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THE KENYAN DUAL PURPOSE GOAT PROGRAM

AN OVERVIEW

J.F. Moses Onim, P.P. Semenye, N.A. Mbabu, and H.A. Fitzhugh

Introduction

The Kenya Government and the United States Agency for International Development (USAID) started the Kenyan Dual Purpose Goat (DPG) program in 1980. USAID funds were a grant provided from Title 12 of U.S. Congress of 1975. The Kenyan DPG program is part of a larger organization encompassing research on small ruminants operating in five countries, including Morocco, Peru, Brazil, Indonesia, and Kenya. The Small Ruminant Collaborative Research Support Program (SR-CRSP) in these five countries is a collaboration between scientists of the host countries and those from U.S. universities and other institutions. In Kenya, SR-CRSP is conducting multidisciplinary farming systems research in which the following institutions and disciplines are involved:

- Kenya Agricultural Research Institute in the Ministry of Science and Technology
- Texas A&M University - Animal breeding and systems analysis
- Washington State University - Animal health
- University of Missouri - Sociology
- Winrock International - Economics, and

  - Production systems:

- Goat nutrition and management
- Feed resources
- University of California, Davis - Management entity (ME)

Kenya has a policy of self sufficiency in crop and livestock production in the small scale farming sector. Average human population in Kenya grows at the rate of 4% per year. This has subdivided farming land where an average household of six people in western Kenya now owns about one hectare. Competition between pasture and crop land has forced farmers to reduce their livestock herds and grow more food crops (Sidahmed et al. 1984). As cattle decreased, milk for household use was reduced to the extent that protein deficiencies among children and expectant mothers became apparent. In view of this, Kenya approved SR-CRSP research proposal to introduce into the heavily populated rural areas of western Kenya DPGs that would produce meat and milk as protein sources. It was argued that the DPG would not suffer from tick borne diseases as crossbred dairy cattle would, and one goat would require a fifth of what one adult cow would need for feeds. These arguments convinced the Kenya government to make available several agricultural/livestock research stations for the program, and USAID to give a grant to fund this research activity.

Baseline Surveys

Once the areas for the on-farm crop/livestock research was identified in western Kenya, a rapid survey was done to characterize them and identify goat production constraints (Sands et al. 1982).

This and other late surveys studied several parameters including land holding per household, types and numbers of different livestock, livestock grazing management, e.g., communal grazing, tethering, zero-grazing, etc., major livestock diseases, types of crops grown and their combinations, cash vs food crops, size of household, labour availability throughout the year, division of this labour between crops and livestock, and cash flow within, out of, and into the farm. A list of important constraints was detailed and became priority areas for research before and during the introduction of the DPGs on-farm.

Constraints to overcome before introducing DPGs to farmers

There were several constraints that various research disciplines of the Kenyan SR-CRSP had to overcome before introducing the DPGs to small scale farmers in western Kenya. The major constraints were:

- **Social factors.** Especially the consuming of goat meat and milk in certain sections of the community. Labour profiles and economics of the DPG had to be worked out.

- **Diseases.** The most important ones were pneumonias, brucellosis, and orf.

- **Pest and parasites.** Important pests were external ones (ecto) especially fleas, mites that cause mange, and ticks. Intestinal parasites especially nematode worms - ***Haemonchus contortus***, and liver flukes (fasciolasis) appeared in lowlands.

- **Adaptation of the breed** under small scale intensive management.

- **Nutrition and management of the DPGs.**

- **Development of feeds** for the DPGs and agronomic packages that are suitable for small scale farmers.

To tackle these research problems, a multidisciplinary team consisting of an animal scientist, an animal breeder, veterinarian, agronomist, agricultural economist, and a sociologist was hired by the program. To work with each of these scientists was at least one government scientist. Most of the participating government scientists soon had an opportunity to pursue further training (MSc or PhD) overseas.

On-farm research implementation

Different programs have taken various approaches to conduct on-farm research. The SR-CRSP in western Kenya adopted a five step approach.

- Baseline surveys for identifying constraints.

- On-station component research on the DPGs and developing suitable feeds and feeding experiments. A large scale crossbreeding project was started between two locally adapted breeds (females) and two exotic well known dairy breeds (males). Characterizing socioeconomic factors continued and monitoring of a limited number of DPGs placed on the farms (Brown et al. 1983a).

- Continuing on-station research; scientist managed on-farm trials; on-farm production of DPGs; and an expanded on-farm performance monitoring program (Brown and Ndrito, 1983b; Ruvuna et al. 1983; Brown et al. 1984).

- Extensive on-farm evaluation of DPG systems based on technology packages developed in the first two steps. Researchers monitor adaptation and changes that farmers suggest to make technical packages work better for them.

- Revised technical packages are given to extension personnel for wider use within the country and beyond.

Selection of farmers for on-farm crop/livestock research

SR-CRSP in western Kenya used the random selection to identify farmers to participate in on-farm for research for better representation of the general population.

Before the arrival of SR-CRSP in western Kenya, several villages had been selected by the Ministry of Economic Planning to study the import of various economic changes. The SR-CRSP team selected three of these villages on the basis of their demographic and edaphic characteristics, ecological zones, and farming practices. In each village (referred to as a cluster), a land register was used to select farmers randomly to participate in the SR-CRSP baseline survey.

Respondent farmers were given one or two pregnant does or a doe and a kid. For up to five farmers with does, one improved breeding buck was provided to serve the does. The doe belonged to the program. The farmer, however, could use the milk, the kids born on the farm, and manure in return for his labour and participation.

For crop experiments, the land for scientist managed on-farm experiment, was rented from the farmer. However, the farmer was expected to observe differences in various treatments and protect the experiment from livestock damage and crop thieves. After sampling, forages and produce were given to the farmer. Farmers from each cluster were invited to hold a field day at one of these experiments periodically where they participated in discussing results. Those farmers convinced that scientist managed trials are good, are then encouraged to take the next step to farmer managed trials.

Farmer managed experiments should be simplified to deal with one or two variables. For example, the farmer may be asked to compare milk yield between local does and DPGs to see which one produces more milk for the same inputs. Similarly, the farmer can easily compare the effect of green manure on maize yields in a "with and without" unreplicated trial. Several farmers doing the same trial within one cluster can be used as replicates. This data can then be statistically analyzed and reported.

Research Highlights for solving the identified constraints: Development of the Kenya DPG breed

The animal breeding project set out a breeding scheme in which two adapted local Kenyan breeds (females) would be crossed to three exotic dairy breeds (males). The local breeds were the Small East African Goat (SEAG) and Gala *(G)*. The exotic breeds were Toggenberg *(T)*, Anglo-Nubian *(AN)* and Alpine *(A)*. However, three alpine breed was later dropped. The Kenyan DPG *(F1)* progeny would then be crossed with each other to produce a synthetic population (a four-way progeny). Each four-way cross kid would then have genes from two local and two exotic parents, and their gene pool would be intercrossed to stabilize the population.

Kenyan DPG so far tested on-farm have faster growing kids which mature at 10 kg more than the SEAG. Their milk yield is approximately 1.0 kg and dry matter manure output is 0.5 kg/day respectively. The project has also developed, and is still fine tuning, a simulated goat model in their Systems Analysis subproject.

Social studies

The DPG has been readily accepted by farmers in six villages in three districts in western Kenya. The program currently has 150 respondent farmers, but the number could easily reach thousands if more DPGs were available. The rate of generating DPGs cannot match the farmers demand for DPGs.

Goat milk has also been readily accepted by farmers in all the six villages. When the program started in 1980, it was feared that religious and customary taboos in the communities, might deter some members of the villages from consuming goat products (Nolan, 1982). However, currently the demand for goat milk by the respondent households and neighbours is greater than the present level of production.

A study was conducted to establish whether people distinguish goat milk (fresh or sour) and cheese from similar products from cow milk (Boor et al. 1983). When ranked for taste and quality, the heat treated cow milk was last, while fresh cow and goat milk ranked equal as "good". Farmers have many positive things to say about goat milk including that, fewer people react adversely to it compared to cow milk, and that it is more readily digestible.

Both sociological and economic projects have studied availability and household labour profiles throughout the year to assess how the introduction of DPGs would fit into or interfere with these profiles. Data show that a DPG's enterprise is economical and socially acceptable to small scale farmers. According to Conelly et al. (1987), overall, based on 9496 random observations over the year in Hamisi cluster, the direct labour costs of maintaining livestock in Hamisi required 2% of all daylight time, or about 15 min/person per day. This compares to an average of 1.5h/day (11.6%) devoted to crop production, 40min/day (5.4%) to off-farm labour, 2.5h (20.8%) to household tasks, 30 min/day (4.0%) to social and religious activities, 4.2 h/day (34%) inactive, 2.5 h/day (20.1%) attending school and 2.1% unknown. When comparing an intensive (cut-and-carry) livestock management system in Hamisi cluster to that of semi-intensive one in Masumbi cluster where there is more herding, Conelly and Nolan (1986) observed that 18.7 and 6.0% of working day time is spent on livestock by the household in Masumbi and Hamisi respectively. The farmer, therefore, saves 12.7% of farming time when s/he opts for intensive livestock management.

DPGs health

Diseases of the DPGs in western Kenya of economic importance have been ranked by Siamba and Semenye (1989) as pneumonias, helminthiasis, ectoparasites (mange and ticks), diarrhoeas and scours, abscesses, trauma and wounds, malnutrition, and abortions.

The most common cause of pneumonia with high death rates is a Mycoplasma strain F38. The Health project has developed an easy to store and administer field vaccine for Contiguous Caprine Pleuro-Pneumonia (CCPP) (Rurangirwa et al. 1986). This vaccine is effective and will benefit many countries in Africa and the near East where CCPP is rampant.

For helminths, especially ***Haemonchus contortus,*** suitable drenching schedules have been developed. However, this is expensive for small scale farmers, and, therefore, cheaper management methods are being sought to reduce drenching frequencies. The nutrition and Management project is conducting an experiment on the effect of wilting forages before feeding it to the goats. Preliminary results indicate that wilting forages reduce the number of ***H. contortus*** larvae in the feeds, parasite intake. The health project also observe breed resistance/tolerance differences to this parasite. Local SEAG showed the least infestation in a study where several goat breeds were artificially inoculated with ***H. contortus*** larvae (Shavulimo et al. 1986).

Ectoparasites are controlled with strategic dipping and management, e.g., tick picking and pricking. Diarrhoeas and scours, abscesses, traumas, and wounds are attended to by the veterinary field staff, assisted by SR-CRSP field staff. The farmers pay cost price for the treatments.

Malnutrition is occasionally observed where farmers tether their animals without changing them often, or where the cut-and-carry system is practised without adequate feeding. This is simply a management problem.

Nutrition and management (NM)

Major nutritional constraints to the DPGs in western Kenya are: low availability and quality of feeds; high moisture content of feeds; low mineral contents in feeds; toxicities, and high levels of antinutritional factors in feeds, especially in tropical legumes.

Some of the constraints will be addressed by the Feed Resources project. NM project has conducted experiments which demonstrated that sweet potato vines can replace milk for goat kids. This can lead to an earlier weaning of up to 60 days, thereby relieving up to 60 kg of milk for household use (Semenye et al. 1987). Sweet potato vines have high crude protein content (20%), high palatability, digestibility (70%), and water content (80%).

To overcome low mineral contents in feeds, NM is developing a mineral feed block which contains the deficient minerals in feeds and added ingredients high in protein and energy. The feed block will replace the conventional mineral block.

Several experiments have been conducted to determine the suitable levels of feeding forages from tropical legumes that are known to contain toxic substances and other antinutritional factors (Semenye et al. 1987). Examples are leucaena ***(Leucaena leucocephala)*** and sesbania ***(Sesbania sesban*** var. ***nubica)***. The former contains mimosine while the latter contains sapponin, which is perhaps the toxic principle. When fed at the right quantities, these legume forages have shown good values as sources of protein for low quality crop residue diets (Anon. 1986, Semenye et al. 1987).

Experiments are underway to study the effect of reducing moisture content in feeds, by wilting on intake and growth rates of goats. Preliminary results indicate that animals on wilted feeds gain more live body weight by approximately 22.8% (Semenye - personal communication).

In goat management, the routine livestock management procedures were followed. Sole tethering and tethering with some herding were studied with respect to uptake of intestinal worms and its impact on access to grazing and feeding. Milk hygiene and management are emphasized to farmers because of milk-borne diseases, especially brucellosis.

Feed resources (FR)

The feed resources project is to develop interventions for generating adequate feeds for the DPGs on small scale farms in western Kenya. One of the major constraints has been low soil fertility with low pH (e.g., 4.4). Low soil fertility has resulted in high deficiencies of phosphorus (*P*) and high levels of iron (*Fe*) and Alluminium (*Al*), making the soil toxic to plants and leading to low crop and forage yields. To overcome these constraints, experiments have shown that use of green manures from legumes (leucaena and sesbania) can increase maize grain and biomass yields by 70.5 and 79.3% respectively (Onim et al. 1989). Similarly, goat manure increased maize grain yields by 57.8%. Forage yield responses to manure and fertilizer application is often higher than that of grain yields.

High population density (up to 900 people km^2) means that there are, therefore, few pastures and fallow lands. Intercropping food and feed crops and developing crop cultivars that have high yields of food and feeds e.g., maize, sweetpotato, finger millet, pigeon pea, etc., and especially the double cobber maize cultivar (Onim et al. 1986) has been attempted and is popular with the farmer. The double cobber maize cultivar has a potential for alley cropping since it produces double cobs at a frequency of 50%.

Simplified hay baling (Onim et al. 1985b) and silage making (Otieno et al. 1986) have been good feed conservation technologies for small scale farmers. To overcome low quality crop residue, diet supplementation with legume forages has shown excellent potential. A large gene bank of sesbanias (14 species and 200 accessions) is being screened at Maseno Research Station to meet this challenge.

Discussion

The assessment of on-farm crop/livestock trials should be done with two groups in mind. The first and most important are farmers. Farmers should be partners in on-farm research, since they will have to apply the results of these trials to increase crop and livestock production. Assessing of such trials should use simple and practical methods and units, e.g., crop yields should not only be weighed, but also measured (e.g., in tin-fulls) to show yield differences from various treatments. For livestock experiments, milk yields should be measured in millilitres but also simply in full bottles. Kid, lamb, and calf growth rates should not only be determined by weighing, but also by such crude methods like visual estimates and handlifting. Farmers' abilities to estimate weights and sizes by such methods should not be underestimated. They are capable of detecting small differences. Results obtained from farmers' estimates should then be compared to the conventional methods and be correlated. This approach gives farmers confidence in the results obtained and it makes adoption of the improved methods easier and faster.

The treatments proposed for such on-farm experiments should, therefore, be those that show conspicuous differences with the traditional method. On-station experiments therefore, should precede on-farm experiments to screen out trials which may not show obvious differences between treatments in on-farm trials. It is difficult for a scientist to explain a failure to a group of farmers in on-farm trials. Should there be a failure, its causes must be clearly explained to farmers in terms that they can understand.

The second level of assessment should be done through suitable statistical analyses and interpretation. Because of variable conditions in the farms, researchers should expect larger coefficients of variation than most of their laboratory and station colleagues are used to. Most refereed journals do not readily accept such data for publication. This has frustrated many researchers who have conducted excellent on-farm trials and obtained good practical and applied results. There are however, several journals now that accept to publish results from on-farm experiments.

On-farm trials should be assessed using biological parameters but must also be subjected to a thorough economic analysis. Although on-station experiments often show large yield differences compared to farmers, when inputs are costed, usually the on-station results may not be any better.

Similarly, on-farm trials should be subjected to sociological evaluation. Once a trial on on-station is showing good biological and economic potentials, it should next be tested for its social acceptability. A high yielding crop variety may be rejected by the farmers at a later stage because it has poor cooking and eating qualities. A lot of time and money could have been saved if farmers' views were sought. Similar examples will also be found in livestock on-farm trials. And that the good farmer response for the DPGs in western Kenya provides a good case to support the on-farm research approach where farmers are fully participating in developing and testing of the DPG technologies.

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