

LONG-TERM EFFECTS OF MONENSIN SUPPLEMENTATION ON
PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF BEEF COWS ¹²

H. A. Turner and D. C. Young ³
Eastern Oregon Agricultural Research Center
Burns, Oregon 97720

Summary

This study was designed to investigate the effects of wintering cows on a supplement containing monensin on cow and calf production over a 3-year period. Hereford x Angus cows (123) were stratified by age, weight, production index and age of fetus and randomly assigned to 3 treatments, control (C), monensin daily (D) and monensin 3 times/week (T) with all cows receiving the equivalent of .91 kg of a barley based supplement and D and T receiving the equivalent of 200 mg of monensin/day with a full feed of meadow hay during the winter and on range thereafter. Supplements were initiated in late November and terminated in mid-June (204 days) with calves dropped during March through May and weaned in early September. In Year 1, precalving, end of supplement period and weight at weaning cow weights were all significantly increased over the controls in the monensin treatment groups ($P < .05$). Calf weaning weights and conception rates were improved by the monensin treatments. The effects of monensin diminished in subsequent years. Pooled data over the 3 years show pre-calving weight changes for C, D and T, respectively, were $+34 \pm 1.33$, $+34 \pm 1.56$ and $+35 \pm 1.31$ kg ($P > .05$); at the end of the supplement period -13 ± 1.50 , -9 ± 1.48 ($P < .05$) and -9 ± 1.34 kg ($P < .05$); and weight change at weaning -18 ± 1.94 , -14 ± 1.82 and -18 ± 1.80 kg ($P > .05$). Birth weights were $36 \pm .39$, $37 \pm .38$ and $36 \pm .41$ kg ($P > .05$), respectively, for C, D and T with adjusted weaning weights of 148 ± 1.80 , 150 ± 1.68 and 151 ± 1.75 kg ($P > .05$) and conception rates of 91, 93 and 95% ($P > .05$) and calving intervals of 367 ± 2.75 , 368 ± 2.37 and 366 ± 3.03 days ($P > .05$). Overall calf production per cow was increased 2 kg and 7 kg by the monensin supplements over the controls. Results indicate a positive response to monensin in overall calf production, however, responses were less in Years 2 and 3.

Introduction

Monensin is a biologically active compound produced by *Streptomyces cinnamonensis* (Haney and Hoehn, 1967). The compound improves feed efficiency in the ruminant by increasing the concentration of propionic acid and reducing acetic and butyric, with total volatile fatty acids remaining the same (Raun et al., 1974b; Dinius et al., 1976). Monensin reduces feed intake without a reduction in daily gain of feedlot cattle (Brown et al., 1974; Raun et al., 1974a), increases gains of pasture-fed cattle (Potter et al., 1974; Oliver, 1975) and improves feed efficiency and body condition for wintering gravid cows (Turner et al., 1977).

With the feeding of monensin and low quality roughages that do not meet the maintenance requirements of cows, the increased energy utilization reduces or eliminates the need for supplementation. Where cow condition is adequate for maximum production and reproduction, and additional gain is not desired and the hay meets or exceeds the maintenance requirements of the cow, feeding monensin reduces the amount of hay needed (Turner et al., 1980).

This study was designed to determine the long-term effects of wintering cows each year on a supplement containing monensin on cow and calf production traits and reproduction performance of the cows. Intermittent feeding of monensin was also evaluated.

Materials and Methods

One hundred-twenty three gravid spring-calving Hereford and Hereford x Angus cows 2 to 9 years old were stratified by age, weight, condition score, breeding date, breed of cow and production index, with the groups randomly allotted to three treatments and three blocks within treatments. Animals were blocked by age, with years serving as replications. The trial was conducted over a 3-year period with cows remaining on their respective treatments for the entire duration. Treatments included a control group receiving no monensin (C) and groups receiving the equivalent of 200 mg of monensin daily (D) or three times per week (T).

Cows were gathered daily and separated by treatment for supplementation. All cows were individually identified by ear tags. The supplement was a barley-based pellet with wheat, alfalfa, beet pulp, cottonseed meal, molasses, salt, trace minerals and vitamins with salt also being fed free choice. Cows received the equivalent of .91 kg per head per day with the C and D groups receiving theirs over a 6-day period and the T's on alternate days over a 3-day period during the week. Feed bunk space was adequate to allow room for all cows to eat at the same time. During the winter, cows received a full feed of native meadow hay and during the remainder of the year were on range made up of native desert range species and crested wheatgrass pastures. Cows were fed and grazed together except in year 1 when the heifers (young block) were fed separate from the mature cows. Salt and water were available at all times.

Prior to and during the trial, cows were bred artificially with Hereford cows bred to a single Angus sire each year and Hereford x Angus cows bred to a single Hereford sire. Red Poll or Hereford x Angus cleanup bulls were utilized at the end of the breeding season. Calves were dropped in March, April and May and weaned in early September. Cows were pregnancy checked by rectal palpation prior to the supplemental feeding period each year with open cows culled. The supplemental feeding treatments were initiated in late November and terminated in mid-June.

¹Oregon State University Agricultural Experiment Station Technical Paper No. 7411.

²Monensin and financial assistance was provided by Eli Lilly and Co.

³Address: Eli Lilly and Co., Vancouver, WA 98986.

Individual cow body weights and condition scores, based on a 1 to 9 system with 1 being very thin and 9 very fat, were taken at the start of the trial and every 28 days thereafter to the end of the supplementation period and at weaning. Cows were weighed after an overnight removal from feed and water. Calves were weighed and identified by ear tag at birth and weighed at weaning. Weaning weights were adjusted for sex based on the entire cow herd for each year and for age with weights adjusted to 148 days. Birth dates were recorded for calving interval calculations.

Data were analyzed using analysis of variance procedures and Duncan's new multiple range test for determining significant differences among means with chi square tests used on data involving percentages (Steel and Torrie, 1960).

Results and Discussion

Cow weight changes are presented in table 1. During the first year, supplements containing monensin increased cow gains at all stages up through weaning ($P < .05$), with no differences between daily or alternate day feeding of monensin ($P > .05$). Precalving cow weight gain was less ($P < .05$) on the daily monensin treatment than the controls in year 2 of the study with all other weight gains or losses similar ($P > .05$) between treatments. There were no significant differences between treatments in year 3 ($P > .05$). Pooling the data over 3 years, weight gain prior to calving was similar between treatments ($P > .05$) with monensin fed daily or on alternate days reducing weight loss ($P < .05$) beyond calving up to the end of the supplement period. Weight losses at weaning were not different ($P > .05$). Condition scores (table 2) indicate that the cows on all treatments were in average or thrifty condition, with changes in scores essentially following the same trends as the weight changes.

These results indicate that the first year gave a typical response to monensin feeding, as reported by Turner *et al.*, 1977, with a substantial increase in body weight gain over the winter period. However, in the earlier studies the same response was obtained in the second year with the same cows remaining on their respective treatments. In this study, the effects of monensin on weight gains diminished in the second and third years. The length of rumensin feeding was 85 and 98 days in the previous studies whereas it averaged 204 days each year in this study. The increased length of the supplemental period may have contributed to the different results either due to a diminishing response by the microorganisms to monensin or less time between periods of increased gains for cows to reequilibrate back to a common condition and weight.

Turner, *et al.*, 1980, reported that when body weight gain or loss was held constant, monensin fed at ratios of 50, 200 or 300 mg per head per day reduced hay requirements of cows by 7 to 13%. An improvement in feed efficiency was also reported by Turner *et al.*, 1977, where cow weight gains were improved by monensin with a corresponding reduction in hay intake. Feed efficiency could not be calculated in this trial as all treatment groups were fed as a unit and feed intake was not measured.

Calf performance data are presented in table 3. Birth weights and actual weaning weights were not different ($P > .05$) between treatments. Monensin fed on alternate days increased adjusted weaning weights over the controls in year 1 ($P < .05$) with

monensin fed daily being intermediate ($P > .05$). There were no significant differences in the second or third years or overall. These results also indicate the effect of monensin possibly diminished over time.

Conception rates (table 4) were 91, 93 and 95% for the control, monensin fed daily and monensin on alternate days treatments ($P > .05$), respectively, with calving intervals of 367, 368 and 366 days ($P > .05$). One more year of calving information will be collected to complete the calving interval data. Total number of calves weaned were 105, 106 and 109 for the control, daily monensin and alternate day monensin and alternate day monensin groups, respectively, with production per cow per year being 127, 129 and 134 kg. Initially, each treatment contained equal numbers of cows. Production per cow would reflect conception rates, adjusted weaning weights and death losses. Calving interval is not reflected in these figures but does not appear to have had a major effect at this time.

In summary, monensin provided a positive response on overall cow production throughout the trial, but the effect diminished over time which may be due to the long supplemental period (200+ days) each year. Cows supplemented with monensin daily or on alternate days produced 2 and 7 kg more calf per cow per year, respectively, than the controls. This was primarily due to a slight increase ($P > .05$) in conception rates, adjusted weaning weights ($P > .05$) and a higher weaning percentage. Monensin fed on alternate days 3 days per week was at least equal to or superior to monensin fed 6 days per week.

Literature Cited

- Brown, H. L., L. H. Carroll, N. G. Elliston, H. F. Grueter, J. W. McAskill, R. D. Olson and R. P. Rathmacher. 1974. Field evaluation of monensin for improving feed efficiency in feedlot cattle. *Proc. Western Sec. ASAS* 25:300.
- Dinius, D. A., M. E. Simpson and P. B. Marsh. 1976. Effect of monensin fed with forage on digestion and the ruminal ecosystem of steers. *J. Anim. Sci.* 42:229.
- Haney, M. R., Jr. and M. Hoehn. 1967. Monensin, a new biologically active compound. I. Discovery and isolation. *Antimicrob. Agents and Chemothe.* p. 349.
- Oliver, W. N. 1975. Effect of monensin on gains of steers grazed on Coastal Bermudagrass. *J. Anim. Sci.* 41:999.
- Potter, E. L., C. O. Cooley, A. P. Raun, L. F. Richardson and R. P. Rathmacher. Effect of monensin on daily gain of cattle on pasture. *Proc. Western Sec. ASAS*. 25:343.
- Raun, A. P., C. O. Cooley, E. L. Potter, L. F. Richardson, R. P. Rathmacher and R. W. Kennedy. 1974a. Effect of monensin on feed efficiency of cattle. *J. Anim. Sci.* 39:250 (Abstr.).
- Raun, A. P., C. O. Cooley, R. P. Rathmacher, L. R. Richardson and E. L. Potter. 1974b. Effect of different levels of monensin on feed efficiency, ruminal and carcass characteristics of cattle. *Proc. Western Sec. ASAS*. 25:346.
- Steel, R. G. D. and J. H. Torrie. 1960. *Principles and Procedures of Statistics*. McGraw-Hill Book Co., Inc., New York.
- Turner, H. A., R. J. Raleigh and D. C. Young. 1977. Effect of monensin on feed efficiency for maintaining gestating mature cows on meadow hay. *J. Anim. Sci.* 44:338.

TABLE 3. CALF PERFORMANCE^a

Treatment ^b	Birth weight	Actual weaning weight kg	Adjusted ^c weaning weight
Year 1			
Control	35 ±.62 ^d	142 ±4.26 ^d	142 ±2.80 ^d
Monensin-daily	36 ±.71 ^d	147 ±4.12 ^d	145 ±2.64 ^{de}
Monensin-alternate	36 ±.55 ^d	148 ±4.07 ^d	151 ±2.77 ^e
Year 2			
Control	37 ±.74 ^d	151 ±4.08 ^d	150 ±2.79 ^d
Monensin-daily	38 ±.54 ^d	151 ±4.05 ^d	152 ±2.87 ^d
Monensin-alternate	37 ±.83 ^d	153 ±3.98 ^d	153 ±3.38 ^d
Year 3			
Control	37 ±.62 ^d	161 ±4.41 ^d	152 ±3.75 ^d
Monensin-daily	37 ±.73 ^d	156 ±4.82 ^d	151 ±3.39 ^d
Monensin-alternate	37 ±.75 ^d	153 ±4.21 ^d	148 ±2.99 ^d
Overall			
Control	36 ±.39 ^d	151 ±2.56 ^d	148 ±1.80 ^d
Monensin-daily	37 ±.38 ^d	151 ±2.48 ^d	150 ±1.68 ^d
Monensin-alternate	36 ±.41 ^d	151 ±2.35 ^d	151 ±1.75 ^d

^a Means ± standard error.^b See footnote b in table 1.^c Adjusted to a common age of 148 days with sex adjustment based on the entire herd average average with a 4%, 5% and 2% upward adjustment for helpers in year 1, 2 and 3, respectively.^d Means within a column and within a time period with different superscripts differ (P<.05).

TABLE 4. REPRODUCTIVE PERFORMANCE

Treatment ^a	Number	Conception rate %	Calving ^b Interval Days
Year 1			
Control	41	90 ^c	365 ±4.34 ^c
Monensin-daily	40	93 ^c	366 ±3.39 ^c
Monensin-alternate	40	98 ^c	369 ±4.76 ^c
Year 2			
Control	37	86 ^c	370 ±3.11 ^c
Monensin-daily	37	92 ^c	370 ±3.28 ^c
Monensin-alternate	38	97 ^c	373 ±3.37 ^c
Year 3			
Control	31	97 ^c	X
Monensin-daily	30	97 ^c	X
Monensin-alternate	37	89 ^c	X
Overall			
Control	109	91 ^c	367 ±2.75 ^b
Monensin-daily	107	93 ^c	368 ±2.37 ^b
Monensin-alternate	115	95 ^c	366 ±3.03 ^b

^a See footnote b in table 1.^b Means ± standard error. Cows had not calved the fourth year for figuring interval for year 3. Cows not weaning a calf were excluded from the data.^c Means within a column and within a time period with different superscripts differ (P<.05).

TABLE 1. COW WEIGHT CHANGES^a

Treatment ^b	Initial ^c weight	Precalving ^c change	End of treatment ^c change	Weaning ^c change
kg				
Year 1				
Control	403	+36±1.82 ^d	0±2.63 ^d	+10±2.72 ^d
Monensin-daily	401	+42±1.75 ^e	+10±2.73 ^e	+20±3.05 ^e
Monensin-alternate	401	+41±1.78 ^e	+11±2.41 ^e	+22±2.63 ^e
Year 2				
Control	448	+24±2.06 ^d	-17±2.32 ^d	-28±2.80 ^d
Monensin-daily	450	+18±1.88 ^e	-21±2.10 ^d	-34±2.67 ^d
Monensin-alternate	459	+22±1.78 ^{de}	-17±2.33 ^d	-35±2.76 ^d
Year 3				
Control	469	+42±1.88 ^d	-23±2.89 ^d	-42±3.81 ^d
Monensin-daily	463	+43±2.33 ^d	-19±2.62 ^d	-35±3.71 ^d
Monensin-alternate	469	+42±1.64 ^d	-19±2.09 ^d	-43±3.50 ^d
Overall				
Control	437	+34±1.33 ^d	-13±1.50 ^d	-18±1.94 ^d
Monensin-daily	435	+34±1.56 ^d	-9±1.48 ^e	-14±1.82 ^d
Monensin-alternate	441	+35±1.31 ^d	-9±1.34 ^e	-18±1.80 ^d

^a Means ± standard error.^b Control and monensin-daily received their pelleted supplement 6 days per week with the monensin-alternate 3 days per week. All cows received the equivalent of .91 kg per head per day with the monensin groups receiving the equivalent of 200 mg per head per day.^c Initial weight represents the weight at the start of the supplement period each year; with precalving change recorded prior to the birth of the first calf; end of treatment change being the last day of the supplement period; and weaning weight change at weaning. All changes are accumulative to that point from the initial weight and only include cows that had a live calf in the end of treatment change and that weaned a calf in weaning change.^{de} Means within a column and within a time period with different superscripts differ (P<.05).TABLE 2. COW CONDITION SCORES^a

Treatment ^b	Initial ^c score	Precalving ^c score	End of treatment ^c score	Weaning ^c score
Year 1				
Control	4.8	5.0	4.6	5.2
Monensin-daily	4.8	5.1	4.7	5.3
Monensin-alternate	4.5	4.7	4.6	5.2
Year 2				
Control	5.1	5.2	5.0	5.1
Monensin-daily	5.5	5.2	4.8	5.3
Monensin-alternate	5.2	5.1	4.6	5.1
Year 3				
Control	5.1	5.5	4.9	5.1
Monensin-daily	5.1	5.5	4.8	5.0
Monensin-alternate	5.3	5.3	4.6	4.9
Overall				
Control	5.0	5.2	4.8	5.1
Monensin-daily	5.1	5.3	4.8	5.2
Monensin-alternate	5.0	5.0	4.6	5.1

^a 1 = very thin, 9 = very fat^b See footnote b from table 1^c See footnote c from table 1 and insert score in place of weight