



Evaluation of diatomaceous earth as an adjunct to sheep parasite control in organic farming

Abstract: *Diatomaceous earth (DE) has been touted as a natural and effective way to control gastrointestinal (GI) parasites in sheep. In this study, grazing lambs were fed DE at 5 and 10 percent of a supplemental ration for periods from 66 to 117 days. Weight gains, hemoglobin, packed cell volume, fecal egg/gram counts, and abomasal GI larval counts were not different in controls vs. DE-fed lambs, although there was a trend toward lower fecal egg/gram counts in DE-treated lambs. DE by itself was not shown to be an effective parasite control agent, but could be used as part of a parasite control program.*

Background

Many sheep producers, including those in certified organic production programs, believe that they cannot raise sheep without using some synthetic parasiticides. Regulatory or certification decisions that ban these synthetic inputs may limit entry of sheep producers into organic production, but allowing the use of such chemical inputs could reduce consumer confidence in the organic production systems. Meanwhile, others think they can successfully rear sheep using only diatomaceous earth (DE), an acceptable natural product, as a parasite control in concert with management practices to reduce parasite impact.

Little experimental work has been done to test the effects of DE on gastrointestinal (GI) nematodes, and the existing evidence is mainly anecdotal or testimonial. DE is believed to be effective as a parasiticide because it is used to control insect infestations in grain stores where it acts either as an abrasive to the exoskeleton or by adsorption of cuticular wax.

Generally, management by rotational grazing, drylot feeding, and immunization has been only partially successful for parasite control. Several studies have shown increased parasite loads when intensive rotational grazing is practiced. This may occur because animals in rotational grazing systems graze closer to the soil surface and dung, thus increasing exposure to parasite ova. A period of three to five months interruption between grazing of spe-

cific areas has been suggested. In most temperate-region rotational grazing systems, this would mean only one grazing cycle per season, which decreases use of available pastures.

If DE is effective in conjunction with other management practices to reduce parasite loads in sheep, then organic producers and those interested in rearing sheep in a low-chemical setting may obtain a relative advantage in sheep production. Conversely, if DE does not provide adequate protection against parasites, sheep may suffer and organic producers will find themselves at a relative disadvantage. Parasitism has been implicated in anorexia, reduced utilization of proteins, altered water and electrolyte balance, anemia, reduced weight gain and feed efficiency, and impaired reproductive performance.

The objectives of this study were to determine whether diatomaceous earth is an effective natural parasiticide control agent for sheep and whether it will improve parasite control and performance when used as a supplement for lambs in a grazing system free of other synthetic inputs.

Approach and methods

Success of treatments in live lambs was determined by measuring growth rate, packed cell volume, hemoglobin, total serum protein, and fecal egg counts. Blood chemistry was evaluated at the beginning of the experiment and

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Budget
\$12,758 for year one
\$12,031 for year two



Sheep pictured were part of DE-feeding trials conducted at ISU's McNay Research Farm.

monthly during the grazing trials.

At the end of the project, one lamb from each replicate of each treatment (20 lambs total for both years) was selected for more detailed examination of the digestive tract. At the post mortem, steps were

taken to isolate and quantify total nematode parasites in both the abomasum and intestines.

Two grazing and DE treatment trials were conducted in successive years. Year 1 began in July 1994 with 24 weanling lambs from the ISU Sheep Teaching Herd. They were fed DE daily to prevent or reduce infestation by gastrointestinal nematodes (GIN). Two of the paddocks were infected in early spring by allowing ewes and lambs positive for GIN to graze in the plots before adding the test lambs. Lambs were randomly assigned to one of four groups. Treatments included:

- 1) Control, given 0.5 kg. concentrate daily, but no DE; lambs pastured in uninfected paddock
- 2) Infection controls, given five 0.5 kg grain daily, but no DE; lambs pastured in infected paddock
- 3) DE fed in 0.5 kg grain daily at the rate of 5 percent of the concentrate; lambs pastured in uninfected paddock
- 4) DE fed in 0.5 kg grain daily at the rate of 5 percent of the concentrate; lambs pastured in infected paddock.

The four treatment pastures were separated by buffer strips and individual watering tanks to minimize cross-contamination by parasite eggs. In all paddocks, lambs became infected with parasites within one month after being weaned and placed on either clean or infected pastures. This was most likely due to existing infection from the ewes which was expressed when lambs began recycling eggs and infective larvae while on pasture.

Since DE may be dusty and unpalatable, and often partitions out from the grain mixes, a

commercial lamb diet was amended with 5 percent DE and the product was prepared in pellet form. This feed was not prone to separation and was well-accepted by the lambs.

Individual feeding stalls, similar to free stalls for cattle or gestation feeding stalls for swine, were constructed from wire panels. These were labor-intensive to use, but effective in monitoring individual feeding and also provided a confinement location for collecting blood and fecal samples.

Based on the results from Year 1, the trial for 1995 was enlarged to 32 lambs, and the comparison was made between two modestly infected pastures where 16 lambs were fed DE-laced rations while the other 16 received the control ration of similar composition but without DE. The portion of DE in the concentrate feed was increased to 10 percent. This provided maximum intake of DE for the greatest potential expression of anti-parasitic effects.

Lambs were randomly assigned to four groups of eight lambs. Each group used a one-quarter acre grazing paddock for the 117-day grazing trial. All lambs were wormed with ivermectin, a broad spectrum parasiticide for gastrointestinal nematodes, just prior to the trial, so that all began the experiment with similar low parasite loads. In Year 2, samples and measurements were taken at three-week intervals; testing proceeded in a similar manner to Year 1.

Results and discussion

When mean body weights for the various groups were compared in Year 1, the lambs receiving the DE-supplemented feed showed slightly more weight gain (30 lbs. for the DE group and 28 lbs. for the control group) over a 66-day pasture trial, but the difference was not statistically significant. No deaths occurred in either group. Since death and impaired weight gain constitute the major negative impacts of GI parasites in sheep, the value of DE for improved performance was not demonstrated.

Blood values for hemoglobin and packed cell volume (indicators of anemia) for the two treatments were not different when tested by statis-

tical analysis. Based on the results from Year 1, there was no indication that DE improved red cell indices or prevented detrimental effects from parasite infection.

Fecal eggs per gram counts were similar at the beginning of the trial. At the end of the 66-day grazing period, counts were 3425 eggs/gram for controls and 1658 eggs/gram for the DE group. Initially this appeared to be a large difference, but because of the great variability within each group, a statistically significant difference was not demonstrated.

In Year 2 (1995), the redesigned trials eliminated potential differences among the controls and principals at the beginning of the study by worming all lambs with ivermectin. [In addition, DE concentration was upped to 10 percent and more lambs were tested. In Year 2, as in Year 1, control lambs gained slightly less weight than lambs fed DE, but the difference was small and not considered significant. Thus, there was no economic benefit to adding DE to the feed rations.

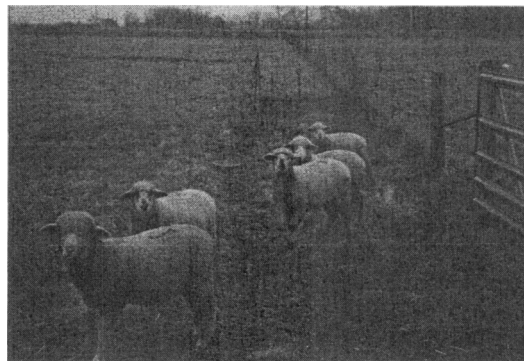
Control sheep (no DE treatment) had higher fecal egg counts than the DE-treated sheep, but there was great variability in egg counts within each group, and the end results were not significantly different. Early in the infection period in Year 2, DE appeared to be associated with decreased fecal egg counts when compared to the controls, but the difference had changed markedly by the end of the trial in September, perhaps because as lambs matured they developed immunity to the parasites.

Blood counts were within normal ranges for both groups and there were no measurable differences in either hemoglobin or packed cell volume in this trial.

Control lambs sampled for GI parasite larvae at slaughter had higher average strongyle worm counts (1625) than DE-fed sheep (775), but the wide variability in individual counts failed to indicate a statistically significant difference.

Conclusions:

- 1) Diatomaceous earth (DE) can be readily and conveniently incorporated into a pelleted lamb diet with good acceptance and no evidence of dust or related respiratory problems.
- 2) DE used as a feed supplement for grazing lambs did not significantly reduce parasite loads as measured by fecal egg counts and abomasal GI larval counts.
- 3) DE had no significant effect on weight gain in lambs consuming supplement containing up to 10 percent DE during grazing trials lasting up to 117 days.
- 4) DE did not improve red cell indices (hemoglobin, packed cell volume) in lambs consuming supplement containing up to 10 percent DE during grazing trials lasting up to 117 days.



White-faced cross-bred lambs typical of a commercial flock were used in the DE project.

Implications

The results of this study greatly confirm and expand the scientific evidence that DE used alone in grazing lambs is not an effective parasiticide or parasite control agent. Producers aiming at low chemical inputs for parasite control in sheep should continue to rely on management, genetic resistance and alternative natural parasitocidal products, and not count on DE to handle the bulk of their parasite control needs.

Education and outreach

These findings were presented in part to the National Organic Standards Board as part of the investigator's service to that group. Presentations were given to the Midwest Organic Farming Conference and the ISU Extension Organic Farming Conference in 1995.

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