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Days to calving in artificially inseminated beef cows: Comparison of potential traits ☆

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Abstract

Four fertility traits were compared for artificially inseminated (AI) beef cows: *A*) for cows that calved to the AI sire (from either the initial or follow-up inseminations that season), the number days from initial AI to calving; *B*) for cows calving either by AI or to a backup bull, the number days from initial AI to calving; *C*) As trait *B* for cows that calved, otherwise the maximum of trait *B* for the contemporary group plus a penalty of 21 days; *D*) Define the 'start date' for a contemporary group as the date the first cow in the group was AI'd. For cows that calved, trait *D* was the number of days from the 'start date' to calving, otherwise the maximum of trait *D* for cows in the group that calved plus a penalty of 21 days.

The vast majority of cows received only one insemination in a season, so trait *A* resembled gestation length and had estimated heritability of 12%. Traits *B*, *C* and *D* had estimated heritabilities of 3.2%, 3.5% and 5.2% respectively; estimated genetic correlations of traits *A*–*D* with naturally mated days to calving were 0.48, 0.60, 0.80 and 0.74 respectively. Trait *D* is therefore the recommended female fertility trait for AI cows. It has a similar frequency distribution to days to calving from natural mating and should be included in a joint analysis with days to calving of naturally mated cows.

Keywords: Beef cattle; Female fertility; Artificial insemination; Days to calving

1. Introduction

Fertility of beef cows is an important aspect of profitable beef production (Ponzoni, 1992; Phocas et al., 1998). For naturally mated cows in Australia, days to calving became the standard trait for genetic evaluation after investigations by Meyer et al. (1990, 1991) and Johnston and Bunter (1996). Naturally mated days to calving (**NMDC**) combines two aspects of a cow's fertility — whether or not she calves, and how quickly she conceives. For cows that calve, it is defined as the number of days from the start of joining to the day of calving; for non-calvers, it equals the longest NMDC of cows that calved in the contemporary group, plus a penalty of 21 days. Although heritability is low (4–8%), NMDC is simple to record and can be measured on the whole herd at every joining, enabling fertility to be maintained or improved.

Increased use of artificial insemination (AI) has enabled breeders to access the best available genetics for their herds, but decreased the number of cows with NMDC measurements. More than 50,000 AI mating records of Angus cows were investigated in this study to determine if any useful measures of female fertility could be derived for cows mated by AI.

☆ This work was carried out while the author was employed at a University of New England Institution.

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2. Materials and methods

2.1. Data

Mating records were obtained from seedstock herds participating in the Australian Angus BREEDPLAN genetic evaluation system (Graser et al., 2005). Records are managed using a total female inventory system. Data were combined into one record per cow per season, comprising AI sire identifier, date first AI'd that season, age of the cow at AI, number of days since the birth of any previous calf and, if the cow calved (either from the first or repeat AIs that season, or by subsequent natural mating to a backup bull) number of days from first AI to calving, sex and sire of the calf, and whether a single or multiple birth. A total of 88,185 records from inseminations in 1983–2001 were available from 643 herds and 4,338 AI sires.

2.2. Checking/validation

To create a simple, consistent dataset, 1543 twin/multiple birth records were deleted, as were those for cows AI'd within 14 days of giving birth (104 records), cows over 10 years old at AI (3453), cows aged more than 3.5 years at AI but no record of a previous calving (1343) and mature cows with no record of any calving in the 1000 days before their AI (97).

Records were tabulated by herd to determine the percentages of inseminations resulting in a calf to the AI sire, a calf to another sire (e.g. a backup bull), or no calf at all. On average, 81% of cows had a calf to the AI sire (from either the first or follow-up inseminations of that sire), 13% calved to another sire and 6% did not calve that season. Notably, some herds had 100% of recorded cows calving to the AI sire. This suggested that the inventory system for some herds failed to include the entire breeding population, so all herds with a pregnancy rate of more than 90% to the AI sire (263 herds with 27,073 records) were excluded from the analysis. This left a total of 54,572 mating records.

Herds were then split into 3 similarly-sized datasets by number of AI records. Eight herds had more than 1000 AI records (dataset 1), 20 herds had 506–967 (dataset 2), 45 herds had 202–444 (dataset 3). There was some concern that managers of herds with less than 200 AI records would have limited experience of AI, and there would be only a few animals in each contemporary group. The remaining 303 herds were therefore omitted, leaving a total of 39,013 records from 21,546 cows mated to 717 AI service sires with 34,126 animals in the cows' pedigree file.

2.3. Contemporary groups

For natural mating, days to calving is defined as the time interval between 'bull-in' date and subsequent calving. Animals managed together in the same contemporary groups are readily identifiable by service sire/'bull-in' date. Non-calvers can therefore be assigned a value equal to the maximum days to calving of that contemporary group plus a penalty of 21 days, as recommended by Johnston and Bunter (1996).

The AI data contained no equivalent indicator of contemporary groups. It was therefore necessary to define contemporary groups from the pattern of inseminations within each herd. The process is illustrated in Fig. 1 for a hypothetical and somewhat idealized example. Dates of each cow's initial AI are shown by short vertical lines. Mating is usually seasonal (most often annually, but sometimes twice yearly), so data were split into seasons whenever there were gaps of more than 50 days with no inseminations (see Fig. 1). Long seasons, whose 'season_span' (the interval between the first and last insemination) exceeded 120 days, were further split ('sliced') into periods of equal length ranging from 60 to 120 days, to define contemporary groups. The number of slices, Nslice, in a season was calculated as (1 + int(season_span/120)), generating contemporary groups of (season_span/Nslice) days.

In natural single-sire mating, contemporary groups have only a single service sire, so they are necessarily confounded with service sire. Breeders often have different management systems for maiden heifers and mature cows. The process described above to identify contemporary groups (**cgp**) was therefore carried out separately within each herd, year and service sire for maiden heifers (<1.9 years at AI) and older cows. To determine the necessity of including service sire in the contemporary group definition, the process was also carried out within each year and heifer/cow classification (ignoring service sires), resulting in a second set of contemporary groups (**cgpxs**). When service sire was not part of the contemporary group definition, it was fitted as an additional fixed factor in the model.

The number of days on which cows in a herd were inseminated was checked as an indicator of whether

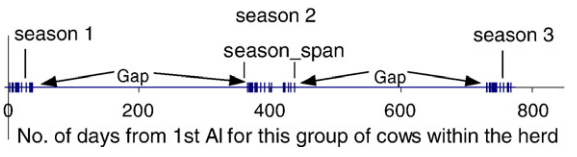

Fig. 1. Illustration of how seasons were identified in order to form contemporary groups.