infertile inseminations were similar for both breeding groups.

The overall occurrence of cystic ovaries was 42 of 375 calving intervals (11.2%). The percent cystic ovaries for the early and late breeding groups were 7.0% and 15.4%, respectively ($P < .01$). However, cows in the early breeding group developed cystic ovaries later after calving and remained cystic longer than cows in the late breeding group. Of the 42 cases of cystic ovaries, 29 recovered without treatment and 13 were still cystic 300 days after calving. Sixteen of 168 cows were removed from the experiment for reproductive failure, 13 with cystic ovaries, two with anestrus and one with complications following acute metritis. Significant differences between the two breeding groups were not found for percent of lost pregnancies (45 to 150 days gestation), retained placenta, acute metritis, dystocias, twins and abortions (151 to 260 days gestation).

The results indicate that although fertility was lower at the first post-partum estrus, the calving interval was shorter compared to the late-bred group. The data did not reveal persisting harmful effects from breeding cows as soon as possible following calving.

Effects of Indwelling Uterine Infusers (IUI's) on Bovine Postpartum Reproductive Performance

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Bovine postpartum uterine conditions such as metritis usually require frequent medication to correct the problem. As a result, the indwelling uterine infuser (IUI) was developed to facilitate frequent infusion of the uterus.

This device was designed to remain in the uterus for a period of time with repeated infusions made through a cannula externally exposed from the vulva, reducing the introduction of infection and the possibility of trauma from daily medication by conventional procedures. The IUI is made of flexible polyethylene tubing which is inserted aseptically through the cervix into the uterus. The end inserted into the uterus is retained by an attached plastic coil which expands within the uterus. The exposed end of the medication tube projects a short distance from the vulva and is stoppered with a small plastic plug. When medication is administered, the plug is removed and a syringe with a 16 gauge needle can be inserted into the exposed end of the IUI.

Reports from veterinarians in the field suggested that the IUI was beneficial in altering estrous cycle length, stimulating estrous behavior, and in reducing the incidence of cystic follicles.

The objective of this study was to determine the effects of IUI's on estrous cycle length, estrous behavior, ovarian activity, and levels of luteinizing hormone in peripheral plasma.

Materials and Methods

Data for this study were collected from 24 primiparous Holstein cows. They were allocated at random to one of three treatment groups at the time of first estrus and ovulation. There were eight cows per group treated as follows:

Group I—IUI inserted into the uterus at day 1 of the estrous cycle (estrus = day 0) and removed at the time of the subsequent estrus.

Group II—IUI inserted into the uterus at day 10 of the estrous cycle and removed at the time of the subsequent estrus.

Group III—Control.

These cows were kept in loose housing and milked in a parlor. They were fed grain, hay and corn silage to meet production requirements.

The reproductive tracts of these cows were palpated *per rectum* at least twice weekly, starting at 7 days postpartum. The following data were recorded at each observation and examination: 1) color of vulva and nature of discharge; 2) diameter

of the cervix; 3) diameter of each uterine horn; and 4) location and size of follicles and corpora on both ovaries. This information was used to verify estrus and ovulation. All cows were observed twice daily for 20 minutes for signs of estrus and to make sure that the IUI was in place. The IUI had to be replaced in one cow in each treatment group.

Each cow was bled from the jugualar vein at the time of estrus (day 0) and on days 2, 4, 7, 11, 18, 20, and daily until estrus. Blood serum luteinizing hormone (LH) was quantified by the double antibody radioimmunoassay procedure (4).

Definitions

Estrus was characterized by the presence of a mature follicle (15-20 mm. in diameter) in conjunction with increased uterine tone, hyperemia and edema of the vulva, and a mucous discharge from the vulva.

Standing estrus was considered to have occurred when the cow stood to be mounted. It was recorded at the time of the initial observation regardless of the duration of estrus.

Silent estrus was considered to have occurred when no behavioral signs of standing estrus were observed, even though the other signs were present. It was recorded as occurring one day prior to ovulation as detected by palpation *per rectum*.

An estrous cycle was the period measured in days between a consecutive silent or standing estrus and ovulation.

A cystic follicle was a follicle that was reater than 2.5 cm. in diameter on three successive examinations over a 10-day period.

A cystic corpus luteum was defined as a corpus luteum which developed after ovulation and contained a fluid-filled central cavity, approximately 10 mm. or more in diameter. A smaller cavity was not usually detectable by palpation *per rectum*.

Results and Discussion

The mean postpartum interval to first estrus and ovulation was 17.0 days in the 24 cows studied (Table 1). The estrous cycle length varied from 18.5 days in the Group II cows (IUI—day 10) and 19.5 days in Group I (IUI—day 1). The controls averaged 18.9 days. These differences were not significant ($P > 0.05$). The mean cycle length for all three groups was 19.0 days. It has previously been reported that the first postpartum estrous cycle is shorter than 21 days in duration (2).

The IUI was removed at the time of estrus in Groups I and II. The subsequent cycle was normal in all three groups (Table 1) with a mean cycle length of 21 days. This data indicates that the IUI has no effect on the estrous cycle when placed in the body of the uterus. In a previous study with cattle, the insertion of a plastic coil into the anterior portion of one uterine horn resulted in a unilateral inhibitory influence on the corpus luteum (1); however, the location of the plastic

Table 1

Effects of IUI's on Postpartum Reproductive Performance in Cattle

Criteria	IUI Day 1 (Group I)	IUI Day 1 (Group II)	Control (Group III)	Mean
Number of Cows	8	8	8	8
Postpartum Interval to First Estrus	17.3	18.1	15.6	17.0
Estrous Cycle Length (Days)				
IUI Cycle	19.5	18.5	18.9	19.0
Subsequent Cycle	21.0	21.4	20.6	21.0
Standing Estrus (%)				
IUI Cycle	100	100	88	96
Subsequent Cycle	88	67	75	77
Ovarian Function				
Corpora Lutea (%)				
IUI Cycle	88	88	75	84
Subsequent Cycle	50	50	50	50
Cystic Corpora Lutea (%)				
IUI Cycle	12	12	25	16
Subsequent Cycle	50	50	33	44
Cystic Follicles (%)				
IUI Cycle	0	0	0	0
Subsequent Cycle	0	0	17	6

coil in the anterior part of the uterine horn was essential to exert a unilateral effect.

Estrous behavior was observed and the occurrence of standing estrus reported. Each standing and silent (unobserved) estrus was verified by palpation *per rectum* to document ovulation and the development of a corpus luteum. Standing estrus occurred in 96% of all cows during the treated cycle and in 77% during the subsequent cycle (Table 1). The differences between treatments and controls were not significant ($P > 0.05$), indicating that the IUI did not affect estrous behavior in cycling animals.

Ovarian activity was measured by the development of corpora lutea, cystic corpora lutea, and cystic follicles. The mean occurrence of corpora lutea was 84% for the treated cycle and 50% for the subsequent cycle (Table 1) while cystic corpora lutea occurred in 16% and 44% of the treated and subsequent cycles respectively. Since cystic follicles occurred in only one control animal during the two cycles studied, field reports that IUI's reduce the incidence of cystic follicles can neither be confirmed or denied. The differences in ovarian activity between treated and control groups were not significant ($P > 0.05$), indicating that the IUI did not affect ovarian activity during either the treated or subsequent cycle. Comparable data reported for 357 cycles in the 139 postpartum cows indicated that corpora lutea occurred during 62.5% of the cycles, cystic corpora lutea during 25.2% and cystic follicles during 12.3% (3).

Peripheral plasma levels of LH declined from four ng/ml at estrus to levels of approximately one ng/ml during the balance of the cycle in all groups. A surge in LH occurred again in all groups at the onset of the next estrus. The levels of LH varied with the stage of the estrous cycle but they were not affected by the IUI's.

The LH peak at estrus was lower than that reported in other studies (5,6) due to the fact that these cows were sampled only on a daily basis at the time of estrus. As a result, the LH surge which may reach 10 to 20 ng/ml for six to eight hours near the onset of estrus was sometimes missed by daily bleeding (5).

It was concluded from this study that an IUI in the body of the uterus in the postpartum cycling cow did not affect the estrous cycle interval, estrous behavior, ovarian activity, or the level of LH in the peripheral plasma during the treated and subsequent estrous cycle. Field reports that the IUI alters estrous cycle length and stimulates estrous behavior were not substantiated by this study unless these effects are due to repeated intrauterine infusions while the IUI is inserted in the body of the uterus.

Summary

Estrous cycle length, estrous behavior, ovarian activity, and peripheral plasma luteinizing hormone (LH) were determined following insertion of indwelling uterine infusers* (IUI's). Twenty-four primiparous Holstein cows were randomly assigned at first estrus to control or to treatment groups which had IUI's inserted into the body of the uterus on Days 1 or 10 of the first estrous cycle (estrus = day 0). Twice weekly palpations *per rectum* were performed. The mean interval from parturition to first estrus was 17.0 days. The mean cycle intervals for the control and treatment groups with the infusers inserted on Days 1 or 10 of the first estrous cycle were 18.9, 19.5, and 18.5 days respectively ($P > 0.05$). The IUI's inserted into the body of the uterus did not affect estrous cycle interval, estrous behavior, or ovarian activity during or subsequent to treatment. A surge in luteinizing hormone occurred before ovulation in all groups.

References

1. Ginther, O. J., C. O. Woody, K. Janakiraman, and L. E. Casida. Effects of an Intrauterine Plastic Coil on the Oestrous Cycle of the Heifer, Journal Reprod. Fert., 12: 1930, 1966. – 2. Morrow, D. A., S. J. Roberts, K. McEntee. Latent Effects of Pregnancy on Postpartum Estrous Cycle Length in Dairy Cattle. Journal Anim. Sci., 27: 1404, 1968. – 3. Morrow, D. A., S. J. Roberts, and K. McEntee. Postpartum Ovarian Activity and Involution of the Uterus and Cervix in Dairy Cattle, Article I: Ovarian Activity. Cornell Vet., 59:180, 1969. – 4. Niswender, G. D., L. E. Reichert, Jr., A. R. Midgley, Jr., and A. V. Nalbandov. Radioimmunoassay for Bovine and Ovine Luteinizing Hormone. Endocrinol., 84:1166, 1969. – 5. Swanson, L. V. and H. D. Hafs, LH and Prolactin in Blood Serum from Estrus to Ovulation in Holstein Heifers. Journal Anim. Sci., 33:1038, 1971. – 6. Swanson, L. V., H. D. Hafs, and D. A. Morrow. Ovarian Characteristics and Serum LH, Prolactin, Progesterone and Glucocorticoid from First Estrus to Breeding Size in Holstein Heifers. Journal Anim. Sci., 34:284, 1972.

*Indwelling Uterine Infuser, Fort Dodge Laboratories, Fort Dodge, Iowa.