

EFFECTS OF SUPPLEMENTATION WITH LASALOCID AND SYNCHRONIZATION WITH MELENGESTERAL ACETATE ON HEIFERS TO IMPROVE REPRODUCTIVE EFFICIENCY¹

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ABSTRACT

Forty crossbred heifers were utilized in an experiment at the Sam Houston State University Country Campus Agricultural Complex to determine the effects of an ionophore (lasalocid) and a synchronization feed additive (melengesterol acetate) on improving weight gains and reproductive efficiency in first estrus heifers. Ten heifers each were assigned to four equal size paddocks in a randomized block design for 136 days with feeding treatments consisting of; (1) oat/rye forage + 2 lbs/head/day cottonseed meal(csm) + lasalocid, (2) oat/rye forage + csm, (3) dormant pasture + bermudagrass hay + csm with lasalocid, and (4) dormant pasture + bermudagrass hay + csm.

The last nine days of the trial, each treatment group was randomly divided into two equal groups (20 animals each) with all heifers fed .5 mg/hd/d of melengesterol acetate (MGA) in the csm. One group was then injected with 25 mg each of prostaglandin to encourage heat synchronization. All animals were inseminated via artificial insemination techniques 80 hrs. later.

Analyses of variance indicate that the oat/rye forage was responsible for greater weight gains and larger frame sizes regardless of lasalocid supplementation. The synchronization treatment did not result in improved conception rates among the heifers via artificial insemination techniques, however 70% of the heifers were bred within 60 days following the treatment period.

Key words: Melengesterol acetate, lasalocid, forage, estrus synchronization

INTRODUCTION

Productivity of beef cattle depends on reproductive efficiency and is often measured by the number of offspring per breeding animal per unit of time. Reproductive management in turn, relies on using the resources available to the best advantage. Heifers that conceive early in their breeding season have a greater probability of weaning more and heavier calves during their lifetime (Burriss and Priode, 1958; Lesmeister et al., 1973). In most management systems, replacement heifers are bred for production of the first calf at approximately 24 months of age, thus they must conceive at 14 to 16 months of age. Management techniques affecting puberty and attainment of puberty must be considered an important management goal.

Heifer Management

Rate of gain from weaning until puberty has a marked effect on age at first estrus (Wiltbank et al. 1969; Lamond, 1970; Fleck et al. 1980; Lemenager et al. 1980). Short and Bellows (1971) determined the effects of weight gains on puberty and subsequent reproduction in heifers assigned to gain .23, .45, or .68 kg daily during the first 152 day wintering period following weaning. Twenty percent of the heifers fed the low level supplement failed to show estrus during the first 20 day period compared to 62% and 60% for heifers from the moderate and high groups, respectively. These results do not mean that excessive feeding is desirable. In addition to incurring unneces-

sary cost, Arnett et al. (1971) summarized data indicating that overfeeding of heifers had a detrimental effect on fertility and milk production.

Because puberty is correlated with body weight, Lamond (1970) suggested the use of a target weight concept to assure adequate nutrition to reach a given body weight in developing replacement heifers.

Nutrition

Most cattle will spend their lives grazing medium to low quality forages. Large numbers of cattle will also receive substantial proportions of their feed requirement from crop aftermath, winter cover crops, and by-products from grain and oilseed processing. An understanding of the factors that affect the ability of a ruminant to utilize such feed sources is essential. A wide variety of forage species are utilized and great differences in quality can occur within a single forage species due to management practices, climate, and other factors. Each of these may affect the growth of a young animal.

As most forage plants mature, they increase in fiber content and generally become lower in protein. Because the fibrous fractions of a forage are less digestible and require more time for digestion than the non-fibrous fractions, forage intake and total energy intake generally decline as forage matures.

It takes less time for rumen bacteria to digest less fibrous material or higher quality feeds. Because the rumen is filled to capacity with most forage diets, any factor that speeds the passage of the diet through the rumen will allow the animal to consume more feed. The digestibility of less fibrous forage is also higher and the combination of higher intake and higher digestibility greatly increases the total energy intake of ruminants fed high quality forages. The intake of digestible energy can be as much as 3 times higher for very high quality hay than for poor quality forage (Neumann and Lusby, 1986).

Supplementation can improve the performance of cattle consuming forages. The primary consideration in utilizing any supplement is the performance and profitability which can be obtained from such. Protein supplementation can increase total energy intake by increasing the rate of digestion of the forage, allowing the forage to move more quickly through the rumen. Since rumen fill is the major factor limiting intake of most forages, a decreased retention time permits more forage to be consumed allowing the animal to maintain or gain more weight (Neumann and Lusby, 1986).

Feed Additives

Studies have shown that feeding ionophores will hasten puberty in heifers (Moseley et al. 1977). Moseley et al. (1982) found that this effect was not due to increased gain or body weight, which tends to agree with the findings of Bushmich et al. (1980) who reported monensin, an ionophore, enhanced ovarian response to gonadotropic stimulation. These findings are important since they indicate another tool that can be utilized in heifer management. The research also suggests metabolic- endocrine relationships may be acting in the bovine and that other ionophores, such as lasalocid (BovatecTM) may also have positive effects on puberty and/or reproduction. Monensin and lasalocid are antibiotic feed additives. The term ionophore refers to the compound's capacity to aid the passage of cations across lipid membranes of cells (Bergen & Bates, 1984). Monensin and lasalocid have been approved for use in replacement heifers to improve feed efficiency and rate of weight gain.

Considerable research has shown that ionophores will increase rate of gain in cattle grazing forages of sufficient quality to permit

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gains. The result is that some types of microorganisms are selectively eliminated in the rumen and other types are left to proliferate. Ionophores alter rumen fermentation causing dose-related decreases in acetate and increases in propionate in cattle fed either low or high roughage diets. This shift in volatile fatty acids (VFA) is associated with a decrease in methane production, and no accumulation of gaseous hydrogen (Muir 1985), resulting in a selective effect of rumen bacteria. This shift reduces energy losses during fermentation and makes the digestion process more efficient. Ionophores also tend to increase retention time of most feedstuffs in the rumen thus less feed is required to obtain the same amount of gain as compared to an animal not receiving the ionophore.

Hormonal Control

Induction of a fertile estrus in prepuberal heifers given various hormonal treatments has been reported (Neville and Williams, 1973; Short et al. 1976; Burfening, 1979). Success rates have been variable and appears to be associated with age and weight of the heifer. Melengesterol acetate (MGA), a synthetic progesterone, has been found to induce early estrus in heifers. Melengesterol acetate is utilized by the feedlot industry as a feed additive to suppress estrus in feedlot heifers and as yet is not approved by FDA for breeding cattle. Research indicates that before estrus can occur, the heifer's body must be near puberty, fully sexually developed and ready to take over the cycle by itself. Recent studies have indicated that MGA fed to heifers for seven and nine days improved conception rate when prostaglandin was administered on the last day MGA was fed (Boyd & Corah, 1986; Patterson et al. 1986).

OBJECTIVES OF STUDY

The objectives of this study were to determine (1) the effects of 200 mg/hd/day of lasalocid, fed with a cottonseed meal carrier, on growth and development of crossbred heifers grazing two different forage based diets, (2) the effects of .5 mg/hd/day of MGA fed for nine days followed by a prostaglandin injection on synchronization of heifers to improve first service conception rate, (3) the effects of both lasalocid and/or MGA on initiating puberty in heifers and (4) the feasibility and practicality of utilizing an ionophore and synchronization feed additive in a commercial beef cattle operation breeding first estrus heifers.

MATERIALS AND METHODS

Forty crossbred heifers (1/4 and 3/8 brahman) were utilized in this study beginning in the fall of 1987. At weaning, all heifers were weighed and vaccinated for seven strains of clostridia. The heifer calves were orally wormed with Safeguard™ (phenbendazole) and treated for external parasites with Co-Ral™, a liquid systemic. They were then placed on a coastal bermudagrass (*Cynodon dactylon*)

pasture prior to treatment application. Heifers were divided into four treatment groups based on 205 day weight, adjusted for sex of calf and age of dam, and frame score as recorded on November 1, 1987. The four treatment groups consisted of; (1) oat/rye pasture + 2 lbs/head/day cottonseed meal (csm) + 200 mg/hd/day lasalocid, (2) oat/rye pasture + csm, (3) dormant warm season pasture (bermudagrass) and cottonseed meal (csm) with lasalocid and free choice bermudagrass hay (9% crude protein), and (4) dormant pasture + bermudagrass hay and csm. Heifers were group fed the concentrate in the morning and allowed to graze and/or consume hay ad libitum.

Heifer weight and frame scores were determined for 6 different periods of a 136 day trial. The last nine days of the trial, each treatment group of heifers was randomly divided into equal groups. All forty crossbred heifers were fed .5 mg/head/day of MGA in the supplement. On the ninth day the MGA was withdrawn from the supplement and five heifers per treatment group were injected with 25 mg of prostaglandin (lutylase). All heifers were artificially inseminated 80 hours following the prostaglandin injection with Brangus semen. Each heifer was artificially inseminated again at 21 days after first service. Brangus bulls were used as clean-up bulls for the following 40 days after the last MGA feeding.

Results were determined by the use of randomized block design with or without lasalocid on two forage types as blocks and MGA with or without prostaglandin as treatment groups. Analyses of variance were employed to determine statistical significance of heifer weight across time, frame size across time, number of heifers bred at first and second service and number of heifers bred at 60 days post-MGA feeding. Duncan's multiple range test was used as a means separation technique.

RESULTS AND DISCUSSION

An analysis of variance did not indicate any significant differences between feeding treatment groups when comparing mean hip heights at each date of measurement throughout the treatment period (Table 1). However, when the initial frame size (hip height) is subtracted from the final size, animals grazing the small grains pasture made greater gains in height than those on dormant pasture and hay (Figure 1). Lasalocid supplementation did not affect this characteristic. Animals allowed free choice small grains pasture grew an average of 4.3 inches over the treatment period compared to 3.0 inches for those consuming dormant perennial grasses and free-choice bermudagrass hay; a difference of 1.3 inches. This can only be attributable to variations in protein content of available forage since all animals were allowed as much forage as they could consume and allowed free-choice minerals. The high protein content of small grain forage (>15% crude protein) allows for a greater rate of passage, thus greater total feed consumption than the poorer quality bermudagrass hay (approximately 9% crude protein). Digestible energy also varies from one forage species to another, but not to the extent of protein content.

Table 1. The effect of lasalocid supplementation on mean heifer frame sizes (hip height) when pastured on small grain forage or dormant warm season grass plus free-choice bermudagrass hay, Huntsville, Texas, 1987-88.

Feeding Treatment*	Date					
	12/20/87	1/21/88	2/25/88	3/23/88	4/5/88	5/5/88
	inches to hip					
SG+L	45.80	47.35	48.18	49.03	49.47	50.05
SG-L	45.65	47.48	48.20	49.15	49.71	50.05
H+L	46.20	47.33	47.90	48.23	49.10	49.40
H-L	46.40	47.10	47.70	48.10	48.80	49.13

*SG - Small grain pasture (oat-rye mixture)

H - Bermudagrass

L - Lasalocid supplementation in a cottonseed meal carrier

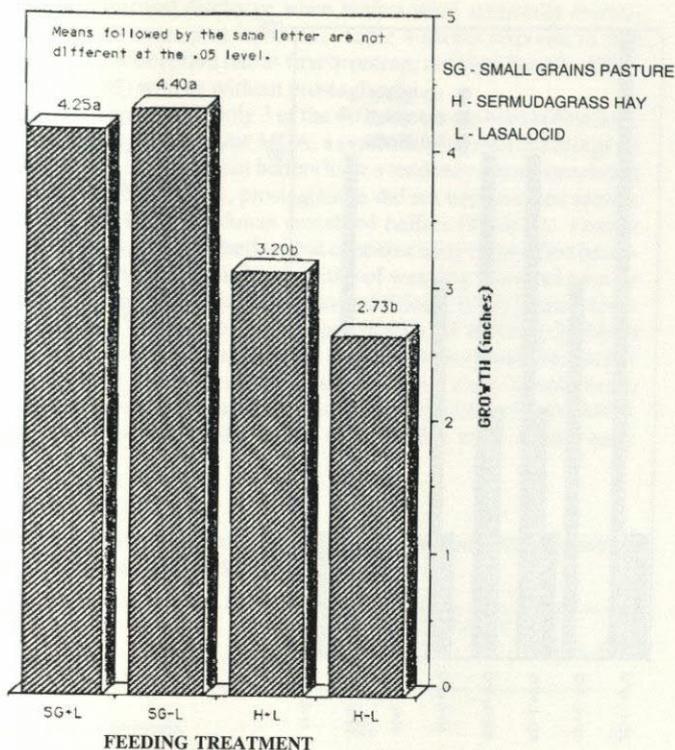


Figure 1. Gains in hip height of heifers as affected by forage and supplementation with lasalocid.

study, it was noted that neither medium nor high protein forage with lasalocid had an affect on weight gain in beef heifers. Though not quantitatively measured, it was observed that the small grain pasture with heifers receiving lasalocid was more completely denuded of forage than that in which lasalocid was not fed. It was noticed that animals fed lasalocid were willing to consume plant parts (stem and inflourescence) that the other animals considered undesirable or unpalatable. However, this did not result in improved gains, likely due to the poor nutritive values of those plant parts. These results show that the ionophore lasalocid did not improve weight gains or body frame size when added to two very different forage-based diets.

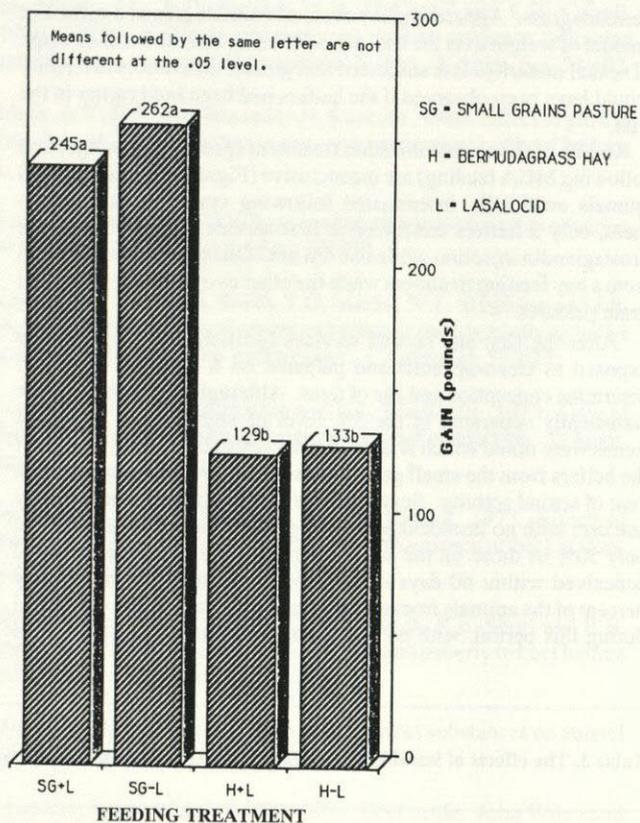


Figure 2. Weight gains in heifers as affected by forage and supplementation with lasalocid.

Similar results were seen with gains in weight. Though no differences were attributable to lasalocid in a cottonseed meal carrier, heifers grazing the small grains pasture gained an average of 253.50 lbs over the treatment period compared to a 130.75 lb gain for hay-fed heifers (Figure 2). Differences in body weights between forage treatment groups became detectable about 60 days into the trial (Table 2). The same general response was seen throughout the study period. Little information is available concerning lasalocid supplementation with high forage diets; especially diets of grazing weanling beef heifers. Improvements in performance of growing animals fed high forage diets (Gutierrez et al. 1982; Spears and Harvey, 1984) suggest an application for beef cows, but reports have been inconsistent (Berger et al., 1981). In the case of feedlot rations of high energy, lasalocid administered at 200mg/hd/day, dramatically improved average daily gain and feed efficiency of steers and heifers. But heifers on different types of roughages have been inconsistent in performance. Jacques et al. (1987) found that beef cows grazing poor to low quality forage were not affected by the addition of lasalocid and that weight gain and forage intake were not affected. In this

Table 2. The effect of lasalocid supplementation on mean heifer weights when pastured on small grain forage or dormant warm season grass plus free-choice bermudagrass hay, Huntsville, Texas, 1987-88.

Feeding Treatment*	Date					
	12/20/87	1/21/88	2/25/88	3/23/88	4/5/88	5/5/88
	pounds					
SG+L	536.5	576.5	660.5a**	684.5a	765.0a	781.5a
SG-L	540.0	586.5	671.5a	707.0a	788.0a	802.0a
H+L	546.5	559.5	594.5b	582.5b	668.0b	675.5b
H-L	537.0	547.0	581.5b	574.0b	670.5b	669.5b

*SG - Small grain pasture (oat/rye mixture)
 H - Bermudagrass
 L - Lasalocid supplementation in a cottonseed meal carrier

**Means followed by the same letter are not significantly different at the .05 level according to Duncan's multiple range test.

Intake and digestibility of protein deficient forages is usually depressed resulting in energy deficiency as well as protein deficiency. In this study cottonseed meal was fed to all treatment groups to maintain the protein needs of the animal, but it was obvious ($p < .05$) that additional protein and energy from the small grain pastures improved rate of gain. For adequate fermentation by rumen microorganisms, 8% crude protein is required (Neuman and Lusby, 1986). Adding high protein supplements to a forage diet that is deficient in protein can greatly increase forage intake. Thus, the more feed the animal consumes, the greater the weight gain achieved.

The initial condition score for the heifers was approximately 5.5 for all test groups. Upon completion of the feeding trial there was considerable difference between the condition of heifers on small grain pasture and those on dormant pasture with hay (Table 3). Though heifers on small grain pasture were in considerably better condition when observed at the end of the study, improvements in fertility were not evident (Figure 3). As noted in Table 3, heifers on small grain pasture gained at almost double the rate of those on bermudagrass. Apparently however, all animals gained a sufficient amount of weight over the trial period to bring them to a similar stage of sexual maturity. It is suspected that greater differences in fertility would have been observed if the heifers had been bred earlier in the trial.

Results of the synchronization treatment (prostaglandin injection following MGA feeding) are inconclusive (Figure 3). Of the total 40 animals artificially inseminated following synchronization treatment, only 3 heifers conceived at first service. Two received the prostaglandin injection while one did not. One of these animals was from a hay feeding treatment while the other two were from the small grain pastures.

After the first and second services (artificial), all heifers were exposed to clean-up bulls and palpated on 6 June and 7 July to determine conception and age of fetus. Although means could not be statistically separated at the 5% level of significance, important trends were noted which warrant further research. Eighty percent of the heifers from the small grain pastures conceived during their first year of sexual activity. Seventy percent of the heifers receiving hay and csm with no lasalocid added were diagnosed as pregnant while only 50% of those on the same forage diet but receiving lasalocid conceived within 60 days of the prostaglandin treatment. Eighty percent of the animals from the two small grain treatments conceived during this period, with no significant differences detected due to

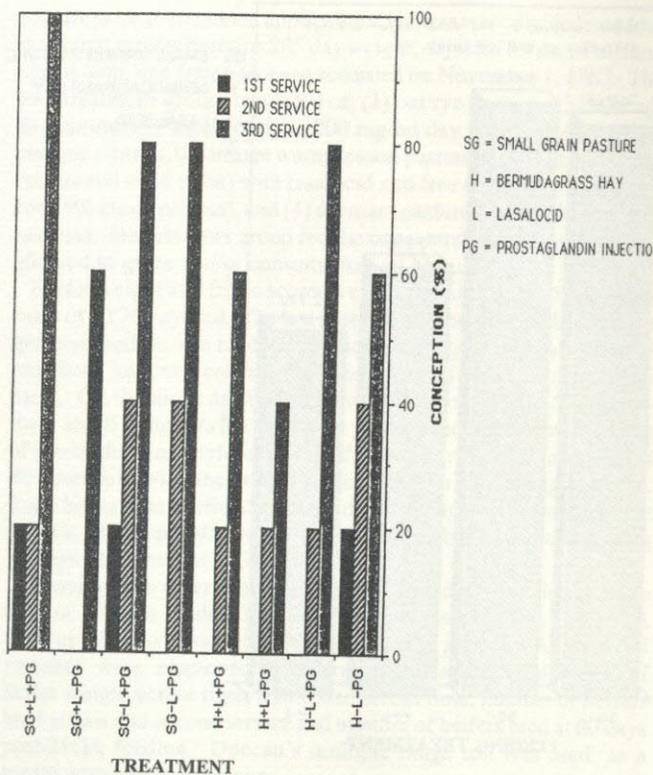


Figure 3. Conception rate as affected by forage, lasalocid, and prostaglandin.

lasalocid. These rates of conception in a controlled breeding season are considered desirable for 14-16 month old heifers, especially those with Brahman influence.

In this study, heifers that did not respond to melengestrol acetate treatment were considered not to have reached puberty. Heifers synchronized with MGA with or without prostaglandin were not different in mean weight or hip height at the time of breeding. Heifers responded to both treatments as indicated by cervical dilation and

Table 3. The effects of lasalocid supplementation on average daily gain and animal condition under two forage-based systems.

	Small grains		Bermudagrass hay	
	with lasalocid	without lasalocid	with lasalocid	without lasalocid
Number of animals	10	10	10	10
Average daily gain, lbs	1.80a*	1.93a	.95b	.97b
Initial condition score	5.4**	5.5	5.5	5.5
Final condition score	6.50	6.25	5.75	5.50

*Means followed by the same letter are not significantly different at the 5% level.

**Scale of 1 to 9; 1 - very thin, 9 - very fat.

cervical mucosal discharge when heifers were artificially inseminated at 80 hours post injection. Table 4 shows response to first estrus and conception rate at first breeding; not significantly different ($p < .05$) with or without prostaglandin.

In this experiment, only 3 of the 40 heifers were bred at first heat. It is well documented that MGA, a synthetic progesterone brings on early estrus in heifers, but heifers have a tendency not to conceive at first heat. In this study, prostaglandin did not improve first service conception rate in brahman crossbred heifers (Table 4). From a production viewpoint, heifers that conceive early in their first breeding season have a greater probability of weaning more and heavier calves during their lifetime (Burriss and Priode, 1958; Lesmeister et al. 1973). The feasibility and practicality of utilizing MGA to synchronize heifers to shorten the breeding season could be a useful tool in beef cattle operations. An additional study is now being designed in which a treatment group of heifers will not receive MGA prior to breeding to determine if the MGA itself affects early conception.

Table 4. Heifer response to melengesterol acetate (MGA) with or without a prostaglandin injection (PG).

	Treatment	
	MGA + PG	MGA-PG
Number of animals	20	20
Mean weight, lbs	725.25	720.50
Mean hip height, in	48.94	48.31
Sexual response	17	15
Sexual response, %	85	75
1st service conception	1	2
2nd service conception	4	3
Natural service conception	7	11
Animals bred within 60 days following treatment	12	16
Percent bred	60	80
Heifers with no cyclic activity	1	2

CONCLUSION

While it is evident from these data that the overall level of protein nutrition was a more important determinant of gains in weight and frame size in weanling heifers, these results indicate that even those heifers fed only bermudagrass hay with 2lbs. of cottonseed meal per day made sufficient gains to reach puberty at 14-16 months of age. Lasalocid did not improve the rate of gain of the heifers on either high or medium quality forage-based diets. A seventy percent conception rate in heifers of this age is considered to be an acceptable level of fertility in beef heifers.

This study has been extended to determine possible differences in birthing difficulties of these treatment groups and conception rates during their second year of sexual activity. Additional study using larger treatment groups must be conducted to determine the impact of MGA on conception rates of first and second calf heifers.

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