could transform these areas into an important livestock area.

The question most often asked in the high rainfall areas is: "What is the role of veld fertilization and veld reinforcement? With a wealth of information available from research over the past 50 years why don't more farmers use these methods of improving production?" The answer probably lies in the relative return on inputs into planted pastures and RVI (radical veld improvement). Whilst the potential for planted pastures is not fully realized farmers are unlikely to attempt RVI. Despite research inputs suitable species for RVI programmes are also still lacking, illustrated by the lack of persistence of introduced species.

Along the **Southern Cape Coast** in the **South-Western** natural veld (Forest and Fynbos) plays a minimal role in livestock production systems. The environmental conditions are, however, very comparable with parts of Australasia and adapted species and production systems play a dominant role in livestock production systems. Apart from some sub-tropical grass species under irrigation for the provision of summer grazing, the main dependence is on temperate and Mediterranean species. The latter, especially subterranean clovers, annual medics and lucerne, have revolutionized both livestock and crop production systems in this area. With the current uncertainty amongst wheat farmers of the South-Western Cape it is possible that the area under pastures may be expanded even more. These are likely to be largely legume based so the emphasis in fertilization programmes will be on P, K, Ca, Mg and trace elements rather than N.

Conclusion

Although planted pastures, in one form or another, are becoming more important in the stabilization and intensification of livestock production the emphasis differs from area to area. Whilst Karoo and Savanna areas cover large areas, and alternative pastures have the potential to be established on millions of hectares, fertilizer usage in these areas is likely to be at a low level. Even on the Western Highveld the area suited for establishment to pastures is large but because of the relatively marginal soils and low rainfall the level of fertilization is likely to remain low. In the higher rainfall areas there is both the need and the potential for planted pasture. Initially the emphasis will be on grass based on N fertilizer but as more information on legume species, cultivars, management etc. becomes available there will be a shift to replace at least some of the grass pastures with legume based pastures. This trend has already become evident in the Southern and South-Western Cape, in irrigated pastures in areas where dryland lucerne has proved itself.

In the final analysis the livestock producer needs to become very market orientated. Whether it be wool or mohair for the export market or meat and dairy produce for the local market, the needs of the market must be recognized. The producer should in fact become more involved with the consumers. The more consumers with a better living standard the better the turnover of livestock products and when combined with technological advances, the bigger the profit.
In a like vein the fertilizer industry needs to examine its inputs into its market. We are currently in a situation where grain is oversupplied, where meat is in short supply and fibres such as wool and mohair are in high demand on international markets. To stabilize or increase livestock production large areas of planted pasture to supplement our natural veld are needed. The viability of this potential market for fertilizer is dependent on a rational approach to the planned incorporation of pastures. We've seen it in the past, and we'll see it in the future. If pastures are established and incorporated into livestock production systems without considerable technological and economic planning they are often uneconomic.