

COMPARATIVE EFFICACY OF TWO OR THREE INJECTIONS OF DORAMECTIN AND THE ROUTINE FARM PROGRAM FOR THE CONTROL OF ECTO AND ENDOPARASITE IN GROWING CATTLE IN THE NORTH REGION OF PARANA STATE

M.H. YAMAMURA¹; A.B. DA LUZ PEREIRA¹; J. DA S. GUIMARÃES JR.¹; L. CAPRONI JR.²; L.C.B. GONÇALVES² & O. UMEHARA²

(1) Universidade Estadual de Londrina/Centro de Ciências Agrárias/Departamento de Medicina Veterinária Preventiva - Campus Universitário - Caixa Postal 6001, Cep 86051-990 - Londrina, PR, Brazil; (2) Laboratórios Pfizer Ltda., Rua dos Ingleses, 569, Cep 01329-905, São Paulo, SP, Brazil.

SUMMARY: A study was conducted during the period of July 1992 to July 1993, in Cornélio Procopio, Parana State, Brazil, to evaluate the efficacy of two and three Doramectin treatments administered subcutaneously (SC) at a dose rate of 200 mcg/kg compared to the farm program of three doses each of Levamisole (3.75 mg/kg - SC), Trichlorfon (10 mg/kg - SC) and Deltamethrin (7.5 mg/kg - topic) for parasite control in growing beef cattle. Criteria for comparison were weight gains, nematode egg counts per gram of feces (e.p.g.), tick scores and live warble nodule counts. Ninety-six crossbreed zebu cattle, 8 to 9 months old, were allocated randomly to three groups of 32 animals each based on body weights. Animals of T1 group, received two treatments of Doramectin on days 0 and 91. Animals of T2 group were treated with three doses of Doramectin on days 0, 91 and 152. Animals of T3 group were treated with three doses of Levamisole on days 0, 123 and 305, and three doses of Trichlorfon and three Deltamethrin on days 0, 185 and 273. After treatments, the animals of each group were maintained in equal but separated paddocks during the whole experimental period of 364 days. Weighing and parasite burden evaluations were made on day -1 and at monthly interval thereafter until the end of the study. Doramectin treated groups at either two or three doses regimens resulted in significantly better ($p < 0.05$) parasite control than the farm program. The superior parasite control afforded by the two or three Doramectin treatments was consistent with improvements of 24.12 kg and 27.61 kg in mean weight gain per animal during 364 days compared to the farm program. There was no significant difference between the two and three Doramectin treatment regimens.

KEY WORDS: Doramectin, growing cattle, endoparasite, ectoparasite.

INTRODUCTION

Doramectin is an endectocide of the avermectin class, obtained by mutational biosynthesis of *Streptomyces avermitilis* (GOUDIE *et alii*, 1993). The efficacy of this compound was equal to or higher than 99.6% against immature or adult stage of 14 species of gastrointestinal and pulmonary nematodes of cattle in North America and Europe (JONES *et alii*, 1993) and 99.9% or higher against natural nematode infection of cattle in Latin America (EDDI *et alii*, 1993). Doramectin was also highly effective against ectoparasite infestations of cattle such as mites and lice (LOGAN *et alii*, 1993), tropical warble, *Dermatobia hominis* (MOYA-BORJA *et alii*, 1993 a), myiasis caused by *Cochliomyia hominivorax* (MOYA-BORJA *et alii*, 1993 b) and against the cattle tick, *Boophilus microplus* (GONZALES *et*

alii, 1993). For the traditional control of ecto and endoparasites it is still commonly used Levamisole or Benzimidazole derivatives against gastrointestinal nematodes and organophosphorous and pyrethroid based products, such as Trichlorfon and Deltamethrin for the control of ectoparasites (MELO *et alii*, 1969; ANDERSEN, 1961; RUEDA & MATEUS, 1967; SOUSLBY, 1982; GUIMARÃES *et alii*, 1982; LUZ *et alii*, 1982). Many studies have been conducted to evaluate productivity performance of cattle treated with antihelmintics compared to untreated controls. For example, BIANCHIN (1982), used Levamisole (20 ml, injectable) in the control of gastrointestinal nematodes during the period of 120 days and obtained a mean total and daily weight gains per animal of 7.6 kg and 0.06 kg respectively higher than untreated control, although this difference was not significant. BIANCHIN & MELO (1985), in

1975 and 1976 carried out studies with four groups of 12 weaned calves each, naturally infected by gastrointestinal nematodes: group 1 - untreated; group 2 - treated with Tetramizole injectable in May and September (beginning and ending of the dry season); group 3 - treated in May, June, September and December; group 4 - treated at monthly interval. The strategic treatments (groups 2 and 3) were as effective as the monthly treatment in the control of gastrointestinal nematode infections. There was an improvement in weight gains of 15 kg per animal favorable to the treated animals compared to untreated controls. The objective of the present study was to evaluate the efficacy of two and three treatments with Doramectin given subcutaneously (SC) at a dose rate of 200 mcg/kg compared to the farm program for the routine control of ecto and endoparasites using three doses of Levamisole (3.75 mg/kg - SC), three doses of Trichlorfon (10 mg/kg - SC) and three Deltamethrin (7.5 mg/kg - topic) in growing cattle.

MATERIALS AND METHODS

The study was conducted during the period of July 1992 to July 1993, in the Santa Maria Farm, County of Cornelio Procopio, in the north region of Parana State, Brazil. Ninety-six (96) crossbreed zebu, castrated male calves, with ages varying from 8 to 9 months and weights ranging from 130 kg to 200 kg, were selected from a bigger herd and allocated randomly to three groups (T1, T2 and T3) of 32 animals each on the basis of body weights. Treatments followed the experimental design shown in Table 1.

The animals of T1 group were treated with two SC injections of Doramectin at a dose rate of 200 mcg/kg on days 0 and 91. The animals of T2 group were treated with three doses of Doramectin on days 0, 91 and 152. The animals of T3

group were treated with three doses of Levamisole (3.75 mg/kg - SC) on days 0, 123 and 305, three doses of Trichlorfon (10 mg/kg - SC) and three doses of Deltamethrin (7.5 mg/kg - topic) on days 0, 185 and 273. All animals were maintained in equal paddocks separated by treatment at a stocking rate of 0.7 animal units per hectare for the entire experimental period of 364 days. Pasture consisted of "brizantao" (*Brachiaria brizantha*) and salt licks were provided as a source of Ca, P and other trace elements. Observations were made at monthly interval. At each observation day, animals were individually weighed, fecal samples were collected for nematode eggs per gram of feces (e.p.g.) counts, and coprocultures in pooled fecal sample for species determination. On the same days, clinical assessment of tick populations, presence of screwworm infestations and counts of warble nodule (*Dermatobia hominis*) were done on the same 20 animals of each group selected randomly. The number of ticks (*Boophilus microplus*) present on the right side of each animal was estimated visually and recorded as zero (0) when no ticks were present; one (1) when the number of engorged and semi-engorged ticks varied from 1 to 6; and two (2) when more than 6 ticks were present. The presence of screwworm (*Cochliomyia hominivorax*) infestations was recorded as zero (0) if absent and (1) when one or more myiasis were present. At every monthly weighing, the animals were confined the night before without food and water.

Statistical Analysis

The data collected were analyzed by the statistical method of Analysis of Variance (GLM in SAS). Variables analyzed were weight gains, geometric mean number of warble nodules, geometric mean of nematode egg counts in feces and geometric mean tick scores. The level for rejection of null hypothesis was set at 0.05.

Table 1 - Experimental Design.

Group	Treatment/Dose	Route	Treatment Day	Number of Animals
T1	Doramectin (x2) 200 mcg/kg	SC	0 and 91	32
T2	Doramectin (x3) 200 mcg/kg	SC	0, 91 and 152	32
T3	Levamisole (x3) 3.75 mg/kg Deltamethrin (x3) 7.5 mg/kg Trichlorfon (x3) 10 mg/kg	SC Topic SC	0, 123 and 305 0, 185 and 273 0, 185 and 273	32

Table 2 - Mean weight gains of cattle treated with two and three doses of Doramectin compared with the farm program for parasite control with three doses each of Levamisole, Trichlorfon and Deltamethrin.

Groups	Treatment Regimen	Initial Mean Weight (kg)	Final Mean Weight (kg)	Mean Weight Gain (Kg)
T1	Doramectin (x2)	156.66	337.60	180.94 ^a
T2	Doramectin (x3)	156.84	341.27	184.42 ^a
T3	Levamisole (x3) Trichlorfon (x3) Deltamethrin (x3)	157.00	313.81	156.81 ^b

^{a, b} = Between treatments, means with different superscripts are significantly different (p=0.0001).

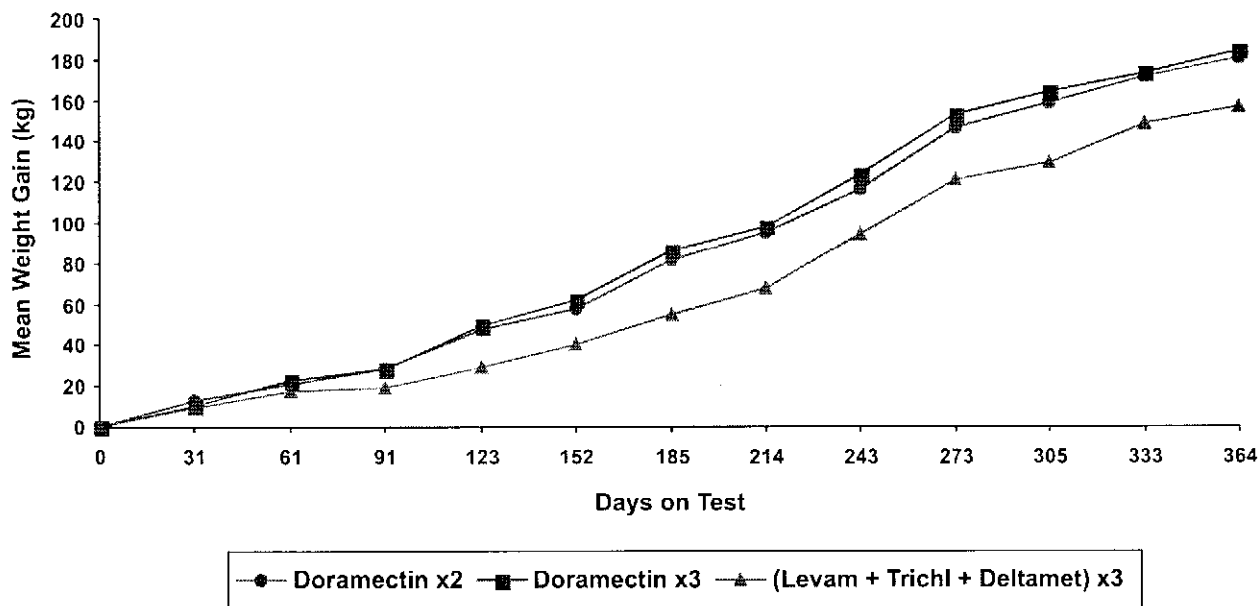


Figure 1 - Cumulative mean weight gains during the experiment.

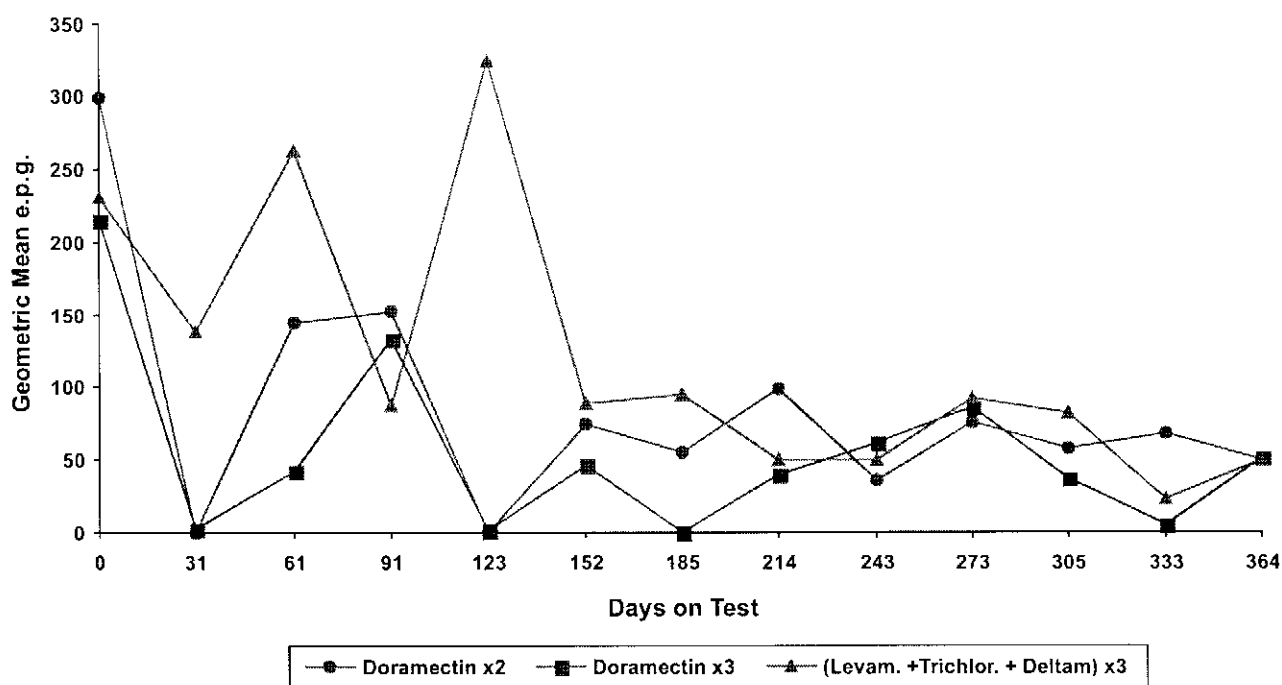


Figure 2 - Geometric mean e.p.g. at each observation day during the experiment.

RESULTS

Weight Gain

Treatment of growing beef cattle against endo and ectoparasites with two or three doses of Doramectin at a dose

rate of 200 mcg/kg of live weight resulted in significantly higher ($p = 0.0001$) weight gains than cattle treated as per the farm routine program, with three doses each of Levamisole, Trichlorfon and Deltamethrin (Table 2 and Figure 1). The mean weight gain per animal were respectively 180.94 kg, 184.42 kg

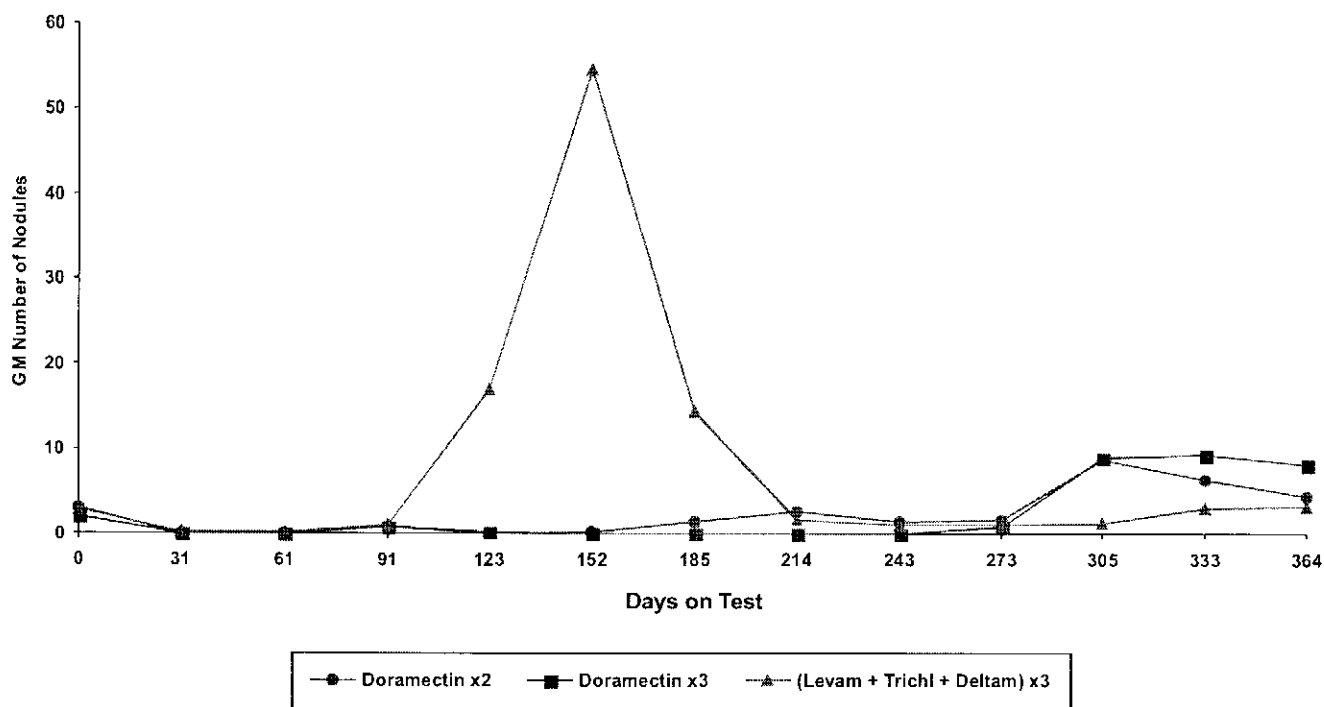


Figure 3 - Geometric mean (GM) of *Dermatobia hominis* nodules.

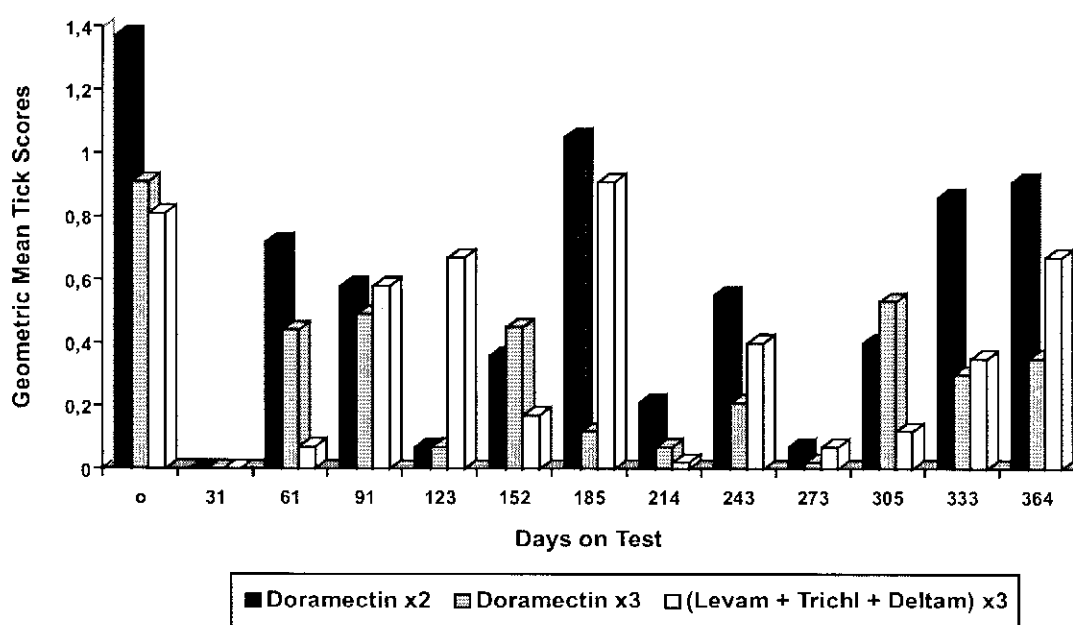


Figure 4 - Geometric means of tick scores.

and 156.81 kg for the groups treated with two and three Doramectin, and the farm program during the 364 day study period. Although the animals treated with three doses of Doramectin had higher weight gain than animals treated with two doses, the difference was not significant. Compared to the farm program, Doramectin two treatments had an improvement

of 24.12 kg and the group treated with three doses of Doramectin had an improvement of 27.61 kg per animal.

Parasite Control Nematodes

The two groups treated with Doramectin (two or three doses), had a significantly better ($p < 0.05$) control of

gastrointestinal nematode eggs output when compared to three doses of Levamisole (Figure 2). Thirty-one (31) days following each Doramectin treatment, nematode egg counts were zero and maintained at low level until the end of the experiment. The farm program-treated animals did not reduce the e.p.g. after the first dose. After the second and third doses on days 123 and 305, the e.p.g. counts were reduced in this group and maintained low counts similar to the 2 groups treated with Doramectin. No significant difference was observed between Doramectin two and three doses. The results of coprocultures (data not shown) revealed that the genus *Cooperia* predominated during the study period, mainly in the Doramectin treated groups, except during the colder months (June-July) when the number of *Oesophagostomum* was increased. It is worth to note that after Doramectin treatment, the larvae obtained in the coproculture did not develop completely to infective forms.

Tropical Warble Nodule

Tropical warble (*D. hominis*) infestations were very low at the beginning of the experiment and maintained in low level throughout the study period in animals treated with two or three doses of Doramectin (Figure 3). The warble nodule counts in the farm program-treated animals were also low when the experiment started and increased steeply from day 91 to 185 when animals received the second treatment. After the second treatment on day 185, the infestation in this group was reduced and maintained at low level until the end of the study. The overall control of warble infestations in the groups treated with two or three Doramectin were significantly better ($p < 0.05$) than in the group treated according to the farm program. There was no significant difference between two and three treatments with Doramectin.

Tick Control

Doramectin was very effective against *B. microplus* infestations for 31 days following treatment (Figure 4). At day 61 post treatment (p.t.) new tick infestations appeared, and maintained fluctuating in level throughout the experimental period in both Doramectin groups. The farm program treatment was also very effective, showing the same pattern of infestations observed in the groups treated with Doramectin. The overall performance in tick control was better ($p < 0.05$) for the three doses regimen of Doramectin and the farm program than the two doses of Doramectin.

Screwworm infestations were not found and thus no analysis was done.

DISCUSSION

Parasites management aims for their control by the use of the available technology, isolated or combined and among this concept it is included the integrated control of ecto and endoparasites. There are no much studies developed in this area of the animal health (HONER & GOMES, 1990). Following these objectives, the present study showed that the therapeutic efficacy and prolonged activity of Doramectin at a dose rate of 200 mcg/kg given subcutaneously, had a satisfactory integrated control of ecto and endoparasite in growing cattle.

HONER & GOMES (1990), raised that the presence of parasite in a cattle population may result in reduction of productivity related to the infestation level. In the case of ectoparasites, this relationship is practically linear: the greater the parasite burden present, greater will be the total losses, until the limit of tolerance of the host. Thus, the total loss may be calculated as

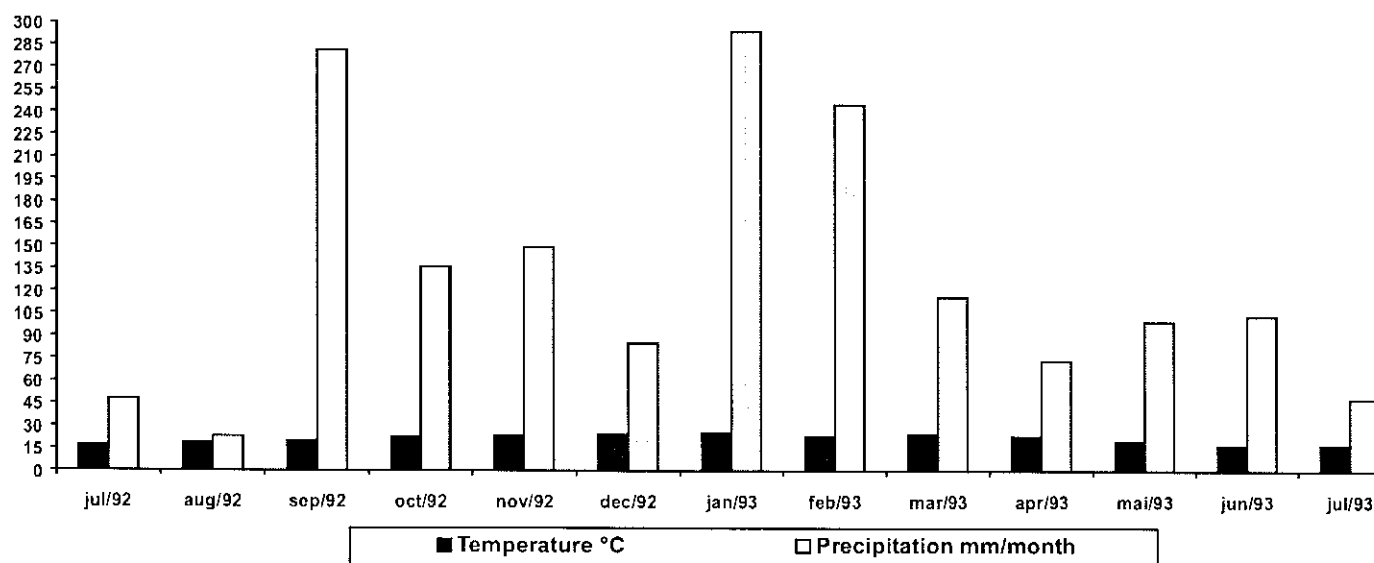


Figure 5 - Climatic data obtained from IAPAR - Instituto Agronomico do Parana - Estação de Bandeirantes. Period of July 1992 to July 1993.

the sum of the losses caused by individual ectoparasite present. In the case of helminths however, this cannot be made as it is impossible to count the number of worms present and the indirect techniques available do not permit to establish a direct relationship between infection (worm burden) and the economical loss. For this reason, it is necessary to develop strategic scheme for the control of endoparasites based on long term epidemiological observations. BIANCHIN & MELO (1984), showed that strategic antihelmintic treatments with Tetramizole in calves starting from the weaning time, resulted in improvements of 43.4 kg of weight gains per animal compared to untreated control during a period of one year. Similar results were obtained by RAMOS *et alii* (1984), when testing antihelmintic treatment schemes in weaned calves in Santa Catarina State. The animals treated three times (February- June-September) had an improvement of 18 kg per animal and animals treated four times (at 45 days interval) had an improvement of 49.61 kg more than the untreated controls, during the period of 12 months. Although the present study did not include untreated control, the better performance in the parasite control afforded by either Doramectin two or three treatments, resulted in 24.12 kg and 27.61 kg higher mean weight gain than the farm program.

The pluviometric precipitation and the temperature are the climatic factors that determine the epidemiological patterns of gastrointestinal nematodes, and the great diversity of these factors between the different regions do not permit the generalization of control schemes (HONER & VIEIRA-BRESSAN, 1992), specially in the north region of Parana State. In the present experiment, the climatic conditions were favorable for the development of nematodes, when the montly mean temperature were above 17°C and the pluviometric precipitations were above 50 mm/month during almost the entire period of the study, according to the climatic data obtained from IAPAR - Instituto Agronomico do Parana - Estação de Bandeirantes (Figure 5). Temperatures between 13°C and 26°C are adequate for the development of the larvae of *C. punctata*, *T. axei* and *O. radiatum* (WILLIAMS & MAYHEW, 1967). The minimum pluviometric precipitation favorable for nematode development is 50 mm/month (WILLIAMS & MAYHEW, 1967) and only in the beginning of the study (July-August 1992), the rain fall was below that level.

The use of Doramectin injectable at a dose rate of 200 mcg/kg of live weight in growing cattle was efficacious in the control of gastrointestinal nematodes as *Cooperia*, *Oesophagostomum*, *Haemonchus* and *Trichostrongylus* identified in the coprocultures. The results reported here, are in agreement with the results of EDDI *et alii* (1993), that reported an efficacy equal to or greater than 99.9% against those species. Thirty-one (31) days after treatment with Doramectin in this study, the e.p.g. counts were zero and the mean e.p.g. counts were low during the remaining period of the study. These results confirm those reported by VERCRUYSSSE *et alii* (1993), which evaluated the efficacy of Doramectin at the same dosage in the control of *Cooperia oncophora* in calves in field conditions. In Doramectin treated animals, the first nematode eggs appeared in fecal

samples, 40 and 46.5 days, i.e., 19 and 22 days longer than in the untreated controls. Similar results were obtained by WEATHERLEY *et alii* (1993), which conducted studies to evaluate the persistent activity of Doramectin against experimental infections of *O. ostertagi*, *C. oncophora* and *Dictyocaulus viviparus* in calves and observed a minimum period of protection of 14 days against *C. oncophora*, 21 days against *O. ostertagi* and higher than 28 days against *D. viviparus*.

The predominance of the genus *Cooperia* obtained in the coprocultures in this study, are in agreement with the studies of LIMA *et alii* (1990), in Brazil and by VERCRUYSSSE *et alii* (1993), in Belgium and the increase in the proportion of *Oesophagostomum* during the colder months (June and July), are coincident with the reported by YAMAMURA *et alii* (1989), on the occurrence of acute oesophagostomosis in cattle in the north region of Parana.

Regarding the larvae of *D. hominis*, the groups medicated with Doramectin, had significantly ($p < 0.05$) lower level of infestations than those observed in the animals treated with Trichlorfon. These results confirm the efficacy of Doramectin against *D. hominis* observed by MOYA-BORJA *et alii* (1993 a), which reported a 100% efficacy against induced *D. hominis* infestations and a prolonged activity higher than 35 days. The results of MOYA-BORJA and co-workers, also indicated a potent larvicidal activity 48 hours post-treatment, suggesting the exposure of the parasite to effective levels of Doramectin soon after injection.

The results against the cattle tick *B. microplus*, with high efficacy at 31 days p.t. in the present study, are similar to the results of GONZALES *et alii* (1993). These authors demonstrated the therapeutic and prophylactic efficacy of a single injection of Doramectin against *B. microplus* -which persisted for 20 days under conditions of continuous reinfestation and showed no development of teleoginas up to 42 days p.t. The results of the present study, show that the treatments given in October for tick control were strategic, avoiding the increase of tick population of first generation by December (LEMONS DA SILVA *et alii*, 1993). The subsequent treatments maintained the tick infestations in relatively low level until the end of the study. However, a more precise evaluation of tick control in this study, is only speculative due to the criteria adopted of scoring the level of tick infestation.

Doramectin, administered subcutaneously at either two or three doses of 200 mcg/kg regimens, had a significantly better ($p < 0.05$) performance in the control of ecto and endoparasites of growing cattle compared to the conventional farm program which used three doses of Levamisole, three doses of Trichlorfon and three doses of Deltamethrin. The better performance of Doramectin was consistent with a significantly ($p = 0.0001$) superior weight gain. Doramectin two and three treatments had respectively a mean weight gain of 24.12 kg and 27.61 kg per animal higher than animals treated under the farm program during the 364 days growing period. The difference between Doramectin two doses and three doses was not significant.

SUMÁRIO

Um estudo foi conduzido no período de julho de 1992 a julho de 1993, em Cornélio Procopio, Paraná, para avaliar a eficácia de duas e tres doses de Doramectin, administrado via subcutânea (SC) na dose de 200 mcg/kg, comparado com o programa de controle de parasitas da fazenda com tres doses de Levamisole (3,75 mg/kg - SC), tres de Trichlorfon (10 mg/kg - SC) e tres de Deltamethrin (7,5 mg/kg - tópico), em bovinos de recria. Os critérios comparativos foram: ganho de peso dos animais, contagem de ovos de nematódeos por grama de fezes (o.p.g.), escores de carrapatos *Boophilus microplus* contados na metade direita do animal e contagem de larvas de *Dermatobia hominis*. Foram utilizados 96 bovinos machos castrados, azebuados, com idade entre 8 e 9 meses, distribuídos ao acaso, em tres grupos (T1, T2 e T3) de 32 animais cada com base no peso corporal. Os animais do grupo T1 receberam duas doses de Doramectin nos dias 0 e 91. Os animais do grupo T2 foram tratados com tres doses de Doramectin nos dias 0, 91 e 152. Os animais do grupo T3 receberam tres doses de Levamisole nos dias 0, 123 e 305 e tres doses de Trichlorfon e tres de Deltamethrin nos dias 0, 185 e 273. Os animais de cada grupo foram mantidos em iguais condições, mas em pastos separados durante os 364 dias do experimento. O peso dos animais e a dinâmica parasitária foram avaliados mensalmente desde o dia -1 até o final do experimento. O controle parasitário nos animais tratados com duas ou tres aplicações de Doramectin, foi significativamente ($p < 0,05$) melhor do que nos animais controlados através do programa da fazenda. Como consequência do melhor controle parasitário, o ganho de peso dos animais tratados com Doramectin foi significativamente ($p = 0,0001$) superior com médias de 24,12 kg/animal e 27,61 kg/animal a mais nos grupos tratados respectivamente com duas e com tres doses de Doramectin comparados com o grupo tratado com o programa da fazenda durante o período de 364 dias. Não houve diferença significativa entre os grupos tratados com duas e com tres doses de Doramectin.

PALAVRAS-CHAVE: Doramectin, endoparasitas, ectoparasitas, bovino de recria.

REFERENCES

- ANDERSEN, E.II. (1962). Control of *Dermatobia hominis* in Central America. *Veterinary Record*, v. 74, p. 784-787.
- BIANCHIN, I. (1982). Uso de anti-helmintico em animais em confinamento. In: *CONGRESSO BRASILEIRO DE MEDICINA VETERINÁRIA*, 18. Balneário de Camboriú, SC, 1982.
- BIANCHIN, I.; MELO, H.J. (1984). Epidemiologia e controle de helmintos gastrointestinais em bovinos de corte nos cerrados. EMBRAPA - CNPGC, Campo Grande, MS, *Circular Técnico* n. 16, 59 p.
- EDDI, C.; BIANCHIN, I.; HONER, M.R.; MUNIZ, R.A.; CARACOSTANTO GOLO, J.L.; NASCIMENTO, Y.A. (1993). The efficacy of doramectin against field nematode infections of cattle in Latin-America. *Veterinary Parasitology*, v.49, p.39-44.
- GONZALES, J.C.; MUNIZ, R.A.; FARIAS, A.; GONÇALVES, L.C.B.; REW, R. S. (1993). The therapeutic and persistent efficacy of Doramectin against *Boophilus microplus* in cattle. *Veterinary Parasitology*, v. 49, p. 107-119.
- GOUDIE, A.C.; EVANS, N.A.; GRATION, K.A.F.; BISHOP, B.F.; GIBSON, S.P.; HOLDOM, K.S.; KAYE, B.; WICKS, S.R.; LEWIS, D.; WEATHERLEY, A.J.; HERBERT, A.; SEYMOUR, D.J. (1993). Doramectin - a potent novel endectocide. *Veterinary Parasitology*, v. 49, p.05-15.
- GUIMARÃES, M.P.; LIMA, W.S.; LEITE, A.C.R.; COSTA, J.O. (1982). Efeito de tratamento anti-helmintico sobre a produção leiteira de vacas com helmintoses sub-clínicas. In: *CONGRESSO BRASILEIRO DE MEDICINA VETERINÁRIA*, 18. Balneário de Camboriú, SC, 1982.
- HONER, M.R.; GOMES, A. (1990). O manejo integrado de mosca dos chifres, berne e carrapato em gado de corte. EMBRAPA - CNPGC, Campo Grande, MS. *Circular Técnico*, n. 22, 60p.
- JONES, R.M.; LOGAN, N.B.; WEATHERLEY, A.J.; LITTLE, A.S.; SMOTHERS, C.D. (1993). Spectrum of activity of Doramectin against nematode endoparasites of cattle. *Veterinary Parasitology*, v.49, p. 27-37.
- LEMONS DA SILVA, N.; PEROTTO, D.; CUBAS, A.; LESSKI, C.; MOLETTA, J.L.; MOTTA, J.B.O. (1993). Modelo populacional de *Boophilus microplus* (CANESTRINI, 1887) em bovinos de corte, na região sul do estado do Paraná. In: *SEMINÁRIO BRASILEIRO DE PARASITOLOGIA VETERINÁRIA*, 8 (resumos), Londrina, PR., 1993.
- LIMA, J.D.; LIMA, W.S.; GUIMARÃES, A.M.; LOOSS, A.C.S.; MALACCO, A. (1990). Epidemiology of bovine nematode parasites in Southeastern Brazil. Proceedings of the *WORLD BUIATRICS CONGRESS*, 16, Salvador, BA, Brazil, 118p., 1990.
- LOGAN, N.B.; WEATHERLEY, A.J.; PHILLIPS, F.E.; WILKINS, C.P.; SHANKS, D.J. (1993). Spectrum of activity of doramectin against mites and lice of cattle. *Veterinary Parasitology*, v.49, p.67-73.
- LUZ, E.A.T. da; SANTANA, J.C.R.; BARBOSA, S.J. (1982). Efeito de cloridrato de Levamisole no ganho de peso em bovinos de corte no sul da Bahia. In: *CONGRESSO BRASILEIRO DE MEDICINA VETERINÁRIA*, 18. Balneário de Camboriú, SC, 1982.
- MELLO, D.; QUEIROZ, J.C.; MADUREIRA, F. (1960). Efeito do 0-0 Dimetil 5 a - Mecapto-N-metilacetamidoditiofosfato em larvas da *Dermatobia hominis* e em carrapato *Boophilus microplus* em bovinos. *Arquivos do Instituto Biológico (São Paulo)*, v. 27, p.43-49.
- MOYA-BORJA, G.E.; MUNIZ, R.A.; SANAVRIA, A.; GONCALVES, L.C.B.; REW, R.S. (1993 a). The therapeutic and persistent efficacy of Doramectin against *Dermatobia hominis* in cattle. *Veterinary Parasitology*, v. 49, p.85-93.
- MOYA-BORJA, G.E.; OLIVEIRA, C.M.B.; MUNIZ, R.A.; GONCALVES, L.C.B. (1993 b). The prophylactic and

- persistent efficacy of Doramectin against *Cochliomyia hominivorax* in cattle. *Veterinary Parasitology*, v.49, p.95-105.
- RAMOS, C.I.; PALOSHI, C.G.; RAMOS, J.C. (1984). Sistemas de tratamentos anti-helmínticos para terneiros desmamados no planalto catarinense. EMPASC. *Boletim Técnico*, n.25, 23 p., 1984.
- RUEDA, C.H.; MATEUS, G. (1967). Efeito de alguns compostos fosforados sistêmicos en el control de larvas de *Dermatobia hominis* en bovinos. *Rev. Inst. Colomb. Agropec.*, v.2, p.11-12.
- VERCRUYSE, J.; DORNY, P.; HONG, C.; HARRIS, T.J.; HAMMET, N.C.; SMITH, D.G.; WEATHERLEY, A.J. (1993). Efficacy of Doramectin in the prevention of gastrointestinal nematode in grazing cattle. *Veterinary Parasitology*, v.49, p.51-59.
- WILLIAMS, J.C.; MAYHEW, R.L. (1967). Survival of infective larvae of the cattle nematodes, *Cooperia punctata*, *Trichostrongylus axei* and *Oesophagostomum radiatum*. *American Journal of Veterinary Research*, v.28, n.124, p.629.
- YAMAMURA, M.H.; VIDOTTO, O.; PEREIRA, A.B.L.; GUIMARÃES JUNIOR, J.S. (1989). Ocorrência de oesophagostomose aguda em bovinos na região de Londrina, PR. In: *SEMINÁRIO BRASILEIRO DE PARASITOLOGIA VETERINÁRIA*, 6 Bagé, RS, 1989.

(Received 10 May 1999, Accepted 22 July 1999)