IMPROVEMENT OF CATTLE PRODUCTION IN MYANMAR THROUGH THE USE OF PROGESTERONE RIA TO INCREASE EFFICIENCY AND QUALITY OF ARTIFICIAL INSEMINATION SERVICES

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Abstract

IMPROVEMENT OF CATTLE PRODUCTION IN MYANMAR THROUGH THE USE OF PROGESTERONE RIA TO INCREASE EFFICIENCY AND QUALITY OF ARTIFICIAL INSEMINATION SERVICES.

A survey of Artificial Insemination (AI) status in Myanmar was carried out in the Mandalay region. Most farms are smallholdings with 1–12 breedable cattle per farm. During the survey a total 435 first inseminations carried out by 5 AI technicians were recorded. The conception rate (CR) at first service was 60.7% and the overall CR was 63.3%. Interval from calving to first service was 103.6 ± 40.0 days. Progesterone measurement on the samples collected on the day of AI (day 0) showed that 6.3% of the services were done when progesterone was high (>3nmol/L), indicating that the cows could not have been in oestrus. Most of the farmers detected oestrus based on signs such as mucus discharge, bellowing and mounting. After the preliminary survey a study was conducted to test of two intervention measures: to reduce the interval from calving to first service by nutritional supplementation with urea molasses multinutrient blocks (UMMB); and to reduce the number of AI done during the luteal phase. In this study 245 first AI were recorded. Interval from calving to first oestrus was 95.8 ± 24.8 days. Incidence of AI at luteal phase declined to 4%. In spite of better heat detection, the conception rate was 55.9%, which is lower than during the survey phase. This could be attributed to lower fertility of semen from certain bulls used in the second phase. Assessment of progesterone values in the samples showed that 3.8% of AI were done during anovulatory oestrous cycles, 7.8% in anoestrous cows and 5.9% in cows with irregular or short oestrous cycles.

1. INTRODUCTION

According to recent estimates Myanmar has 9.7 million cattle and 2.1 million buffaloes. The proportion of cows used for dairy purpose constitutes only 10% of the total population. At present the number of artificial inseminations (AI) done range from 70 000 to 80 000 per year. AI is performed in 35% of the total dairy cow population.

Use of fresh semen for AI was introduced in 1967 but has never proved to be popular with farmers, due to the low conception rate (CR) obtained and the limited choice of breeds. It was in 1976 that, with the introduction of frozen semen of European breeds, AI became popular among farmers. In 1981 use of fresh semen was abandoned with substitution of frozen semen throughout the country. During the World Bank financed Livestock Development Project (1976–1981), a total of 150 000 doses of imported semen were introduced from North America and Europe. Fertility resulting from AI using imported semen was recorded at around 57% [1].

After the World Bank Project, imported semen was gradually substituted with locally produced semen. The conception rate in general was acceptable, but there were occasional decreases in fertility, most likely due to fluctuation in the semen quality. However, a thorough investigation of the causes of failure has never been carried out. The Joint FAO/IAEA Division's Co-ordinated Research Programme based on radioimmunoassay (RIA) for measuring progesterone to improve efficiency and quality of AI provided a good opportunity to address this problem in Myanmar.
2. MATERIAL AND METHODS

2.1. Location and farms

The research activities were carried out in Mandalay Division located in the central part of Myanmar. It is situated in the dry and arid zone of Myanmar where annual rain fall ranges between 1000–1500 mm. Mandalay is also the most developed area in cattle raising both for dairy as well as draught purpose. Most dairy cattle are Holstein-Friesian crosses but some villages still maintain a few local Zebu (Pya Zein) for milk purpose. Most of the dairy cattle are well fed and well managed.

Two studies were conducted, comprising a survey phase and an intervention phase. The first was conducted from February 1995 to December 1997 and the second from March 1998 to September 1998.

2.2. Survey phase

The survey was aimed at collecting samples and data from 500 cows from smallholder farmers. For this purpose, five inseminators were selected and each was assigned to sample 100 cows during the survey phase. They were asked to fill up the survey forms which had been developed for this programme when they first visited a farm, and for each cow inseminated. Milk samples were collected on the day of AI (day 0) and on days 10–12 and 22–24 after AI and were sent to RIA laboratory in Yangon for analysis. Pregnancy diagnosis was performed by the technicians themselves, between 50–150 days after AI. Milk samples were not collected regularly on day of pregnancy diagnosis during the first phase.

2.3. Intervention phase

This phase was undertaken to correct some of the drawback of the AI service that had been identified during the survey phase. The aim was to collect samples and data from 250 cows from smallholder farmers. The procedures for collecting samples and data were as described previously.

Firstly, the nutritional status of cows was improved during the pre and post partum periods in an effort to reduce the interval from calving to resumption of estrous cycles. This was done by supplementation of the feed with UMMB. The composition of the UMMB was: molasses = 35%, rice bran = 33%, urea 12%, cement = 5%, salt = 5%, and lime = 10%. Each cow was given approximately 320 g of UMMB per day (each block of 1.6 kg for 5 days). Supplementation commenced before parturition and was continued until they conceived again.

Secondly, AI technicians were briefed on the findings of the previous survey with regard to those cows which had shown high concentration of progesterone at the time of AI, and were provided with instructions and guidelines for avoiding the performance of AI during the luteal phase and other inappropriate times.

2.4. Processing of samples and data

Milk samples (10 mL) were collected by stripping of the udder, at the time of the AI technician’s visit, in to vials containing a tablet of preservative (Sodium Azide). The samples were centrifuged at 2000 G for 15 min within 2hr to 3 days after collection. The skim milk fraction was transferred to another vial and stored frozen (−20°C) until assay.

Progesterone was measured in skim milk using a direct solid-phase method employing ^125I labelled progesterone as tracer. All samples and standards were run in duplicate. After adding standards, QC, samples and tracer, all tubes were incubated for 3 hours at room temperature. The tubes were then decanted and counted for 60 sec in a single well Gamma Counter. Counter efficiency was 63.5% and the intra-assay coefficient of variation ranged from 3.1 to 5.2%.

Information relating to the farms, cows, inseminations, AI technicians, semen batches, pregnancy diagnoses and progesterone results were recorded in the artificial insemination database application (AIDA, FAO/IAEA, Vienna) and reports were generated using the application.
3. RESULTS

3.1. Survey phase

3.1.1. Farm information:
There were 50 villages or regions involved in the survey, with distances from the AI center varying between 0–9 Km. Most of the farms were smallholdings, with 1–12 breedable females per farm. There was only one large farm, with 35 breedable females. Cows were milked 1–2 times per day and calves were weaned between 1–9 months of age.

3.1.2. AI technicians and semen batches:
The 5 AI technicians were aged between 39–55 years, had been doing AI for 10–23 years and were performing 50–80 AI per month. Formal training for all AI technicians was less than one month. Four of them had received training as veterinary assistants for two years and one was a veterinary graduate.

There were 51 batches of semen from 11 bulls. Semen dose ranged from 10–35 million live sperms per straw. Motility before freezing ranged from 60–80% and after freezing from 35–39%. The minimum standard required by the AI service is 35% post-thaw motility.

3.1.3. Cow information and fertility indices:
There were 435 cows recorded in the study, varying in parity from 1 to 8. Calving dates were between 9 February 1995 and 29 December 1996. Calving weights ranged from 204–652 kg and body condition score (BCS) from 2–5 on a 5 point scale. Inseminations were recorded starting 1 August 1996. The interval from calving to AI varied from 20–315 days. Services were recorded up to the third insemination. Milk production ranged from 2 to 24 kg, with an average yield of 11.1 kg.

The interval from calving to first service (CFSI) was $103.6 \pm 40.0$ days ($n = 421$) and the interval from calving to conception (CCI) was $111.2 \pm 56.3$ days ($n = 315$). The CR to first service was 60.8% ($n = 435$), while the overall CR was 63.3% ($n = 501$). Since it is expected that cows which do not conceive to first service should return to a second service, there should have been about 171 repeat services. However, there were only 62 second inseminations and 3 third inseminations recorded.

3.1.4. Effect of AI Technician on conception rate:
The CR achieved by the five technicians ranged from 57–68%. There was a significant difference in CR between the two sites of semen deposition: 55.7% for deposition in the cervix and 64.5% for deposition in the uterus. The CR was 64% where the passage of the pipette was easy, whereas it was 25% when passage was difficult.

3.1.5. Effect of cow on conception rate:
Conception rate increased with advancing parity from parity 2 up to 6, and then declined at parities 7 and 8. Cows of parity 1 had lower conception rate than those of parity 2. With regard to signs of oestrus, highest conception rate (70%, $n = 100$) was observed with standing heat, while signs such as bellowing, mounting others and mucus was associated with CR of 62.3% ($n = 332$). There was no difference in CR when the vulval swelling was marked (63.2%, $n = 475$) or slight 64.0%, $n = 25$). There was a significant difference in CR when AI was done in the presence of marked uterine tone (63.7%, $n = 488$) compared with that when uterine tone was slight (41.7%, $n = 12$).

3.1.6. Effect of bull, semen source and time of AI:
Semen from the 11 bulls used gave CR ranging from 50.0% to 83.3%. Semen from the local AI station gave a CR of 60.5% ($n = 362$) compared with a CR of 75.9% ($n = 29$) for imported semen.

There was no difference in fertility when AI was performed either 6 hours or 12 hours after the first detection of oestrus (61.3%, $n = 194$ and 64.1%, $n = 287$ respectively), or in the morning or afternoon (62.3%, $n = 223$ and 63.6%, $n = 275$ respectively).
3.1.7. Progesterone data interpretation:

During the survey a total of 496 milk samples collected on day of AI (day 0) were assayed for progesterone and showed that 83.5% of AI were performed when concentration was below 1 nmol/L, indicating that these cows were at a stage other than the luteal phase, while 6.3% were done when progesterone level was above 3 nmol/L, indicating inappropriate timing. Inconclusive progesterone values (1–3 nmol/L) were recorded in 10.3% of samples.

There were 454 services with two milk samples collected on days 0 and day 10–12. The progesterone values showed that 61.9% of the cows had normal ovulatory cycles, 7.3% were either anoestrous, anovulatory or had short luteal phases and 5.3% had high progesterone in both samples indicating AI during pregnancy or with luteal cysts. Inconclusive progesterone values were recorded in 25% of samples.

All three milk samples (days 0, 10–12 and 22–24) were available for 376 services. These revealed that 55.3% of the cows became pregnant, 7.7% ovulated but failed to conceive, 1.5% had late embryonic death and 1.9% of the cases were inseminated during the luteal phase. Inconclusive progesterone values were recorded in 26% of samples.

3.2. Intervention phase

3.2.1. Fertility indices:

During this phase 245 first inseminations were carried out with a CR of 55.9%. The total number of inseminations was 287 and the overall CR was 58.2%. The CFSI was 95.8 ± 24.8 days (n = 245) and the CCI was 102.2 ± 28.1 days (n = 157). These intervals, subsequent to UMMB supplementation, were shorter than those observed during the survey phase.

3.2.2. AI Technicians and semen batches:

The CR for the five technicians ranged from 50.0% to 58.1%. Eight batches of semen from 8 bulls were used during this period and the CR ranged from 49.2% to 64.3%. These results were inferior to those obtained during the survey phase and one bull in particular had an unacceptably low CR of 49.2%.

3.2.3. Progesterone data interpretation:

Progesterone measurement in 272 milk samples collected on day 0 showed that 94.1% (n = 256) of the services were performed when progesterone was low and 4% (n = 11) when progesterone was high. For 259 services two samples of milk were available for progesterone measurement (days 0 and 10–12), and revealed that 81.5% (n = 211) of AI were done during an ovulatory cycle while 3.9% (n = 10) were performed at inappropriate timing. There were 204 services with progesterone values for all three samples (days 0, 10–12 and 22–24) and the results together with clinical findings and interpretation are given in Table I.

<table>
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<tr>
<th>Progesterone value</th>
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<th>Interpretation</th>
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<td>Day 22–24</td>
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Int. = Intermediate value (1–3 nmol/L)
4. DISCUSSION

The survey done in Mandalay area shows that the dairy cattle population has an average interval of 103.6 days from calving to first service, and of 111.2 days to conception. An effort to reduce these intervals through nutritional supplementation of UMMB and therefore improve reproductive efficiency resulted in corresponding intervals of 95.8 and 102.2 days respectively. The long term cost-benefit ratio of this response needs to be studied in greater detail.

First service CR of 60.7% recorded in the survey is a very satisfactory result. In the Mandalay area routine AI services have been established since many years and in the Amarapura township AI covers over 80% of the dairy cattle population. In these areas dairy cattle are mostly Friesian crosses and because of the small herd sizes animals are well managed. Unlike in large herds where each animals receive less individual attention and care, these owners understand the behaviour of the animals well, resulting in better timing of AI. It is a well known fact that timing of AI is a critical factor for achieving high CR. The AM-PM rule recommended several decades ago for insemination which is still practised seems to be valid for achieving good conception. In the smallholder system, where the cows are tied and housed most of the time, there is no opportunity for the animals to show standing heat. The important thing is for the farmer to judge when the cow really started to come into heat. This judgment by the farmer could be ambiguous and may not coincide with the true onset of heat. The present study however shows that there is no difference in fertility when AI is done either 6 hr or 12 hr after onset of oestrus. There was also no significant difference detected between AI performed in the morning or afternoon. The results in this respect were similar during both phases of the study.

The survey confirmed that there are some cases of wrong detection of oestrus by farmers. The progesterone assay showed that 6.3% of services were performed in the luteal phase of the oestrous cycle. Wrong detection of oestrus as a major cause of poor AI performance is stated in several studies [2, 3]. The finding in the Mandalay survey however indicates the situation was not as serious as in some findings where around 20% of the animals presented for AI have high levels of progesterone

In the intervention phase of this study an attempt was made to correct the faults in detection of heat by holding a workshop for the AI technicians, especially with respect to the animals presented for AI with high concentration of progesterone on day of AI. This measure was found to be effective as in the percentage of animals presented with high progesterone declined to 4%.

Assay results for the progesterone concentration during the survey showed a high occurrence of intermediate values, especially when all three samples were considered, making interpretation difficult in about 25% of cases. In the second phase of study more emphasis was placed on the proper handling, storage and shipment of milk samples. This resulted in a marked reduction in the occurrence of samples with intermediate values to around 3%. This permitted a more accurate assessment of reproductive status, and showed that 81.9% of the services were done during a proper ovulatory cycle. The occurrence of non-fertilization or early embryonic mortality accounted for 11.8% and late embryonic mortality for 2.9%. Other aberrant forms of reproductive status constituted 13.8% and included anoestrus, anovulatory cycles, luteal cysts or persistent CL.

In spite of better accuracy of heat detection the CR during the intervention phase declined slightly compared with that in the survey phase. This could be attributed to one particular batch of semen which had achieved a CR of only 49.2%. Variation in the fertility of bull semen is one of the main attributes that can alter the overall CR. Therefore, the need for special attention to test each batch of semen and to monitor the fertility results regularly is highlighted by this study. However, as discussed above, the nutritional intervention tested during this phase resulted in a reduction in the intervals from calving to first service and to conception, thereby improving reproductive efficiency.

5. CONCLUSION

The survey revealed that fertility to AI in the Mandalay region of Myanmar can be considered as good for a tropical developing country. Supplementary feeding with UMMB was effective in reducing the intervals from calving to first oestrus and to conception. Re-training of inseminators with
emphasis on detection of heat and avoidance of AI during inappropriate times resulted in a lower incidence of such inseminations. An important factor found to influence fertility was the quality of semen, highlighting the importance of testing each batch for fluctuations during storage, and of regularly monitoring the fertility rates achieved by bulls used as semen donors.

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