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## Summary

*Three-hundred seventy six crossbred yearling steers were fed one of four treatments: 1) Control (CON) 2) CRINA RUMINANTS AF (CRINA) 3) CRINA RUMINANTS AF plus Tylan® (CRINA + T), and 4) Rumensin® plus Tylan® (RUM + T) to determine the potential of an essential oil additive to improve steer growth performance and carcass characteristics. There were no differences in Final BW or ADG between treatments. Steers fed RUM + T had lower DMI than other treatments and F:G was improved for the CRINA + T and RUM + T fed steers compared with CON steers. Treatments containing Tylan® had significantly fewer liver abscesses as compared to the other treatments. The addition of CRINA RUMINANTS AF plus Tylan® or Rumensin® plus Tylan® improved F:G and decreased liver abscesses compared to no additives.*

## Introduction

The response from increased production and improved F:G of many common feed additives results in a return on investment that is favorable for cattle producers. As new feed additives are introduced it becomes critical that biological responses and determinations are made in situations that closely simulate industry settings.

CRINA RUMINANTS AF is a flavor enhancer derived from essential oil compounds with various claims such as, appetite stimulant, digestion stimulant, and antioxidant.

This study was conducted to determine the effects of Rumensin®, Tylan®, and CRINA on performance measurements and carcass characteristics of finishing beef steers.

## Procedure

Yearling steers (BW = 878 $\pm$ 74 lb; n = 376) were used in a completely randomized design. Steers were purchased in the fall as weaned calves, grown on cornstalks and summer range, and then finished from September to January. Five days prior to study initiation, steers were limit fed a diet that consisted of 50% alfalfa and 50% wet corn gluten feed (DM basis) at 2% of BW to minimize variation in gastrointestinal fill. On day 0 and 1, steers were individually weighed and the average weight was used to determine starting BW. Based on day 0 weight, steers were blocked by weight into one of three blocks: light, medium, and heavy, stratified by weight within block, assigned to pens, and pens were assigned randomly to treatment. Forty pens were used at the University of Nebraska ARDC feedlot with 9-10 steers/pen. There were a total of four treatments with 10 pens per treatment.

The four dietary treatments (Table 1) all had a similar basal composition of high moisture corn (HMC) fed at 66% of diet, dry rolled corn (DRC) at 16.5% of diet, alfalfa hay at 7.5%, liquid molasses at 5%, and supplement at 5% (DM basis). Supplements were formulated to contain the different feed additives with the control (CON) containing no feed additives, CRINA Ruminants AF (**CRINA**) formulated to provide 1 g/head/day, CRINA Ruminants AF (1 g/head/day) plus Tylan® formulated to provide 90 mg/head/day (CRINA + T), and Tylan® (90 mg/head/day) plus Rumensin® formulated to provide 300 mg/hd/d (**RUM + T**, *Elanco Animal Health, Greenfield, Ind.*). Diets were formulated to meet or exceed the NRC (1996) requirements for metabolizable protein, Ca, P, and K. Steers were adapted to the finishing diet with a step-up period that consisted of 3, 3, 4, 7, and 7 days. During the step-up period, HMC replaced alfalfa and was included at 0, 28.5, 38.5, 48.5, and 58.5% and alfalfa was included at 45, 45, 35, 25, and 15% (DM basis), for each of the respective steps. Steers were fed once daily with a Roto-Mix® (*Roto-Mix®, Dodge City, Kan.*) feed truck.

All steers were implanted with Revalor-S® (*Intervet, Millsboro, Del*) at study initiation and were fed for a total of 115 days. Cattle were slaughtered on day 116 at a commercial packing plant (*Greater Omaha Pack, Omaha, Neb.*) where hot carcass weight and liver scores were recorded. Following a 48-hour chill, carcass data were collected that included: 12-13$^{th}$ rib fat thickness, LM area, KPH percentage, and called USDA marbling scores were recorded. A calculated yield grade was determined from the equation (YG = 2.50 + (2.5*FT, in.) – (0.32*REA, in$^2$) + (0.2*KPH, %)

**Table 1. Composition of dietary treatments and formulated nutrient analysis.**

| Ingredient | % of diet DM |
|---|---|
| Corn, HM[a] | 66.0 |
| Corn, DR[b] | 16.5 |
| Alfalfa hay | 7.5 |
| Molasses | 5.0 |
| Supplement[c] | 5.0 |
| *Formulated Nutrient Analysis* | |
| NEg, mcal/lb | 0.64 |
| Crude protein, % | 13.0 |
| Calcium, % | 0.65 |
| Phosphorus, % | 0.33 |
| Potassium, % | 0.70 |
| Sulfur, % | 0.16 |
| Ether extract, % | 3.7 |

[a]HM denotes high-moisture.
[b]DR denotes dry-rolled.
[c]Supplements differ according to dietary treatment, supplements formulated to provide CRINA Ruminants AF at a rate of 1 g/hd/d, Tylan® at a rate of 90 mg/hd/d, Rumensin® at a rate of 300 mg/hd/d.

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+ (0.0038*HCW, lb.)). Values for final BW, ADG, and F:G were calculated using hot carcass weight divided by an average dressing percentage of 63 to minimize errors associated with gastrointestinal tract fill.

Dry-rolled corn was processed through a single-roll roller mill. High-moisture corn was harvested at 31% moisture, processed through a single-roll roller mill, stored in a horizontal bunker silo, covered, and used throughout the study.

Data were analyzed using the mixed procedures of SAS (*Version 9.1, SAS Inc., Cary, NC)* as a randomized complete block design, with pen as the experimental unit and three weight blocks. When treatment differences were significant based on a protected F-test, means were separated using the PDIFF option of SAS.

## Results

Cattle fed the CON, CRINA, and CRINA + T dietary treatments had significantly higher ($P<0.01$) DMI then cattle receiving the RUM + T treatment (Table 2). Stock et al. (1995) also observed a decrease in DMI and in addition, reported an increase in ADG when Rumensin® and Tylan® were included in finishing steer diets.

ADG was not statistically different between treatment groups ($P=0.52$) but was numerically highest for the CRINA + T treatment group (4.03 lb) and lowest for the CON group (3.89 lb). Cattle receiving the CRINA + T and RUM + T treatments were more efficient than the CON group ($P<0.01$). The CRINA group was intermediate in F:G value compared to CON and the CRINA + T and RUM + T treatments. There was a trend for the CRINA group to have an improved F:G compared to the CON group (6.66 vs. 6.92).

When evaluating carcass differences, there was a significant yield grade difference for the CRINA + T treatment (Table 2). It is not clear why the CRINA + T treatment had a numerically higher 12th rib fat thickness measure and numerically smaller LM area. This observation is most likely an anomaly and therefore the yield grade difference may not be real.

Cattle fed Tylan® had fewer total liver abscesses compared to control cattle and there was a trend for severity of liver abscesses to be lessened as well (Table 3). The response of increased F:G seen in the CRINA + T and RUM + T treatments may be partially attributed to Tylan® inclusion and observed reduction in liver abscesses. Cattle in the CRINA treatment were intermediate in total liver abscesses with no statistical difference between the CRINA and the other treatments.

In summary, this study indicates that cattle fed CRINA Ruminants AF plus Tylan® (CRINA + T) or Rumensin® plus Tylan® (RUM + T) have improved feed efficiency and decreased liver abscesses compared to no additives. In addition, other carcass characteristics were not appreciably different when feed additives were included.

**Table 2. Performance and carcass characteristics of steers fed differing feed additives for a 115 day finishing period.**

| | Treatment[c] | | | | Statistics | |
|---|---|---|---|---|---|---|
| | CON | CRINA | CRINA+T | RUM+T | SEM | *P*-value |
| Pens, n | 10 | 10 | 10 | 10 | | |
| Steers, n | 94 | 94 | 94 | 94 | | |
| Days on feed | 115 | 115 | 115 | 115 | | |
| *Performance* | | | | | | |
| Initial BW, lb | 900 | 896 | 897 | 897 | 2 | 0.29 |
| Final BW[d], lb | 1345 | 1356 | 1361 | 1348 | 9 | 0.55 |
| DMI, lb | 26.8[a] | 26.5[a] | 26.4[a] | 25.3[b] | 0.2 | <0.01 |
| ADG[e], lb | 3.89 | 3.99 | 4.03 | 3.93 | 0.08 | 0.52 |
| F:G[f] | 6.92[a] | 6.66[ab] | 6.55[b] | 6.44[b] | 0.03 | 0.03 |
| *Carcass Characteristics* | | | | | | |
| HCW, lb | 847 | 854 | 857 | 849 | 6 | 0.54 |
| 12th rib fat, in | 0.44 | 0.45 | 0.48 | 0.42 | 0.02 | 0.06 |
| KPH fat, % | 2.08 | 2.01 | 2.01 | 2.02 | 0.03 | 0.20 |
| LM area, in$^2$ | 14.1 | 14.1 | 13.9 | 14.0 | 0.1 | 0.47 |
| Marbling score[g] | 553 | 534 | 555 | 538 | 8 | 0.14 |
| Yield grade | 2.1[a] | 2.3[a] | 2.7[b] | 2.3[a] | 0.1 | 0.02 |

[ab]Within a row means without a common superscript letter differ ($P<0.05$).
[c]CON = Control, CRINA = CRINA RUMINANTS AF, CRINA+T = CRINA RUMINANTS AF + Tylan®, RUM+T = Rumensin® + Tylan®.
[d]Calculated from carcass weight adjusted to a 63% common dressing percentage.
[e]Calculated from carcass adjusted final body weight.
[f]Calculated as total feed intake (DM basis) divided by total gain.
[g]Where 400 = Slight 0, 500 = Small 0.

**Table 3. Effects of treatment on liver abscesses.**

| | Treatment[c] | | | | Statistics | |
|---|---|---|---|---|---|---|
| Liver Scores | CON | CRINA | CRINA+T | RUM+T | SEM | *P*-value |
| Steers, n | 93 | 94 | 93 | 92 | | |
| A+, n | 9 | 7 | 3 | 0 | | |
| A, n | 2 | 0 | 0 | 0 | | |
| A-, n | 15 | 9 | 5 | 6 | | |
| Total abscesses, % | 26.25[a] | 15.65[ab] | 7.75[b] | 5.55[b] | 3.80 | <0.01 |
| A+, % | 8.52 | 6.52 | 2.52 | 0.00 | 2.78 | 0.09 |

[ab]Within a row means without a common superscript letter differ ($P<0.05$).
[c]CON = Control, CRINA = CRINA RUMINANTS AF, CRINA+T = CRINA RUMINANTS AF + Tylan®, RUM+T = Rumensin® + Tylan®.

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