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Reproductive management strategies to reduce postpartum anestrus in dual-purpose cattle

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ABSTRACT

Objective: To share technical aspects and recommendations to improve the reproductive and productive efficiency of dual-purpose cattle.

Design/Methodology/Approach: A review of scientific articles published in journals was carried out to show the importance of some factors that limit reproduction, as well as to identify management strategies to increase the reproductive potential in dual-purpose cows.

Results: The duration of postpartum anestrus is reduced by weaning calves at a few days or weeks of age, restricting suckling to short periods of the day, delaying suckling, and exposing cows to a bull during postpartum. On average, the combined effect of delayed suckling and exposure of cows to a bull reduces postpartum anestrus to less than 50 d and the calving-conception interval to 84 days. Milk production and calf weight gain also are improved without affecting postpartum weight changes in cows.

Study Limitations/Implications: Extensive management of dual-purpose cattle reduces the intensive use of some reproductive biotechnologies commonly applied in other animal production systems.

Findings/Conclusions: Improvement in the reproductive efficiency of dual-purpose cattle can be achieved by reducing the postpartum anestrus by using reproductive management strategies and minor modifications to common management practices.

Keywords: male effect, reproductive strategy, calving interval, suckling.

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INTRODUCTION

Producers in the dual-purpose cattle production system use mainly *Bos indicus* animals, *B. taurus*×*B. indicus* crosses, and a minority of *B. taurus* (González-Padilla *et al.*, 2019); they base cattle feeding on monoculture pastures with grasses, where their availability and quality vary throughout the year (Ku-Vera *et al.*, 2014). Normally, cow milking is done manually with calf support (Pérez-Hernández *et al.*, 2001); reproduction is carried out by "natural mounting" and minimal use of reproductive technologies (Lassala *et al.*, 2020).

The objective of these production systems is to produce meat and milk, however, their reproductive efficiency and levels of production are low (Rojo-Rubio *et al.*, 2009), with an age at puberty greater than 30 months, age at first calving of 42±6 months (Vite-Cristobal *et al.*, 2007), calving intervals of up to 650 days (Abeygunawardena and Dematawewa, 2004; Arce-Recinos *et al.*, 2017), and a calving rate between 40 and 50% (Lassala *et al.*, 2020).

Pre-weaning weight gain of the calves fluctuates between 200 and 700 g d^{-1} depending on the type of suckling used, reaching weights of 93±17 kg at 4 months and ranging between 120 and 156 kg at weaning, commonly performed at 8 months of age (Rojo-Rubio *et al.*, 2009).This low weight gain of calves in these production systems is in part due to the way they are managed during lactation, since it is normal that cows in this production system are milked completely, leaving only "residual" milk for the calves' consumption, or else milking three out of four mammary glands, leaving the fourth (1/4) for the calves' consumption. In addition, it is customary to leave the calves confined in a pen in the afternoon and at night, without adequate access to forage, water or a feed supplement (Pérez-Hernández *et al.*, 2001).

Therefore, it is important to make known the different options that exist to improve the reproductive efficiency of dual-purpose cattle, mainly in relation to age at puberty, duration of postpartum anestrus, calving-conception interval and calving interval, and fof the development of calves. The objective of this review is to present technical aspects, management strategies and recommendations reported in the ligerature to improve the reproductive and productive efficiency of dual-purpose cattle.

POSTPARTUM ANESTRUS AND SUCKLING

Postpartum anestrus. It is characterized by the absence of ovulation in the female, because after calving there is a partial reestablishment of ovarian function, with follicle development, but none reach the ovulatory phase, at least during the first weeks (Pérez-Hernández *et al.*, 2006; Baéz and Grajales, 2009). This is caused in part by a temporary shortage of luteinizing hormone (LH), which is responsible for inducing ovulation. In addition, it is common for the first ovulation not to be preceded by external signs of estrus and for the corpus luteum formed to have a short half-life, small size and reduced steroidogenic activity (Montiel and Ahuja, 2005; Baéz and Grajales, 2009).

In addition to suckling, nutritional imbalances, dystocia at calving and health problems tend to increase the duration of postpartum anestrus (Short *et al.*, 1990). However, it has been shown that suckling and nutrition are the main factors that prolong anestrus in dual-purpose cows (Montiel and Ahuja, 2005; Baéz and Grajales, 2009), so regulating

the suckling stimulus in addition to better feeding schedules is proposed as one of the best options to reduce it.

Suckling. The calving event and the suckling of the cow's teat by the calf, its odor and presence inhibit the increased frequency of LH release (Yavas and Walton, 2000), due to increased concentrations of endogenous opioids in the hypothalamus, prevent the release of gonadotropin-stimulating hormone (GnRH) (Williams, 1990), responsible for inducing LH release. Another inhibition mechanism of LH secretion is due to the high sensitivity to negative feedback of estradiol in the hypothalamus due to the effect of suckling, which decreases as the postpartum period progresses (Garcia-Winder *et al.*, 1984). Therefore, one option to inhibit the negative effect of suckling on the reproductive axis is to remove the calf, but this would imply artificial rearing and an increase in investment.

The most feasible alternative for this production system is to implement a stragegy that helps to reduce the negative impacts of suckling on the restart of the reproductive activity, such as weaning the calf at a few days or weeks of age (early weaning), restricting the suckling period to short periods of the day (restricted suckling or controlled lactation), or else delaying suckling with regards to ending the time of milking (delayed suckling in this document).

The management system adopted by the producer will depend on his resources and operating capacity, but above all, it will allow him to reduce anestrus without negatively affecting calf development, milk production, and change in the cow's body weight, and particularly to ensure better income. Next, some of the most common strategies reported in the literature to manage suckling in production units are presented, and which could present an opportunity for the double-purpose cattle producers in the Mexican humid tropics.

Temporary weaning. It is an alternative for suckling management to provoke the recovery of the postpartum ovarian activity. It consists of the separation of the calf and the mother for periods of 48 to 96 hours, generally between 30 to 90 days postpartum. Weaning increases the frequency in pulsatile LH secretion, estrus onset and ovulation; to obtain better results, it is recommended to accompany temporary weaning with hormonal treatments, and the basic treatment is with progestogens to ensure ovulation (Mackey *et al.*, 2000). Progestogen is applied 7 to 9 days before starting the mating season, and temporary weaning is done for minimum 48h at the time of withdrawing the progestogen. Some modifications of the basic treatment are: applying PGF2α 48h before withdrawing the progestogen, applying eCG 48 after withdrawing the progestogen, with the aim of the estrus presenting shortly after withdrawing the progestogen. It is also important to maintain the calves in a dry and shaded place with food and clean water available during temporary weaning with the object of avoiding greater stress and possible consequences on the health.

Early weaning. In the dual-purpose production system, weaning is performed after 6 months of calf age (Lassala *et al.*, 2020); therefore, calf weaning induces an early onset of estrus and ovulations, which is explained by the removal of the suppressive effect of suckling on the GnRH secretion pattern. However, despite its beneficial effect at the reproductive level, early weaning is not a common practice, due to the extra work involved

(Lassala *et al.*, 2020) and the decrease in lactation length, especially in cows with more zebu characteristics (Pérez-Hernández *et al.*, 2001).

Restricted suckling. This consists of limiting contact between calf and mother for periods of 20 to 120 minutes per day during seven days before mating season, which increases the incidence of estrus and ovulations, and can be started at 45 days postpartum (Mondragón *et al.*, 2016) and up to 13 points in the percentage of gestation (Rodríguez and Segura, 1995), without affecting calf weight gains as long as they are provided with concentrated feed, good quality forage and clean water during the restriction period (Pérez-Hernández *et al.*, 2001). In order to obtain an adequate response, it is important to have a good nutritional status of the mother (Montiel and Ahuja, 2005). The basic treatment to stimulate the restoration of reproductive activity consists in applying a progestogen at 7 to 9 days before beginning the mating season, and transrectal palping can be combined at the time of starting the restricted suckling, with the aim of identifying the females that are cycling (presence of corpus luteum) and those that are not cycling and grouping them (females cycling *vs.* females not cycling); PGF2α is applied with the object of lysing the corpus luteum present and suckling during the day must be allowed.

Delayed suckling. It consists of milking cows thoroughly in the morning, using the calf as a support for milk let-down and allowing suckling the calf 8 hours after milking. After milking, cows are subjected to the tratidional management of the production unit far from the calves, which remain in a pen isolated from the cows, preferably with access to small pastures and water. At 8 hours after milking, cows and calves are brought together for 30 to 60 minutes so that calves consume all the milk synthesized in the 8 h between milking and suckling (Pérez-Hernández *et al.*, 2002a). This management simulates two milking events, with the difference that the morning milk is for the producer and the afternoon milk is for the calf. It is recommended to start this management one week after calving, so that the calf consumes abundant amounts of colostrum, strengthening the calf's bond with its mother and decreasing the incidence of diseases (Pérez-Hernández *et al.*, 2001). The implementation of this management reduces the interval between calving and first ovulation approximately 20 days and achieves for 100% of the cows to present ovulation before 100 days postpartum (Pérez-Hernández *et al.*, 2002a;b; Izaguirre-Flores *et al.*, 2007). Additionally, this management system increases the amount of milk milked (7.0 *vs.* 5.2 kg d^{-1}) and total milk production, obtained by adding the milked milk and the milk consumed by the calf, compared to cows with restricted suckling (11.3 *vs.* 9.2 kg d^{-1}); this allows calf weight gains of 751.1 ± 59.9 g d^{-1} when fed milk and pasture, and 827 ± 34.8 g d^{-1} when calves are fed, in addition to maternal milk and pasture, free access concentrate feed as a supplement, as suggested in controlled lactation or restricted suckling.

EXPOSURE OF COWS TO THE BULL

Exposure of dual-purpose cows to the bull from 7 days after calving allows cows managed with delayed suckling to present their first ovulation before 50 days postpartum (Pérez-Hernández *et al.*, 2002b; Izaguirre-Flores *et al.*, 2007) and for the calving-conception interval to be 84 ± 10.19 days, which meets the ideal objective of producing

one calf per cow per year without affecting calf development, milk production and body weight changes of postpartum cows (Izaguirre-Flores *et al.*, 2007).

RECOMMENDATIONS FOR REPRODUCTIVE MANAGEMENT OF DUAL PURPOSE COWS

It is recommended that the cows and the bull to be in optimal conditions at the time of mating to increase the probability of obtaining a pregnancy and achieving a calving interval of 13 to 14 months. To achieve this, it is important that in cows after calving: 1) To see that fetal membranes are expelled, preferably within the first 6 hours after calving, otherwise attention and treatments should be given for the membranes to be expelled; at a 12-hour interval, it is recommended to apply soft uterine massage and light traction of the externalized part of the placenta, being careful not to pull forcibly. 2) To make sure that the cow is in good health and not presenting high temperature after calfing, since this could be the sign of an infection, and in case of elevated body temperature, to apply antinflammatory, antipyretic and also administer antibiotic. When giving antibiotic, it should be taken into account that the milk that is produced during the period of use of these compounds cannot be used for human consumption and should be kept separate from the rest of the milk to be sold. 3) To monitor uterine involution to reduce infection, at least once a week within the first three weeks after calving, and thereafter at two-week intervals until complete regression of the uterus. Palpations can be performed by ranch personnel, since this is an activity that, through training, can be performed by any trained person. 4) To get cows to resume ovarian activity before 60 days postpartum, for which it is suggested to use some of the methods described above, primarily through suckling management. 5) Starting on day 40 postpartum, it is recommended to conduct palpations to determine if ovulation has taken place, which will manifest by the existence of a corpus luteum. 6) If a bull is used to stimulate reproduction in cows during postpartum, to ensure that the bull to be used is an animal in good health and reproductive state, and that it has good libido and mounting ability, it is important that the bull be selected due to its productive characteristic, given its genetic importance; it is recommended to check the fertility of the bull 30 to 60 days before mating. If the bull were not apt for reproduction or presented physical problems, it would have to be replaced by another male. 8) If a bull were used for reproduction by natural mounting, it is important to maintain a proportion of 1 bull for a maximum of 25 cows. In production units where more than one sire is available and two or more bulls are added to the group of cows at the same time, it is recommended that they be familiar with each other to avoid fights. 9) It is recommended to monitor cows daily to know if they have been "serviced" by the bull, and if possible it is suggested to use markers on the sire's chest or patches placed on the cow's rump that change color from pressure and which allow to determine if a cow has been in contack with the male. 10) In cows that it has been determined that they have been serviced, palpation for pregnancy diagnosis should be programmed 30 to 45 days after mounting, to determine if they are pregnant or not. If they are pregnant, then they should be managed according to gestation. 11) All those cows that do not show signs of having been mounted by the bull or which have not been detected in heat should be palpated to determine their reproductive status. If they

have restarted their sexual activity it is recommended to observe them carefully and carry out a heat synchronization program to increase the possibility of identifying their estrus and programming their insemination or mount. If they have not restarted their cycle it is recommended to use a treatment to induce estrus. It is important to pay attention to the percentage of gestation generated by each bull, for if it is very low, the status of the bull would have to be checked and if it does not fulfill expectations to substitute it. 12) The cows diagnosed as gestating in the first palpation should be subject to a second palpation during the next 30 days, to make sure that they are in fact pregnant. If a cow is not detected as gestating in the second palpation it should be returned to the group of "empty" cows for their management and to offer them a new opportunity to get pregnant.

For production units that use or would like to use artificial insemination, it is highly advisable to establish estrus or heat synchronization programs, for which there are several options. One of these options is using two injections of prostaglandins F2α, with an interval of 12 to 14 days between each application, followed by observing estrus and insemination. It is important to remember that prostaglandins are only effectiveif there is a corpus luteum present, so it is recommended if possible to conduct palpation on the cows to be sure that they are cycling.

A second option to synchronize estrus is the use of "intravaginal devices" that release progesterone or synthetic progestogens, which are placed in the cow for 7 to 9 days. The esturs would present on average at 48 to 72 hours after withdrawing the progestogens. The devices provoke an artificial luteal phase and allow the development of a dominant ovulatory follicle. An advantage of these treatments is that in cows with anestrus they can induce ovulation and the restart of estrus cycles, and their efficacy is not affected by the presence or not of a corpus luteum.

There are a great variety of protocols for estrus synchronization, but the selection and application of each one of them depends on the physiological conditions of the cow and the management of the ranch, so the decision of which protocol to use is the responsibility of the specialized reproductive technician.

CONCLUSION

The production units of dual-purpose cattle have a great opportunity to improve the reproductive efficiency of their livestock through the implementation of integral management practices that include feeding, suckling and exposure of cows to the bull to reduce postpartum anestrus; as well as the use of estrus synchronization to ease the use of artificial insemination.

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