

Evaluation of Injectable Minerals and Growth Implants to Enhance Weaned Calf Development

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Summary

Injectable minerals and growth implants were used in a grazing study to evaluate their effect on performance and health status of weaned beef calves. This 56-day study utilized 131 heifers purchased from two middle Tennessee sale barns in fall 2006. Heifers were randomly allotted to one of four treatments including 1) Control, no mineral injection, no implant, 2) injection of MultiMin, no implant, 3) no mineral injection, Ralgro growth promotant and 4) injection of MultiMin, Ralgro growth promotant. Cattle grazed tall fescue dominated pasture and were supplemented with pelleted corn gluten feed at 0.5% average initial body weight. Cattle were weighed on days 0, 1, 28, 55 and 56 and blood was drawn for glutathione peroxidase activity analysis. Additionally, feed, forage and water samples were collected on day 1. All data were analyzed using the mixed procedure of SAS, with differences determined at ($P < 0.05$). MultiMin injection had no effect on calf performance while Ralgro administration caused higher ($P < 0.05$) weight gains. Glutathione peroxidase activity was not affected by Ralgro but was increased ($P < 0.01$) from d-1 to d-56 by MultiMin injection. MultiMin may be useful in beef calf weaning programs for improving health status.

Introduction

Tennessee ranks 14th in total number of cattle and 10th in number of beef cows within the United States. Beef cattle production is the largest agricultural enterprise in Tennessee making up nearly 20% of the agricultural cash receipts. The primary product marketed by the industry is feeder calves produced on a forage base of 7.4 million acres of forages. Forage mineral deficiencies and imbalances have been identified in Tennessee (Fisher et al., 2002) that are causing rough, discolored hair coats (with cows and calves slow to shed winter hair coats), decreased breeding efficiency (slow breeders, depressed heat cycles), bone and hoof problems and depressed immune system function (less resistance to diseases ranging from scours in young calves to shipping fever in weaned calves and possibly even decreased resistance to parasites).

A survey of 135 High Plains feedlots revealed that good animal health ranked as the lowest of 8 characteristics for southeastern cattle (average of 2.39, with 5 being the best) and that approximately 88% of the feedyards thought southern cattle were inferior to northern-originated cattle (Slaven Associates, 2002). It is hypothesized that mineral deficiencies and imbalances could be contributing to the health and immune problems associated with feeder calves from Tennessee and other southern states.

The objective of this experiment is to evaluate the effectiveness of an injectable mineral solution (MultiMin), a growth implant (Ralgro) and their interaction to overcome mineral deficiencies and poor growth/health status of weaned beef calves.

Methods

Tennessee Livestock Producers, Inc. (Tennessee Farm Bureau Federation, Columbia,

TN) provided 132 weaned beef heifers for this 56-day project. They were procured from two sale barns (Cookeville, TN and Fayetteville, TN) within middle Tennessee. Upon arrival to the Research and Education Center at Greeneville (Greeneville, TN), all heifers were administered an identification ear tag, an anthelmintic and a vaccination program following Standard Operating Procedures as well as Beef Quality Assurance Guidelines.

Cattle were allotted to one of four treatments based on d-0 weight, origin and breed type. Cattle grazed tall fescue dominated pastures between October and November 2006. They were supplemented with pelleted corn gluten feed at 0.5% average initial body weight. Additionally, cattle had free choice access to plain white salt. Treatments included 1) Control, no mineral injection, no implant, 2) injection of MultiMin (no less than 40 mg/ml zinc, 10 mg/ml manganese, 5 mg/ml selenium and 15 mg/ml copper, MultiMin USA, Inc., Porterville, CA) on day 1, no implant, 3) no mineral injection, Ralgro growth promotant administration (Zeranol, Schering-Plough Animal Health, Summit, NJ) on day 1 and 4) injection of MultiMin, Ralgro growth promotant administration on day 1. Heifers were subsequently weighed on days 1, 28, 55 and 56. The average of consecutive weights on days 0 and 1 and days 55 and 56 were used for initial and final weights, respectively. All calves had blood drawn for glutathione peroxidase (GSH-Px) activity analysis on days 1 and 56.

Forage samples (pasture and/or hay) were obtained on d-1 by randomly harvesting 10 total samples from pasture or hay that was provided. When hay was being supplemented, 5 samples each of pasture and hay were taken, respectively. Additionally, 2 samples of supplement (corn gluten feed) and water were sampled. All forage/feed samples were dried, ground and sent to the University of Tennessee Forage Testing Laboratory (Nashville, TN) for mineral and quality analyses. Water samples were placed in an air tight container and also sent to the University of Tennessee Forage Testing Laboratory (Nashville, TN) for mineral analysis. All data were analyzed using the MIXED procedure of SAS with differences determined at $P < 0.05$.

Results

Feed and forage quality data are listed in Table 1 below. Crude protein, fiber and total digestible nutrients in feed and forage were adequate for growth of calves. According to the forage mineral classification published by Mortimer et al., (1999), copper was marginally deficient, manganese was deficient and sulfur was at a level known to be highly antagonistic to copper and selenium utilization.

Table 1. Mean feed and forage quality data.

Parameter	Unit	Corn Gluten Feed	Forage
Number of Samples	.	2	10
Dry Matter	%	90.3	95.0
Crude Protein	%	15.0	21.0
Fat	%	2.8	.
Acid Detergent Fiber	%	.	34.4
Neutral Detergent Fiber	%	.	56.8
Total Digestible Nutrients	%	.	63.2
Calcium	%	0.1	0.7

Phosphorus	%	0.7	0.4
Magnesium	%	0.3	0.4
Potassium	%	1.1	4.6
Sodium	%	0.2	.
Sulfur	%	0.4	.
Manganese	ppm	14	.
Copper	ppm	9	.
Zinc	ppm	40	.

Water mineral levels are listed in Table 2 below. Mineral levels in the water samples were adequate and should not have caused any adverse effects.

Table 2. Mean water mineral levels.

Parameter	Unit	Water
Number of Samples	.	2
Calcium	ppm	25.3
Phosphorus	ppm	0.4
Magnesium	ppm	5.4
Potassium	ppm	3.2
Sodium	ppm	8.5
Sulfur	ppm	4
Iron	ppm	0.02
Manganese	ppm	0
Copper	ppm	0
Zinc	ppm	0.05

Performance data of calves are listed in Table 3 below. No difference was seen in calves that with and without MultiMin administration. As expected, calves that received Ralgro gained faster ($P < 0.05$) than calves without Ralgro during period 2 and throughout the entire experiment. Fisher et al., (2006) reported mixed results on two similar studies using injectable mineral solutions. In first study, an increase in weight gain was seen by using MultiMin, while in second study using MineralMax (no less than 20 mg/ml zinc, 20 mg/ml manganese, 5 mg/ml selenium and 10 mg/ml copper), a similar product to MultiMin, no differences were found. Berry et al., (2000) reported that MultiMin supplemented calves tended to gain more weight than unsupplemented calves in a receiving program in Oklahoma.

Table 3. Performance data summary.

	Initial WT	Mid WT	Final WT	P1 ADG	P2 ADG	Total ADG
	lbs	lbs	Lbs	lbs/day	lbs/day	lbs/day
No MultiMin	622	664	686	1.4	0.8	1.2
MultiMin	616	658	680	1.4	0.8	1.1

No Ralgro	618	659	678	1.4	0.7 ^B	1.1 ^B
Ralgro	620	664	687	1.4	0.9 ^A	1.2 ^A
Control	619	661	682	1.4	0.8 ^{AB}	1.1 ^{AB}
MultiMin Only	618	657	674	1.3	0.7 ^{BC}	1.0 ^{BD}
Ralgro Only	625	668	690	1.4	0.9 ^{ABC}	1.2 ^{ABD}
MultiMin & Ralgro	614	660	685	1.5	1.0 ^A	1.2 ^A

^{A,B}Variables within columns not sharing superscripts are significantly different at $P < 0.05$.

^CPeriod 2 ADG between MultiMin and Ralgro tends to be significant at $P = 0.0865$.

^DTotal ADG between MultiMin and Ralgro tends to be significant at $P = 0.0733$.

Glutathione peroxidase activity data are listed in Table 4 below. There was no difference in initial GSH-Px activity between any groups. Ralgro had no effect on GSH-Px activity status. In contrast, administration of MultiMin caused higher ($P < 0.02$) final GSH-Px activity in all cases, whether given alone or in combination with Ralgro. The increase in GSH-Px activity from the start of the trial to its conclusion was higher ($P < 0.01$) for MultiMin supplemented calves than unsupplemented calves. Selenium is an important component of glutathione peroxidase, an enzyme that protects against oxidative damage to cellular and subcellular membranes (McDowell, 2003). Because glutathione peroxidase is a selenium-dependent enzyme, enzyme activity is a relatively good indicator of selenium status in the animal. Sulfur is known to compromise selenium utilization and diets containing excess sulfur have led to lower GSH-Px activity (McDowell, 2003).

Table 4. Glutathione peroxidase activity data summary.

	Initial GSH-Px Activity nmol/min/ml	Final GSH-Px Activity nmol/min/ml	Change nmol/min/ml
No MultiMin	40.5	54.7 ^B	14.2 ^B
MultiMin	41.9	71.8 ^A	29.9 ^A
No Ralgro	42.2	61.5	19.2
Ralgro	40.2	64.9	24.6
Control	42.6	52.8 ^B	10.2 ^B
MultiMin Only	41.9	70.4 ^A	28.6 ^A
Ralgro Only	38.5	56.7 ^B	18.2 ^{ABC}
MultiMin & Ralgro	42.0	73.1 ^A	31.1 ^{AC}

^{A,B}Variables within columns not sharing superscripts are significantly different at $P < 0.05$.

^cGSH-Px activity between Ralgro and MultiMin & Ralgro tends to be significant at $P = 0.0691$.

Conclusion

Data continues to be mixed for injectable minerals including MultiMin. It has no consistent effect on the performance of beef calves. However, MultiMin has been shown to increase GSH-Px activity in beef cattle and thus may have application in improving the health status of weaned calves. More detailed experiments are needed in this area.

References

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