Improving the Reproductive Potential of Smallholder Dairy Cows: Enhancing the Earning Potential of Smallholder Dairy Farmers

Summary

There is a need to improve the reproductive potential of dairy cattle owned by smallholder farmers as well as enhance their earning potential. Improvement in the reproductive rate will depend on controlling venereal disease, improving nutrition and providing breeds that are adapted to the environment. There is high demand for milk and meeting this demand will require cattle breeds which can produce adequate amounts of milk.

Artificial insemination can reduce the chance of contracting venereal diseases as well as introduce desirable genetic characteristics that increase yield potential. Because of the numbers of small farmers and wide distribution of small herds in sub-Saharan Africa, there is a need to synchronise fertile cows in any given community so that the inseminating team can operate efficiently.

An alternative to artificial insemination is to use crossbred heifers which can be produced privately or by government agencies. The Jersey cross local Zebu is an ideal animal as it is adapted to African environments and has the potential to produce 10 litres of milk a day off grassland. The Holstein may be too large for the local environments and the crossbreed produces far less milk per day off grass.

Smallholder farmers who have an entrepreneurial spirit will ensure that they have the right breed and, even within a communal system, they will ensure that they have adequate access for grazing their cows to be able to produce sufficient milk. It is shown that, even with one or two cows, small farmers have the ability to considerably enhance their earning potential.

Introduction

"Dairy sector development in smallholder farming systems is of strategic importance especially for addressing food security and improved livelihoods in sub-Saharan Africa and countries in the Caribbean and Pacific" (CTA 2012).

This policy brief aims to address the challenges of "Improving the Reproductive Potential of Smallholder Dairy Cows" and "Enhancing the Earning Potential of the Smallholder Dairy Farmers" based on international research that has previously been done, a case study of the dairy sector in Ethiopia and the author's experiences in African countries.

History of milk production in Africa

Milk production in Africa is directly related to the ownership of cattle. Every smallholder cattle owner is a potential dairyman. Early in the 20th century, understanding the role of milk in African households had become of interest to researchers. By 1936 books such as that by F.J. Krige (1936) on "The social system of the Zulus" were published. During the late 1970's there was intense rising interest in documenting the important interaction between cattle, grasslands, milk and wealth in African society (Sandford, 1976; Palmer and Parsons, 1977; Reynolds, 1977; Anthony, Johnston et al., 1979; Bembridge, 1979; Doran, Low et al., 1979; Johnson, 1979) and during the 1980's this surge of interest increased (Crotty, 1980; Low, Kemp et al., 1980; Jerve, 1981; Reh, 1982; Southey, 1982; McDowell, 1983; Sandford, 1983; Bembridge, 1984; Colvin, 1984; Gandar and Bromberger, 1984; Tapson and Rose, 1984; Trollope and Willis, 1984; Wantanabe and Mueller, 1984; Hundleby, Rose et al., 1986; INR, 1989). This surge in interest in understanding the role of cattle and milk production in African society was probably instigated by the need to improve agricultural production to alleviate the obvious poverty that was becoming a major problem across the continent. This was definitely the case in South Africa and many of the above references apply to the South African provinces of Ciskei, Transkei and Zululand, where scientists were working to understand the interaction between cattle, grasslands, milk and wealth. In addition, many researchers in the USA, UK and Europe were also becoming interested.

The Consultative Group on International Agricultural Research (CGIAR) livestock programme was initially led by the International Center for Livestock Production in Africa (ILCA) and the International Center for Livestock Research in Africa (ILRAD). These organisations were then merged into the International Livestock Research Centre for Africa (ILRI). Many of the world's top scientists have spent years in these organisations providing insight into the problems affecting smallholder farmers in Africa and Asia as well as providing direction for improving production. The two most important factors influencing reproductive rate in cattle are nutrition and breed type (Devendra, 2001).

Nutrition

Nutrition has repeatedly been highlighted as a major constraint in animal production systems globally (ILRI, 1995). Devendra (2001) states that, with the decreasing availability of arable land "the principle aim is to maximize the use of available feed resources, notably crop residues and low quality roughages, and also various leguminous forages and protein supplements". He also

emphasises that, “good profits will come from maximising the use of indigenous products” and, very importantly, “losses will come from using imported feeds like maize”.

There will also be a need to develop all year-round feeding strategies. Devendra refers to a number of these strategies (Paterson, 2012), but it must be acknowledged that, in any country, there is an additional cost to ensuring continual milk production throughout the year, especially in countries which have winter droughts which are common in Africa. Of course, even in the rural areas, a premium is paid for ‘off-season milk’, so off-season feeding must be considered as an opportunity to sell milk at higher prices.

The majority of this off-season feed will generally be crop residues (Devendra 2001). In addition, the treatment of crop residues to improve their quality is of major importance. The technical handbook by Kitalyi and Mwangi et al. (2005), deals very effectively with the practicalities of these treatments. The handbook by Topps (1961) gives an excellent review of animal feeds of Central Africa and their feed values. Topps’ knowledge of ruminant nutrition in Africa must be acknowledged and his reports wisely studied as they are still, and will always be, pertinent to the improvement of livestock production in Africa.

With the smallholder dairy farmer being dependant on limited local fodder crops for increased production, and not being able to utilise expensive grains, there is a value in using low levels of supplements to make up for nutritional shortages (Mbwile, Mwakilebe et al., 1992; Dugmore, Ooshuizen et al., 2004). Low productivity from tropical feedstuffs stems from an inefficient utilisation of the feed because of deficiencies in the diet and Leng (1989) advocates the supplementation of high bypass proteins to balance the protein:energy ratio in these feeds. This supplementation is common practice amongst large commercial producers and will become common amongst successful African smallholder dairy farmers.

In commercial herds reproductive performance has generally decreased with the successful increase in milk production (Zintzen, 1972). Programmes that involve increasing milk production in smallholder dairy herds should take note of this and consider the important complex - and generally negative - interactions between milk production and fertility.

Devendra (2001) lists nine important aspects regarding the nutrition of the smallholder dairy cow. These are:

- Knowledge of the totality of feeds throughout the year
- Synchronising the availability to requirements by animal species
- Assessment of the extent to surpluses and feed deficit
- Development of strategies to cope with the shortfalls
- Increased feed production like tree legumes
- Justification for purchased concentrates

- Priorities for use
- Development of feed conservation measures
- Strategic supplementation for milk production

Dugmore (2012) emphasises these points and adds to the many challenges specific to Africa.

Type of breeds

The following comments by Dugmore (2012) regarding breeds selected for milk production in Africa clarify the arguments surrounding breed selection.

> "The evolution of the African cow has resulted in a relatively small animal (300kg) which is adapted to the hot and variable nutritional environment. In addition, they produce enough milk for the calf and often have the ability to move into anoestrus, where no heat activity is observed, when there is nutritional stress".
>
> "The introduction of genes (e.g. from the American Holstein) will bring in desirable milk genetics but could result in the long-term production of an animal that is not adapted to all the constraints common to Africa and the smallholder dairy producer".
>
> "The introduction of desirable milk genetics through the smaller New Zealand Jersey breed, adapted to producing off grass, appears to be a better choice than the Holstein, which is adapted to producing excessive milk off concentrate feeding".

There are many ideas on breed selection to improve reproduction and milk production in Africa. Unfortunately these ideas have been influenced more by the availability of semen and strong marketing efforts than by the reality of what is the best for smallholder farmers (Paterson, 2012). It is interesting that Devendra keeps out of this discussion by simply stating that there is a need for specific studies on genotype x nutrition x disease interactions in developing countries. This implies that there is not enough evidence generated through research to make specific statements on breed selection for smallholder dairy. Presently, the Holstein is seen to be the breed to bring about improved milk production in Africa. This is questioned by the author because of the obvious negative interactions observed in Africa when introducing the Holstein into rural areas. The disastrous effect of upgrading the local Gudali breed in Cameroon through crossbreeding, where the crossbreds were entirely decimated by tick-borne disease will not be easily forgotten (Bayemi, 2012).

The local African breeds require an infusion of dairy genetics to improve the milking potential of these cattle and this has been successfully achieved through using artificial insemination in many countries and this has recently been combined with synchronisation of oestrus in Ethiopia.

Synchronisation of oestrus and artificial insemination in Africa

The practice of artificial insemination (AI), which can improve the quality and yield of milk, is not well established. This is due to a number of technical challenges, including the number and dispersed nature of smallholder dairy herds and farmers, limited technical knowledge and capability. In addition, environmental constraints, including electricity and refrigeration facilities,

contribute to farmers' inability to access and store sufficient quantities of inputs such as hormones and improved genetic stock. These technicalities are all real challenges in Ethiopia which has embarked on an oestrus synchronisation programme. However, through the introduction of synchronisation prior to AI, the Ethiopian government has overcome all these challenges in a test phase and produced AI results (60% conception rates) that are acceptable to any AI programme in developed countries. The synchronisation has allowed for centralisation of AI where well trained teams of veterinarians and inseminators can mitigate all of the above challenges. These teams have been formed through a strong and well developed government structure that is driven by a strict national policy of improving all aspects of agricultural production, including milk production.

Some synchronisation results have been disappointing (13% conception rates). It is hoped that this was during a learning phase and that the results from the 40,000 cows synchronised and subsequently pregnancy tested would provide the desirable 60% conception rate results. This will be the indicator for judging the success of the synchronisation program. The cost of synchronisation has been estimated at Br70 and the government is prepared to support 95% of this cost. There are private companies that provide synchronisation at Br100, which are used by the larger dairies in urban areas.

A key recommendation for further consideration is the use of semen from Jersey crosses rather than from the Holsteins standing at the AI stations. It is worth considering the development of Jersey cross local cattle to be sold to smallholder farmers. The local cattle are less than 300kg in mature size and this suggests that the smaller cow, resulting from the Jersey cross, will be more efficient at producing milk in the smallholder environment than the larger Holsteins.

Milk production depends more on nutrition than genetics in the smallholder environment and the emphasis placed by the Southern Agricultural Research Institute (SARI) programme on the need to improve nutrition before expecting major improvements in milk production is endorsed by the author.

Enhancing the earning potential of the smallholder dairy farmers.

Most smallholder farm families in sub-Saharan Africa live a subsistence existence. They are accustomed to this and maintain this lifestyle for very good reasons. The main factor preventing a change to higher productivity is related to the level of risk they are willing to take. Improving production requires inputs that usually cost money. Borrowing money is a risk they cannot afford. So they continue with this very hard lifestyle. On the other hand there are some individuals who have an entrepreneurial spirit that encourages them to move away from tradition. This entrepreneurial spirit occurs in only 3% of any population except for industrialised cities like New York and Johannesburg where those people with the 'spirit' accumulate, and 11% of the population employ 89% of the population. However, in the rural population the 3% is the norm as has been referred to by Tapson and Rose (1984) and experienced and confirmed in Swaziland by Paterson (2005).

The 3% of the population who have this entrepreneurial spirit, even when living in communal grazing areas, manage to obtain the exclusive right to some pasture. This pasture is then preserved for themselves and their few cows. Sometimes, due to their entrepreneurial spirit, they may purchase concentrate feed to supplement their cows and in this way increase milk production. In Swaziland, Paterson (2005) found that the price of milk in the capital was 5

Emalangeni (E) per litre, while in the rural areas, where the people could not gain access to milk, people were prepared to pay 7E per litre. In addition, these entrepreneurs had no costs related to transport, bottling, cooling nor complying with costly government regulations. Their clients arrived at their farms and filled their containers with fresh milk and paid the 7E per litre. Because of this form of production and marketing their production costs were only 2E per litre (the cost of the concentrates fed) compared to the production costs of 3.5 E with the commercial farmer. The price margin for the commercial farmers selling in the towns was 1.5E per litre (E5 – E3.5) while that of the rural entrepreneur was E5 per litre (E7 – E2). These rural farmers increased their production from 2 litres, after the calf had suckled, to 6 litres a day. With two cows that were properly cared for, milk could be supplied at this rate throughout the year. The margin from two cows was over E10,000 per year (USD 1,300). In the rural subsistence setting this was an extremely good income in 2005.

In a Kenyan example, Paterson (1994) evaluated the position of one lady farmer. She had one cow, one replacement heifer and one calf. The dumping of cheap milk powder into Kenya had been stopped and rural milk prices had risen to 32 shillings per litre. This was considered exceptionally high after years of low prices. The farmer tied the cow to a tree outside her house and went out each day to cut fodder for the zero-grazed cow. The cow was a cross between a Jersey and the local Zebu (Boran). This mature cow weighed less than 300kg and, after the calf had suckled and the homestead had taken 2 litres, this cow gave an additional 6 litres of milk for sale. At the price of milk at 32 shillings per litre the lady farmer was making an exceptional income of 192 shillings a day with no costs except her own labour. Of great importance to the AI project in Ethiopia, this lady's cow was inseminated that day by an inseminator who had been in Mombasa earlier that day, 40 kilometers away. He had somehow received information that this lady had a cow on 'heat' and had boarded an African matatu (bus) and arrived at her farm with his flask and inseminated the cow. The cost of the insemination was 40 shillings plus the bus fare. Due to this entrepreneurial spirit some individuals, probably only 3%, will ensure that they emerge from the crowds and produce more milk and make more profits than others.

The challenge is that most of the people in sub-Saharan countries live in rural areas and depend on milk but only a few are likely to move into the main market place. Hopefully, the example set by the few with entrepreneurial spirit will encourage the others and increase the numbers doing this, well beyond 3%. There is a huge demand for milk in the rural areas, which will be increasing every year (ILRI, 2012), and which rural entrepreneurs could take advantage of. It must be emphasised again that there must be feed available to meet the needs of these cows to produce more milk otherwise milk production cannot increase (Devendra, 2001).

Conclusion

There is need to improve the reproductive potential of dairy cattle owned by smallholder farmers in sub-Saharan Africa as well as enhance their earning potential. Improvement in the reproductive rate will depend on controlling venereal disease, improving nutrition and providing breeds that are adapted to the environment. There is high demand for milk and meeting this demand will require not only improved cattle breeds, which are adapted to local conditions and can produce more milk, but a dedicated scientific community, effective extension support systems, an enabling policy environment and smallholder farmers who have the required entrepreneurial spirit.

References

Anthony, R.R.M., Johnston, B.F., Jones, W.O, and Uchendu, V.C. 1979. *Agricultural Change in Tropical Africa*. Cornell University Press, Cornell, USA.

Bayemi, P.H. 2012. *A focus on artificial insemination*. Institute of Agricultural Research for Development, Cameroon. August 2012, Newsletter, Knowledge for Development 1.

Bembridge, T.J. 1979. Problems of livestock production in the black states and future strategy. *South African Journal of Animal Science,* 9(2): 163-176.

Bembridge, T.J. 1984. *A Systems Approach Study of Agricultural Problems in the Transkei*. Agricultural Department, University of Stellenbosch, PhD.

Colvin, P.M. 1984. *Welfare Economics and African Pastoralism*. Institute of Natural Resources, Pietermaritzburg, South Africa.

Crotty, R. 1980. Cattle, Economics and Development. Commonwealth Agricultural Bureau, Slough, UK.

Devendra, C. 2001. Smallholder dairy production systems in developing countries. Review. *Asian-Aust Journal of Animal Science*, 14(1): 104-113.

Doran, M.H., Low, A.R.C., and Kemp, R.L. 1979. Cattle as a store of wealth in Swaziland. *American Journal of Agricultural Economics*, 61(1): 41-47.

Dugmore, T.J., Ooshuizen, P.A. and du Toit, J.F. 2004. Strategies for dairy production in rural areas. *South African Journal of Animal Science*, 5: 45-47.

Gandar, M.V. and Bromberger, N. 1984. Economic and demographic functioning of rural households: Mahlabatini district, KwaZulu. *Social Dynamics: A Journal of African Studies*, 10(2): 20-37.

Hundleby, J., Rose, C.J. and Mlumbi, B. 1986. *Cattle production in Ciskei: Past, Present and Future*. South African Society of Animal Production, Port Elizabeth, South Africa.

ILRI. 2012. *Livestock matters: Where livestock can make a difference*. ILRI Corporate Report 2010/2011. ILRI, Nairobi, Kenya.

INR. 1989. *Southern Maputaland livestock development survey*. Institute of Natural Resources: University of Natal, Pietermaritzburg, South Africa.

Jerve, A.M. 1981. *Cattle is Wealth: A pastoral economy in a capitalist setting*. DERAP Working Paper No 207. The Christian Michelsen Institute, Fantoft, Norway.

Johnson, D. 1979. Report from the workshop on pastoralism and African livestock production. The Institute for Development Anthropology Binghamton, New York, USA.

Kitalyi, A., Mwangi, D.M., Mwebaze, S. and Wambugu, C. 2005. *More Forage More Milk*. RELMA, Nairobi, Kenya.

Leng, R.A. 1989. *Recent advances in applied aspects of ruminant physiology and nutrition*. Japan Society of Zootechnical Science, Japan.

Low, A.R.C., Kemp, R.L. and Doran, M.H. 1980. Cattle wealth and cash needs in Swaziland: Price responses and rural development implications. *Journal of Agricultural Economics*, 31(2): 225-236.

Mbwile, R.P., Mwakilebe P.A., and Madata G.S. 1992. Effects of levels of supplement concentration on dairy cattle fed tropical forages. *Journal of Zimbabwe Society for Animal Production*, 4: 55-57.

McDowell, R.E. 1983. *Strategy for Improving Beef and Dairy Cattle in the Tropics*. Mimeograph No 100. Cornell International Agriculture, Cornell, USA.

Palmer, R. and Parsons, N. 1977. *The Roots of Rural Poverty in Central and Southern Africa*. University of California Press, Berkley, USA.

Paterson, A.G. 1994. *Report on an agricultural investigative visit to Ethiopia, Kenya and Malawi*. Stockowners Livestock Cooperative, Howick, South Africa.

Paterson, A.G. 2005. *Technical livestock annex to the development CMP*. Swaziland Agricultural Development, Lower Usuthu smallholder irrigation project, Swaziland.

Reh, J. 1982. *The Importance of Beef as a By-product of Cattle Draught in Small-scale Farms in West Africa*, University of Berlin, PhD.

Reynolds, N. 1977. *Rural Development in Botswana*. SALDRU Working Paper No 13. University of Cape Town, Cape Town, South Africa.

Sandford, S. 1976. *The Objectives of Pastoral Development.* Agricultural Administration Unit, Overseas Development Institute, UK.

Sandford, S. 1983. *Management of Pastoral Resources in the Third World*. John Wiley and sons, Chichester, UK.

Southey, C. 1982. *Land Tenure in the Transkei: A report prepared for the planning committee*. Alice, South Africa.

Tapson, D. R. and Rose, C.J. 1984. *Investigation into the Kwazulu cattle industry*. Fort Hare, Agricultural and Rural Development Research Institute, South Africa.

Topps, J.H. 1961. *Animal Feeds of the Federation*. Department of Agriculture, Rhodesia and Nyasaland.

Trollope, W.S.W. and Willis, M.J. 1984. Grazing capacity of the veld types of the Eastern Province. *Dohne Agriculture*, 6(2): 27-34.

Wantanabe, B. and Mueller, E. 1984. A poverty profile for rural Botswana. World Development, 12(2): 115-127.

Zintzen, H. 1972. *Fertility and nutrition in dairy cows*. South African Society of Animal Production, Johannesburg, South Africa.

Credits:
Author: Alastair Gavin Paterson of Paterson Agri-Services

CTA leader and editor: Judith Francis