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Poster #43

The Evaluation of Three Feeding Regimens and Three Anthelmintics in a Meat Goat Production System: a Florida A&M University Research/ Extension Project

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ABSTRACT.

Food safety starts at the farm gate. Proper management and feeding are important to the productivity and survivability of the farm as well as to the health and safety of the food supply. Nutrition and internal parasites are two factors that affect the growth of the meat goat industry in Florida. The project evaluated three common feeding strategies [(i) a cracked corn feed, (ii) a 12% crude protein commercial feed, and (iii) a 16% crude protein commercial feed)] and three anthelmintics for their effects on weight gain and economic efficiency, and any resistance among the herd, respectively. The results indicated that the 12% crude protein commercial feed-feeding regimen was the most economical / sustainable, and had the lowest weight gain. In addition, the results indicated that Florida A&M University, Research Extension Center herd might be resistant to the Levamisole type anthelmintic. One of the objectives, also, was to apply the most efficient resources to maintain food safety. The aim is to attain healthier animals through proper nutrition, weight gain and carcass quality, thereby maximizing safe food supply.

KEYWORDS: food safety, anthelmintic, resistance

INTRODUCTION

Feed management and internal parasites are two of the biggest constraints to the growth of the meat goat industry in Florida. Proper management of these issues is a necessity to the survival of a small ruminant enterprise in terms of profitability and productivity. Producers must think of efficiency and effectiveness when developing a management system for their herd.

In most livestock production systems, cost of feed amounts to 60-75% of the total cost of production. Feed efficiency is, therefore, key to the profitability of a livestock project. The basic goal of feed efficiency is to maximize profits while assuring that the animals receive the necessary amount of nutrients to perform for growth and development. For small farmers in particularly, sustainability is important.

Internal parasite infection is one of the biggest problems in the small ruminant industry. Internal parasite infestations of herds cause great losses to the producer by decreasing the performance ability of the herd. Since anthelmintic resistance among goat herds is increasing, the proper management of internal parasites is extremely important to the success of the goat producer. The misuse (or overuse) of anthelmintics is one of the main cause of the build up of resistance. Misuse and overuse of anthelmintics also impact the farmer economically, as anthelmintics can be very expensive (Waller, 2004). Goat producers must be knowledgeable about proper internal parasite management techniques, especially in tropical and subtropical areas like Florida, where internal parasites are a major problem.

The purpose of this project was to evaluate the effectiveness of three common feeding strategies on weight gain and economic efficiency. The project also evaluated three anthelmintics to detect if there was a resistance at the Florida A&M University Research and Extension Center (FAMU REC).

MATERIALS AND METHODS

Weight Gain Analysis:

Thirty-six kids with an average live weight of 36.1 pounds and an average age of five months were used to conduct this study at the Florida Agricultural and Mechanical University Research and Extension Center (FAMU REC) in Quincy, FL. The eight week study was conducted on bahia grass pastures between September and November 2006.

For the feeding regimen evaluation, the animals were randomly placed into three groups of 12 animals with similar average weights. The first group was fed cracked corn (corn) at the rate of 1.0 lb per animal daily and was allowed to graze freely on pasture. The second group was fed a 12% crude protein commercial feed (12%CP) at the rate of 1.0 lb per animal daily and was also allowed to graze freely on pasture. The third group was fed a 16% crude protein commercial feed (16%CP) ad-libitum but was limited in their ability to graze. The conditions of the third treatment simulated a feedlot situation. The animals of the 16%CP group were placed on a smaller amount of pasture land (approximately half the area of the other two groups) in order to increase the stocking density. The pasture of the 16%CP group was also cut to the ground weekly to allow only minimal access to grass. All the animals were weighed every two weeks (Days 0, 14, 28, and 54) for the duration of the study.

The animals in each feed regimen were then randomly divided into three groups of four animals and were treated with either avermectin (Cydectin© at 1 milliliter per 25 pounds), albendazole *(*Valbazen© at 0.75 milliliter per 20 pounds), or levamisole *(*Levaso*l*© at 1 milliliter per 50 pounds). The dosages were based on the suggested rates on the label. The selection of animals for the evaluation of the anthelmintics was done so that there would be an even number of animals among each feed regimen. Fecal samples with an average weight of 1.6 grams were collected from each animal every two weeks (Days 0, 14, 28, and 54) in order to conduct a fecal analysis. Fecal egg counts (FEC) were determined with a simple flotation procedure using a salt flotation solution. The Fecal Egg Count Reduction Test (FECRT) was used to test for resistance among the anthelmintics. The FECRT is the percent reduction of the FECs from Day 0 to Day 54. Resistance in a herd is suspected if the reduction is less than 90 percent (Luginbuhl, 1998).

Economic Analysis:

Economic efficiency was evaluated by measuring the cost of production and weight gain per pound of feed used. Marginal productivity (MP) was calculated as the gain in live weight that resulted from consuming one additional pound of feed. The marginal factor cost (MFC) and the marginal value product (MVP) were computed to determine and compare the optimum least cost production. The MFC is basically the average price per pound of feed. The MVP is the change in the total value of the product (change in live weight multiply by the price received per pound of weight) as a result of feeding one additional unit of feed. The difference between the MVP and the MFC was used to determine if the feeding regimen would earn more revenue than it would cost to follow the regimen. If the MVP is greater than the MFC, the regimen results in a product that could possibly earn a profit when considering only the cost of feed. Also, note that the comparison between the regimens was based only on the purchased inputs of feed and not the other costs related to the management of the animals such as the economic value of the pasture, the cost of medications, etc. The comparison relates the relative efficiency in live weight gain and profit potential between the feeding regimens with respect to the use of purchased inputs (McGowan & Leong, nd). The feed conversion rate and the feed per pound of weight gain were also calculated.

Fecal Analysis:

The fecal egg count (FEC) was used to identify the level of internal parasite infestation. The level of infestation was evaluated based on the following chart, which is the protocol for the FAMU REC.

100-250 EPG = Not a significant amount
250-500 EPG = Low infection level
500-1000 EPG = Moderate infection level
>1,000 EPG = High infection level

Statistical analysis was done using the general linear model procedure (PROC GLM) of SAS© software (SAS Institute, Inc., 1998). Significant differences were analyzed using the Least-squared Denominator test, using a level of significance of alpha=0.05. The percent reduction of the fecal egg counts from Day 0 to Day 14 was calculated and used to determine if there was resistance to the particular anthelmintic based on the limit of 90%.

RESULTS AND DISCUSSION

Weight Gain:

Animals under the 16%CP feeding regimen had the highest average weight, while animals in the 12%CP feeding regimen had the lowest average weight (Figure 1). Overall, animals under the 16%CP feeding regimen had the highest mean weight gain compared to the other treatments. The reason could be linked to the higher plane of nutrition because of the high protein level of the 16% feed and to the fact that the animals in this group were fed *ad libitum*. For the corn group, the weight gain was higher than that of the group fed with the 12%CP feed. This could relate to the fact that the corn feed contained more energy than the 12%CP feed. For the 12%CP group and the corn group, weight loss began to occur during the 55-70 day period, whereas the animals in the 16%CP treatment continued to gain weight. One possible explanation for this is that the quality of the pasture normally begins to decrease as winter approaches. The 12%CP group and the corn group relied on pasture more than the 16%CP group, which was limited in its ability to graze and was given supplement *ad libitum*.

Economic Analysis

While the aim is to attain healthier animals through proper feeding and management techniques and strategies, economic efficiency and sustainability is also important. The group fed 16%CP resulted in the highest cost of feed per pound gain at $1.80 per pound of gain (Table 1). Although this is expected because protein is normally the most expensive component of a feed, the cost per pound of gain for this regimen is more than the average price that producers receive per pound of live weight, which is $1.25 per pound (Cosenza et al., 2003). Basically, this regimen would result in a producer spending more on feed than the revenue they would receive per pound of gain when the animal is sold, which would result in a negative profit. Although the average weight gain of goats in the 12%CP group was the lowest, it cost $0.79 for enough feed to produce a pound of gain. Additionally, the difference between the MVP and the MFC was the greatest for the 12%CP, which means that this feeding regimen has the possibility to produce the greatest amount of profit out of the three regimens evaluated when comparing the cost of feed to the potential revenue. Thus, the 12%CP feeding regimen is the most economically efficient.

Fecal Analysis:

The average FEC of the entire herd remain in and around the "not a significant amount" to the "low infection level" throughout the study. Although some individuals had large fecal egg counts at times, the average remained low. This also points to the need to treat individual animals instead of the entire herd because it is usually a minority of animals that shed the majority of the parasites.

Overall, the total worm FECs were similar for each feeding regimen**.** The difference in FECs over time did not change significantly, but a decreasing trend can be observed (Figure 2). The FECs decreased on Day 14 because of the effects of treatment with anthelmintics and increased after Day 14 because of re-infestation of the herd by parasites on the respective contaminated pastures. On Days 42 and 54, the animals in the 16%CP group had significantly higher FECs than the other two groups. The higher FEC could be attributed to the higher stocking density of the group in the 16%CP group and the lower grass levels of the paddock of this group, which could have led to a faster rate of re-infestation. In addition, the 16%CP group had the highest FEC's of Eimeria and Strongyloides (Figure 3). The FECs of Haemonchus, Nematodirus, and Monezia were similar for each feeding regimen.

The average FEC over all days for each anthelmintic were similar (Figure 4). Generally, the efficacy of the different common anthelmintics when used properly is trivial and should not be used to decide which anthelmintic to use. Although the three anthelmintics had similar FECs on Day 0, animals treated with levamisole had the highest mean FEC on Days 14 and 28. The percent reduction in FEC according to the FECRT described previously was found for each anthelmintic (Table 2), and it is suspected that the herd at the FAMU REC might be resistant to levamisole. Scarfe (1993) suggests that a less than acceptable FEC reduction could also indicate an improper dosage or an improper administration of the anthelmintic evaluated. After the completion of this study, the dosage of levamisole was increased and another FECRT was performed. The reduction in the fecal egg counts of the animals treated with levamisole increased but more research needs to be done in order to make a conclusion. If under-dosing or improper dosing is suspected on a farm, those issues should be addressed relatively quickly as they will accelerate the build up of resistance. In addition, it is important to note that resistance varies between herds and the fact that resistance is suspected in one herd does not mean that another herd will also have the same level of resistance. The FECs between all anthelmintics at Day 54 were similar, which suggest that all the drugs no longer had any residual effects and were excreted from the system by this time.

The effects of the anthelmintics on the FECs of the individual species of parasites were also similar (Figure 5). According to the product labels, avermectin and levamisole are not effective against Monezia; whereas, albendazole is effective against Monezia. The mean FECs of Eimeria (coccidia) were similar for each anthelmintic. None of these anthelmintics are effective against coccidia. Coccidiosis is normally treated with sulfa drugs (Albon©) and Amprolium (Corid©). The sulfa drugs do not directly cure the coccidiosis but instead prevent secondary bacteria diarrhea.

CONCLUSION

Many of the methods of evaluation used in this study including the economic efficiency, weight gain, the FEC, and the FECRT can all be done on the farm of the average producer. It is important to evaluate feeding regimens for economic efficiency and their effect on animal performance. The most expensive feeds are often the least economically efficient. It is suggested that an extension agent be contacted to help develop a suitable feeding regimen for a particular production system.

For this study, the most economically efficient feeding regimen was the 12%CP feeding regimen although this feeding regimen had the lowest weight gain. With regards to the use of anthelmintics to control internal parasites, the most important consideration when using an anthelmintic is not what anthelmintic is used but proper dosage and administration techniques to impede the build up of resistance. It is important to consult a credible and knowledgeable source on proper management of internal parasites because many stress the importance of finding methods of parasite control that will allow producers to decrease their reliance on anthelmintics. The ability to properly manage and evaluate feeding regimens and internal parasite infestations will be beneficial to any goat producer.

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Parameters Evaluated	Corn	12%CP	16%CP
Initial Avg. Weight (lbs)	32.2	31.3	32.0
Final Avg. Weight (lbs)	42.6	40.2	45.4
Avg. Weight Gain[a] (lbs)	10.4	8.9	13.4
Avg. Feed Consumed[b] (lbs)	69.9	70.5	136.0
Feed Conversion Rate[c] (lbs)	1 : 6.7	1 : 7.9	1 : 10.1
Feed Cost/Pound of Feed[d]	$ 0.17	$ 0.10	$ 0.18
Feed Cost/ Pound of Weight Gain[e]	$ 1.14	$ 0.79	$ 1.80
Marginal Productivity[f]	$ 0.15	$ 0.13	$ 0.10
Value of Marginal Product[g]	$ 12.99	$ 11.16	$16.80
Marginal Value Product[h]	$ 0.19	$ 0.16	$ 0.10
Marginal Factor Cost[i]	$ 0.17	$ 0.10	$ 0.18

Table 1. Analysis of the economic efficiency of three feeding regimens.

[a]Avg. Weight Gain (AWG) = (Final Avg. Weight – Initial Avg. Weight)
[b]Avg. Feed Consumed (AFC) = Amount Fed / Number of Days
[c] Feed Conversion Rate (FCR) = AFC / AWG
[d] Feed Cost/Pound of Feed (FC:F) = Cost of Feed / Total Amount of Feed
[e]Feed Cost / Pound of Weight Gain (FC:WG) = FC:F x AFC / AWG
[f]Marginal Productivity (MP) = AWG / AFC
[g]Value of Marginal Product (VMP) = (AWG x price per pound of weight) /AFC
[h]Marginal Value Product (MVP) = VMP / AFC
[i]Marginal Factor Cost = FC:F

Table 2. Fecal egg count reduction test (FECRT)

	Avermectin	Levamisole	Albendazole
FECRT[a]	0.95	-0.11	1.00

[a]FECRT equals the average fecal egg count of Day 0 minus the average fecal egg count of Day 14 divided by the average fecal egg count of Day 0.

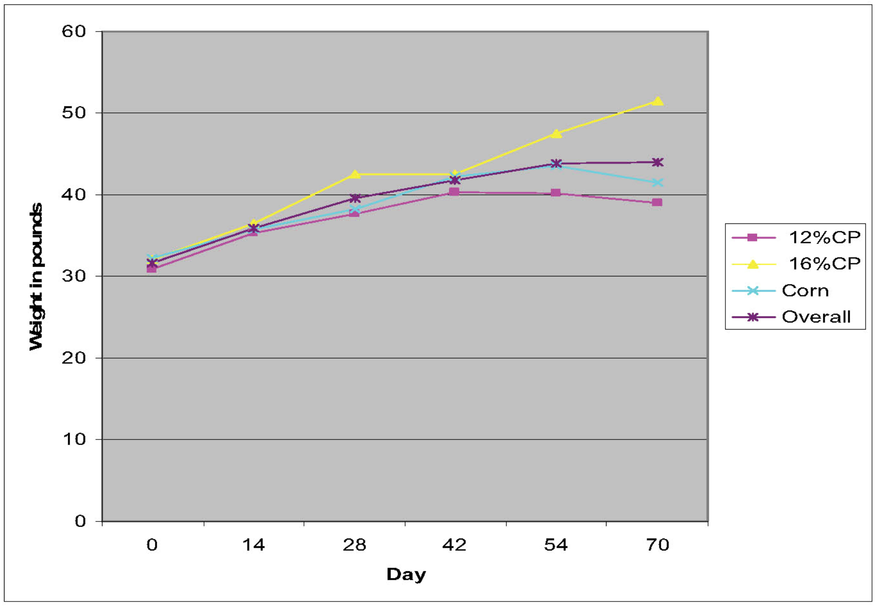

Figure 1. Average weight by feed regimen over time

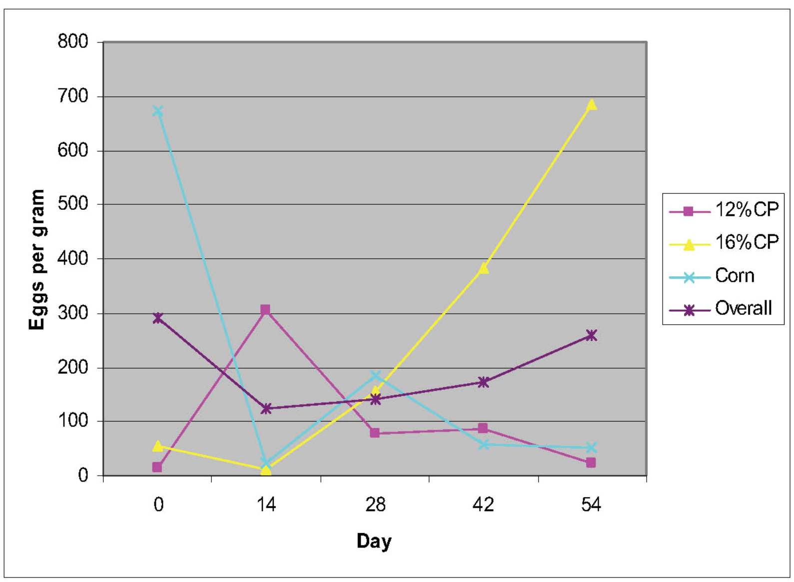

Figure 2. Fecal egg counts by feed regimen over time

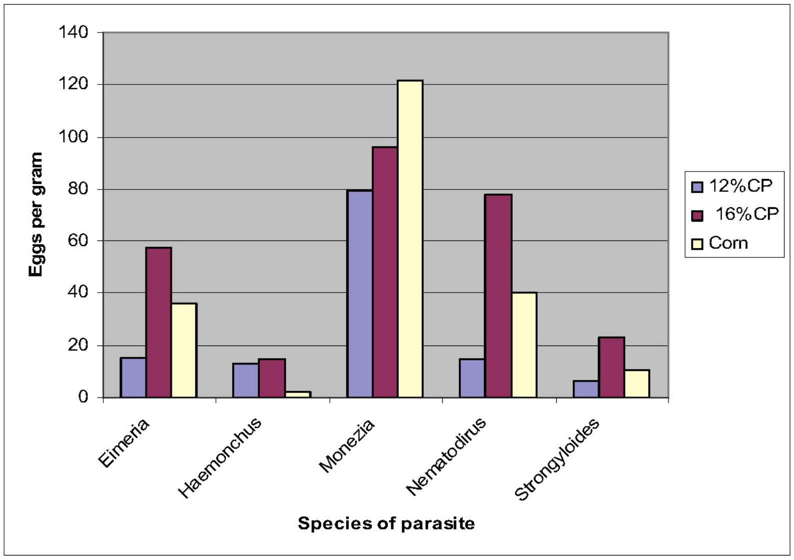

Figure 3. Fecal egg counts by species of parasite for each feed regimen

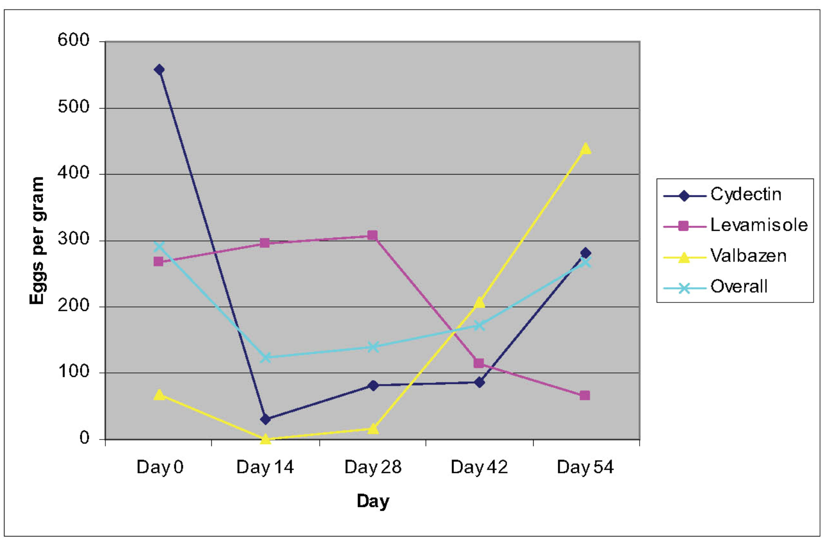

Figure 4. Fecal egg counts by anthelmenthic

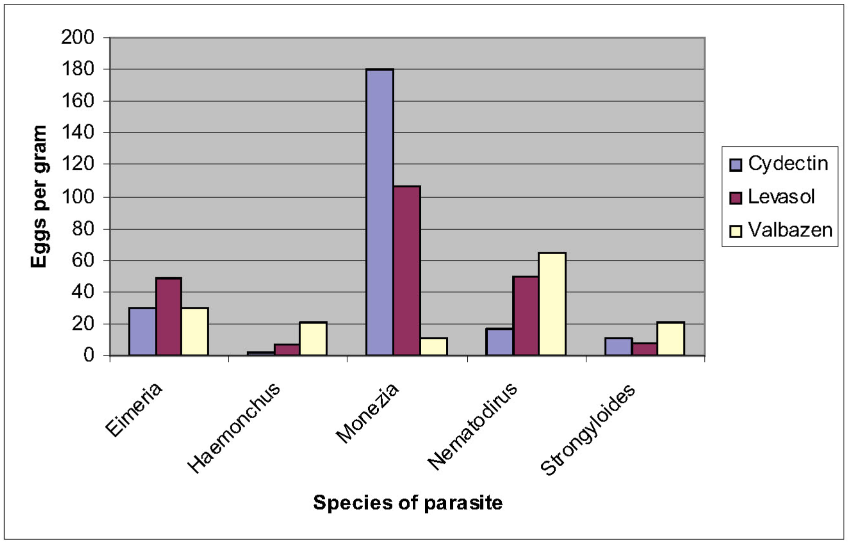

Figure 5. Fecal egg counts by species of parasite for anthelminthics