

EFFECT OF HEIFER SYNCHRONY ON REPRODUCTIVE OUTCOMES, PRODUCTIVITY AND PROFITABILITY

Objective

To evaluate the effect of synchrony treatment of nulliparous heifers on reproductive outcomes during both their first mating period (2020), and their subsequent mating (2021), as well as the economic benefit, compared to not synchronising.

Background

Oestrus synchrony of 15-month old dairy heifers prior to their first mating season is a tool that is used relatively infrequently in NZ.

The benefits of heifer synchrony include:

- production of additional heifer calves which can be kept (or sold) as replacement heifer calves
- concurrent faster genetic gain that can be achieved by breeding from the highest genetic merit animals in the herd
- additionally, there are productivity and efficiency gains that can be achieved with heifer synchrony, such as additional days in milk and better reproductive performance in the subsequent mating season

These additional benefits have not been formally measured under NZ farming and management conditions, compared to not synchronising. This study compared the reproductive performance and net economic benefit in nulliparous dairy heifers during their first mating period with an oestrus synchrony program followed by bull mating period, against heifers which were not synchronised and only mated with a bull mating program. Reproductive outcomes were assessed for the initial mating period, and are yet to be assessed for the subsequent mating period as first-lactation dairy cows.

Materials and methods

The study was undertaken in 5 New Zealand dairy herds, and was conducted in 2 parts, measuring reproductive performance following the first mating season as nulliparous heifers, and following the second mating season as primiparous heifers. The study enrolled 1,454 dairy heifers 9 days prior (D -9) to the planned start of mating (PSM) in season 1, in the North Canterbury region.

Heifers were enrolled into the study on one calendar day (D -9) for each farm, and were randomly assigned to treatment groups. Half of each heifer mob (treatment heifers) was treated with a Co-Synch program consisting of an intravaginal progesterone insert (DIB-h) and IM injection of 2mL Gonasyn (100µg gonadorelin, GnRH) on D -9, removal of DIB-h and IM injection of 2mL Cycloset (500µg cloprostenol) on D -2, IM injection of

2mL Gonasyn and artificial insemination on Day 0 (D0). The remaining half of the heifer mob (control heifers) did not receive any treatments and had bulls introduced on D0. The treatment and control heifers were run together in a single mob prior to and during the study period except for a 4-day period from D -2 to D2, where the treated heifers were kept separate for their heat period and artificial insemination. On D2 the heifer groups were comingled, with bulls at a ratio of 40 heifers per bull plus 1, except for the oestrus return period (D18-D24) where the ratio was decreased to 30 heifers per bull plus 1.

Pregnancy diagnosis was conducted on average 66 days and 119 days after the start of the breeding program, with age of gestation in days to establish the date of conception.

Breed, body weight within the month prior to mating, conception date and health records for all enrolled heifers were retrieved from electronic records (e.g. Infovet, MINDA).

Data was collated and analysed to assess the effect of treatment (synchrony) on pregnancy status at 7, 21, 28 and 42 days after PSM, and at the end of the mating period using separate logistic regression models. Kaplan-Meier was used to estimate the median time to conception from the PSM, dependent on treatment. A partial budget was created to estimate the economic effect of synchrony treatment of heifers compared with no treatment. The budget was built using data from the current study, and current local market values obtained from stock agents involved with the sale of dairy animals in NZ. The economic benefit of using Co-Synch in comparison to no synchrony was calculated.

Results

Results are presented here following the first mating season, and will be updated when results from the second mating season become available.

The final analyses included data from 1,440 heifers; 703 control and 737 treated. Fourteen observations were excluded from the dataset due to missing weight data or pregnancy diagnosis. Summary information by farm is presented in Table 1.

	Group	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5
Observations	Syn	104	127	124	179	203
N	Con	106	126	118	155	198
	Total	210	253	242	334	410

Table 1: Summary information of 1,440 heifers either treated with Co-Synch (Syn) or untreated (Con) prior to the PSM.



In univariate models, pregnancy was significantly associated with farm and body weight at all time-points and with treatment at 7, 21 and 42 days after PSM, and at the end of mating. There was no evidence of interaction between treatment and farm or treatment and pre-mating weight. Adjusted for farm, pre-mating weight was not associated with pregnancy at any time-point.

Accounting for farm, compared to no treatment, heifers in the Co-Synch group had a greater probability of conceiving within 7, 21 and 28 days of the PSM, whereas there was no significant effect at 42 days (Table 2). This pattern makes sense given the reproductive biology and the timing of oestrus and return to oestrus in the synchronised heifers compared to untreated heifers.

Statistic	Day 7	Day 21	Day 28	Day 42	EoM
Synchrony (%)	55.3	75.7	80.7	87.1	93.6
Control (%)	36.1	68.4	75.4	83.8	90.7
Difference (%)	19.2	7.3	5.3	3.3	2.9
p-value	<0.0005	0.001	0.015	0.076	0.040

Table 2: Predicted probability of pregnancy at 7, 21, 28 and 42 days after PSM, and at the end of mating (EoM) in heifers.

The median time to pregnancy for the treated group was 1 day versus 12 days in the control group. This indicates that the median time to conception was 11 days earlier for the synchronised heifers (Figure 1).

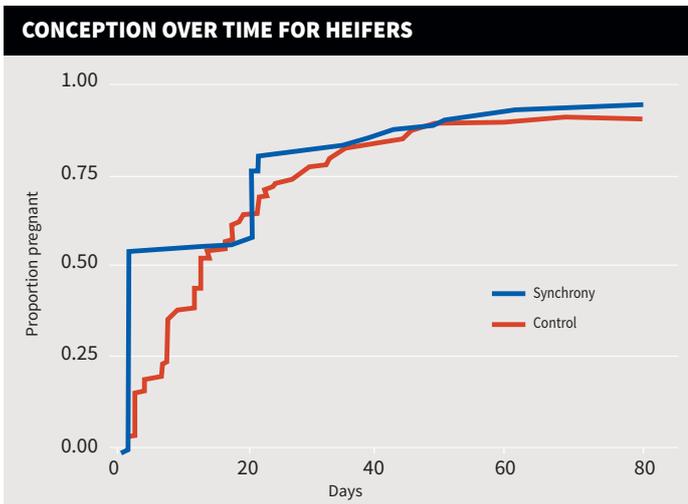


Figure 1: Kaplan-Meier Survival Time to pregnancy

An economic analysis using a partial budget shows the benefits and costs of synchrony treatment (Table 3). Factors not taken into account in the partial budget include value attributed to the increase in the rate of genetic gain, additional recovery time after calving (as the effect of this is not yet quantified), easier and more efficient management of the heifer mob at calving, or additional feed required for earlier calving.

Partial budget	Description	Value
Co-Synch program	\$45 per heifer x 100 heifers	-\$4,500
Semen for AI	\$25 per heifer + \$10 insemination x 100 heifers	-\$3,500
27 additional heifer calves	27 x \$120 per 4-day old calf	\$ 3,240
27 fewer bobby calves	27 x \$15 per 4-day old calf	-\$ 405
11 additional days in milk	11 days x 1.2kgMS x \$6.25/kgMS = \$82.50/cow x 100 cows	\$ 8,250
3% fewer empty heifers	\$800 differential value per heifer x 3 heifers	\$ 2,400
Net farmer financial benefit		\$ 5,485

Table 3: Partial budget analysis for synchrony treatment of 100 heifers with Co-Synch compared to no treatment. Assumptions: conception rate to Co-Synch program 55%; heifer:bull ratio of calves born 50:50; in-calf heifer value \$1,500; empty heifer value \$700.

Discussion

Overall, nulliparous heifers that were treated with a Co-Synch program had superior reproductive and economic performance compared with untreated heifers. Synchronised heifers conceived earlier than untreated heifers, and therefore more heifers were pregnant within the first 4 weeks of mating. An additional 3% of heifers were pregnant at the end of the mating period in the synchronised group.

The proportion of synchronised heifers pregnant at 7 days (55%) is synonymous to the conception rate of the treatment program. This result is comparable with previous studies in NZ examining synchrony treatment of heifers with modern programs incorporating progesterone, GnRH and PGF_{2α}^{1,2,3,4}. A 2013 study by McDougall et al² showed that a Co-Synch program achieved better pregnancy rates to AI and at 21 and 42 days after PSM compared to a double-PGF_{2α} synchrony program, and the median interval to conception was 19 days earlier for Co-Synch compared to double-PG. The net economic benefit of the Co-Synch program was shown to be superior to double-PG synchrony in heifers even taking into account the difference in treatment costs. This proven reproductive and economic superiority formed the basis for selection of the Co-Synch program used in the current study.

The synchronised heifers conceived 11 days earlier than the untreated heifers in the current study, which will result in these heifers calving 11 days earlier, generating additional milk production, and also gives these heifers an additional 11 days for recovery after calving prior to the start of the next mating period. It is widely accepted that primiparous heifers take longer than multiparous cows to recover after calving, so this additional recovery time for synchronised heifers should help to mitigate this.

Synchronising heifers had significant economic benefit compared to untreated heifers. Ignoring any benefit that might be achieved by speeding the rate of genetic gain via obtaining replacement heifer calves from the highest genetic animals in the herd, economic gains were shown for heifer synchrony due to the increased lactation length, the higher number of animals that were pregnant at the end of the mating period, and the value of additional heifer calves being born in the ensuing calving season. The scale of economic return from the initial heifer synchrony may increase once the reproductive outcomes in the second mating season, after recovering from calving, are measured at the end of the 2021 mating season as first lactation heifers in the dairy herds. Regardless, the positive productivity effect of synchrony treatment of first-calving heifers has been shown in the first mating and calving season, with a return on investment of 1.6 : 1.

Conclusion

Synchrony of nulliparous dairy heifers using a Co-Synch program resulted in increased number of heifers pregnant at the end of mating period, with treated heifers conceiving earlier, which returns additional milk production and additional valuable replacement heifer calves. Synchrony of heifers had higher reproductive and economic outcomes compared to untreated heifers, with a favourable return on investment.

Clinical relevance

Heifers synchronised with Co-Synch program have:

- An additional 3% of heifers pregnant at the end of the mating period
- Conceived 11 days earlier, which will result in heifers calving 11 days earlier. For farmers, it means 11 additional days in milk and higher total milk production
- 11 additional days for recovery after calving prior to the next mating period
- Tighter calving spread which is simpler to manage for farmers

References

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This study was conducted under approval 15130 of the Ruakura Animal Ethics Committee.