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COMMUNITY-BASED LIVESTOCK IMPROVEMENT: - A CASE STUDY OF FARM-AFRICA'S GOAT IMPROVEMENT PROJECT IN MERU, KENYA:

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Abstract
With the ever-increasing human population, the need for efficient utilization of natural resources will always remain a challenge for both scientists and development workers. Land sizes are constantly decreasing with each new generation inheriting land, making it difficult to keep cattle or larger ruminants in high potential mixed crop-livestock production systems in the eastern highlands of Kenya. Government services are equally dwindling and it can no longer maintain breeding studs in research centres and Government farms, most of them having been sub-divided and given out. FARM-Africa has been implementing a community-based goat improvement programme whose purpose is to improve the productivity of the local goats through better management, develop a more intensive goat milk and meat production system for farmers in areas under land and population pressure which are increasingly less able to support cattle. Toggenburg dairy goats have been imported and used as improver breed in crossbreeding with the local goats. This paper discusses the role of farmer groups in breed improvement and development. Also discussed is the role of improved goat genotypes in improving the livelihoods of the rural resource poor farm families as well as the problems that have to be overcome when such initiatives are being undertaken.

Introduction

The small flocks of goats in the highlands mixed crop-livestock production system are an integral part of the whole farming system with multiple biological (meat, milk, manure and skin) and non biological (asset, security and socio-cultural) functions in the subsistence economy and these functions are very important in providing stability to the whole farming system, (Davendra 1976; Fitzhugh 1982; Kotze and Schonfeldt 1996).

Goats have received increased attention from both research and development workers in the last two decades due to their suitability and importance in small farm systems in the developing countries, this importance is related to their varied role and size of the herd, relative proportion to the other animals, if any, scale and intensity of production. Although the role of goats has been recognized and appreciated by African governments, international

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development partners and farmers, properly designed programmes have been lacking and where attempts have been made to genetically improve the local goat populations, farmers participation in the design and initial improvement phase have been minimal (Okeyo 1997; Okeyo 2000). Moreover the contributions and or preferences of the very farmers intended to benefit from such efforts are usually ignored, leading to expensive delays in the adoption of the technologies, low adoption rates or total failures.

Prior to the project whose activities are discussed here, goat genetic improvement programmes in Kenya had long been concentrated at and either big private ranches or government farms and research stations. However, with the dwindling government resources and more importantly, the invariable dismal performance of such past efforts, farmer participatory (on-farm) options continue to attract more attention and favour.

Materials and methods

The experiences and project whose results are discussed in this paper were obtained from a community-based dairy goat genetic and animal healthcare improvement project, that is currently being undertaken in Meru districts in Kenya by FARM- Africa. The overall goal of the project is to reduce poverty through increased income and improved nutrition of the target poor households and communities in the eastern central highlands of Kenya.

Description of the project's technical design and implementation protocols is given by Ahuya (1997) and is based on the potential heterotic gains and complementarity benefits achievable when indigenous goat breads (Galla and East African) are upgraded towards the Toggenburg dairy goat breeds to beyond 50% level of the latter. However, other than improving the genetic potential of the goat population, the other purpose of the project is to increase the productivity of local goats through better management, access to relatively affordable community-based and therefore sustainable healthcare and improvement systems. In order to achieve the above, the project is working with self-help farmers groups comprising of mainly the poorer members of the community, some of whom were too poor to own even a local goat, prior to the project.

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Cross-breeding

Indigenous goats are generally low producers both in terms of milk production and growth (low mature weights) and genetic improvement by selection is considered too slow and also requires that most of the flocks be officially performance and pedigree recorded if desired levels and rates of genetic improvements are to be achieved.

With increased population and increased demands for livestock products, especially in the high potential areas with high population densities and very small landholdings per family it is essential to adopt more efficient crop-livestock production systems, which incorporates smaller sized dairy livestock species such as dairy goats to meet the increasing animal protein demands (Stotz 1981; Bradford 1981; Davendra 1986; Peacock 1999). Rapid improvements in genetic potential for milk production of the local goats can only be achieved through combining different breeds i.e. crossbreeding (Bradford 1981).

Based on past crossbreeding trials and experiences in Kenya (Ruvuna *et al*. 1997; Ruvuna *et al*. 1988a &b; Ruvuna *et al*. 1992; Ahuya *et al*., 1987; Mwandotto *et al*. 1990), involving crossbreeding of the indigenous goats with exotic breeds, the Toggenburg gave better general and specific combining results when crossed to the indigenous Kenya goat breeds, hence, the reason it was chosen as an improver breed in this project. Furthermore, the Ministry of Agriculture and Rural development considers the Toggenburg as the exotic breed of choice (Ahuya 1999 personal communication). In order to avoid the mistakes of the past goat crossbreeding initiatives in Kenya and drawing from experiences elsewhere (Iniguez 1996), a community based breeding programme was adopted. This refers to breeding activities, where improver breed, especially the males, are kept by individual farmer-group members in buck-stations for use by the rest of the group members and local community to serve their local and crossbred does as detailed out elsewhere (Ahuya 1997).

Organizational structure

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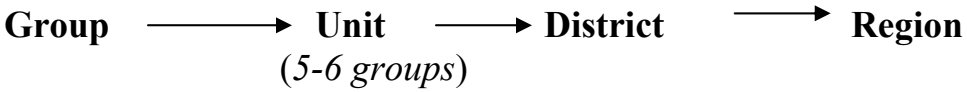
The community-based dairy goat improvement project is centred on an empowered (organized and well trained) local breeder association. In this case a new society had to be formed, because hitherto there was none. The local breeder society is called Meru Goat Breeders Association (MGBA). The MGBA draws membership from registered farmer-groups, whose members have interest in dairy goats. The association makes decisions on all the day-to-day activities with technical backstopping by Farm Africa and government extension staff.

Currently most groups and therefore members of MGBA are from the project area. The hierarchical set up of MGBA is as shown in Figure 1. Memberships to all the levels of MGBA i.e. group, unit, district and regional are through open and democratic elective process. The functions of the various organs of MGBA are listed in Table 1a, while the matrix of functions, activities, associated costs and expected outputs are presented in Table 1b.

Figure 1: Organization Levels of Meru Goat Breeders Association



The characteristics of the community-based breeding programme.

Like all other community-based breeding programmes, the MGBA is characterized by:

- Composed of communities of smallholder farmers usually at subsistence level.
- Sub-optimal feed availability, with large seasonal and yearly variations.
- Low level of organization and formal education.
- Lack of or non-functional hierarchical structures to enable proper flow of information between the levels.
- Performance and pedigree data recording is often lacking.

Table 1a: Role or duties of the different organizational levels of Meru Goat Breeders Association.

Levels	Duties

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Group	- Record keeping/buck performance. - Stock inspection - Ear tagging - Castration - Reporting stock for sale, breeding animals.
Unit	- Supervision to ensure conformity. - Organizing inter-unit shows. - Organizing inter-unit movements. - Provide linkage with extension. - Represent farmers at dist. Level. - Organize training. - Organize auctions.
District	- Recording & organizing buck movement. - Collecting information of farmers for sale. - Coordination of goats' shows and inspection.
Region	- Registration of purebred and ¾brd with the studbook. - Organizing & contribution to national shows. - Certification of judges & inspection. - Networking & linkage with KSB, ASK & KEGODEN

Table 1b: Functions & activities of the Meru Goat Breeders Association and the associated inputs/costs

Functions	Activities	**Input/Cost**
1. Maintenance of breed improvement services	- Performance recording - Setting breeding standards. - Supply of information. - Breed inspection. - Breed judging. - Extension. - Registration with Stud Book	- Office space requirement. - Stationery. - Communication. - Transport
2. Marketing	- Identification of marketing outlets - Organizing shows. - Transportation of goods to shows.	- Transport - Market - Studies

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	- Organizing auctions. - Publicity and advertising	- Advertising - Auction ground
3. Training	- Training officials/manager of MGBA, breed judges and inspections	- Training

The statistics of the population of different goat genotypes among households within the project domain were obtained. Projections of the future performance levels were made using the observed attrition rates, reproductive performance and adoption rates, and expert opinion. Problems and their possible solutions were obtained during several participatory stakeholder planning and evaluation workshops.

Results and discussion

The number of services and crossbred goats born from buck-stations in the project area

The number of services by the improved bucks, and the number of crossbred goats born from buck-stations in the project area between 1997 and 2001 are given in Table 2a, while the actual and projected number of households benefiting and the nature of such benefits in terms of goat sales and milk production from crossbred goats is presented in Table 2b. Against the background of past dismal performance of goat improvement programmes in Kenya (Okeyo 1997) and given the fact that, only 40,000 of the 11 million goats in Kenya are improved (dairy types) (GoK, 1996), despite the over twenty-five years of genetic improvement efforts, the results so far attained and the projections (Tables 2a and 2b) made by the Farm Africa Project in Meru in the last 4 years is commendable.

Using the community-based approach, the number of genetically improved goats in the project area has increased from an initial number of imported pure Toggenburg goats from 130 (68 males and 62 females in 1997 to 386 by mid June 2001. These figures exclude a total of 87 entire males that have been sold to other farmers and NGOs both within and outside the country for breeding.

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The tremendous achievement was made possible by the fact that the number of services per year from the buck station increased from 770 in 1997 to 4800 by 2000, while the average annual rate of loss of females born remained fairy low at 1%, resulting in steady increases in additional buck stations (Table 2a). From these figures translates to over 2.13 improved dairy does (1 year old and above) per households by 2001, up from 1.5 local does /household in 1997, it is clear that in 10 years the population of improved female dairy goats (3/4 Toggenburg: 1/4 local), greater than 1 year in age, in the project area alone will have reached well above 12,000. This is equivalent to over 32% of the improved dairy national goat population, which has been achieved through over 25 years countrywide, using on-station–based approaches. Given the large multiplier effect of the community based approach, as evidenced by the many requests and purchases for and of improved bucks by other projects and farmers both within and outside Kenya, it is reasonable to state that this is, indeed, the best way forward as far as upgrading programmes are concerned.

The additional advantage of community-based breeding programmes, include the fact that, process such as progeny testing and technical aspects such as breeding values estimations and why, are easily assimilated and understood by the farmers regardless of their level of formal education. This makes it a lot easier to convince the farmers to keep performance and pedigree records as the use of such records and applications are immediately appreciated and realized.

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Table 2a: The actual and projected number of services and crossbred goats born from buck-stations in the project area. 1997-2006.

Parameter	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Number of new buck stations in year	**22**	**22**	**6**	**10**	**11**	**12**	**13**	**15**	**16**	**18**
Cummulative no. of buck-stations	**22**	**44**	**50**	**60**	**71**	**83**	**96**	**111**	**127**	**145**
Average services to all does/buck-stations/yr	**35**	**45**	**60**	**80**	**90**	**100**	**100**	**100**	**85**	**85**
Total services to all doe/buck stations/yr	**770**	**1980**	**3000**	**4800**	**6390**	**8310**	**9641**	**11105**	**10808**	**12314**
Cummulative services (all buck stations)	**770**	**2750**	**5750**	**10550**	**16940**	**25250**	**34891**	**45996**	**56804**	**69118**
Proportion of services to local does	**1.00**	**0.81**	**0.62**	**0.59**	**0.50**	**0.47**	**0.39**	**0.35**	**0.22**	**0.29**
Average services to local does/buck-station/yr/yr	**35**	**36**	**37**	**48**	**45**	**47**	**39**	**35**	**19**	**25**
Total services to local does/buck-station/yr	**770**	**1599**	**1866**	**2856**	**3226**	**3866**	**3728**	**3938**	**2409**	**3562**
Kidding rate (kids born/doe/yr)	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**
Number of ½ crosses born (male and females	**847**	**1759**	**2052**	**3141**	**3549**	**4252**	**4100**	**4332**	**2649**	**3918**
Number of ½ cross females born	**424**	**879**	**1026**	**1571**	**1775**	**2126**	**2050**	**2166**	**1325**	**1959**
Average annual loss rate of females	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Cumulative ½ cross does>1yr old		**381**	**1134**	**1944**	**3164**	**4444**	**5913**	**7167**	**8400**	**8752**
Ave services to 1/2cross does/buck-station/yr	**-**	**-**	**23**	**32**	**45**	**53**	**61**	**65**	**66**	**60**
Total services to 1/2cross does/buck-station/yr	**-**	**-**	**1134**	**1944**	**3164**	**4444**	**5913**	**7167**	**8400**	**8752**
Kidding rate(kids born/3/4 doe/yr	-	-	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**
Number of 3/4 crosses born (male and females	**-**	**-**	**1248**	**2139**	**3480**	**4889**	**6505**	**7884**	**9240**	**9627**
Number of 3/4 cross females born	**-**	**-**	**624**	**1069**	**1740**	**2444**	**3052**	**3942**	**4620**	**4814**
Average. annual loss rate of 3/4females	**-**	**-**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Cumulative 3/4cross does>1yr old	**-**	**-**	**-**	**562**	**1468**	**2887**	**4798**	**7246**	**10069**	**13220**

Source: Hendy 2001

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Table 2b: Number of household benefiting from goat sales and milk production from crossbred goats

Parameter	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Assumed ave no. total does> 1yr/househol (hh)	**1.50**	**1.75**	**1.88**	**2.00**	**2.13**	**2.25**	**2.38**	**2.50**	**2.50**	**2.50**
No. household receiving buck service	**513**	**1131**	**1600**	**2400**	**3007**	**3693**	**4059**	**4323**	**4323**	**4926**
Assumed ave. no. of local doe>1yr/ household	**1.50**	**1.75**	**2.0**	**1.75**	**1.50**	**1.25**	**1.0**	**1.0**	**1.0**	**1.0**
Available ½ cross doe>1yr/household	**-**	**0.34**	**0.71**	**0.81**	**1.05**	**1.20**	**1.46**	**1.94**	**1.94**	**1.78**
Avilable3/4 cross doe>1yr/household	**-**	**-**	**-**	**0.23**	**0.49**	**0.78**	**1.18**	**2.33**	**2.33**	**2.68**
Available total doe>1yr/household	**1.50**	**2.09**	**2.71**	**2.79**	**3.04**	**3.24**	**3.64**	**5.27**	**5.27**	**5.46**
Assumed local doe>1yr sold/household/yr	**-**	**0.34**	**0.72**	**0.50**	**0.40**	**0.25**	**0.20**	**0.09**	**0.09**	**0.09**
No. crossbred doe>1yr sold/household/yr	**-**	**0.00**	**0.11**	**0.29**	**0.52**	**0.74**	**1.06**	**2.68**	**2.63**	**2.87**
No. crossbred male>1yr sold/household/yr	**0.74**	**0.87**	**0.93**	**0.99**	**1.05**	**1.11**	**1.18**	**1.24**	**1.24**	**1.24**
No. of household with 1 purchased crossbred doe	**-**	**0**	**178**	**706**	**1549**	**2715**	**4318**	**11594**	**11594**	**14140**
Assumed ave. milk yield/doe/yr (lts)	**-**	**120**	**130**	**150**	**160**	**180**	**200**	**200**	**200**	**200**
Hh milk production/hh/yr (lts)										
Hh milk prod. for purchasing household/yr (lts)	**-**	**40.8**	**77.74**	**112.5**	**164**	**225**	**390**	**318**	**318**	**318**
	-	**0**	**0**	**150**	**160**	**180**	**200**	**200**	**200**	**200**

Source: Hendy 2001

Assumptions:

Based on buck-station performance observed over 1997 to 2000 and expected expansion rates in the project area
Accounting only for services and kids born through buck-stations (i.e. excluding offspring of bucks sold by breeding units)
Services to non-member household go to the same household in successive years
Average holding sizes of crossbreeding flocks increase from 1.5 to 2.5 breeding female goats by 2004
Households elect to replace local breeding does as crossbreds become available

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Average annual milk yields gradually increase as the age of crossbred does rises and the proportion of ¾-bred does increases

Excess crossbred does sold by producing households to purchasing households at rate of 1 per purchasing household

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Problems encountered by groups

During the participatory planning and evaluation workshops, the following problems were identified:

- Inactive five-members committee. (Each group has a five-member committee that does most of livestock activities on behalf of the group).
- Lack of transparency & accountability by some buck keepers. (some buck keepers done record regularly service charges).
- Insufficient number of weighing scales.
- Dependency syndrome shown by some members.
- Communal feeding in groups, some members were taking insufficient feeds to the animals.
- Insufficient number of breeding bucks.
- MGBA leaders without goats, all group officials are encouraged to have goats.
- External political influence.
- Some uncooperative Community Animal Health Workers (CAHWs) as far as castration & hoof trimming.
- Registration of individuals & groups with MGBA.
- Default in Annual renewal of membership with Ministry of Community and Social Services.
- Lack of proper flow of information from group to region and vice versa.

Other additional roles of the community-based organization like MGBA

The following were identified as additional roles that the MGBA could play and were therefore added to their function domain:

- Could play a critical role in representative and advocacy role since most of its members are marginalized from mainstream policy decision-making.
- Provide services & information to the rural poor (access inputs & credits).
- Can support social & environmental objectives.

The long list of problems listed above, were found to be solvable through training of the MGBA members and leaders. The areas where the MGBA members need to be trained on include:

- Group dynamics.
- Record keeping.

- Leadership training.
- Judging and inspection.
- Fodder production, management and utilization.
- Fodder Conservation and Storage

Conclusion

Given the impressive adoption and improved goat population growth rates, group and community-based breeding programmes would be replicable elsewhere, so long as the problems discussed above are solved and the local and national socio-political environment remain conducive to such initiatives. It is however noteworthy, that animal healthcare and services be affordable and within the reach of the poor households.

References

Ahuya, C.O, **T.C**. Cartwright, F. Ruvuna and A.M. Okeyo. 1987. Additive and Heterotic Effects from Crossbreeding Goats In Kenya. *Proc. Of 6th SR-CRSP Kenya Workshop. Held at ILRAD, Kabete, Nairobi, Kenya, 4-6, November 1987. pp:15-22.*

Ahuya, C.O. 1997. Community-based Goat Improvement Project in Meru Central and Meru South Districts: The Farm Africa experiences. *In Ahuya and Van Houton (eds.). Proc. of Goat Development in Easte Africa, Workshop, 8th-l1th December, l997. Izaac Walton Inn, Embu, Kenya.pp.55-66.*

Bradford, G.E. 1981. Potential of dairy goats as a source of milk on smallholder farms in Kenya. *In Wachira (ed.) Vol XIIIth Proc. of Animal Production Society of Kenya, 24th April and 20th Novemeber, l981, Nairobi, KEnya.pp.48-54.*

Davendra, C. 1976. Goat production on small farms in South East Asia. In integration of livestock with crop production at small farm level. *FAO. Expert group meeting on livestock programmes for small farmers, 31 May-4th June, 1976, Bangkok, Thailand. Food and agriculture Organization, Rome, Italy. Pp. 176-210.*

Fitzhugh, H. A. 1982. Dual-purpose goat production systems for smallholder agriculturalists. *Proc. of 7th SR-CRSP Kenya Workshop. Held at Nairobi, Kenya, 15, March, 1982. pp:10-11.*

Government of Kenya, Ministry of Agriculture and Rural Development. 1996.

Mwandotto, B.A.J., C.O. Ahuya, F. Ruvuna and J.F. Taylor. 1990. Milk yield potential of the Kenya Dual Purpose Goat (DPG). *Proc. of 7th SR-CRSP Kenya Workshop. Held at ILRAD, Kabete, Nairobi, Kenya, 7-8th,March, 1990. pp:12-14.*

Hendy, C. 2000. Meru Dairy Goat and Animal Healthcare Project: Phase II, Mid-term Review Report *pp. 50.*

Kotze, J.E. and H.C. Schonfeldt. 1996. Nutritional value of animal products and its impact on human health. *In Meissner(ed.). Proc. of Food Security in Africa, Second All Africa Conference on Animal Agriculture, 1-4 April, l996. Pretoria, South Africa.pp.115-136.*

Okeyo A.M., l997. Challenges in goat improvement in developing rural economies of Eastern Africa with special reference to Kenya. *In Ahuya and Van Houton (eds.). Proc. of Goat Development in Easte Africa, Workshop, 8th-l1th December, l997. Izaac Walton Inn, Embu, Kenya.pp.55-66.*

Okeyo, A.M. 2000. The role of crossbreeding in the development of a dual purpose goat for small-holder production systems in Kenya**.** *In Proc. Workshop on Dairy goat Research & Production in Kenya: 20 Years on-Which way?, Held at The Garden Hotel, Machakos, Kenya, 11-12, October, 2000.*

Peacock, C. 1999. Annual Report, Farm Africa, 1999.

Ruvuna, F., T.C. Cartwright, A.M. Okeyo and S. Tallam. 1987. Appraisal of A mating Strategy and Selection Criteria for Evolving a Dual Purpose Boat Breed for Kenya. *Proc. of 6th SR-CRSP Kenya Workshop. Held at ILRAD, Kabete, Nairobi, Kenya, 4-6, November, 1987. pp:4-14.*

Ruvuna, F., C.O. Ahuya, M. Okeyo and T.C. Cartwright. 1989. Growth parameters of indigenous goat breeds and crosses with Toggenburg and Anglo Nubian in Kenya. *Proc. of 7th SR-CRSP Kenya Workshop. Held at ILRAD, Kabete, Nairobi, Kenya, 22-23, February, 1989. pp:11-19.*

Ruvuna, F., Cartwright, T.C., Okeyo, M., C.O. Ahuya and Chema, S. 1988a. Characterization of Goats Production Potential in A tropical Environment: Factors Affecting Body Weight of East African and Galla Goats and Estimates of their Mature Weight. ***J. Agric. Sci. 1988***.

Ruvuna, F., Cartwright, T.C., Blackburn, H., **Okeyo, M.** and Chema, S., 1988b. Lactation performance of goats and growth rates of kid under different milking and rearing methods in Kenya. ***Anim. Prod., 46:237-242***.

Ruvuna, F., J.F. Taylor, M. Okeyo, M. Wanyoike and C. Ahuya. 1992. Effects of breed and castration on slaughter weight and carcass composition of goats. ***Small Rum. Res. 7: 175-183.***

Iniguez, L. 199. Community breeding programmes for small ruminants in the Andean region. *In Proc. 6th World Congress on Genetics Applied to lIvestock Production.* ***Vol 25****:249*

Stotz, D. 1981. Dairy goats or dairy cattle? A smallholder farm management analysis. *Working paper No. 2, Ministry of Livestock Development, Government of Kenya, Nairobi, Kenya.*