Improved heifer reproduction following treatment with a modified Cosynch program

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Introduction

Currently the most frequently used program for synchronisation of dairy heifers for fixed-time artificial insemination (FTAI) in New Zealand is the 7-day Cosynch (7dC) program (McDougall *et al.* 2013). Increasing knowledge of the physiological differences between heifers and lactating dairy cows resulted in the development overseas of 5-day Cosynch programs which are now commonly used for heifer synchrony.

Following on from the development of a 5-day Cosynch program, Karakaya-Bilen *et al.* (2019) documented a 12.7% increase in conception rate (CR) to FTAI with a modified 5-day Cosynch (m5dC) program compared to a standard 5-day Cosynch program. The m5dC program included a pre-synchrony treatment, a single injection of prostaglandin (PG) two days prior to the commencement of a 5-day Cosynch program, which aimed to improve ovulatory response to GnRH treatment by inducing luteolysis and thereby reducing serum progesterone concentration.

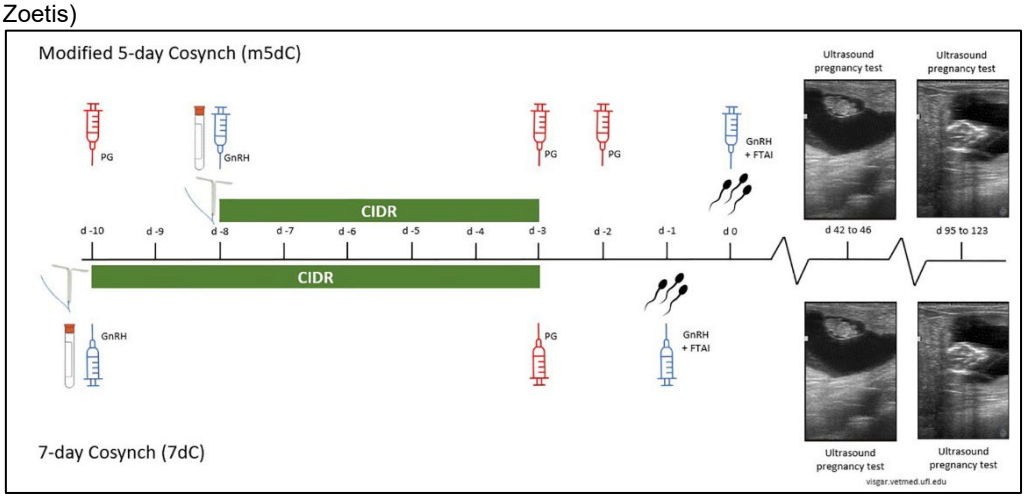
There is currently no information on performance of 5-day Cosynch programs in seasonal pasture-based dairy systems or in comparison to the performance of the 7dC program. The purpose of this study was to evaluate reproductive performance in dairy heifers in a pasture-based seasonal system submitted to FTAI following the m5dC program compared to the 7dC program.

Materials and methods

In this randomized controlled study, 565 spring-born non-pregnant dairy heifers from four Manawatu dairy farms were randomly allocated to synchronisation for FTAI with either the m5dC program or the 7dC program. All heifers had a body condition score (BCS) recorded by a single accredited condition scorer at the time of enrolment and the synchrony programs commenced on day -10 of the study; (Figure 1) for full details of the treatments administered and timings for each treatment program.

Following FTAI, heifers were mated by a combination of AI to observed heat and/or natural bull mating as per normal farm practice. Heifers were pregnancy tested via trans-rectal ultrasound examination between study days 42 and 46 to allow a preliminary evaluation of CR to FTAI. All heifers were pregnancy tested via trans-rectal ultrasound examination for a second time between study days 95 and 123 to confirm conception date for each heifer and determine final pregnancy status. Estimated foetal age was recorded at each pregnancy test, with all pregnancy testing carried out by a single veterinarian.

Figure 1. Timing of study interventions for both the modified 5-day Cosynch and 7-day Cosynch treatment groups. GnRH = 100µg gonadorelin acetate(GONAbreed, Parnell Animal Health) by intramuscular injection. PG = 500µg cloprostenol sodium (estroPLAN, Parnell Animal Health) by intramuscular injection. CIDR = 1.38g intra-vaginal progesterone releasing device (CIDR Cattle Insert, Zoetis)



Start and end times were recorded on treatment recording sheets at each synchrony treatment visit; this information was used to calculate the longest and shortest possible intervals between all the synchrony treatments for each treatment group.

Differences in ovarian function at the time of CIDR insertion and GnRH treatment between the two treatment programs were evaluated via serum progesterone measurement (study day -10 for the 7dC treated heifers and study day -8 for the m5dC treated heifers) in a subset of 34 enrolled heifers on one farm (17 heifers from each treatment group). Serum progesterone concentration data were summarized for each treatment group using descriptive statistics such as geometric mean, 95% confidence intervals (95% CI), minimum and maximum values.

The primary outcome criterion was CR to FTAI, based on the final pregnancy test result at 95-123 days. This binary outcome variable was summarised for each treatment group and analysed using a generalized linear mixed model with terms including the fixed effect of treatment group and the random effect of site. Odds ratios for each treatment group were presented, along with 95% confidence intervals. Secondary outcome criteria of pregnancy at six weeks and pregnancy at the final pregnancy testing (to get the final pregnancy rate) were summarized and analysed in the same way as for the primary outcome. Mean and median values for time to conception were calculated for each treatment group.

Findings

Data from a total of 528 heifers were carried forward for analysis following the exclusion of data from 37 heifers. Heifers were excluded for at one (or more) of several reasons; they did not successfully complete the synchrony treatment program, were found not to be both spring-born and non-pregnant, were identified to have a reproductive abnormality/disease, or died between enrolment and pregnancy testing.

Mean BCS at enrolment was the same (5.1) for heifers in both treatment groups. Interval between CIDR removal and FTAI ranged from a minimum of 69.9 hours to a maximum of 77.5 hours for heifers treated with the m5dC program, and from a minimum of 46.9 hours to a maximum of 51.2 hours for heifers treated with the 7dC program.

Table 1. Conception rate to fixed-time artificial insemination based on the results of pregnancy testing between days 95 and 123 of the study, with results split by farm and treatment group. 7dC = 7-day Cosynch. m5dC = modified 5-day Cosynch.

		Farm								TOTAL	
		Farm 1		Farm 2		Farm 3		Farm 4			
		7dC	m5dC	7dC	m5dC	7dC	m5dC	7dC	m5dC	7dC	m5dC
Pregnant		19	11	32	26	56	33	36	31	143	101
No	n										
	%	65.5	44.0	43.2	32.5	62.9	37.5	51.4	42.5	54.6	38.0
Yes	n	10	14	42	54	33	55	34	42	119	165
	%	34.5	56.0	56.8	67.5	37.1	62.5	48.6	57.5	45.4	62.0

CR to FTAI was higher for heifers synchronised with the m5dC program (62.0%) compared to those synchronised with the 7dC program (45.4%), with a significant difference between the two groups based on the odds ratio (1.96, 95% CI 1.38 to 2.77, p=0.0002) (see table 1).

Evaluation of long-term reproductive performance found that 6-week pregnancy rate was higher for heifers synchronised with the m5dC program (87.6%) compared to that for heifers synchronised with the 7dC program (74.4%), with a significant difference between the two groups based on the odds ratio (2.42, 95% CI 1.53 to 3.84, p=0.0002).

In contrast to other measures of reproductive performance, there was a numerical difference in final pregnancy rate for heifers synchronised with the m5dC program (95.9%) compared to those synchronised with the 7dC program (91.2%), but the difference between the two groups was not significant based on the odds ratio (2.46, 95% CI 0.58 to 10.38, p=0.18). Serum progesterone at CIDR insertion/GnRH treatment was lower for heifers synchronised with the m5dC program compared to those synchronised with the 7dC program (see Table 2).

Table 2. Serum progesterone concentration (ng/ml) reported as geometric mean, 95% confidence intervals, minimum and maximum values for a subset of heifers from both treatment groups.

Treatment group	Geometric mean	Lower 95% conf. limit for mean	Upper 95% conf. limit for mean	Minimum	Maximum
7dC	2.95	1.79	4.84	2.9	8.2
m5dC	1.35	1.04	1.76	1.4	3.4

When reported as mean values, time to conception was 9.9 days shorter for heifers synchronised with the m5dC program compared to those synchronised with the 7dC program. When reported as median values, time to conception was 20 days shorter for heifers synchronised with the m5dC program compared to those synchronised with the 7dC program.

Conclusions

Both the 7dC and m5dC programs can be used to synchronise dairy heifers for FTAI. However, these results demonstrated that both CR to FTAI and 6-week pregnancy rate were superior for heifers synchronised with the m5dC program. The reduction in serum progesterone (measured for a subset of heifers) at the time of CIDR insertion and GnRH treatment in the m5dC group compared to the 7dC group indicated that a single injection of PG two days prior to GnRH treatment caused CL regression in these heifers and supports the findings of Karakaya-Bilen *et al.* (2019).

There are several key differences between the m5dC program and the 7dC program:

- Pre-synchrony treatment with PG in the m5dC program.
- Shortened period of progesterone supplementation in the m5dC program.
- Additional PG treatment approximately 24 hours after CIDR removal in the m5dC program.
- Extended interval between CIDR removal and FTAI in the m5dC program.

This study design did not permit an evaluation of the relative contributions of each of the differences in synchrony program design described above to the observed differences in reproductive performance. Therefore, it was only possible to conclude that, in combination, these differences in synchrony program design resulted in an improvement in the reproductive performance of dairy heifers. As such it is worth considering the m5dC program as an alternative option for synchronisation of dairy heifers to achieve improved reproductive performance compared to the existing 7dC program.

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References

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