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The evaluation of kiwifruit vinegar as a stock feed

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ABSTRACT

Two trials were conducted to assess the effect of kiwifruit vinegar on a number of production parameters in sheep. Trial A evaluated the effect of kiwifruit vinegar (8.2g/100ml, as acetic acid) on lamb liveweight gain, fleece production (midside growth rate, yield and colour), and internal parasite burdens. Trial B evaluated the effect of kiwifruit vinegar on two-tooth liveweight change prior to mating, and subsequent fertility.

In trial A 138 ewe lambs were randomly assigned to one of four treatment groups: i) "Extender 100" Albendazole drench capsule + 10 ml vinegar; ii) "Extender 100" Albendazole drench capsule only; iii) normal drenching (trigger level 1500 epg) + 10 ml vinegar; iv) normal drenching. The only trait for which there was strong evidence of an effect was wool yield which decreased in response to kiwifruit vinegar. Vinegar treated lambs tended to have reduced faecal egg counts during the period of the trial.

In trial B 140 two-tooth ewes were randomly assigned to one of two treatment groups: i) 15 ml vinegar administered at 12, 8, 4 and 1 weeks prior to mating; ii) control. Reproductive status was assessed by ultrasound 38 days after removal of the ram. No significant differences were found in liveweight or in reproductive status between the two groups. Evidence from these two trials would suggest that any effect of kiwifruit vinegar on performance traits in sheep is small and not necessarily beneficial.

Keywords: kiwifruit vinegar, internal parasites, albendazole capsule, wool growth, wool yield, wool colour, liveweight gain, fertility.

INTRODUCTION

Kiwifruit vinegar is sold in New Zealand as a stock feed, and there are some suggestions among farmers that the product can improve stock health and performance. However to date there have been no published data to support this belief. Other types of vinegar have traditionally been the subject of claims regarding beneficial properties, particularly cider vinegar. Rice vinegar has been used in Japan for thousands of years in the belief that it promotes good health and cures a wide range of ailments in man (Kuroiwa 1977).

Kiwifruit vinegar is produced by fermentation of kiwifruit wine, in the same way that apple wine has traditionally been used to produce cider vinegar. The main component is acetic acid (8.2 g/100 ml). Chemical analysis of kiwifruit vinegar indicates it containes a range of micronutrients such as magnesium (52 mg/l), calcium (92 mg/l), phosphorus (143 mg/l) and some trace elements (eg copper, 0.28 mg/l; zinc, 0.56 mg/l). Total solids amount to 2.6 g/100 ml.

The aim of this experiment was to investigate the effect of kiwifruit vinegar on liveweight gain and wool production and quality in lambs, and the fertility of two-tooth ewes. It is possible that kiwifruit vinegar may affect production in lambs due to anthelmintic properties (Rutherford 1987). The trial design therefore allowed a comparison of the effects of vinegar in both a parasitised and an unparasitised environment.

MATERIALS AND METHODS

Trial A

One hundred and thirty eight ewe lambs were randomly allocated to one of four treatment groups in January 1992. These were: extender 100 Albendazole capsules (CAP); extender 100 Albendazole capsules plus 10ml vinegar (CAP+VIN); Normal drenching only (NONCAP) and normal drenching plus 10ml vinegar (NONCAP+VIN). The extender 100 Albendazole capsules contain 2.1 g Albendazole released at a rate of 0.5 mg Albendazole/kg LWT/day for a 40 kg animal.

Of the 138 ewe lambs, 101 were born at the usual time (Aug/Sept) and 37 were early-born (May). Both age groups were evenly distributed amongst the four treatment groups. Prior to allocation to treatment groups all lambs were drenched at a rate of 1 ml/4 kg of levamisole (Nilverm, Coopers-Pitman-Moore, New Zealand Limited) to eliminate any existing internal parasite worm burden. Midside wool growth was measured from samples taken on the right midside of lambs while they lay on a flat surface (Bigham 1974). An initial patch measuring 20 cm x 20 cm was cleared of wool on day 1. Subsequently an area of approximately 100 cm² was clipped and measured using callipars. Kiwifruit Vinegar (Prestons Kiwifruit Winery, Tauranga, New Zealand) was administered orally on days 1, 28, 56 and 86 of the trial (10ml per animal of an 8% kiwifruit vinegar solution diluted with equal parts of water) according to the manufacturer's recommendations. All animals were weighed on days 1, 28, 56, and 86, and the midside wool patch was clipped on day 116. Greasy wool samples were scoured to determine clean growth rate, yield and colour (Bigham *et al.* 1984) under standard conditions (Parker *et al.* 1991).

"Extender 100" albendazole slow release drench capsules (TM FERNS Corporation Ltd) were inserted into CAP and CAP+VIN lambs (day 1) to suppress adult worm burden.

The capsules provide protection from internal parasites for 100 days. Four capsule treated animals were sampled for faecal egg count on day 86 of the trial and were found to have zero eggs per gram of faeces.

NONCAP and NONCAP + VIN lambs were allowed to develop subclinical parasitism, until a trigger level of 1500 eggs per gram was reached, at which time all lambs in these two groups were faecal sampled and drenched (days 55, 91 and 119). The rise in internal parasite burden was monitored using a random sample of 20 animals, measured 28 days after each drench, and then every 10 days until the trigger level was reached. This trigger level has been used by other workers, to indicate when drenching is required (Watson *et al.*, 1986). FEC was assessed using the Modified McMaster Technique where each egg counted represents 50 eggs per gram (Watson *et al.* 1986).

Trial B

One hundred and forty two-tooth ewes were randomly allocated to either a control or kiwifruit vinegar treatment group in December 1991. All animals were drenched with an anthelmintic on day 1. Kiwifruit vinegar was administered on days 1, 31, 60 and 87 (15ml of 8% vinegar solution, according to manufacturer's recommendations). All animals were weighed at these times. Mating took place between days 84 and 132 and pregnancy status was assessed by ultra-sound on day 170, 38 days after removal of the ram.

In Trial A liveweight gain and wool traits were analysed using standard univariate analysis of variance techniques. The model used took account of the effects of vinegar, capsule and age. The distribution of faecal egg counts at each sampling time was found to be positively skewed. Transformation by squareroot gave the best improvement in normality so all FEC data has been analysed using this transformation. Repeat measures analysis of variance was considered for the analysis of FEC but was found to be unsuitable due to the number of missing values. All results are presented as least squares means and standard errors, or for faecal egg counts as re-transformed least squares means. In trial B reproductive status was analysed using maximum likelihood estimation of parameters.

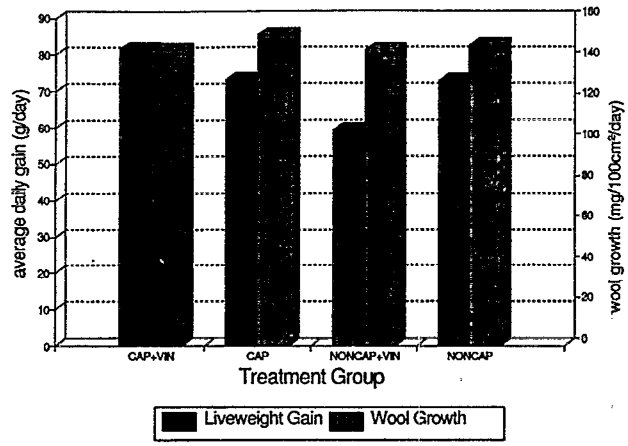
RESULTS

Trial A

Age of lamb was found to have no effect in all traits except wool colour. It was therefore decided to pool results across ages for all other traits to give increased statistical power for the detection of differences between vinegar-treated and control groups.

Fig. 1 shows the effect of vinegar on liveweight gain and clean wool growth. In non-capsule animals the vinegar treatment caused a reduction in liveweight gain whereas in the capsule-treated animals, kiwifruit vinegar caused a slight increase (significant vinegar x capsule interaction, $P<0.05$). Clean wool growth was not affected by vinegar treatment in either the capsule-treated or non-capsule groups. However wool yield (%) was lower in the vinegar-treated lambs compared to the untreated controls (81 ± 0.35 *vs* 82 ± 0.36; $P<0.05$) with no effect of capsule treatment.

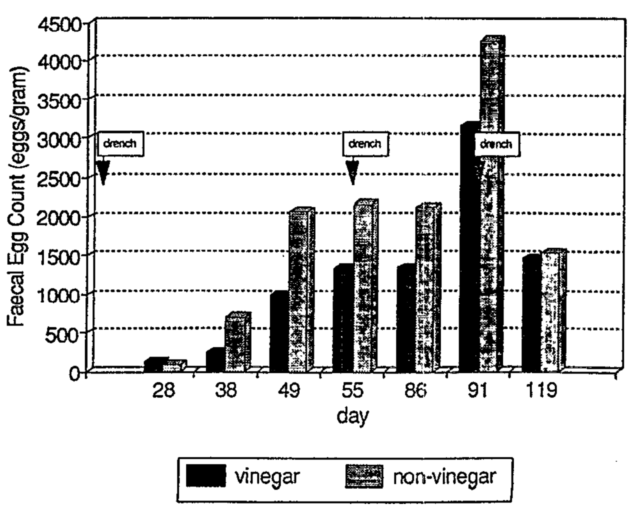
FIGURE 1: The effect of kiwifruit vinegar (+VIN) and anthelmintic capsules (CAP) on liveweight gain and clean midside wool growth in ewe lambs



Early-born lambs which received vinegar had poorer wool colour compared to controls (Y minus Z values of 1.42 ± 0.15 *vs* 0.98 ± 0.15; $P<0.05$). In the normal aged lambs this trend was reversed with vinegar treated lambs having slightly better colour compared to the non-vinegar lambs (Y minus Z values of 2.15 ± 0.09 *vs* 2.26 ± 0.10; significant vinegar x age interaction, $P<0.05$). Capsule treatment had no effect on wool colour.

Faecal egg counts are given in Fig. 2 and indicate that at all faecal sampling times except for day 28 the vinegar-treated lambs had lower faecal egg counts. However this difference could only be shown to approach significance at day 38 ($P=0.092$) and day 55 ($P=0.087$). Only on days 55, 91 and 119 were samples from all non-capsule animals included, the other four sample times were monitoring counts of a sub-sample of 20 animals.

FIGURE 2: The effect of kiwifruit vinegar on faecal egg count in non-capsule treated ewe lambs.



Trial B

Ewe liveweight prior to mating, and at mating, was not significantly different between vinegar-treated and control groups (Table 1). Reproductive status (dry, single or twin) also did not differ between treatment groups, 38 days after removal of the ram. The respective proportions of dry, single and twin bearing ewes were 5.9%, 42.6% and 51.5% in vinegar treated ewes and 7.4%, 38.9% and 53.7% in non-vinegar treated ewes.

TABLE 1: The effect (±SEM) of kiwifruit vinegar on liveweight (kg) in two-tooth ewes during the mating period.

Day of Trial	Vinegar	Non-vinegar
Day 1[1]	54.70 ± 0.68	55.31 ± 0.70
Day 31	58.07 ± 0.70	58.47 ± 0.72
Day 60	56.54 ± 0.65	57.46 ± 0.66
Day 87	56.74 ± 0.62	56.88 ± 0.64

[1]day 1 = 18th January

DISCUSSION

Trial A addressed two main issues. Firstly, whether kiwifruit vinegar had an effect on liveweight gain and wool traits. Secondly whether any differences which did arise could be attributed to an anthelmintic effect. It should be noted that although the capsules prevented the establishment of an adult worm burden, the lambs were still exposed to larval challenge. There are no published data available on what effect, if any, this exposure might have on production (e.g. as a result of an immune response), when capsules are being used. Thus it would be unwise to assume that the capsule-treated animals are strictly in an "unparasitised environment", when comparing capsule and non-capsule groups.

The vinegar-treatment did not appear to have any effect on wool growth overall. In the case of liveweight gain there was the suggestion of an interaction between vinegar and capsule treatments, but in the opposite direction to that expected if vinegar has an anthelmintic effect.

The decrease in wool yield due to vinegar treatment implies an increase in the yolk content of the fleece. Yolk is made up of two fractions, wool wax produced by the sebaceous glands, and suint which is mainly potassium salts (Henderson 1967). An increase in sebaceous gland activity would tend to support the claim by users of vinegar that it improves the shine on an animal's coat. This trial did not determine which part of the yolk increased, or whether it was a combination of both parts. Although the amount of greasy wool grown was not significantly different between groups there is no evidence to suggest that the increase in yolk comes at the expense of clean wool grown. This lower yield is in contrast to unpublished evidence that suggests cider vinegar reduces wool grease in adult ewes (New Zealand Farmer 1991). The detrimental effect of kiwifruit vinegar on wool colour in lambs is unlikely to be economically important. The interaction between vinegar and age group is likely to be the result of a combination of age differences and the small management differences which occurred.

The faecal egg count data suggests that the rate of re-infection by internal parasites following anthelmintic drenching may be lower in the vinegar-treated lambs. However this result should be interpreted with caution since the relationship between FEC and worm burden may have been disrupted by vinegar treatment. Fecundity of the worms may have been reduced rather than the actual number of worms. If this is the case we would expect the relationship between FEC and production to be different for the vinegar and non-vinegar groups. There was however, no significant relationship between FEC and production at any sampling time. A lower FEC in itself can still be considered a desirable effect because of the possibility of reduced pasture contamination. It should also be noted that running vinegar and non-vinegar animals together would have tended to underestimate any differences in FEC which may exist, because of cross-infection.

Kiwifruit vinegar had no effect on pre-mating liveweight change or fertility (dry, single or twin) in two-tooth ewes. This is to be expected considering the infrequent dosing intervals and low dose rates administered throughout the trial.

Evidence from these two trials suggest that any effect of kiwifruit vinegar on performance traits in sheep is small and not necessarily beneficial. Further work will be needed to confirm these findings and will require varying the treatment frequency and dose rates.

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