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# Reproductive Response in Heifers Fed Soybeans During Post Weaning Development

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## Summary

*Three experiments were conducted to determine effects of soybeans on reproduction in heifers. In Experiment 1, heifers received whole soybeans or control diet with wet corn gluten feed for 110 days. Heifers receiving soybeans had decreased synchronization rate and delayed estrous response. Diet did not affect AI conception, AI pregnancy, or final pregnancy rates. In Experiments 2 and 3, heifers received supplements of ground soybeans or dried distillers grains. Heifers in Experiment 2 were predominantly prepubertal and supplemented 161 days. Heifers in Experiment 3 were postpubertal and supplemented 30 days. Heifers fed soybeans had larger dominant follicles than those fed distillers grains.*

## Introduction

Fat supplementation has been shown to have positive reproductive effects independent from the energy contribution. In previous research conducted with pregnant and postpartum beef females, fat supplementation improved first service conception rates when fed prepartum, decreased the duration of the anestrus period, and increased circulating levels of reproductive hormones. Supplemental fat has been reported to increase the lifespan of an induced

corpus luteum and increase the number and size of follicles on the ovary. Research on supplemental fat in heifer development diets is limited and results have been inconclusive. Soybeans are a locally produced crop high in fat. Therefore, the objectives of this study are 1) to determine the effects of supplemental fat (soybeans) on reproductive characteristics in developing heifers, and 2) to determine the effect of reproductive status (prepubertal vs. postpubertal) on response to fat supplementation.

## Procedure

### Experiment 1

The objective of the first experiment was to determine how soybeans in heifer development diets would affect 1) pubertal status 2) response to estrous synchronization 3) AI conception rate, and 4) overall pregnancy rate. One-hundred-four crossbred virgin beef heifers weighing 659 lb at 10 months of age were allotted by weight and randomly assigned to receive one of two diets (Table 1). Heifers received either 3 lb of whole raw soybeans (SB) as part of a total mixed diet (4% added fat) or a con-

trol diet containing wet corn gluten feed (WCGF; 2% fat). Diets were formulated to be isocaloric and isonitrogenous and fed for 110 days.

Two blood samples were taken 7 days apart before and during the feeding period and a single sample on day 110 to determine cycling status. Body weights were determined at the time of blood collection. Heifers in both groups were synchronized using 14-day melen-gestrol acetate (MGA, 0.5 mg/day) treatment 19 days before prostaglandin F<sub>2α</sub> (PGF<sub>2α</sub>) injection (25 mg) given on day 110 of the trial. Heifers were artificially inseminated (AI) 12 hours after visual detection of estrus. Bulls were placed with heifers 10 days after the last AI day for a 60-day breeding season. Pregnancy to AI was detected using ultrasonography 45 days after the last AI.

### Experiment 2

The objective of Experiment 2 was to determine the effects of feeding soybeans to prepubertal heifers. Fifty crossbred virgin beef heifers weighing 463 lb at nine months of age were randomly assigned to one

(Continued on next page)

Table 1. Soybean and control diets, Experiment 1.

Ingredient, % of diet (DM)	Control Diet (2% added fat)		Soybean Diet (4% added fat)	
Corn silage	48.7		54.5	
Wheat straw	14.2		32.7	
Whole soybeans	0		10.4	
Wet corn gluten feed	13.4		0	
Brome grass hay	21.4		0	
Supplement	2.3		2.3	
CP	11.2		10.8	
TDN	65.3		64.2	

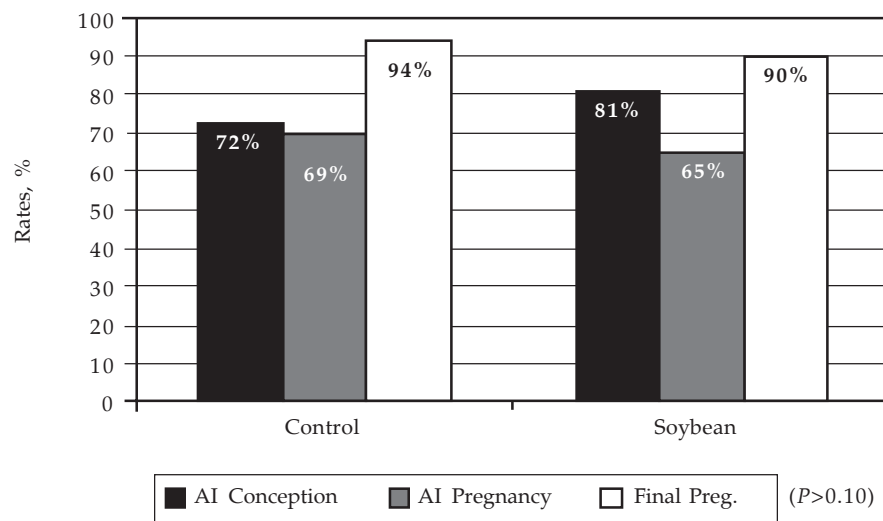


Figure 1. Artificial insemination (AI) conception, AI pregnancy, and final pregnancy rates, Experiment 1.

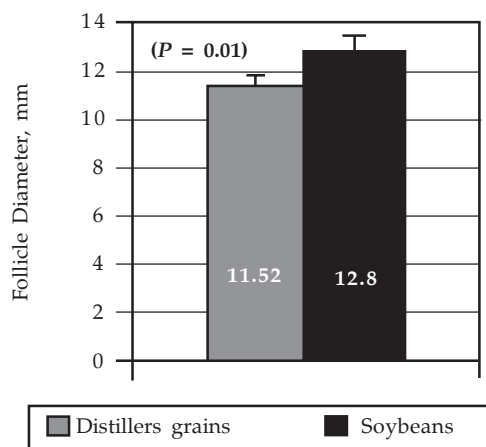


Figure 2. Follicle diameter, Experiments 2 and 3 combined.

of two treatment groups and to one of two pens per group. All heifers were fed ad libitum late harvested Sandhills meadow hay (9% CP) and supplemented with either 3 lb raw soybeans ground with 1 lb corn (SB; 17% fat) or 4 lb dried distillers grain (DDG; 11% fat) for 83 days. Both supplements were 31% CP and were approximately isocaloric. On day 84, heifers in both groups were put on native Sandhills pasture and supplementation continued for 78 days. Two blood samples were taken seven days apart before and during the feeding period to determine cycling status. Body weights were determined at

the time of blood collection, and a final weight was taken on day 146.

Heifers were synchronized with two injections of PGF<sub>2α</sub> 14 days apart. Blood samples were taken 48 and 60 hours after the second PGF<sub>2α</sub> injection (given day 146). Sixty hours after the second injection of PGF<sub>2α</sub>, ovarian follicular aspirations were collected using an ultrasound-guided vaginal probe. The diameter of the dominant follicle was measured before aspiration. Granulosa cells were harvested from follicular fluid, follicular fluid and granulosa cells were then frozen until subsequent analysis. Fourteen days after aspi-

rations were performed (day 161), supplements were discontinued and bulls were placed with all heifers for a 45-day breeding season. Pregnancy was determined by ultrasonography approximately 45 days after the end of the breeding season.

### Experiment 3

The objective of Experiment 3 was to examine the effects of short-term soybean supplementation on ovarian follicle characteristics in postpubertal heifers. Twenty cross-bred virgin beef heifers weighing 780 lb were randomly allocated to

one of two treatments and individually fed the same supplements as in Experiment 2. The experimental period was 30 days. Follicular aspirations were performed by the same procedure as in Experiment 2.

## Results

### *Experiment 1*

Heifers weighed 825 lb at the time of PGF<sub>2α</sub> injection and ADG did not differ between groups throughout the experimental period (1.25 lb/day). Treatment did not affect cycling status at any time point measured. At the initiation of the feeding period, 82% of the heifers were cycling. Ninety-eight percent had reached puberty by day 55-62 of treatment, and all heifers had cycled at least once by the end of the experimental period. More ( $P < 0.05$ ) heifers on the control diet (96%) exhibited estrus during the four-day breeding period compared to heifers fed soybeans (81%). Among the heifers fed soybeans and exhibiting estrus during the synchronization period, there was a delay in the average time of estrus compared to the control group (3.2 days vs. 2.9 days for SB and control, respectively;  $P = 0.05$ ). Diet did not affect the percentage of synchronized heifers becoming pregnant to AI (AI conception rate), the percentage of heifers in each group

becoming pregnant to AI (AI pregnancy rate), or the percentage of heifers in each group becoming pregnant to AI or natural service (final pregnancy rate;  $P > 0.10$ ; Figure 1).

The reason for the reduced synchronization rate and delay in estrus is not known; however, upon analysis of soybeans by high performance liquid chromatography, three phytoestrogens were detected: 1) genistein at 1095 ppm, 2) daidzein at 940 ppm, and 3) glycitein at 100 ppm. The combination of these phytoestrogens may have altered reproductive response in heifers fed soybeans.

### *Experiment 2*

Thirty-eight percent of the heifers were cycling at the beginning of the feeding period and 90% had become pubertal by day 80-87 of treatment. Diet did not affect pubertal status at this time. Heifers receiving DDG supplement were heavier than SB supplemented heifers at the end of the feeding period (775 lb vs. 738 lb, respectively;  $P < 0.05$ ) and had a higher ADG throughout the experimental period (2.08 lb/day vs. 1.83 lb/day for DDG and SB, respectively;  $P < 0.01$ ). Final pregnancy rates were not affected by treatment (80% and 88% for DDG and SB, respectively).

### *Follicle Diameter, Experiments 2 and 3*

There was no treatment  $\times$  experiment interaction for follicular diameter; therefore, data from Experiments 2 and 3 were combined. Follicle diameter was larger in SB heifers than DDG heifers (12.8 vs. 11.52 mm, respectively;  $P = 0.01$ ). It is not known whether the increase in follicular diameter is a response to greater levels of fat in the soybean supplement or due to phytoestrogens in the soybeans. The ovulation of larger follicles may result in formation of larger corpora lutea and greater progesterone production, which has been associated with higher conception rates.

In conclusion, soybeans may be a viable protein and energy source in heifer development diets, depending on availability and price. There also may be direct positive effects on reproduction due to ovulation of a follicle with greater diameter.

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