Dairy fertility: improvements and synchronisation programmes

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looks at various techniques on achieving optimal performance in dairy heifer neonate rates, including monitoring options and breeding programmes

HEIFER rearing has been receiving attention across the dairy sector, as farmers look to improve efficiencies. This follows the work by Brickell et al (2009) that identified high mortality rates and suboptimal growth rates on many dairy farms. The consequence was dairy heifers often didn't calve for the first time until 30 months of age, or older.

With recognition that for optimal performance heifers needed to calve at 24 months, there was a great deal of interest in the neonate. Colostrum intakes, milk volumes and milk quality have all received a great deal of attention to get a good start in the rearing process. As calf rearing has improved and reasonable growth rates are achieved, the focus, in the author's opinion, is now shifting to age at first calving and breeding.

This is a further area for efficiency as the rearing costs are around £50 per animal for each month delay beyond the 22 to 24-month target. A 200-cow farm with typical replacement rates of 26 per cent will need to keep an additional 26 heifers if calving at 30 months rather than 24 months of age (DairyCo, 2015). This can only add to labour, land and management costs. As a consequence, we are being asked more often to advise on breeding programmes for heifers.

The first consideration is to assess whether the heifers are big enough to breed. They need to be 55 per cent of adult weight, but weighing facilities are often not available. A simple, alternative approach is to look at withers height. Provided Holstein-Friesian heifers are at least 125cm to 129cm tall, they are suitable for breeding. This height can be marked on a wall in the race to allow easy assessment (**Figure 1**).

In addition, a vaccination plan, trace element status and plane of nutrition must all be taken into account in advance of breeding.

Prostaglandin

Breeding programmes allow focus on heifers when time may be limited, batch management and ensure breeding is carried out as soon as cattle are eligible, rather than reliance on oestrus expression and detection (**Figure 2**).

By far the most popular approach among Shepton Vets' clients is to use a "one-and-a-half times" prostaglandin treatment. This keeps vet and treatment costs to a minimum, but relies on heat observation. All unbred heifers are treated with a single injection of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) and observed over the following week.

Heifers in the luteal phase can be expected to come into oestrus and typically show standing heats after two to four days. This variation reflects the time for a dominant follicle to emerge and accounts for differing follicular status at the time of treatment. Improved heat detection rates are likely to be achieved where heat detection aids are used, whether tail paint or heat mount detectors.

Service to observed oestrus allows the use of sexed semen. We find sexed semen is popular as it gives easy calving, increases the numbers of heifers born and allows more rapid genetic advancement. The compromise is sexed semen typically gives a conception rate of only 40 per cent, compared to 60 per cent with conventional semen.

Heifers not served after the initial prostaglandin are presented again 11 to 14 days later and, if timed with routine cow fertility visits, the number of visits and costs can be kept to a minimum. These remaining animals – the half in "one-and-a-half" – are given a second $PGF_{2\alpha}$ treatment, this time served at a fixed time. The ideal is to serve twice at 72 and 96 hours, but a single service at 84 hours is acceptable and will reduce conception rates by 10 to 15 per cent. Sexed semen should not be used with fixed-time artificial insemination (AI).

Progesterone

Use of progesterone devices gives a tighter synchrony of oestrus than prostaglandin alone, allowing timed AI to be used. The main advantage is this avoids the need for observation, ensures 100 per cent submission rates and has the simplicity of all animals being managed in the same way. Typical use, and data sheet use, involves progesterone device insertion for seven days with prostaglandin treatment 24 hours prior to device removal.

Heifers should be served 56 hours after removal, but sexed semen should not be used. We find the main use of this programme is in embryo transfer programmes where recipients need to have heats closely synchronised with donors. There is limited uptake of this programme otherwise in this practice, perhaps due to the need for four handling sessions.

There has been recognition progesterone uptake from intravaginal devices diminishes over time. This fall in progesterone to sub-physiological levels can affect follicular waves, so shorter duration is recommended by the Dairy Cattle Reproduction Council (DCRC). The DCRC recommended protocol is given in **Figure 3**. While this involves four handling sessions, the protocol can be reduced to three with a single PGF treatment, reducing cost and the time required. Use of a gonadotropin-releasing hormone (Gn-RH) injection at the time of timed AI will create a luteinising hormone surge to induce ovulation. The author has no experience with this programme to comment on its effectiveness, but adoption would allow improved batch management, with around 50 per cent of heifers expected to be in calf to a single service date. Three aforementioned breeding programmes are compared in **Table 1**.

Table 1. Parameters of three breeding programmes

Approach	Observed AI	Timed AI	Cost	Vet visits	Handling sessions including AI
One-and-a-half times PGF	Yes	After second PGF	1.5 treatments	Two	Observation, multiple
PRID and PGF	No	Yes	2 treatments	Two	Three (single serve)
DCRC five-day progesterone-synch	No	Yes	3 treatments	Two	Three (single serve)

AI – artificial insemination; PGF – prostaglandin F; PRID – progesterone releasing intravaginal device; DCRC – Dairy Cattle Reproduction Council.

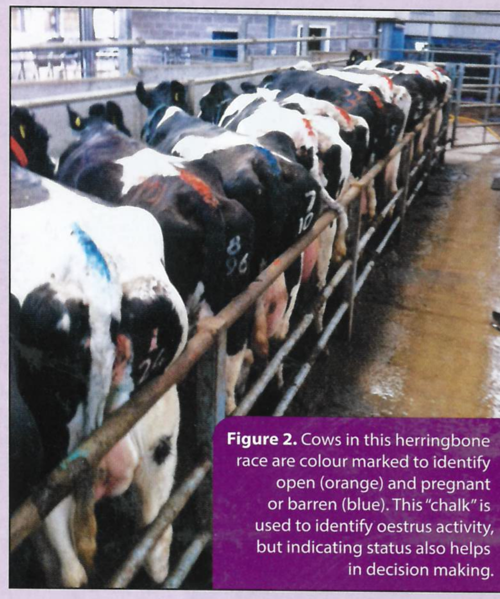

Figure 2. Cows in this herringbone race are colour marked to identify open (orange) and pregnant or barren (blue). This "chalk" is used to identify oestrus activity, but indicating status also helps in decision making.

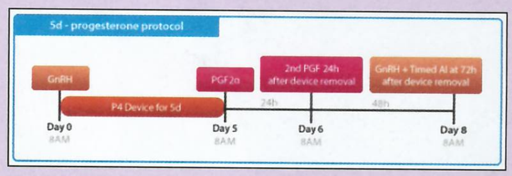

Figure 3. Five-day progesterone protocol recommended by DCRC.

Fertility

In the adult dairy cow, fertility can also be a challenge, but the author senses some progress in tackling this issue in the modern Holstein. Two major issues with fertility exist due to the higher yields of the Holstein – changes in endocrine physiology, which results in low conception rates, and secondly, reduced oestrus expression, increasing the likelihood of low submission rates. Progress is being made in tackling these areas through genetics and fertility management. One option is to change the genetic base, as this gives permanent and cumulative effects.

There is now greater emphasis on fertility, with an increased weighting for a fertility index. This means we are now selecting sires and producing cows with improved genetics for fertility. Marco Winters (2014) showed these changes have started to be implemented from 2008.

Given two to three years for heifer rearing and a 25 per cent replacement rate, we are only now seeing the impact of selection of more fertile animals. For those impatient for change, or looking for a step change, crossbreeding provides an immediate improvement in fertility. Buckley et al (2014) identified crossbreeding was widespread in New Zealand, where more than 50 per cent of cows are crossbred. His work showed hybrid vigour is worth £100/cow/year in extra profit from improved milk yield, fertility and health, and these benefits can be seen in high input systems as well.

If farms operate a two-way cross then they retain 67 per cent of the benefit in future generations, while a three-way cross retains 86 per cent benefits. Within our practice we are now seeing significant numbers of crossbred animals and dairy cow conception rates now reaching levels more than 50 per cent – something the author has not seen since graduating more than 20 years ago.

Wiltbank et al (2014) have indicated low progesterone profiles – in particular, during the pre-ovulatory follicular wave – result in changing follicular dynamics. This effect is much more marked in the high-yielding cow, increasing the likelihood of twin pregnancies. Cows giving less than 40kg of milk are unlikely to have a double ovulation (zero to six per cent rate), whereas cows giving more than 40kg show a 25 per cent to 52 per cent double ovulation.

There is also a difference in rates of double ovulations between heifers and cows, with rates of two per cent in heifers and 25 per cent in cows. We do not see twinning at anything like these rates due to higher pregnancy losses in twin pregnancies. This does help to explain the apparent paradox that the Holstein is both less fertile and more likely to give birth to twins.

In the high-yielding cow there is a higher metabolic rate, resulting in rapid blood clearance of hor- ➩ page 10

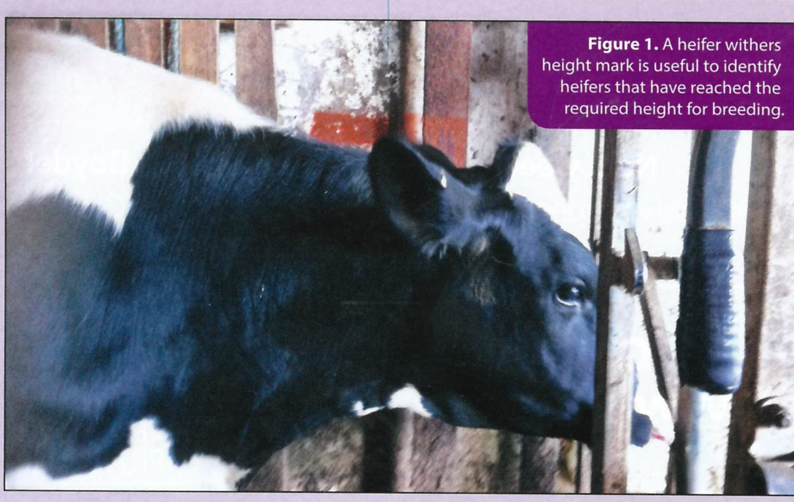

Figure 1. A heifer withers height mark is useful to identify heifers that have reached the required height for breeding.

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mones including progesterone, reducing oocyte quality and oestrus expression. Improvement in health and achieving target body condition scores are regarded as key aspects to achieve satisfactory progesterone profiles.

Enhancing the progesterone profile prior to breeding has been shown to increase conception rates by up to 15 per cent, while addressing progesterone levels around service or postservice are only likely to increase conception rates by up to five per cent. This suggests emphasis on Gn-RH holding injections 12 days postservice or use of Gn-RH to induce ovulation is likely to have only limited impact. Our approach to high-yielding herds where there are low conception rates should look at ways to improve progesterone profiles and follicle dynamics. Thus, intervention with progesterone devices or Ovsynch regimes (**Figure 4**) should assist with improved progesterone levels, oocyte quality and early embryo development, resulting in higher conception rates, lower twinning rates and, perhaps, fewer embryonic deaths.

Figure 4. Cows on an Ovsynch programme are clearly identified to improve compliance with the treatment programme. Colour changes are used to identify week started.

Paul Fricke (2014) discussed how management practices can tackle the issue of poor oestrus expression. While recognising activity collars can play a part in improved oestrus detection rates, he emphasised the need for identification and treatment of the 30 per cent of cows that fail to be detected in oestrus. He also identified conception rates need to be in excess of 30 per cent to justify the use of heat detection over timed AI.

Timed AI

With UK conception rates at an average of 34 per cent, some herds will be below this threshold. There are a number of reasons why UK herds do not use timed AI, including cost, but mainly because heat detection is still regarded as an important part of the skill set of UK dairymen. Timed AI does have a place and it is to reduce days open, particularly in cows that fail to show oestrus or fail to be detected in oestrus.

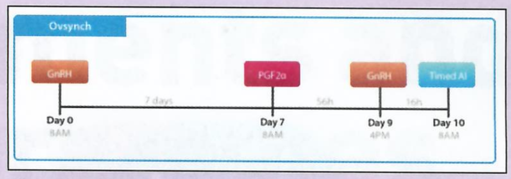

Figure 5. Ovsynch protocol.

In the UK we have, for many years, examined these "oestrus not observed" cows and where a corpus luteum is present, treated with prostaglandins to induce oestrus. When this treatment is supported with good cow identification and heat mount detectors, the submission rates are good. However, some cows will fail to respond to prostaglandin (10 per cent to 15 per cent), some will fail to display oestrus (10 per cent) and some will fail to be detected in oestrus (variable 10 per cent to 40 per cent), or vets may be inaccurate in selection of cows for treatment. As a consequence, we see increased uptake of synchronisation and timed AI as a "backstop" for cows that fail to respond to initial prostaglandin, and sometimes in circumstances such as seasonal calving or manipulation of calving pattern.

Options for timed AI in adult dairy cows include a range of approaches with similar-sounding acronyms. The simplest and most commonly used approach is the Ovsynch-56 outlined in **Figure 5**, but there are variations. For more details, visit www.dcrcouncil.org/protocols.aspx

The Gn-RH treatment can be initiated by the vet on weekly routines, or by the farmer a week preceding the vet visit, as this allows vet control over prostaglandin treatments. The author's approach is to scan all cows on day seven prior to PGF treatment, as he can ensure cows are in the luteal phase. If they are not then they can be restarted – a so-called GnRH-GnRH-Prostaglandin-GnRH (GGPG) regime – or a progesterone device can be used. With good compliance and appropriate timing of injections, in particular a second Gn-RH 16 to 20 hours prior to AI, then good conception rates can be achieved – typically within four per cent of serve to observed oestrus.

On review of fertility results for one well-run dairy, the author found Ovsynch was used as a backstop approach on six per cent of serves. The outcome was conception rates of 31 per cent, four per cent lower than cows served to observed oestrus. Unfortunately, 12 months later conception rates to Ovsynch dropped to 25 per cent, but further investigation found this was due to poor compliance, with cows failing to be injected with their second Gn-RH treatment or incorrect timing.

Many of the large number of regimes used in the US are aimed at pre-synchronisation prior to timed AI. These are implemented to increase conception rates by maximising the number of cows at days five to nine of the oestrous cycle.

By starting the Ovsynch regime in the early luteal phase and at the end of the first follicular wave, more cows will respond to treatments in a predictable way and a higher conception rate will be achieved.

As most cows in the UK are only synchronised having failed other treatments, rather than routinely synchronised, the adoption of these approaches is low, the author believes.

Summary

In summary, advances in our understanding of the issues with cow fertility and economics of dairy farming are driving a more structured approach. Dairy vets need to look at clients' needs, and adopting an organised approach, as well as increased skills, can help them run their herds more efficiently.

Acknowledgement

With thanks to Ceva Animal Health for provision of images for timed AI programmes.

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