THE EFFECT OF SPAYING, ABORTING AND IMPLANTS ON THE PERFORMANCE OF BEEF HEIFERS — A REVIEW

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Interest in the spaying of heifers prompted a review of available research (Dinusson, 1977). The data presented in the review showed that spaying caused heifers to "stand still" or lose weight for two or three weeks following the operation and the spayed heifers gained less than intact, open heifers. Older heifers, more than one year of age at time of spaying, were affected less than heifer calves. Implanting the spayed heifers with Synovex-H increased gains almost as much as implanting open heifers. A continuing interest and newer research on spaying, implanting and abortofacients has made it desirable to update the previous review.

In 1977 Montana researchers (Cameron et al., 1977) reported on grazing trials involving 377 Angus and Angus X Hereford crossbred yearling heifers which were selected from a one-owner herd of about 1000 heifers. Of these heifers, 305 had been wintered on maintenance rations and were used for six treatments (Group A — Table 1); 72 were late calves that had been grown out on high energy rations (Group B — Table 1). The table indicates that even though they were younger, their weights were similar to those in Group A (Table 1).

The heifers were rounded up in May 1976, run through a chute and received one of six treatments. About three times as many heifers were spayed (incision through flank) as were left intact. The intact or spayed groups were allotted to either a control group (non-implanted) or were implanted with Ralgro or Synovex-H implants. The design and treatments of Groups A and B and averge daily gains are given in Table 1. The heifers were grazed together from mid-May to mid-October on low mountain grassland in the foothills of north central Montana. Group A was on pasture 159 days and Group B for 153 days.

Spaying resulted in a loss of about 22 pounds, but this was recovered when heifers were implanted. The lowest gains were made by the spayed heifers without implants with their gain significantly less than all other treaments ($P > .05$). Heifers implanted with either Ralgro or Synovex-H made significantly greater gains ($P > .05$) than spayed or intact heifers without implants. Heifers in Group B gained significantly less ($P > .05$) than those in Group A which may have been related to the higher energy rations fed during previous wintering.

Colorado researchers (Yamamoto et al., 1978) reported on an experiment with heifers spayed using the K-R spaying device (ovaries removed by means of vaginal approach and not by flank incision). The

Table 1. Weight Gains of Intact and Spayed Heifers as Affected by Ralgro or Synovex-H Implants (Group A)

	Intact			Spayed		
Treatment	No implants	Ralgro	Synovex-H	No implants	Ralgro	Synovex-H
No. of heifers	26	23	25	75	75	74
Avg wts/lbs						
Initial	394.0	391.2	402.2	394.9	400.0	398.0
Daily gain	2.08[b]	2.09[b]	2.15[a]	1.95[c]	2.12[a]	2.17[a]
No. of heifers (GROUP B)	4	5	5	19	18	18
Avg wts/lbs						
Initial	370.0	438.0	407	394.5	425.0	416.0
Daily gain	2.00[b]	1.95[b]	1.98[b]	1.84[a]	1.93[b]	1.98[b]

[a,b]Means having different superscripts are significantly different at ($P < .05$).

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Since preparation of this manuscript a new product, Fenprostalene (Bovilene™) has been reported to be very effective in aborting heifers which were pregnant 130 days or less.

treatments compared were spayed heifers with and without Ralgro implants, and intact heifers with and without Ralgro implants. A few days after spaying the heifers were sent to pasture for a 171 day period (from May 13 to October 31). Since the heifers were being grazed on a public grazing area it was difficult to keep bulls from neighboring pastures. The results of the pasture phase is presented in Table 2.

Table 2. Performance of Spayed and Nonspayed Heifers on Summer Pasture.

Treatment	No. heifers	% pregnant	Gain (NP)[1]	Gain (P)[2]	Gain (Av)[3]
Spayed + Ralgro	30	0	184.1	----	184.1[a]
Spayed	29	13.8	185.9	155.5	181.7[a]
Ralgro	30	70.0	176.6	186.7	183.7[a]
Control	29	48.3	166.6	155.9	161.4[b]

[1]Nonpregnant animal mean.
[2]Pregnant animal mean.
[3]Treatment mean.
[a,b]Means with different superscripts differ significantly (P<.05).

Spayed plus Ralgro, spayed and Ralgro-implanted intact heifers gained 14.1, 12.6 and 13.8 percent more than the intact control heifers. With the exception of the Ralgro treated heifers, the pregnant heifers gained less than the nonpregnant heifers, but the Ralgro-implanted pregnant heifers were heavier due to more advanced pregnancy than the other groups. The Ralgro-treated intact heifers showed a substantial increase in pregnancies compared to the other heifers. The spayed group showed 13.8 percent pregnant. It is likely that this method of spaying resulted in incomplete removal of ovaries.

At the end of the grazing period, pregnancy status was checked and the pregnant heifers were aborted by an intramuscular injection of estradiol cypionate or by decapitation, depending on stage of pregnancy.

Table 3 reports on the results of the subsequent feedlot phase. Feed intake was greater for all groups over the control. Average daily gains were 5.1, 3.8 and 8.9 percent greater for the Ralgro, spayed and spayed plus Ralgro than the control group but feed efficiency among treatments differed by only 1 percent.

In 1981, Rush and Reese reported on effect of spaying and implanting heifers on grazing and subsequent finishing periods. Heifers were spayed using high flank incision and implanted 7-20 days before being turned on grass. The heifers were grazed from early May to late September and then transported to the Scottsbluff station for the finishing phase. Table 4 presents the treatments and summary of results. The heifers were weighed when they were spayed and implanted and then again when turned on grass. The initial weights used in Table 4 were those taken when they were spayed and implanted. At the start of the finishing phase, one-third of the heifers from each of the initial five treatments during the grazing period were either: 1) not implanted, 2) implanted with Ralgro, or 3) implanted with

Table 3. 120-Day Feedlot Performance of Spayed, Implanted or Intact Heifers.

	Treatment			
	Control	Ralgro	Spayed	Spayed plus Ralgro
No. animals	29	30	29	30
Initial weight, lbs.	643	677	656	662
Final weight, lbs.[1]	924	974	949	969
ADG, lbs.	2.35	2.47	2.44	2.56
Avg. daily ration, lbs:[2]				
Corn	10.17	10.73	10.58	10.97
Beet pulp	1.92	2.01	2.00	2.07
Protein supplement	0.73	0.76	0.75	0.78
Silage	6.31	6.52	6.58	6.82
Alfalfa hay	1.56	1.63	1.62	1.67
Salt	0.036	0.020	0.028	0.028
Total air dry feed	20.73	21.67	21.56	22.34
Feed/cwt. gain[3]	882	877	884	873
Dressing %[4]	61.8[a,b]	62.4[a]	61.2[b]	61.8[a,b]
Fat thickness, in.	0.54	0.55	0.54	0.55
% KPH fat	3.89[a]	3.67[a,b]	3.51[b]	3.58[b]
Ribeye area, sq. in.	13.0	13.1	12.6	12.9
USDA carcass grade				
% Prime	24.1	3.3	10.3	16.7
%Choice	72.4	86.7	86.2	76.7
%Good	3.4	10.0	3.4	6.7
Yield grade	2.4	2.4	2.5	2.4

[1]Estimated final weight (1.45Xcarcass weight + 70).
[2]Air dry basis.
[3]Air dry basis
[4]Hot carcass weight divided by final weight.
[a,b]Means with different superscripts differ significantly (P<.05).

Table 4. Performance of Intact, Spayed and Implanted Spayed Grazing Heifers and Subsequent Feedlot Performance (Trial 1)[a]

	Treatment for grazing period				
	Intact	Spayed			
	No implant	No implant	DES	Ralgro	Synovex-H
No. heifers	46	48	46	45	47
Grazing performance					
Initial wt., lb[b]	467	452	458	460	461
Fall wt., lb	691	675	710	718	707
Daily gain, lb	1.56	1.55	1.75	1.79	1.71
No. exhibiting side effects[c]	1	2	16	3	14
Shrink, feedlot adj. period, %	4.7	5.0	4.0	4.1	4.4
Finishing performance[d]					
Finished wt., lb[e]	918	903	904	942	917
Daily gain, lb	2.04	2.06	1.75	2.00	1.91
Feed (DM)/gain	8.85	8.96	11.37	9.82	10.47
Total performance (grazing & finishing)					
Total gain, lb	451	451	446	482	456
Daily gain, lb	1.56	1.56	1.54	1.67	1.58

[a]Grazed from 5-8-78 to 9-29-78 then finished to 2-22-79. (Feedlot adjustment period from 9-29-78 to 10-18-78.)
[b]Weights were taken at time of spaying and implanting.
[c]Principally, udder development—evaluated visually.
[d]One-third of the heifers in each grazing treatment were 1) not implanted, 2) implanted with Ralgro and 3) implanted with Synovex-H at the start of finishing.
[e]Finished weights were adjusted to constant 61% dressing percent.

Synovex-H. This allowed an evaluation of reimplanting with the same implant or switching to a different implant from grazing to finishing.

Table 5. Performance of Spayed and Intact Heifers When Unimplanted or Implanted with Ralgro and Synovex-H and Subsequent Feedlot Performance (Trial 2).[a]

	Treatment for grazing period					
	Intact			Spayed		
	No Implant	Ralgro	Synovex-H	No Implant	Ralgro	Synovex-H
No. heifers	36	33	35	36	32	35
Grazing performance						
Initial wt., lb	397	398	398	379	383	393
Fall wt., lb.	629	649	645	613	646	656
Daily gain, lb.	1.74	1.89	1.85	1.75	1.98	1.98
No. exhibiting side effects[c]	0	2	4	0	1	6
Shrink, feedlot adj. period, %	5.7	4.5	8.4	6.2	6.4	7.4
Finishing performance[d]						
Finished wt., lb.	976	999	967	975	1006	987
Daily gain, lb.	2.28	2.26	2.39	2.39	2.39	2.25
Feed (DM)/gain	7.5	8.0	8.0	7.0	8.2	8.3
Total performance (grazing & finishing)						
Total gain, lb	579	601	569	596	623	594
Daily gain, lb	1.89	1.96	1.85	1.94	2.03	1.93

[a]Grazed from 5-1-79 to 9-11-79, finished from 9-18-79 to 3-3-80. (Feedlot adjustment period from 9-11-79 to 9-18-79.)
[b]Initial weights were taken 14 days after spaying and implanting.
[c]Principally udder development, evaluated visually.
[d]One-half of the cattle in each treatment were implanted with Ralgro and the other half with Synovex-H at initiation of finishing.
[e]Final weights were adjusted to constant 61% dressing percent.

The following year (1979), 220 lightweight crossbred heifers were allotted to six treatments as shown in Table 5. Weights were not taken when spayed but were taken when the heifers were turned out on grass. When the heifers entered the feedlot, half of the heifers within each of the initial six treatments were implanted with Ralgro and the other half with Synovex-H.

Gain on grass was improved by implanting both spayed and intact heifers. Spaying did not appear to have any adverse effect in either experiment. Implants increased gains more in the spayed heifers than in the intact heifers. This was also noted in the Colorado work (Table 3). In the finishing phase the heifers of implanted on grass (and which had the lowest gain on grass) had feedlot gains equal to or greater than heifers implanted on grass. The difference was greater for feed efficiency as heifers not implanted on grass had a substantial advantage over heifers implanted on grass. In the first trial the spayed heifers, not implanted during grazing, were 17.8 percent more efficient than comparable implanted heifers, and in the second trial the spayed and intact non-implanted grazing heifers were 6.7 and 17.9 percent, respectively, more efficient in the feedlot than heifers implanted on grass. Switching from one type of implant during grazing to another for finishing was not beneficial.

In another trial, Nebraska researchers (Kittok, et al., 1981) found that Ralgro did not stimulate growth in bred heifers or consistently increase pelvic area in treated animals. Several heifers actually aborted due to Ralgro implants.

Nicks (1978) reported that MGA (Melengestrol Acetate) increased gains by 10.3 percent and improved feed efficiency by 6.5 percent. These were pooled averages for 47 trials with intact heifers. He also summarized three trials comparing feedlot performance of spayed and intact heifers. In this summary, spaying decreased gains by 7 percent and decreased feed efficiency by 8 percent as compared to intact heifers.

Nevada researchers (Phelps et al., 1980) tried to sterilize heifers by placing a Franklin Castrating Ring over the protruding external os certix to slough the posterior cervix and seal the cervical lumen by strangulation. Results suggest that this method is not practical and needs more work before final assessment of the technique can be made.

Several workers have conducted experiments on ways to abort pregnant heifers going into the feedlot and some have measured subsequent gains and feed efficiency in the feedlot. An extensive trial was conducted by Purdue researchers (Hortsman et al., 1982). A group of 321 crossbred heifer calves was assembled in Kentucky and shipped to the Purdue Research Farm. The mean weight of these heifers was 497 pounds. All calves were backgrounded for 35 days. During backgrounding they were immunized for IBR, BVD, Hemophilus, Pasteurella and Clostridia. All calves were treated with a pour-on (Tiguvon) and implanted with Ralgro, dewormed with Levasole, and injected with 2,500,000 units of Vitamin A. The ration was hay free choice, 2 pounds of cracked corn and 2 pounds soybean oil meal. After five days the hay was replaced with corn silage. After 50 days the corn was increased and silage decreas-

ed until heifers were on full feed. Water and minerals were available. Six calves died and nine were removed due to respiratory disease. Table 6 gives design, treatments and number of calves.

Table 6. Experimental Design

Group No.	Procedure
1	Ovariectomized—left flank
2	Melangestrol Acetate (MGA) 0.4 mg/head/day
3	Manually aborted per rectum
4	Estradiol Cypionate (ECP)—20 mg/head I.M.
5	Dinoprost Tromethamine (PG2-a)—20 mg/head I.M.
6	Nontreated controls

Each lot—17 calves
Replicates—3
Total calves per treatment—51
Total treatments—6
Total calves—306

Tables 7 and 8 summarize the feedlot data; Table 7 for the first 24 days (15 days post treatment) and Table 8 for the entire trial. The heifers were sent to slaughter on five occasions as they reached choice grade. The experiment lasted 108 days.

As can be seen in Table 7, the ovariectomized heifers gained poorly, ate less and had poorer feed efficiency for the first 24 days. They never fully overcame this setback (Table 8).

Some interesting observations are not documented in the summary tables and will be summarized.

Group 1—spayed—four heifers were pregnant at time of surgery. Five had uteri suggestive of recent abortion. Two of the heifers aborted prior to slaughter and two delivered full term calves 123 and 113 days after spaying. Spaying did not cause abortion when pregnancy was this far advanced.

Group 2—MGA—Three heifers were pregnant and two had previously aborted. Two of the pregnant heifers aborted and one was pregnant at slaughter. It is doubtful that MGA was the cause of the abortions.

Group 3—Manual abortion—The pregnant heifers in this group were manually aborted by rupturing the amniotic vesicle or decapitation of the fetus. Only three of the nine pregnant heifers could be manually aborted because of the smallness of the heifers. However, four of the five aborted from some other cause and one was pregnant at slaughter.

Group 4—ECP—Five heifers were pregnant in this group. One was pregnant at slaughter, another delivered a dead calf, prolapsed and was sent to slaughter 16 days later.

Group 5—Prostaglandin F2-α—Ten heifers were pregnant in this group and all less than 120 days into gestation. All of these heifers aborted prior to slaughter.

Group 6—Control—Eight heifers were pregnant in this group but only two were pregnant at slaughter. No reasons were given for the six abortions in this gorup.

It was unfortunate that so many abortions occurred in these treatments which could not be explained. There are many diseases which cause abortions. However, brucellosis was ruled out by blood tests.

In Upjohn's Veterinary Report ™12, research on abortion of heifers in the feedlot is given and can best be summarized by their conclusion: "A single 25 mg. intramuscular dose of Lutalyse (dinoprost) has been proven to be effective in terminating pregnancy in feedlot heifers during the first 100 days of gestation. Abortion takes place within a time period acceptable to feedlot managers and side effects associated with the use of

Table 7. The Effect of Various Treatments on Productivity of Feedlot Heifers

Treatment Group	Period I* Ovariectomized	MGA	Manual Abortion	ECP	Prostaglandin	Control
Average Starting Weight (lbs)	549.6	550.7	551.6	532.3	568.5	551.2
Average Daily Gain (lbs)	1.48[a]	2.28[b]	2.45[b]	2.03[b]	2.42[b]	2.43[b]
Average Daily Feed/ Animal (lbs)[e]	27.23[c]	30.30[cd]	32.80[d]	30.70[cd]	33.23[d]	32.10[d]
Feed Efficiency lbs Feed / lbs Gain	18.65	13.32	13.53	15.76	13.91	13.29

*Day 0 to 24; 15 ± 1 days post-treatment.
[ab]Means within a row with different superscripts differ (P < .01).
[cd]Means within a row with different superscripts differ (P < .05).
[e]as fed basis.

Table 8. The Effects of Various Treatments on Productivity of Feedlot Heifers

Treatment Group	Period II* Ovariectomized	MGA	Manual Abortion	ECP	Prostaglandin	Control
Average Starting Weight (lbs)	549.6	550.7	551.6	523.3	568.5	551.2
Average Daily Gain (lbs)	2.12	2.32	2.33	2.19	2.37	2.35
Average Daily Feed/ Animal (lbs)[c]	26.47	27.80	28.10	27.63	28.63	28.23
Feed Efficiency lbs. Feed / lbs. Gain	12.52	12.08	12.10	12.62	12.11	12.04
Average Days on Feed	189.13[a]	190.00[a]	183.53[ab]	187.03[ab]	181.53[b]	184.13[ab]
Hot Carcass Weight (lbs)	520.53	544.90	539.00	523.50	551.30	539.23
lbs. Feed/Animal / Hot Carcass Weight (lbs)	5.44	5.46	5.59	5.65	5.57	5.61
Yield[d]	2.50	2.6	2.6	2.7	2.6	2.6
Grade[e]	1.9	2.0	2.1	2.2	2.1	2.2

*Day 0 to 108; 99 ± 1 days post-treatment.
[ab]Means within a row with different superscripts differ (P < .05).
[c]as fed basis.
[d]Range 1 to 5.
[e]Prime = 1, choice = 2, choice minus = 3.

Lutalyse are minimal." A literature search did not uncover any reference to use the intrauterine devices to prevent conception in cattle.

In summary, implanting of spayed heifers with either Ralgro or Synovex-H will restore the rate of gain lost during spaying. Aborting with Lutalyse in the first 100 days of gestation is effective. Aborting after 150 days of pregnancy is not always effective.

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