

# **The importance of breeding infrastructure and support services: the success/failure of artificial insemination as a method of disseminating genetic material to smallholder dairy farmers in southern Africa**

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## **Background**

Important breeding infrastructure includes livestock identification, performance recording and evaluation programmes, research, training and extension programmes, farmers' associations, and supply of replacement animals. Lack of dairy stock suitable for the smallholder sector has been cited, at national and regional levels, as one of the major limitations to dairy development in southern African countries. Smallholder farmers usually produce their own replacement animals. However, for dairy development programmes, genotypes not normally used by smallholder farmers are required; various methods have been used to introduce these genotypes and to supply farmers with replacement animals.

Various government departments, non-governmental organisations and farmers themselves have addressed the problem dairy cattle breeding stock supply. Methods that have been used include:

- Heifer breeding units (HBU) or livestock multiplication units (LMU) which were either privately or publicly owned and were set up to produce crossbred heifers for distribution to farmers.
- Purchase of livestock from large-scale farms (including purebred bulls) and other smallholder farmers (mainly females).
- Import of live animals (males and females).
- Production of replacements on-farm using natural service.
- Production of replacements on-farm using artificial insemination (AI), using either imported or locally produced semen.

The success of AI as a method of dissemination of genetic material to smallholder farmers in southern Africa (Malawi, Tanzania, Zambia and Zimbabwe) is discussed.

## **The problem**

The success of the methods used to produce replacements can be assessed by growth of the smallholder dairy sector which can be measured by (a) increase in the number of dairy animals in the smallholder sector or (b) increase in milk production by the smallholder sector. The growth of the smallholder dairy sector was studied over a 30-year period for Malawi, Tanzania and Zambia and over an 18-year period for Zimbabwe. The rate of growth of the sector has been slow in the four countries, partly due to failure or unavailability of AI services. Increased use of AI for livestock production would undoubtedly allow livestock improvement schemes to

be accelerated since AI, unlike natural service, enables an outstanding male to sire many offspring in a year, i.e. AI allows faster and wider dissemination of the selected animal's genes.

## **Successes and failures of AI services**

In Malawi, Tanzania and Zambia, HBU or LMU and use of AI were the most common methods of producing dairy crossbreds. However, in Zimbabwe, the most common source of dairy animals for smallholder farmers has been the purchase of stock from large-scale dairy farmers and production of replacements on-farm using natural service.

AI services have not been available in the smallholder sector in Zimbabwe. A subsidised pilot scheme was tried in six areas between 1962 and 1964. The scheme was terminated after the trial period because it was concluded that, for the service to make economic sense, large numbers of cows would have to be inseminated. The number of animals submitted for AI in these areas was low due to both political interference and the scattered nature of the settlements. However, AI is used widely in the large-scale commercial sector in Zimbabwe. It is practised on a 'do-it-yourself' basis and farmers send their workers to attend AI courses. Smallholder farmers have not been able to use AI due to costs of equipment and semen. A dairy development programme introduced after independence in 1980 has encouraged the use of bulls instead of AI, as it is still believed that an AI service would be not sustainable.

In Malawi, Tanzania and Zambia, AI was delivered in one of three ways:

1. Inseminations were carried out by inseminators who were employed by the governments. Farmers would report their cows that were on heat and then inseminators would come to inseminate them.
2. Cows were taken to road-side crushes. Inseminators would come to these crushes at designated times in order to inseminate the cows.
3. There were AI centres where farmers took their cows and collected them after they were diagnosed pregnant.

The factors that influenced the success of the AI services included:

### ***Reliability of services***

The AI services were subsidised and were, therefore, either free-of-charge or provided with minimal charges. However, the services were not available at all times as inseminators did not have reliable transport to visit farmers. Some AI centres and road-side crushes were too far from farms and therefore not accessible to farmers. In some cases, the management at these AI centres was low resulting in loss of animals. Reliability of services was also influenced by breakdown of liquid nitrogen producing plants. This, in turn, affected the quality of the semen, which in turn influenced conception rates. In some cases, because of unreliable liquid nitrogen plants, fresh semen was used. Trying to provide a countrywide service, including areas with low stock density, overstretched resources resulted in generally poor AI services. Because of inadequate resources, state-run AI services have collapsed and are being privatised in all three countries. Unreliable services have resulted in low rates of use of AI, as farmers do not want to rely on a service that worked only part of the time. Malawi has built up a dairy cow population of 5500 since 1968 and carries out about 3000 inseminations per year. Tanzania, with a dairy cow population of 120 thousand carries out about 5000 inseminations per year.

### ***Lack of training of staff and farmers***

The use of AI requires a much higher standard of management ability than does a natural service programme. The success of AI depends on successful heat (oestrus) detection by a stockman and inseminations being done while cows are still on heat. An efficient stockman and efficient stock record keeping are essential prerequisites of an efficient AI service. The training of farmers or stockmen in heat detection is, therefore, vital. However, poor funding has resulted in poor extension services and little or no training of farmers, except in areas where there are externally funded dairy development programmes. Since standing heat may last only for 12 hours, stockmen and inseminators must be highly motivated and prepared to work long hours if successful AI results are to be achieved consistently.

Conception rates with the use of AI in Malawi, Tanzania and Zambia have been low. For example, conception rates at a university farm in Malawi were lower with AI (56%) than with natural service (78%).

### ***Source of bulls or semen***

Although AI can be a very useful technique in disseminating genetic material, it will only effect improvement if the semen is derived from genetically superior or suitable bulls. The use of below-average bulls will exert a detrimental effect on the genetic value of herds on which they are employed. It is important that AI schemes are linked with performance or progeny testing programmes in order that they are correctly designated as parts of an overall genetic improvement policy. It is only when AI programmes employ demonstrably better sires, which produce outstandingly better offspring, that the costs and administrative complications are justified.

When AI was introduced in Malawi, all semen used was imported. Local semen collection was introduced in 1984 and by 1989, locally produced semen was used in the smallholder sector while imported semen was used by large-scale farmers. The bulls supplying semen to the smallholder sector were either imported from Europe or New Zealand, or 'borrowed' from the private sector. In Tanzania, the use of AI was introduced in 1958 with semen imports from Kenya. Local semen collection started in 1966 at Mpwapwa and was moved to Usa River in 1981. Bulls at Usa River are from Kenya, Zimbabwe and Europe. The source of semen for the smallholder sector has been from bulls that were tested overseas or in neighbouring countries or from untested bulls that have been bred locally.

### ***AI compared to other methods***

The impact of AI or bulls in terms of milk and income is not apparent until after about four years (from conception to time when a heifer starts producing milk). During these four years the farmer has to spend more money on feeding the crossbreeds than (s)he would on feeding indigenous calves. Therefore, farmers may prefer to buy-in crossbred heifers that are ready to produce milk rather than produce and rear their own heifers. AI services therefore competed with HBUs and LMUs, and heifers from such centres were sold at subsidised prices. Heifers were also available through schemes such as heifer-project-international. There has been little emphasis on internal generation of dairy stock by smallholder farmers themselves, except in Zambia and Zimbabwe where HBUs were either inadequate or non-existent. However, HBUs in Tanzania and Malawi are being either privatised or sold. This should make farmers produce their own replacements or buy from other farmers.

The replacement heifers will be produced using either AI or natural service. The cost of producing heifers is likely to be lower with AI than with bulls. This is because an AI bull, even

with as low as 1000 services/bull per year, can replace up to 20 bulls for natural service. As a consequence, the rate of return on AI compared with natural service can be very attractive from the smallholder's standpoint, even if no allowance is made for improved dairy merit of the progeny. However, whether AI or natural service is used will depend on availability and reliability of the AI services. The rate of development of AI schemes in southern Africa has been slow, partly because the initial cost is high. Therefore, the early development of AI schemes should be subsidised as the efficient introduction of AI in developing countries is a vital step in cattle improvement.

## Conclusions

Production of dairy stock by smallholders (on their own farms) might assist in increasing local independence and self-sufficiency and is, therefore, sustainable. Producing heifers on-farm using AI or bulls allows a gradual upgrading process, giving farmers time to concurrently gradually upgrade their management skills to match the genetic potential of the improved genotypes as the latter are introduced or produced on their farms. However, whether AI and/or natural service becomes the predominant method will depend on the reliability or availability of AI services. The effectiveness of AI as a dissemination tool also depends on technical competence of staff doing the inseminations and ability of farmers to detect oestrus.

However, the use of AI by itself will not remove many of the underlying difficulties of low reproductive efficiency in the tropics. Improvements in animal health and management, and training of farmers and officers must be a prerequisite of livestock improvement before AI can be fully exploited. Since costs are high, satisfactory levels of conception from an AI service must be obtained. Currently, in many cases, conception rates achieved in practice on AI schemes are far too low to make good economic or even good genetic sense. AI has been used mainly in dairy cattle production. Little progress has been made in introducing AI for other livestock enterprises.

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