# ESTRUS SYNCHRONIZATION OF DAIRY HEIFERS AND COWS WITH MGA[1]

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## Introduction

Maintaining a high level of herd fertility is one of the biggest challenges faced by today's dairyman. Many dairymen have been unsuccessful in meeting this challenge as indicated by the fact that approximately $25 - $75 per cow is lost each year in the United States due to reproductive problems. This represents a financial loss in the form of decreased milk production, fewer calves, extra maintenance for the dry cow, higher replacement costs, forced culling and treatment of reproductive disorders. Each year 20-25 percent of the cows culled go out of the herd because of infertility. In the average high producing herd, four out of ten cows require at least two or more services per conception. Consequently, there is considerable potential for improvement of reproductive efficiency in dairy herd operations.

Inadequate estrus detection and insemination of cows at the improper time are major management problems that reduce breeding efficiency in cattle. When kept in stanchions, dairy cows usually exhibit signs of estrus soon after being released. However, cows managed under loose conditions, as in Florida, show overt signs of estrus less frequently, This requires longer periods of observation for estrus by the herd manager. The managerial problem of estrus detection increases with increases in herd size and with greater automation of dairy herd operations. Consequently, less time is spent on a per cow basis in checking for estrus. Also, high ambient temperatures alter reproductive behavior. Cow estrus periods average 13 hr duration in subtropical environments compared to 18-19 hr in temperate regions. A higher incidence of silent ovulation is associated with hot weather. All of these factors contribute to inefficient estrus detection resulting in a high incidence of missed heat periods that delay breeding.

Any system which truly improves estrus detection will improve a herd's breeding program. I am very optimistic about the possibilities of utilizing estrus and ovulation control in the future, through the treatment of dairy cows with synchronization compounds in a reproductive management system. Such a system would hopefully eliminate the failure to detect cows in estrus as a major source of infertility since the occurrence of estrus will be controlled. However, research to date indicates that fertility of the

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synchronized estrus in cattle has been variable and generally lower than the fertility of control cattle.

Our laboratory has conducted a study to evaluate the effectiveness of a progestational synchronization compound, Melengestrol Acetate (MGA), to control estrus in dairy heifers, and to evaluate possible hormonal factors that may contribute to the poor fertility of the synchronized estrus. The specific objectives of this study are:

1. To determine the effect of MGA feeding on the control of estrus in dairy heifers.

2. To characterize the concentration of peripheral plasma progesterone and estradiol, during the period of MGA feeding and from the time of MGA withdrawal to the onset of estrus.

3. To compare these changes in plasma sex steroid hormones with the normal changes preceeding the second estrus after MGA feeding, and with the normal changes in a separate group of control heifers.

Materials and Methods

Fifty-two normally cycling purebred heifers (Holstein, Jersey, Guernsey and Ayrshire) from the Florida Agricultural Experiment Station Dairy Herd were used. All heifers were 13 months of age or older and were judged free of anatomical abnormalities based on rectal palpations prior to initiation of the study. Heifers within each breed were randomly assigned to either the MGA treatment group or the control group. All heifers were checked for estrus using visual observation, Kamar heatmount detectors and a vasectomized bull wearing a marking harness. Heifers were observed for estrus for a period of 50 days prior to initiation of the experiment, during MGA feeding and for 50 days after MGA treatment. Twenty-six treated heifers received orally 1 mg of MGA by gelatin capsule daily for 14 days. MGA treatment was initiated without regard to the stage of the estrous cycle. Rectal palpation was used to evaluate ovarian status (follicular development, corpus luteum development and corpus luteum regression) at days 1, 7 and 14 of MGA feeding. Blood samples (100 ml) were drawn from the jugular vein during treatment (days 1, 7 and 14). After treatment samples were collected daily until first estrus, from day 15 of the first cycle to the day of second estrus and also from day 15 to day of estrus of control heifers. At the second estrus after MGA feeding treated heifers were artificially inseminated and fertility compared to control heifers. Plasma estradiol and progesterone were isolated on Sephadex LH-20 columns (solvent system - chloroform:ethanol (96:4)) and measured by radioimmunoassay and competitive protein binding procedures, respectively.

In this study the degree of synchronization was determined as the percentage of heifers in heat within a five day period from the day of first heat after MGA withdrawl.

Results and Discussion

Feeding of MGA caused a significant decrease ($P<.01$) in the occurrence of palpable corpora lutea (<5mm) by day 14 of MGA feeding compared to day 1 (Table 1). At the last day of MGA feeding 88.5% of the heifers had a palpable follicle on one or both ovaries.

Table 1 Ovarian status of dairy heifers receiving 1 mg Melengestrol Acetate (MGA) daily for 14 days.

| | Days of treatment when palpated | | |
|---|---|---|---|
| | 1 | 7 | 14 |
| Number of heifers | 26 | 26 | 26 |
| Number of heifers with a corpus luteum | 20(76.9%)[a] | 13(50.0%) | 2( 7.7%) |
| Number of heifers with a follicle | 16(61.5%) | 15(57.6%) | 23(88.5%) |

[a] Percentage of total animals on treatment

After withdrawal of MGA, 25 of the 26 heifers came into heat within a five day period (Table 2). This is a 96% synchronization of estrus with the first detected heat occurring at day 4 after withdrawal of MGA. Due to the close grouping of synchronized heats or first heats, there was a high degree of estrus synchronization (92%) at the second estrus after MGA feeding. The excellent degree of synchronization observed in this study was partially due to the fact that all heifers definitely received the entire 1 mg of MGA due to the use of gelatin capsules administered by a bolus gun. Whereas, top dressing the feed with MGA may not have resulted in total consumption of the compound daily. Due to the synchronization of heat all MGA treated heifers exhibited two heats within a 28 day period. In contrast, heats occurred at random in the control group during a 23 day period. The conception rates of inseminations made at the second estrus after MGA feeding and that of control heifers were 40% and 44%, respectively.

Plasma hormone measurements were made in ten MGA treated heifers and in ten control heifers. Plasma levels of estradiol were elevated during MGA feeding, but not significantly so ($.10>P<.25$). Daily estradiol levels approaching the first estrus after MGA feeding were higher ($P<.01$)

than estradiol levels approaching second estrus or approaching estrus of the control heifers. Average estradiol values for pre-estrus days -4, -3, -2, -1 and day 0 (estrus) of the first estrus after MGA feeding were 3.4± 1 (n=6), 4.9± 1(10), 8.2 ± 1.5 (10), 9.1 ± 1.2(9) and 7.7 ± 1.9(10) pg/ml plasma, respectively; control estradiol levels (second pre-estrus after MGA feeding plus pre-estrus of control heifers) were 1.4± 0.2(17), 1.6 ± 0.2(19), 3.2 ± 0.4(19), 5.9 ± 0.7(20) and 5.3 ± 1.1(20) pg/ml plasma, respectively. Plasma progesterone levels (days -4 to 0) of the first estrus after MGA feeding were lower than controls ($p < .01$). The characteristic precipitous decline of plasma progesterone in controls associated with corpus luteum regression was not observed during the first pre-estrus period after MGA feeding. Thus, ovarian secretory activity may be altered immediately following MGA treatment resulting in elevated estradiol levels and lowered progesterone levels as compared to controls. In the practical sense, this means that the sex steroid hormonal balance after MGA feeding is not normal. The cow is under a greater estrogenic influence, and the normal events occurring at the time of insemination (ova transport, sperm transport and nutrition of the fertilized egg) could possibly be influenced by this altered hormonal environment in such a way to reduce fertility. Additional studies are needed to determine the possible site of action of hyper-estrogenism on key physiological processes affecting fertility.

With the current development of knowledge in animal and human reproduction, it will soon be possible to develop practical systems of controlled artificial insemination. It has been suggested by Hansel (Hansel, W. 1970, Der Tierzuchter, In Press) that a practical system for estrous cycle control should meet the following criteria:

1. Synchronization of estrus and ovulation following treatment should be so precise that insemination can be performed at predetermined times, and without the necessity of checking animals for estrus.

2. The treatments should be simple and should require that the animals be treated individually no more than three times, including the insemination.

3. The conception rate of animals inseminated at the first estrus after treatment should be normal.

4. The additional costs involved in synchronization must be relatively small.

5. No potentially harmful drug residues must remain in the meat or milk of treated animals.

In summary, the present study substantiates that MGA effectively synchronizes the occurrence of estrus. In addition, hormone levels of estrogen and progesterone are altered by MGA feeding. Fertility at the second estrus after MGA feeding is comparable to the fertility of control animals.

Table 2: Distribution of heats at the first and second estrus periods after feeding of melengestrol acetate (MGA)

| | Days Post MGA Feeding; First Estrus | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Heat Freq. | 0 | 0 | 0 | 4 | 9 | 7 | 4 | 1 | 1 | 0 |
| | | | | | 96%[a] | | | | | |

| | Days Post MGA Feeding; Second Estrus | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| Heat Freq. | 5 | 2 | 4 | 5 | 8 | 0 | 0 | 0 | 0 | 2 |
| | | | | | 92%[a] | | | | | |

[a]Percentage of total detected heats within a 5 day period