Effect of strategic deworming of village cattle in Uganda with moxidectin pour-on on faecal egg count and pasture larval counts

J W Magona[a*], G Musisi[a], J Walubengo[a] and W Olaho-Mukani[a]

ABSTRACT

Strategic application of moxidectin pour-on (Cydectin®) was evaluated in Uganda for its effect on pasture larval counts and gastrointestinal nematode faecal egg counts in village cattle kept under tethering (semi-intensive) grazing management. The strategic deworming schedule involved treating cattle twice at an interval of 2 months, at the end of the 1st wet season and during the 2nd wet season. Two groups of 30 cattle, each consisting of a treated and a control group, were examined for nematode infections every 4 weeks from June 1999 to January 2000. The treated group had significantly lower mean faecal egg counts than the untreated groups (t-value = 2.47, $P < 0.05$). Generally, the pasture larval counts on treated farms were lower than on untreated ones, but not significantly so (t-value = 2.22, $P = 0.068$). Pasture larval counts with different nematode species on treated farms were lower than on untreated ones, but the differences were not significant for *Haemonchus* spp. (t-value = 1.68, $P = 0.145$), *Oesophagostomum* spp. (t-value = 1.87, $P = 0.111$), *Trichostrongylus* spp. (t-value = 1.93, $P = 0.102$), *Dictyocaulus* spp. (t-value = –0.74, $P = 0.485$) and *Cooperia* spp. (t-value = –1.00, $P = 0.356$). Treated farms did , however, have significantly lower pasture larval counts of *Bunostomum* spp. (t-value = 4.64, $P < 0.05$). This study has revealed that the application of moxidectin pour-on on cattle has an effect on faecal egg count and pasture contamination under the tethering grazing system. Moxidectin pour-on and the strategic deworming schedule evaluated here could be used for the control of gastrointestinal nematode infections in cattle by small-scale farmers who practise tethering or semi-intensive grazing management in Uganda and other tropical countries, especially where there is a bimodal rainfall pattern.

Key words: cattle, moxidectin pour-on, tethering grazing management, Uganda.

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INTRODUCTION

Gastrointestinal nematode infections are widespread in cattle kept under traditional management in Uganda[11,12] and constrain cattle health and productivity. Approximately 95 % of the national cattle population of 5.4 million consists of indigenous Zebu and Sanga breeds, kept under traditional communal grazing management, while exotic breeds constitute only 5 %[5].

Use of controlled grazing is not feasible under the traditional communal grazing systems on shared pasture in Uganda. In addition, continuous survival of helminth larvae in pastures due to favourable climatic conditions leads to frequent re-infection of cattle, which necessitates frequent dosing of cattle. Broad-spectrum anthelmintics with an extended antiparasitic activity, such as moxidectin, are desirable for farmers in such a situation, since reliance on short-duration anthelmintics is prohibitively expensive. The efficacy of moxidectin pour-on in livestock under modern management in temperate countries has been documented[2,15,19]. In Uganda, the injectable moxidectin has been reported to maintain an efficacy of over 90 % against gastrointestinal nematodes in cattle under communal grazing management for 11 weeks[6]. Given the bimodal rainfall pattern in Uganda that favours survival of nematode larvae on pasture year round, strategic deworming of cattle twice a year with an anthelmintic with extended antiparasitic activity, such as moxidectin, was thought necessary. In this study, a strategic deworming schedule involving treating cattle with moxidectin pour-on twice at an interval of 2 months, firstly at the end of the 1st wet season and then during the 2nd wet season, was evaluated on village cattle kept under tethering (semi-intensive) grazing management.

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MATERIALS AND METHODS

Study area

This study was conducted on 6 farms located within a radius of approximately 7 km in Tororo district, Uganda (00°40′N, 34°10′E). The vegetation comprises of Savannah grassland interspersed with *Lantana camara* shrubs. Tororo district receives 1200–1500 mm rainfall annually. Normally, the rainfall is bimodal with 2 wet seasons (March–May) and (September–November), and 2 dry seasons (December–February) and (June–August). The seasons vary somewhat from year to year. The area has a mean relative humidity of 65 % and daily mean temperatures range between 15 °C (minimum) and 27 °C (maximum).

Cattle

Each farm used in the study had 12–15 Zebu cattle aged 6–18 months kept under tethering grazing management on 2–5 acres of land, giving an average grazing pressure of 13 animals per hectare, which was similar on all farms. This involved securing each animal with a sisal rope to a peg during the day and moving it from one peg to another every other day throughout the pastures, according to availability of herbage. Although all farms practised rotational grazing, intervals between grazing of a particular section of the pasture were not consistent on all farms. However, cattle of all ages were grazed on the same pasture. The pastures were utilised throughout the year. Cattle in the trial (10 from each farm) shared the pastures with 2–5 other cattle of which the age composition was similar between treated and control farms. The farms were located in the same ecosystem and were managed in a similar manner, the quality and amount of pasture thus varied little between farms.

Experimental design

Sixty Zebu cattle were selected from 6 farms; 10 cattle per farm. The 6 farms

were randomly allocated to treatment (3 farms) and control groups (3 farms), thus giving 30 animals per group. Cattle on the treated farms received 0.5 % moxidectin pour-on (Cydectin®, Cyanad Animal Health, UK) along the back-line at a dosage rate of 1 ml per 15 kg body weight (0.35 mg/kg body weight) at the end of June 1999 (end of the 1st wet season) and at the beginning of September 1999 (during the 2nd wet season). The weight of animals in the treated group was estimated using a weighband (WE-BO, Denmark). The control animals were left untreated. All animals in the treated and control groups were monitored at 4-week intervals for faecal egg count from June 1999 to January 2000. Pasture larval counts were monitored on all 6 farms at similar intervals throughout the study period.

Faecal sampling and examination

Faecal samples were taken directly from the rectum. Each sample was placed in a separate plastic bag, clearly labelled with the ear tag number of the individual animal and then dispatched in a cool box on ice to the laboratory, located 5–7 km away from the farms, for immediate examination. Faecal egg counts were carrried out on each sample using a modified McMaster method at an accuracy of 50 strongyle-type eggs per gram (epg) of faeces[14].

Pasture sampling and nematode larval extraction

During each sampling visit, approximately 400 g of herbage were collected per site from 3 randomly scattered sites on each farm following a 'W' collection route[3]. There were 3 sampling points per 'W' route. The herbage was placed in separately labelled plastic bags and transported to the laboratory where the samples were processed immediately.

Nematode larval extraction from the herbage samples was done as described by Hansen and Perry[3]. Herbage was placed in a gauze bag and immersed in water in a large plastic beaker for 3–4 hours, during which time the water was removed, drained and replaced several times to agitate the sample. The bag was left in the beaker of water at room temperature (26°C) overnight. The following day it was removed and washed with tap water. The washings were collected in a beaker and the contents left to form a sediment for 1 hour. The bag of grass was left to dry completely before it was weighed. Meanwhile, the supernatant fluid of the sediment was decanted into a funnel provided with a tube, clamped at the bottom. The funnel was left to stand for 1 hour whereafter the sediment with 15 ml of fluid was drained into a test-tube. This was placed at 4 °C for 1 hour and the supernatant fluid decanted, leaving 35 ml to which 35 drops of iodine were added and left for 1 hour before counterstaining with 3 drops of sodium thiosulphate. Total counts were done of the parasitic larvae, which were then identified to genera using the identification key of Hansen and Perry[3].

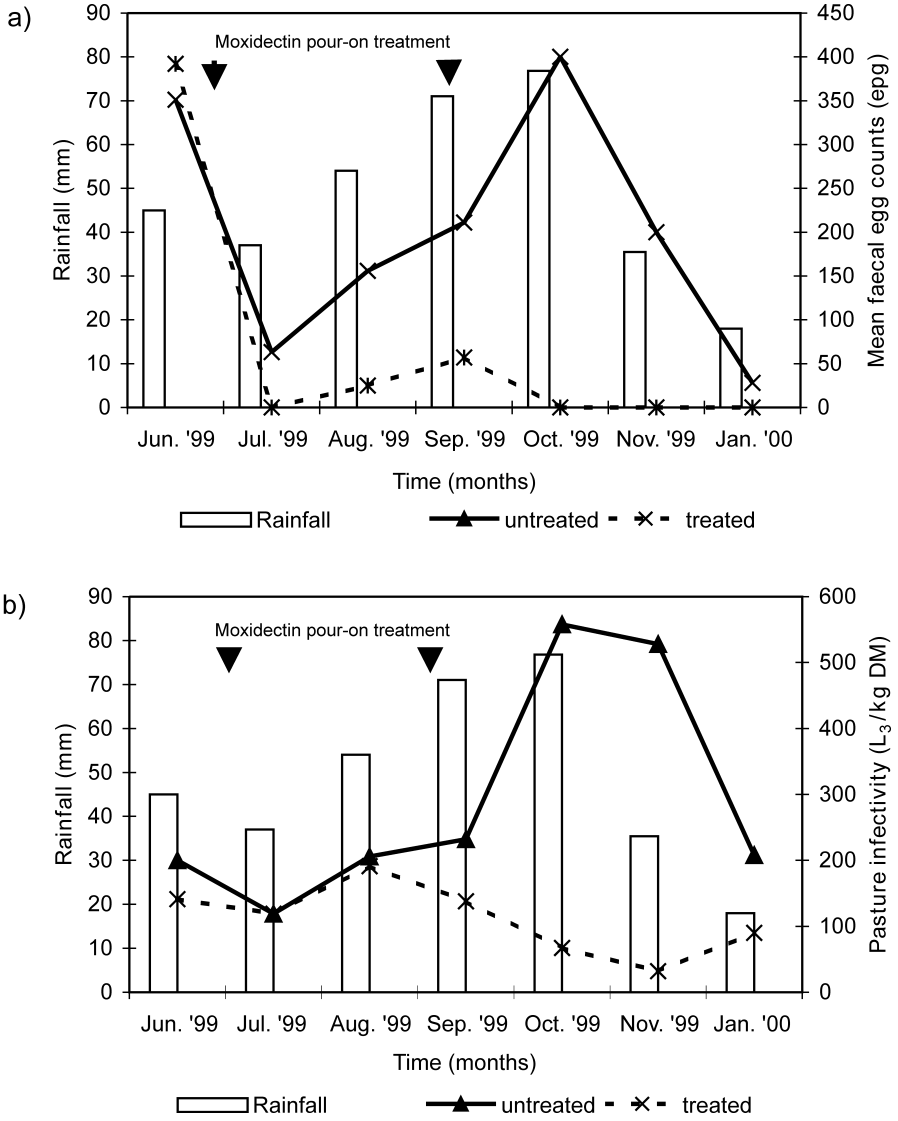

Fig. 1: **Mean faecal egg counts** (a) **and pasture larval counts** (b) **of farms with treated and untreated cattle in Tororo district, Uganda.**

Data analysis

The arithmetic mean faecal worm egg counts of cattle and parasitic larval counts of the treated farms were compared with those of the untreated farms over the entire experimental period, using Student's *t*-tests performed with Minitab (Minitab Statistical Software, Minitab Inc., Pennsylvania, USA). Pasture nematode larval counts of different genera were plotted separately for treated and untreated farms.

RESULTS AND DISCUSSION

The arithmetic mean faecal egg counts of cattle in the treated and untreated groups (Fig. 1a) initially declined for both the treated and untreated cattle, but the decline was more pronounced in the treated than in the untreated group (t-value = 2.47, $P < 0.05$).

During the first 2 months there were no significant differences in pasture larval counts between the treated and the untreated farms in terms of the levels and trends (Fig. 1b). However, after the second moxidectin treatment the pasture larval counts substantially declined on the treated farms, concurrent with an increase on untreated farms, although the differences were not statistically significant (t-value = 2.22, $P = 0.068$).

Figure 2 illustrates pasture larval counts, differentiated to genera, on the untreated farms. *Haemonchus* spp. had the highest pasture larval counts (60–300 L_3/kg DM), followed by *Bunostomum* spp. (10–80 L_3/kg

DM), *Oesophagostomum* spp. (10–100 L_3/kg DM), *Trichostrongylus* spp. (0–40 L_3/kg DM), *Dictyocaulus* spp. (0–20 L_3/kg DM) and *Cooperia* spp. (0–5 L_3/kg DM).

Figure 3 illustrates pasture larval counts, differentiated to genera, on the treated farms. The pasture larval counts on treated farms were lower than on untreated farms with *Haemonchus* spp. being predominant (10–100 L_3/kg DM), followed by *Bunostomum* spp. (10–20 L_3/kg DM), *Oesophagostomum* spp. (0–40 L_3/kg DM), *Trichostrongylus* spp. (0–20 L_3/kg DM), *Dictyocaulus* spp. (0–25 L_3/kg DM) and *Cooperia* spp. (0–15 L_3/kg DM).

There was no significant difference between the untreated and treated farms in terms of pasture mean larval counts of *Haemonchus* spp. (t-value = 1.68, P = 0.145), *Oesophagostomum* spp. (t-value = 1.87, P = 0.111), *Trichostrongylus* spp. (t-value = 1.93, P = 0.102), *Dictyocaulus* spp. (t-value = –0.74, P = 0.485) and *Cooperia* spp. (t-value = –1.00, P = 0.356) over the entire period, but treated farms had significantly lower pasture larval counts of *Bunostomum* spp. than untreated ones (t-value = 4.64, $P < 0.05$). Although there was no significant difference between the untreated and treated farms in terms of pasture larval counts of *Haemonchus* spp., *Oesophagostomum* spp., *Trichostrongylus* spp., *Dictyocaulus* spp. and *Cooperia* spp., there was a reduction of pasture larval counts of these nematode species on treated farms.

Generally, there was a rise in the faecal egg count, overall pasture larval counts and the pasture larval counts of different nematode genera on both treated and untreated farms during the wet season. This trend was minimised by moxidectin pour-on treatment on the treated farms, where a downward trend was observed throughout the experiment.

In the present study, the effect of strategic application of moxidectin pour-on on faecal worm egg count of village cattle and pasture larval counts under tethering grazing management was evaluated over a period of 7 months in Uganda. The strategic deworming schedule of treating cattle twice at an interval of 2 months, firstly at the end of the first wet season and then during the second wet season, was based on the rainfall pattern and previous findings on the period of residual efficacy of moxidectin against gastrointestinal nematode infections in cattle in Uganda[6].

Mean faecal egg counts for both the treated and untreated cattle initially declined. However, the decline was much higher for the treated group. Under temperate conditions, 0.5 % pour-on moxidectin has been reported to maintain a high efficacy against gastrointestinal nematode infection in grazing cattle[9,13,18]. In Uganda, studies have revealed that injectable moxidectin has a residual efficacy of 90 % against gastrointestinal nematode infections in village cattle for about 11 weeks[6]. Furthermore, pour-on and injectable moxidectin have been found to have similar periods of residual efficacy[9].

The general trend of faecal egg count and pasture larval counts observed on both treated and untreated farms could

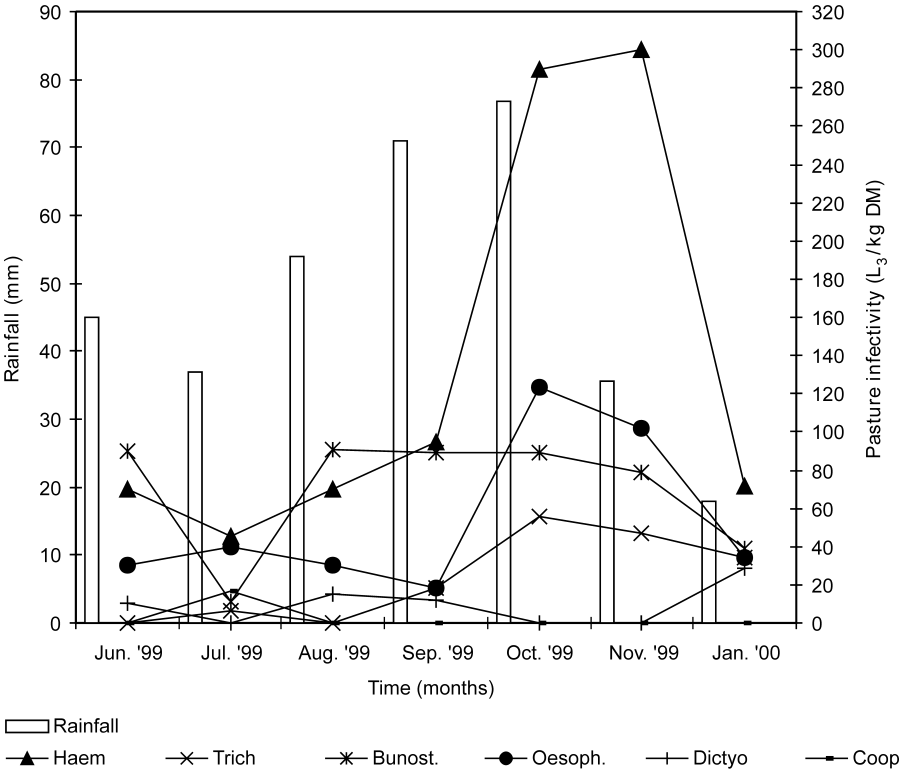

Fig. 2: **Pasture larval counts per nematode genus on farms with untreated cattle in Tororo district, Uganda. Haem = *Haemonchus* spp., Trich = *Trichostrongylus* spp., Bunost. = *Bunostomum* spp., Oesoph. = *Oesophagostomum* spp., Dictyo = *Dictyocaulus* spp. and Coop = *Cooperia* spp.**

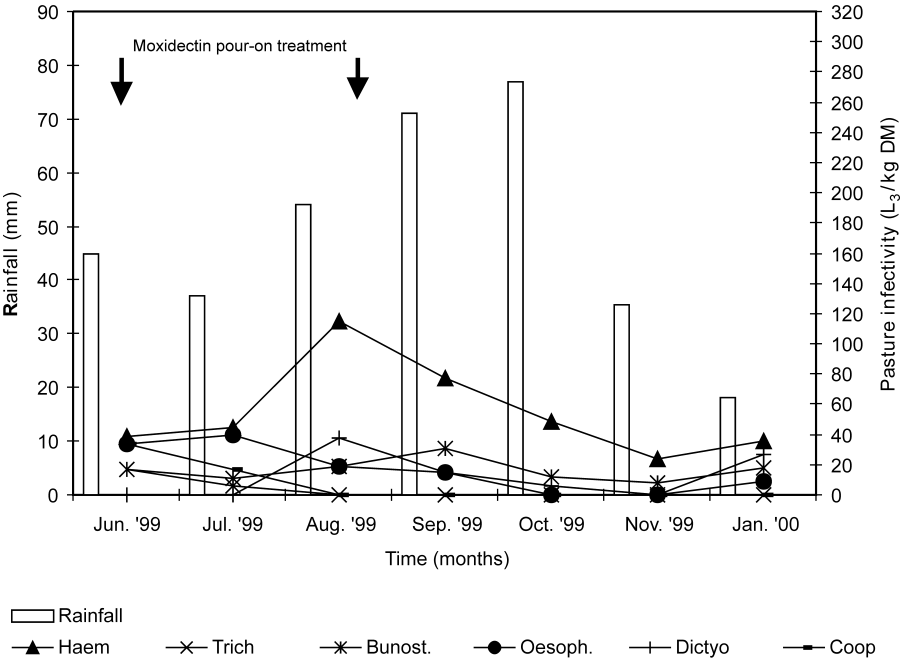

Fig. 3: **Pasture larval counts per nematode genus on farms with treated cattle in Tororo district, Uganda. Haem = *Haemonchus* spp., Trich = *Trichostrongylus* spp., Bunost. = *Bunostomum* spp., Oesoph = *Oesophagostomum* spp., Dictyo = *Dictyocaulus* spp. and Coop = *Cooperia* spp.**

be attributed to the background effect of the rainfall pattern, since there was a rise according to the amount of rainfall. In addition, host immunity could have been largely responsible for decreases in epg and slow increases as immunity waned while pasture counts were low, which probably explains why faecal egg counts decreased considerably before the end of the wet season and during the dry season, while this was not observed for pasture larval counts. However, this trend was reversed by moxidectin pour-on treatment on the treated farms especially after the second application when persistent decline was observed. This effect portrayed the persistent activity of moxidectin[8] on faecal egg count and the resultant reduction on pasture contamination.

Haemonchus placei, Trichostrongylus axei, Bunostomum phlebotomum, Oesophagostomum radiatum, Cooperia pectinata and *Cooperia punctata* are considered to be the major nematode species that cause parasitic gastroenteritis in cattle in tropical Africa[1,4,7,10,12,16,17]. Of these nematodes, *H. placei* and *O. radiatum* are recognised as the most pathogenic and economically important parasites of cattle in the tropics[17]. Basano and colleagues[1] found moxidectin pour-on to have good therapeutic efficacy (100 %) against *Haemonchus* spp., *Oesophagostomum* spp., *Trichostrongylus* spp. and *Cooperia* spp. in cattle in field trials under Mediterranean climatic conditions. Under temperate conditions, moxidectin pour-on has been reported to have higher persistent efficacy against worms from the lungs and abomasa than those from the small intestines[2].

Moxidectin pour-on and the strategic deworming schedule evaluated in this study appear to be suitable for control of nematode infections in cattle in tropical Africa, especially for small-scale farmers practising tethering grazing management in areas that receive bimodal rainfall. The persistent activity of moxidectin makes worm control cost-effective since farmers need to use moxidectin only a few times per year. The pour-on formulation is easy for farmers to apply. However, use of moxidectin might not be sustainable due to the potential for development of worm resistance, since drugs with a long residual efficacy are inclined to select for resistance.

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