2002 Annual Report

Beef Section

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Effect of Timed Nutrient Limitation on Replacement Heifer Development

Interim Progress Report

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Introduction

Developing herd replacements is associated with significant cost to the cow-calf enterprise. Therefore, heifer development strategies strive to lower costs while enhancing productivity. Contemporary recommendations for heifer development depend on delivering constant energy levels per day based on required growth necessary to reach a predetermined prebreeding target weight equaling 65-70% of mature body weight. Mature weight is estimated using the following formula: *Mature Weight = (frame score x 75) + 800 lbs*.

Ringwall et al. (1998) evaluated benchmark production and heifer development costs using ND Beef Cattle Improvement Assoc. cooperator heifers. Heifers were grown at an average 1.67 pounds/day from a pre-test weight of 599 lbs. to a pre-breeding weight of 884 lbs were successfully developed. Of the 78% expressing estrus following administration of either MGA®/ PGF2 or Syncro-Mate-B® synchronization programs, 54.3% conceived to an initial AI service, and within a 45-day breeding season an overall pregnancy rate of 91.5% was achieved.

Observations from subsequent studies with prepuberal heifers subjected to a restricted/ compensating development regime suggests heifers developed with the technique are consistently more reproductively responsive. In recent research at the Dickinson Research Extension Center to evaluate a stair-step heifer development regime , Poland and Ringwall (2001) found the percentage of heifers pregnant overall after a 63 day breeding season to be 14% greater than heifers developed to breeding using a continuous level gain approach. Accompanying the improvement in reproductive efficiency, heifers developed using a compensating gain regimen were observed to consume less dietary dry matter overall, and were more growth efficient.

Forage type used for heifer development may also contribute to reducing development costs both directly and indirectly. Oats grown for hay is the most commonly grown cereal forage in North Dakota. Wheat hay, on the other hand, is not commonly grown for forage, however, when harvested in the milk stage produces a highly nutritious forage too. Indirectly, planting wheat for forage on a grain and livestock farm makes sense because wheat as grain is worth 3 or more times that of oats, and has higher commodity loan and loan deficiency payment (LDP) values. Planting wheat as forage affords the producer greater flexibility. Also, in cropping seasons of good to above average growth, when less forage acres are needed to meet livestock demands, the balance of acreage initially planted for forage can be harvested for grain of considerably higher value than oats.

This experiment is designed to evaluate forage type (oat vs. wheat hay) and heifer development regime (continuous gain vs. timed compensating gain) on first service and overall reproductive efficiency and heifer development costs.

Objectives

1. Evaluate the suitability of either spring wheat (Keene var.) or oat (Otana var.) hays as forage bases in a timed variable gain heifer development program.

2. Evaluate heifer response and reproductive efficiency among heifers grown at .9 lbs/day during a 7 week period followed by a 7 week ad libitum compensating growth period.

3. Document direct system development costs and create forage system simulation model under varying USDA farm program scenarios.

Procedure

One hundred-twenty virgin heifers weighing approximately 680 pounds will be assigned each year of a three year investigation based on target breeding weight to a 2 x 2 factorial design to evaluate two cereal forages and either a continuous-gain or compensating-gain development methods beginning 14 weeks prior to the start of breeding on May 15.

Heifers will be managed in the continuous-gain group (Control) to grow at a constant rate of gain to reach a predetermined target breeding weight (70% of mature body weight) at the start of the breeding season on May 15. Heifers in the compensating-gain group, will be managed at a restricted rate of gain (58% of control gains) followed by compensating gain (142% of control gains) to attain a similar breeding weight. Mature weight will be determined using the following formula: Mature Wt = (Frame Score * 75) + 800 lb.

Project Goals:

1. Heifer mature weight: (5.0 frame x 75) + 800 lb. = 1175

2. Target weight: 1187 lb. x .70 = 832 lb.

3. Target gain: 152 lb.

4. Daily continuous gain (98 days): 1.55/day

5. Daily compensating gain: Phase 1 - .9 lb/day, Phase 2 - 2.20 lb/day

Prebreeding Cycles:

Estrous behavior is being continuously monitored using the HeatWatch® Estrus Detection System from the trials initiation until AI breeding is completed. Onset of estrus will be defined as the first of two mounts detected within 4 h, and the end of estrus as the last mount, with a mount within 2h before, followed by a quiescent period of at least 12h.

Synchronization & Breeding:

An MGA/PGF_2 synchronized breeding program will be used. All heifers received 1 lb. of a daily top dressed supplement containing .5 mg. of melengesterol acetate (MGA) for 14 days beginning April 11 and continuing through April 24. Seventeen days after the last MGA feeding (May 12), at 8 am, all heifers were administered a single 20 mg. dose of Lutalyse® IM and were inseminated according to standing heat 12 - 14 hours after detection using the HeatWatch® system. Heifers will be artificially inseminated according to estrus from May 15th to June 8th when Hereford clean-up bulls were turned in. Clean-up bulls were removed on July 2nd for a total breeding season of 48 days.

Diets and Estimated Phase-1 and -2 Intake:

Diets to attain the desired rates of gain will be computed using the net energy system. Oat hay- and wheat hay-based TMR diets will be delivered to each pen replicate daily. Treatments will be weighed weekly to monitor growth and when necessary, intake levels are being adjusted to achieve the desired gain.

Results

Results obtained during the first year of this three year study are shown in Tables 1 through 4. Differences exist, however, they may change as additional years are added to the data set. The reader is cautioned not to draw conclusions until the project has been completed.

Literature Cited

Poland, W. and K. Ringwall. 2001. Effect of nutritional management for either constant or stair-stepped rates of gain on subsequent breeding performance of beef heifer calves. J. Anim. Sci., Western Section, Vol 52:582-586.

Ringwall, K.A., K.J. Helmuth, J. Dhuyvetter, J.L. Nelson, and G.O. Ottmar. 1998. Production and associated costs of heifer development - the benchmark values. In 1998 Annual Report, Dickinson Research Extension Center, North Dakota State University, pp 80-86.

Table 1. Diets fed during restricted and compensating phases.

	Wheat Hay	Oat Hay	Oat Hay	Wheat Hay
	Continuous Gain	Continuous Gain	Compensating Gain	Compensating Gain
PHASE 1 (Restriction Phase)				
Wht Hay	80.9	--	--	86.9
Oat Hay	--	80.9	86.9	--
Corn	18.3	18.3	12.4	12.4
N-Serve Min	.50	.50	.50	.50
TM Salt	.20	.20	.22	.22
Limestone	.09	.09		
	100.0	100.0	100.0	100.0
Pounds Fed/Day	17.5	17.5	15	15
PHASE 2 (Compensating Phase)				
Wht Hay	66.6	--	--	50.4
Oat Hay	--	66.9	50.3	--
Corn	30.6	30.3	46.9	46.8
N-Serve Min	.50	.50	.47	.47
TM Salt	.20	.20	.20	.20

Limestone	.01	.01	.06	.06
MGA	2.14	2.12	2.08	2.08
	100.0	100.0	100.0	100.0
Pounds Fed/Day	18.5	18.5	19.2	19.2

Table 2. Growth, body condition score and ultrasound fat depth comparisons.

	Continuous Gain		**Compensating Gain**	
	Oat Hay	Wheat Hay	Oat Hay	Wheat Hay
No. Heifers	30	30	30	30
Frame Score				
Phase 1 Growth (Restricted)				
Days Fed = 49da				
Phase 1 Starting Wt. (Feb. 6)	653	651	636	649
Phase 1 Ending Wt. (Mar. 27)	739	730	691	691
Gain	86	79	55	42
ADG	1.76	1.61	1.12	0.86
Phase 2 Growth (Compensating)				
Days Fed = 42da				
Phase 2 Starting Wt. (March 27)	739	730	691	691
Phase 2 Ending Wt.(May 8)	823	802	788	779
Gain	84	72	97	88
ADG	2	1.71	2.31	2.1
Combined Growth				

Days Fed = 91da				
Initial Wt. (Feb 6)	653	651	636	649
Prebreeding Wt.(May 8)	823	802	788	779
Gain	170	151	152	130
ADG	1.87	1.66	1.67	1.43
Condition Score Change				
Initial (Feb 6)				
Interim (Mar 27)	5.9	6.1	5.7	5.5
Prebreeding (May 8)	6.2	6.1	6	5.9
Postbreeding (June 8)	6.2	5.9	5.8	5.8
Fat Depth Change				
Initial (Feb 6)	0.33	0.28	0.31	0.28
	0.29	0.29	0.3	0.28
Interim (Mar 27)	0.34	0.32	0.31	0.29
	0.34	0.32	0.27	0.28
Final (May 8)	0.46	0.39	0.4	0.35
	0.32	0.27	0.3	0.25

Table 3. Measurements of reproduction for continuous and compensating gain development.

	Continuous Gain		**Compensating Gain**	
	Oat Hay	Wheat Hay	Oat Hay	Wheat Hay

Heifer Frame Score	5.27	5.23	5.02	5.17
Estimate of Mature Wt., lb.	1195	1192	1176	1188
Target Weight (70% of Mature Wt.)	837	834	823	831
Percent of Mature Wt. At PGF2	69	67	67	66
Prebreeding Reproductive Tract Score (1-4)	3.1	3	3	2.6
Follicle Size at AI Breeding, cm	1.16	1.16	1.23	1.23
Percent Displaying Estrus For AI	87	97	90	87
Percent Displaying Estrus To Synch.	77	63	70	53
Average Number of AI Services	1.35	1.33	1.25	1.17
First Service AI Conception Rate, %	47	50	63	47
Repeat Ser. AI Conception Rate, %	13	3	7	13
Overall AI Conception Rate, %	60	53	70	60
Overall Pregnancy Rate, %	83	80	77	83

Table 4. Cost summary for phases 1, 2, and 3.

			Continuous Gain		**Compensating Gain**	
			Oat Hay	Wheat Hay	Oat Hay	Wheat Hay
No. Heifers			30	30	30	30
Feed/Head		Phase 1	971.5	982.9	850.1	847.5
		Phase 2	647.4	657.8	673.7	672.4
	(Brd. Fd)	Phase 3	732.3	730.1	729	727
ADFI		Phase 1	17.3	17.6	15.2	15.1

		Phase 2	18.5	18.8	19.2	19.2
	(Brd. Fd)	Phase 3	23.6	23.6	23.5	23.5
Feed Cost/Hd, $		Phase 1	$23.62	$23.89	$20.01	$19.95
		Phase 2	$22.03	$22.31	$24.13	$24.08
Development Cost, $						
(Phases 1 & 2)			$45.65	$46.20	$44.14	$44.03
	(Brd. Fd)	Phase 3	$20.44	$20.30	$20.88	$20.81
Overall Dev.						
Cost (Phases 1,2,3), $			$66.09	$66.50	$65.02	$64.84

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