

The PregCard study: assessing the impact of routine management strategies on reproductive performance of beef herds in the upper Great Plains

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Abstract

Summary data from pregnancy examinations were submitted by participating veterinarians over a 2-year period to assess the impacts of routine management decisions on reproductive performance in beef herds. Upon completion of pregnancy examination, the PregCard was completed by indicating the number of females evaluated, number non-pregnant, female age (cows, heifers, or both), number and age (yearling, mature, or mixed) of bulls used, breeding season dates, and whether groups were exposed to artificial insemination. Data were reported by 8 clinics and included 242,967 females in 1,782 groups. Number of females/bull and breeding season were calculated for each group. Each group was also assigned to categories for females/bull, breeding group size, breeding season length, and age class of breeding bulls. Groups consisting of only cows had greater ($P \leq 0.01$) reported pregnancy rates compared with groups consisting of only heifers (90.1% and 86.6%, respectively). Reported pregnancy rates were also influenced ($P \leq 0.01$) by breeding group size, breeding season length, and bull age. Females/bull decisions were impacted ($P \leq 0.01$) by breeding system (artificial insemination or natural service), and reported pregnancy rates were impacted by a breeding system \times females/bull interaction ($P \leq 0.001$). The PregCard system provided an excellent platform to gather benchmarking data and to assess the impact of routine management practices on reported pregnancy rates in beef herds in the upper Great Plains.

Key words: cattle, pregnancy examination, reproductive management

Résumé

Des données sommaires provenant d'examen de gestation ont été soumises par des vétérinaires participants sur une période de deux ans afin d'examiner l'impact des pratiques courantes de gestion sur la performance en reproduction dans des troupeaux de bovins de boucherie. Après avoir complété l'examen de gestation, les participants remplissaient le formu-

laire *PregCard* en indiquant le nombre de femelles évaluées, le nombre de non-gestantes, l'âge des femelles (vaches, taures ou les deux), le nombre et l'âge (jeune de l'année, adulte ou mélangé) des taureaux utilisés, la date de la saison de reproduction et si l'insémination artificielle avait été utilisée. Les données provenaient de huit cliniques et incluaient 242 967 femelles dans 1782 groupes. Le rapport du nombre de femelles par taureau et la saison de reproduction ont été obtenus pour chaque groupe. Chaque groupe a aussi été classé dans différentes catégories selon le rapport femelles/taureau, la taille du groupe de reproduction, la longueur de la saison de reproduction et la classe d'âge des taureaux utilisés pour la reproduction. Le taux de gestation signalé était significativement plus élevé chez les groupes comportant seulement des vaches ($P < 0.01$) que chez les groupes comportant seulement des taures (90.1% et 86.6%, respectivement). Le taux de gestation signalé était aussi influencé par la taille du groupe de reproduction, la longueur de la saison de reproduction et l'âge du taureau ($P < 0.01$). Les décisions à l'égard du rapport femelles/taureau étaient influencées ($P < 0.01$) par le système de reproduction (insémination artificielle ou accouplement naturel). Il y avait aussi une interaction entre le système de reproduction et le rapport femelles/taureau sur le taux de gestation signalé ($P < 0.001$). Le système basé sur les formulaires *PregCard* forme une excellente plateforme pour collecter des données d'étalonnage et pour examiner l'impact des pratiques courantes de gestion sur le taux de gestation signalé dans les troupeaux de bovins de boucherie de la région haute des Grandes Plaines.

Introduction

Reproductive performance in beef herds is a management area of paramount to profitability. To provide a positive financial contribution in the form of a saleable calf, a cow must become pregnant, give birth to a live calf, and raise that calf to weaning. The greatest expense accrued for a beef cow/annum is the cost of feed, which accounts for over 60% of cow-calf producers' total cost.⁸ The practice of pregnancy checking prior to the start of the winter feeding period to identify

and remove non-pregnant females may result in significant cost savings. However, less than 20% of all beef herds in the United States incorporate this reproductive technology into their herd management system.⁹

Each year veterinarians, extension personnel, and others that serve in a consulting role for cow-calf producers respond to numerous inquiries shortly after pregnancy examination about perceived poor pregnancy rates and the possible impact of adverse events on overall beef herd reproduction. Depending on the year, inquiries can include such things as the impact of extreme heat, extreme cold, record rains, extended drought, delayed pasture turnout, delayed initiation of winter feeding, noxious pasture plant exposure, and disease concerns in the region. To respond to the inquiries many testimonials are collected from producers and veterinarians, and some responses may indicate that pregnancy rates have been impacted. However, real-time data from sentinel herds that could be used to verify testimonials are lacking.

The PregCard system was initiated in an attempt to gather real-time data regarding reproductive performance of beef herds at the time of pregnancy examination, to provide veterinary clinics with benchmarking data and summary reports for their current clients, and to determine the impacts of several routine management practices on overall beef herd reproductive performance in the upper Great Plains.

Materials and Methods

After extensive conversation with a focus group of veterinarians, producers, and industry representatives, the PregCard emerged as a 4 × 5½" preprinted postage-paid card that can be completed after pregnancy examination in a group of cattle. Cards were distributed to sentinel veterinary clinics for completion after pregnancy determinations over a 2-year period. Pregnancy diagnoses were conducted by veterinarians via palpation per rectum or transrectal ultrasonography of cattle managed on clients' operations.

The PregCard was designed to take only a few minutes to complete with pertinent information including total number of females evaluated, total number non-pregnant, date of first artificial insemination (AI) or bull turnout, whether bulls passed a breeding soundness exam, and total number of yearling and mature bulls stocked with each group of females. In addition, fields defined the class of females (heifers, cows, or both), whether cattle were seedstock or commercial, whether females were exposed to AI, and vaccination status of male and female breeding stock. The completed PregCards were mailed to North Dakota State University for data entry and analysis.

Calculations made with the data include overall pregnancy rate (1 - (number of non-pregnant females ÷ total number of females)), breeding season length (last day of bull exposure - first day of bull exposure or first AI), and females/bull (number of females ÷ number of bulls). Each group of females was also assigned to management categories for

females/bull (low = <15, medium = 15 to 25, high = 26 to 36, and very high = >36 females/bull), group size (<50, 50 to 99, 100 to 199, and ≥200 females), breeding season length (< 45 days, 45-65, 66-85, 86-105, and >105 days), and age of breeding bulls in pastures (yearling, mature, or mixed ages).

Effects of herd characteristics and management strategies on overall pregnancy rates were evaluated using the GLM procedure of SAS^a. Models were developed to evaluate the impacts of year, previously mentioned management categories, and appropriate interactions on reported pregnancy rates. Effects were considered significant at $P \leq 0.05$.

Results and Discussion

Data submitted provide insight into a representative cross-section of the beef industry in the upper Great Plains. The PregCard dataset includes 242,967 females from 1,782 groups (Table 1). Examinations conducted via transrectal ultrasonography accounted for 66.8% of the groups, whereas examinations conducted via palpation per rectum accounted for the remaining 33.2% of the groups. A variety of herd management practices and operation sizes are included in the reported data. For example, the number of breeding females maintained on operations represented in the dataset ranged from under 15 to over 1,400, and females/bull ranged from 0 (100% AI breeding) to 140 cows/bull in breeding pastures.

Practitioners in participating clinics submitted cards from 4 states representing 79.2% of counties in North Dakota (42 of 53 counties), 33.3% of counties in South Dakota (22 of 66), 12.5% of counties in Montana (7 of 56 counties), and 13% of counties in Wyoming (3 of 23). Reported pregnancy rates ranged from 2.9% to 100% of females evaluated in a group, with 45.9% of groups having reported pregnancy rates ≤ 90% and 11.4% of groups having reported pregnancy rates ≤ 80%.

Groups consisting of only cows had greater ($P \leq 0.01$) reported pregnancy rates compared to groups consisting of only heifers (90.1 ± 0.09% and 86.6 ± 0.11%, respectively). A major emphasis of selection pressure in the beef industry is on the ability of females to become pregnant and raise a calf every year. Perhaps our dataset revealed this selection pressure occurs to a greater degree in heifers, and the greater reported pregnancy rates observed in mature females are simply a function of infertile animals being identified and removed as heifers.¹⁰

Table 1. Summary of data collected using the PregCard in participating veterinary clinics.

	Year		Total
	1	2	
Total cards, n	742	1,040	1,782
No. females	96,821	146,146	242,967
Females/group, no.	131	141	--
Pregnancy rate, %	89.4	88.0	--
Breeding season length, days	89.4	89.6	--
Females/bull, no.	31.0	28.9	--

Interestingly, when reported pregnancy rates were compared among group sizes, pregnancy rates increased ($P \leq 0.05$) as group size increased, and plateaued when group size reached 100 females (Figure 1). As group size increased, the subsequent number of bulls placed with each group increased ($P \leq 0.05$) as well (data not shown). Farin et al⁴ reported a greater number of services/female in single-sire breeding groups compared with multi-sire breeding groups, but no difference in pregnancy rate. While large variation exists in the number of calves sired by each bull in a multi-sire breeding pasture,¹⁴ perhaps having multiple bulls present provides an advantage in cases when members of the bull battery experience injury or lack of physical fitness over the course of the breeding season.³ In addition, in cases where group size is related to herd size, a portion of differences in pregnancy rates observed among group sizes might simply be indicative of management level of producers maintaining the respective group sizes. As herd size increases, the likelihood of monitoring for reproductive disorders of breeding bulls, controlling calving seasons, seeking veterinary consultation, and knowledge of diseases also increases.⁹ Interestingly, reported pregnancy rates were not different ($P = 0.19$) among groups of females exposed to bulls that had passed a breeding soundness examination and those that did not in the current dataset (88.9 ± 0.26 and 88.1 ± 0.56 , respectively)

Groups with breeding seasons <45 days ($81.9 \pm 1.1\%$) had poorer ($P \leq 0.01$) reported pregnancy rates compared with other breeding season length categories (88.9 , 89.0 , 89.2 , and $89.4 \pm 0.5\%$ for breeding season categories of 46 to 65, 66 to 85, 86 to 105, and > 105 days, respectively). Similarly, Deutscher et al² reported that cows exposed to a 30 or 45-day breeding season had reduced pregnancy compared to cows exposed to a 75-day breeding season. No additional advantage in reported pregnancy rate was observed in the current report by maintaining a breeding season longer than 45 to 65 days. However, recommendations for timing of bull removal must be balanced with the reality of pasture

facilities, labor resources, and handling aptitude of individual cattle managers. In addition, interventions at the time of pregnancy determination (specifically identifying and removing females that became pregnant outside of a specified period) can ultimately achieve the benefits that come with a defined breeding season.¹

Placing 15 to 25 females/bull ($89.7 \pm 0.4\%$) resulted in greater ($P \leq 0.05$) reported pregnancy rates compared with placing 26 to 35 ($88.3 \pm 0.5\%$) and >36 females/bull ($88.3 \pm 0.5\%$), both of which were greater ($P \leq 0.05$) than groups where <15 females were placed with each bull ($82.7 \pm 1.2\%$). The observations in the non-synchronized females in the current report reinforce the findings of Healy et al,⁵ who found the optimal mating load for synchronized females exposed to natural service to be 1 bull/25 females. In addition, a New Zealand Beef and Lamb study¹¹ showed potential reductions in fertility as number of females/bull decreased to fewer than 20 females/bull. It is unknown why pregnancy rates were reduced when fewer than 15 females were placed with each bull.

Many breeding programs that incorporate AI will use a single AI service for all or a portion of females, followed by exposure to natural service bulls for the remainder of the breeding season.⁹ With this strategy a portion of females will be pregnant to AI (typically $\geq 50\%$ in well-managed herds⁶) at the time of bull turnout to breeding pastures. With a portion of cows already pregnant, the opportunity may exist to place breeding bulls with a greater number of females after AI compared with natural service breeding systems. However, a portion of producers are hesitant to adjust the number of females/bull after AI because of concerns that synchronized females that did not become pregnant to AI may subsequently return to estrus in a synchronized fashion and overwhelm the breeding ability of herd bulls. Indeed, a partial budget analysis included in a comparison of fixed-time AI and natural service breeding systems reported that number of females/bull must be adjusted in order for breeding systems incorporating AI to have an economic advantage over natural service breeding systems in commercial cattle.¹³ In the current report, number of females/bull for groups of females exposed to AI (39.2 ± 0.59 females/bull) was greater ($P \leq 0.01$) than number of females/bull for females exposed to natural service breeding systems (24.8 ± 0.48 females/bull). In addition, a females/bull \times breeding system interaction ($P \leq 0.001$) revealed that reported pregnancy rates of females exposed to AI and stocked at a rate of > 36 cows per bull were greater ($P \leq 0.05$) than reported pregnancy rates of females exposed to natural service breeding systems and stocked at a similar rate (Figure 2). These findings indicate that producers are altering the number of females/bull when AI is incorporated, and that the opportunity may exist to alter the number of females/bull to some inflection point >36 females/bull without negatively impacting pregnancy rates. However, a controlled experiment is required to define the upper limit of females/bull that are appropriate for use after AI without sacrificing pregnancy rates.

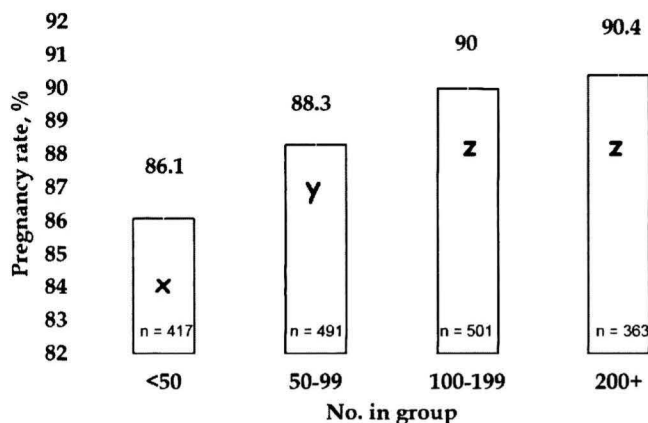


Figure 1. Impact of number of females in group on reported pregnancy rate.

*y) Means lacking common superscript differ ($P \leq 0.05$).

Reported pregnancy rates in groups of females bred by mature ($88.8 \pm 0.43\%$) and mixed age ($89.28 \pm 0.40\%$) bulls were greater ($P \leq 0.01$) than those of groups bred by yearling bulls ($86.6 \pm 0.67\%$). Similarly, Pexton et al¹² reported that synchronized females exposed to bulls ≥ 3 years of age had greater overall pregnancy rates than females exposed to 2-year-old bulls, which were also greater than pregnancy rates of females exposed to yearling bulls. No differences were reported, however, when pregnancy and calving rates of groups of females exposed to yearling or 2-year-old bulls were compared.⁷ In the design of the PregCard only “yearling” and “mature” options existed, so we were unable to evaluate whether differences in pregnancy rates exists in groups of females exposed to 2-year-old bulls and those exposed to bulls that were ≥ 3 years of age. It is interesting to note, however, that participating veterinarians indicated the number and age of breeding bulls placed with pasture groups were the data fields most difficult to recall or unknown (representing 20.5% of groups) by producers. In the current era of record prices of commercial and seedstock cattle, perhaps veterinarians, extension personnel, and others serving in consulting roles need to place a renewed emphasis on underscoring the true costs associated with breeding bulls (beyond purchase price), and on simple tools to monitor inventories of breeding stock for cow-calf producers.

Implications/Conclusions

The novel PregCard system established an effective platform for monitoring reproductive performance in beef herds in the upper Great Plains that could be expanded to all regions. Upon analysis of data, individual consultation and summary meetings were held that provided veterinarians and producers with an understanding of using reproductive benchmarking, and the opportunity to decipher the impacts of routine management strategies on reproductive performance. In addition, trends observed in reported data through the

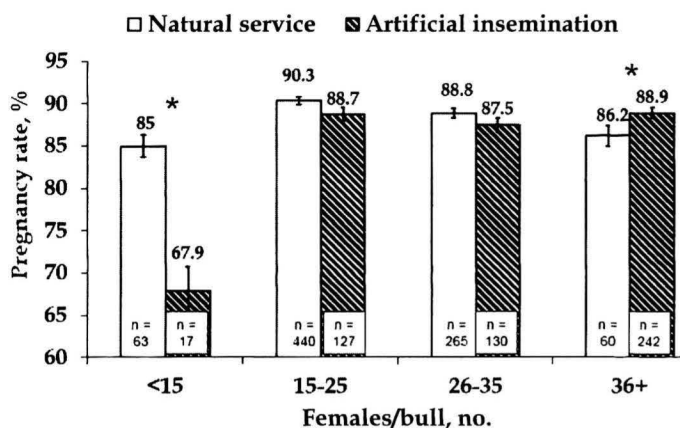


Figure 2. Impact of females per bull and breeding system on reported pregnancy rates. Females per bull \times breeding system ($P \leq 0.001$).

*Means within category of females per bull differ ($P \leq 0.05$).

PregCard system provide clear direction for future controlled research efforts. Furthermore, data generated provide new tools and insight into areas of focus for educational programming that can have rapid adoption by producers and ultimately influence overall profitability.

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Endnote

^aSAS Version 9.3, SAS Institute, Cary, NC

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