Veterinary Parasitology 200 (2014) 271–275

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Impact of integrated gastrointestinal nematode management training for U.S. goat and sheep producers

N.C. Whitley[a,*], S.-H. Oh[a], S.J. Lee[a], S. Schoenian[b], R.M. Kaplan[c], B. Storey[c], T.H. Terrill[d], S. Mobini[d], J.M. Burke[e], J.E. Miller[f], M.A. Perdue[b]

[a] North Carolina Agricultural and Technical State University, Greensboro, NC, USA
[b] University of Maryland Extension, Keedysville and Princess Anne, MD, USA
[c] University of Georgia, Athens, GA, USA
[d] Fort Valley State University, Fort Valley, GA, USA
[e] USDA-ARS, Booneville, AR, USA
[f] Louisiana State University, Baton Rouge, LA, USA

ARTICLE INFO

Article history:
Received 3 July 2013
Received in revised form 24 October 2013
Accepted 30 October 2013

Keywords:
Gastrointestinal nematodes
Integrated parasite management
Small ruminants

ABSTRACT

The objective of this study was to determine the impact of integrated parasite management (IPM) training, including FAMACHA© eyelid color scoring, on the ability of U.S. sheep and goat producers to control gastrointestinal nematodes (GIN) on their farms. A survey was developed and provided to over 2000 producers trained from 2004 to 2008 in IPM with questions involving farm size (number of sheep/goats), location (U.S. state), impact of training on parasite control efforts and parasite problems on farm, and IPM practices used. Responses were divided into U.S. Census regions of the U.S. Descriptive statistics and logistic regression were used to describe results. Most of the 729 respondents were from the southern region of the U.S. (54.3%) and were small-scale producers (50 or less animals; 64.8%). Nearly all of the respondents (95.1%) agreed that IPM workshop attendance made a difference in their ability to control and monitor parasitism in their herd or flock and employed IPM practices to control GIN (96.3%). The most popular practices respondents used were rotational grazing (71.2%), genetic selection (choosing a parasite resistant breed and/or culling susceptible animals; 52.7%), grain supplementation on pasture to improve nutrition (44.0%), and increased height of plants being grazed (41.8%). Although reporting using a practice decreased ($P < 0.05$) the likelihood of reporting fewer problems, for each 1-point increase in the number of practices which producers employed to control internal parasitism in their herd or flock, they were 16% more likely to report fewer GIN problems ($P < 0.05$). Approximately 75% of respondents indicated an economic benefit of IPM on their farm ($P < 0.05$), and those reporting savings of over $80 were more likely to report fewer problems ($P < 0.05$) with parasites after the training while those reporting no economic benefit were less likely to report fewer problems with GIN ($P < 0.001$). Overall, IPM training resulted in positive impacts for producers responding to the survey and should continue.

1. Introduction

Small ruminant production is an important part of the livestock industry worldwide, and has grown in popularity in the U.S., especially over the last 30 years. This growth is primarily due to an increase in ethnic markets, and a

* Corresponding author at: North Carolina Agricultural and Technical State University, PO Box 21928, Greensboro, NC 27420, USA.
Tel.: +1 336 285 4684; fax: +1 336 334 7432.
E-mail addresses: ncwhitle@ag.ncat.edu, whitleyniki@yahoo.com (N.C. Whitley).

0304-4017/$ – see front matter
http://dx.doi.org/10.1016/j.vetpar.2013.10.029

mounting interest in alternatively produced livestock such as organic, grass-fed and others (Green and Kremen, 2003). However, a major obstacle to continued growth of small ruminant production is gastrointestinal nematode (GIN) parasite infection. The most challenging GIN in the industry is the blood-feeding *Haemonchus contortus*, or barber pole worm.

In order to help producers address the challenges of GIN, the American Consortium for Small Ruminant Parasite Control (ACSRPC) was formed. This group of scientists, extension specialists and veterinarians has concentrated on developing research-based options to make up a toolbox of practices for controlling parasites. One of the tools used to combat specifically *H. contortus*, is the FAMACHA© eyelid color scoring chart and system. This decision making tool, originally developed in South Africa (Van Wyk, 2001; Van Wyk and Bath, 2002) but validated for use in the U.S. (Kaplan et al., 2004), is designed to identify anemic animals for targeted, selective anthelmintic (deworming) treatment. In addition to use of the chart, techniques for parasite control include grazing strategies (Burke et al., 2009), use of improved nutrition and breeding (Torres-Acosta et al., 2004), and others (Terrill et al., 2012).

Although training was conducted in smart drenching and FAMACHA© previously, in 2008, a comprehensive training manual was developed based on information gathered through work of the ACSRPC (Terrill, 2013), and users can update training materials as needed. The training manual is used for education of trainers who are then able to use the information in the manual to provide instruction to small ruminant producers. This study was designed to determine the impact of such integrated parasite management (IPM) training on the ability of U.S. goat and sheep producers to control parasites on their farms.

2. Materials and methods

2.1. Data and sample

From 2004 to 2008, IPM training was conducted in the United States to help sheep and goat producers who wanted to improve control of gastrointestinal parasites on their farms. The main focus of the training was the FAMACHA© eyelid color scoring system, but this training opportunity was enriched by including additional practical and important information necessary for proper implementation of IPM. Training included information on common GIN parasites and their life cycles, anthelmintic (dewormer) classes, issues with parasite anthelmintic resistance, methods to determine possible GIN anthelmintic resistance on farms, and research involving possible alternative or natural products for GIN control. The training also included information about best management practices to control GIN and manage anthelmintic resistance, such as animal and facilities management, rotational and/or multi-species grazing, breed selection, genetic selection, forage selection and pasture management, fecal egg counting, and smart drenching (proper use of anthelmintics). Detail information similar to that provided in the trainings is available in the proceedings from the 2013 American Consortium for Small Ruminant Parasite Control 10th Anniversary Conference, available online at www.acsrpc.org.

The goal was to survey those producers that had at least one season available for use of knowledge and skills learned at the training before responding. From April 2009 to July 2010, The Cooperative Extension Program at North Carolina A&T State University, in cooperation with members of the ACSRPC, mailed or emailed follow-up surveys to over 2000 training participants. Email messages sent to the participants included a link to the survey hosted online by SurveyShare©. Individual trainers also solicited responses using their websites and mailing lists. A total of 729 surveys were completed, including paper ($n = 224$) and online responses ($n = 507$). Participant responses were grouped by U.S. Census regions as follows: Northeast: CT, NH, NY, MA, ME, PA, RI and VT; Midwest: IA, IL, IN, KS, MI, MN, MO, NE, ND, OH, SD and WI; South: AL, AR, GA, FL, KY, LA, MS, NC, OK, SC, TN, TX, VA and WV; West: AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA and WY (available at www.eia.gov).

2.2. Data analysis procedure

The IBM Statistical Package for the Social Sciences (SPSS) version 21 was used to analyze data. Descriptive statistics were employed to describe the overall results of the survey. A binary logistic regression was used to determine how well the set of predictor variables explained the ability of producers to control parasites after IPM training. The dependent variable of problem level after training was coded as "1" if a producer had fewer problems with internal parasites after the IPM training and "0" if a producer had the same or more problems with internal parasites after the IPM training. The model contained six independent variables: (1) census region of the U.S., (2) use of the FAMACHA© eyelid color scoring chart to help make deworming decisions, (3) economic benefit in the first year after the workshop, (4) number of practices which producers employed to control GIN, (5) using practices to help control GIN in herd/flock, and (6) farm size (number of goats/sheep). For categorical independent variables, each category was compared with a reference group. A significance level of $\alpha = 0.05$ was used. Possible differences among results for paper compared to electronic response methods were determined using one way ANOVA for continuous variable data (number of practices only) or Chi-square analysis for categorical data (all other variables).

For the binary logistic regression analysis, the full model was statistically significant with $\chi^2(df = 9, n = 681) = 82.27$, $P < 0.05$, indicating that the model was able to distinguish between the producers who had fewer problems with GIN after the IPM training and those who had the same or more problems. Based on the value of Nagelkerke R^2, the model as a whole explained 16.4% of the variance in level of problems with internal parasites. Overall, 74% of respondents were correctly classified as those who would have fewer problems after the IPM training. The Chi-square value for the Hosmer–Lemeshow Goodness of Fit Test was 6.765 with a significance level of 0.562 ($P > 0.05$), indicating support for the model (Pallant, 2007).