Tsetse and trypanosomiasis control measures: Restricted application of insecticide to livestock

SUMMARY:

Since tsetse flies feed mostly on the legs and mostly on the largest animals in the herd, an application of pour-on insecticides or sprays restricted to the legs of cows, bulls and draught animals has been shown to be effective in controlling tsetse. This also results in a significant cost saving to the farmer, of up to 80 to 90%.

KEYWORDS:
Tsetse flies [1]
environmental control [2]
pest control [3]
Insect control [4]
Traps [5]
Livestock [6]
Insecticides [7]

CATEGORY:
Livestock production [8]

COUNTRIES:
Zimbabwe

DESCRIPTION:

Background

Tsetse flies occur in 36 countries and a total area of about 10 million square kilometres in Africa. Throughout this area the disease transmitted by the tsetse fly, Trypanosomiasis (or Trypanosomosis), has a significant effect on large numbers of livestock. About 50 million cattle and tens of millions of small ruminants are considered to be at risk from Trypanosomiasis, and the disease is recognized to be an obstacle to poverty reduction and food security in Africa. In addition, according to the World Health Organization (WHO), more than 60 million people, mainly living in rural areas of sub-Saharan Africa, are at risk of human African Trypanosomiasis, or sleeping sickness. Furthermore, a general decline in the capacity and funding of national veterinary institutions means that Trypanosomiasis-affected communities are forced to control the disease themselves. Consequently, community-based initiatives to control tsetse has become one of the major methods of controlling trypanosomiasis.

Control methods

In addition to the use of trypanocidal drugs, control of Trypanosomosis has been tackled largely by control of the tsetse fly vector and a range of techniques are available, each with advantages and disadvantages. Methods include aerial spraying, sterile insect techniques, insecticide treated cattle, and odour bait traps and targets. Both targets and insecticide treated cattle are particularly suited as control techniques for use by local communities.

Controlling tsetse with insecticide-treated cattle

Insecticide treatment of cattle and other livestock is considered as one of the important methods for control of tsetse, and thus reducing the incidence of Trypanosomiasis. The principle is similar in practice to the use of targets for tsetse control, in that tsetse are attracted to the target ? in this case cattle ? land and attempt to obtain a blood meal, but instead picks up a lethal dose of deltamethrin or alphacypermethrin insecticide which has been applied to the animal.
The insecticides applied to cattle to control tsetse do not act as repellents. Consequently, they do not actually prevent tsetse from biting cattle. However, each fly that either lands on, or lands and bites a treated animal will die within a few hours. Therefore, if a sufficient proportion of the cattle population are treated within an area then the population of tsetse will be reduced, cattle will be bitten less often by tsetse, and the incidence of Trypanosomiasis will decrease. In situations where there is a wild herbivore animal population, the numbers of animals treated as a proportion of the total domestic plus wild herbivore population may be critical (CIRAD pers. comm.) However, this record does not attempt to determine what this proportion should be.

Treating cattle with insecticides to control Trypanosomiasis should always be considered as part of a large-scale tsetse control operation using a range of different and complimentary control techniques. For instance, cattle situated at the edge of a control operation that is adjacent to a tsetse-infested area, will be continuously affected by tsetse moving into the controlled area. To prevent this, it may be necessary to use a protective barrier of targets, in addition to the use of insecticide treated cattle. Farmers may also be treating their cattle with insecticides to control other ectoparasites such as ticks. Consequently, control operations should take care to inform livestock owners about the use of all insecticides potentially used by livestock keepers.

Formulations designed for controlling ticks are not necessarily effective against tsetse, although in most cases formulations effective against tsetse will also kill ticks. The formulations effective against tsetse will generally be either a suspension concentrate or a pour-on formulation of a persistent pyrethroid such as deltamethrin, alphacypermethrin or beta-cyfluthrin.

A single insecticide-treated cow potentially kills about as many tsetse as a single odour-baited target. Therefore, if there is a reasonably large population of cattle in an area, the use of insecticide treated cattle offers several advantages over using targets. Treating an animal is cheaper than constructing and deploying an insecticide-treated target. In addition, cattle owners are strongly inclined to treat their cattle with insecticide, to maintain them and protect them from theft. As a result, several problems associated with using targets are overcome by using insecticide-treated cattle, including the loss of targets due to general wear and tear, theft, and animal damage. However, in practice a combined approach using both traps and insecticide treated cattle may represent the best option.

For example cattle are managed in herds, and a group of ten cattle does not kill ten times as many tsetse as an individual. It is considered that densities of four cattle per square kilometre are not sufficient to control savanna species of tsetse, whereas this same density of targets provides adequate control if well maintained.


Application of insecticide

The application of insecticide can be either by dips, sprays, or by pour-on. In the case of dips or larger sprays, the cattle may already be dipped or sprayed for control of ectoparasites such as ticks and this can be combined with application of insecticides for tsetse control.

Pour-ons

Pour-ons are formulations of a number of different synthetic pyrethroid (SP) insecticides that can be applied to livestock. These have been commercially available for more than a decade and some of these products have been shown to be highly effective against tsetse flies as well as ticks. Pour-on treatment involves the application of an insecticide along the backline of livestock at a prescribed dosage. Pour-ons are generally available in a ready-to-use form, or are prepared from a concentrate. They are applied using graduated ladles, graduated squeeze bottles, or dosage-adjustable hand-guns. It is important that the correct dosage be applied to the animals to ensure control of the targeted pest (and to avoid poisoning the animal) Because pour-on application requires less chemical, is considered less wasteful than dips or whole-body sprays, and the dosage is more precise than whole-body sprays, pour-on applications are increasingly popular.

Impacts

The widespread use of pyrethroids (and other insecticides) can have an adverse impact on the invertebrate dung fauna (e.g. dung beetles), which play an important role in maintaining soil fertility in mixed crop/livestock farming systems. In addition, by killing ticks as well as tsetse they prevent young animals from being sufficiently exposed to local tick-borne diseases to become adequately immunized to them, resulting in potentially serious disease risks later in adult animals.

Mitigation by restricted application of insecticide

A solution to the problem of adverse impacts on invertebrate dung fauna was suggested by the observation that tsetse feed preferentially on the legs and belly of larger/older cattle. Restricted application of insecticide to these areas only has been shown to significantly reduce the impacts on dung fauna whilst still being effective against tsetse (see Bourn et al.[11], 2005 and Grant[12] 2005) However, with a restricted application the effective life of the treatment is reduced. (BOURN et al., 2005) report that the most cost-effective regime was treatment of the belly and legs of cattle at 2-3 week intervals, rather than the monthly interval recommended for whole body treatment. This restricted application regime halves the amount of insecticide used, while improving overall efficacy and is appropriate for all four species of tsetse. This provides benefits not only to the farmer in terms of cost, but also to the environment. For poor livestock keepers it is the cost that represents the most prohibitive aspect of tsetse control. For further information on impacts see also Kamuanga (2003) http://www.fao.org/docrep/006/y4619ey/y4619e00.HTM[13].
Researchers have demonstrated that this restrictive application of these pyrethroids to the legs of cows, bulls and draught animals is effective in controlling the fly. An economic analysis of the use of these products in Ethiopia showed a return in higher productivity and lowered livestock mortality for farmers using pour-ons at traditional application levels. Furthermore, while applying pour-ons still makes demands on farmers¿ time, the reduced need for cash as a result of legs-only application makes it a more viable option for poor farmers, with cost savings of up to 80 to 90%. However there are concerns related to the proportion of tsetse that are able to bite before being killed. In research conducted in West-Africa, a higher proportion are able to bite before being killed in the case of restricted treatment than in full body treatment (CIRAD pers. comm.)

The pyrethroids are irritating to the skin, especially when in the concentrated pour-on formulations intended to make good contact with the body. This irritation, and possibly the presence of vegetable oils in the formulation, results in the animals licking off a significant proportion of the applied insecticide. After ingestion, a portion of the insecticide is subsequently found in the dung, and results in mortality of dung fauna and consequently in reduced soil fertility. However, the licking is not only a threat to dung fauna, a proportion of costly insecticides used extensively throughout the cattle industry can rapidly be removed from the point of contact with target pests.

**Application using sprays**

Pour-ons are generally not designed to be applied to only the legs and belly. However, sprays can be directed at specific parts of the body. The use of sprays targeted at only the legs and belly, as alternatives to pour-ons, would substantially reduce the risks to dung fauna without affecting much the efficacy against tsetse. Moreover, the sprays could also be more economical since they are usually about a quarter of the cost of pour-ons. (Dips can also be used to apply insecticide treatments only to legs and belly) The problem in some countries is that unlike pour-ons, the sprays (or dips) require the inconvenience and expense of spray races or dip tanks, and need plenty of water to operate. In many areas this infrastructure is not available.

**Application using small hand-sprayers or brushes**

The restriction of insecticide treatments to the legs promises to reduce yet further the insecticide costs and the risks to dung fauna. It also requires relatively little water and might be achieved by comparatively inexpensive leg-baths, small hand-sprayers or even brushes. As legs-only treatments require so much less insecticide than the whole-body applications, it means that substantial savings in insecticide costs can be made. Furthermore, these methods do not require the infrastructure associated with dip tanks of spray races. Further information on use of these application methods is also available at [www.cirdes.org](http://www.cirdes.org) (see Stachurski 2005, and Bouyer et al., 2005)

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*Click on [Reducing risks while manipulating pesticide](http://www.cirdes.org)*

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**References and further reading**


Contact details for DFID research project teams

To view table click here[18].

Evidence of validation

To view table click here[19]

e-Resources

www.tsetse.org[20]. Programmes and information to assist in the planning and implementation of tsetse control operations. Web site created by Steve Torr, Glyn Vale and David Hall as an output of research Project R7173 funded by the Animal Health Programme of the UK Department for International Development (DFID)

Use of Pour-on Technology to Control Ectoparasiteshttp://www.virtualcentre.org/en/dec/toolbox/Grazing/Pour_on.htm[21].


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FURTHER READING:


SOURCE(S):

UK Department For International Development (DFID) [23]