

EFFECT OF NZ HEIFER SYNCHRONY ON PRODUCTIVITY AND PROFITABILITY

Objective

To evaluate in-calf rates in nulliparous heifers synchronised with a DIB Co-Synch program in comparison to untreated herd mates, and calculate the economic benefits.

Background

The benefits of oestrus synchrony of 15-month old dairy heifers prior to their first mating season may include the following:

- 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

This is the first study to formally measure the benefits of synchronising heifers, compared with only bull mating, under NZ farming and management conditions.

Materials and methods

The study was undertaken in 5 New Zealand dairy herds, and enrolled 1,454 dairy heifers 9 days prior (D -9) to the planned start of mating (PSM), 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 (synchrony heifers) was treated with a DIB 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 Cyclase (500µg cloprostenol) on D -2, IM injection of 2mL Gonasyn and artificial insemination on Day 0. The remaining half of the heifer mob (control heifers) did not receive any treatments and had bulls introduced on Day 0. The synchrony and control heifers were kept in a single mob prior to and during the study period except for a 4-day period from D -2 to D2, where the synchrony 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 during 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 again at 119 days after the start of the breeding program, with age of gestation in days to establish 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 versus time 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.

Results

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
	Con	106	126	118	155	198
	Total	210	253	242	334	410

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

In univariate models, pregnancy was significantly associated with 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.

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.

Overall the heifers synchronised with the DIB Co-Synch program had significantly higher 7 day, 3 week and 4 week in-calf rates, and tended to be higher at 6 weeks. There were significantly more heifers pregnant in the DIB Co-Synch group at the end of mating.

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

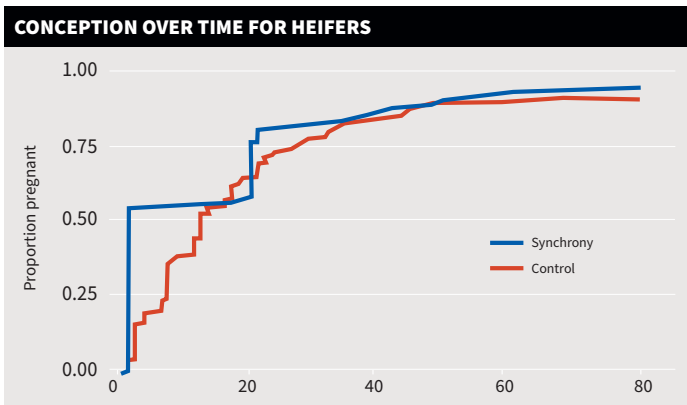


Figure 1: Kaplan-Meier Survival Time to pregnancy

An economic analysis using a partial budget shows the benefits and costs of synchrony treatment (Table 3). Factors excluded from these partial budget calculations were the value attributed to the increase in the rate of genetic gain, easier and more efficient management of the heifer mob at calving, and additional feed required for earlier calving.

Partial budget	Description	Value
DIB 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 \$8.00/kgMS x 100 cows	\$ 10,560
3% fewer empty heifers	\$800 per heifer x 3 heifers	\$ 2,400
Net farmer financial benefit		\$ 7,795

Table 3: Partial budget analysis for synchrony treatment of 100 heifers with DIB 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

Heifers synchronised with a Co-Synch program had superior reproductive and economic outcomes compared with untreated heifers.

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

Conceiving 11 days earlier generally means 11 more days in milk for seasonal calving heifers, and provides more time 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 might help to mitigate this. However, when in-calf rates of the study heifers following the subsequent mating as 2 year olds were evaluated the anticipated 'follow on year' improvement in pregnancy rates was not evident between synchronised and control groups.

Synchronising heifers had significant economic benefit compared to untreated heifers. Potential benefits achieved by speeding the rate of genetic gain via obtaining replacement heifer calves were excluded from these calculations. Economic gains were shown for heifer synchrony due to the increased lactation length, more pregnant heifers at the end of the mating period, and the value of additional heifer calves born in the following calving season.

Conclusion

Synchrony of nulliparous dairy heifers using a Co-Synch program resulted in increased number of heifers pregnant at the end of mating period, and synchronised heifers conceived earlier, which leads to 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 the DIB Co-Synch program have:

- Higher 7 day, 3 week and 4 week in-calf rates
- 3% more heifers pregnant at the end of mating
- Median calving date 11 days earlier, leading to 11 additional days in milk and hence higher total milk production
- 11 additional days for recovery after calving, prior to mating
- Tighter calving spread which is simpler to manage for farmers

References

- ¹ Xu, Z, Burton, L. Reproductive performance of dairy heifers after estrus synchronization and fixed-time artificial insemination. Journal of Dairy Science 82, 910-917, 1999.
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- ³ Sahu, S, Parkinson, T, Laven, R. Conception rates to fixed-time artificial insemination of two oestrus synchronisation programmes in dairy heifers. New Zealand Veterinary Journal 63 (3), 158-161, 2015.
- ⁴ Baxter, K, Smyth, L. Mating heifers without bulls in an extensive grazing system: A case study. Conference Proceedings of the Society of Dairy Cattle Veterinarians of the NZVA, 2019.

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