

## Bovatec® for Pasture Cattle

### Summary

Bovatec is a unique feed additive that improves the nutritional value and cost effectiveness of pasture cattle supplements. It increases average daily gain of stocker and feeder cattle on different types of pasture during any season of the year.

Results of 15 research studies involving more than 1000 cattle demonstrate that Bovatec, at the recommended level of 200 mg/head/day, increased average daily gain by 11% over nonmedicated controls. This provides an extra 15 lb of liveweight gain per head per 107 days on pasture.

Bovatec is the most palatable (acceptable) feed additive of its kind for pasture cattle. Because cattle adapt quickly and easily to Bovatec, from day one they can consume a nutrient supplement containing Bovatec at the recommended level of 200 mg/head/day. Bovatec does not cause cattle to back-off the supplement.

Bovatec is the safest feed additive of its kind for pasture cattle. Dramatic changes in weather or pasture conditions may cause individual cattle in the herd to over consume supplement. Results of trials show that at levels up to 5 times greater than the recommended level of 200 mg/head/day, Bovatec did not adversely affect health and performance of pasture cattle.

In addition, Bovatec has a wide margin of safety if accidentally consumed by horses. Bovatec was shown to be 7 to 10 times less toxic to horses than Rumensin® (monensin) based on oral LD<sub>50</sub> values. However, Bovatec should not be fed to horses.

Through its unique safety and ease of adaptation, Bovatec has improved the standards of safety and palatability for a feed additive of its kind in pasture cattle.

### Bovatec Improves Cost-Effectiveness of Pasture Supplementation

#### *Enhanced Nutrition, More Beef Per Acre, Better Bottom Line*

Grazing stocker and feeder cattle on pasture enables the rancher to “market” their forage through the animals for better economic returns.

Pastures may not always provide adequate amounts of nutrients for cattle during all seasons of the year. For example, dormant pasture in late fall and winter, corn stalks in late summer and early fall, and mature perennial pasture in the summer may be nutritionally inadequate.

Nutritional supplements are fed to provide the protein, energy, vitamins and minerals that pasture alone may not supply. Nutrient supplementation helps prevent deficiencies and leads to improved growth and health.

Pasture supplements generally provide balanced nutrition required for normal weight gains of cattle. Adding Bovatec to the supplement improves weight gain over supplement alone. It accomplishes this by improving the efficiency of energy utilization in the rumen.

Consequently, Bovatec improves the cost effectiveness of pasture supplementation. The benefits to the rancher are enhanced cattle nutrition and improved growth leading to more beef per acre and a better bottom line.

### Pasture Trials

#### *Optimal Level*

Fifteen trials involving over 1000 cattle were conducted in 12 states to determine the effect of Bovatec at different levels on weight gain of cattle. Various Bovatec levels tested included 0, 50, 100, 200 and 300 mg/head/day.

**TABLE 1.** Average daily gain of cattle fed Bovatec at different levels (summary of 15 individual pasture trials).

Trial no.	Bovatec (mg/head/day)									
	0		50		100		200		300	
	(controls) lb	lb	Difference vs controls	lb	Difference vs controls	lb	Difference vs controls	lb	Difference vs controls	
C-84	1.42	–	–	1.47	3.5%	1.65	16.2%	–	–	
C-51	0.94	–	–	0.94	0.0%	0.94	0.0%	–	–	
C-171	1.42	1.51	6.3%	1.53	7.7%	–	–	–	–	
C-102	0.99	1.04	5.1%	1.05	6.1%	1.15	16.2%	–	–	
C-94A	1.08	–	–	1.10	1.9%	1.19	10.1%	1.27	17.6%	
C-79	2.17	–	–	2.24	3.2%	2.37	9.2%	2.24	3.2%	
C-103	1.34	–	–	1.55	15.7%	1.66	23.9%	–	–	
C-92	1.06	–	–	1.10	3.8%	1.13	6.6%	1.14	7.5%	
C-50	1.12	–	–	–	–	0.98	-12.5%	–	–	
C-62	1.00	–	–	–	–	1.12	12.0%	–	–	
C-91	1.11	–	–	–	–	1.32	18.9%	1.26	13.5%	
C-185	1.07	1.12	4.7%	1.25	16.8%	–	–	–	–	
C-172	1.16	1.15	-0.9%	1.23	6.0%	–	–	–	–	
C-156	1.33	–	–	1.28	-3.8%	1.39	4.5%	1.56	17.3%	
C-80	1.37	1.37	0.0%	1.45	5.8%	–	–	–	–	

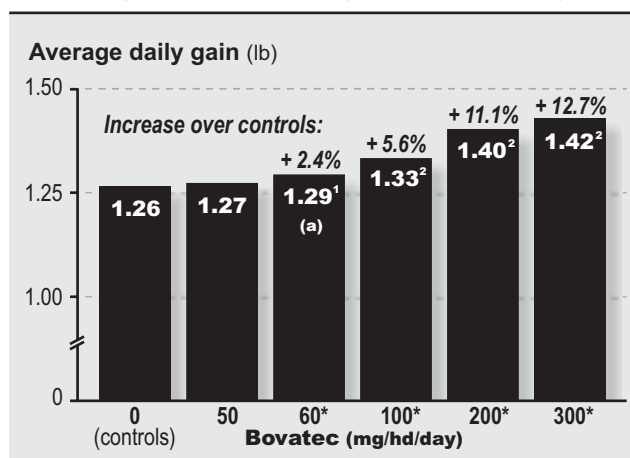
Table 1 shows the results of each trial, and Figure 1 is a pooled summary of the results.

Each trial was performed in accordance with pre-clearance guidelines for drug feed additives established by the Food and Drug Administration. Bovatec or non-medicated grain supplements were fed once daily in bunks located in the pastures. During each trial, cattle were rotated from pasture-to-pasture to reduce pasture effects on the trial results.

Appendix 1 presents information about each of the 15 individual trials. This includes location, days on trial, number of pastures per treatment group, number of cattle per pasture, type and condition of pasture, and kind and quantity of supplement fed daily. The cattle weighed an average of 569 lb initially and were on test for an average of 107 days.

As shown in Figure 1, Bovatec at 100, 200 and 300 mg/head/day significantly increased ( $P < 0.01$ ) average daily gain of pasture cattle over the nonmedicated

controls. At 200 mg/head/day, Bovatec produced an 11.1% increase in average daily gain. This improvement provides an additional 15 lb of gain per head per 107 days on pasture.

**FIGURE 1:** Effect of various Bovatec levels on average daily gain of pasture cattle (summary of 15 trials).

<sup>a</sup> Extrapolated; \* Approved dose (200 mg/hd/day is the recommended dose); <sup>1</sup>  $P < 0.05$ ; <sup>2</sup>  $P < 0.01$

At the 300 mg/head/day level, the improvement in weight gain was not significantly increased over that at 200 mg/head/day. Consequently, the highest approved level is 300 mg/head/day; however, the recommended dose for pasture cattle is 200 mg/head/day.

The lowest approved level is 60 mg/head/day because it is the lowest level that would have significantly improved weight gain ( $P < 0.05$ ) over the controls. It was extrapolated from the growth responses to Bovatec at 0, 50 and 100 mg/head/day.

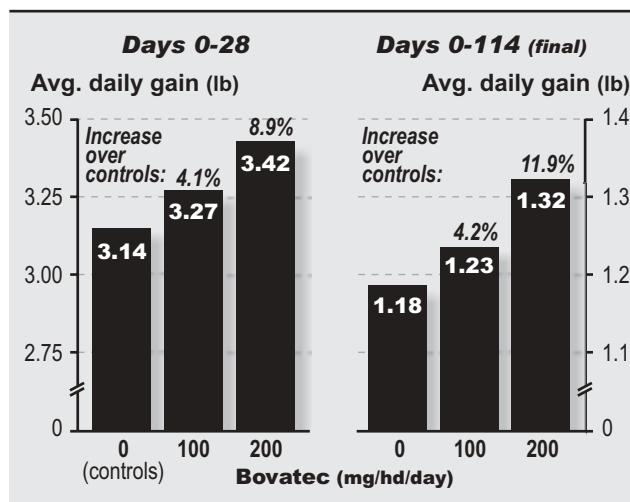
### Adaptation

Adaptation of pasture cattle to Bovatec was determined from the results from 6 of the 15 trials in which it was fed at 100 or 200 mg/head/day during the first 28 days. The cattle included in the studies had an average initial weight of 593 lb.

During the first 28 days, the full Bovatec and nonmedicated supplements were consumed. The results show that Bovatec improved weight gain over the nonmedicated controls during this period (Figure 2). Feeding 100 mg of Bovatec/head/day during the first 28 days improved weight gain by 4.1%; whereas 200 mg of Bovatec/head/day improved weight gain by 8.9%.

These data show that pasture cattle adapt quickly and easily to Bovatec. From day one they can consume a supplement containing Bovatec at the recommended level of 200 mg/head/day. No step-up program is required. Bovatec is the most palatable feed additive of its kind for pasture cattle.

FIGURE 2: Adaptation of pasture cattle to Bovatec (summary of 6 trials).\*



\* Trials C-51, C-84, C-92, C-102, C-103 and C-156

Data from the entire 114-day grazing period suggest that Bovatec improvements in weight gain over controls were higher than during the first 28 days. Feeding Bovatec at 100 mg/head/day resulted in a 4.2% improvement in growth rate compared with nonmedicated cattle. However, Bovatec fed at 200 mg/head/day improved growth rate by 11.9% compared with nonmedicated cattle. Clearly, feeding Bovatec at the recommended dose (200 mg/head/day) results in a greater improvement in growth rate and return on investment.

TABLE 2. Effect of Bovatec (200 mg/hd/day) on average daily gain of cattle on different types of pasture (summary of 11 trials).

Type of pasture	No. of trials	Trial numbers	ADG controls (lb)	ADG Bovatec (lb)	Bovatec increase vs controls
Bromegrass	3	C-79, C-103 & C-156	1.61	1.81	12.4%
Fescue, clover and on mixed pastures	6	C-50, C-51, C-62, C-84, C-91 & C-92	1.11	1.19	7.2%
Alfalfa and orchardgrass	1	C-94A	1.08	1.19	10.2%
Stargrass	1	C-102	0.99	1.15	16.2%

**TABLE 3.** Effect of Bovatec (200 mg/hd/day) on weight gain of cattle on cool-season pastures.

Location	Trial no.	Sex	Avg. initial wt. (lb)	Days on test	No. cattle/treatment	Pasture type	Supplement type	Suppl. (lb/hd/day)	ADG controls (lb)	ADG Bovatec (lb)	Bovatec inc. vs controls
Oklahoma	C-203 & C-83-86**	Heifers	475	100*	9	Winter wheat	Corn	2	2.27	2.51	10.6%
Texas	C-67	Heifers	480	100	14 to 16	Winter oat	Milo	1	1.12	1.28	14.3%
Texas	C-68	Heifers	450	64	10	Rye-wheat	Milo	1	2.31	2.55	10.4%
<b>Average:</b>									<b>1.90</b>	<b>2.11</b>	<b>11.10%</b>

\* Average of 2-year study.  
\*\* Reference #4 in Literature Cited

### Efficacy in Different Types of Pasture and Seasons

Pasture trial data confirm that Bovatec improves weight gain of cattle on different types of pasture during any season of the year. The effects of Bovatec on average daily gain of cattle on different types of pasture are shown in Table 2. The data are from 11 of the above 15 trials in which Bovatec was fed at the recommended level of 200 mg/head/day. These trials were conducted on cool and warm season grasses; 10 were initiated during April to July and one was started in December.

The results show that Bovatec improved weight gain of cattle on bromegrass; fescue, clover and/or mixed pastures; alfalfa and orchardgrass; and stargrass over the nonmedicated controls.

An additional three trials were conducted with Bovatec on cool season wheat, rye and/or oat pastures. Bovatec at 200 mg/head/day increased average daily gain by 11.1 % over the nonmedicated controls (Table 3).

### More Cost-Effective Pasture Supplementation

The nutrient content of lush growing spring and early summer pasture generally helps maintain normal weight gains of stocker cattle. However, the nutrient content of pasture may become deficient when it matures and dries-up starting in the late summer and continuing through the fall and winter. Figure 3, for example, shows that during these months, range forage may not supply the amounts of digestible forage required by a 550-lb yearling steer for average daily gains of 1.10 and 2.20 lb.<sup>3</sup>

Feeding a good quality protein supplement during the months when pasture may be protein-deficient will supply the amounts that cattle require for normal weight gains.

Bovatec improves the cost-effectiveness of pasture supplementation. Adding Bovatec to the supplement improves weight gains over the supplement and pasture alone. The pooled summary of the 15 trials, described previously, shows that Bovatec at the recommended level of 200 mg/head/day increased average daily gain by 0.14 lb over the nonmedicated controls. Applying this improvement to the data in Figure 3, Bovatec would increase the average daily gains of 1.10 and 2.20 lb to 1.24 and 2.34 lb, respectively.

**FIGURE 3:** Comparison of amount of digestible nitrogen (DN) required by 550-lb yearling steer for maintenance and growth to amount supplied by range forage.<sup>3</sup>

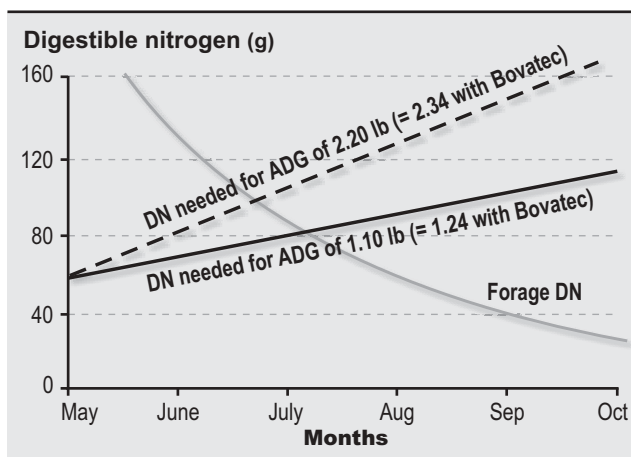


TABLE 4. Effect of Bovatec on average daily gain of pasture cattle (2 safety trials).

Trial no.	Sex	Avg. initial wt. (lb)	Days on test	No. cattle/treat.	Pasture type	Supplement type	Suppl. (lb/hd/day)	ADG controls (lb)	Bovatec (mg/hd/day)			
									ADG 200 (lb)	Increase over controls	ADG 600 (lb)	ADG 1000 (lb)
C-161	Steers	500	90	8	Brome	Corn	1	0.95	1.54	62.1%	1.21	1.30
A-178	Steers	615	98	8	Fescue, orchard-grass & bluegrass	Corn	1	1.85	2.14	15.7%	1.76	1.79
<b>Average:</b>								<b>1.40</b>	<b>1.84</b>	<b>31.4%</b>	<b>1.49</b>	<b>1.55</b>

## Safety

### Pasture Cattle (Stocker, Feeder and Slaughter Cattle)

Bovatec is the safest ionophore for pasture cattle. Results of safety trials demonstrate that feeding Bovatec at levels of up to 1000 mg/head/day for 90 or 98 days did not adversely affect health and performance of pasture cattle (Table 4).

Within the 2 safety studies, feeding Bovatec at the recommended level of 200 mg/head/day increased average daily gain by 31.4% over nonmedicated controls.

### Breeding Cattle

Trials conducted to test the safety of Bovatec in breeding cattle on pasture are discussed as follows:

#### Replacement Heifers –

Bovatec was fed at 200 mg/head/day in a protein supplement to replacement heifers fed low or high energy rations

on pasture in a 168-day safety trial.<sup>1</sup> The heifers were examined twice daily for estrus activity (heat) and artificially inseminated during a 60-day breeding season.

Weight gains of the Bovatec-fed heifers were better than those of the nonmedicated controls on the low and high energy rations (Table 5).

In addition, Bovatec did not adversely affect sexual development. In the Bovatec-fed heifers fed the low energy ration, first heat appeared in fewer days than in the controls. There were no significant differences in the number of days in which first heat appeared in the Bovatec-fed heifers and controls on the high energy ration.

Also, there were no significant differences in the pregnancy rates of the Bovatec-fed heifers and controls on the low or high energy rations.

TABLE 5. Safety of Bovatec in replacement heifers on pasture (trial C-126, 168 days on test).

Type of ration	Target ADG (lb)	Bovatec level (mg/hd/day)	No. cattle	Actual ADG		Days from start of trial to when following % heifers in 1st heat		Pregnant (%)
				lb	Index	50%	75%	
Low-energy	0.75	0	30	0.81	100	115	140	87
Low-energy	0.75	200	30	1.02	126	94	108	97
High-energy	1.25	0	30	1.24	100	99	115	87
High-energy	1.25	200	30	1.44	116	106	125	86

**TABLE 6.** Safety of Bovatec (200 mg/head/day) in breeding bulls on pasture (trial C-115).<sup>2</sup>

	Nonmedicated controls	Bovatec
No. cattle	12	12
Average daily gain (lb)	1.56	1.72
Average daily gain (index)	100	110
Average daily feed intake (lb)	16.1	15.8
Feed efficiency (lb feed/lb gain)	10.3	9.2
Age at puberty (days)	463	436
Weight at puberty (lb)	825	805
Testicular volume (cm <sup>3</sup> )	56	91

#### Breeding Bulls –

Bovatec was fed at 200 mg/head/day in a supplement to breeding bulls on coastal bermuda grass hay pasture in a safety trial.<sup>2</sup> The Bovatec-fed bulls gained weight faster and converted feed more efficiently than the nonmedicated controls (Table 6). Average daily feed intakes of the Bovatec and control bulls were not significantly different.

In addition, Bovatec did not adversely affect sexual development. Bulls fed Bovatec reached puberty sooner and their testicular volume at puberty was greater compared to the controls (determined by length × width × depth of testicle).

#### Horses

Horses are frequently exposed to a drug feed additive fed to pasture cattle. Bovatec has been shown to be 7 to 10 times less toxic to horses than Rumensin based on oral LD<sub>50</sub> values (Table 7).<sup>5</sup>

Additional test results indicate that Bovatec in a concentrated premix form is not palatable to horses, minimizing the risk of accidental intake of Bovatec Premix. Horses were exposed to Bovatec premixes at concentrations of 45, 60, 80 and 227 g/lb. They did not consume any of the Bovatec premixes.

In another study, horses were offered and consumed a pelleted ration containing 113 g of Bovatec per ton. They refused to eat the unpelleted mash containing this level.

**TABLE 7.** Comparative oral LD<sub>50</sub> values of Bovatec and Rumensin in horses.<sup>5</sup>

	Estimated oral LD <sub>50</sub> in horses	
	mg/kg BW	mg/lb BW
Bovatec	21.5	9.8
Rumensin	2 to 3	0.9 to 1.4

In addition, horses ate a ration providing Bovatec at 1.52 to 1.88 mg/kg (0.7 to 0.9 mg/lb) of body weight per day for 11 days and showed no toxicity signs. These Bovatec feeding rates were 7 to 9% of the oral LD<sub>50</sub> of Bovatec in horses. These would provide a 1000-lb horse with Bovatec at levels of 700 to 900 mg/head/day which are 3.5 to 4.5 times greater than the recommended level of 200 mg/head/day for pasture cattle.

Bovatec, however, should not be fed to horses.

#### Literature Cited

1. Coroh, L., and J. Riley. 1984. Effect of lasalocid on the sexual development of beef heifers. Report of Progress No. 448, 1984 Cattleman's Day. Kansas State Univ. Agr. Expt. Sta.
2. Neuendorff, D.A., L.M. Rutter, D.R. Hardin, L. A. Peterson, J. Schenk and R. D. Rondel. 1983. The effect of lasalocid on growth and pubertal development in Brahman bulls. J Anim Sci 57, Suppl. 1:17 (Abstr.).
3. Raleigh, R.J. Chapter 9. "Range cattle nutrition" in D.C. Church. 1974. *Digestive Physiology and Nutrition of Ruminants*. Vol. 3. Practical nutrition. p. 188.
4. Anderson, M.A., G.W. Horn and R.W. McNew. 1985. Effect of lasalocid on weight gain, forage intake and rumen fermentation of stocker cattle grazing winter wheat pasture. Annual Meeting Southern Section ASAS (Abstr.)
5. Hanson, L.J., H.G. Eisenbeis and S.V. Givens. 1981. Toxic effects of lasalocid in horses. Am J Vet Res 42:456.

## APPENDIX 1. Procedures of 15 individual pasture trials.

Location	Trial no.	Sex	Avg. initial wt (lb)	Days on test	Dates of trial	No. pastures/treatment group					No. cattle/pasture
						Bovatec (mg/head/day)					
						0	50	100	200	300	
Arkansas	C-84	Steers	760	90	4/15-7/14	3	–	3	3	–	7
Arkansas	C-51	Steers	475	113	7/23-11/13	2	–	2	2	–	8
Colorado	C-171	Heifers	510	98	6/10-9/16	4	4	4	–	–	8
Florida	C-102	Heifers	530	112	6/8-9/28	3	3	3	3	–	16
Illinois	C-94A	Steers	520	112	5/5-8/26	2	–	2	2	2	10
Kansas	C-79	Steers	550	102	4/7-7/24	4	–	4	4	4	4 & 7
Kansas	C-103	Steers	640	112	6/24-10/14	3	–	3	3	–	8
Kentucky	C-92	Steers	460	112	5/16-9/5	2	–	2	2	2	8
Missouri	C-50	Steers	485	112	4/29-8/19	3	–	–	3	–	5
Missouri	C-62	Steers	465	105	12/16-3/31	4	–	–	4	–	5
N. Carolina	C-91	Steers	660	126	4/30-9/3	3	–	–	3	3	8
Oregon	C-185	Steers	610	91	8/19-11/18	4	4	4	–	–	5
S. Carolina	C-172	Steers	555	98	7/15-10/22	3	3	3	–	–	7
S. Dakota	C-156	Steers	690	142	5/26-10/15	4	–	4	4	4	4
Tennessee	C-80	Heifers	625	84	4/16-7/9	5	5	5	–	–	3

## APPENDIX 1. (continued) Procedures of 15 individual pasture trials.

Location	Trial no.	Pasture type	Pasture condition	Supplement	
				Type	Feed rate (lb/hd/day)
Arkansas	C-84	Fescue, clover, bermudagrass, rye & wheat	Abundant forage	Sorghum	6-10
Arkansas	C-51	Bermudagrass from 7/22-10/13, then fescue from 10/14-11/13	Pasture irrigated when forage limited. Switched to fescue when season changed.	Corn	2
Colorado	C-171	Bromegrass & wheatgrass	Excellent quality pasture	Corn	2
Florida	C-102	Stargrass	Marginal quality pasture at end of trial due to heavy rain.	Corn	1
Illinois	C-94A	Alfalfa & orchardgrass	Adequate pasture	Corn	2
Kansas	C-79	Bromegrass	Abundant pasture	Wheat middlings	2
Kansas	C-103	Bromegrass	Adequate pasture	Sorghum	3-5
Kentucky	C-92	Clover, bluegrass, orchardgrass & fescue	Good-excellent quality pasture	Corn	1
Missouri	C-50	Fescue	Forage adequate from day 0-56, then hot, dry, poor quality up to day 112.	Corn	2
Missouri	C-62	Fescue	Dormant pasture. Fescue hay available when snow on pasture.	Corn	4
N. Carolina	C-91	Fescue, orchardgrass & clover	Drought. Limited pasture. Oat hay fed from 8/11-8/14.	Corn	2
Oregon	C-185	Clover, fescue & ryegrass	Pasture inadequate at start of trial due to dry summer weather. Hay fed at two ranches, then discontinued at one ranch. Fall rain improved pasture.	Corn	2
S. Carolina	C-172	Bermudagrass	Pasture deteriorated rapidly after light frost in early-October	Corn	2
S. Dakota	C-156	Bromegrass	Moisture above average. Pasture clipped in mid-August to remove seed stalks.	Corn	2.1
Tennessee	C-80	Fescue	Dormant, marginal quality pasture during summer.	Corn	2