Incidence and control of bovine gastrointestinal nematodes in the East of the Province of La Pampa, Argentina

SUÁREZ, V.H. [1]; MIRANDA, A.O. [1]; ARENAS, S.M. [1]; SCHMIDT, E.E. [2]; LAMBERT, J. [3]; SCHIEDA, A. [3]; FELICE, G. [1]; IMAS, D. [3]; SOLA, E. [3]; PEPA, H. [3]; BUGNONE, V.[3]; CALANDRI, H. [3]; LORDI, L.V. [3].

ABSTRACT

A cross-sectional survey including 350 stocking farms and bovine establishments that operate the full cycle (FC) as well as fattening operations (IN) was carried out in the East of the Province of La Pampa to record cases of verminous gastroenteritis (VGE) as well as control and management practices applied by the farmers. Farms were stratified by herd size into three categories: more than 900 (G), 900-500 (M) and 500-300 (P) bovines. Samples from each category were collected at random. 33% of the farmers surveyed indicated that their animals had been affected by clinical cases of VGE with morbidity and mortality rates between 11.2% and 0.42%, respectively.

More cases of VEG (P<0.004, X^2 8.33) occurred in herds on FC establishments (37%) that on fattening farms (IN) (21%); the relative risk (RR) was 1.77 (95%; IC 1.18 – 2.74) but no differences were noted between categories. Ninety-four percent of the farmers use avermectins alone (AVM) (71%) or combined with benzimidazole (BZD, 20%) or levamisole (3%); 6% use BZD alone. The percentage of use of other drugs in addition to AVM increases (P<0.005, X^2 7.80) with larger herds (G: 32%, M: 21%, P: 15%).

Of the treatments, 95.2% include avermectins alone in injectable form (82.6%) or combined with oral (16.5%) or intraruminal (0.9%) forms. Approximately 2.42 treatments per year are performed and are more prevalent (P<0.01) in G and IN farms (2.7 treatments). 35% of the farmers deworm twice a year, in the fall (between March and July) and in late winter-spring (between August and October-), 16% deworm only once (between February and April) and 12% twice (between late summer and early winter). 18% of the farmers (G: 24%, M: 18%; P: 13%) prevent VGE losses by administering treatment at a specific time of the year. 60% of the farmers consult the veterinarian although only 29% perform an egg count (hpg) although differences (P<0.001) between herd sizes were noted: G: 41%, M: 26%; P 19%. 12% (FC 10%; IN 16%). 12% of the farmers (FC 10%; IN 16%) perform a follow-up of parasite infections with an egg count and administer treatment based on this monitoring and the recommendation of a veterinarian.

94% of those surveyed indicated that VGE alone (55%) or in conjunction with other pathologies were a major problem and 30% said it was the main health problem. The study shows the economic importance of GIPs for the competitiveness of the systems in the region. The use of a significant quantity of anthelmintics, mainly avermectins, and a low participation of veterinarians in planning the controls were observed. A trend indicating that large farms and fattening operations assign more importance to control, use of anthelmintics and participation of professionals was noted.

Key words: Gastrointestinal nematodes, Cattle, Survey, Control, La Pampa.

1 INTA EEA Anguil, CC11, 6326 Anguil (La Pampa), E-mail: vSuárez@correo.inta.gov.ar
2 School of Veterinary Sciences, UNLPam, calle 5 esq. 116, Gral. Pico, La Pampa.
3 Ministry of Production, Government of La Pampa, Luro y Corrientes, Santa Rosa, La Pampa.

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INTRODUCTION

Among the health problems that affect cattle in the Province of La Pampa, gastrointestinal nematodes (GINs) merit attention since they cause significant losses in beef production. This condition, known as verminous gastroenteritis (VGE), causes a parasitosis of mixed etiology. The main genera of gastrointestinal nematodes in the Pampas and central region of the country are *Ostertagia, Cooperia, Trichostrongylus and Haemonchus* (Suárez, 1990).

Fattening calves and stocking farms are more prone to be affected and major losses occur after weaning, in the first fall-winter of grazing due to subclinical weight gain loss that may range from 9 to 22% (between 18 and 44 kg) in the spring when the animals are one year old (Suárez, 1995). In yearling steers and heifers over one year old, subclinical losses are observed in intensive grazing systems. In midsummer, when there is food shortage, weight gain losses may range from 7 to 11% (15-23 kg) as indicated previously by Suárez et al. (1999). The most frequent effect is low efficiency in grass to beef conversion due lower intake which may drop by 18 to 25% (Parkins and Holmes, 1989; Rossanigo et al., 1988; Suárez et al., 1997). Furthermore, depending of the severity of the condition, bones and muscular development may be affected (Entrocasso, 1987; Suárez et al, 1991). VGE affects the health of the animals and may cause death, among other problems. Although this is rare, the impact is high although, in general, mortality does not exceed 3%. Less frequently, animals over 18 months may develop clinical signs in late summer due to disinhibition of Ostertagia followed by infestation (Suárez, 1995).

Information on, and an estimate of the number of cases per year would allow an assessment of the magnitude of VGE in the region and the implementation of actions providing better control and therefore higher beef production efficiency.

On the other hand, competitiveness of grass-fed beef necessarily requires controlling GIPs. This need of beef farmers coupled with the availability of more effective, simple to dose, low cost anthelmintics that have been developed in the past 15 years has almost certainly led to their adoption as the main tool to control the worms. The massive use of drugs as the nearly only resource to control the nematodes probably accelerated the selection of resistant nematode populations (Anziani et al., 2004). A high prevalence (64%) of anthelmintic resistance to avermectins and benzimidazoles has been described in the western area of the Pampas region (Suárez and Cristel, 2006).

Information on cattle management practices, doses administered, anthelmintics and other methods used to control verminous gastroenteritis in bovines in the East of La Pampa is necessary as these practices, in addition to benefiting productivity, may appear as residues in cattle products and in the environment and become non-tariff barriers to foreign trade in the future or further accelerate the appearance of anthelmintic resistance. Additionally, this information is important for official bodies to design research and transfer projects and implement livestock policies that may be of use to pharmaceutical companies in the formulation of products, dosing forms and estimation of market implications, among others.

For these reasons, a survey of beef farmers in the East of La Pampa was conducted to collect basic information regarding the incidence and control of gastrointestinal nematodes in bovines.

MATERIALS AND METHODS

The survey was conducted by staff of the INTA Anguil Experimental Station and the Undersecretariat of Agrarian Affairs of the Province of La Pampa between May and July 2004 in the eastern region of La Pampa which includes the districts of Atreucó, Catriló, Capital, Quemú-Quemú, Conhelo, Maracó, Trenel, Rancul, Realicó and Chapaleufú where there are establishments operating the full cycle, some fattening operations and a few stocking farms. In addition to the responses from the farmers, the farms were divided into two groups according to the proportion of adult (cows and bulls) and young animals and fattening operations, as follows: full cycle and stocking farms (FC > 9% adults) or fattening operations (IN > 95% young animals). The farms were grouped by the number of animals they kept. Three categories were defined: 1st category (P), establishments keeping 300 – 500 heads; 2nd category (M), establishments keeping 500 – 900 heads and; 3rd category (G), establishments keeping over 900 heads. The number of farms surveyed by district and category was proportional to their size and the probability of occurrence was estimated with a 5% confidence (Cochran, 1997).

Survey data included number of bovines on the farm, husbandry area, main activity and information on gastrointestinal nematodes (GINs) in particular such as, for example, presence of verminous gastroenteritis, control methods and anthelmintics used.

For cases of verminous gastroenteritis, information on presence or absence of occurrence in the previous two years was requested and, if the response was positive, the morbidity, mortality and severity rates of the cases, category and breed of the affected animals, season of the year and type of paddock in which the cases occurred was recorded.

Information on the normal frequency of treatment, time of year and age categories treated, dosage form and type of anthelmintics administered was also requested. The form of administration was divided into: injectable, oral and intraruminal and/or their combinations throughout the production cycle. In the case of stocking farms and fattening operations, anthelmintics were divided into avermectins, benzimidazoles and levamisole and their combinations. The term “combination” refers to a practice or drug that is administered at two different times of the year, always separately.

Farmers were requested to provide information on whether they consulted a veterinarian, performed a diagnosis based on faecal egg count (hpg), had a strategic control plan for GINs and did a follow-up with an hpg.

Farmers were also asked about the importance they assigned to GINs and which were, in their opinion, the most important diseases on their farm.

The statistical analysis was based on descriptive techniques and association measures such as relative risk (RR) according to factors like establishments with more (A) or less (B) than 610 heads of cattle, production systems (FC or IN) and stocking rate. A Multiple Correspondence Factorial Analysis was also performed (Dagnelli, 1975) using STAT-ITCF (1988) software to better understand the relationship between the documented factors.

RESULTS

A total of 350 livestock establishments having a total surface area of 250,841 Hectares (average: 717 ha) and a population of 327,920 cattle (average: 937 heads) were surveyed. 63% of the cattle establishments operated the full cycle, 33% were fattening operations and only 4% stocking farms. The location of the districts and farms sampled by percentage of young bovines is shown in figure 1.

Cases of verminous gastroenteritis (VGE): one hundred and thirteen farmers (33%) in all the districts that were surveyed reported having had mild/moderate (28%) or severe (5%) clinical cases of VGE (fig. 2). Morbidity in herds affected by mild cases was 8.3% and 27.9% in those affected by the severe form of the disease and, in this case, farmers reported 2.1% mortality. Only young animals (59%) or yearling steers and heifers (35%) were affected. Only 6% of the farmers surveyed indicated that steers and cows, in addition to young animals, had been affected by VGE. Most of the affected animals were of British breeds or crossbreeds (95%) although 5% of the cases occurred in animals with zebu blood. 87% of the cases occurred between April and early October and 40% between June and August. 5% of the farmers reported that they had had problems between mid-January and March. 66% of the cases occurred in paddocks with seeded pastures whereas the remaining 26% and 8% on stover/greenfeed or rangeland, respectively. 58% of the farmers that reported these cases applied rotational grazing practices. The analysis by type of production system indicated that FC operations had more (37%) VGE cases ($P<0.004$, X^2 8.33) than fattening farms (21%) with a RR of 1.77 (95%; IC 1.18 – 2.74) although no differences by herd size of the establishments were noted. Characteristics of VGE cases by category of farm and systems sampled are included in table 1.

Nematode control practices: Anthelmintics used, frequency of annual treatments and type of treatment are shown in table 2.

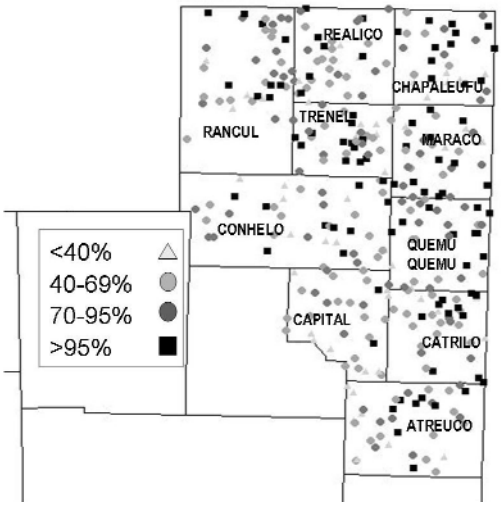

Figure 1: Percentage of young animals (calves, steers and heifers based on surveys in the Districts of: Atrucó, Catriló, Capital, Quemú-Quemú, Conhelo, Maracó, Trenel, Rancul, Realicó y Chapaleufú.

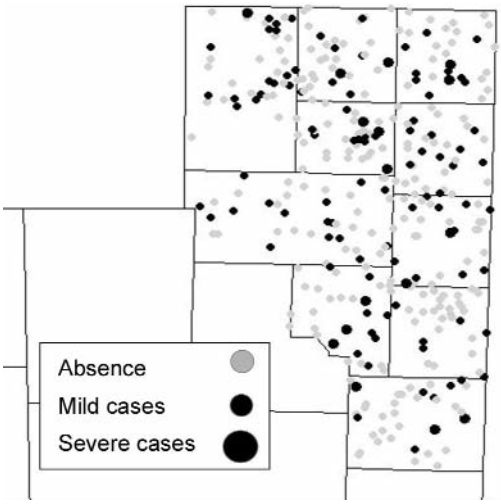

Figure 2: Cases of Verminous Gastroenteritis reported according to survey findings

Three active ingredients for nematode control were reported: avermectins (AVM), benzimidazoles (BZD) and levamisole (LVM). Over 95% of the farmers could name the anthelmintic used. Among these, 94% used avermectins as a single drug (71%) or combined with other active ingredients at a different time of the year. 53% used ivermectins (IVM) alone and 12% doramectin usually combined during the year with AVM or BZD. No farmers indicated use of moxidectin or abamectin. BZDs were mainly used in combination with another product (20%) (mainly AVM) although 6% of the farmers used it alone. 8% of the farmers surveyed reported use of ricobendazole in injectable form, usually combined with another product. Use of injectable LVM combined

Category	Positive Cases	Mean Morb. (%)	Mean Mort. (%)	Categories affected (%)	Time of year (%)	Type of paddock (%)
"G" farmers n :112 heads >901 heads. 1.70 heads/ha	31 28%	12.1	0.38	Calves: 43 Calves and yearling steers/replacement: 46 Yearling steers/ Replacement and steers/heifers: 7 Cows and/or bulls: 4	Mar-Jun: 31 Jun-Aug: 42 Aug-Oct: 19 other: 8	Pasture: 60 Greenfeed-Stover: 36 Pasture-greenfeed: 4
"M" farmers n:120 heads >501 heads 1.57 heads/ha	42 35%	9.8	0.57	Calves: 68 Calves and yearling steers/replacement: 25 Yearling steers/ Replacement and steers/heifers: 4 Cows and/or bulls: 3	Mar-Jun: 32 Jun-Aug: 39 Augo-Oct: 13 other: 16	Pasture: 60 Greenfeed-Stover: 29 Pasture-greenfeed: 6 Natural Pastures: 6
"P" farmers n:118 heads <500 heads 1.57 heads/ha	40 34%	12.1	0.30	Calves: 59 Calves and yearling steers/replacement: 30 Yearling steers/ Replacement and steers/heifers: 7 Cows and/or bulls: 4	Mar-Jun: 40 Jun-Aug: 40 Aug-Oct: 9 other: 11	Pasture: 68 Greenfeed-Stover: 16 Pasture-greenfeed: 3 Natural Pastures: 13
IN n: 109 heads 1.58 heads/ha	23 21%	10.4	0.23	Calves: 59 Calves and yearling steers/replacement: 36 Steers/replacement and steers/heifers: 5	Mar-Jun: 32 Jun-Aug: 45 Aug-Oct: 14 other: 9	Pasture: 56 Greenfeed-Stover: 22 Pasture-greenfeed: 11 Natural Pastures: 11
FC n: 241 heads 1.44 heads/ha	90 37%	11.1	0.50	Calves: 59 Calves and yearling steers/replacement: 31 Steers/replacement and steers/heifers: 6 Cows and/or bulls: 4	Mar-Jun: 46 Jun-Aug: 38 Aug-Oct: 12 other: 14	Pasture: 62 Greenfeed-Stover: 27 Pasture-greenfeed: 3 Natural Pastures: 8

Morb.: morbidity; Mort.: mortality

Tabla 1: Cases of verminous gastroenteritis reported by farmers included in the survey by number of animals on the farm (over 900 heads: G; over 500 heads: M; less than 500 heads: P) and type of production system (Fattening: IN and Full Cycle and stocking farms: FC.

with other active ingredients during the year was reported by only 3% of the farmers. Differences between farmers keeping over 610 bovines (A) and those that kept fewer animals (B) were noted; a higher percentage of A farmers combined AVMs (29%) with other drugs (BZD and LVM) than B farmers (15%). An analysis by category (table 2) showed that the use of other drugs in addition to AVM was higher among farmers that kept larger herds. 32% of the farmers that kept over 900 heads combined AVM with other active ingredients.

The injectable form predominated (95.2%) although differently by herd size (P<0.002, X^2 10.1) as 23%, 11% and 7% of G, M and P farmers indicated they combined AVM with oral or intraruminal anthelmintics during the year. Only 3.8% only used oral products and 0.9% combined intraruminals.

On average, farmers performed 2.42 ± 1.1 treatments per year and administered between one (16%) and eight (0.6%) doses. Only 0.6% did not administer anthelmintics (table 2). Fattening farms administered significantly higher (P<0.001) doses (2.7 treat./year average) than FC operations (2.3 treat./year average); 54% and 31% of fattening and FC farms, respectively, treated the animals 3 or more times per year (P<0.001, X^2 16.1). The same difference (P<0.001, X^2 10.5) was observed among farmers in category A. 45% of these farmers administered treatment more than 3 times a year whereas only 28% of those in category B did. The spatial distribution of treatment frequency is shown in figure 3.

Regarding age categories treated in FC, 10% of the farmers administered anthelmintics to cows and bulls and 1% only to bulls. Additionally, 15% of FC operations also treated

Categories	Drug used (%)	Form of application (%)	N°. of mean doses	Frequency of treatments (%)	Strategic Control Plan (%)
"G" farmers n: 112 heads >901 heads 1.7 heads/ha	AVM alone: 60 AVM + BZD + LVM: 32 BZD alone: 8	Injectable: 74 Injectable+oral +intraruminal: 23 Oral: 4	2.74	≤1 treat.: 13 2 treat: 35 3 treat.: 29 ≥4 treat: 23	Yes: : 24
Prod. M n: 120 cab. >501 1.57 cab/ha	AVM alone: 75 AVM + BZD + LVM: 21 BZD alone: 5	Injectable: 85 Injectable+oral +intraruminal: 11 Oral: 3	2.46	≤1 treat.: 15 2 treat.: 44 3 treat.: 25 ≥4 treat.: 16	Yes: : 18
Prod. P n: 118 cab. <500 1.57 cab/ha	AVM alone: 79 AVM + BZD + LVM: 15 BZD alone: 6	Injectable: 88 Injectable+oral +intrarruminal: 7 Oral: 4	2.8	≤1 treat.: 24 2 treat.: 50 3 treat.: 18 ≥4treat.: 8	Yes: : 13
IN n: 109 1.58 cab/ha	AVM alone: 72 AV+ BZD + LVM: 24 BZD alone: 4	Injectable: 81 Injectable+oral +intraruminal: 17 Oral: 2	2.70	≤1 treat: 13 2 treat.: 33 3 treat.: 31 ≥4 treat.: 23	Yes: : 23
CC n: 241 1.44 cab/ha	AVM alone: 71 AVM + BZD + LVM: 22 BZD alone: 7	Injectable: 83 Injectable+oral +intraruminal: 12 Oral: 5	2.31	≤1 treat 18 2 treat: 50 3 treat: 20 ≥4 treat: 12	Yes: : 16

AVM: avermectin; BZD:benzimidazole; LVM: levamisole; treat: treatment

Tabla 2: Anthelmintics applied, mode and frequency of use as reported by the farmers by number of animals on the farm (over 900 heads: G; over 500 heads: M; less than 500 heads: P) and type of production system (Fattening: IN and Full Cycle and stocking farms: FC).

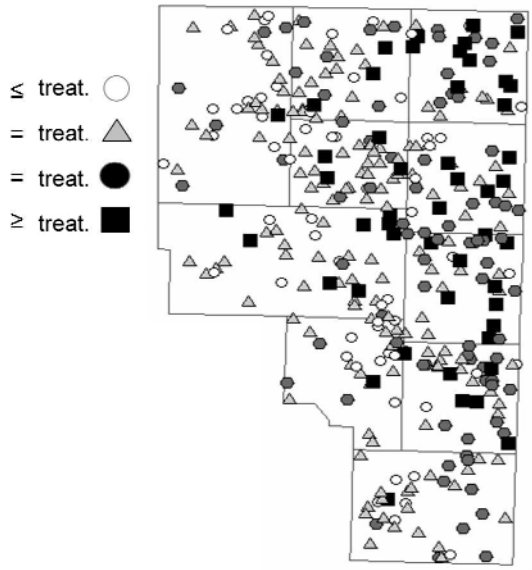

Fig. 3: Number of annual anthelmintic treatments administered to the herds as reported by the farmers

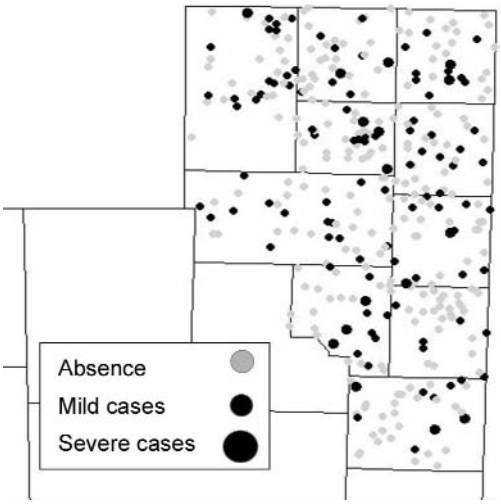

Fig. 4: Farmers that reported having a planned control strategy

yearling steers and calves and 47% of the fattening farms also dewormed the steers.

As regards the season and distribution of treatments, a significant percentage of farmers (35%) dewormed the animals twice a year, in the fall (between March and July) and late winter-spring (between August and October) whereas only 16% only once (between February and April) and another 12% between late summer and early winter. Fattening farms (33%) treated the animals every 3 months (P<0.001,

X^2 18.9), more frequently than FC operations (11%). FC establishments administered the treatment mostly in the fall and late winter-spring (P<0.02, X^2 6.6) whilst fattening farms (25%) usually between March-June and August-October.

As regards planning of treatments, 18% of the farmers (FC 16%; IN 23%) prevented weight gain loss by applying a fixed-time treatment strategy; more A farmers (22%) (P<0.04, X^2 4.28) followed this practice than B farmers (13%). The correspondence between larger herds and the use of a control strategy is shown in table 2. However, as indicated in figure 4, most of the farmers that applied strategic treatments were in the districts of Maracó and Quemú Quemú.

Diagnosis, veterinary advice and importance assigned to nematodes: As regards veterinary advice (table 3), 60% of the farmers requested advice although only 29% (IN 33%; FC 27%) performed a coprological diagnosis (nematode egg count per gram of faeces – hpg -) at least once a year. However, A farmers (36%) requested an hpg significantly more often (P<0.001, X^2 9.7) than B farmers (21%). Farmers that kept larger herds requested faecal egg counts more frequently (table 3). The spatial distribution of hpg testing, which was more frequent in the Districts of Maracó, Quemú Quemú and Atreucó, is shown in figure 5. Only 12% of the farmers (FC 10%; IN 16%) performed a follow-up of parasitic infestations with an hpg and administered treatment based on this monitoring and the recommendations of a veterinarian. In this regard, significant differences (P<0.03, X^2 5.1) were observed only between farmers that kept more (A 16%) or less (B 8%) than 610 animals and between categories of farms.

When asked about the importance they assigned to endoparasitic infections, 94% of the farmers indicated that nematodes were a major problem in beef production. When asked about which was the most significant problem on the farm (table 3) 30% mentioned GIPs as the single (55%) or most important problem together with other pathologies having different etiology. Farms with 900 heads (41%) and fattening operations (35%) tended to assign more importance to nematodes than farms that kept few animals (29%) and establishments that operated the full cycle (FC 26%). The most important health problems on the farms, as reported by the farmers, are listed in Figure 6 which shows that the importance assigned to GIPs increases towards the northeast of the province, except in Atreucó.

DISCUSSION

The number of cases reported shows the importance of VGE in the Province of La Pampa where most of the grass in converted into beef. Considering that 33% of the farmers indicated presence of clinical although mild (28%) cases of VGE, production loss in weight gain of the animals could be estimated at not less than 20% without including lower carcass quality (Suárez, 1995). In addition to lower weight gain there are surely other losses in herds where GIPs are not detected (subclinical cases) (67%) and, according to observations in the region (Suárez and Busetti, 2000), subclinical losses in weight gain could range from 7 to 15%. Based on these findings, fewer cases occur in fattening herds probably because more importance is assigned to parasite control either through more frequent use of anthelmintics or control strategies. The same trend was also observed among farmers that keep large herds. Another possible explanation could be that fattening farms perform better checks on incoming animals and that full cycle operations do not keep animals for fattening totally separate from cal-

Categories	Main problem: GIPs	Consult veterinarian	Perform hpg	Administer doses based on diagnostic follow-up with hpg
"G" farmers >900 heads	41%	62%	41%	19%
"M" farmers >500 heads	28%	62%	26%	12%
"P" farmers <500 heads	31%	57%	19%	6%
Fattening	35%	66%	33%	16%
FC	26%	58%	27%	10%

Tabla 3: Use of coprological diagnosis (hpg) and importance assigned to GIPs as reported by farmers included in the survey by number of animals on the farm (over 900 heads: G; over 500 heads: M; less that 500 heads: P) and type of production system (Fattening: IN and Full Cycle and stocking farms: FC

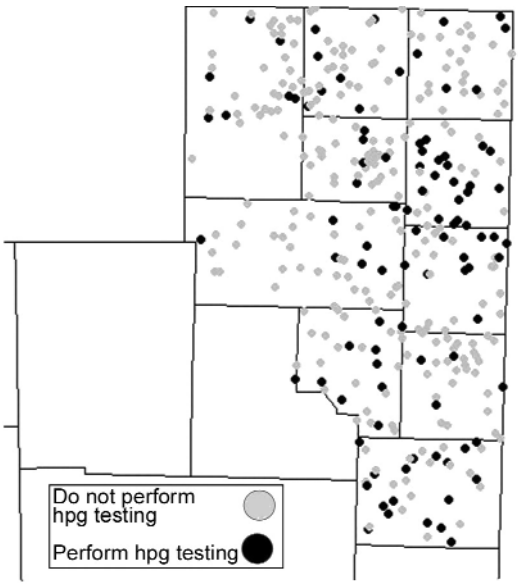

Fig. 5: Farmers that use hpg testing as a diagnostic tool

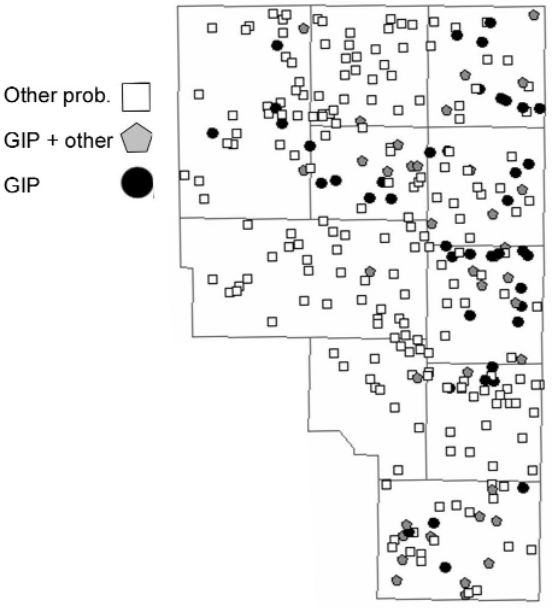

Fig. 6: Main animal health problem in the opinion of the farmers surveyed: -Only gastrointestinal parasites -GIPs plus one or two more problems (GIPs + other) -Other health problem

ves which could facilitate contamination of the paddocks having more susceptible animals or make control measures more difficult. The high level of nematode resistance in the herds of the region would also be a warning as regards production losses caused by the lower efficacy of the drug, as reported by some farms in Córdoba and Buenos Aires (Anziani and Fiel, 2004) where clinical signs and death of bovines (3.7%) occurred due to mixed infestations in spite of the administration of avermectins and benzimidazoles.

As regards control practices, results clearly show a high use of avermectins (96%) in the region and frequency of anthelmintic administration. A slight reduction in the use of AVM alone was noted on large establishments which prefer to combine AVM more frequently with BZD throughout the fattening period. In the short term this massive administration of AVM (mainly ivermectin) could cause resistance not only to Cooperia but also to other genera of nematodes that would considerably endanger the sustainability of nematode control since the drugs are not renewable resources and the industry currently has no plans to invest in developing new anthelmintics for use in cattle. A survey on prevalence of anthelmintic resistance in bovines conducted in the western Pampas region indicated a significant association between 3 or more applications of anthelmintics and anthelmintic resistance in the herds (3.7%). Studies on the extended effect of macrocyclic lactose residues on coprophilic fauna that participate in the breakdown of faeces of grazing bovines showed the toxicity and negative impact of these residues on the environment (Herd, 1995; Suárez, 2002). In addition to having a negative incidence on the sustainability of the environment and appearing as residues in products such as beef, this could have an incidence on exports of derived products in a not too distant future. It should be noted that of the 350 farmers surveyed, none indicated that they administered moxidectin to the animals which, as demonstrated in previous studies, is more environmentally friendly (Doherty *et al*, 1994; Suárez *et al.*, 2003).

Most farmers (95.2%) use the injectable form and prefer AVM because it is simple to administrate and probably because of its broad spectrum, extended action, safety and, in recent years, lower cost of generic formulations. The findings also show that in spite of the availability of injectable formulations of ricobendazole (8%) and levamisole (3%) these drugs are not much used. Regarding other dosage forms, oral anthelmintics (16.5%) are rarely used and intraruminal formulations even less (0.9%). None of the farmers use pour on formulations which differs from the practice in other countries, like New Zealand, where this is the most widely used form.

As regards treatments, most of the herds (35%) are treated twice a year (in the fall and late winter or spring) which does not provide good control of parasites since an effective reduction of the parasitic load in calves at the beginning of the fall depends on forage management and pasture contamination (Suárez, 1994). Intensive systems usually require more than one treatment per year. Treatments in early spring are often insufficient to prevent nematode-related weight loss as growth of the calves in winter is not compensated later which, in turn, affects the conformation of the carcass (Suárez, 1995). Oppositely, 17% of the farmers (mainly those that keep larger herds) deworm the animals 4 times a year or more. Depending on the farm management system, this practice is not always in line with the epidemiological patterns and, in many cases, this number of treatments is unnecessary. 18% of the farmers (mainly those that keep larger herds) apply treatments at a specific time of the year

but not all apply a rational strategy based on the epidemiological patterns (Suárez, 1994) of GIPs in the region to effectively prevent possible production losses.

Regarding veterinarians providing advice and diagnostic services, although a high percentage of farmers responded they retained a professional, in practice only 29% (mainly large farmers: 41%) consult a veterinarian for hpg testing and, to a lesser degree (12%) for hpg-based diagnostic monitoring and treatment based on the results. Although farmers assigned great importance to GIPs, data shows that control is mainly based on the administration of drugs with little professional intervention. However, the survey indicated that large farms and fattening operations assign more importance to GIPs, plan controls more effectively and request more support from veterinarians. This could probably be explained by the lower incidence on costs due to the production scale, better access to information or more informed farmers.

CONCLUSIONS

This study demonstrates the economic importance of GIPs for the competitiveness of the systems in the region not only because of the number of cases reported and their consequences on beef production but also because of the cost of using anthelmintics and other control measures.

Results also indicate intensive use of anthelmintics, principally avermectins, which could potentially affect the sustainability of the systems as it accelerates selection of resistant vermin populations and affects the environment or could result in trade restrictions due to the presence of residues.

Finally, in spite of the importance that farmers assign to GIPs, the survey does not indicate a high participation of veterinarians in GIP testing and few farmers have control strategies that respond to the epidemiological patterns of the disease suggesting that there is a need for outreach activities involving planning and implementation of the most appropriate control methods for the different systems or types of herds. A trend indicating that larger farms and fattening operations assign more importance to control, the use of anthelmintics and the participation of professionals was noted.

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