

**HEIFER DEVELOPMENT AND REPRODUCTIVE TRACT SCORING  
FOR A SUCCESSFUL HEIFER PROGRAM: THE SHOW-ME-SELECT  
REPLACEMENT HEIFER PROGRAM,  
A COORDINATED MANAGEMENT CONCEPT**

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**Introduction and Program Description**

The Missouri Show-Me-Select Replacement Heifer Program has developed a comprehensive set of guidelines for a beef replacement heifer development and marketing program. The program coordinates established management practices known to be beneficial to appropriate heifer development into a total quality management approach. The specific objectives of the program are:

- Improve existing developing programs through a Total Quality Management approach.
- Provide a reliable source of quality replacements through genetics and management.
- Increase marketing opportunities for and add value to Missouri-raised heifers.

The following description of this program can serve as a guide for others trying to develop or improve systems of heifer development.

Participants enrolled in the Show-Me-Select Replacement Heifer Program begin with a comprehensive health and vaccination program on their heifers starting at or before weaning. The health program is administered under the advice and guidance of the producer's veterinarian to insure proper use of health products according to label directions. The health program is focused on maintaining good health and providing adequate protection against the major diseases that cause reproductive losses and reduced reproductive performance in cattle.

Pre-breeding examinations served as a monitor point to evaluate the post-weaning to pre-breeding phase of heifer development. These examinations were scheduled to take place when the average age of the heifers was 12 to 13 months (range 10-14 months). These examinations included reproductive tract scores (RTS), pelvic measurements, weights, and visual observations for structural soundness.

Pre-breeding examinations were scheduled between 30 and 60 days prior to the planned breeding season. University of Missouri State Extension specialists met with the producer's veterinarian and regional extension livestock specialist to perform these examinations. Working together as a team insured all involved parties had the same appreciation and understanding of the technical procedures performed and that interpretation of the results would be uniform.

Each participating producer received individual and summary data on their herds from the pre-breeding examinations. These data were used to identify problems associated with heifer development to this point, and provide recommendations on the breeding program of the heifers.

Pregnancy examinations were scheduled on heifers from enrolled herds such that they were performed prior to 120 days of gestation in order to determine fetal age. Herds that used artificial insemination allowed a minimum of 2 weeks between the AI period and natural service cleanup. This permitted the examiner to distinguish AI bred heifers from natural serviced bred heifers.

Each producer received individual and summary data from the pregnancy examinations. These data included stage of gestation (in days) for each heifer and a projected calving date based on the observation. Producers utilizing synchronization and AI were provided with synchronization response and AI conception rates. The summary data included total pregnancy rates and pregnancy rates by 21-day intervals.

### **Program Summary**

The program was initiated as a pilot project in two regions of Missouri in 1997. A programmatic effort to establish the program statewide was supported by a grant from the University of Missouri Outreach and Extension Outreach Development Fund in 1998. Four additional regions participated in the program in 1998 and another four regions participated in 1999. Since 1999, several regions of the state have coordinated a program for fall born heifers. Table 1 shows the number of participants in the Show-Me-Select program since 1997.

Table 1. Show-Me-Select replacement heifer program participation

Year of program	Number of herds	Number of heifers
1997	33	1,873
1998	123	5,189
1999	232	8,799
2000	186	8,038
2001	176	7,367
1999 Fall-Born Heifers	21	1,436
2000 Fall-Born Heifers	14	1,353
2001 Fall-Born Heifers	34	1,970
1997-2001	393*	36,025
*Number of producers participating in one or more years.		

Table 2 shows the adoption rate of various management practices by herds enrolled in the Show-Me-Select Replacement Heifer program from 1997 to 2001 compared to the percent of operations utilizing these practices reported in the 1994 NAHMS survey.

Table 2. Adoption of management practices in beef replacement heifer development

Management practice	Percent of herds enrolled	Percent of Operations (NAHMS, 1994)
Completed Program*	69%	N/A
Completed Records*	90%	N/A
Reproductive Tract Scores	100%	1.2%
Pelvic Measurements	100%	3.0%
Pregnancy Examination	100%	15.9%
Weighed	87%	7.9%
Artificial Insemination	71%	3.3%
Synchronized Estrus	79%	3.0%
*Completed Program -Enrolled in program and provided data from pre-breeding, breeding season, and pregnancy examination.		
*Completed Records – Submitted records completed such that data could be used in calculations and analyses.		

### Reproductive Summary

Table 3 summarizes the results of pregnancy examinations statewide and the relationship between reproductive tract scores and reproductive performance. The minimum criteria for heifers included in this analysis were a complete pre-breeding examination performed within 30 to 70 days prior to scheduled breeding, and complete pregnancy examination records.

Table 3. Reproductive performance by RTS

RTS	Exposed	Pregnant	Open	Pregnancy Rate			
1	75	46	29	61.3			
2	1055	854	201	81.0			
3	4504	3911	593	86.8			
4	4912	4322	590	87.9			
5	3675	3261	414	88.7			
TOTALS	14221	12394	1827	87.2			
Reproductive performance by cycle of breeding season							
RTS	Exposed	1 <sup>st</sup> 21 days		2 <sup>nd</sup> 21 days		3 <sup>rd</sup> + 21 days	
		Hd	%	Hd	%	Hd	%
1	75	26	35	13	27	7	17
2	1055	505	48	185	34	164	45
3	4504	2443	54	842	41	626	51
4	4912	2875	59	855	42	592	50
5	3675	2269	62	586	42	406	50
TOTALS	14221	8118	57	2481	41	1795	50

The reproductive performance of heifers with an RTS of 1 or 2 is less than that of heifers with an RTS of 3 or greater. These data indicate that heifers tract scoring 1 or 2 are less likely to be cycling at the beginning of the breeding season and therefore are less

likely to become pregnant or if they do become pregnant, they do so later in the breeding season. Current management recommendations advocate that heifers bred to calve as 2-yr-olds should be exposed for breeding before mature herd mates, and that early calving periods should be used as a means of increasing production efficiency. This practice often results in heifers being bred on their pubertal estrus (Wiltbank, 1970). Fertility of heifers that are bred at the pubertal estrus was 21% lower than those bred on their third estrus (Byerley et al., 1987). This means that heifers should reach puberty 1 to 3 months before the average age at which they are to be bred. Earlier age at puberty in relation to breeding is to ensure that a high percentage of heifers are cycling and that the effects of lowered potential fertility at the pubertal estrus are minimized (Short et al., 1990).

The reproductive summary from herds that utilized MGA/prostaglandin protocol for estrous synchronization and artificial insemination in their breeding program is presented in Table 4. The minimum criteria for heifers included in this analysis were a complete pre-breeding examination performed within 30 to 70 days prior to scheduled breeding, and complete synchronization and pregnancy examination records. These data are similar to those reported by Patterson and Bullock (1995).

Table 4. Reproductive performance in synchronized and AI'd herds

RTS	Exposed	Synchronization Response		Synchronized Pregnancy		Pregnancy Rate	
		Hd	%	Hd	%	Hd	%
1	38	14	37	10	26	22	58
2	509	341	67	194	38	409	80
3	2475	1806	73	1085	44	2096	85
4	3163	2530	80	1544	49	2752	87
5	2417	2004	83	1240	51	2127	88
TOTALS	8602	6695	78	4073	47	7406	86
<p><b>Synchronization Response</b> – Total number of heifers with recorded heat within 7 days of the start of the breeding season. The percent is equal to synchronized /exposed.</p> <p><b>Synchronized Pregnancy</b> – Total number of heifers conceiving within synchronized period based on staged pregnancy diagnosis. The percent is equal to synchronized pregnancy/exposed.</p>							

The following tables summarize the herd reproductive performance from 1997 to 2001. The criteria for herds included in these analyses were a complete pre-breeding examination performed between 30 and 70 days prior to scheduled breeding with complete records.

Table 5 summarizes the reproductive performance in all herds irrespective of the type of breeding program utilized. These herds include natural service breeding as well as herds incorporating estrus synchronization and artificial insemination. There is a trend of improvement in weaning to pre-breeding development as evidenced by the increase in percent cycling and average pre-breeding weight by year. Pregnancy rates are not different between years and are lower than an anticipated pregnancy rate of 90 percent or better. The percent of animals becoming pregnant in the first cycle of the

breeding season are comparable to expected values, however the percent of animals becoming pregnant in the second and subsequent cycles are much lower than expected.

Table 5. Herd reproductive summary

Year	Cycling %	Avg Wt kgs	PR %	PR 1 <sup>st</sup> Cycle	PR 2 <sup>nd</sup> Cycle	PR 3 <sup>rd</sup> + Cycle
1997	49	342	86	65	41	30
1998	55	325	85	55	37	44
1999	59	326	86	54	44	46
2000	61	339	86	58	43	43
2001	65	339	87	57	42	43

Cycling – A recorded 4 or 5 RTS at pre-breeding examination  
 PR – Pregnancy rate

Table 6 summarizes the reproductive performance in herds incorporating MGA/prostaglandin protocol for estrus synchronization and artificial insemination. The same trend of improvement in weaning to pre-breeding development is seen as above evidenced by the increase in percent cycling and average pre-breeding weight by year. Estrus response to synchronization (ER) is expected to approach 80% given properly developed heifers capable of responding to synchronization and adequate heat detection. ER is defined in these herds as a recorded heat within the first 7 days of the breeding season. AI pregnancy rate (AI PR) in herds using synchronization and one insemination based on observed estrus is expected to approach 50%. The AI PR in these herds is defined as the number of heifers diagnosed as AI pregnant divided by the number of heifers exposed at the start of the breeding season. The AI conception rate (AI CR) is a measure of accurate heat detection and the inseminator's success at AI. The AI CR is defined as the number of heifers conceiving to AI divided by the number of heifers inseminated. The number reported in these herds represents the first AI service only. The anticipated AI CR is 60%. Taken together, the ER, AI CR, and AI PR reported in these herds indicate successful synchronization and artificial insemination, however pregnancy rates (PR) are lower than anticipated. This is due primarily to the fact that the percent of animals becoming pregnant in the second and subsequent cycles are much lower than expected.

Table 6. Herd reproductive summary from synchronized and AI'ed herds

Year	Cycling %	Avg Wt kgs	ER %	AI PR %	AI CR %	PR %	% Preg 1 <sup>st</sup> Cycle	% Preg 2 <sup>nd</sup> Cycle	% Preg 3 <sup>rd</sup> + Cycle
1997	54	340	76	71	78	87	75	30	29
1998	56	327	74	54	62	84	58	37	41
1999	61	328	80	55	58	86	58	42	42
2000	64	340	78	60	62	87	63	41	41
2001	69	340	77	54	59	87	57	43	43

Cycling – Recorded 4 or 5 RTS at pre-breeding examination  
 ER – Estrus Response: No. of animals with recorded heat within first 7 days of breeding season  
 AI PR – AI Pregnancy Rate: No. of animals AI pregnant/No. of animals exposed for breeding  
 AI CR – AI Conception Rate: No. of animals AI pregnant/No. of animals inseminated  
 PR – Pregnancy Rate: No. of animals pregnant/No. of animals exposed for breeding

Table 7 stratifies herds using synchronization and artificial insemination into quartiles (bottom 25% to top 25%) based on pregnancy rates. The top 25% of the herds meet or exceed all expectations in terms of developing heifers to breeding and successfully incorporating synchronization and artificial insemination into their breeding programs. Only the bottom 25% fell short of anticipated outcomes. Final pregnancy rates differ primarily due to the differences in the number of heifers becoming pregnant in the second and subsequent cycles of the breeding season.

Table 7. Herd Reproductive Summary from Synchronized and AI'ed Herds by Quartile based on Preg Rate

Quartile	Cycling %	Avg Wt kgs	ER %	AI PR %	AI CR %	PR %	PR 1st cycle %	PR 2 <sup>nd</sup> cycle %	PR 3 <sup>rd</sup> + cycle %
Bottom 25%	61	325	73	49	54	72	51	24	19
Mean	63	334	78	56	61	86	60	41	41
Top 25%	65	341	79	63	68	97	68	56	68

Cycling – Recorded 4 or 5 RTS at pre-breeding examination  
ER – Estrus Response: No. of animals with recorded heat within first 7 days of breeding season  
AI PR – AI Pregnancy Rate: No. of animals AI pregnant/No. of animals exposed for breeding  
AI CR – AI Conception Rate: No. of animals AI pregnant/No. of animals inseminated  
PR – Pregnancy Rate: No. of animals pregnant/No. of animals exposed for breeding

### Summary

Results from the Show-Me-Select Replacement heifer program indicate that the coordination of management practices known to be beneficial for beef replacement heifer development into a total quality management approach have been positive. Data collected can be effectively used to institute management changes necessary to improve development of beef replacement heifers and reproductive performance. The program provides a valuable source of information and education for beef producers and also indicates areas of needed research to refine certain parameters and procedures related to replacement female production.

### Literature Cited

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