FEEDLOT GROWTH PERFORMANCE OF STEERS ON SALINOMYCIN, MONENSIN AND A DAILY ROTATION BETWEEN THE TWO

N H CASEY*, R H WESSELS* and H H MEISSNER*

ABSTRACT
The effects of salinomycin (20 mg kg⁻¹ feed), monensin (33 mg kg⁻¹ feed) and a daily rotation of these ionophores, on average daily gain (ADG), average daily feed intake (ADFI) and feed conversion efficiency (FCE) were investigated in 60 steers (273 kg) over an 84-day feedlot period. Individual feed intakes and weight gains were recorded. The data were fitted to linear regressions with individual animals as replicates, from which ADGs, ADFIs and FCEs were calculated. Means of parameters of the control, salinomycin, monensin and rotation treatments were respectively ADG (kg): 1.56, 1.74, 1.58 and 1.66; FCE (kg DM/kg): 5.83, 5.43, 5.53 and 5.38; ADFI (kg): 9.10, 9.43, 8.83 and 8.90; final weight (kg): 402, 419, 407 and 413. Salinomycin showed the greatest improvement in gain, whereas monensin did not affect gain and tended to decrease feed intake. The rotation programme did not result in added benefits above those that could be obtained with a single ionophore (salinomycin), although feed efficiency tended to increase.

Key words: Salinomycin, monensin, rotation, ionophores, feedlot.


INTRODUCTION
Salinomycin and monensin are polyether ionophores that have been shown to enhance the overall efficiency of ruminants in the feedlot. The primary effects are related to shifts in fermentative efficiency. Reported responses of steers to monensin and salinomycin compared with controls, are: rate of weight gain 2.5% and 6.4%; daily feed intake -5.2% and -1.8%; feed conversion efficiency 7.2% and 8.1%. Although the results were not from direct comparisons, they suggest that salinomycin and monensin improve feed efficiency of cattle to a similar extent, but that their effects on weight gain and feed intake may differ.

A recent development in ionophore technology has been the ionophore rotation programme for feedlot cattle. By alternating a diet containing monensin with one containing lasalocid, researchers have achieved benefits above those obtained with only lasalocid or monensin. Initial rotation programmes incorporated a weekly change of ionophores, but a daily rotation could improve efficiencies even further. A number of studies have found evidence of microbial adaptation to ionophore feeding taking place over time. However, a daily rotation would seem too frequent to inhibit possible microbial resistance, due to the lag phase and reaction time required for the microbial population to adapt, and because of the probability that both ionophores would be present in the rumen simultaneously.

This study was undertaken with a two-fold objective. The first was to compare the effects of salinomycin with monensin as dietary additives in the feedlot while the animals received an anabolic implant in an attempt to quantify possible differences observed in the literature. The comparison also had to be free of any other confounding dietary additives which have clouded previous comparisons or rotation programmes. The second objective was to investigate the possibility of increasing ionophore benefits by way of a daily rotation between salinomycin and monensin, as data for the rotation of these ionophores are lacking.

MATERIALS AND METHODS
Sixty intermediate-maturity Bonsmar steers of approximately 8 months of age were obtained from a commercial producer. The animals were treated with anthrax vaccine, leukotoxin, tafanoxanide (Ranide); Logos Agvet), combined botulism-blackquarter vaccine, vitamin A and deltamethrin (Decaspot); Coopers Animal Health (Pty) Ltd) dip, implanted with growth promoter containing trenbolone acetate and 17β-oestradiol (Revalor; Roussel Uclaf) and ear-tagged. The steers were then restrictively randomised according to initial body weight into 4 treatment groups and accommodated in 8 pens (two parallel blocks of 4 pens each).

The animals were fitted with neck bands carrying electromagnetic transponders which opened individual electronic feeding gates (American Calan Inc. Northwood, New Hampshire, USA). This made it possible to measure individual feed intakes accurately. Adaptation to the feeding stations took place over 21 d,
The 4 treatments, which all received the same basal ration, were:

- **Treatment 1**: control, with no ionophore
- **Treatment 2**: salinomycin (Salocin®; Hoechst Animal Health (Pty) Ltd) at 20 mg/kg feed
- **Treatment 3**: monensin (Logoban®; Logos Agvet); Treatment 4: a daily rotation between Treatment 2 (salinomycin) and Treatment 3 (monensin)

The basal ration consisted of dried brewer’s grain 21.3%, Molbag® (bagasse and molasses meal) 25%, hominy chop 20.5%, maize meal 16%, lucerne hay 3%, minerals and vitamins mix 6%, and dried brewer’s grain 29.75%. This ration provided 10.59 MJ ME/kg DM on an 88% DM basis and 13.84% crude protein, 11.5% crude fibre, 0.71% Ca, 0.29% P and 0.64% salt. Thereafter the experimental rations were fed for a further 84 d.

The data were fitted to linear regressions, using the GLM procedure of SAS (1985) with individual animals as replicates as follows: cumulative feed intake (cumFI) (y): days (x); weight (y): days (x); cumFI (y): weight (x).

The average daily feed intake (ADFI), average daily gain (ADG) and feed conversion efficiency (FCE) respectively, as well as final weight were recorded fortnightly at a set time of day, without overnight withdrawal of feed and water.

RESULTS

The regression equations used to calculate ADG, ADFI, FCE are shown in Table 1. The regression between the variables were excellent with the coefficients of determination ranging between 0.9943 and 0.9997. The initial weights of the treatment groups shown in Table 2 did not differ significantly, but the variation that did occur was corrected in the statistical comparison. The ADG of salinomycin-treated steers was significantly greater (P<0.05) (11.5%) than the control, and nonsignificantly (NS) greater (P=0.7) than the monensin (8.08%) and rotation (4.08%) treatments. The mean final weight of the salinomycin treatment, as calculated from the regression (Table 1), was 4.2% heavier than the control (P=0.06) and 2.9% heavier than the monensin treatment. The mean final weight of the rotation treatment was 2.7% more than the control steers (NS), and 1.5% more than the monensin treatment (NS). Differences in ADFI between treatments were nonsignificant (P>0.05), but the ranking was salinomycin > control > rotation > monensin. The difference between the salinomycin and monensin was 6%. The rotation treatment steers had an 8.7% better FCE than the control (P<0.05), followed by salinomycin which was 7.7% (P=0.06) better than the control and monensin 5.8% (NS).

DISCUSSION

Efficiency in a feedlot is determined by the animal’s growth rate and feed conversion. Growth rate affects the time the animal spends in the feedlot, which in turn affects the number of days during which time a starter ration containing no ionophore was fed. The composition of the starter ration was dried brewer’s grain, 29.75% inclusion, Molbag® (bagasse and molasses meal) 25%, hominy chop 20.25%, maize meal 16%, lucerne hay 3%, minerals and vitamins mix 6%. This ration provided 10.59 MJ ME/kg DM on an 88% DM basis and 13.84% crude protein, 11.5% crude fibre, 0.71% Ca, 0.29% P and 0.64% salt. Thereafter the experimental rations were fed for a further 84 d.

The 4 treatments, which all received the same basal ration, were:

- **Treatment 1**: control, with no ionophore
- **Treatment 2**: salinomycin (Salocin®; Hoechst Animal Health (Pty) Ltd) at 20 mg/kg feed, 13.84% crude protein, 10.37% crude fibre, 0.71% Ca, 0.29% P and 0.64% salt. Thereafter the experimental rations were fed for a further 84 d.

The rotation treatment steers had an 8.7% better FCE than the control steers (NS), and 1.5% more than the monensin treatment (NS). Differences in ADFI between treatments were nonsignificant (P>0.05), but the ranking was salinomycin > control > rotation > monensin. The difference between the salinomycin and monensin was 6%. The rotation treatment steers had an 8.7% better FCE than the control (P<0.05), followed by salinomycin which was 7.7% (P=0.06) better than the control and monensin 5.8% (NS).
animals processed per year. Growth rate is determined by the genotype, the growth phase (lean deposition versus fattening) and the extent to which growth rate is enhanced by growth promoters. The growth promoters are either of an anabolic nature or influence the efficiency of feed utilisation, as do the ionophores [11, 12]. In this trial, all the animals received an anabolic implant (trenbolone acetate + oestradiol-17β; Revalor®; Roussel Uclaf) which has been demonstrated to improve the growth rates steers of similar maturity type, over the weight range of 300 to 400 kg, on a ration providing 10,733 MJ ME/kg by 25%. In combination with a ration formulated to provide 12,1 MJ ME/kg, as in this trial and in animals of sound constitution, the contribution of an ionophore to improved growth rate may not be significant. In this trial, there was a significant difference between salinomycin treatment and the control. Although both the monensin and rotation groups grew better than the control, the differences were non-significant.

All 4 treatments had good FCRs which ranged between 5.85 and 5.38. This can be ascribed to the well formulated ration, the highly efficient growth phase (average of 272 to 410 kg live weight) and the anabolic growth promoter. The differences between treatments were non-significant, but the improved efficiencies of 8.8 to 5.8% would have an accumulative effect and can be a considerable saving in a feedlot over a year. The greater efficiency achieved with the rotation, treatment points to a possible synergistic effect of combining salinomycin and monensin. A theory to explain this is that a rotation does not allow sufficient time for microbial resistance build-up against any one of the ionophores to occur, assuming in the first place that some amount of resistance does build up after prolonged feeding of a particular ionophore. However, a daily rotation would seem too frequent to overcome possible microbial adaptation, because of the probability that both ionophores would be present in the rumen simultaneously. A more plausible explanation could be that monensin and salinomycin have slightly different microbial target areas and that by using them together, the scope for manipulation of the digestive processes is increased.

Differences between salinomycin and monensin should be exploited, because it could afford the feedlot manager some flexibility when deciding upon an ionophore schedule. It could be more advantageous, for example, to include salinomycin in feedlot starter rations where the emphasis is on stimulating intake of newly arrived, stressed animals as opposed to using monensin that was considered to be another reason for choosing salinomycin as it also has been shown to be at least 3 times as potent as monensin in preventing lactic acidosis [14].

Salinomycin showed the greatest improvement in feed intake and weight gain, whereas monensin did not affect gain and tended to decrease feed intake. The rotation programme did not result in added benefits above those that could be obtained with a single ionophore, salinomycin, although feed efficiency tended to increase. Individual ionophore characteristics should be considered in order to obtain optimal benefits from their use.

ACKNOWLEDGEMENTS

The authors wish to express their appreciation to Beefcor for providing the steers and basal ration.

REFERENCES

1. Bartley E, Herod E L, Bechtle R M, Sapienza D A, Brent B E, Davidovich / 1979 Effect of monensin or lasalocid, with or without niacin or amicloral, on rumen fermentation and feed efficiency. Journal of Animal Science 49:1066-1075
5. Eng K 1988 Theories emerge on mechanisms of ionophore rotation. Feedstuffs 60:18
12. Mclaren N R, Berger L 1985 Effect of
Book review/Boekresensie

ANIMAL HEALTH AND VETERINARY MEDICINE IN NAMIBIA

H P SCHNEIDER*


The publication of this review coincides with the centenary of veterinary science in Namibia: Dr Wilhelm Rickmann, a military veterinarian with the German "Schutztruppe", arrived in the country in 1894.

In a general introduction, the livestock farming systems in the various regions of Namibia are described. After an account of animal health in pre-colonial times, the most important animal diseases in Namibia are discussed, i.e. diseases of more than one species, followed by diseases of cattle, small stock, equines, pigs, poultry, game, dogs and cats. Ecto- and endoparasites of the various hosts are listed, and an account is given of toxic conditions reported in Namibia. The final chapter is devoted to an account of the development of state veterinary services and an outline of current regulatory mechanisms pertaining to veterinary practice in Namibia.

This review will make fascinating reading for those interested in the history of veterinary science and of Namibia. When quoting from this review, it would be prudent to check the references, as in some cases they are personal communications or departmental files and thus have to be treated with caution.

The review is marred by a large number of errors and would have benefitted from judicious editing. Apart from typographical and grammatical errors, germanistic syntax crops up repeatedly. Some confusing statements could also have been avoided:

In the account of Contagious Bovine Pleuroneumonia it is stated (page 128) that the local community of the Windhoek area had established a quarantine station at a place halfway between Eikhams (Windhoek) and Gross Barmen, probably in the vicinity of today's Dusternbruck, while on page 136 it is stated that the station was established by Chief Jonker Afrikaner near Otjihorongo.

Both Haemaphysalis leachi and Rhipicephalus sanguineus are stated to be "the main vector" of canine babesiosis (pages 212/213).

Babesia bovis is reported from Windhoek, Outjo, Okahandja, Grootfontein and Gobabis, and is even regarded as responsible for most outbreaks of redwater in the latter district (pages 119/120), and yet the vector, Boophilus microplus, has not been recorded in Namibia (page 212).

B L Penzhorn