A Comparison of Two Dosages of Prostaglandin $F_{2\alpha}$ for the Treatment of Functional Anestrus in Dairy Cattle

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Introduction

In nearly all dairy herds bred by artificial insemination (AI) functional anestrus is the leading cause of infertility. Functional anestrus cows and heifers are cycling, but signs of estrus are not observed.[1] Reduced expression of estrus and inadequate detection methods account for the lack of observation of estrus.

Prostaglandin variably lyses the corpus luteum (CL) between days 6 and 17 of the estrus cycle, and its use in the management of functional anestrus is well established and widely utilized. The percentage of induced estrus periods detected is dependent on the correct identification of a functional CL, adequate expression of estrus, and accurate observation of induced estrus activity. While fixed time insemination at 80 or 72 and 96 hours after treatment is an option, insemination according to standing estrus is the preferred method.

The manufacturer's recommended dosage of prostaglandin $F_{2\alpha}$ (Lutalyse®: Upjohn, Kalamazoo, MI) for non-superovulated females is 25 mg (5ml) IM regardless of bodyweight.[2] However, some veterinarians and producers increase the dosage above that recommended because 1) they feel a higher dosage will result in a better response, or 2) cows of greater bodyweight require a larger dosage.

Because of questions from veterinarians and producers about the advisability of using an increased dosage, and because of the claims by some veterinarians that a higher dosage improves the response, a field trial was designed to compare the response of dairy cows and heifers to the normal dosage (1X) and double normal dosage (2X) of prostaglandin $F_{2\alpha}$ (Lutalyse®).

Materials and Methods

Two Holstein herds: the Purdue University Dairy Center (herd A) and the Indiana State Farm (herd B) were utilized. The trial ran for one year from October 1990 through September 1991. Both herds were fed a total mixed ration, housed in free stalls, milked twice daily in milking parlors, and enrolled in the DHI program.

Herd A had 150 cows and a rolling herd average of 20,500 pounds of milk. All breeding was by AI, estrus detection was done twice daily, tailheads were chalked at the time of prostaglandin injection, and cows had access to dirt mounds. Average bodyweights were 1270, 1470, and 1540 pounds for first, second, and third and greater lactations, respectively.

Herd B had 300 cows and a rolling herd average of 17,000 pounds of milk. The major portion of the breeding was by AI with some pen mating of problem cows by natural service. Estrus detection was done twice daily, tailheads were chalked at the time of prostaglandin injection, and cows had access to dirt lots. Estimated average bodyweights were 1100, 1350, and 1380 pounds for first, second, and third and greater lactations, respectively.

Some pertinent reproductive information from the DHI summary sheets of both herds is shown in Table I. In both herds cows and heifers were identified with plastic ear tags which had been assigned in numerical order at birth. In herd A both cows and heifers were included in the trial, but only cows in herd B.

Table I. Some DHI Reproductive Summary Data.

	Herd A	Herd B
Average days to first service	93	84
Average days open	142	126
Percent successful services	40	43
Percent heats observed	42	40
Percent of herd culled for reproductive failure	16	10

Reproductive herd health examinations were made each two weeks in a herd A and each three weeks in herd B. Animals examined were typical of most reproductive health programs. Possible candidates for treatment with prostaglandin were cows greater than 60 days postpartum; and heifers, of proper bodyweight, over 15 months of age that had not been inseminated for the first time, and females found to be nonpregnant at pregnancy examination. If the animals in these categories were judged, by rectal palpation to have a functional CL, they were assigned by ear tag numbers

to either group 1X (odd numbers) or group 2X (even numbers). Neither blood nor milk progesterone determinations were done to verify the presence of functional luteal tissue. Animals in groups 1X and 2X were given 25 mg (5 ml) and 50 mg (10 ml) of prostaglandin $F_{2\alpha}$ IM, respectively. A positive response was the observation of estrus within five days of treatment, and a negative response was no observation of estrus within five days. Only animals that were observed in estrus were bred. Animals with a negative response were retreated if they met the criteria outlined at a subsequent examination. Formation of ovarian cysts the first examination after treatment was recorded. Individual bodyweights were available for 100 of 105 treated cows in herd A but not for the heifers in herd A nor cows in herd B.

The year was divided into quarters (seasons) to determine if there were any seasonal differences. The divisions were: spring (March, April, May), summer (June, July, August), fall (September, October, November), and winter (December, January, February).

Results

There were 177 treatments (105 cows) and 82 treatments (49 heifers) in herd A and 284 treatments (206 cows) in herd B. Total animals, times treated, and total treatments are listed in Table II.

Table II. Total Number of Animals and Times Treated by Herds.*

Herd A	Cows		Heifers	
Times Treated	Number Treated	Number of Treatments	Number Treated	Number of Treatments
1	61	61	30	30
2	23	46	9	18
3	15	45	7	21
4	5	20	2	8
5	1	5	1	5
Total	**105**	**177**	**49**	**82**
Herd B	**Cows**			
1	145	145		
2	46	92		
3	13	39		
4	2	8		
Total	**206**	**284**		

*Groups 1X and 2X combined

Comparing groups 1X and 2X there were no significant differences between cows in herd A, heifers in herd A, cows in herd B, and between cows in herds A and B in percent in estrus within five days after treatment, percent pregnant of those bred, and percent pregnant of the total treated (Table III).

Table III. Number of Treatments, Number and Percent in Estrus and Percent Pregnant by Herds and Groups.

	Total Number of Treatments	Number in Estrus Within 5 days (%)	Percent Pregnant of Those Bred	Percent Pregnant of Total Treated
Herd A				
Cows 1X[a]	99	34 (34)*	41	14**
Cows 2X[b]	78	34 (44)	38	17***
Combined	177	68 (38)****	40	15*****
Heifers 1X[a]	42	25 (60)*	52	31**
Heifers 2X[b]	40	24 (60)	58	35***
Combined	82	49 (60)****	55	33*****
Herd B				
1X[a]	141	60 (43)	42	18
2X[b]	143	74 (52)	51	27
Combined	284	135 (48)	47	22

a— 1X 25 mg prostaglandin $F_{2\alpha}$ IM
b— 2X 50 mg prostaglandin $F_{2\alpha}$ IM
*— Significant ($P < .01$)
**— Significant ($P < .05$)
***— Significant ($P < .05$)
****— Significant ($P < .01$)

In herd A (group 1X) there were significant differences ($P < .01$) between cows (34%) and heifers (60%) in estrus within five days of treatment and between cows (14%) and heifers (31%) pregnant of the total treated ($P < .05$). Likewise, in group 2X, heifers (35%) had a higher percent pregnant of the total treated than cows (17%) ($P < .05$) (Table III).

When groups 1X and 2X were combined in herd A, there were significant differences ($P < .01$) between cows (38%) and heifers (60%) in percent in estrus within five days and between cows (15%) and heifers (33%) pregnant of the total treated (Table III).

In both herds and groups the response rate was not different between animals treated one time and those treated more than once.

Table IV shows the day of observed estrus following treatment and percent pregnant for each day. Eighty-one percent were observed in estrus on days three (50%) and four (31%). Percentages pregnant by day of estrus were not significantly different.

Table IV. Number in Estrus and Percent Pregnant by Days Following Treatment.*

Day in Estrus After Treatment	Number in Estrus	(%)	Percent Pregnant of Those Bred
1	3	(1)	67
2	23	(9)	61
3	126	(50)	45
4	77	(31)	39
5	23	(9)	61
Total	**252**	**(100)**	**46**

* Includes all animals in groups 1X and 2X in both herds A and B.

Of 260 cows examined either two (herd A) or three (herd B) weeks after an unresponsive prostaglandin treatment, 16 (6.2%) were diagnosed with ovarian cysts.

The average bodyweight of 100 cows in herd A was 1393 pounds. Cows were divided into lightweight (range: 1071-1389 pounds) and heavyweight (range: 1400-1840 pounds) groups after the trial was completed. Table V shows the number of cows treated, number and percent in estrus, and percent pregnant by bodyweight and dosage. There were no significant differences according to bodyweight and dosage.

Table V. Number of Cows Treated, Number and Percent in Estrus, and Percent Pregnant by Bodyweight and Dosage.

	Lightweight[a]		Heavyweight[b]	
	1X[c]	2X[d]	1X[c]	2X[d]
Number of Cows	26	24	28	22
Number in Estrus Within 5 days (%)	11 (42)	14 (58)	10 (36)	9 (41)
Percent Pregnant of Those Bred	64	43	40	33
Percent Pregnant of Total Treated	27	25	14	14

a Range 1071-1389 pounds
b Range 1400-1840 pounds
c 25 mg Prostaglandin $F_{2\alpha}$ IM
d 50 mg Prostaglandin $F_{2\alpha}$ IM

Cows and heifers in groups 1X and 2X in herd A and both treatment groups in herd B were combined to evaluate any seasonal effect. As seasons were defined, there was a significant difference ($P < .01$) in percent of animals in estrus within five days between summer (31%) and fall (54%), winter (55%), and spring (52%) in herd A, but not in herd B (Table VI).

Table VI. Number of Treatments, Number and Percent in Estrus, and Percent Pregnant by Herds and Seasons.

	Total Number of Treatments	Number in Estrus Within 5 days (%)	Percent Pregnant of Those Bred	Percent Pregnant of Total Treated
Herd A[a]				
Fall[1]	28	15 (54)*	33	18
Winter[2]	62	34 (55)*	59	32
Spring[3]	73	38 (52)*	37	19
Summer[4]	96	30 (31)*	50	16
Herd B[b]				
Fall[1]	78	43 (55)	53	29
Winter[2]	52	21 (40)	29	12
Spring[3]	82	42 (51)	50	26
Summer[4]	72	29 (40)	45	18

a Both cows and heifers in combined groups 1X and 2X
b Cows in combined groups 1X and 2X
1 September, October, November
2 December, January, February
3 March, April, May
4 June, July, August
* Significant ($P < .01$) difference between summer and other seasons

Discussion

Functional anestrus is a major cause of infertility in AI bred dairy herds and there is extensive use of prostaglandin as a treatment. However, the results (observation of the induced estrus and conception at the induced estrus) are quite variable. Correct identification of a functional CL, age of the CL, expression of estrus, and intensity of estrus detection are factors which can alter the results.

The correct identification of a CL by rectal palpation is subject to error. In four reports the average compatibility of palpation of CLs and progesterone concentration was 77%.[3-6] The major error was the inability to identify a CL, but progesterone levels were high indicating the presence of luteal tissue. When in doubt, this finding should favor the treatment of such cows with prostaglandin. The great difficulty or near impossibility of determining the age of the CL according to the days of the estrus cycle can have a definite effect on the response. Expression and detection of estrus has been consistently greater when prostaglandin is given during the second half of the estrus cycle.[7-9] Expression of estrus varies widely; however, when two or more ani-

mals are treated at the same time there is better response rate when compared to only one animal treated.[10] In this trial there was no examination day when only one animal was treated, so detection of estrus should have been enhanced by multiple animals being treated the same day.

Day three was the most common day for observed estrus, and the 81% observed on days three and four was very similar to the findings of others.[10,11]

The reduced response in the summer season in herd A is not unexpected. While it did not occur in herd B, the reduction in estrus expression and estrus detection efficiency is common during periods of high ambient temperatures.

The incidence of ovarian cyst formation (6.2%) following prostaglandin treatment is very similar to the 7.3%[12] and 6.7%[13] ovarian cysts after prostaglandin treatment in two other studies.

Increasing the dosage of prostaglandin $F_{2\alpha}$ two fold had no effect in either herd. In herd A, where bodyweights were available, there were no differences in response between lightweight and heavyweight cows which agrees with the manufacturer[2] and another study.[10] Even though there were no individual bodyweights in herd B, it is very likely that there was fairly even distribution of weights within treatment groups as was the case in herd A. Heifers were more responsive than cows which is in agreement with another trial.[14]

In conclusion, there appears to be no advantage to increasing the dosage of prostaglandin $F_{2\alpha}$ above the manufacturer's recommendation for the management of functional anestrus in non-superovulated cattle.

Summary

Two dosages (25 and 50 mg) of prostaglandin $F_{2\alpha}$ (Lutalyse®) were compared for the treatment of functional anestrus in two herds of Holstein cattle. Response was measured by percent in estrus within five days after treatment, percent pregnant of those bred, and percent pregnant of total treated. Doubling the recommended dosage (25 mg) had no effect on response in either herd. Nor were there any differences in response between lightweight and heavyweight cows. Heifers were significantly more responsive than cows. Of those exhibiting estrus after treatment 81% were observed on days three and four, and 6.2% developed ovarian cysts by the first examination after an unresponsive treatment. In one herd there were significantly less animals observed in estrus in the summer when compared to the other three seasons.

References

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