Treatment of the Non-Cycling Cow

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Summary

A series of field trials have been conducted to evaluate a variety of treatment protocols for dairy cows which have not been seen in oestrus (NDO) by the start of mating. Results of these trials are presented in this paper.

Treating NDO cows which had a detectable corpus luteum (CL+ve) with a combination of oestradiol benzoate (ODB), progesterone (P4) and prostaglandin $F_{2\alpha}$ (PGF) did not improve conception or pregnancy rates, compared with leaving them untreated.

The effectiveness of using GnRH in combination with P4, PGF and ODB for the treatment of anovulatory anoestrous (AA) cows was compared with the standard P4 and ODB protocol. In addition, the effectiveness of the GnRH programme in NDO CL+ve cows was compared with no treatment. In AA cows, there was no difference in reproductive performance following the GnRH programme compared with the standard protocol. In contrast, treatment of NDO CL+ve cows with the GnRH programme significantly improved submission and pregnancy rates compared with no hormonal treatment.

Treatment of AA cows with GnRH, PGF and GnRH ('Ov-synch' protocol) resulted in similar submission rates and pregnancy rates compared with using P4 and ODB.

The effect of grazing NDO cows separately from the main herd from 7 days before, to 21 days after the planned start of mating, was examined in combination with hormonal treatment. Separate grazing did not improve submission rates or conception rates of AA cows compared with grazing in the main herd, however, pregnancy rates after 21 days of mating were significantly reduced. The reproductive performance of NDO CL+ve cows did not differ when grazed separately compared with grazing in the main herd.

Introduction

Cows not detected in oestrous (NDO) at the commencement of seasonal mating period (PSM) are still a significant problem within the New Zealand dairy industry. An average of 20% of cows have not been detected in oestrus by 7 days before the PSM (McDougall *et al*., 1993). Traditionally, these cows have been presented for veterinary examination either 1 week before the PSM or at the end of the first 3 to 4 weeks of the mating period. Cows are differentiated into anovulatory anoestrous (AA; i.e. no detectable corpus luteum) or cycling (corpus luteum detectable) on the basis of transrectal examination of the ovaries manually or by ultrasonography.

The reproductive performance of NDO cows is reduced compared with cycling herd mates (Macmillan 1997; McDougall and Rhodes 1999). Progesterone (CIDR) based treatment programmes result in 87% of cows being inseminated on detection of estrus within 7 days of the end of the treatment period. Seven percent of cows ovulate without expressing oestrus, 6% express oestrous without ovulating and 5% neither ovulate or express oestrous (Rhodes *et al*. 1998a). Conception rates to first insemination average 45% compared with 71% in cows which have displayed oestrus spontaneously (Xu and Burton 1997). Response to progesterone treatment varies significantly between herds and regions, varying from 27% to 62% (Rhodes *et al*. 1998). Cows which are NDO but have a detectable corpus luteum have either been left untreated in the belief that they will cycle naturally or been treated with either prostaglandin $F_{2\alpha}$ (PGF) or with protocols adapted from synchrony programmes using a combination of progesterone (P4), oestradiol benzoate (ODB) and PGF.

These NDO cows represent a significant cost to herd owners due to treatment costs and loss of genetic material due to high culling rates. This does not mean that CIDR treatment is ineffective, but rather that further improvements in reproductive performance following CIDR treatment may still be achieved.

This paper summarises some recent results from field trials which have evaluated a number of treatment protocols which aimed to improve conception rates, evaluated non-P4 based systems for AA cows and aimed to improve the reproductive performance of NDO cows with a detectable corpus luteum.

Treatment of NDO cows with a detectable corpus luteum

The reproductive performance of NDO cows with a detectable corpus luteum (CL+ve) is poorer than cycling herd mates (McDougall and Rhodes 1999). This group of cows had lower pregnancy rates in the first 28 days of mating (59% vs. 67%), higher empty rates (10% vs. 4%) and took 4 days longer to conceive than cycling cows (McDougall and Rhodes 1999). The current study evaluated treatment of NDO CL+ve cows with a combination of ODB, P4 and PGF, compared with no treatment.

Cows in 18 herds which had been diagnosed NDO CL+ve were allocated to either be treated (n = 232; P4+PG group) or left as untreated controls (n = 243). Cows in the P4+PG group were injected with 2 mg ODB and treated with intravaginal progesterone (CIDR insert) for 7 days, then injected with PGF on the day of insert removal.

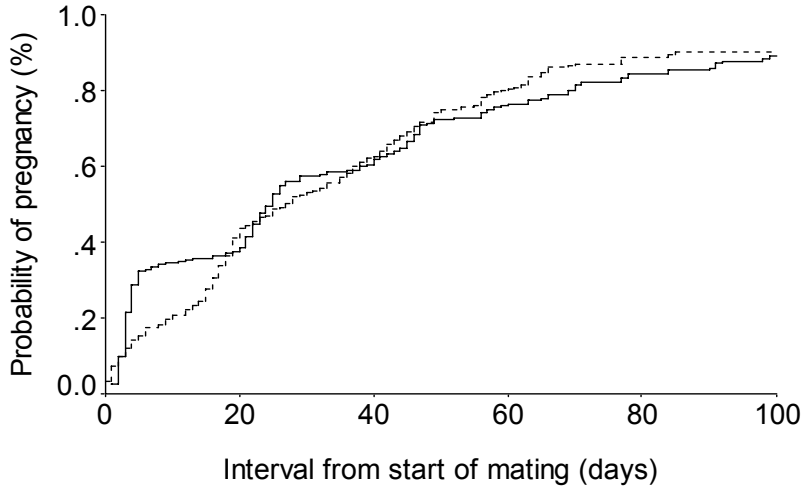
More treated than control cows were inseminated in the first 7 days of mating and conceived in the first 7 days of mating (Table 1). However, conception rates to first insemination, pregnancy rates after 21 days, and at the end of the mating period and the median interval from the start of mating to conception did not differ between treatment groups (Table 1, Figure 1).

Table 1. Reproductive performance of NDO CL+ve cows which were treated with ODB, P4 and PGF (P4 + PG) or remained untreated (Control). Results relative to planned start of mating.

	Control	P4+PG	p[a]
Cows enrolled	243	232	
Inseminated in first 7 days	37.4%	65.9%	<0.001
Inseminated in first 21 days	77.8%	74.1%	0.73
Conception rate to first insemination in first 21 days	51.6%	48.0%	0.21
Pregnancy rate in first 7 days	20.4%	36.3%	0.001
Pregnancy rate in first 21 days	47.8%	42.5%	0.17
Not pregnant at end of breeding season	5.3%	6.1%	0.65

[a] Significance of difference between groups.

Figure 1. Predicted probability of pregnancy during the mating period of NDO CL+ve cows which were treated with P4, ODB and PGF (P4+PG —) or were untreated (Control - -).



Treating postpartum dairy cows which had not been seen in oestrus, but had a detectable corpus luteum, with progesterone, ODB and PGF did not improve their reproductive performance compared with no hormonal intervention.

Use of GnRH with P4 for NDO cows

The aim of this study was to compare the effectiveness of using GnRH and P4 with the currently recommended CIDR programme for AA cows. GnRH was injected at progesterone device insertion to initiate luteinisation of the ovarian dominant follicle, resulting in follicle turn-over and emergence of a new wave of follicles (Xu *et al.* 2000). PGF was injected at device removal to lyse any accessory corpora lutea that may have developed. An injection of ODB after device removal was given to induce oestrus and ovulation of the new dominant follicle with release of a young and healthy ovum.

Cows from 18 herds which had not been seen in oestrus during the 35 days before the PSM (Day 0) were examined using rectal palpation on Day -9. Cows with no palpable corpus luteum were diagnosed AA and allocated to two treatment groups balanced for breed, age and calving date. Cows in the AA-GnRH group (n = 951) were injected with GnRH (2.5 ml Receptal) and treated with a CIDR device on Day -9, they were then injected with PGF (5 ml Lutalyse) on Day -2, when CIDR devices were removed. Cows in the AA-CIDR group (n = 993) were treated with a CIDR device on Day -8, which was removed on Day -1. Cows in both groups which had not been seen in oestrus were injected with 1 mg ODB on Day 0.

Cows which had a palpable corpus luteum on Day -9 were also allocated to one of two treatment groups. One group remained untreated (Control CL+, n= 117)); while the other received the same treatment as the AA-GnRH group (GnRH CL+, n = 135).

Treatment of AA cows with GnRH and P4 resulted in significantly more cows being inseminated during the first 3 days of mating compared with cows in the AA-CIDR group. However, submission rates after 21 days, conception rates to first insemination and pregnancy rates after 21 days were similar between both groups (Table 2).

Table 2. Summary of reproductive performance of AA cows treated with P4, GnRH and PGF (AA-GnRH) or P4 alone (AA-CIDR), followed by ODB.

	AA-CIDR	AA-GnRH	p[a]
Cows enrolled	993	951	
Inseminated in first 3 days of mating	89.7%	95.5%	< 0.001
Inseminated in first 21 days of mating	95.6%	97.0%	0.09
Conception rate to first insemination [b]	41.6%	43.7%	0.36
Pregnancy rate after 21 days	39.8%	42.4%	0.24

[a] Significance of difference between groups.

[b] Cows inseminated in the 1st 21 days of mating.

Treatment of cows with a palpable corpus luteum with GnRH, P4 and PGF resulted in a significant increase in submission rates after 3 and 21 days of mating and in pregnancy rates after 21 days of mating, compared with no treatment. Conception rates to first insemination were similar between both groups (Table 3).

Table 3. Summary of reproductive performance of NDO CL+ cows treated with P4, GnRH and PGF (GnRH CL+) followed by ODB or remaining untreated (Control CL+).

	Control CL+	GnRH CL+	p[a]
Cows enrolled	117	135	
Inseminated in first 3 days of mating	27.1%	95.1%	<0.001
Inseminated in first 21 days of mating	76.3%	97.6%	<0.001
Conception rate to first insemination [b]	42.0%	51.4%	0.17
Pregnancy rate after 21 days	31.9%	49.8%	0.004

[a] Significance of difference between groups.

[b] Cows inseminated in the 1st 21 days of mating.

These results demonstrate that although using GnRH in addition to P4 in the treatment of AA cows does not improve conception rates or pregnancy rates, this protocol does have beneficial effects on the reproductive performance of cows which have not been seen in oestrus but have a palpable corpus luteum. Historically, this group have been left untreated, but conceive later and have higher empty rates than cows which have resumed oestrous cycles (McDougall and Rhodes 1999). The results of this current study demonstrate that it is worthwhile palpating the ovaries of NDO cows and treating those with a palpable corpus luteum.

Treatment of AA cows with GnRH and prostaglandin $F_{2\alpha}$

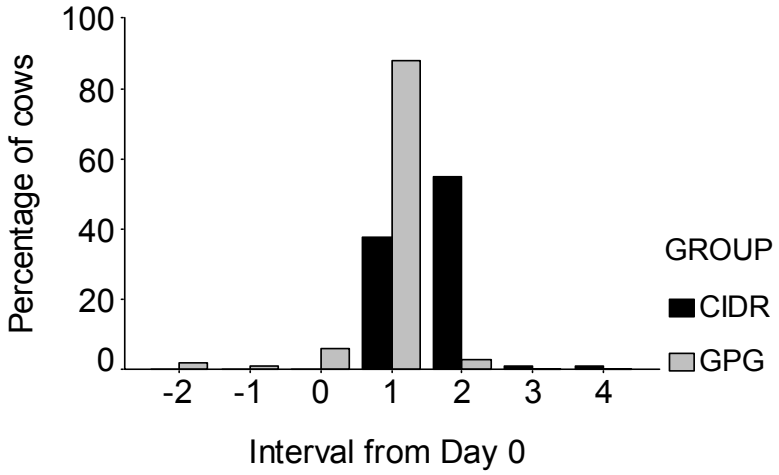
Cow synchronisation protocols involving a combination of GnRH, PGF and GnRH at 7 and 2 days intervals, respectively, have become widely used in the USA (Wiltbank, 1998). Cows are inseminated at 16 to 24 hours after the final GnRH injection without oestrus detection. These treatments have resulted in pregnancy rates in cycling cows no different from cycling cows mated on detection of oestrus and resulted in shorter intervals from treatment to conception (Wiltbank, 1998). This treatment (termed 'Ov-synch') is cost effective in the USA due to the reduction in the interval from treatment to conception (Pursley *et al.,* 1997). The initial GnRH injection results in either ovulation or luteinisation of the dominant follicle, thus allowing emergence of a new dominant follicle. Following the luteolysis induced by the PGF, the second GnRH treatment results in predictably timed ovulation of the newly emergent dominant follicle.

In AA cows, progesterone priming is required for ODB induced expression of behavioural oestrus and ovulation (McDougall *et al*., 1992). Induction of luteinisation or ovulation of the dominant follicle in AA cows following GnRH treatment results in an increase in peripheral P4 concentrations (Crowe *et al*., 1993; McDougall *et al*., 1995). The emergence of a new dominant follicle following GnRH treatment in AA cows has been demonstrated (Crowe *et al*., 1993; McDougall *et al*., 1995). The sensitivity of the newly ovulated/luteinised corpus luteum to PGF and the ability to induce ovulation of the newly emerged dominant follicle in AA cows has not been previously examined. Hence, the effectiveness of the 'Ov-synch' system was examined in AA cows in New Zealand.

Cows which were diagnosed AA, as previously described, from five seasonally-calving herds were selected for treatment 9 days before PSM (Day -9). The cows were blocked by age group (2, > 2 years) then randomly assigned within herd to one of two treatments. The first group (n = 99, GPG) were treated with an intramuscular injection of 250 mg of synthetic PFG analogue, (Fertagyl, Chemavet NZ Ltd) followed 7 days later by 2 ml (15 mg) of a synthetic PGF, luprostiol (Prosolvin, Chemavet NZ Ltd). Two days later the cows were injected with 250 mg of gonadorelin. Cows were artificially inseminated approximately 16 to 24 hours after the second GnRH injection irrespective of oestrous status. The second group (n = 98, CIDR) were treated with intravaginal P4 (CIDR-B, InterAg NZ Ltd) for 6 days, followed 24 hours later by an intramuscular injection of 1.0 mg ODB. Cows were inseminated upon detection of oestrus. Cows were pregnancy tested using ultrasonography approximately 35 days after the initial insemination. Cows found to be still anoestrus were treated as appropriate at this time. Pregnancy diagnosis was repeated twice at approximately 6 to 8 week intervals.

The total number of animals submitted for mating in the first seven days did not differ between treatments (Figure 2; Table 4), between herds and was not affected by the interval between calving and the planned start of mating ($P > 0.3$). However, fewer CIDR than GPG treated cows were mated on Day 1 ($P < 0.01$) and more CIDR than GPG-treated cows were mated on Day 2 ($P < 0.01$; Figure 2).

Figure 2. Submission rates of anovulatory anoestrous cows by treatment group (Day 0 = day of ODB injection or final GnRH injection).



There was no difference between treatments in the conception rate to a service in the first seven days of the mating period (Table 4). The first service conception rate ranged from 25.6% to 45.0% among herds, although this was not significant ($P > 0.3$). Nine GPG cows were mated on detection of oestrus before the second injection of GnRH. The conception rate of these cows was not different from cows mated at fixed time after treatment (33.3% and 37.5%, respectively).

The proportion of cows conceiving in the first 28 days of the mating period and the median interval to conception did not differ among treatment groups (Figure 3; Table 4).

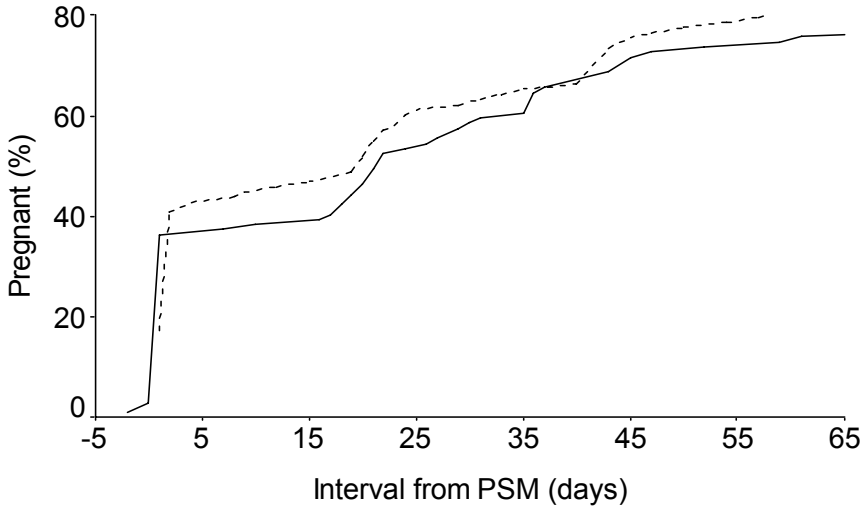
Table 4. Summary of reproductive performance of AA cows treated with P4 and ODB (CIDR) or with GnRH and PGF (GPG). Results relative to planned start of mating.

	CIDR	GPG	p[a]
Cows enrolled	98	99	
Inseminated in first 7 days	94.9%	100%	0.87
Conception rate to first insemination[b]	42.4%	37.1%	0.41
Pregnancy rate in first 28 days	62.5%	56.7%	0.31
Median interval to pregnancy (days)	20	21	0.34

[a] Significance of difference between groups.

[b] Submitted for mating in first 7 days.

Figure 3. Cumulative percentage of cows pregnant within CIDR (- - -) or GPG (-----) groups, during the mating period.



This preliminary study indicates that 'Ov-synch' treatment of AA cows results in similar reproductive performance to that achieved following treatment with P4 and ODB. Although the numbers of animals are small, and small differences in performance could not be detected, the data suggest that further research work evaluating 'Ov-synch' treatments in AA cows is justified. The time interval between treatments and the actual time of ovulation needs to be determined to optimise conception rates.

Separate grazing and NDO cows

Separating NDO cows from the main herd for some period of time before or during mating is a commonly used strategy by herd owners. Anecdotally, herd owners report that there is a 'good' response to this approach. Grazing NDO cows separately may reduce social stress, reduce time in yards during milking, reduce distances walked and/or increase dry matter intake.

A recent DRC trial examined the effect of separate grazing with or without concurrent hormonal treatment on the reproductive performance of NDO cows.

The trial was carried out in 8 Waikato herds. Cows which had not been seen in oestrus by 7 days before the PSM (Day 0) were examined using manual palpation or transrectal ultrasonography. Animals with no detectable corpus luteum (n = 676) were allocated to 4 groups, balanced for age and calving date, within each herd:

- Main herd (Control)
- Separate herd (Sep)
- Main herd + P4 (CIDR)
- Separate herd + P4 (Sep + C)

Cows treated with P4 received the standard CIDR treatment protocol, as described previously. Animals with a palpable corpus luteum were either grazed separately or with the main herd. Behavioural oestrus was recorded from Day -7 and cows were inseminated on detection of oestrus from Day 0. Any cow which had not been seen in oestrus by Day 28 was re-examined and treated with either a CIDR device or PGF, as required. Conception dates were confirmed by pregnancy diagnosis 6 weeks after the end of the periods of artificial insemination and natural mating, respectively. Milk production and liveweights of individual cows were measured at the start of the trial and 28 days later. Cows were kept in the two herds during this period and were offered the same pasture allowances.

Separate grazing did not increase submission rates or conception rates during the 28 day period, but the percentage of cows pregnant after 28 days was significantly lower, compared with control cows. Cows in the CIDR group had a significantly higher submission rate and more cows were pregnant after 28 days compared with Control cows (Table 5). In cows with a detectable corpus luteum, separate grazing had no significant effect on reproductive performance ($P > 0.1$; Table 6).

Table 5. Reproductive performance of AA cows grazed separately (Sep) and/or treated with a CIDR device (CIDR) compared with untreated cows (Control). Results relative to planned start of mating.

	Control	Sep	CIDR	Sep + C
Number of cows	172	177	168	159
Inseminated by 21 days	54.7%	46.3%	93.5%*	86.8%*
Conceived to 1st insemination	40.4%	33.3%	36.1%	26.9%*
Pregnant by 21 days	26.4%	18.9%*	42.1%*	31.4%
Not pregnant at end of mating	10.0%	9.1%	10.8%	13.9%

* Significantly different from Control group ($P < 0.05$)

Table 6. Reproductive performance of NDO cows with a palpable corpus luteum grazed separately (Sep) or with the main herd (Control). Results relative to planned start of mating.

	Control	Sep
Number of cows	89	71
Inseminated by 21 days	76.4%	84.7%
Conceived to 1st insemination	58.2%	48.3%
Pregnant by 21 days	51.7%	45.1%
Not pregnant at end of mating	13.5%	5.6%

Separate grazing resulted in an average liveweight increase of 14.9 kg, over the 28 day period, which was not significantly different from the 13.6 kg increase in cows in the main herd ($P > 0.1$).

The effect of separate grazing on milk production varied among herds. In 3 herds there was a positive effect on milk solids production, in 2 herds there was a negative effect and in the remaining 3 herds there was no significant effect (Figure 4).

Herd owners estimated that between half and one hour per day was spent in managing the extra herd of cows.

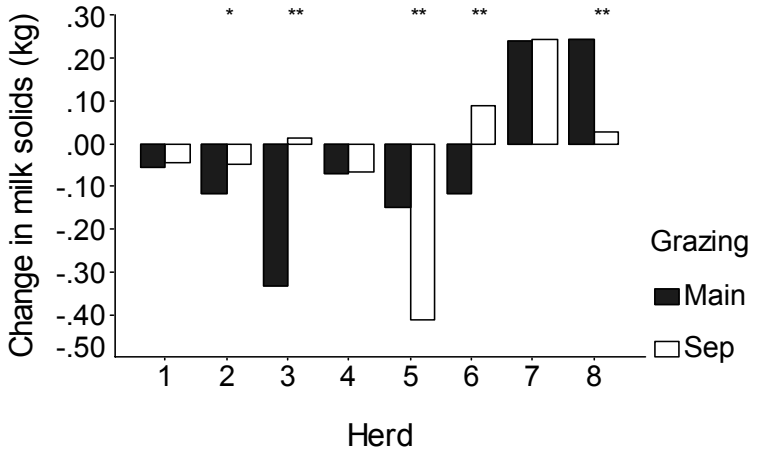


Figure 4. Effect of grazing NDO cows in a separate herd (Sep) compared with the main herd (Main) on the change in milk solids production over 28 days in eight herds. * $P = 0.08$; ** $P < 0.01$.

It was concluded from this trial that grazing NDO cows separately did not result in an improved reproductive performance compared with leaving the cows in the main herd. Additionally, the response to P4 treatment was not improved by separate grazing. The additional labour costs and the lack of reproductive response means that it is unlikely that there is any cost-benefit in grazing NDO cows separately, when carried out near the start of the mating period and when pasture allowances are not increased. Herd owners may choose to put cows on once a day milking, increase pasture allowance or offer supplements as well as separate grazing. This combined strategy has not been tested. However, previous data suggest that once a day milking is not a cost-effective tool due to the large decrease in production over the period of once a day milking with no improvement in pregnancy rates (Rhodes *et al*., 1998b).

Acknowledgements

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