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EFFECT OF TWO DIFFERENT ESTRUS SYNCHRONIZATION PROTOCOLS ON PREGNANCY RATE IN BLONDE D'AQUITAINE CATTLE BREED REARED IN BULGARIA

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Abstract

In the study, two protocols for synchronization of estrus and ovulation in seventeen Blonde d'Aquitaine cows reared in Bulgaria are presented. The animals were similar in age (5-6 years), physiological status (non-pregnant with weaned calves, more than 210 days post-calving), and body condition score (average 5 on a 9-point scale). The experiment was conducted on a beef cattle farm near the Danube River at the end of the grazing season. The objective was to investigate the pregnancy rates under different estrus synchronization schemes. Two synchronization schemes with artificial insemination (FTAI – 72 hours) at fixed time were applied. The schemes were based on prostaglandin F2 alpha (PGF2 α) and Gonadotropin-Releasing Hormone (GnRH), with one of them using a Progesterone Releasing Intravaginal Device Delta - PRID DELTA. After executing the two protocols, 47.92 \pm 12.34% of the Blonde d'Aquitaine cows were confirmed to be pregnant. In the synchronization protocol using PRID DELTA 62.50 \pm 17.87% of inseminated cows were pregnant. In the protocol without the device, 33.33 \pm 16.94% of inseminated cows were confirmed to be pregnant.

Keywords: beef cattle, estrus synchronization, PRID-Synchprotocol

INTRODUCTION

The optimal timing for detecting estrus and performing artificial insemination in cattle is a factor with significant economic importance for reproductive efficiency (Fesseha & Degu, 2020). Estrus synchronization and fixed-time artificial insemination (FTAI) protocols have been successfully tested for reproduction improvement in beef herds (Richardson et al., 2016; Nirwana et al., 2021). Such programs require selection of technically accurate and practically feasible protocols (Bihon & Assefa, 2021). One of the most commonly used programs, based on progesterone for manipulating follicular development in cattle, combines prostaglandin F2 α (PGF2 α) with GnRH (Arya et al., 2023). This combination proves to be more effective without the need for estrus detection when using FTAI (Kasimanickam, 2021). In short-term protocols, the aim is also to control follicular waves, which

is related to the timing of PG administration (Oosthuizen et al., 2021). In recent years, the efforts in beef cattle breeding have focused on optimizing progesterone devices for more cost-effective and safer use (De Graaff & Grimard, 2018). Improving reproductive methods in beef breeds with suckling calves enhances their economic efficiency (Grimard et al., 2017). The authors report specific reproductive characteristics in Blonde d'Aquitaine, such as a longer anestrus period post-calving and a longer estrus compared to dairy breeds reared in France. Currently, fixed-time AI estrus synchronization schemes are under-research in beef cattle breeding, especially for the Blonde d'Aquitaine breed (Hervé, 2020; Mialot et al., 1998).

The objective of this study is to assess the effectiveness of two different estrus synchronization protocols in Blonde d'Aquitaine beef cows bred in Bulgaria.

MATERIALS AND METHODS

The study was conducted from 2021 to 2022 and included seventeen Blonde d’Aquitaine beef cows. The animals were similar in age (5-6 years), physiological status (non-pregnant with weaned calves, more than 210 days post-calving), and body condition score (average 5 on a 9-point scale). All animals were examined using ultrasound. The cows are offspring of imported parents from France and are reared on a farm near to Lom, Montana region. From May to November, the cows graze on natural pastures along the Danube River, without supplementary concentrated feed. In winter, they are kept in free-group housing and fed a balanced total mixed ration.

On the 40th day after artificial insemination, the cows underwent ultrasound pregnancy diagnosis using a portable ultrasound WED3000V^o with a 6.5 MHz linear transducer. Pregnancy diagnosis was based on the following criteria: presence of anechogenic amniotic fluid in the lumen of uterus, a differentiating embryo as a hyperechoic structure, the presence of placentation, and other indicators.

The data were processed by SPSS (ver. 21), applying univariate model of the following statistical type: $Y_{kl} = \mu + S_k + e_{kl}$, where Y_{kl} - observation vector; μ - total average constant; S_k is fixed effects of k - scheme (Pr1 and Pr2); e_{kl} – residual variance.

RESULTS AND DISCUSSION

For the purposes of the study, two synchronization protocols were developed – with and without progesterone device. In the first scheme (Fig. 1), two PGF2 α treatments (ENZAPROST T – single administration of 25 mg dinoprost) were administered 8 days apart. On the seventh day, a GnRH treatment (100 μ g GnRH or 2 ml OVARELIN[®]) was administered. Cows were inseminated at a fixed time on the 10th day - 72 hours after the GnRH treatment.

The second synchronization scheme applied to nine cows is shown in Fig. 2. On day 0, each animal was intramuscularly injected with 100 μ g GnRH (gonadorelin) (2 ml OVARELIN[®] per animal) and a PRID delta progesterone-releasing intravaginal device containing 1.55 g progesterone was inserted.

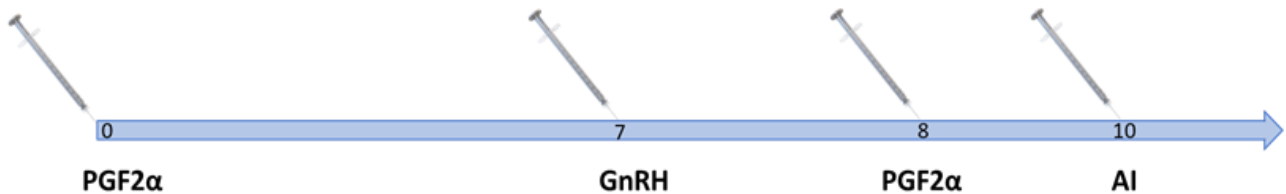


Figure. 1 Protocol 1 for synchronization of estrus and fixed-time artificial insemination (FTAI) in Blonde d’Aquitaine cattle breed.

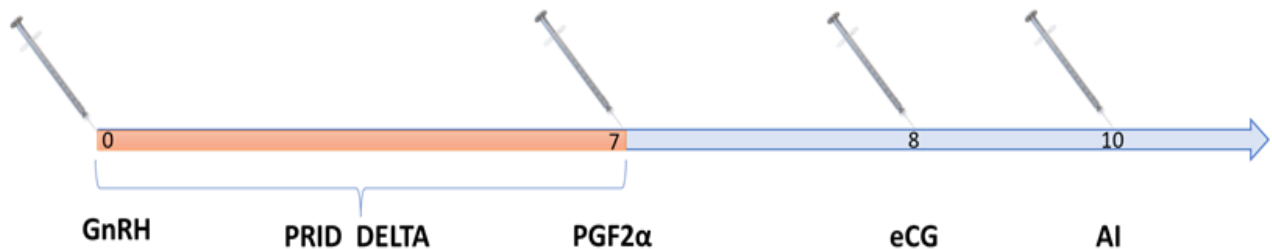


Figure. 2 Protocol 2 for synchronization of estrus and ovulation with a fixed-time artificial insemination in Blonde d’Aquitaine cattle breed.

The removal of vaginal progesterone devices was performed on the 7th day after protocol began, followed by administration of ENZAPROST T (25 mg dinoprost). Artificial insemination was performed at a fixed time – 72 hours after the removal of the progesterone device. On the 8th day, all animals were injected with 500 IU Equine serum gonadotrophins (eCG), corresponding to 2 ml of the solution.

According to Wiltbank et al., (2015) the dual PGF treatments in Ovsynch or Double-Ovsynch protocols can increase fertility by approximately 10%. In another similar experiment, higher fertility was observed when a double dose of PGF was applied to the FTAI protocol in Nellore cows (Ferreira et al., 2020). Cedeño et al. (2021) concluded that several factors influence the success of such protocol, including body condition, and physiological status. Furthermore, higher fertility rates are achieved when GnRH is used. According to Lamb et al. (2001), progesterone device improves ovulation rates after the first GnRH administration in anestrus lactating cows. In a study by Bó et al. (2016), using GnRH or estradiol and devices releasing progesterone allowed FTAI without the need for estrus detection, achieving fertility rates of 50% or more with a single insemination. Administering eCG at the time of P4-device removal stimulates ovulatory follicle growth, enhancing fertility (Bó et al., 2018). In the same study, beef heifers had the highest pregnancy rates with the FTAI – 72h protocol compared to FTAI – 60h and FTAI – 48h.

Table 1 presents the pregnancy rates resulting from the tested estrus synchronization protocols applied to the cows in the studied groups. The overall pregnancy rate for Blonde d'Aquitaine cows was $47.92 \pm 12.34\%$. The animals treated according to Protocol 2 had a 29.22% higher pregnancy rate compared to those treated according to Protocol 1, although the influence of the scheme on fertility was not statistically significant.

For the protocol involving a progesterone device the reported pregnancy rate was $62.50 \pm 17.97\%$, while (in) the Protocol 1, the established pregnancy rate was $33.33 \pm 16.94\%$. Day (2018) modified the classic 7-day CO-Synch + CIDR protocol in beef cattle by reducing the days for CIDR to 5 days and increasing the time to GnRH administration and AI, resulting in higher fertility. Cedeño et al. (2021) report that animals which did not exhibit estrus but treated with GnRH had a higher pregnancy rate per AI (53.8%, $P < 0.04$) compared to those not receiving GnRH (37.9%).

Table 1. Pregnancy rates upon application of estrus and ovulation synchronization schemes in Blonde d'Aquitaine cows.

Protocol	N	Pregnant, % (Pregnant/ nonpregnant, N)	±SE
1	9	33.33 (3/9)	16.94
2	8	62.50 (5/8)	17.97
Mean	17	47.92 (8/17)	12.35

CONCLUSION

After executing the two protocols, we found an average pregnancy rate of $47.92 \pm 12.34\%$ in Blonde d'Aquitaine cows. In the synchronization protocol using PRID Delta, $62.50 \pm 17.87\%$ of inseminated cows were confirmed pregnant. In the protocol without PRID Delta, the pregnancy rate was $33.33 \pm 16.94\%$. Estrus synchronization protocols using progesterone devices have proven effective in synchronizing estrus and achieving pregnancy in Blonde d'Aquitaine cows, with a higher pregnancy rate by 29.22%. These findings underscore the importance of progesterone devices in synchronization schemes to improve fertility in beef cows. Further studies are required to refine these protocols for specific breeds and rearing conditions in Bulgaria.

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REFERENCES

- Arya, D., Goswami, R., & Sharma, M. (2023). Estrous synchronization in cattle, sheep and goat. *Multidisciplinary Reviews*, 6(1), 2023001-2023001.
- Núñez-Olivera, R., Cuadro, F., Bosolasco, D., de Brun, V., de La Mata, J., Brochado, C., & Menchaca, A. (2020). Effect of equine chorionic gonadotropin (eCG) administration and proestrus length on ovarian response, uterine functionality and pregnancy rate in beef heifers inseminated at a fixed time. *Theriogenology*, 151, 16-27.
- Mialot, J. P., Ponsart, C., Gipoulou, Ch, Bihoreau, J. L., Roux, M. E. E., & Deletang, F. (1998). The fertility of autumn calving suckler beef cows is increased by the addition of prostaglandin to progesterone and eCG estrus synchronization treatment. In: *Theriogenology*. 1998. Vol. 49, p. 1353-1363.
- Bihon, A., & Assefa, A. (2021). Prostaglandin based estrus synchronization in cattle: A review. *Cogent Food & Agriculture*, 7(1), 1932051.
- Bó, G. A., Huguenine, E., de la Mata, J. J., Núñez-Olivera, R., Baruselli, P. S., & Menchaca, A. (2018). Programs for fixed-time artificial insemination in South American beef cattle. *Animal Reproduction*, 15 (Suppl 1), 952.
- Grimard, B., Agabriel, J., Chambon, G., Chanvallon, A., Constant, F. F., & Chastant-Maillard, S. (2017). Particularités de la reproduction des vaches allaitantes de races françaises. [Reproductive characteristics of beef cows of French breeds], *INRA Productions Animales*, 30(2), 125-138. [In French]
- Bó, G. A., de la Mata, J. J., Baruselli, P. S. & Menchaca, A. (2016). Alternative programs for synchronizing and resynchronizing ovulation in beef cattle. *Theriogenology*, 86(1), 388-396.
- Cedeño, A. V., Cuervo, R., Tríbulo, A., Tríbulo, R., Andrada, S., Mapletoft, R., & Bó, G. A. (2021). Effect of expression of estrus and treatment with GnRH on pregnancies per AI in beef cattle synchronized with an estradiol/progesterone-based protocol. *Theriogenology*, 161, 294-300.
- Day, M. L. (2018). State of the art of GnRH-based timed AI in beef cattle. *Animal Reproduction*, 12(3), 473-478.
- De Graaff, W., & Grimard, B. (2018). Progesterone-releasing devices for cattle estrus induction and synchronization: Device optimization to anticipate shorter treatment durations and new device developments. *Theriogenology*, 112, 34-43.
- Fesseha, H., & Degu, T. (2020). Estrus detection, Estrus synchronization in cattle and it's economic importance. *Int. J. Vet. Res*, 3(1), 1001.
- Kasimanickam, R. (2021). Pharmacological intervention of estrous cycles. *Bovine reproduction*, 458-470. <http://doi.org/10.1002/9781119602484.ch37>
- Lamb, G. C., Stevenson, J. S., Kesler, D. J., Garverick, H. A., Brown, D. R., & Salfen, B. E. (2001). Inclusion of an intravaginal progesterone insert plus GnRH and prostaglandin F2 α for ovulation control in postpartum suckled beef cows. *Journal of animal science*, 79(9), 2253-2259.

- Nirwana, A. U. A., Toleng, A. L., & Yusuf, M. (2021). Pregnancy rate of Artificial Insemination in beef cows after estrous synchronization at different region. In IOP Conference Series: Earth and Environmental Science, 788(1), 012139. IOP Publishing.
- Oosthuizen, N., Melo, G. D., Seidel, G. E., Stewart, R. L., Rowden, L., Lamb, G. C., & Fontes, P. L. (2021). Effects of prolonging the interval from progestin removal to prostaglandin F₂ α injection from 16 to 17 d in a long-term estrus synchronization protocol in beef heifers. *Translational Animal Science*, 5(2).
- Richardson, B. N., Hill, S. L., Stevenson, J. S., Djira, G. D., & Perry, G. A. (2016). Expression of estrus before fixed-time AI affects conception rates and factors that impact expression of estrus and the repeatability of expression of estrus in sequential breeding seasons. *Animal reproduction science*, 166, 133-140.
- Wiltbank, M. C., Baez, G. M., Cochrane, F., Barletta, R. V., Trayford, C. R., & Joseph, R. T. (2015). Effect of a second treatment with prostaglandin F₂ α during the Ovsynch protocol on luteolysis and pregnancy in dairy cows. *Journal of dairy science*, 98(12), 8644-8654.
- Sales, J. N. D. S., Bottino, M. P., Silva, L. A. C. L., Giroto, R. W., Massoneto, J. P. M., Souza, J. C., & Baruselli, P. S. (2016). Effects of eCG are more pronounced in primiparous than multiparous *Bos indicus* cows submitted to a timed artificial insemination protocol. *Theriogenology*, 86(9), 2290-2295.
- Gaievski, F. R., Lamb, G. C., Weiss, R. R., Bertol, M. A. F., Segui, M. S., Abreu, A. C. M. R., & Kozicki, L. E. (2015). Gonadotropin releasing hormone (GNRH) and equine chorionic gonadotropin (ECG) improve the pregnancy rate on protocols for timed-artificial insemination in Beef cattle. *Veterinária E Zootecnia*, 22(3), 471-480.
- Hervé, A. (2020). Comparaison de deux protocoles de synchronisation des chaleurs fondés sur l'utilisation de progestérone et de prostaglandines F₂ α chez les vaches allaitantes en France, [Comparison of two estrus synchronization protocols based on the use of progesterone and prostaglandins f₂ α in beef cows in France]. (PhD dissertation), p.63. [In French] Médecine vétérinaire et santé animale. <https://dumas.ccsd.cnrs.fr/dumas-04532676v>