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# AN EVALUATION OF THE APPLICATION OF STOCK LICKS IN SOUTH AFRICA

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**(Sleutelwoorde:** *Veelekke, waardebepaling)*

The supplementation of grazing for ruminants with mineral and rumen stimulating licks has lately become a sophisticated practice in South Africa. The application of stock licks gathered momentum ever since Theiler, in the early twenties, began to advocate the feeding of bonemeal to combat the incidence of botulism in cattle. Theiler's slogan of "Bonemeal for beef" laid the foundation of a farming practice which in later years enabled South African livestock farmers to obtain maximum production from poor and inferior range land.

It was the introduction of urea during the post-war years, namely the formulation of urea-containing rumen stimulating licks, that brought about the final revolution in the utilization of poor quality grassland and roughages.

It is extremely difficult to determine exactly how much lick is actually consumed by livestock in South Africa. Formulations vary and the flow of raw materials cannot be easily checked. These raw materials mainly consist of salt, bonemeal, calciumphosphate, maize meal, molasses, molasses distillers dried solubles (MDDS) and trace minerals. Of these products the purchases of bonemeal and calciumphosphate may serve as an indicator of lick consumption. Despite sophisticated monitoring methods, the actual figure is only an indication and must be regarded as such.

The annual consumption of stock licks in South Africa and South West Africa is fairly constant and is mainly influenced by climatic conditions and the price of beef and mutton. An estimated pattern of average consumption is as follows:

| | |
|---|---|
| Phosphate licks (commercial) | 29 000 tons |
| Rumen stimulating licks (commercial) | 88 000 tons |
| On-farm mixed licks | 27 000 tons |
| Total | 144 000 tons |

At an average value of R140,00 per ton, total expenses involved amount to approximately R20 million per annum. Such a significant variable cost in one particular sector of livestock production necessitates a critical evaluation of the practice of supplementary feeding.

Factors to be considered in this respect are basically the nutritional requirements of cattle and sheep for sodium chloride (NaCl), phosphorus and nitrogen x energy necessary for optimal utilization of plant material available, either on the veld or in terms of crop residues. When dealing with the subject of lick supplementation the following are some of the basic principles which should be adhered to at all times:

1. The object of supply licks is to supplement certain nutrients which are deficient in grazing in order to create a better balance among nutrients which will ensure optimal utilization of available plant material.
2. The lick should be supplementary and should never substitute feed in any form.
3. The acceptance of the lick by animals should be such that voluntary intake can be controlled and take place at a consistent basis.

Any deviation from these guidelines will render the lick less effective and may result in poor financial returns.

## Salt

It is generally accepted that most grazings in South Africa are deficient in NaCl and that this compound exerts a major influence on the feeding and grazing behaviour of livestock. The most classic example is the way in which the movement of game in the Kalahari is regulated by availability of water and salt in the various regions.

Salt deficiencies in animals can be induced also by extremely hot climatic conditions. According to Blair-west, Bott, Boyd, Coghlan, Denton, Goding, Weller, Wintour and Wright (1965), a change from lush grazing to a dry area causes the doubling of the volume of fluid necessary for ruminal digestion. In dry, hot areas it is observed that cattle drivel many litres of saliva per day. Saliva is rich in sodium and continual loss of this element may have negative consequences in the long run.

A deficiency of salt causes animals to refrain from drinking water with the result that feed intake decreases accordingly. The supply of salt in adequate quantities rectifies the condition almost immediately. This aspect can be best illustrated by the following data of Louw and Steenkamp (1973).

A group of 12 merino wethers were fed *ad lib* in metabolic crates on *Antephora pubescens* hay for a period of 60 days. They were then divided into two groups of six animals each and subjected to a trial consisting of 20 days "adaption" and seven days "collection" periods. The treatments were as follows:

Group 1 – 60 mℓ water, dosed twice daily
Group 2 – 60 mℓ water + 7,5 g NaCl, dosed twice daily.

The chemical composition of the hay was as follows (on a dry basis):

| | Percent |
|---|---|
| Crude Protein | 3,5 |
| Phosphorus | 0,08 |
| Calcium | 0,07 |

The results are presented in Table 1.

**Table 1**

*The influence of NaCl supplementation on the utilization of Antephora pubescens hay by sheep (Louw & Steenkamp, 1973)*

| | Group 1 | Group 2 |
|---|---|---|
| Dry matter intake (g/day) | 264 | 437 |
| Dry matter digestibility (%) | 33,4 | 42,5 |
| Digestible dry matter intake (g/day) | 88 | 186 |
| Water intake (mℓ/day) | 977 | 1 930 |

From Table 1 it is evident that salt alone has a pronounced influence on feed utilization by ruminants. It is a relatively inexpensive commodity and should be made available to livestock at all times.

As regards the nutritional requirement of salt, it is fortunate that intake is controlled by satiety and there is very little danger of misapplication.

**Phosphorus**

Although the supplementation of grazing with phosphorus has been propagated and practised in South Africa since 1920, the nutritional requirements of cattle and sheep for this element are still uncertain. It is often argued that livestock are overfed on phosphates and that this practice puts an overdue financial burden on the farmer. Recently, this argument gained momentum with particular reference to sheep and is still causing much speculation.

It is therefore, essential to consider certain asepcts of phosphorus metabolism before embarking on an evaluation of the practical aspects. A fact seldom fully appreciated is that phosphorus is not only a major consituent of the skeleton, but is also plays a key role in various facets of metabolism. Apart from bone and phospholipid metabolism it has a particular role in the complex processes of nutrient oxidation.

The pyrophosphate bond of adenosine triphosphate (ATP) is formed from food energy and adenosine diphosphate (ADP), a process which controls the energy metabolism of all living creatures.

$$\text{Food} + O_2 + \text{ADP} + \text{P} \rightarrow CO_2 + H_2O + \text{ATP}$$

In the case of glucose the equation is

$$C_6H_{12}O_6 + 6O_2 + 38\text{ADP} + 38\text{P} \rightarrow 6CO_2 + 6H_2O + 38\text{ATP}$$

It follows that 38 moles of ATP are formed from ADP and inorganic phosphate when one mole of glucose is oxidised to carbon dioxide and water. The energy represented by the pyrophosphate bond of ATP constitutes a large proportion of the energy of the glucose oxidised and is estimated to be 62 per cent (Blaxter, 1962).

The metabolic relationship between energy and phosphorus was clearly illustrated by Louw and Steenkamp (1972) who summarized the results of metabolic trials carried out with 432 merino wethers on diets ranging from low quality roughage, such as wheat, straw, to medium high-energy fattening rations.

The sheep were subjected to standard digestiblity trials in which the retention of nitrogen, phosphorus and calcium were determined. The relationship between the energy intake of the sheep and the quantity of phosphorus required to maintain phosphorus balance in the body is illustrated in Figs 1 and 2.

Each plotted value in Fig. 1 represents the metabolic data of a total of six sheep. The data in Fig. 2 represent the zero intercepts of the different regression lines calculated from the individual sheep data in Fig. 1 on a P intake *versus* energy intake axial system.

From Figs 1 and 2 it is evident that the phosphorus requirement of an animal is highly significantly influenced by its digestible energy intake. Should the daily digestible energy intake increase from maintenance to fattening level, the phosphorus requirement increases accordingly.

These data imply that phosphorus utilization will be inadequate should energy intakes not be on a proportional level or *vice versa.* It also confirms the finding of Myburgh and Du Toit (1970) that digestible energy and protein are not adequately utilized when phosphorus intake is inadequate. The absorption of phosphorus by sheep is determined not only by the level of phosphorus in the feed, but also by the amount of energy available.

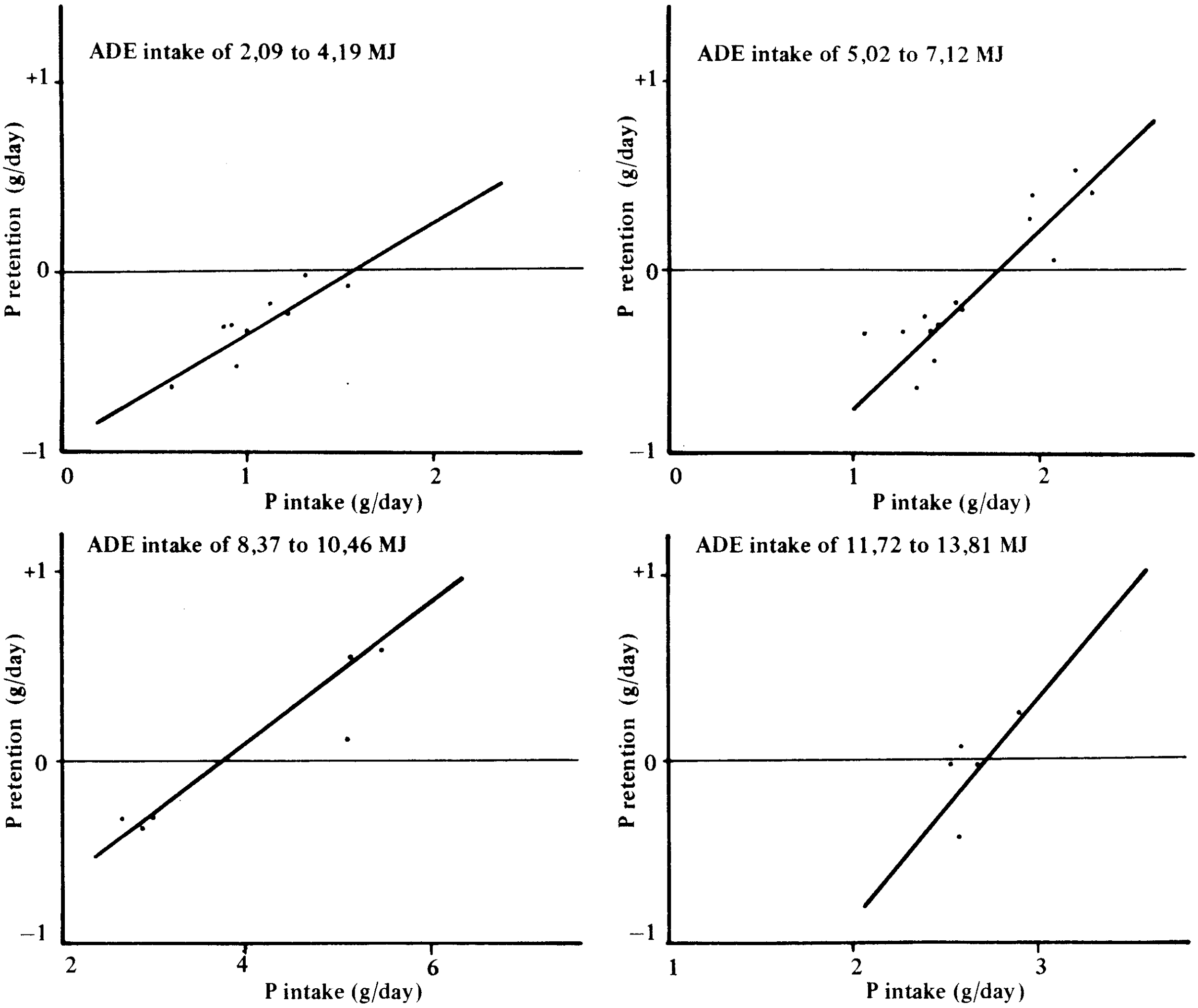


*Fig. 1* *Scatter diagrams of phosphorus intake* versus *phosphorus retention at some of the levels of apparent digestible energy intake (Louw & Steenkamp, 1972)*

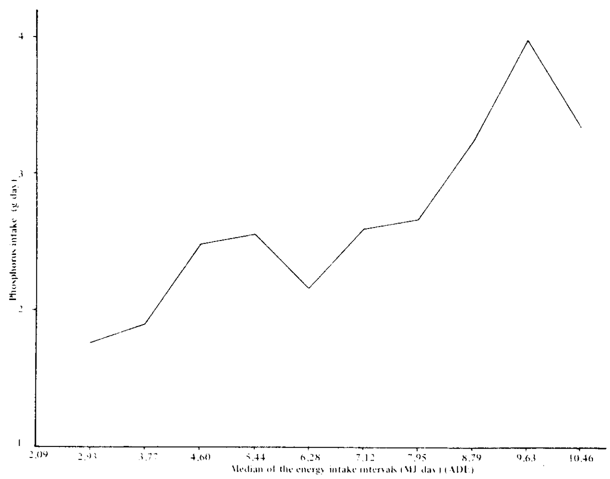

*Fig. 2* *The zero intercepts of the different regression lines on a phosphorus intake* versus *energy intake axial system (Louw & Steenkamp, 1972)*

Little (1970) found a significant linear response in the voluntary intake of phosphorus-deficient cattle when these animals were given incremented supplements of phosphorus to a diet adequate in all other respects. Furthermore, supplementation of phosphorus to these animals did not result in growth responses when increases in feed intake were not permitted. Theiler (1932) was therefore fully justified to conclude that the phosphorus level of a grazing could be evaluated correctly only if its energy value is duly considered.

The effectiveness of phosphorus supplementations does, however, not relate to factors like other inorganic elements and energy alone. The relationship between energy and protein in nutrition has been well documented. According to Balch, (1967) optimum utilization of energy is dependent on an adequate supply of other nutrients, but the required amount will depend upon the amount of energy available. If, for instance, the energy input is known, the protein requirement can be, to some extent, estimated. At a given protein intake different growth rates can be attained, depending on the energy intake. The opposite, to a certain extent, is also possibly true, because of the utilization of protein as an energy source.

It is understandable that, due to the close relationships of energy x phosphorus and energy x protein, protein may exert a significant influence on phosphorus metabolism. Myburgh and Du Toit (1970), fed sheep on and *ad lib* basis on veld grass and recorded a negative nitrogen balance. When the diet was supplemented with phosphate, however, the nitrogen utilization was depressed even further as reflected in an even greater negative nitrogen balance. The addition of adequate digestible protein and energy resulted in improved utilization of both nitrogen and phosphorus.

Over a period of 22 months Louw and Steenkamp (1971), fed various licks to weaner steers on grassveld in Northern Natal. The data obtained under these extensive conditions confirmed those of Myburgh and Du Toit (1970), namely, that the supplementation of phosphorus alone in licks to poor quality grassveld in winter may exert a deleterious effect on the condition of animals.

Three groups of 50 steers each were kept on grassveld for the period December 30, 1969 to October 4, 1971. The treatments were as follows:

Group 1 – Salt
Group 2 – Salt + monocalcium phosphate
Group 3 – Commercial rumen stimulating lick (Rumevite)

**Table 2**

*Live mass of steers fed different supplements (Louw & Steenkamp, 1971)*

| | Salt (S) | Phosphate + Salt (PS) | Rumen stimulating lick (R) | Significance |
|---|---|---|---|---|
| Period 1 | | | | |
| 1969 12 30 to 1970 04 29 (120 days) | | | | |
| Average initial live mass (kg) | 270,6 | 274,8 | 274,7 | |
| Average final live mass (kg) | 341,8 | 347,3 | 350,5 | NSD |
| Gain/loss (kg) | + 72,2 | + 72,5 | + 75,8 | |
| ADG/Loss (kg) | + 0,60 | + 0,60 | + 0,63 | |
| Period 2 | | | | |
| 1979 04 30 to 1970 09 14 (138 days) | | | | |
| Average initial live mass (kg) | 341,8 | 347,3 | 350,5 | ** |
| Average final live mass (kg) | 302,7 | 288,9 | 326,6 | |
| Gain/loss (kg) | –39,1 | –58,4 | –23,9 | PS>S & R |
| AGD/Loss (kg) | – 0,28 | – 0,42 | – 0,17 | S>R |
| Period 3 | | | | |
| 1970 09 15 to 1971 05 25 (253 days) | | | | |
| Average initial live mass (kg) | 302,7 | 288,9 | 326,6 | ** |
| Average final live mass (kg) | 450,1 | 468,3 | 489,6 | |
| Gain/loss (kg) | +147,4 | +179,4 | +163,0 | PS>R & S |
| ADG/Loss (kg) | + 0,58 | + 0,71 | + 0,64 | R>S |
| Period 4 | | | | |
| 1971 05 25 to 1971 10 04 (127 days) | | | | |
| Average initial live mass (kg) | 450,1 | 468,3 | 489,6 | ** |
| Average final live mass (kg) | 405,0 | 409,1 | 441,2 | |
| Gain/loss (kg) | –45,1 | –59,2 | –48,4 | PS>S |
| ADG/Loss (kg) | – 0,36 | – 0,47 | – 0,36 | S = R |

NSD – No significant differences
** = P<0,01

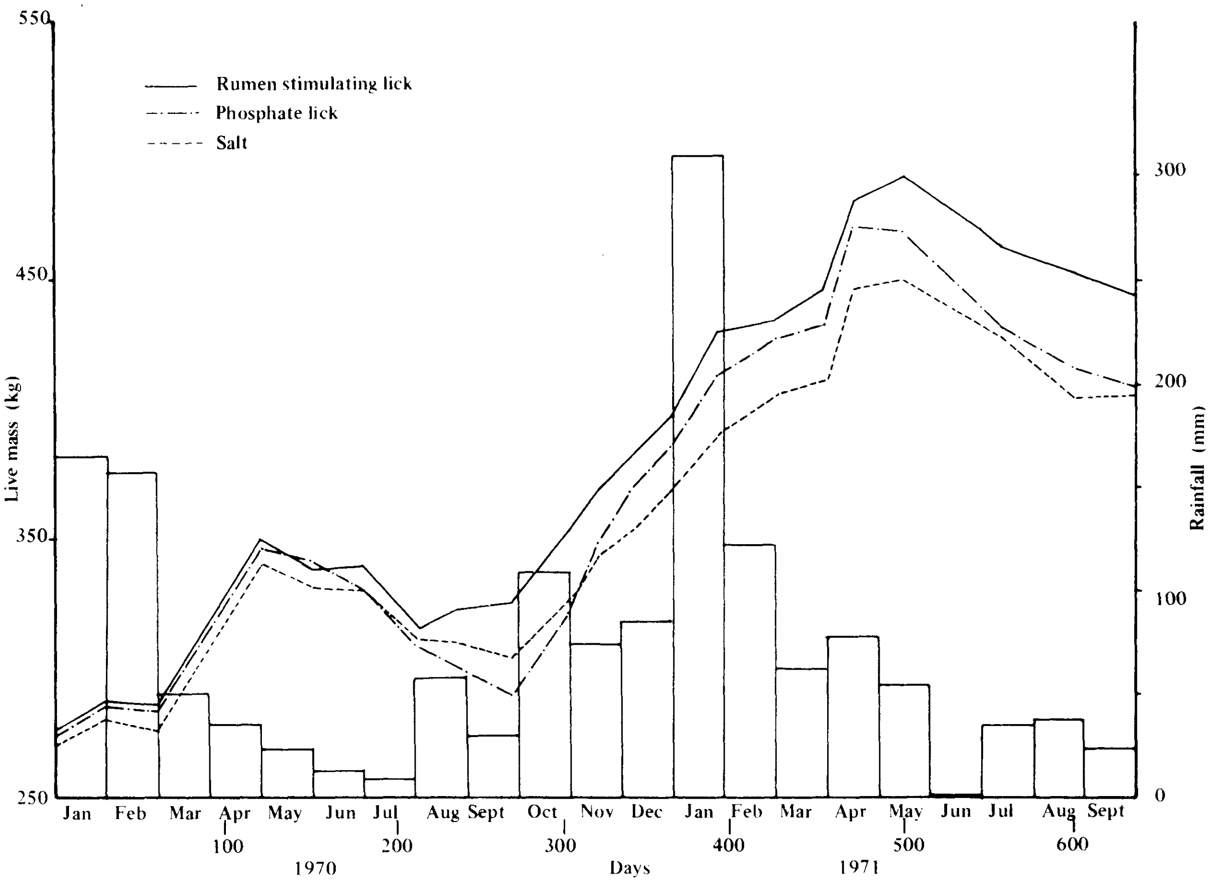


*Fig. 3 Live mass of steers and monthly rainfall (Louw & Steenkamp, 1971)*

The animals were weighed monthly and the data are presented in Fig. 3 and Table 2.

In view of the results obtained by Myburgh and Du Toit (1970) it may be accepted that the depressive effect of the phosphate lick in winter, as illustrated in Fig. 3 and Table 2 may be due to an induced imbalance between phosphorus, nitrogen and digestible energy intake on winter grass diets.

The interrelationship between nutrients constitutes a much wider matrix than pictured in this instance. The following statement by Munro and Allison (1964) concerning protein deficiencies may be relevant:

> "A less obvious effect of protein depletion of individual organs is the loss of other important nutrients. Co-enzymes and minerals may be lost in significant amounts. Thus, the capacity to retain dietary riboflavin diminishes in the protein-depleted animal, and there is a similar loss of body nicotinic acid, presumably because enzyme systems in which these function are among the more labile tissue proteins. It is thus not surprising that the dietary requirements for protein repletion are more than those for essential amino acids. For example, Cannon *et al.* (1952) and Frost and Sandy (1953) have demonstrated that potassium and phosphorus, respectively, can become limiting factors in the diet during repletion of protein-depleted rats."

This explains why the feeding of phosphate and rumen stimulating licks in summer result in increased animal performance as reported by Bisschop (1964) and Louw (1978).

The results discussed above indicated that the supplementation of phosphorus to low quality roughage diets such as winter grass has a depressive effect on animal well-being and productivity. However, when fed in conjuction with nitrogen and energy as a rumen stimulating lick, the results are competely opposite and beneficial.

This situation refers to dry and non-reproductive animals only. In the case of reproductive animals, however, the situation may be more serious. Ideally, breeding cows are dried off in late autumn and should be pregnant every winter. If they calve down in the period July to October, it means that much of the foetal growth must take place during the worst part of the grazing season.

This sequence of events in the metabolic cycle of the female may have the following consequences:

1. The skeletal phosphorus reserves may be partly depleted as a result of the lactation period;
2. the phosphorus requirement of the foetus may deplete the labile phosphorus reserves even further.

The effect of phosphorus nutrition, and its interaction with other nutrients on fertility and reproduction has been well considered in the past. However, it is doubtful if the adverse effects on the reproductive performance of female beef cattle are caused either by a phosphorus deficiency alone, or by wide ratios of Ca:P in the diet (Bisschop, 1964). This is because it is difficult to distinguish between anoestrus which may result from a low phosphorus intake which, in turn, may be associated with low intakes of energy, protein and other minerals (Hemingway & Fishwick, 1976; Teleni, Siebert, Murray & Nancarrow, 1977).

Theiler (1932) and Du Toit, Louw and Malan (1940) maintained that anoestrus was due to a combination of severe aphosphorosis and a low plane of nutrition, especially with respect to protein. Teleni *et al.* (1977) concluded that under conditions of poor protein nutrition, phosphorus supplements have no effect on ovarian activity. The mature animal, however, is more resistant to dietary restriction than immature ones and oestrous activity frequently continues until a major reduction in body mass has occurred (Lamming, 1971). Oestrus will resume once deficient reserves have been repleted.

O'Donovan and Groenewald (1979) are presently conducting a long-term trial with Afrikaner-crossbred cows on grassveld in Northern Natal. Four groups of 40 cows each have been receiving the following supplements since January 1976:

Group 1 – Salt
Group 2 – Commercial phosphate lick, 6 g P/head/day
Group 3 – Commercial phosphate lick, 12 g P/head/day
Group 4 – Commercial rumen stimulating lick.

The different groups rotate among camps on a two-weekly basis and calving takes place during October to December.

The average calving percentages are given in Table 3.

The 1976 figures are not indicative of the treatments, since mating started one month after commencement of the trial. What is of much more interest is that those cows which do not conceive in a particular season, get into an excellent condition and will almost certainly conceive the next year. In the case of the Salt Group, this is particularly the case, which explains the variable pattern in annual performance. Those animals raising

**Table 3**

*Average calving percentages of cows receiving various levels of phosphorus in lick form (O'Donovan & Groenewald, 1978)*

| | Treatment | | | |
|---|---|---|---|---|
| Period | 1 | 2 | 3 | 4 |
| | Salt | 6 g P | 12 g P | Rumen stimulating |
| 1976 | 88 | 90 | 93 | 83 |
| 1977 | 46 | 68 | 63 | 84 |
| 1978 | 73 | 52 | 77 | 94 |

calves appear scruffy and emaciated, while the dry ones are fat and shiny.

This trial will cover the complete reproductive lifespan of the cows and it is still too early for conclusions on the reproductive patterns. However, as a possible indication of the overriding effect of the nutrients involved in livestock fertility, it is interesting that Groups 3 and 4, in that order, apparently out perform Group 1.

Apparently the animals in Group 1 (Salt) recover effectively when a calf is produced once every second year. Only time can prove whether this ability will be maintained over an extended period. Nevertheless, this observation leads to a very interesting aspect of phosphorus supplementation to sheep.

The data in Table 3 obviously show that a reproducing female should either receive sufficient phosphorus in her diet to maintain reproductive functions at a reasonable level, or should be given time to replete deficient reserves from natural resources. In the case of cattle the reproduction cycle is such that cows are either pregnant, lactating or pregnant + lactating every single day of the year. By comparison ewes producing only one lamb per year are pregnant and lactate separately and then still have about three months left to restore condition before the next reconception. This point is best illustrated in Fig. 4.

According to Underwood (1964) phosphorus deficiency is more common and usually more severe in grazing cattle than in grazing sheep. This is due to the fact that sheep are smaller and consequently have a higher food consumption per unit body mass. Because of the smaller proportion of bone to body mass sheep satisfy their physiological need for phosphorus with diets containing slightly lower concentrations of the mineral than cattle. Furthermore, sheep are more selective in their grazing than cattle and can choose the more nutritious ingredients from mixed herbage (Engels, Ferreira, Swart & Niemann, 1978).

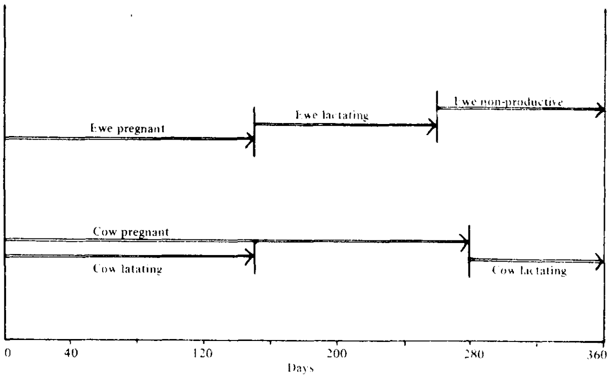


*Fig. 4 A typical reproduction cycle of cows and ewes reproducing once every year*

Evidently the phosphorus requirement of sheep is lower than that of cattle because of:

(i) Selective grazing behaviour;
(ii) Shorter gestation and lactation periods;
(iii) Relatively long intervals between weaning and reconception.

Accordingly it could be inferred that sheep ingest more phosphorus from the grazing, excrete less of this element per unit of time in terms of offspring and milk and still have sufficient time to restore skeletal reserves.

It is evident from the above discussion that there are so many imponderables concerning the nutritional requirement of cattle and sheep for phosphorus that it is impossible to even try and solve the problem in this paper. Until more information becomes available about South African conditions it will suffice to employ the standards laid down by the NRC (1964) and ARC (1965).

**Rumen stimulating licks**

The principle of rumen stimulating licks is based on the fact that, apart from the necessary phosphorus being supplied to the animal, nitrogen and energy are supplied in such quantities that rumen fermentation is stimulated and accelerated. According to Louw (1978) the results obtained with these licks vary with the quality of roughage to which it is supplemented. The results in Table 4 substantiate this statement.

The results in Table 4 show that the supplementation of roughages with urea-containing rumen stimulating licks results in increased nitrogen retention by animals as the quality of the roughage increases. Louw (1978) concludes that this phenomenon can be, and is in fact being, exploited fruitfully in practice. The supplementation of summer grazing with rumen stimulating licks facilitates the fattening of animals on the veld. At present this is being done on a large scale by farmers in our country.

**Table 4**

*The influence of rumen stimulating lick supplementation on utilization of various roughages by sheep (Louw, Steenkamp & Van der Merwe, 1970)*

| | | Group | |
|---|---|---|---|
| | | Control* | Experi-mental** |
| **Wheat straw** | | | |
| Crude protein: | 4,2% | | |
| Daily intake (g) | | 340 | 772 |
| Digestibility (%) | | 38 | 45 |
| Nitrogen retention (g/day) | | -2,51 | -0,53 |
| **Barley straw** | | | |
| Crude protein: | 3,3% | | |
| Daily intake (g) | | 411 | 657 |
| Digestibility (%) | | 38 | 50 |
| Nitrogen retention (g/day) | | -2,41 | +0,25 |
| **Teff hay** | | | |
| Crude protein: | 6,0% | | |
| Daily intake (g) | | 730 | 1 276 |
| Digestibility (%) | | 54 | 53 |
| Nitrogen retention (g/day) | | +0,97 | +2,92 |
| **Oat hay** | | | |
| Crude protein: | 6,9% | | |
| Daily intake (g) | | 1 528 | 1 827 |
| Digestibility (%) | | 47 | 56 |
| Nitrogen retention (g/day) | | +0,40 | +7,03 |

* Control group was supplemented with phosphate + salt
**Rumen stimulating lick was the commercial product "Rumevite"

The nature of rumen stimulating licks is very often misunderstood and divergent interpretations of advisors cause confusion among farmers. The value of these products is sometimes calculated in terms of price per kilogram of protein content (Steenkamp, 1978). This approach is misleading as proved by a series of digestibility trials conducted by Louw and Steenkamp (1970).

A total of 48 adult Merino wethers were accustomed to metabolic crates and a series of digestibility trials were carried out on the following roughages:

| | |
|---|---|
| Oat hay | 6,9% crude protein |
| Teff hay | 6,0% crude protein |
| Wheat straw | 4,2% crude protein |
| Wheat straw | 2,1% crude protein |
| Barley straw | 3,3% crude protein |

The following products were added to these roughages in order to supply eight different experimental diets:

1. Control diet, roughage + 2,50% mineral/ vitamin mixture.
2. Experimental diets No. 1 to 7, roughages +,

| | |
|---|---|
| Molasses Distillers Dried Solubles (MDDS) | 5 % |
| Urea | 0,75% |
| Mineral/vitamin mixture | 2,50% |
| Maize meal | 0, 1, 2, 3, 4, 5, 6% |

These roughages were milled by a hammermill fitted with a 1,25 cm screen and the mixtures were cubed. The adaptation and collection periods lasted for 21 and seven days respectively. A summary of the data is presented in Fig. 5.

From Fig.5 the following deductions can be made:

1. The addition of MDDS + urea increased utilization of the roughages.
2. The addition of maize meal improved utilization even further. However, utilization reached a peak, dependent on the quality of the roughage. The better the quality, the sooner a peak is reached, and *vice versa.*

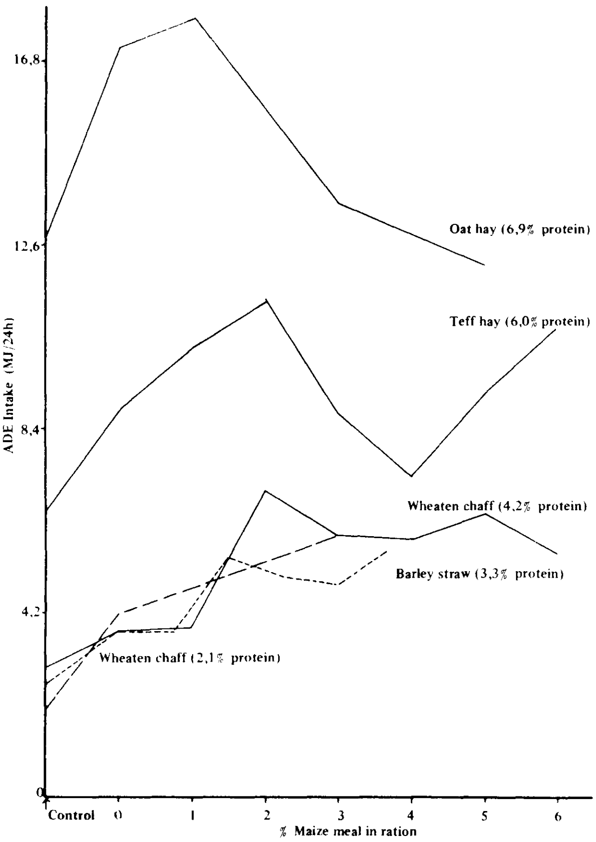


*Fig. 5 Total ADE intake vs % maize meal in the ration (Louw & Steenkamp, 1972)*

These data prove that optimal rumen stimulation is not a function of protein or nitrogen supplementation only. The best results are obtained by applying that particular combination of nitrogen + energy, and minerals, which will ensure optimal utilization of a particular roughage. The evaluation of a rumen stimulating lick in terms of cost of protein per kilogram contents is therefore invalid. Products like cotton seed oil cake may, and in fact do, yield good results. The general mistake, however, is to ascribe the results to the protein content only and then to evaluate the supplementary value of all other rumen stimulating products in terms of this nutrient. It must always be remembered that oil cakes contain approximately 25 per cent nitrogen free extract which plays an important role in rumen fermentation. Apart from this, large quantities of hydrocarbons are also produced by the deamination and dissolution of proteins in the rumen.

The situation with rumen stimulating licks is different from that discussed previously regarding the phosphorus supplementation of cows and ewes. Live mass of the female is a factor determining sexual activity and reproductive performance. It suffices to refer to the work of Marais (1970) with Angora goats and Harwin, Lamb and Bisschop (1967) with heifers to support this aspect. Not only are lambing and calving percentages affected significantly, but the time-interval from parturition to reconception is also altered.

Research in this connection has lagged behind, particularly in the Merino industry. Wherever licks were tested, it was mostly in the form of phosphate and salt only.

Roberts (1978) conducted a series of demonstration trials with a farmer in the district of Dewetsdorp over a period of 12 months. Three flocks of similar Merino ewes were supplemented as follows:

| | | |
|---|---|---|
| Group 1 | Winter | rumen stimulating lick |
| | Summer | no supplement |
| Group 2 | Winter | rumen stimulating lick |
| | Summer | phosphate lick |
| Group 3 | Winter | rumen stimulating lick |
| | Summer | rumen stimulating lick |

Mating took place during December to January.

The lambing percentages and fleece masses are given in Table 5.

Due to practical farming conditions, the animals could not be weighed at mating. However, the data presented in Table 5 are sufficiently indicative to warrant more extensive trials under more controlled conditions. The relatively low lambing percentage in all flocks may be ascribed to the seasonal effect on general sexual activity of sheep.

**Table 5**

*Lambing percentage and fleece mass of Merino ewes which received various supplements in the Dewetsdorp district (Roberts, 1978)*

| Group | Lick cost (R) | Lambing percentage | Wool production data | |
|---|---|---|---|---|
| | | | Fleece mass (kg) | Value (R) |
| 1 | 3,00 | 33 | 4,95 | 7,82 |
| 2 | 3,91 | 41 | 6,45 | 10,19 |
| 3 | 3,97 | 62 | 6,50 | 10,26 |

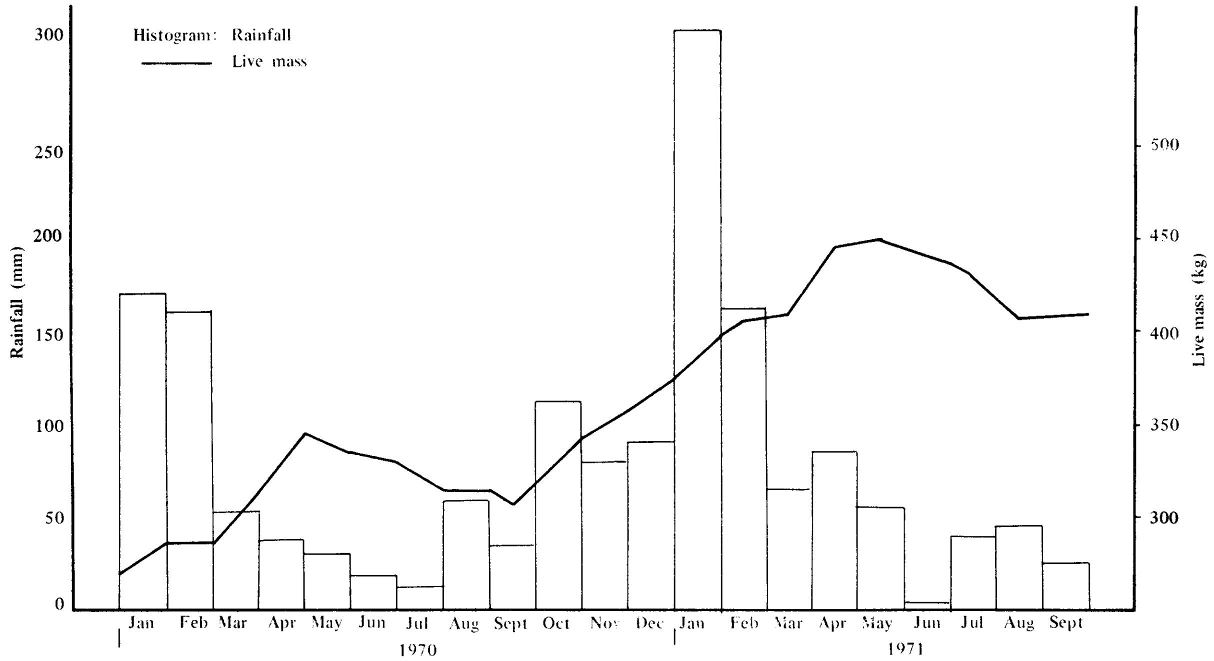


*Fig. 6 Monthly rainfall and live mass of cattle at Waterkloof, Ladysmith, Natal (Louw & Steenkamp, 1971)*

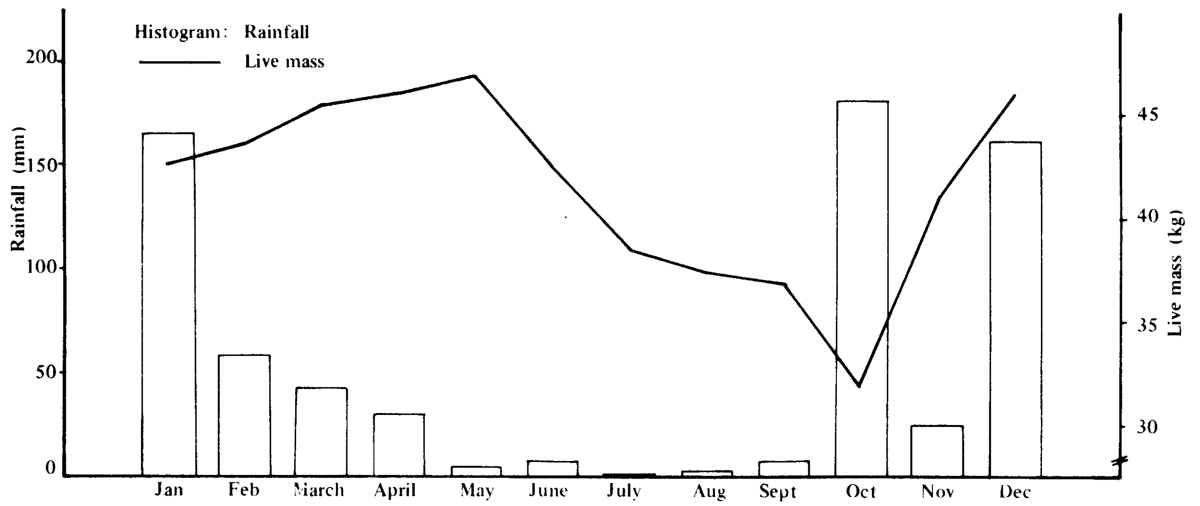


*Fig. 7 Monthly rainfall and live mass of Merino wethers in the Bankenveld near Pretoria (De Jager, 1966)*

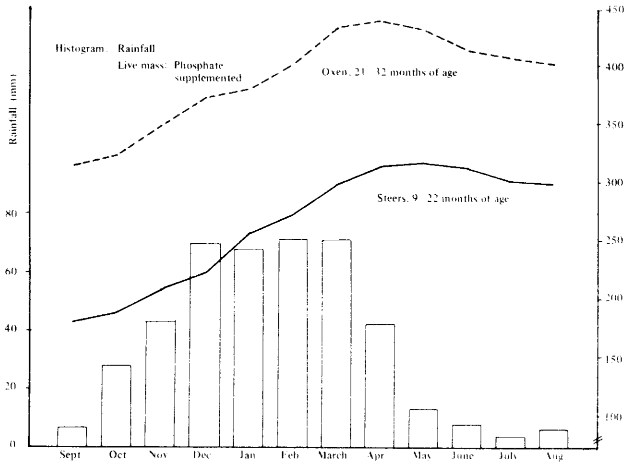


*Fig. 8 Average monthly rainfall and live mass of cattle on Armoedsvlakte, Vryburg (Bisschop, 1964)*

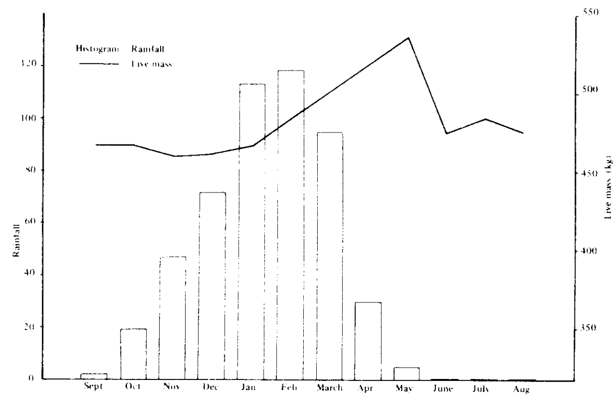


*Fig. 9 Monthly rainfall and live mass of cattle on the Palm Flats, S.W.A. (Freyer, 1967)*

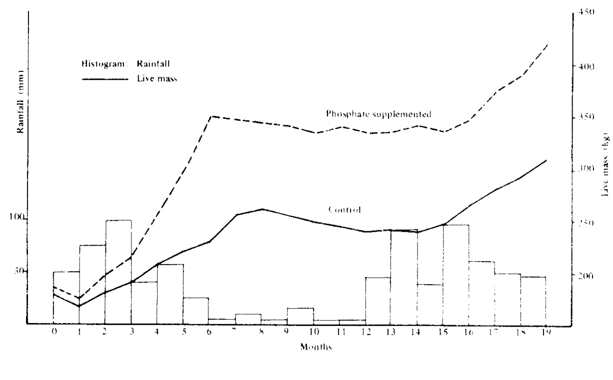


*Fig. 10 Monthly rainfall and live mass of cattle in Kwaneng, Botswana (A.P.R.U., Gaberones, 1971)*

**Nutritive value of grazings as related to strategic supplementary feeding**

Louw (1969) summarized most data available on the nutritive value of natural grazing in South Africa. Apart from sporadic deficiencies in trace elements the major problem is a general deficiency in phosphorus and the relatively very low digestibility of grassveld in winter. Much controversy exists concerning the methods employed to determine the nutritive value of natural grazings. The most reliable method is, however, to place animals on the veld and determine their live mass patterns. Data obtained in this way reflect the nutritive value x carrying capacity of the grazing. This is the ultimate information required.

A summary of live mass patterns available from South African literature is given in Figs 6, 7, 8, 9 and 10. These data are plotted in conjuction with rainfall figures to demonstrate the influence of the latter on livestock production.

Figs 6 to 10 show clearly that the growth patterns of cattle and sheep on grassveld, relative to rainfall, are constant right across southern Africa. The animals start growing actively after the first rains in spring and continue to do so until three to four months after the months of maximum rainfall. When the winter sets in they begin to lose live mass.

These data are of considerable interest when cognizance is taken of the fact that most grass species seed approximately at the time of maximum rainfall. At that stage the crude protein content of the tufts decreases sharply to approximately 5 per cent on the dry basis. It is possible that for the last three months of positive animal growth the overriding factor is the selective grazing of the regrowth, as well as the abundance of bulk material and the fact that cattle eat much seed in some areas.

The feeding of licks may be expensive and uneconomic if it is not programmed according to type of animal involved, as well as the condition of the grazing. At low digestibility of roughages, like winter grass, the live mass of animals can at best be maintained only if effective rumen stimulating licks are fed. Louw, Steenkamp and Van der Merwe (1972) published data which showed that the live mass of Merino wethers can be maintained at any practical level between 36 and 50 kg on a diet consisting of wheat straw + rumen stimulating lick, provided that the digestibility of the final diet is 45 per cent and that voluntary feed intake is not restricted in any way.

By making use of the principle illustrated in Table 4 and the data supplied in Figs 6 to 10, it is now possible to devise a system which will ensure maximum utilization of natural grazing.

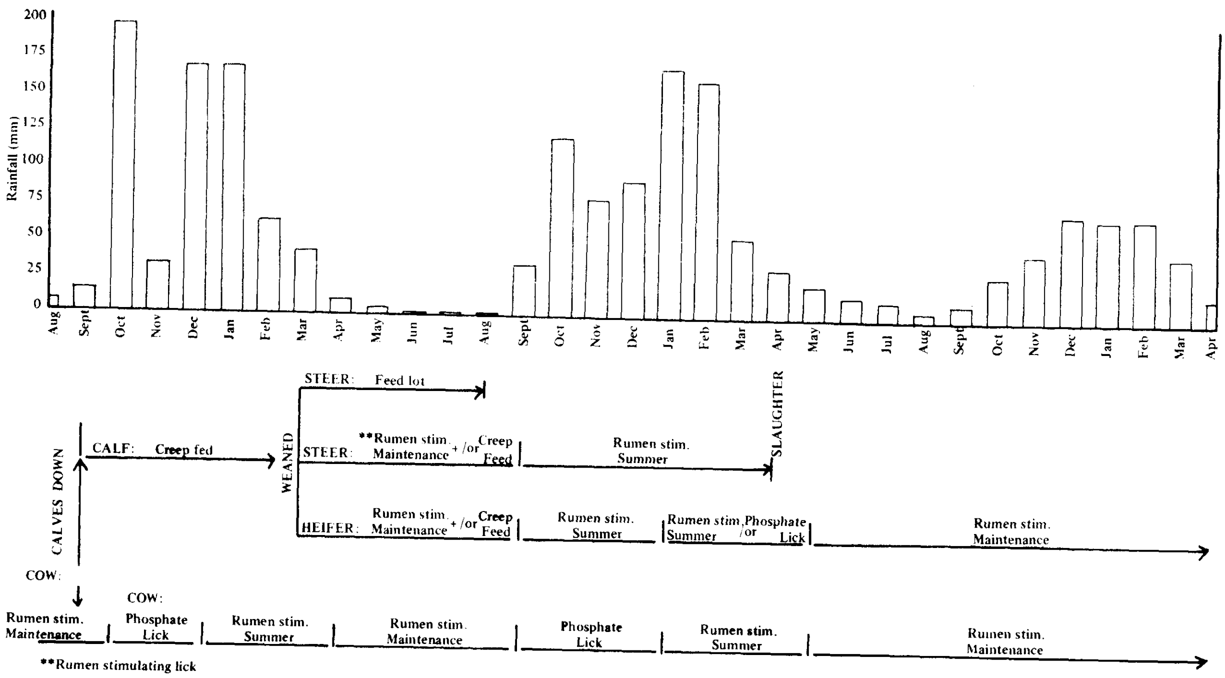

*Fig. 11 A schematic adaptation of a supplementary feeding system for cattle to seasons and rainfall.*

Phosphorus should be supplied as a phosphate-salt lick from first rains until the month of maximum rainfall. On green grass the nutritional level of animals is positive and phosphorus utilization at its best. Should extra growth be required a switch to a rumen stimulating lick at this point in time should have the required effect. The animals will reach a relatively optimum live mass before winter sets in. This level will be maintained during winter if sufficient plant material is available and a rumen stimulating lick is applied correctly. The advantages of a larger live mass in females has already been referred to.

The programme outlined in Fig. 11 may serve as a guide for supplementary feeding under extensive conditions. Economically it is imperative that the nature and application of licks should be determined by the biological relationships of animal x grazing. In the long run any deviation from the basic principles will render the practice uneconomical.

## Conclusions

1. It is essential to supplement NaCl in lick form to all natural grazing where livstock develop a hunger for salt.

2. The phosphorus requirement of livestock is largely determined by the dietary energy intake, as well as the level of production.

3. The need for phosphorus supplementation of a reproductive female depends on the frequency and duration of pregnancy and lactation. In the case of cattle, which reproduce annually, the supplementation of phosphorus, in conjunction with salt or a rumen stimulating lick, is essential. However, uncertainty still exists as far as sheep are concerned. Ewes lambing once a year have approximately three months' rest between weaning and reconception. This apparently contributes much to restore body phosphorus reserves, or part of them.

4. The supplementation of phosphorus to low quality roughage diets, like winter grass and crop residues, appears to have a depressive effect on animal productivity. Nevertheless, when phosphorus is supplemented in conjunction with nitrogen and energy in the form of rumen stimulating licks even on green grazing, the reaction is positive and beneficial. It is therefore not advisable to feed phosphate-salt licks during the worst time of the year. Lick supplementation in winter should be preferably in the form of rumen stimulating compounds.

6. The supplementation of winter grassveld or crop residues with rumen stimulating licks results in greater live mass of females. This is essential for better fertility and reproduction.

7. Extra live mass gain may be obtained to a high economic degree if rumen stimulating licks are fed during summer after the month of maximum rainfall.

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