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EFFECTS OF BODY WEIGHT GAIN AND WINTER DIETS CONTAINING OATS SILAGE COMPARED TO OATS-PEA SILAGE ON REPRODUCTIVE PERFORMANCE IN REPLACEMENT BEEF HEIFERS.

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SUMMARY

Beef cattle producers who raise their own replacement heifers have questioned the required level of heifer gain, in particular, when their late-winter or early-spring feed supplies are low. Furthermore, there has been an increase in the production of oats-pea forage crops in ND within recent years. Many producers are interested in the addition of field peas grown with oats because of the potential for increased forage protein concentrations. Therefore, forty-eight British crossbred beef heifers were used to investigate the effects of body weight gain and basal diets composed of either oats silage or oats-pea silage on reproductive performance. Heifers were fed in 8 pens (6 heifers/pen) to achieve an expected gain of .5 lbs./hd/day (LOW GAIN) or 1.75 lbs./hd/day (HIGH GAIN). Within these treatments (4 pens/treatment), basal diets were formulated with either oats silage (OAT-SIL) or oats-pea silage (OAT-PEA). Heifers were fed their respective treatments for 57 days (March 24 to May 19) until breeding. Silage treatment had no effect on body weight gain during the treatment period. However, by design, ADG was less for LOW GAIN compared to HIGH GAIN heifers (.72 vs. 1.63 ± .14 lbs./hd/day, respectively). Furthermore, LOW GAIN heifers continued to weigh less than HIGH GAIN heifers at the end of summer grazing (987.5 vs. 1031.6 ± 10.8 lbs., respectively). Body condition scores were also lower at the end of the treatment and summer grazing periods for LOW GAIN compared to HIGH GAIN heifers. Early pregnancy rates tended to be higher (P =.13) for

OAT-SIL (75.0%) compared to OAT-PEA (54.2%) heifers, however, this numeric difference was reversed for final pregnancy rates (79.2% vs. 91.7%, respectively). Neither early (62.5% vs. 66.7% for LOW GAIN compared to HIGH GAIN, respectively) or final (87.5% vs. 83.3% for LOW GAIN compared to HIGH GAIN, respectively) pregnancy rates were affected by body weight gain treatments. Heifer performance was not affected by OAT-PEA silage, however, the amount of protein supplementation required for this treatment was less than for heifers fed OAT-SIL. These research results indicate that reproduction was not impaired by reducing gains to .72 lbs./hd/day, 57 days prior to breeding. Although feed costs can be reduced in this manner, producers must consider the final BW heifers will achieve at the beginning of breeding.

PROJECT OBJECTIVES

Compare high versus low body weight gain 57 days prior to breeding on beef replacement heifer reproduction.

Evaluate beef replacement heifer growth and reproductive performance when fed basal diets comprised of either oat silage or oat-pea silage.

INTRODUCTION

Introducing females into the beef herd, is first achieved by proper development of replacement heifers, thereby ensuring a successful breeding season. Previous research has found that heifers should weigh approximately 65% of their mature cow weight at breeding, for optimal reproductive success (Bolze and Corah, 1993). Short and Bellows (1971), in research conducted at Miles City, Mt., found that winter heifer gains of 1.0 or 1.5 lbs./day, provided for satisfactory reproductive performance. Some beef producers have questioned the importance of heifer weight gain in late winter and early spring when winter feed supplies are low. The importance of maintaining weight gains above 1.0 lb./day may be questioned in particular, when heifers have reached puberty, and(or) are near their target body weight (65% of mature cow weight) well in advance of the breeding season. A reduction in weight gains may allow for reduced feed inputs, however, the impact on reproduction must be considered. Work done in Nebraska (Clanton et al., 1983) found that varying the rate of heifer body weight gain either early or late over the winter feeding period, did not affect reproductive responses, when compared to heifers managed for a constant rate of gain. As long as heifers achieved a minimum body weight at breeding, it appeared that the method by which the

weight was obtained was not important.

Field peas have gained considerable interest by ND livestock producers in recent years, as a potential forage crop when grown with oats. Oats-pea combinations have been grown on crop land to produce hay or silage for beef producers. The major advantage for incorporating field peas into cereal grain forages is the potential to increase crude protein levels in the forage. This may decrease the amount of supplemental protein that is required in growing diets.

MATERIALS AND METHODS

Forty-eight British crossbred beef heifers were used to investigate the effects of body weight gain and basal diets composed of either oats silage or oats-pea silage on reproductive performance. Treatments were initiated on March 24, 1994 in a 2 X 2 factorial arrangement for a completely random design. In the first level of treatments, heifers were fed in 8 pens (6 heifers/pen) to achieve an expected gain of .5 lbs./hd/d (LOW GAIN) or 1.75 lbs./hd/d (HIGH GAIN). Within these treatments (4 pens/treatment), basal diets were formulated with either oats silage (OAT-SIL) or oats-pea silage (OAT-PEA). Diet formulations and nutrient analysis are given in Tables 1 and 2, respectively. Heifers were fed their respective treatments for 57 days until breeding (May 19). Following estrus synchronization with MGA (April 20 to May 3) heifers were artificially inseminated on May 23 and 24, and then moved to summer pasture. Clean up bulls were turned out on pasture with heifers from June 10 to July 14, resulting in a total breeding season of 53 days. The experiment ended on September 9.

Body condition scores (BCS) were measured on March 8, May 19 (end of the treatment period) and September 9. Body weights were recorded on March 24, May 19 and September 9. Average daily gain (ADG) was calculated for the 57 day treatment period. Change in BCS and BW were tested for the treatment period. Furthermore, BW change during the summer (May 19 to September 9) was tested for treatment effects. Heifer pregnancy rates were determined by ultrasonography on June 24 (early pregnancy) and August 21 (final pregnancy).

RESULTS

There were no interactions (P >.10) between silage type and rate of gain treatments. Therefore, treatment

combinations will not be discussed. Silage treatments did not effect BSC (P =.25, Table 3) or BW change (P =.16, Table 4) during the treatment period. OAT-PEA heifers appeared to have greater ADG's during the treatment period (Table 4) compared to OAT-SIL heifers, but this difference was not significant (P =.16). However, OAT-SIL heifers gained 176.8 lbs. compared to 158.8 lbs. for OAT-PEA heifers (P <.04) during summer grazing. This increase in BW change over the summer for OAT-SIL heifers may have been a compensation for numerical differences that occurred during the treatment period. Daily ration costs are given in Table 1. Because the CP concentration of oat-pea silage was higher, the amount of commercial protein supplementation was reduced by 50 to 75% for the OAT-PEA treatments. This can have a significant effect on ration costs when the costs of commercial protein supplements are high.

By design, LOW and HIGH GAIN treatments produced different (P <.01) daily gains during the treatment period (Table 4). HIGH GAIN heifers gained 93.0 lbs. compared to 40.8 lbs. for LOW GAIN heifers over the 57-day treatment period. LOW GAIN heifers had achieved 65% of a 1245 lb. mature cow at breeding. This compared to HIGH GAIN heifers that reached 65% of a 1345 lb. mature cow. Hip height measurements were collected prior to the study but have not been analyzed for predicting mature cow weights. This may not be possible because these heifers were purchased and birth dates may not be available. During summer grazing, LOW GAIN heifers compensated (P <.01) somewhat, but not enough to recover BW losses that occurred during the treatment period (Table 4). This was evident by LOW GAIN heifers weighing 987.5 lbs. compared to 1031.6 lbs. for HIGH GAIN heifers in the fall (P <.05). BCS measurements (Table 3) corresponded well with gain treatment effects on BW. During the treatment period LOW GAIN heifers lost .3 condition score units while the HIGH GAIN heifers maintained body condition (Table 3). Differences in BCS (P <.07) were also observed in the fall (Table 3).

Early pregnancy rates tended to be higher (P =.13) for OAT-SIL (75.0%) compared to OAT-PEA (54.2%) heifers. However, numeric differences (P =.22) were reversed for final pregnancy rates (79.2% vs. 91.7%; OAT-SIL vs. OAT-PEA, respectively). An explanation for these findings is difficult from the data which was collected. Neither early (62.5% vs. 66.7% for LOW GAIN compared to HIGH GAIN, respectively) or final (87.5% vs. 83.3% for LOW GAIN compared to HIGH GAIN, respectively) pregnancy rates were affected (P >.68) by body weight gain treatments. These results agree with research from Nebraska (Clanton et al., 1983) where decreased heifer gains prior to breeding did not impair reproduction as long as heifers reached their target weight at breeding.

IMPLICATIONS

Although body weight gains were reduced by treatment design, and body weight differences were still apparent at the end of summer grazing, this research indicates that reproduction was not impaired by reducing heifer gains 57 days prior to breeding. Feed cost savings by including straw and limiting intake are given in Table 1. These experimental diets resulted in a savings of $11.40/heifer for the 57 day treatment period prior to breeding with the given feed costs. It may be suggested for replacement heifers that have been on a higher plane of nutrition early, a decrease in rate of gain prior to breeding does not affect subsequent reproduction, as long as heifers weigh approximately 65% of their mature weight at breeding. This information can assist producers who may have fed excess nutrients early and are running low on feed supplies in late-winter to early-spring. It is probably more cost effective to develop heifers with lower weight gains early, and then increase nutrition as breeding approaches to achieve target body weights. Caution is advised when restricting nutrients to growing heifers, particularly prior to breeding. Producers need to monitor heifer growth periodically to ensure that heifers are on track for achieving their target weight by breeding.

LITERATURE CITED

Short, R. E. and R. A. Bellows. 1971. Relationships among weight gains, age at puberty and reproductive performance in heifers. J. Anim. Sci. 32:127.

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Clanton, D. C., L. E. Jones and M. E. England. 1983. Effect of rate and time of gain after weaning on the development of replacement beef heifers. J. Anim. Sci. 56:280.

Table 1. Diet formulations (lbs./hd/day, as-fed basis) for oats silage (OAT-SIL) or oats-pea (OAT-PEA) silage based diets fed to replacement beef heifers managed for a high (HIGH GAIN) or low (LOW GAIN) gain, 57 days prior to breeding.

Ingredient	OAT-SIL HIGH GAIN	OAT-SIL LOW GAIN	OAT-PEA HIGH GAIN	OAT-PEA LOW GAIN
Silage	20.00	11.00	23.00	12.00
Barley	6.00	1.50	6.00	1.50
Wheat Straw	3.00	9.00	3.00	9.00
38% CP Supplement[a]	.39	.29	.10	.15
Mineral Supplement[b]	.10	.10	.10	.10
Ionophore Supplement[c]	.06	.06	.06	.06
Total	29.55	21.95	32.26	22.82
Ration Cost[d], ($)	.49	.29	.50	.29

[a] An all-natural commercial supplement containing 38% crude protein on an as-fed basis.

[b] Calcium and phosphorus (24:6) commercial supplement.

[c] Commercial ionophore supplement containing Bovatec.

[d] Based on the following prices; silages, $20/ton; straw, $15/ton; barley, $1.60/bu.; protein supplement, $200/ton; ionophore supplement, $200/ton; mineral supplement, $390/ton.

Table 2. Nutrient composition (DM-basis) of feeds used in experimental diets and fed to replacement beef heifers managed for a high (HIGH GAIN) or low (LOW GAIN) gain, 57 days prior to breeding.

Ingredient	DM (%)	CP (%)	NE (Mcal/lb.)
Oat silage	51.0	6.4	0.35
Oat-pea silage	48.0	8.6	0.43

Wheat straw	89.0	4.5	0.07
Barley	88.0	14.0	0.64
38% CP supplement	90.0	40.0	0.40

Table 3. Body condition score (BSC) and BCS change measurements for replacement beef heifers fed basal diets comprised of oats silage (OAT-SIL) or oats-pea silage (OAT-PEA) and managed for a high (HIGH GAIN) or low (LOW GAIN) gain, 57 days prior to breeding.

Item	OAT-SIL	OAT-PEA	LOW GAIN	HIGH GAIN	SE[a]
Heifers	24	24	24	24	
Initial BCS	7.1	7.1	7.1	7.1	.04
May 19, BCS	6.9	7.0	6.8[c]	7.1[d]	.05
Fall BCS	6.9	7.0	6.8[c]	7.1[d]	.05
BCS change[b]	-.20	-.10	-.30[c]	.0[d]	.03

[a] SE = Standard error of the means and represents the variability in the measurements collected.
[b] BCS change = May 19, BCS - initial BCS (change during the treatment period).
[c,d] Values within each row are different (P <.06) when they possess uncommon superscripts.

Table 4. Body weight (BW) and BW change measurements for replacement beef heifers fed basal diets comprised of oats silage (OAT-SIL) or oats-pea silage (OAT-PEA) and managed for a high (HIGH GAIN) or low (LOW GAIN) gain, 57 days prior to breeding.

Item	OAT-SIL	OAT-PEA	LOW GAIN	HIGH GAIN	SE[a]
Heifers	24	24	24	24	
Initial BW	784.3	765.4	768.5	781.2	9.2
May 19, BW	841.8	841.7	809.3[c]	874.3[d]	11.6
Fall BW	1018.6	1000.5	987.5[c]	1031.6[d]	10.8
ADG[b]	1.01	1.34	.72[c]	1.63[d]	.14
TRT[e] BW change	57.5	76.3	40.8[c]	93.0[d]	7.7
SUM[f] BW change	176.8[c]	158.8[d]	178.3[c]	157.3[d]	2.7

[a] SE = Standard error of the means and represents the variability in the measurements collected.
[b] ADG = Average daily gain to May 19 (ADG during the treatment period).
[c,d] Values within each row are different (P <.04) when they possess uncommon superscripts.
[e] TRT = May 19 BW - Initial BW (BW change during the treatment period).
[f] SUM = Fall BW - May 19 BW (BW change over summer grazing).

Table 5. Early pregnancy (June, 24) and final pregnancy (August 17) rates for replacement beef heifers fed basal diets comprised of oats silage (OAT-SIL) or oats-pea silage (OAT-PEA) and managed for a high (HIGH GAIN) or low (LOW GAIN) gain, 57 days prior to breeding.[a]

Item	Heifers	June 24	August 17
OAT-SIL	24	18 (75.0%)	19 (79.2%)
OAT-PEA	24	13 (54.2%)	22 (91.7%)

Total	48	31 (64.6%)	41 (85.4%)
OSL[b]		.13	.22
LOW GAIN	24	15 (62.5%)	21 (87.5%)
HIGH GAIN	24	16 (66.7%)	20 (83.3%)
Total	48	31 (64.6%)	41 (85.4%)
OSL[b]		.76	.68

[a] Values represent the number of heifers determined pregnant followed by the percentage of heifers pregnant within each treatment group.

[b] OSL = Observed significance level. Table values can be compared to the level of significance at which differences are determined to be due to treatment effects (P <.10).

Back to 1994 Research Report Table of Contents

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