

# IMPROVING THE LIVELIHOOD OF RESOURCE-POOR GOAT FARMERS IN SOUTHERN AFRICA THROUGH STRATEGIC DRUG AND NUTRITIONAL INTERVENTIONS AGAINST GASTRO-INTESTINAL NEMATODE INFECTIONS

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## Abstract

The Department for International Development (DFID) Animal Health Programme (AHP) is to fund a project (R8151) in South Africa from April 2002 for three years. It will test the hypothesis that under the farm management and agro-ecological conditions found in the resource-poor areas of the Republic of South Africa (RSA), the holistic approach of strategic anthelmintic treatment of gastro-intestinal nematode infections of goats and, or, additional supplementation of their diet with urea-molasses blocks will lead to sustainable and cost-effective improvements in health and the value of livestock products. The study will include an *ex ante* analysis to collect baseline socio-economic data, and on-station and on-farm trials. The first hypothesis is that a strategic treatment administered before the peak in faecal egg counts will lead to a lower worm burden and hence better production. The second hypothesis being tested is that supplementation with urea-molasses blocks leads to increased microbial protein post-ruminally. Less protein is then diverted from bone, muscle and fat deposition towards the processes of regeneration, repair and mounting of an immune response (in parasitised animals) and hence body weight is maintained. The third hypothesis to be tested, and which will provide particularly novel information, is that the interaction between appropriate nutritional supplementation with molasses-urea blocks and strategic anthelmintic treatments for gastro-intestinal parasitism will lead to measurable improvements in goat productivity. These three hypotheses will be investigated at Onderstepoort Veterinary Institute during the first year of the trial. The results of this trial will then be tested in the field and will investigate the fourth hypothesis that the benefit to production of the improved feeding and drug treatments will not be unduly affected by extrinsic management practices in a selected agro-ecological zone. The project includes the dissemination of current information on worm control during the course of the project as well as the results of the proposed research programme towards the end of the project.

## Background

Parasitic gastro-enteritis is indisputably a cause of serious production losses to small ruminants in sub-Saharan Africa (Connor *et al.*, 1990; Over *et al.*, 1992), and indeed worldwide (Fabiyi, 1987). Within the resource-poor semi-arid summer rainfall areas of South Africa, information on the production constraints caused by parasitic gastro-enteritis is relatively sparse, as the main emphasis was previously directed to the South African commercial sector. However, *Haemonchus* has been shown to be one of the most important helminth species in the small ruminants farmed (Vatta *et al.*, 2002) in these resource-poor areas.

The application of a strategic drug treatment for the control of parasitic gastro-enteritis has been shown to improve production in small ruminants in sub-Saharan Africa (Connor *et al.*, 1990; Over *et al.*, 1992), as have improvements in the nutritional status of goats (Chartier *et al.*, 2000).

Partly to slow down the rate of development of anthelmintic resistance, which is widespread in the commercial sheep farming sector of South Africa (Van Wyk *et al.*, 1999), attention has been directed more recently towards a holistic approach to parasite management involving sustainable integration of options which reduce the reliance on frequent chemotherapy. This includes examining the interaction between helminthosis, nutrition and strategic drug intervention (Mahato *et al.*, 2000). Although the individual effects of strategic anthelmintic treatment and nutritional supplementation on goat productivity in the RSA are to be established in the present project, the effect of the interaction between nutritional supplementation, drug treatment, gastro-intestinal nematode infections and goat productivity will also be examined. This information is currently almost totally lacking and needs to be quantified.

In the resource-poor farming situation, it appears that strategic treatments are not administered, but the practice could be promoted. Given that *Haemonchus* egg counts peak in about February, a strategic treatment might be appropriate in early December. Importantly the treatment would also be given at a time which should not promote the rapid development of anthelmintic resistance since there would be adequate numbers of susceptible infective nematode larvae on pasture to dilute any larvae derived from eggs laid by resistant worms remaining in the goats after treatment.

A clinical assay, the FAMACHA<sup>®</sup> system, for the identification and subsequent treatment of sheep suffering from haemonchosis by examining the ocular mucous membranes has been developed in South Africa (Malan *et al.*, 2001). This has recently been shown to have a test sensitivity of 76-85% in goats (Vatta *et al.*, 2001) and will be promoted amongst participating smallholder farmers as part of the holistic worm-control approach. This should allow farmers to identify more accurately those goats for which the strategic and nutritional interventions do not suffice and which consequently require additional symptomatic anthelmintic treatment.

Supplementation of protein has been shown to enable parasitised sheep to compensate for the loss of endogenous protein and to allow them to mount an effective immune response. This occurs particularly in cases where the host normally has access to food low in protein (Kahn *et al.*, 2000) such as occurs in the resource-poor areas of South Africa during winter. The promotion of nutritional supplementation should be particularly well received by resource-poor farmers since the effects (improvements in body condition, increased live weight, improvements in reproductive capacity, etc.) are immediately visible.

A cheap source of nitrogen is that derived from non-protein nitrogen compounds such as urea and some resource-poor farmers are feeding diets in the dry winter season which include crop residues, maize grain and relatively cheap molasses-based, non-protein nitrogen supplements. Supplementation with non-protein nitrogen sources such as urea increases microbial fermentation of poor quality roughage which leads to increased amounts of microbial protein post-ruminally. Supplementation of sheep by means of urea-molasses

blocks leads to higher daily dry matter intakes, weight gains, higher body condition scores and mitigates the effects of endoparasites (Anindo *et al.*, 1998).

## Research hypotheses

The project will test the hypothesis that: under the farm management and agro-ecological conditions found in the resource-poor areas of the Republic of South Africa (sub-Saharan Africa), the holistic approach of strategic anthelmintic treatment of gastro-intestinal nematode infections of goats and/or additional supplementation of their diet with urea-molasses blocks will lead to sustainable and cost-effective improvements in health and the value of livestock products.

This general hypothesis gives rise to four specific hypotheses which will be addressed through on-station and on-farm experiments, which will attempt to answer the following:

**Hypothesis 1.** That a strategic treatment administered before the peak in faecal egg counts will lead to a lower peak (lower worm burden) and hence better production.

**Hypothesis 2.** That supplementation with urea-molasses blocks leads to increased microbial fermentation which leads to increased microbial protein post-*ruminally*. This increased protein is thus available for the processes of regeneration and repair in the damaged alimentary tract and for mounting of an effective immune response. This in turn leads to less protein being diverted from bone, muscle and fat deposition and hence maintenance of body weight.

**Hypothesis 3.** That the interaction between appropriate nutritional supplementation with urea-molasses blocks and strategic anthelmintic treatments for gastro-intestinal parasitism will lead to measurable improvements in goat productivity. This will provide particularly novel information.

**Hypothesis 4.** That the benefit to production of the combined improved feeding and drug treatment strategy will not be unduly affected by extrinsic management practices in a selected agro-ecological zone.

In the first year of the project, an *ex-ante* analysis will be carried out by gathering data in South Africa, in collaboration with a socio-economist. Full use will be made of data gathered in earlier studies by various authors, as well as rapid rural appraisal methodologies, informal farm interviews and semi-structured questionnaires where appropriate. Data such as current income from livestock, livestock numbers, numbers of small-scale farmers, numbers of women involved in farming and current marketing practices will be collected. The data will be used to estimate the costs to South African resource-poor farmers of the supplementation methods, the cost of anthelmintic treatments and the availability of anthelmintics, and the value of the stock. This information can then be used as a baseline to determine whether or not the various suggested management changes are indeed cost-effective and acceptable.

Faecal egg count reduction tests will be used to assess the efficacy of the four anthelmintic groups available in South Africa (namely benzimidazoles, macrocyclic lactones, levamisole/morantel group and salicylanilides) before an anthelmintic is chosen for the trial. The test is based on the calculation of the reduction in faecal egg counts of treated animals compared with those of untreated controls at 10-14 post-drenching (Coles *et al.*, 1992).

## Animal health packages

Information, on a variety of topics, has been developed by the Animal Health for the Developing Farmers Programme of the Onderstepoort Veterinary Institute (OVI) into posters, information booklets, slide sets and 'infotoons', for use by extension workers working with

resource-poor farmers. Information on topics such as internal and external parasites, the correct use of remedies, and basic stockmanship procedures such as castration and hoof trimming will be provided to resource-poor farmers participating in the on-farm trials, and where appropriate and possible to neighbouring farmers and at information days for farmers. Information on topics such as supplementary feeding, strategic treatment and the correct use of worm remedies still need to be developed into posters and brochures.

## Experimental programme

### Experiment 1 (on-station)

The purpose of this trial is to quantify, under the conditions at OVI, the effect of urea supplementation in ameliorating the negative effects of gastro-intestinal nematode infection of goats, with or without the inclusion of strategic anthelmintic interventions. This will test hypotheses 1, 2 and 3 and will allow the most cost-effective management programme to be determined. This management programme will be selected for the on-farm trials.

### Experiment 2 (on-farm)

This experiment will determine the effect of varying management practices on the production benefits of improved feed/strategic anthelmintic treatment. This will investigate hypothesis 4.

Following the outcome of the on-station and on-farm trials, and taking into consideration any other disease or management deficiencies noted on-farm, a modified animal health package will be produced and distributed to participating farmers, Provincial Departments of Agriculture, the Society for the Prevention of Cruelty to Animals, local NGOs, Nufarmer and African Entrepreneur (a local newspaper aimed at the developing farmer), the Community Outreach Programme of the Faculty of Veterinary Science, and through the activities of the Animal Health for Developing Farmers Programme at OVI.

Assessment of uptake and impact will be conducted through recognised participatory methods. The project will arrange for a farmers' day half-way through the on-farm work and invite neighbouring farmers to see the work being done on the two project farms, explain what is being done and assess their level of interest and willingness to pay for such interventions. The exercise will be repeated at the end of the trial.

It is anticipated that such an approach will lead to the rapid dissemination of the project findings to the target beneficiaries (goat farmers in resource-poor areas of South Africa). The findings would equally be applicable to other areas of sub-Saharan Africa and the information will be disseminated to appropriate bodies.

## Acknowledgement

This document is an output from a project funded through the Animal Health Programme of the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID. Project R5181, Animal Health Programme.

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