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The application of controlled calving and breeding programmes to the management of large dairy herds

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ABSTRACT

Programmes for controlled calving and controlled breeding were evaluated with a group of large herds of dairy cows and heifers. The former procedure involved an injection of an analogue of prostaglandin F_{2a} (PGF) at about Day 274 of gestation. Groups totalling 650 cows mainly calved in the following 4 days, with a peak between 36 to 60 h. The maximum calving rate was 138 cows within one 24 h period. Although calf survival rate was high (97%) and the incidence of calving difficulties low (3%), 14 cows were subsequently culled because of complications caused by retained foetal membranes.

The controlled breeding programmes involved the use of CIDR-B devices for 8 days (cows) or 10 days (heifers) combined with a capsule containing 10 mg of oestradiol benzoate at device insertion (all cows and heifers), and with an injection of PGF at 6 days after insertion (cycling cows and all heifers), or an injection of equine chorionic gonadotrophin (eCG) at device removal (anoestrous cows). These systems were used with herds of 300 and 500 heifers, as well as with 350, 400, 480 and 904 lactating cows. Every heifer was inseminated initially at about 48 h after device removal, but cows were inseminated on detection over 4 days. All inseminated animals were retreated with a previously used CIDR device to re-synchronise oestrus before a second insemination about 21 days later. A second re-synchrony was also applied with some cows before their third insemination. These programmes produced 4-day submission rates in the cows of 87% to 95% and 48 h synchrony rates of 94% and 95% in the heifers.

The consequences of these programmes mean that about 90% of animals in each herd will have conceived to AB or natural mating within 6 weeks. The rate of use of induced calving next season should be reduced to about 5%. The increased concentration in calving is expected to reduce the incidence of treatments for anoestrum (from as high as 44% in one of the herds) to about 10%. Additional advantages include time saving, less labour, reduced labour stress, more cows and heifers in calf to AB sires, fewer bulls and earlier culling of bulls and empty cows. The maximum daily numbers were 904 CIDR devices inserted in 5 h, 504 heifers inseminated in 4 h and 689 cows inseminated in 5 h.

Whereas calving and breeding had previously been major constraints in herd management, the use of these systems can realistically allow the herd size to be increased to more than 1000 cows. Many of the identified advantages will be equally applicable to herds of less than 200 cows.

Keywords: controlled calving, prostaglandin $F_{2\alpha}$, controlled breeding, CIDR-B, oestradiol benzoate, oestrous synchrony, tailpainting, dairy cattle.

INTRODUCTION

Significant constraints to the effective management of large dairy herds involve a limited number of occasions when an animal requires specific attention. Routine procedures like milking and feeding can be accommodated by developing appropriate systems which allow comparatively inexperienced staff to "process" large numbers of cows per labour unit within limited time periods. This can improve the opportunities for the effective utilisation of capital and also reduce variable production costs per unit output. These methods can be applied less successfully to those situations when an animal has a specific need for attention. They include calving, inseminating, mastitis treatment and health crises precipitated by accident and injury, sickness and life-threatening conditions like bloat or hypomagnesaemia. Some of these events can be controlled or prevented by routine prophylactic treatment (such as drenching), or by monitoring (somatic cell counting) and udder checking.

Over 90% of cows require no assistance at calving and complications are most frequent in primiparous heifers. This could be reduced if calving could be controlled and the process monitored during a predictable period of time within a day or over several days. Special care for large numbers of newborn calves can be organised to focus on warmth and colostrum feeding. Artificial breeding (AB) is a specific-needs situation which can be particularly difficult to integrate into the management of a large herd. The inseminating process is relatively simple and it is not time consuming; but it must occur within a 24-hour period around oestrus and ovulation. In addition, it may need to be repeated in some

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animals about 3 weeks later. Lack of diligence in oestrous detection produces delays in conception which extend calving patterns in the subsequent season, and reduce lactation length. In many cases, these calving patterns can only be corrected by the extensive use of induced calving. Failure to detect oestrus or mis-identification will also reduce the number of AB heifer calves produced in a herd. This will reduce genetic progress and may mean that some replacement heifers must be purchased.

Conventional calving and breeding programmes were recognised as major constraints to effective herd management once herd size exceeded 600 cows, or where contract labour was largely responsible for routine herd management. The situation described in this paper involved one herd comprising 1350 spring and autumn cows as well as two herds of over 400 cows managed by contract milkers. As well as this total of over 2300 cows, there were two herds containing 800 yearling heifers which had to be artificially inseminated. Although cow numbers were increased substantially during 1992, the previous year's calving and mating programmes were associated with significant management problems. These contributed to unacceptably high numbers of calf deaths, empty cows and late calvers. Further expansion could not be contemplated before these problems were resolved.

MATERIALS AND METHODS

Programmes for controlled breeding and controlled calving were selectively applied in three herds of cows and two herds of primiparous heifers. Herd A comprised 350 cows calving in April and 1000 calving in August. The former cows had to be bred in July before the others started calving. These 1350 animals were divided into two groups of approximately equal size. Herd B included 130 autumn and 480 spring calving cows managed mostly as one herd by a contract milker. Herd C had only 400 spring calving cows also managed by a contract milker. These two herds were located 20 km from Herd A. Controlled breeding was used in Herds B and C to allow herd owner supervision of the AB programme as well as avoiding the employment of extra labour in Herd A.

The primiparous heifers were grazed 50 km from Herd A. Most of the 300 animals to be winter mated were slightly less than 14 months of age. There were 504 15-month old animals in the group to be spring mated. The objective in these two groups was to use a new synchrony programme expected to allow single set-time inseminating with resynchrony for a second insemination also on one day, based on the use of the previously used CIDR device.

A report published in the New Zealand Dairy Exporter described a programme involving the strategic use of an analogue of prostaglandin $F_{2\alpha}$ (PGF) to produce a precise and predictable calving pattern. A single intramuscular injection of 2 ml Estrumate (Pitman Moore; Australia) was given at Days 272 to 276 of gestation with most cows or heifers calving from 40 to 80 h later. This system was modified for use with 650 of the August calving cows in Herd A. It was found that an injection of either 2.5 ml Lutalyse (Upjohn NZ Ltd) or 1 ml of Estrumate was equally effective. Cows with due-to-calve dates in the ensuing week were examined by the herd veterinarian and injected on the Sunday evening so that the rush in calving occurred during the working week.

There were 5 groups of cows (2 winter and 3 spring mating) with from 130 to 1000 cows/group and 2 groups of heifers (1 winter and 1 spring mating) which were included in controlled breeding programmes. Every cow in each group was tailpainted about 4 weeks before the respective date selected for the start of the breeding programme. About 3 weeks later, a CIDR-B device (Eazibreed CIDR-B; Inter-Ag; Hamilton) incorporating a CIDIROL capsule containing 10 mg oestradiol benzoate (ODB; Douglas Pharmaceuticals; Auckland) was inserted into the vagina of each cow. If the original tailpaint had been removed previously, the animal was classified as cycling, and it was tailpainted with a second colour. The reproductive tract of each 'non-cycling' cow was palpated by a veterinarian before CIDR-device insertion. The three main diagnoses were: (i) cycling because a corpus luteum was palpated; (ii) anoestrous because there were no significant ovarian structures and no other evidence of a post-partum oestrus; or (iii) not suitable for treatment because of incomplete involution, uterine pathology or other abnormalities. The cycling cows were injected with 5 ml Lutalyse either 2 days before CIDR-device removal with a treatment period of 10 days (CIDR 10 + ODB 0 + PGF 8) in the 3 spring-mated groups, or at the time of device removal (CIDR 7 + ODB 0 + PGF 7) in the 2 winter-mated groups. Each of the non-cycling cows was injected with 400 IU eCG (Pregnecol; NZ Pastoral Consultants; Otane) at device removal (CIDR 7 + ODB 0 + eCG 7 or CIDR 10 + ODB 0 + eCG 10). These treatments and CIDR device removal were completed during milking. Cows were presented for insemination over a 4 day period after being diagnosed in oestrus on the basis of raddle and tailpaint removal. The first day of inseminating was 2 days (48 h) after device removal. The used CIDR devices were washed in cold water, air dried and stored in sealed plastic bags.

Two Hereford bulls each fitted with a chin-ball harness ran with each herd from the day of initial CIDR device insertion. They were removed on dates coinciding with device removal and returned after each of the three inseminating sequences. Eighteen days after initial device removal, a previously used CIDR device was reinserted into the vagina of every cow except those which had been neither inseminated nor bred by a bull. These unmated cows were re-examined by a veterinarian and classified as cycling or anoestrus. The former cows were injected with PGF and received a previously used CIDR device; the latter animals received a new CIDR device and were injected with eCG at device removal.

The resynchrony treatment lasted 5 days and was followed by 3 days of inseminating on detection from 48 h after device removal. The re-examination and re-synchrony routines were repeated with those cows which had a second insemination or bull mating from 18 days after the date for the removal of the previously used devices. The third insemination sequence involved 2 days of inseminating which were 45 and 46 days after the date of the first day of inseminating. Bulls ran with the herd for another 6 weeks after the last day of inseminating.

The variations made to this controlled breeding programme for use with the heifers was to presume that they were all cycling and to use a CIDR device combined with CIDIROL and Lutalyse as a CIDR 10 + ODB 0 + PGF 6 schedule. They were all inseminated from 48 to 52 h after device removal. The previously used CIDR devices were reinserted 18 days after initial removal for 5 days with second inseminations on detection only at 48 h after re-removal. Harnessed bulls ran with the herds from the date of original device insertion until 4 weeks after the date of the second inseminations except for two 3-day periods following device removal.

Cows and heifers were subsequently pregnancy tested, but the date of conception was not always confirmed. Both tailpaint and aerosol raddle were strategically used to identify individual cows during the treatment and the inseminating periods. Cows for inseminating as well as the sire whose semen was used for an insemination could all be colour-coded. These details were essential to successfully implementing the programmes.

RESULTS

The 650 cows injected with PGF in late gestation had synchronised calvings over a 4-day period. The Sunday evening treatment was followed by a peak in calving frequency for 24 h from late Monday evening. On one occasion 138 cows calved in a 24 h period. Calf survival was high (97%) and calving difficulties only 3%. These mostly occurred on the Wednesday or Thursday after the peak had passed. The major problem with the technique was that 14 cows subsequently had to be culled because of pyometra associated with retained foetal membranes.

The loss rate of CIDR devices was less than 2% except in cows re-synchronised after a second insemination and before the third insemination when it increased to 3.5%. On the single day for first inseminating for the two groups of heifers, 95% (winter mating) and 94% (spring mating) had significant raddle and paint removal. The re-insemination rates 23 days later were 36% and 39% respectively. The percentage of cows inseminated during the initial 4 days of inseminating varied from 87% (Herd A) to 95% (Herd C). There were 400 anoestrous and 504 cycling cows synchronised in Herd A, and it was the former animals which contributed to the lower 4-day result as their 4-day submission rate was only 78%. In Herd A, 689 cows (76%) were inseminated on the first day of AB, and 264 cows (29%) were re-inseminated (or had their first insemination) 23 days later. The synchrony programmes in Herds B and C were combined so that 620 cows (70%) were inseminated on the first day of AB.

The non-return rates based on harnessed bull service dates and insemination dates for Herd A indicate that 42% of all the cows in the herd conceived to first inseminations made over a 4-day period. Another 26% conceived during the 3 days of inseminating 3 weeks later and 11% during the 2 days for third inseminations. This total of 79% in calf to AB sires was increased to 85% by including cows conceiving to the herd sires used during the intervals between synchrony. Initial results indicate that a further 10% of cows should conceive to these same sires during the 6 weeks following dates of the third inseminations and that 5% of cows will have failed to conceive. The heifers were pregnancy tested by rectal palpation; 88% (winter mated) and 90% (spring mated) of these animals conceived within a 45-day period.

DISCUSSION

One season's experience with the use of these controlled breeding and controlled calving systems indicate that both have application to the management of large herds. The results obtained in 1992 will significantly alter and condense calving patterns in 1993 with fewer cows induced to calve prematurely or treated for anoestrum. Under optimal conditions the controlled breeding programme would have 50% of the cows in a herd conceive to first inseminations in the first 4 days, another 34% conceiving to second and third inseminations and only 9% in calf to the bulls running with the herd between the synchronised insemination periods. This would mean that 93% should have conceived within a 46 or 47-day period with only 9 days of detecting and inseminating. The calving spread for these animals could be regulated to 44 days from the date for the planned start of calving with the strategic use of controlled calving. Only 3% of cows would have to be induced to calve prematurely because they conceived after the first 47 days of breeding.

If the extra effort and time in calf rearing or calf deaths are included in the costs of using the normal calving induction procedure as well as the reduced production (7%), then the current cost of about $140/cow would be equivalent to using controlled breeding with 7 cycling cows ($20/cow). The use of CIDR devices and eCG with non-cycling cows would not be an additional cost of controlled breeding as these animals should be treated routinely in this manner. A single day for inseminating all of the yearling heifers will mean that some heifers will be inseminated before they are in oestrus. If this percentage can be controlled to less than 7%, and they can be successfully re-synchronised with oestrous herdmates which fail to conceive to first insemination, then the target of 80% conceiving to AB with 2 days of inseminating about 3 weeks apart is realistic and profitable. The benefits include supervised or controlled calving to reduce dystocia losses in these young heifers, a longer post-partum interval to re-breeding and less anoestrum.

Having to inseminate 500 heifers or up to 690 cows in one morning was a daunting prospect; but the occasions passed uneventfully. Giving cows access to extra pasture 24 h after initial device removal appeared to prevent the expected occurrence of acidosis sometimes seen as a sequel to reduced feeding during oestrus. There were no animal injuries. Nonetheless, the identification of oestrous cows and sire-coding animals when an individual was inseminated on consecutive days, as well as applying separate injectable treatments to cycling or inseminated and anoestrous cows was critically dependent on the strategically effective use of tailpaints and raddles of varying colours. Their use also minimised the incidence of errors of omission for CIDR device insertion (tailpaint applied) and removal (raddle applied). Staff were keen to be trained in device insertion and removal. Vaccination equipment was modified and adapted so that up to 500 cows could be injected with PGF or eCG during milking. A false gate was made at the exit of the herringbone so that each cow had its head facing into the pit. Veterinary examination, device insertion and inseminating could then proceed from the alleyway normally used for drenching. The 689 cows in Herd A were inseminated in 4 hours by four experienced technicians with two assistants loading pistolletes. The team effort involving the veterinarian, farm staff and inseminators was stimulating and rewarding. It eliminated the tedium of daily detection. This task had previously involved a minimum of 2 h/day for 6 weeks for an experienced labour unit. Allowing harnessed bulls to run with the herds except for the 9 days of inseminating and one day preceding each of the three insemination periods meant that isolated incidences of oestrus were rarely missed. The concept of controlled breeding also allowed an owner to supervise and coordinate AB-use in other herds (Herds B and C) managed by contract milkers.

It may take two or three seasons to obtain a calving pattern which will allow the principles of controlled breeding and controlled calving to achieve the maximum advantages. Many of these will be equally applicable to herds of less than 200 cows. However, these systems have the potential to allow herds of over 1000 cows to be successfully calved and mated, and to meet the specific requirements of individual cows at these isolated but critical occasions in the annual lactation cycle. One season's experience has demonstrated that controlled breeding in particular has many previously unrecognised advantages. It is an excellent example of successfully adapting technology to suit the specific needs of cows in large dairy herds. It could even become as common as tailpainting.

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