Life Cycle Feeding
(Beef Section)

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Management Program for Improving Reproductive Performance

Feedlot Nutrition

Management Program for Improving Reproductive Performance

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What do we expect of a beef cow as far as reproduction is concerned? We would like to have every cow in the herd wean a calf every year and have all the calves dropped early in the calving season. All cows don't wean a calf and we have late calvers. Therefore, we need to find ways to improve this situation. This paper will point out some of the reasons for poor reproductive performance and then outline ways to improve reproduction. Three steps can be taken to improve reproduction performance:

1. Shorten the breeding season
2. Develop replacement heifers properly
3. Feed proper level of nutrition.

Short Breeding Season

If a beef cow calves every year she has one big problem. She is pregnant for 280-285 days. That only leaves her 80 to 85 days from calving until she must be pregnant again if she is going to calve the same time next year. You say, well, that's a lot of *time*, why get so excited about it? It isn't a lot of *time* especially when you consider how long it takes her to come in heat after calving and conception rate. The proportion of cows in heat at various times following calving is shown.

No. Days Since A Cow Calved	Cows In Heat At This Time	
	Cow 5 Or Older	Cows 2 Or 3 Years Old
40	55%	15%
50	70%	30%
60	80%	40%
70	90%	65%
80	90%	80%
90	95%	80%
100	100%	90%

You can see that it takes time for a cow to return to heat following calving. Only 55% of the older cows had been in heat by 40

days after calving and only 15% of the two and three year old cows. By 60 days after calving 80% of the older cows and 40% of the younger cows had shown estrus. Because of this long time from calving to first heat, a cow which calves late has very little chance of calving early next year.

Look at the difference in the number of cows in heat the first 20 days of breeding in cows that calve early compared to cows that calve late.

Calving Time	Avg. No. Days Calving to Start of Breeding	In Heat 1st 20 Days of Breeding Season (May 1 to May 21) Cows 5 or Older	2 and 3 Year Old Cows
Feb. 10 to March 1	70 Days	95%	79%
March 2 to March 21	50 Days	88%	64%
March 22 to April 10	30 Days	70%	32%
April 11 to May 1	10 Days	29%	10%

Ninety-five percent of the cows five years of age or older which calved from February 1 to March 1 showed heat the first 21 days of the breeding season, while only 29% of those cows calving from April 11 to May 1 showed heat early in the breeding season. In the two- and three-year-old cows 79% of the cows calving February 10 to March 1 showed heat in the first 20 days of the breeding season compared to 10% in the late calving cows. You can see that very few cows which calve late in calving season show heat early in the breeding season. So if we want a cow to calve early she must calve early the first time she calves. This is the only way she will have the necessary *time* to be able to return to heat each year. The proportion of young cows in heat can be increased by separating them from old cows and giving them extra feed.

The next problem with *time* is that when a cow calves late she has a low conception rate. She doesn't have *time* for the uterus to clean up.

	Avg. No. Days Calving to Start of Breeding	Cows Conceiving on First Service
Feb. 10 - March 1	70 Days	62%
March 2 - March 21	50 Days	58%
March 22 - April 10	30 Days	33%
April 11 - May 1	10 Days	33%

Cows need *time* for the uterus to clean up, otherwise conception rates at first service will be low. You can see in cows which were 70 days post-partum at the start of breeding 62% of the cows conceived on first service while only 33% of the cows which were only 30 days post-partum at the start of breeding conceived.

The combination of a low number of cows showing heat and a low

conception rate means a low pregnancy rate early in the breeding season. The number pregnant early is found by multiplying the number in heat early in the breeding season by the conception rate at first service.

Calving Time	Avg. Days Calving to Start of Breeding	Older Cows In Heat First 21 Days		Conception Rate First Service First 21 Days		Older Cows Pregnant First 21 Days
Feb. 10 - March 1	70	95	x	62	=	59
March 2 - March 21	50	88	x	58	=	51
March 22 - April 10	30	70	x	33	=	23
April 11 - May 1	10	29	x	33	=	10

You can readily see a cow that calved late this year doesn't stand much chance to calve early next year. Only 10% of the cows calving from April 11 to May 1 conceived the first 21 days of the breeding season. A cow that calves late one year tends to calve late the rest of her life. This statement applies even more in younger cattle. Only 3% of the young cows calving late became pregnant the first 21 days of the breeding season. If we want cows to calve early they must calve early that first time. Our recommendation would be to start calving heifers 20 days earlier than the cow herd and only calve for 40-45 days. Look at what this would mean in terms of early calves for next year in heifers calving first at two years of age.

			Second Calving Season			
			Cows Calving			
Calving Time for first calf	No. Cows Calving	Avg. Calving Date to Start of Breeding	Feb. 10 to Mar. 1	Mar. 2 to Mar. 21	Mar. 22 to Apr. 11	Open Cows
Jan. 21 - Feb. 9	100	90	62	24	7	7
Feb. 10 - Mar. 1	100	70	50	31	11	8
Mar. 2 - Mar. 21	100	50	37	26	22	15
Mar. 22 - Apr. 10	100	30	10	32	23	35
Apr. 11 - May 1	100	10	3	9	30	58

It is obvious that not as many of the two-year-old cows calving late that first year get pregnant that second year. In a sixty-day breeding season there were 58% of the heifers open in the heifers that calved from April 11 to May 1, compared to 7 and 8% in cows calving in the first two periods. The difference in cows calving early that second year was even greater; only 3% of the late calving cows would calve early the next year in contrast to 62% of those early calving cows. Cows that calve early with their first calf have the *time* necessary to return to heat and the *time* needed for conception rate to be at a high level. This means more early calves that next year. To achieve this, heifers must calve early at the first breeding. *Time* is important. Cows need *time*. They can all have the *time* needed when they calve early

with the first calf. This means a short breeding season. Cows should calve at least 40 days prior to calving or they will not cycle early in the breeding season.

Puberty

How do we make certain heifers breed early that first year? They must be in heat. To do this they need some weight and they need some age. What does this mean in terms of nutrition? First, we must feed them to make 1 pound to 1-1/4 pound gain through the winter. Notice the difference in the heifers in heat at 13, 14 and 15 months of age when they are wintered two different ways. Gain in the spring and summer was high in both groups. These data show that puberty was delayed in heifers on the low level of feed. Why? The big difference is that heifers on the low level of feed didn't weigh as much as heifers on the high level. So puberty was delayed because the heifers weren't heavy enough at 13, 14 and 15 months of age on the low level of feed.

	Hereford			Angus			Angus-Hereford Crossbred		
Age in Months:	13	14	15	13	14	15	13	14	15
Winter Gain:									
0.5 lb. per head/day (% in heat)	4	22	41	33	57	77	41	75	91
1.0 lb. per head/day (% in heat)	38	65	77	76	80	92	74	82	97
Differences (% in heat)	34	43	36	43	23	15	33	7	6

Information available indicates that heifers don't reach puberty until they have sufficient weight. Note that very few heifers had reached puberty when they weighed 500 pounds and heifers in this experiment had to weigh 700 pounds before a large proportion had reached puberty.

	% In Heat When Heifers Weighed				
	500 lbs.	550 lbs.	600 lbs.	650 lbs.	700 lbs.
Hereford					
Wintered at 0.5 lb. per head per day	11	30	44	85	92
Wintered at 1.0 lb. per head per day	0	0	27	50	62
Angus					
Wintered at 0.5 lb. per head per day	43	70	73	97	100
Wintered at 1.0 lb. per head per day	8	44	72	84	88
H X A					
Wintered at 0.5 lb. per head per day	24	54	85	91	94
Wintered at 1.0 lb. per head per day	0	18	43	68	78

Why didn't as many heifers on the high level of feed reach puberty

at 650 pounds? The big difference between the groups is that the heifers on the high level of feed reached 650 pounds at a younger age, therefore, were not as old. So age kept them from coming in heat at 550 or 650 pounds.

These data show that both age and weight are important in determining whether heifers reach puberty. They must reach a certain weight in order to attain puberty. However, excessive feeding does not hasten puberty because they also must reach a certain age. This data showed that 1 to 1-1/4 pounds of gain per day during the winter is sufficient for heifers of British breeds. What about other breeds we don't know?

The other tool that should be used in breeding heifers is to breed more than is needed for replacements. Select the heifers on the basis of pregnancy and cull the open heifers. This will assure you of some early calving cows for that first calf. We recommend breeding 50% more than needed. For example, if you need 20 replacements, breed 30 heifers.

Management System For Improving Reproductive Performance

We have attempted to put some of these things together into a program. We have had two groups, a new management system and a control group. These groups have been fed the same. The differences between the two groups are outlined below.

	No. Exposed	No. Preg. Replacements Needed	No. Cycling 4-12	Started Breeding	Length of Breeding	Estrus Synchronization
Control	54	50	35 (63%)	5-12	90 Days	no
New Management	85	50	54 (64%)	4-22	45 Days	yes

The new management system is an attempt to have heifers have their first calf early in the calving season. This was done by breeding more heifers than needed as replacement, breeding earlier than the cow herd, breeding only 45 days, and using estrous synchronization. The system was successful in getting heifers to calve early the first year.

	New Management	Control
Avg. calving date first year	2-5	3-19
First calf born	1-17	2-12
Last calf born	3-1	5-17

The big question—did these cows have better reproductive performance in subsequent years and thus continue to calve early? Data on two additional years of breeding are available. These data show that more heifers were in heat after 21 days of breeding; 29% in the second breeding season and 24% in the third breeding season. These differences, after 45 days of breeding, were 20% for the second year

and 7% for the third year. The pregnancy rate also favored the new management system after 21 days of breeding. The difference was 5% in the second year and 21% in the third year. After 45 days of breeding the difference was 29% and 17%. The proportion pregnant at the end of the breeding season (45 days in new management system and 90 days in the control group) was similar in both years.

These data indicate that the reproductive performance can be improved by some simple management techniques, such as shortening the breeding season, exposing more heifers than needed as replacements and selecting those getting pregnant early in the breeding season, and breeding heifers earlier than the cow herd.

	New Management	Control	Differences
Heat after 21 days of breeding			
2nd breeding season	92%	63%	29%
3rd breeding season	100%	76%	24%
Heat after 45 days of breeding			
2nd year	100%	80%	20%
3rd year	100%	93%	7%
Heat after 90 days of breeding			
2nd year	--	100%	--
3rd year	--	100%	--
Pregnant after 21 days of breeding			
2nd year	46%	41%	5%
3rd year	79%	58%	21%
Pregnant after 45 days of breeding			
2nd year	74%	45%	29%
3rd year	97%	80%	17%
Pregnant after 90 days of breeding			
2nd year	--	78%	--
3rd year	--	93%	--

Nutrition

Reproductive performance in beef cows varies from year to year. One of the main causes for this variation is nutrition. Two nutrients, phosphorus and energy, will be discussed here. A phosphorus deficiency causes poor calf crops and long calving intervals.

Effect of Phosphorus on Calf Crop

	No Phosphorus	Bone Meal
No. Cows	168	168
Calf Crop Weaned (%)	64	88
Avg. No. Days Between Calving	459	365

The level of energy fed before and after calving has a marked effect on pregnancy rate. Energy level exerts its effect by influencing the occurrence of post-partum estrus and conception rate at first

service. This was demonstrated in a series of experiments conducted on cows confined to a dry lot.

Cows received adequate levels of protein, minerals, and vitamins in all experiments and thus it was hoped that the difference noted was mainly the result of differences in energy intake. Checks for estrus were made at least twice daily. In most cases sterilized bulls wearing a marking device were placed in lots with the cows for at least 6-8 hours each day. Breeding was done by hand mating in the first two experiments and by artificial insemination in the last experiment. Rectal examinations for ovarian activity and pregnancy were done routinely.

In cows receiving low levels of energy both before and after calving, only 20% became pregnant in a 90-day breeding season (Table 1). This poor reproductive performance was the result of only 22% of the cows showing estrus and a low conception rate at first service (33%) (Table 1). Thus, continuously low levels of energy are disastrous as far as reproductive performance is concerned.

Reproductive Performance of Cows on Inadequate Energy Levels

Before Calving Lbs.	After Calving Lbs.	No. Cows	Cows Pregnant: 1st 20 days brdg. %	Cows Pregnant: End of brdg. %	Cows Showing Estrus: 50 days after dalving %	Cows Showing Estrus: 70 days after dalving %	Cows Showing Estrus: 90 days after dalving %	Pregnant from 1st Service
9.0	16	21	60	95	65	90	95	67
4.5	8	20	15	20	22	22	22	33

Pregnancy Rate and Early Calving in Cows on Two Levels of Energy Prior to Calving

Level of Feed: Before Calving Lbs. TDN	Level of Feed: After Calving Lbs. TDN	No. Cows	Weight Changes: Start of Expt. to 1 week before Calving	Weight Changes: 24 hrs. after Calving to 90 days Post-calv.	% Pregnant: At end of 20 days of Brdg.	% Pregnant: End of Breeding Season
		Older Cows				
9.0	16.0	21	67	-14	60	95
4.5	16.0	20	-118	22	46	95
		2-year Cows				
8.0	13.0	37	115	81	54	71
4.3	13.0	41	18	136	32	73
		2-year Cows				
8.0	13.0	24	129	43	54	79
4.3	13.0	23	6	87	48	83

In cows receiving a low level of energy before calving, but adequate levels of energy after calving, little or no difference in pregnancy rate at the end of the breeding season was noted, but the

number of cows becoming pregnant early in the breeding season was decreased with 6-22% more cows on the high level of feed becoming pregnant in the first 20 days of the breeding season.

This effect was the result of delay in the onset of estrus following calving. This can be seen by looking at the next table.

At 50 days post-calving 65, 68, and 38% of the cows in the different experiments and receiving the 8 or 9 pounds of TDN before calving had shown heat compared to 25, 27, and 30% in cows on the lower level of TDN before calving. At 60 and 70 days post-calving large differences in the proportion which had shown heat were still apparent.

The number of cows conceiving at first service was not affected by the level of energy fed prior to calving. Thus, the level of energy prior to calving has a marked effect on the occurrence of early estrus following calving, while conception rate at first service was not effected by energy level prior to calving.

Occurrence of Post-Partum and Conception Rate in Cows on Two Levels of Energy Prior to Calving

Level of Feed								
Before Calving Lbs. TDN	After Calving Lbs. TDN	Days after Calving 40	50	60	70	80	90	Pregnant from 1st Service
		% which had shown heat						%
				Older Cows				
9.0	16.0	-	65	80	90	90	95	67
4.5	16.0	-	25	45	70	80	85	65
				2-year Cows				
8.0	13.0	22	68	81	90	92	97	63
4.3	13.0	7	27	49	66	73	83	53
				2-year Cows				
8.0	13.0	21	38	71	92	96	100	50
4.3	13.0	13	30	52	70	83	91	56

Cows which had been on an adequate level of energy prior to calving but received a low level of energy after calving showed a marked decrease in the proportion of cows pregnant either after 20 days of breeding or at the end of the breeding season. This can be seen by looking at the next table. In the older cows at the end of 20 days of breeding 60% of those receiving adequate levels of energy (9 pounds before and 16 pounds after) were pregnant while only 34% of the cows which received adequate levels before (9 pounds) and a low level after (8 pounds) were pregnant. The differences in percent pregnant at the end of 20 days of breeding in 2-year-old cows was also large and favored cows receiving adequate energy both before and after calving. The differences in the percent pregnant at the end of the breeding season in all cases favored the cows on adequate levels of feed. In the older cows 95% were pregnant at the end of the breeding season when

cows received adequate levels of energy but only 77% when the cows received a low level of feed after calving. In younger cows the differences were not nearly as large with the difference in percent pregnant being 7% in one group and 3% in the next.

Pregnancy Rate and Early Calves on
Two Levels of Feed After Calving

Level of Feed			Weight Changes		% Pregnant	
Before Calving Lbs. TDN	After Calving Lbs. TDN	No. Cows	Start of Expt. to 1 week before Calving	24 hrs. after Calving to 90 days Post-calv.	At end of 20 Days of Breeding	End of Breeding Season
		Older Cows				
9.0	16.0	21	67	-14	60	95
9.0	8.0	22	89	-97	34	77
		2-year Cows				
8.0	13.0	37	155	81	54	71
8.0	7.0	42	192	-79	33	64
		2-year Cows				
8.0	13.0	24	129	43	54	79
8.0	7.0	13	138	-56	23	76

There are two reasons for poor reproductive performance in cows which are on low levels of feed following calving and are consequently losing weight. There is a certain number of cows in this category which do not show heat during the breeding season. In these older cows on inadequate energy level after calving there was only 86% which had shown heat at 90-day post-calving and no more showed heat after this time. In the younger cows comparable figures were 81% and 92%. In cows on adequate levels of feed after calving 95% to 100% had shown heat at this time.

Occurrence of Post-Partum Estrus and Conception Rate in Cows
on Two Levels of Energy Post-Calving

Level of Feed								
Before Calving Lbs. TDN	After Calving Lbs. TDN	Days after Calving						Pregnant from 1st Service
		40	50	60	70	80	90	
		% which had shown heat						%
				Older Cows				
9.0	16.0	–	65	80	90	90	95	67
9.0	8.0	–	76	81	81	86	86	42
				2-year Cows				
8.0	13.0	22	68	81	90	92	97	63
8.0	7.0	6	73	64	81	81	81	53
				2-year Cows				
8.0	13.0	21	38	71	92	96		50
8.0	7.0	23	85	92	92	92		37

In an effort to overcome the detrimental effects of a low level of energy prior to calving, cows were fed high levels of energy after calving. In experiments 2 and 3 cows were put on self-feeders from calving until they were diagnosed pregnant or the end of the breeding season. In experiment 2, 92% of the cows which were full fed were pregnant, at the end of a 90-day breeding season compared to 72% and 79% in two other groups which received lower levels of energy.

This increase in reproductive performance for cows on the high level of feed after calving was mostly a result of an increase in conception rate at first service. In Experiment 2, 83% of the cows on full feed after calving conceived on first service compared to 54 and 31% of the cows in the other two groups. The same trends were observed in Experiment 3. In Experiment 2, it appeared that the onset of estrus was delayed in cows on the high level of energy. This same trend was apparent in Experiment 4, however, the difference observed was again not significant. Marked differences in ovarian follicular growth were noted in both experiments.

Pregnancy Rate and Early Calves in Cows on High Levels of Energy After Calving

Level of Feed			Weight Changes		% Pregnant	
Before Calving Lbs. TDN	After Calving Lbs. TDN	No. Cows	Start of Expt. to 1 week before Calving	24 hrs. after Calving to 90 days Post-calv.	At end of 20 days of Breeding	End of Breeding Season
		Older Cows				
4.7	12.0	14	-69	-1	23	72
4.7	16.0	14	-69	36	24	79
4.7	25.0	13	-69	247	38	92
		2-year Cows				
4.3	13.0	41	18	136	32	73
4.3	22.0	41	15	284	51	90
8.0	13.0	37	155	52	54	73
8.0	22.0	42	148	258	56	78

Two experiments were then designed to: (a) confirm the results of the last experiments that high levels of energy after calving had a beneficial effect on reproductive performance and (b) to determine if cows could be full fed for short periods of time and receive the beneficial effects of high level of energy feeding noted.

In the next two experiments all cows were fed 4.3 pounds of TDN prior to calving. After calving they received a full feed for varying periods of time. Breeding started 60 days after calving and continued for 120 days post-calving, so some cows were full fed for 20, 40, or 60 days before breeding. The results of high energy feeding noted in the last two experiments were not confirmed in these two experiments. Little or no difference in pregnancy rate was noted between cows fed

Occurrence of Estrus and Conception Rate in Cows
on High Level of Energy after Calving

Level of Feed							
Before Calving Lbs. TDN	After Calving Lbs. TDN	Days after Calving 50	60	70	80	90	Pregnant from 1st Breeding %
		% which had shown heat					
		Older Cows					
4.7	12.0	7	–	43	–	64	54
4.7	16.0	57	–	78	–	93	34
4.7	25.0	15	–	46	–	77	83
		2-year Cows					
4.3	13.0	27	49	66	73	83	53
4.3	22.0	20	39	80	88	93	73
8.0	13.0	68	81	90	92	97	63
8.0	22.0	40	62	90	93	95	63

13 pounds of TDN continuously after calving and those full fed for varying periods after calving. The onset of estrus and conception rate at first service was remarkedly similar in all groups. It was concluded from these data that full feeding after calving has little or no effect on reproductive performance in young cows.

Reproductive Performance of Cows Full Fed
for Varying Periods of Time after Calving

No. Days of Full Feeding	No. Cows	Wt. Change Calving to 120 days Post-calving	Days Post-calv. 80	100	120	Days Post-calv. 50	60	70	80	90	1st Conceiving 1st Ser.-%

Reproductive Performance of Cows Full Fed
for Varying Periods of Time after Calving

No. Days of Full Feeding	No. Cows	Wt. Change Calving to 120 days Post-calving	Days Post-calv. 80	100	120	Days Post-calv. 50	60	70	80	90	1st Conceiving 1st Service-%
			% Pregnant			% in Heat					
	2-year Cows										
0	23	100	48	74	83	30	53	70	83	91	56
80	25	210	36	72	76	28	56	68	69	96	54
100	25	250	44	66	76	16	48	72	84	96	56
120	27	256	37	74	85	22	41	66	85	89	56
	3-year Cows										
0	30		33	67	80	43	70	80	90	97	50
90	38		37	58	76	32	53	68	84	89	37
120	34		50	68	79	32	59	68	88	94	58