API STOCK PHOTO BY SHAUNA ROSE HERMEL

Heifer Development

Nebraska researchers report feeding of DDGs improved AI conception rates among heifers.

*by **Ed Haag***

Even the herdsmen of ancient Mesopotamia understood the economic importance of achieving a high rate of timely pregnancies among their heifers. For that reason they assigned the task of oversight to their most important god, Baal.

While worshipping Baal has fallen out of favor with the majority of today's beef producers, the financial motivation behind wanting as many cows as possible to begin calving with a timely pregnancy has not.

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>
> ***— Rick Funston***

A comprehensive Agriculture Canada study was designed to identify and rank variables relating to reproduction production and price. The study revealed eight categories in which a 1% change would be most likely to influence profitability in a beef operation. Out of those eight identified categories (see Table 1, page 108), increasing the conception rate by 1% proved to have the greatest positive effect on farm income, scoring even higher than increasing the price of calves.

This view carries even greater weight as it applies to the conception rates in young animals. Researchers at the U.S. Department of Agriculture–Agricultural Research Service (USDA-ARS) Range Livestock Experiment Station at Miles City, Mont., followed the production history of 1,583 heifers during a 23-year period to determine the role that early conception rates in heifers played in the rest of their production lives.

After analyzing the data, it was determined that heifers that produced a calf early in the calving season continued to calve early and wean heavier calves throughout their lifetimes. Heifers that produced their first calf late in the calving season had a more erratic lifetime reproductive performance and were less likely to produce a calf every year.

"The trend indicated that cows that were less than 730 days old at first calving were at less risk of being culled than those that were greater than 730 days," says Andy Roberts, the ARS researcher at the experiment station. "What that means is that in a group of cows that were all born within two weeks of each other, [the] ones that were bred early in the season were less likely to be culled and

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would, in most cases, prove to be the most profitable."

Lower feed costs, raise conception rates

With feeding costs soaring — since 2000, hay prices have climbed 58% while corn, in many parts of the country, has doubled — carrying an open female, for any time longer than necessary is taking serious money out of the calf producer's pocket. "The real challenge is to keep feed costs down while doing everything we can to raise the conception rates," says Rick Funston, beef researcher at University of Nebraska's West Central Research and Extension Center. Funston says the two objectives can often work at cross-purposes.

The best example of this is reducing quality and quantity of feed to cut a cow's carrying costs, which could, in turn, negatively affect the chances of a timely conception.

But there are exceptions, Funston says, noting that a study he and his colleagues recently conducted exploring the role of dried distillers' grains (DDGs) for developing beef heifers appears to have led to a very important one.

While the availability of DDGs and the economics of feeding the byproduct to cattle improve with the expansion of the ethanol industry, Funston and his research team have discovered what appears to be a direct relationship between the feeding of DDGs and improved conception rates among artificially inseminated (AIed) heifers.

"The AI conception rates were significantly higher in the heifers fed distillers' grains when compared to heifers fed a supplement that was equal in crude protein (CP), equal in fat, equal in energy and equal in everything else but the bypass component," Funston says. He says the AI pregnancy rate for DDG-fed heifers was 22% higher when compared to the control group (75% vs. 53%).

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Study results not foreseen

Funston admits that he and his colleagues did not expect that result. In some previous studies involving other supplements containing high levels of bypass protein (such as feather, fish or blood meal), negative effects on conception rates had been recorded.

"The objective of our study was to determine if supplementing beef heifers with excess UIP (undegraded intake protein) from DDGs during development affects heifer growth or reproduction," he says.

Because the results of the previous studies were known, Funston's research project focused on nutrient values that were comparable.

"We designed our DDG study using levels of bypass protein similar to those in earlier studies to test whether or not the bypass protein in DDGs acted the same way," he says. "People were blaming DDGs for lots of things, but in reality there were no scientific studies to back up those claims."

The two-year study involving 316 crossbred heifers was conducted at two locations, the University of Nebraska Dalbey-Halleck Farm and the University of Nebraska Agricultural Research and Development Center, Ithaca.

Study heifers at the Dalbey-Halleck Farm were weaned in mid-October at an average age of 200 days, with supplementation beginning in mid-November — 39 days later. During that interim period, between weaning and initiating the study, heifers at the farm were confined in a drylot and received prairie hay. Animals at the development center in Ithaca grazed cool-season grasses between weaning and the onset of the study.

The duration of the supplementation phase of the study was 196 days in the first year and 190 days in the second year. Both supplementation periods began in November and ended in late May.

Variables reduced to bypass protein

During the supplementation phase of the study, heifers in both locations were confined to a drylot and were allowed unlimited access to prairie hay. No effort was made to calculate per-animal hay intake, but samples were analyzed to determine forage nutrient concentration.

Each year, half the heifers received supplemental DDGs [27.7% CP, 53.9% of CP as UIP, on a dry-matter (DM) basis] while the control group received a mix of dried corn gluten feed pellets (20.4% CP, 20.8% of CP as UIP) and whole corn germ (13.6% CP, 21.5% of CP as UIP) in a blend that provided a source of digestible fiber and lipid comparable to the DDG supplementation.

For Funston, a critical aspect of the supplementation phase of the study was in providing the control group with a supplement that possessed an equally balanced nutritional profile to the DDG supplement with one exception.

"So when AI pregnancy rates were higher with the heifers fed distillers' grain, we knew that the control group received supplementation equal in CP, fat, energy and everything else but the bypass component."

In order to maintain a similarity in relative supplemental CP, energy and lipid intake between the DDG and the control groups, Funston based the supplementation rate on body weight, allocating 0.78% of body weight for the control group and 0.59% of body weight for DDG-fed heifers.

Heifers were weighed monthly through mid-February and then every 14 days through the completion of the study, with their supplementation rate being adjusted after each weighing. An average daily gain (ADG) of 1.5 pounds (lb.) per day was

Table 1: Contribution of production variables to net cow-calf income

Production variables	Effect on net farm income	$/cow
Conception rate	1% increase	+6.34
Winter feed	1% increase	–1.28
Calving rate	1% increase	+3.59
Birth weight	1% increase	+0.46
Difficult calvings	1% increase	–1.80
Postnatal calf death loss	1% increase	–3.59
Weaning weight	1% increase	+3.30
Price of steer calves	1% increase	+3.30

Source: Adapted by Ritchie (1995) from Agriculture Canada data.

targeted to achieve approximately 60% of mature body weight at the time of breeding. In order to determine the approximate age at puberty, blood samplings were taken every two weeks starting in mid-February. Concentrations of progesterone greater than 1 nanogram (ng) per milliliter (mL) were interpreted to indicate ovarian luteal activity and, therefore, attainment of puberty.

All things equal

After the analysis of the initial data, researchers concluded that initial age, body weight and body condition score (BCS) did not differ ($P > 0.92$) for control and DDG heifers. Nor did the final body weight, ADG and final BCS.

Researchers also determined from the data gathered during and after the supplementation period that estimated age and body weight at puberty did not differ ($P > 0.23$) between treatments, and the proportions of pubertal heifers did not differ at the initiation of the experiment ($P > 0.82$), at the beginning of the 14-day sampling intervals, or before synchronization.

In the AI part of the study, all heifers were synchronized using two injections of $PGF_{2\alpha}$ (PGF; as Prostamate) administered 14 days apart. After the second injection, estrus detection was performed in the morning and the evening for the next five days. Heifers received AI within 12 hours of detection.

Clean-up bulls were introduced to the heifers for approximately 45 days, beginning 10 days after final AI.

Conception rate to AI was determined via transrectal ultrasonography approximately 45 days after AI. An additional ultrasound pregnancy diagnosis was performed 45 days after removal of bulls to determine the final pregnancy rate.

Results

In spite of their efforts to implement identical insemination regimens for both the DDG and control heifers, Funston and his fellow researchers observed some significant differences in the response rates of the two groups.

While body weight or BCS at pregnancy diagnosis did not differ between DDG and control heifers, a greater proportion of DDG heifers conceived to AI (75.0% vs. 52.9%), resulting in greater AI pregnancy rates for DDG heifers (57.0% vs. 40.1%).

"We had a positive effect on conception and pregnancy by feeding excess bypass from distillers', and it was independent of fat because the other supplement was equal in fat to distillers'," Funston says. "It would have been a similar fat source because both the distillers' and the control supplements were corn-derived."

He notes while there was a difference in AI conception and pregnancy rates, final pregnancy rates after bull exposure were similar.

Funston also notes that although any explanation of what in the DDGs is affecting AI conception is speculative, what is likely happening is the unique combination of amino acids in the bypass protein is responsible for the higher rate.

"What we think is happening is that there are certain amino acids that have a positive effect on GnRH (gonadotropin-releasing hormone) release, which is the master hormone that initiates all reproduction," he says. "In all protein sources there are a certain number of amino acids that have both positive and negative effects on reproduction. In the distillers', there are probably more amino acids that have a positive effect on reproduction, while in the high-bypass-protein supplements tested earlier — blood meal, feather meal and fish meal — it is the other way around." AJ

Table 2: Effects of supplementation with dried distillers' grains (DDGs) during development on pubertal development, estrus synchronization response, and reproductive performance of composite beef heifers

	Location 1		Location 2	
Trait	**Control[1]**	**DDG[2]**	**Control[1]**	**DDG[2]**
No. of heifers	75	76	82	82
Pubertal in November,[3] %	12.0	9.2	6.0	6.1
Pubertal in February,[4] %	64.0	52.6	36.1	34.1
Pubertal before $PGF_{2\alpha}$,[5] %	100.0[a]	98.7[a]	56.6[b]	74.4[b]
Age at puberty, days	351	359	355	357
Body wt. at puberty, lb.	695	705	692	747
Estrous response,[6] %	82.7	77.6	69.5	74.4
Time of estrus,[7] hours	65.4[a]	64.0[a]	78.1[b]	69.1[b]
AI conception rate,[8] %	50.0[a]	71.2[b]	56.1[a]	78.7[b]
AI pregnancy rate,[9] %	41.3[c]	55.3[d]	39.0[c]	58.5[d]
Overall pregnancy rate, %	82.7	89.5	91.5	93.9
Body wt. at pregnancy diagnosis,[10] lb.	902	906	926	957
BCS at pregnancy diagnosis[11]	5.51	5.54	5.68	5.77

[a,b]Within a row, means without common superscripts differ at $P \leq 0.05$. [c,d]Within a row, means without common superscripts differ at $P = 0.07$.

[1]Supplemented daily with control supplement at 0.78% of body wt. [2]Supplemented daily with DDG supplement at 0.59% of body wt. [3]Proportion of heifers pubertal in November, immediately prior to beginning of supplementation. [4]Proportion of heifers pubertal in mid-February, when 14-day sampling intervals began. [5]Percentage of heifers that had attained puberty prior to initial $PGF_{2\alpha}$ injection. [6]Percentage of heifers detected in estrus within 5 days following second $PGF_{2\alpha}$ injection. [7]Time elapsed between the second $PGF_{2\alpha}$ injection and observed standing estrus. [8]Proportion of heifers detected in estrus that conceived to AI. [9]Percentage of total group of heifers that conceived to AI. [10]Body wt. at final pregnancy diagnosis. [11]BCS at final pregnancy diagnosis.