

Bovatec[®] for Cattle Grazing Pasture and Rangeland: Effects of Pasture Type and Bovatec Level on Performance Enhancement

Abstract

A summary of published research studies was compiled to evaluate the impact of forage type and Bovatec (lasalocid) level on the growth response from Bovatec supplementation. Fifty-eight research studies were compiled that included 84 comparisons of a supplement medicated with Bovatec and the same supplement without Bovatec. Of the 84 comparisons, 77 included pasture descriptions that were used to group pastures into one of four categories: cool season, warm season, mixed season, and winter annuals. To be included in the summary, a study needed to contain a comparison between a non-medicated control supplement and the same supplement medicated with Bovatec. Replication of treatments and randomization of cattle to pastures and pastures to treatments were also requirements for inclusion in the database. Data were further subdivided within forage type based on Bovatec feeding level to allow evaluation of the impact of Bovatec dose within forage type on growth rate responses. When cattle received at least 150 mg of Bovatec on a daily basis, growth rate was improved to the greatest extent when grazing winter annuals (0.24 lb/hd/d), least when grazing mixed-season (0.11 lb/hd/d) or warm-season (0.12 lb/hd/d) pastures, and intermediate when grazing cool-season pastures (0.18 lb/hd/d). For each forage type, results were consistently positive based on 95% confidence intervals. When Bovatec was supplemented at less than 150 mg/hd/d, growth rate improvements were approximately half of that noted with higher levels of Bovatec for all forage types except warm-season grasses. Confidence intervals surrounding mean improvements were consistently positive but approached zero with cool season, mixed season, and winter annuals, suggesting an increased possibility of disappointing results compared with higher levels of Bovatec. Supplementing grazing cattle with at least 150 mg of Bovatec results in consistent improvements in cattle growth rate without depressing supplement and nutrient intake needed to avoid nutrient deficiencies.

Introduction

Pasture and range conditions vary widely throughout the year and by region of the country, making nutrient supplementation programs necessary for meeting animal maintenance and growth requirements. Level and type of supplementation can interact positively or negatively with forage consumption and digestibility. Bovatec, an ionophore approved for increased rate of weight gain for cattle consuming grass resources, can improve the efficiency of ruminal fermentation, enhance energy capture from forage and supplement resources, improve forage digestibility, and increase cattle growth rate.

Cattle response to Bovatec is consistently positive across a wide range of forage types but tends to be greater with winter-annual pastures (Technical Bulletin CD 0384¹). Growth rate enhancement with Bovatec is dose-dependent (Technical Bulletins CD 0352² and CD 0385³). Within the approved range of 60 to 300 mg/hd/d, growth rate improvements increase with increasing dose up to 200 mg/hd/d. The interaction of forage type and Bovatec level has not been investigated.

The objective of this Technical Bulletin was to determine the impact of forage type and Bovatec level on cattle growth rate response compared with cattle consuming non-medicated supplements.

Summary of the Experiments

Research experiments from Alpha records, state beef cattle reports, and peer-reviewed articles that compared performance of grazing cattle consuming supplements (with and without Bovatec) were compiled into a data set. The data includes 58 research studies with 84 comparisons of Bovatec and an appropriate supplemented non-medicated control treatment. Research studies included in the data set were replicated with cattle randomly assigned

to pasture and pastures assigned to treatment. In addition, supplements used within each experiment needed to be identical across treatments, with the exception of Bovatec inclusion. Research observations were grouped based on forage type: cool season, warm season, mixed season, and winter annuals (7 research studies did not provide adequate pasture information to establish predominate forage types). Data were further divided based on the amount of Bovatec supplemented within each forage type. Two groups were analyzed: cattle receiving more than or less than 150 mg of Bovatec/hd/d (Table 1).

The approved range of Bovatec for improvement of daily weight gain for cattle grazing rangeland and pastures is 60 to 300 mg. The optimal dose for improvements in weight gain is 200 mg/hd/d. Most research studies included Bovatec at either 100, 200, or 300 mg/hd/d in hand-fed supplements. However, supplements that were provided free-choice for self-feeding have a more variable intake (Technical Bulletin CD 0384¹). The range of Bovatec levels consumed in the 77-comparison summary ranged from 100 to 300 mg/hd/d. When doses were ranked from highest to lowest, the natural break in the data occurred between 148 mg/hd/d and 122 mg/hd/d. Consequently, within each forage type, Bovatec response was evaluated when more than or less than 148 mg of Bovatec was supplemented per head per day. Studies where more than 148 mg of Bovatec was fed had a mean intake of approximately 200 mg/hd/d, whereas studies where less than 148 mg of Bovatec was fed had a mean intake of approximately 100 mg/hd/d. For simplicity, these groups will be referred to as 200 mg Bovatec and 100 mg Bovatec, respectively.

Warm-season pasture and winter-annual studies tended to include cattle of lower initial weight than studies where cool-season or mixed-season pastures were grazed. The use of lighter-weight cattle in studies grazing warm-season and winter-annual pastures may result in greater rates of weight gain for non-medicated and Bovatec-treated cattle than for cool- and mixed-season pastures. However, differences between non-medicated control performance and Bovatec performance should not be affected by differences in initial weight. Studies were of similar average length (99 to 108 days) across forage types.

To evaluate treatment means within the database, an F-test for equal variance was conducted. Within the data-

TABLE 1. Bovatec database-summary of experimental information by grass type.

Cool-season observations, # (% of total)	19 (24.7%)
Avg. Bovatec dose, mg/hd/d (\pm std dev)	179 (\pm 62.9)
Range in Bovatec dose, mg/hd/d	100 to 300
Number of observations above 150 mg/hd/d	13
Number of observations below 150 mg/hd/d	6
Avg. initial weight, lb (\pm std dev)	554.9 (\pm 151.9)
Avg. duration of studies, days (\pm std dev)	107.8 (\pm 17.6)
Warm-season observations, # (% of total)	16 (20.8%)
Avg. Bovatec dose, mg/hd/d (\pm std dev)	158 (\pm 47.1)
Range in Bovatec dose, mg/hd/d	100 to 252
Number of observations above 150 mg/hd/d	9
Number of observations below 150 mg/hd/d	6
Avg. initial weight, lb (\pm std dev)	513.9 (\pm 155.8)
Avg. duration of studies, days (\pm std dev)	97 (\pm 14.6)
Mixed-season observations, # (% of total)	25 (32.5%)
Avg. Bovatec dose, mg/hd/d (\pm std dev)	183 (\pm 59.8)
Range in Bovatec dose, mg/hd/d	100 to 300
Number of observations above 150 mg/hd/d	19
Number of observations below 150 mg/hd/d	6
Avg. initial weight, lb (\pm std dev)	587.5 (\pm 93.8)
Avg. duration of studies, days (\pm std dev)	108 (\pm 19.6)
Winter-annual observations, # (% of total)	17 (22.1%)
Avg. Bovatec dose, mg/hd/d (\pm std dev)	173.5 (\pm 56.2)
Range in Bovatec dose, mg/hd/d	100 to 300
Number of observations above 150 mg/hd/d	12
Number of observations below 150 mg/hd/d	5
Avg. initial weight, lb (\pm std dev)	502.1 (\pm 52.2)
Avg. duration of studies, days (\pm std dev)	99 (\pm 27.0)
Studies not reporting forage type	7

base, across study means, the assumption of equal variance was demonstrated ($P \leq 0.01$) for control and Bovatec treatments, so that rate of weight gain (ADG) for control and Bovatec-fed cattle were compared within forage type and Bovatec level using a two-sample t-test. Confidence intervals (95%) were computed for the difference in ADG between control and Bovatec cattle within forage type and Bovatec level. Results should fall within the 95% confidence interval in 95% of observations due to the effect of Bovatec supplementation, while 5% of the observations

should fall within the range due to random chance. Confidence intervals were used to determine the range of improvements in performance anticipated, and to determine if a positive improvement should be expected. Means used in all statistical analyses were based on individual studies within the database, with each study given equal weight.

Results and Discussion

Bovatec enhances grazing cattle growth rates by an average of 0.14 lb/hd/d across various forage types, supplement formulations, and Bovatec consumption levels (Technical Bulletin CD 0385³). While effective growth enhancement occurs at levels less than 150mg/hd/d, the greatest improvements in growth occur when Bovatec is supplemented at or near the optimum dose of 200 mg/hd/d (Technical Bulletin CD 0352²). Forage type also influences the relative growth enhancing capabilities of Bovatec. The greatest absolute improvements in ADG occurs when cattle graze winter-annual pastures. Intermediate enhancements were noted with cool- or warm-season pasture grazing, and lesser improvements when mixed-season pastures were grazed (Technical Bulletin CD 0384¹). Bovatec consumption and forage type

information was pooled to determine if all forage types result in similar growth rate enhancement at Bovatec levels above (200 mg) and below (100 mg) 150 mg/hd/d.

When Bovatec was consumed at 200 mg/hd/d by cattle grazing cool-season grasses, growth rate was enhanced by 13.6%, with an absolute improvement of 0.18 lb/hd/d (Table 2). By comparison, when Bovatec was consumed at 100 mg/hd/d, growth rate enhancement was only 0.09 lb/hd/d greater than noted for cattle consuming a non-medicated supplement. While the confidence intervals for Bovatec consumption of 100 and 200 mg are similar in width (approximately ± 0.09 lb/hd/d) when Bovatec was consumed at 200 mg/hd/d, a range from 0.09 to 0.28 lb/hd/d improvement in ADG would be expected. However, when 100 mg/hd/d of Bovatec was consumed, a range of 0.00 to 0.18 lb/hd/d improvement in ADG would be expected. Therefore, a Bovatec dose of 200 mg/hd/d more consistently produces positive growth enhancement when cattle graze cool-season grasses than a Bovatec dose of 100 mg/hd/d.

Warm-season pasture results, while similar when averaged across Bovatec dose, have a different pattern than

TABLE 2. Effect of Bovatec on cattle performance when grazing cool-season grasses.

Parameter	Bovatec Database		Difference ^a	% Change
	Control	Bovatec		
<i>Cool-Season Grasses - 200 mg/hd/d</i>				
Number of observations	13	13		
Mean ADG, lb/hd/day	1.48	1.66	0.18	13.65
Standard error	0.13	0.14	0.03	2.77
Upper confidence level ^b	1.70	1.90	0.28	22.92
Lower confidence level ^b	1.26	1.43	0.09	4.38
<i>Cool-Season Grasses - 100 mg/hd/d</i>				
Number of observations	6	6		
Mean ADG, lb/hd/day	1.47	1.56	0.09	5.51
Standard error	0.14	0.17	0.04	2.94
Upper confidence level ^b	1.75	1.90	0.18	11.27
Lower confidence level ^b	1.19	1.22	0.00	-0.26

^a Values are the mean of Bovatec - Control obtained from each study. Consequently, differences calculated from Bovatec and control values in this table may not match means shown in the Difference column.

^b 95% confidence level

TABLE 3. Effect of Bovatec on cattle performance when grazing warm-season grasses.

Parameter	Bovatec Database		Difference ^a	% Change
	Control	Bovatec		
<i>Warm-Season Grasses - 200 mg/hd/d</i>				
Number of observations	9	9	9	10
Mean ADG, lb/hd/day	1.53	1.64	0.12	10.11
Standard error	0.18	0.18	0.02	2.33
Upper confidence level ^b	1.87	2.00	0.17	14.69
Lower confidence level ^b	1.18	1.29	0.07	5.54
<i>Warm-Season Grasses - 100 mg/hd/d</i>				
Number of observations	6	6		
Mean ADG, lb/hd/day	1.35	1.52	0.17	12.56
Standard error	0.18	0.19	0.04	2.86
Upper confidence level ^b	1.70	1.90	0.24	18.16
Lower confidence level ^b	1.00	1.14	0.09	6.97

^a Values are the mean of Bovatec - Control obtained from each study. Consequently, differences calculated from Bovatec and control values in this table may not match means shown in the Difference column.

^b 95% confidence level

that noted with cool season forages (Table 3). When Bovatec was supplemented at 200 mg/hd/d, growth rate was enhanced by 0.12 lb/hd/d, or 10.1%. However, when Bovatec was supplemented at 100 mg/hd/d, growth rate was improved by 0.17 lb/hd/d. Reasons for a response pattern different than other pasture types may be attributed to several issues. For example, there was a more limited number of studies in this group, and there may have been differences in cattle quality, as well as a more limited forage availability. In addition, there may have been a negative associative effect between forage type, supplement type, and Bovatec. The 95% confidence intervals for 200 and 100 mg of Bovatec consumption overlap, suggesting that similar results would be expected for the two ranges of Bovatec consumption. Neither 95% confidence interval included 0, suggesting that a consistent positive growth improvement should be expected regardless of Bovatec dose when warm-season grasses are grazed. While the absolute improvement in ADG was greater with 100 mg of Bovatec, feeding Bovatec at 100 mg/hd/d resulted in a more variable growth response as evidenced by a much larger standard error (0.04 vs 0.02) and a wider confidence interval (± 0.15 vs ± 0.10) when compared with Bovatec consumed at 200 mg/hd/d. A

Bovatec consumption of 200 mg resulted in more consistent growth enhancement than Bovatec consumption of 100 mg.

When 200 mg of Bovatec/hd/d was supplied to cattle grazing mixed-season grasses, ADG was improved by 0.11 lb/hd/d or 9.12% (Table 4). When Bovatec dose was reduced to 100 mg/hd/d, growth rate was enhanced by only 0.06 lb/hd/d or 5.99%, approximately half the response obtained with a higher Bovatec level. Bovatec supplemented to cattle grazing mixed-season pastures resulted in response patterns similar to cool-season pasture results. The 95% confidence interval obtained from feeding 200 mg/hd/d was consistently positive and did not approach zero. The 95% confidence interval noted when 100 mg/hd/d was fed was positive but approaches zero (Table 4). Greater and more consistently positive improvements in growth rate can be obtained by feeding 200 mg of Bovatec/hd/d when cattle are grazing mixed-season pastures or rangelands.

Winter-annual pastures are one of the highest quality forages grazed by stocker cattle and result in the greatest response to Bovatec supplementation (Table 5). Bovatec

TABLE 4. Effect of Bovatec on cattle performance when grazing mixed-season grasses.

Parameter	Bovatec Database		Difference ^a	% Change
	Control	Bovatec		
<i>Mixed-Season Grasses - 200 mg/hd/d</i>				
Number of observations	19	19		
Mean ADG, lb/hd/day	1.39	1.50	0.11	9.12
Standard error	0.12	0.11	0.02	1.64
Upper confidence level ^b	1.62	1.72	0.14	12.34
Lower confidence level ^b	1.17	1.28	0.07	5.90
<i>Mixed-Season Grasses - 100 mg/hd/d</i>				
Number of observations	6	6		
Mean ADG, lb/hd/day	1.03	1.09	0.06	5.99
Standard error	0.11	0.11	0.02	2.56
Upper confidence level ^b	1.24	1.31	0.11	11.02
Lower confidence level ^b	0.82	0.87	0.01	0.97

^a Values are the mean of Bovatec - Control obtained from each study. Consequently, differences calculated from Bovatec and control values in this table may not match means shown in the Difference column.

^b 95% confidence level

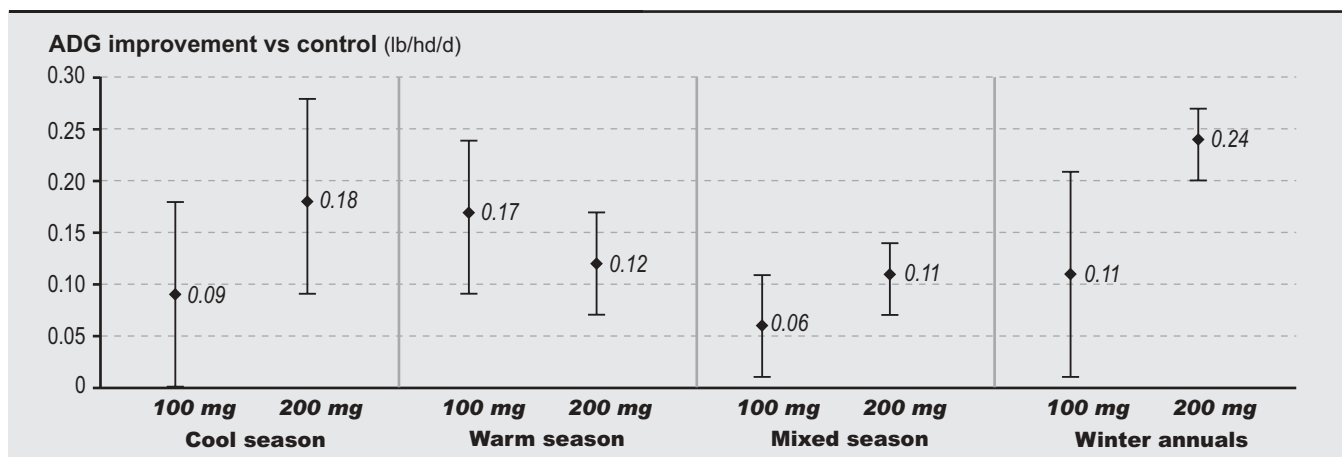
TABLE 5. Effect of Bovatec on cattle performance when grazing winter annuals.

Parameter	Bovatec Database		Difference ^a	% Change
	Control	Bovatec		
<i>Winter Annuals - 200 mg/hd/d</i>				
Number of observations	12	12		
Mean ADG, lb/hd/day	1.95	2.18	0.24	12.52
Standard error	0.17	0.18	0.02	0.81
Upper confidence level ^b	2.28	2.54	0.27	14.11
Lower confidence level ^b	1.61	1.82	0.20	10.94
<i>Winter Annuals - 100 mg/hd/d</i>				
Number of observations	5	5		
Mean ADG, lb/hd/day	1.93	2.04	0.11	5.59
Standard error	0.15	0.17	0.05	2.66
Upper confidence level ^b	2.22	2.39	0.21	10.80
Lower confidence level ^b	1.64	1.70	0.01	0.38

^a Values are the mean of Bovatec - Control obtained from each study. Consequently, differences calculated from Bovatec and control values in this table may not match means shown in the Difference column.

^b 95% confidence level

FIGURE 1: Effects of forage type and Bovatec level on growth response (\pm 95% confidence intervals).



supplementation of 200 mg/hd/d improved growth rate by 0.24 lb/hd/d or 12.5%. The consequences of supplying 100 mg/hd/d are more extreme than noted with other forage types as evidenced by a growth rate response that is less than half of that noted when 200 mg of Bovatec is supplemented on a daily basis. Supplying 100 mg/hd/d of Bovatec resulted in a growth rate improvement of 0.11 lb/hd/d or 5.59%. Supplementing 200 mg/hd/d resulted in a narrow 95% confidence interval that ranged from 0.20 to 0.27 lb/hd/d, whereas, supplementing 100 mg/hd/d resulted in a wide 95% confidence interval with a lower limit of 0.01 lb/hd/d (Table 5). A wider 95% confidence interval suggests greater variability in growth rate enhancement when lower levels of Bovatec are fed to cattle grazing winter-annual pastures.

When Bovatec is supplemented at 200 mg/hd/d, growth rate improvements are greatest and most consistent when winter annuals are being grazed, least when either warm-season or mixed-season grasses are grazed, and intermediate when cool-season grasses are grazed (Figure 1). Confidence intervals surrounding the means were relatively narrow, with the exception of cool-season pasture results, and consistently positive for all forage types. Regardless of forage type, 95% confidence intervals for growth response did not approach zero. Effects of supplement type and level provided might interact with Bovatec levels and forage types to alter results. This is potentially of greatest concern with warm- and mixed-season grasses.

Feeding 100 mg/hd/d of Bovatec reduced growth rate enhancement compared with feeding 200 mg Bovatec/hd/d by approximately 50% for all forage types except warm-season grasses (Figure 1). The greatest improvement in ADG occurred when warm-season grasses were grazed, poorest with mixed-season grasses, and intermediate with cool-season and winter-annual pastures. The consequences of feeding 100 mg/hd/d are much more severe than just reduced mean growth rate response. For all forage types, except warm-season, 95% confidence intervals approached zero, indicating the potential for small Bovatec responses when 100 mg of Bovatec is supplemented. This scenario can be easily and cost effectively avoided by feeding 200 mg of Bovatec daily.

Summary

Bovatec consistently enhances growth rate across forage types when 200 mg are supplemented daily. The greatest improvements in animal performance occur when Bovatec is supplemented to cattle grazing winter-annual pastures. Cattle grazing cool-season pastures supplemented with 200 mg of Bovatec rival the ADG improvements noted with winter annuals. Growth rate enhancements noted with warm-season and mixed-season pastures are consistently positive but numerically less than noted with other forage types. Feeding 100 mg of Bovatec per day reduces growth rate responses by approximately 50% while increasing variability and the likelihood of disappointing results for all forage types except warm-season grasses.

Cattle grazing winter-annual pastures had the greatest depression in ADG response caused by under-supplementation of Bovatec, followed by cool-season and mixed-season grasses. When warm-season grasses were grazed, daily weight gain was not reduced; however, variability was still increased when compared with 200 mg of supplemental Bovatec. Results with warm-season pastures may be confounded by supplement form and level.

Growth rate enhancement is only one of the many criteria to be considered when selecting a feed additive for use in supplementation programs. Safety to cattle and other species that may inadvertently consume supplement should be considered. Supplement and consequently nutrient intakes are part of the formulation process to meet animal requirements for optimal growth. Feed additive palatability is an important consideration to insure formulated and consistent supplement intake. When all factors are considered, Bovatec remains the clear ionophore of choice for supplements provided to cattle grazing pastures and rangeland.

Literature Cited

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