THE EFFECT OF THREE GROWTH PROMOTERS ON FATTENING BEEF PERFORMANCE

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SUMMARY

- 81 Charolais bulls of 430 kg LW on average were divided into three groups (4 pens/group). After a pre-treatment phase (used as covariate) of 4 weeks with all the animals fed a standard ration, the three groups were fed as follows: Monensin Sodium (MS), Avoparcin (AV) and Virginiamycin (VM) all at 150 mg/head daily. Both during the "grower" (105 d) and the "finisher" phase (50 d) liveweights were recorded individually and feed intake by pen.

In the "grower" phase average daily weight gains (DWG, g) were 1273, 1312 and 1456 (VM *vs* MS: $P<0.01$; VM *vs* AV: $P<0.05$) and feed conversion ratios (FCR, kg DMI/kg DWG) 6.84, 6.98 and 6.27 for MS, AV and VM, respectively.

In the "finisher" phase DWG were 1055, 1226 and 1302 (VM *vs* MS: $P<0.01$; AV *vs* MS: $P<0.05$) and FCR 8.37, 7.86 and 6.78 (VM *vs* MS: $P<0.01$; VM *vs* AV: $P<0.05$) for MS, AV and VM, respectively.

Global DWG and FCR were respectively 1203, 1277, 1413 (VM *vs* MS: $P<0.001$; VM *vs* AV: $P<0.05$) and 7.26, 7.23, 6.38 (VM *vs* MS and AV: $P<0.05$) for the three groups. Dressing percentages at slaughter were similar in all groups.

INTRODUCTION

- Feed additives are extensively used in beef cattle feeding to stimulate growth and improve efficiency. Among feed additives, antibiotics inhibit the growth of some rumen bacterial strains and modify the proportion of VFA and the degradability of nutrients in the rumen. These effects improve feed conversion ratio (FCR) and daily weight gain (DWG) of cattle, by reducing losses of energy (methane) and nitrogen and enhancing, in general, the production of propionic acid which, energetically, is the most efficient VFA.

Monensin Sodium (MS), a monocarboxylic ionophore, acts by facilitating sodium entry into the bacterial cell of ruminal microorganisms, with disruption of the internal ionic environment of Gram$^+$ bacteria. The effects of MS on rumen fermentations and its efficacy as growth promoter in fattening bulls have been extensively studied (among others: Bergen et al., 1984; Bonsembiante and Andrighetto, 1984; Byers, 1980; Chalupa et al., 1980; Daenicke et al., 1982; Dyer et al., 1980; Goodrich et al., 1984; Johnson et al., 1979; Piva et al., 1986; Russell and Strobel, 1988; Schelling, 1984; Shell et al., 1983; Thornton et al., 1981). MS has been shown to induce a shift in the pattern of rumen fermentation in favour of propionate; consequently the proportion of acetic, butyric and lactic acids is decreased. The reduction of lactic acid is particularly strong with rations containing large amounts of carbohydrates and it is useful in the prevention of ruminal acidosis (Dennis et al., 1981; Nagaraja et al., 1981; Schelling, 1984). Also methane production can be reduced by a variable amount depending on characteristics of the ration (Pastore, 1987). The inclusion of MS in the diet of beef cattle generally decreases feed intake without affecting DWG. In some cases, it was also registered a slight increase in DWG: this results in a high improvement of FCR.

Avoparcin (AV) is a water soluble glycopeptide antibiotic; its primary action on the cell of Gram$^+$ bacteria is to inhibit cell wall mucopeptide biosynthesis. AV, similarly to MS, alters acetate/propionate ratio in the rumen in favour of propionate; on the contrary, AV does not seem to have any effect on lactic acid production (Chalupa et al., 1981; Flachowsky et al., 1990; Froetschel et al., 1983; Ingle et al., 1978; Johnson et al., 1979). The addition of AV to the diet improves DWG and FCR and does not seem to have any effect on feed intake (Dyer et al., 1980; Flachowsky et al., 1990; Johnson et al., 1979; Sherrod et al., 1979).

Virginiamycin (VM), an antibiotic comprised of a complex of two chemical components, inhibits protein synthesis in ribosomes. Similarly to MS and AV, VM is effective against Gram$^+$ bacteria and enhances propionic acid production in the rumen as do MS and AV (Piva et al., 1986); however, the effect appears to be variable depending on the concentration of VM in the diet (Nagaraja et al., 1987). The addition of VM strongly reduces lactic acid production, thus lowering acidosis occurrence in the rumen (Ballarini et al., 1986). The inclusion of VM in the diet generally leads to improved DWG and FCR (Crovetto et al., 1991; Hedde et al., 1980). VM does not seem to have any influence on feed intake.

The present trial was carried out to compare, in practical field conditions, the efficacy of MS, AV and VM on fattening beef performance.

MATERIALS AND METHODS

- 81 Charolais bulls of 400 kg liveweight (LW) on average, after their arrival to the farm were individually tagged, dewormed (Ivermectine), vaccinated for respiratory diseases (IBR, PI3 and RS) and fed an adaptation diet. After two weeks in the paddock ("compensatory growth" phase), every animal was individually weighed and assigned to one for 12 pens (6 or 7 heads each). Access to feed and water throughout the trial was free and ad libitum. The diets (total mixed rations) were fed once a day, in the morning.

After pen allocation, all the animals were fed ad libitum the same standard diet (table 1) for a 4 week-period (covariate phase). At the end of the covariate period every animal was weighed again in order to calculate the daily weight gain (DWG) of each bull and the feed conversion ratio (FCR, kg DMI/kg DWG) of each pen and use them as covariates in the statistical analysis. The pens were then randomly assigned to the following treatments: Monensin Sodium (MS), Avoparcin (AV) and Virginiamycin (VM) with four replications per treatment. All the performance promoters were fed at the level of 150 mg/head daily. MS was fed at half dose (75 mg/head daily) for the first 14 days, in order to adapt the animals.

Two types of diets were fed during the experimental trial: "grower" (105 days, 470-610 kg LW) and "finisher" (50 days, 610-670 kg) (table 1). Within each of the two phases, the diets of the three groups differed only for the kind of the performance promoter. The diet "grower" with Virginiamycin did not include $NaHCO_3$ as buffering agent against rumen acidosis. Feed consumption of each pen was recorded every day and the quantity of diet fed was adjusted to appetite accordingly.

Every bull was weighed, without fasting, in the afternoon, always at the same time and in the same order each time, at the beginning and the end of each period. An intermediate weighing was done at the middle of the "grower" phase.

Animal health was carefully checked during the trial. Differences between treatments were analyzed by means of covariance analysis, GLM procedure (SAS, 1989).

RESULTS and DISCUSSION

- During the trial 5 animals (1 MS, 2 AV, 2 VM) had to be excluded from the experiment for different reasons, mainly for traumatic leg injuries during weighings. Therefore the trial was effectively performed on 76 animals: 26, 25 and 25 for MS, AV and VM groups, respectively.

a) <u>Feed intake</u> - Table 2 shows by phase and global feed intakes of the three groups of animals both as kg dry matter intake (DMI) and as a percentage of the rations initially foreseen and reported in table 1. Compared to MS's, AV bulls had higher feed intakes (9.36 *vs* 8.71 kg DMI/d) while VM bulls had similar consumption (8.87 kg DMI/d). It is thus confirmed the fact that MS tends to reduce feed intake in bulls both versus a negative control and versus AV, in agreement with previous data (Dyer et al., 1980; Goodrich et al., 1984; Johnson et al., 1979) . Also VM seems to have a slight negative influence on this parameter as reported in other works (Crovetto et al., 1991; Piva et al., 1986).

b) <u>Liveweight (LW) and daily weight gain (DWG)</u> - LWs and DWGs of the animals are reported in table 3 and 4, respectively. Despite the similar LWs at the beginning of the pre-treatment period, MS, AV and VM bulls had quite different DWGs (yet not statistically significant) in the 28 days covariate phase: 1416, 1505 and 1328 g.

The average LW of the animals at the beginning of the experimental period was very similar in the three groups: 469.4, 469.4 and 470.7 kg for MS, AV and VM, respectively. Looking at the DWGs in the grower and in the finisher phases (table 4) it is evident that VM improves growth performances of the bulls both in the grower (1273, 1312 and 1456 g DWG for MS, AV and VM, respectively) and in the finisher phase (1055, 1226 and 1302 g DWG for MS, AV and VM, respectively).

On the whole experimental period VM fed-bulls grew faster (1413 g DWG) than MS's (1203 g DWG, $P<0.001$) and AV's (1277 g DWG, $P<0.05$). Previous experiments have shown superiority of VM and AV, respectively, to MS in terms of both DWG and FCR (Crovetto et al., 1991; Johnson et al., 1979). In comparison with MS, AV fed-bulls had significantly higher DWGs in the finisher phase (P<0.05), but not on the whole experimental period.

c) Feed conversion ratio (FCR) - The data obtained (table 5) confirm VM efficacy also in this respect. The lower level of statistical significance of the differences between treatments is due to the fact that the data were per pen, with consequent few degrees of freedom. Nevertheless VM improved FCR both during the grower and, particularly, the finisher phase. Over the whole experimental period the FCR were 7.26, 7.23 and 6.38 for MS, AV and VM bulls, respectively (P<0.05).

d) Dressing percentage (DP) - No significant difference between treatments was revealed for cool DP: 62.9, 62.8 and 62.4% for MS, AV and VM, respectively.

CONCLUSIONS

- The data obtained in this experiment are in agreement with those obtained in previous trials (Crovetto et al., 1991; Wawrzynczak et al., 1993) confirming the efficacy of Virginiamycin, compared to Monensin and Avoparcin, as growth promoter in fattening bulls.

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