

K. A. Cash*, J. D. Caldwell, B. C. Shanks, A. L. Bax, L. S. Wilbers, H. L. Hilsenbeck, A. T. McKnelly, T. N. Drane, K. L. Basinger, J. K. Clark, and H. L. Bartimus, Lincoln University, Jefferson City, MO 65101; H. D. Naumann, University of Missouri, Columbia, MO 65211.

Abstract

Gastrointestinal nematode parasitism is one of the greatest threats to economic sheep production in the United States. With increased incidences of anthelmintic resistance and the constraints of organic production, there is an increased interest in alternative natural dewormers, such as plants containing condensed tannins (CT). Therefore, the objective of this study, supported by The CERES Trust, was to evaluate the effects of organic fermented Pinot Noir (PN) grape extract on parasite level and performance of Katahdin lambs. A total of 45 Katahdin ewe and ram lambs (23.13 kg ± 0.60) were stratified by fecal egg count, weight, and sex, and were allocated randomly to one of three treatments: 1) an oral dose (10 mL per 4.54 kg of BW) of fermented PN grape extract at 7 day (D7) intervals, 2) the same dose at 14 day (D14) intervals, or 3) control (C; oral dose of water at 14 day intervals). Condensed tannins were extracted, purified, and standardized from the organic PN by the Naumann method and found to have a concentration of 0.20 mg/mL. Lambs were housed on pasture with no additional feed, for the duration of the 63 day study. Fecal egg counts were lower ($P = 0.05$) and packed cell volumes were greater ($P = 0.05$) for D7 and D14 lambs compared to the control group. Average daily gain and total weight gain were greater ($P = 0.02$) for D7 and D14 lambs compared to control lambs. Body condition scores and FAMACHA[®] scores did not differ ($P \geq 0.50$) across treatments. Therefore, fermented grape extract can be an effective organic and sustainable strategy for controlling nematodes and increasing performance in lambs.

Introduction

- The drive to find organic, natural, and sustainable practices to maintain healthy livestock is crucial in providing global food security.
- Plant extracts can be high in certain phenolics such as Proanthocyanidins or condensed tannins (CT). Condensed tannins have been shown at certain levels to produce benefits in ruminants such as:
 - better utilization of dietary protein.
 - faster growth rates.
 - an improvement in animal health through a decrease in fecal egg counts (FEC).
- Red grapes and red grape by-products such as juice, fermented grape extract (wine), and grape pomace should be examined because they contain high levels of CT.
- Condensed tannin-rich products could make small ruminant production in the United States more sustainable by:
 - reducing synthetic anthelmintic use
 - reducing the instance of parasite resistance.

Objective

The objective of this study was to evaluate the effects of organic fermented Pinot Noir grape extract on parasite level and performance of Katahdin lambs.

Materials and Methods

Animals

- 45 organic Katahdin ewe and ram lambs (23.13 kg ± 0.60).

Treatments

- Lambs were stratified by FEC, weight, and sex, and allocated randomly to 1 of 3 treatments:
 - 1) Oral dose (10 mL/4.54 kg of body weight) of organic Pinot Noir extract every 7 days (D7).
 - 2) Oral dose (10 mL/4.54 kg of body weight) of organic Pinot Noir extract every 14 days (D14).
 - 3) Oral dose of water every 14 days (control).
- Organic fermented Pinot Noir grape was extracted, purified, and standardized by the Naumann method and found to have a CT concentration of 0.20 mg/mL.

Lamb Management

- Lambs were grazed on primarily mixed fescue pastures.
 - 63 day grazing period.
 - Ad libitum access to water and trace minerals.
 - No additional feed provided.
- Animals were rotated between pastures based on available forage.

Measurements

- Taken every 7 days from each lamb.
 - Weight.
 - Body condition score.
 - Fecal egg count.
 - FAMACHA[®] score.
 - Packed cell volume.

Statistical Analyses

- One year summary.
- PROC MIXED of SAS.
- Experimental unit: animal.
- Treatment means were reported as least squares means.
- Contrast:
 - 1) The mean of control versus D7 and D14.
 - 2) The mean of D7 versus D14.



Results

Effects of organic fermented grape extract on parasite level in Katahdin lambs.

Item	Treatment ¹			SEM ²	Contrast ³
	C	D7	D14		
Start FEC ⁴ , eggs/g	43.0	39.6	48.7	8.11	ns
End FEC ⁴ , eggs/g	50.6	28.1	24.7	9.57	W
FEC ⁴ change, eggs/g	10.5	-13.1	-18.5	10.82	W
Start FAMACHA ^{®5}	1.6	1.4	1.8	0.60	ns
End FAMACHA ^{®5}	1.5	1.5	1.5	0.12	ns
FAMACHA ^{®5} change	-0.2	-0.1	0.0	0.20	ns
Start PCV ⁶ , %	34.2	31.4	33.4	1.31	ns
End PCV ⁶ , %	36.3	37.0	36.8	1.05	ns
PCV ⁶ change,%	2.2	5.6	2.2	1.19	X

¹Treatments C = Control.
D7 = Oral dose of organic Pinot Noir every 7 days.
D14 = Oral dose of organic Pinot Noir every 14 days.

²SEM Pooled standard error of the mean.

³Contrasts W = mean of Control lambs compared with the mean of Day 7 and Day 14 lambs ($P \leq 0.05$); X = mean of Day 7 compared with the mean of Day 14 lambs ($P \leq 0.05$); lowercase letters represent statistical tendencies ($P \leq 0.10$); ns = no significant difference ($P > 0.10$).

⁴FEC Fecal egg count, number of eggs per gram of feces.

⁵FAMACHA[®] Mucus membrane of the eye, color system based on a scale of 1 to 5; 1-best color to 5-devoid of all color, near death.

⁶PCV Packed cell volume.

Effects of organic fermented grape extract on performance in Katahdin lambs.

Item	Treatment ¹			SEM ²	Contrast ³
	C	D7	D14		
Start BW, kg	23.8	22.7	23.4	1.06	ns
End BW, kg	28.0	28.2	28.9	1.05	ns
Start BCS ⁴	2.9	2.9	2.7	0.14	ns
End BCS ⁴	2.5	2.6	2.5	0.11	ns
BCS ⁴ change	-0.3	-0.3	-0.3	0.13	ns
ADG, kg	0.07	0.09	0.08	0.006	W
Gain, kg	4.2	5.4	5.2	0.39	W

¹Treatments C = Control.
D7 = Oral dose of organic Pinot Noir every 7 days.
D14 = Oral dose of organic Pinot Noir every 14 days.

²SEM Pooled standard error of the mean.

³Contrasts W = mean of Control lambs compared with the mean of Day 7 and Day 14 lambs ($P \leq 0.05$); X = mean of Day 7 compared with the mean of Day 14 lambs ($P \leq 0.05$); lowercase letters represent statistical tendencies ($P \leq 0.10$); ns = no significant difference ($P > 0.10$).

⁴BCS Body condition score based on a scale of 1 to 5; 1-thin to 5-obese.



Discussion

- Fecal egg counts were lower ($P = 0.05$) and packed cell volumes were greater ($P = 0.05$) for D7 and D14 lambs compared to the control group.
- Average daily gain and total weight gain were greater ($P = 0.02$) for D7 and D14 lambs compared to control lambs.
- Body condition scores and FAMACHA[®] scores did not differ ($P \geq 0.50$) across treatments.

Conclusion

- Fermented grape extract can be an effective organic and sustainable strategy for controlling nematodes and increasing performance in lambs.
- Additional research is needed to determine:
 - the most accurate dose of condensed tannins.
 - dosage timing.
 - bioactivity of the tannins that are required to produce the best results.
- An increase in total weight gain and average daily gain could suggest an added benefit of condensed tannins ability to bind to protein causing a by-pass protein effect; this needs further exploration.



Acknowledgements

This project was supported by the Ceres Trust Graduate Grant. The project was conducted at the Lincoln University Allen T. Busby Farm in Jefferson City, MO. Fermented organic grape extract was provided by Badger Mountain Winery, Kennewick, WA.