

7. Summary

Reproductive management in dairy heifers: Comparison of timed artificial insemination and insemination on observed estrus after synchronization with GnRH and Prostaglandin F_{2α}

This study was conducted to improve reproductive efficiency and to increase the knowledge of follicular dynamics after synchronization of estrus with GnRH and Prostaglandin F_{2α} in dairy heifers.

Three experiments were carried out on a confinement housing heifer raising unit in Brandenburg. Each experiment compared reproductive management protocols based on synchronization of estrus by means of treating heifers with GnRH (Fertagyl®, Intervet) and Luprostiol (Prostaglandin F_{2α} analogue, Pronilen® Intervet) 7 days apart. The control group of all experiments was watched for signs of estrus during 5 days after the administration of PGF_{2α}. In experiment 1 this procedure (Group 1a) was compared to two timed artificial inseminations (TAI) carried out 72 and 96 hours after the application of PGF_{2α} (Group 2).

In experiment 2 Group 1b was compared to a group inseminated twice at 72 and 104 hours after treatment with PGF_{2α} (Group 3).

In experiment 3, Group 1c was compared to Group 4. Heifers in Group 4 were inseminated twice at 72 and 96 hours after treatment with PGF_{2α} but received a second dose of GnRH at the first insemination.

Follicular dynamics were observed by ultrasound during a period between 48 and 104 hours after PGF_{2α} in all groups. Examinations were carried out twice daily in the morning and in the afternoon on three consecutive days. The diameter of large follicles was documented in a spreadsheet. An ovulation was characterized by the disappearance of a large diameter follicle, that had been observed during the previous examination.

In experiment 1 conception rates did not differ between the two groups (46.9 % vs. 53.6 %, $p>0.05$). However, as all heifers in Group 2 were inseminated, pregnancy rates on induced estrus were higher in Group 2 (40.6 % vs. 53.6 %, $p<0.05$). Insemination of heifers returning to estrus in Group 1a compensated for this (Conception rate: 88,2%), so that the number of pregnancies per time interval was significantly higher in Group 1a than in Group 2.

In experiment 2 postponing the second TAI did not improve conception rates (43.8 % in Group 1b vs. 49.0 % in Group 3). However, in Group 1b only few heifers were bred after returning to estrus. Their Conception rate was slightly lower (80%) than in experiment 1. Therefore the number of pregnancies per time interval did not differ between Group 1b and Group 3.

In experiment 3 conception rates were significantly higher for Group 1c as compared to Groups 1a and 1b in experiment 1 and 2, respectively. However, as estrus detection rate was slightly lower, pregnancy rate did not differ between 1a, 1b and 1c, respectively. The second dose of GnRH administered at the first TAI did not improve conception rate significantly as compared to Groups 2 and 3. Neither conception rates (Group 1c 61.4 % vs. Group 4 54.9 %) nor pregnancy rates (47.8 % vs. 54.9 %) differed significantly between Group 1c and Group 4.

In all three TAI protocols the number of straws of semen needed per pregnancy was higher than in the program based on estrus detection.

A partial budget for the 4 Programs including costs for AI, veterinary services and estrus detection revealed that pregnancies in Group 1 were cheaper than in all three groups receiving TAI. TAI reduced costs for estrus detection to zero. However, costs for insemination were nearly doubled and in Group 4 the second treatment with GnRH increased veterinary costs.

Ovulation occurred between 56 and 104 hours after the administration of $\text{PGF}_{2\alpha}$ in 69.0 % of 174 heifers in Groups 1, 2 and 3, respectively. 13 heifers (7.5 %) ovulated before 56 hours after treatment and 41 heifers (23.5 %) did not ovulate until 104 hours after treatment. The administration of GnRH at the first TAI caused all of heifers to ovulate before 96 hours after $\text{PGF}_{2\alpha}$. However, 17.7% of these heifers already ovulated before the administration of GnRH. The second treatment with GnRH decreased the size of the ovulating follicles.

Conception rate was not influenced significantly by the interval between AI and ovulation in 74 heifers in Group 1.

From these results it can be concluded that on this farm insemination on observed estrus was economically superior to protocols based on TAI. The second treatment with GnRH in Group 4 improved degree of synchronization but did not result in improved conception and pregnancy rates. This may be due to the percentage of heifers ovulating before the first AI or to a reduced fertility of oocytes released in these induced ovulations. Further research is required to ameliorate the understanding of follicular dynamics in heifers during and after synchronization

of estrus with GnRH and PGF_{2α}. All protocols tested during the experiments offered the opportunity to plan reproductive management in this herd strategically. However, the TAI programs with zero estrus detection and optimal planning capacity did not prove beneficial from an economic point of view.