

A new iodine-selenium-cobalt bolus supplement for cattle

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Summary

This article describes the long-term effects of a new bolus IONOX™ (developed and manufactured by Animax and distributed in Ireland by Bayer) on levels of PII, GPx and Haemoglobin (Hb) in steers on a Kilkenny farm, in which unsupplemented cattle had a very low I-status and a low Se-status in 1994-1995, as assessed by blood levels of PII and GPx at that time.

Introduction

In many countries, slow-release boluses are used successfully to supplement cattle and sheep with selenium (Se), copper (Cu) and cobalt (Co). An Australian team (Ellis et al, 1983) developed an intraruminal device for slow release of iodine (I) in sheep. Each device contained 1000mg I and released 0.5-1.1mg I/day over a period of three years. The concept does not appear to have been exploited since then. Recently, Rogers et al, (unpublished) found that, if it could carry and release sufficient I, a slow release-bolus could be valuable as an I-supplement for cattle. Plasma inorganic iodine (PII) level in cattle is a very sensitive index of dietary I-status over the previous few days (Rogers and Mee, 1996). Whole blood glutathione peroxidase (GPx) is a good test of dietary Se-status over the previous few months (Backall and Scholz, 1979). Dietary inputs of I and Se from unsupplemented Irish forages usually are inadequate to maintain optimal blood status (Rogers and Mee, 1996). Irish research and clinical experience indicates that mean herd PII-levels of 105-285µg/L and GPx-levels of 42-161iu/g Hb are optimal (Rogers and Mee, 1996). Irish forage-fed cows need supplements of circa 30-60mg I and 3-5 mg Se/day to maintain



ABOVE: Reticularuminal boluses have many applications in the husbandry and welfare of ruminants.

RIGHT: IONOX is designed to retain most of its weight, in order to ensure a prolonged retention time.

such blood levels (Mee et al, 1996). Other cattle need supplementation *pro-rata* with bodyweight.

Materials and methods

IONOX™ contains 3400mg I, 500mg Se and 350mg Co. It is designed to retain most of its weight, in order to ensure a prolonged retention time in the reticulorumen during its period of trace element release. I and Se are leached as soluble salts from a zinc-ballasted resin matrix. Co is released by erosion of a small composite plug bonded within the main bolus.

The farm had home-reared Hereford x Charolais steers, 15 to 18 months old. On 16/11/1995 (Day 0), 21 steers, *circa* 421 kg live weight, were identified by two numbered tags and were allocated at random to three treatment groups of seven steers each: Group 0 = untreated controls; Group 1 = one bolus; Group 2 = two boluses. The treatments were given on Day 0. No other supplements of I or Se were given during the course of the trial.

Blood Sampling: Before treatment on Day 0, and thereafter on days 26, 61, 93, 119,

159, 181, 208 and 236, blood was drawn into a heparised vacutainer from the caudal vein of each steer. The samples were analysed by standard methods at the Grange Research Centre.

Plasma inorganic iodine: Samples were assayed by a modification of the method of Aumont and Tressol (1987). PII was separated by protein precipitation with ethanol, followed by cation exchange chromatography. PII-results were expressed as µg/L.

Blood glutathione peroxidase: Samples were assayed by Blanchflower and McMurray's modification of the method of Paglia and Valentine (1967) on a Ciba Corning Express 500 clinical analyser. GPx- results were expressed as iu/g Hb.

Blood Haemoglobin: Samples were assayed by the method of the International Committee for Standardisation in Haematology (ICSH) on a Gilford Stasar-3 spectrophotometer. Hb-results were expressed as g/dl.

Results:

Figures 1 and 2 show group mean levels for PII and GPx. Throughout the trial, Group 0 (control) cattle maintained very low to low PII-levels and normal to marginal GPx-levels.

Effect of treatment on PII:

Pre-trial mean PII-levels in groups 0, 1 and 2 were 15.0, 17.7 and 16.3 µg/L respectively. This indicated a very low I-status, not significantly different between groups ($p=0.759$). From day 26 to Day 159, mean PII levels in Groups 1 and 2 were significantly ($p < 0.001$) higher than those in Group 0 at these times (Figure 1).

Effect of treatment on GPx:

Pre-trial mean GPx-levels in groups 0, 1 and 2 were 48.3, 57.0, IU/g Hb, respectively. This indicated an Se-status in the low-normal range with the groups not significantly different ($p=0.258$) from each other (Figure 2). Comparison of the changes in mean GPx from pre-trial levels showed that the changes in Group 1 and 2 significantly exceeded those in Group 0 cattle by day 26 ($p < 0.67$) and at all subsequent samplings to Day 159 ($p < 0.01$ to $p < 0.001$). The effect of two boluses on the change in blood levels of GPx was still significant at Day 236 ($p < 0.012$).

Effect of treatment on Hb:

Mean Hb-levels did not differ significantly between groups throughout the trial, and remained within normal herd limits (11.13-14.16 g/dl).

Discussion: Reticuloruminal boluses have many applications in the husbandry and welfare of ruminants. These include electronic identification (Fallon and Rogers, 1995), release of permitted ruminal enhancers (such as monesin), anthelmintic drugs and essential nutrients (magnesium, vitamins and trace elements).

Internationally, I-deficiency is the most common trace element deficiency in ruminants (Underwood, 1962). The critical blood

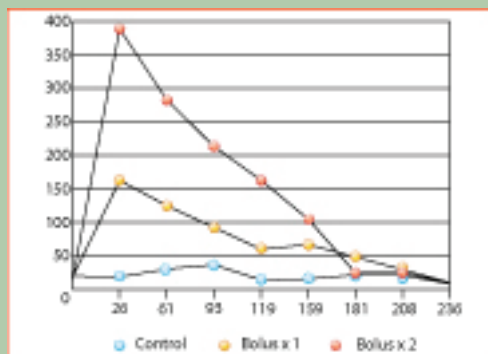


Figure 1: Mean PII-levels in control and bolus-treated cattle

levels of PII and GPx and the daily target of supplementary trace elements needed to maintain them are controversial issues. Some authorities accept lower blood levels of PII and GPx and correspondingly lower amounts of supplementary I and Se, than those cited in the introduction. Others advise targets higher than our targets, while others advise much lower targets. For example, experts in the UK, many European states, Australia and New Zealand accept supplementary I and Se at half, or less or our targets. Whatever levels of supplementation are adopted, it is difficult to ensure that all at-risk cattle at pasture receive supplementary I and Se at those levels. This is because of practical constraints of farm layout, uncontrolled water supplies and the cost of feeding concentrates at pasture (optimal methods of fixed-rate mineral supplementation of grazing cattle include provision of specially formulated summer feeds, or a mineralised water supply but many farmers can not, or will not, use these options). Use of slow release boluses is a practical solution to the difficulties of fixed-rate supplementation of grazing cattle with trace elements.

To maintain normal blood levels effectively in cattle which would otherwise be deficient

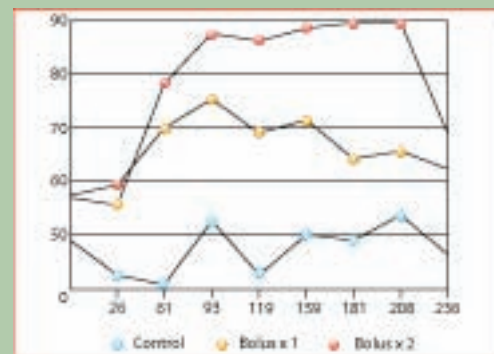


Figure 2: Mean GPx-levels in control and bolus treated cattle

in minerals, a bolus must release generous amounts of minerals evenly and over a prolonged period.

The results of this trial show that one bolus provided a useful supplement of both I and Se. In this trial, control animals weighing circa 421 kg pre-trial had very low PII-levels and normal to marginal GPx-levels. In this situation, one bolus significantly raised blood levels of PII and GPx in the currently accepted range for 23 weeks and 33+ weeks, respectively.

No abnormalities in haemoglobin levels were detected, nor were between treatment differences significant. In this trial, with currently available techniques, it was not possible to assess the efficacy of the cobalt supplementation.

Conclusion:

Levels of PII and GPx in the blood of control cattle indicated that the supply of I from herbage was very low and supply of Se was normal to marginal during the trial. One IONOX™ bolus gave a very significant supplement of I and Se for 23 weeks and two boluses were sufficient to maintain normal levels of PII for 23 and normal GPx levels for 33+ weeks.

References and suggested reading

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