Using cattle to attract Tsetse Flies*

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*Preliminary Study of the Effects of Host Physiology on the Efficacy of Cattle as Baits for Tsetse Control

Executive Message

- Tsetse flies infest vast areas of sub-Saharan Africa and the trypanosomiasis they carry severely inhibits agricultural production by reducing livestock keeping. It also causes sleeping sickness in man.
- With tsetse eradication campaigns now giving way to tsetse control programmes the use of dipped cattle as bait to kill tsetse flies provides a cost-effective option for reducing the effects of trypanosomiasis.
- This DFID project found that tsetse flies where attracted to mature oxen rather than younger animals because they gave off more odour and tolerated biting.
- Between 50-90% of tsetse flies attracted to an insecticide treated oxen are killed by the chemical.
- Densities as low as four treated oxen per square km gave some control over tsetse populations although cattle movements and composition of herds indicate higher numbers are needed for the tsetse population to be reduced sufficiently to significantly enhance successful livestock keeping by reducing trypanosomiasis.
- The findings offer livestock keepers wanting to keep cattle in tsetse infested areas of sub-Saharan Africa an alternative cost effective environmentally kind strategy to control tsetse and trypanosomiasis for the benefit of their animals and families.

Background

Tsetse flies infest over 11 million square kilometres of Africa where they are vectors of trypanosomiasis that affect both man and domestic livestock. Animal trypanosomiasis is a massive inhibitor to agricultural production, greatly reducing the productivity of animals used for draught power and the production of milk meat and manure. Sleeping sickness in man is a powerful constraint to productivity and when combined with HIV has become a national disaster in some African countries. Throughout sub-Saharan Africa, there is increasing interest in the use of insecticide-treated cattle to control tsetse, stimulated in part, by a shift in emphasis from eradication to control. This technique has potential for cost recovery from participants and so reductions in total cost. It might also offer options that reduce total chemical use and thus a reduction in the potential pollution of the environment. Where cattle are kept in Zimbabwe the dipped cattle technique is the cheapest control option available. A number of other countries including Ethiopia, Kenya, and Tanzania are keenly watching developments.

There is currently no information on the effectiveness of dipped cattle as baits, the density of dipped cattle required, or how this density is affected by variations in cattle and tsetse populations. Consequently, there is no rational

Oxen are more attractive to tsetse flies than cows or calves.
basis for planning and managing a control campaign based on this approach.

Objectives

This project aimed to provide quantitative data on the role that cattle might play as bait in the development of sustainable and cost effective strategies for controlling trypanosomiasis in Zimbabwe and other tsetse-infested countries of sub-Saharan Africa.

This new knowledge can be combined with existing tsetse population models to develop rational strategies to control tsetse. The project attempted to fulfill this aim through the following outputs:

1. Establish preliminary quantitative relationships between host nutrition and age and cattle:fly contact.
2. Make recommendations on methodology and benefits of further research on factors affecting cattle :tsetse contact.
3. Make recommendations on the effects of stock composition and density on the efficacy of cattle as baits for tsetse control

Ultimately, the project outputs will be combined with outputs from the Zimbabwe Tsetse and Trypanosomiasis Control Branch, the ODA/DFID-funded Insect Pest Management Initiative and the Regional Tsetse and Trypanosomiasis. These will include tsetse population dynamics, the responses of tsetse to mobile baits and economic data, which can all be used to produce a predictive model of the cost effectiveness of using insecticide -treated cattle to control tsetse.

Highlights

The project undertook two studies. In Zimbabwe field studies were made of the attraction and feeding responses of tsetse to cattle of different age, sex and nutrition. Tsetse flies were trapped whilst trying to reach or leave different types of Mashona cattle. The defensive behaviour of cattle was also observed in terms of avoidance tactics like skin twitching, tail flicking, stamping and kicking the lower torso.

At NRI in the UK scientists examined the physiological reasons for the differences in attractiveness by analysing the odour from host cattle used in field trials. The main findings included:

- the odour from the mature ox was at least as attractive as the blend of synthetic attractants used in odour-baited targets with carbon dioxide generation playing a major role.
- Oxen were more attractive than cows and cows more than calves.
- Tsetse had less success in feeding from calves than from cows and from cows than oxen.
- 50 - 80% of Tsetse flies land on the lower legs of cattle.
- 50 - 90% of tsetse approaching an insecticide-treated ox will pick up a lethal dose of insecticide.

Impact

1. Establishing preliminary quantitative relationships between host nutrition and age and cattle:fly contact.

This project found that tsetse flies were much less attracted to smaller or younger animals than to mature oxen. Larger cattle attract more tsetse mainly because they generate more carbon dioxide. Calves are also very intolerant of tsetse feeding from them and so do not make good bait animals. In studies of the feeding responses of tsetse to mature oxen and calves, it was shown that a mature ox attracts more than twice as many tsetse as a calf and 20 times as many tsetse feed on it. This large difference is due to differences in size, in the odours produced by oxen and calves, and in animal behaviour to tsetse. These findings suggest that young animals make ineffective baits for tsetse.

There were no significant differences between two groups of four Mashona oxen, one grazed naturally and the other given concentrate during the dry season. Seasonal changes in the weight of the grazed cattle, which lost weight during the dry season and gained weight during the wet season, had no significant effect on the numbers of tsetse attracted to or feeding on the oxen. The findings suggest that the natural fluctuations in the weight and condition of communal cattle does not have a significant effect of the efficacy of insecticide-treated cattle.

2. Make recommendations on methodology and benefits of further research on factors affecting cattle :tsetse contact.

The methods used in successfully completing this research can now be used in future research which will be required to find out which insecticides work best as pour-ons or dips for cattle used as bait. There is also a need to look at cattle
movements to study how moving animals and cattle management practices will affect tsetse populations. All such work would have to consider the environmental impact of treating cattle with insecticides.

3. Make recommendations on the effects of stock composition and density on the efficacy of cattle as baits for tsetse control

The main practical implications of these findings are that Mashona oxen, weighing ca. 450 kg are effective as insecticide-treated targets. Densities of 4 oxen/km² will control tsetse populations. However, this estimate takes no account of the distribution, movement or physiological variation of cattle. The results indicate that since cows, young animals (<3 years) and calves are less effective than oxen as baits, increased densities of these animals would be required to control tsetse populations. Herds in Zimbabwe typically comprise 30% young animals and 50% females so minimal densities of insecticide-treated cattle required to control tsetse will have to be greater than 4 km². Moreover, cattle are not normally distributed evenly because they are managed in herds. This would further inflate the numbers needed to control tsetse populations.

Selected Publications


Meetings/presentations

**Zimbabwe:** RTTCP Research and Development Workshop, Harare, March, 1996.

**USA:** Biting Fly Symposium, New Orleans, May 1996