NITROGEN FERTILIZATION OF PASTURES AND VELD*

G F S HYAM and A H PENDERIS
Fertilizer Society of South Africa

Introduction

Nitrogen is the key to increased productivity from pastures and veld. Obviously other elements, chiefly phosphorus and potassium (and sometimes calcium and magnesium) play an important part in raising soil fertility. It follows that nitrogen is usually not the only product which is applied and furthermore the application of fertilizers to pasture land is an operation that should not be considered in isolation.

The production of herbage and its utilization by the animal are complex biological processes involving environmental interactions of climate, soil, fauna, vegetation and the grazing animal. These interactions are well described by Williams (1973) in his discussion of the pastoral industries of Australia.

In a paper outlining the huge potential which South Africa offers for increasing animal production Davies (1968) made a plea for a holistic approach to pasture problems. He stressed the importance of studying the influences of soil, plant and animal as controllable factors in the environment.

Blaxter (1968), when dealing with the subject of fertilizers and animal production, emphasized the importance of the planned integration of crop production with animal production.

The production of good quality herbage and its utilization by the grazing animal must be developed into a sound economic undertaking.

Forage flow

For successful animal production, feed of high nutritive value must be available throughout the year. The bulk of this feed can be supplied from grasslands provided the forage flow is carefully planned. In planning such a flow, consideration must be given to degrees of intensification. Booysen (1972) outlined certain steps which should be taken and these should subsequently be evaluated in terms of both the biological environment and the economic situation.

Theron & Mappledoram (1974) reported the results of an experiment which evaluated different degrees of radical veld improvement (RV1) at the Tabamhlope Research Station.

They found that the profitability of the enterprize was positively related to the degree of intensification. They also reported that the inclusion of white clover in the intensification programme resulted in a very significant improvement in the gradings of the carcasses of beef steers.

An accurate appreciation of the total forage availability in each particular situation is a *sine qua non*. Furthermore it is essential to obtain a clear picture of seasonal variations in production from both natural and sown grasslands. The peaks and the valleys in the production cycle should be pin-pointed.

Heard & Wiseman (1973) suggested the use of production curves to assist in the planning of a pasture programme. Jones & Bartholomew (1973) and Broom (1973) dealt with mathematical processes and linear programming techniques which could be followed in production planning.

Even a comparatively simple study of the fodder flow of a farm will highlight production peaks and troughs. It is likely that these will reach their maxima or minima during one or more of the following periods of the fodder year — winter, early spring, summer, late summer or autumn.

Winter feed requirements can be met by supplying silage or hay or both. Cool season pastures can also play a part in certain areas of the country. However, ways and means should be sought to reduce the period during which these somewhat costly feedstuffs have to be fed.

It is not within the scope of this paper to discuss the many genera and species of grasses which grow successfully during the warmer months of the year, but preliminary results of trials with *Eragrostis curvula, Cenchrus ciliaris* and fertilized, reinforced veld are presented.

If well fertilized, *E. curvula* will supply good quality grazing in early spring. It produces well in summer and can be the source of hay of high feeding value.

C. ciliaris is a grass which is eminently suited to drier areas of South Africa and has considerable potential. When properly fertilized it is readily taken by stock and can be made into a good quality hay. A *Cenchrus* pasture can supply the fodder requirements for animals for 365 days of the year. *Cenchrus* can be integrated into a Bushveld grazing system which will result in a considerably increased carrying capacity for the farm.

In the higher rainfall areas of the Republic success has been achieved by fertilization of veld in association with the introduction of an improver grass. This procedure has particular value in areas where the terrain is classified as non-arable. Some aspects of the field application of this technique were described by Hyam (1974).

Troughs in fodder flow are frequent in autumn and early winter. Considerable success has been reported in Great Britain in the extension of the grazing season. This has been achieved by the well-timed application of nitrogenous fertilizers to grassland (ICI Limited). The use of foggage could play an important rôle under South African conditions. Grasses used for this purpose must be well fertilized, particularly with nitrogen. The value of Kikuyu (*Pennisetum clandestinum*) as a foggage in the Eastern Transvaal Highveld is described by Rethman and Gouws (1973) who conclude that the grass possesses a definite potential for that purpose.

Field trials — some preliminary results

With the overall objective of increasing red meat production from grasslands, pasture and animal scientists from the Department of Agricultural Technical Services and from the private sector are conducting long-term field trials with fertilized reinforced veld and with fertilized pastures.

Preliminary results which have been obtained from some of the trials undertaken by the private sector are reported.

Eragrostis curvula

In the Ermelo district an area of 42 hectares of land which was not entirely suitable for maize production was sown to a mixture of teff and *Eragrostis curvula* in mid-October 1972.

At establishment, fertilizers were applied at the rate of 28 kg N, 29 kg P and 9 kg K per hectare.

The project area was divided into five camps and water points were laid on.

After the first mowing of teff, an application of 90 kg N was given. The grass was later cut a second time, and the total yield of teff hay was 4,1 tonnes per hectare.

At commencement of the 1973/74 season, 75 kg N, 15 kg P and 15 kg K were applied. In mid-summer 92 kg N were given and in March a further 39 kg of N were applied. This made the total N for the 1973/74 season 206 kg.

Animals were introduced into the *Eragrostis curvula* pasture on 19 November 1973. These comprised two herds which consisted of 74 Herefords (45 cows and 27 calves) and 26 South Devons (20 cows and 6 calves).

Grazing was rotated between the camps, depending on the herbage on offer. By May 1974, the pasture had given 345 grazing days per hectare at a stocking rate of 1,86 MLU* per hectare. In addition a total of 182 tonnes of hay were made, which is equivalent to a yield of 4,3 t/ha.

*1 MLU =500 kg

*Omitted in error from Fertilizer Society of South Africa Journal 1 1975.

Between November 1973 and March 1974, a period of 124 days, the Hereford calves gained an average of 975 grammes per day. Calves had access to a creep in which a mixture of milled lucerne hay and maize meal was supplied. Over the whole period, the cows have consistently gained in mass.

Cenchrus cilliaris

The trial area comprises 30 hectares of established *C. ciliaris* in the Springbok Flats. At the commencement of the project in October 1973 the pasture was entering its 4th season and was growing under dryland conditions. The area was divided into 6 camps. Water was supplied in a loafing camp, where free choice minerals and a molasses/urea lick were available at all times.

In October 1973 an application of 16 kg P was given to all the camps. A total of 60 kg N was given in two equal dressings to five of the camps. The first application was in October and the second varied according to grazing management. This meant that the nitrogen was applied in the period December to February. One camp received a third application of nitrogen which made the total for that particular camp 90 kg.

Grazing commenced on 16 November 1973 with a herd of 30 Afrikander x Hereford cows and their 30 calves (average age 40 days). For a period of 185 days, that is from 16 November to 20 May 1974, the camps were grazed in rotation. On 20 May the 18 heifer calves were removed. The 12 bull calves remained on the pasture but received a whole maize supplement in a creep feeder so that they would be ready to enter a feedlot as soon as possible.

The 30 cows and 12 calves were still grazing the pasture on 20 June 1974. This means that the pasture has supplied 292 grazing days per hectare at a stocking rate of 1,18 MLU/ha. A total of 80,7 tonnes of hay was made, that is, 2,7 t/ha.

The heifer calves have gained an average of 716 grammes per head per day over a period of 185 days. Over the same period, that is prior to receiving the grain supplement, the bull calves gained 770 grammes per day.

The cows have maintained their mass and have in fact gained 52 kg per head.

Fertilized reinforced veld

Two examples are given — one deals chiefly with performance obtained from veld which had been fertilized and oversown shortly afterwards. The second reports animal performance on veld which was oversown later in the season.

An area of 24 hectares of Highland sourveld in the Natal Midlands was divided into 6 camps which were fertilized with 70 kg N, 50 kg P and 55 kg K per hectare in March 1973. Four of the camps were oversown also in March 1973 as follows: Camp 1 with *Paspulum dilatatum,* Camp 3 with Cocksfoot (*Dactylis glomerata)* and *P. dilatatum,* Camp 4 with Cocksfoot, Camp 5 with *P. dilatatum* and Alta Fescue (*Festuca sp.*). Chewings Fescue was oversown on Camp 2 in February 1974.

At the commencement of the 1973/74 season, 70 kg N and 50 kg P were given. A second application of 70 kg N were given in February 1974.

From 5th November 1973 until 17 January 1974 (101 days), the trial area has carried a total of 153 MLU, ie 6,38 MLU/ha. This means that 298 grazing days/ha were obtained from November 1973 until January 1974.

The animals which grazed the area comprised 51 weaner oxen, 57 heifers and 92 cows. The trial area was withdrawn from grazing from 17 January 1974 until 25 April 1974 to be utilized later as foggage when an estimated 80 MLU were introduced for 46 days until 10 June 1974. This represents a further 153 grazing days/ha, making a total of 451 grazing days/ha from November 1973 until June 1974.

An area of 36 hectares of Highland sourveld in the Eastern OFS (Highland Sourveld to *Cymbopogan/Themeda* transition) were selected for a fertilization/reinforcement trial.

The 6 camp project was fertilized in February 1973 with 45 kg N. In September 1973 the application was 36 kg N and 24 kg P. A second nitrogen dressing (90 kg N) was given in February 1974. Two camps were oversown with *Eragrostis curvula* in February 1974.

In February 1973, 30 cows were put to graze the recently fertilized veld. This number was increased to 60 in March and 90 in April in order to fully utilize the grass. All animals were withdrawn in May 1973.

In November 1973, 40 cows and 37 calves were introduced to the project where they remained until May 1974.

During the 1973/74 season the area carried 49 MLU for 178 days. This means a stocking rate of 1,36 MLU/ha and equals 242 grazing days per hectare.

In total the trial area has carried 45 MLU for 246 days during $1\frac{1}{2}$ seasons at an average stocking rate of 1,26 MLU per ha.

The parcel of 37 calves gained a daily average of 860 grammes per head. The herd of 40 cows maintained their mass and in addition gained an average of more than 70 kg each between November 1973 and May 1974.

Conclusion

The application of fertilizers to grasslands has considerably increased herbage production. As the projects progress it has become more apparent that careful management of animals and pastures is a key to success. It is imperative that these skills keep pace with the increasing intensification of land use.

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