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Improving fertility in beef cow recipients

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Abstract

In the 1970s, bovine embryo transfer (ET) shifted from research in a laboratory environment to commercialization of this technology for beef producers. With the quarantine requirements and expense of importing Continental breeds of cattle from Europe, embryo transfer became the logical means to reproduce greater numbers of these animals at a lower cost. The ET industry grew very rapidly and soon would become what it is today, a common practice utilized by select ranchers and breeders. Research over the years has primarily focused on methods to increase the number of ovulations and fertilized ova from the donor female, but the total number of transferable embryos has not changed markedly in the last 20 years. More recent advances have been in the area of in vitro production of embryos that allow for greater numbers of embryos to be produced and easier accessibility to incorporate technologies such as sexed sperm, sperm injection, or transgenics. This paper will focus on the second part of the equation, the recipient, and decisions that will enable both the customers and practitioners to most efficiently utilize embryos from superovulation, in vitro production, or nuclear transfer, so that the maximum number of pregnancies can be produced.

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1. Introduction

The greatest economic cost to embryo transfer can be found in the procurement and upkeep of recipients. Recipient females that become pregnant after first transfers are logically more profitable than those that require two or three transfers and especially more economical than those that must be culled for failure to become pregnant. Days on feed,

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synchronization costs, and transfer costs are increased with each unsuccessful transfer. Proper nutritional management and post-partum intervals are basic, but important factors that are the foundation for ET to be successful. Once these basic requirements are met or exceeded, there are multiple other components of the procedure that can have positive or negative effects on the transfer of embryos. Synchrony of donors and recipients is a vital element of ET that cannot be overlooked. Recent developments in synchronization protocols using progesterone supplementation with estradiol and prostaglandin (PGF) enable more efficient use of recipients due to tighter synchrony of ovulations and the ability to transfer embryos without estrus detection [1,2]. Several studies have evaluated the effects of supplementation of recipients with various pharmaceutical agents, hormones, or nutritional additives. Finally, the ability and competence of the technical staff is as important as any of the previous factors. All of these processes that begin with identifying recipients to finally achieving pregnancy and parturition are steps that must be performed as correctly and accurately as possible to ensure success with ET. This paper will address the management, embryo, recipient, and transfer factors that may alter pregnancy rates.

2. Management factors

Two management factors that strongly influence the success rate of an embryo transfer program are post-partum interval and nutrition. Cows entering our synchronization program must have a post-partum interval of at least 50 days, and the first-calf heifer must have an interval from calving that is greater than 50 days before synchronization. Post-partum intervals in beef cattle are influenced by many factors. Cattle that experience no problems at parturition and are maintained on an adequate nutritional plane should usually be cycling 50 days post-partum or shortly thereafter [3]. Nutrition is a key factor in all aspects of reproduction and is especially critical for recipient females. Energy, protein, vitamins, minerals, and water, and the balance among these elements are important. Body condition score and energy are major factors regulating reproductive successes and/or failures in recipients. Mapletoft et al. [4] reported that body condition influenced pregnancy rates, whether embryos were transferred surgically or non-surgically. Pregnancy rates in recipients with a body condition score (BCS) (scale 1–5; 1, extremely thin; 5, extremely fat) of 3 (55%; $n = 633$) and 2 (53%; $n = 460$) were significantly higher than for recipients with a BCS of 1 or lower (44%; $n = 230$). Females with a BCS of 4 or higher (47%; $n = 175$) had pregnancy rates that were intermediate. Lowman [5] reported that a generalized target would be a BCS of 2.5 at calving and at least a 2 at time of transfer; those not at the target condition scores should be fed to improve condition scores and be on a positive energy balance. Superior results cannot be expected in either donors or recipients if there is a deficiency in one or more of the required nutrients.

3. Embryo

The developmental stage and quality grade of the embryo at transfer has long been known to influence the outcome of embryo transfer. Transfer of early morulae result in

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