The use of alpacas as new-born lamb protectors to minimise fox predation

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Summary. Canine attacks on newborn lambs are a problem for sheep farmers, causing substantial economic losses to the sheep industry. Anecdotal evidence indicates that alpacas reduce the losses caused by such attacks when placed within sheep flocks. A trial was conducted at two sheep farms in rural NSW where *experimental* – ewes grazing with alpacas - and *control* – ewes grazing without alpacas – groups, with replication within and across farms were organised with a total of 6,483 breeding ewes. Overall weaning percentages for each flock of sheep were tabulated at 14 weeks and evaluation of performance between groups was conducted using descriptive statistics. An inferential statistical t test for pairs was conducted to find out the level of significance of the difference in performance between the trial and control groups. Combined weaning percentage for the control groups was 69.8% while the experimental groups showed a combined weaning percentage of 82.6%. Assuming equal mortality rate because of natural causes among the groups, it may be concluded that the presence of alpacas within the lambing paddocks increased lambing weaning percentage by 13% with a = 0.025 (i.e. confidence level = 97.5%). The economic benefit is obvious considering that there is an increase of 13 lambs for each 100 breeding ewes that valued at market prices represent a meaningful marginal farm income.

Introduction

Canine attacks on newborn lambs are a problem for sheep farmers, causing substantial economic losses to the sheep industry (D Pixley 2004, pers. comm., 7 April 2004). Anecdotal evidence has indicated that alpacas have an effect on reducing the losses caused by such attacks when placed within sheep flocks (B Richardson, 2004, pers. comm., 23 April 2004). The newborn lamb predators are foxes, wild dogs and domestic dogs (canines) that attack the ewes during the lambing season, often-killing lambs and severely injuring the sheep (Jenkins, 2003). The current literature regarding the use of alpacas as herd protectors is primarily focused on llamas, in American conditions. Research on using alpacas as herd protectors on Australian farms is limited, primarily anecdotal and not quantitative.

Therefore the purpose of this trial was to fill gaps in the existing research by generating quantitative evidence on the benefits of using alpacas as herd protectors on Australian farms.

Objectives

The objectives of this trial were:

- to determine the efficiency of alpacas as protectors of newborn lambs
- to evaluate the economic viability of introducing alpacas as newborn lamb protectors into flocks of lambing ewes
- to identify limiting factors to the use of integrated alpaca:sheep grazing systems; and,
- to explore unidentified issues of this new sheep management system.

Review of previous information

Alpacas are South American camelids, hardy, intelligent and have strong herding instincts (Richards, 2002). It is their dislike of canines, ability to bond with domestic livestock and protective instincts that have identified alpacas as potentially useful livestock guardians (Jenkins, 2003). Traditionally alpacas in South America have several uses, as a source of meat, fibre, skins and organic fertiliser. The most recent use for alpacas is as guards for livestock and poultry (Jenkins, 2003). The species guarded by the alpacas does not seem to matter, once the alpaca has established a paddock as 'their territory' and bonded with the livestock or poultry they are to protect, they work hard to ensure the paddock is clear of canines (Jenkins, 2003). Alpacas and llamas keep sheep and lambs together, patrol constantly and remain alert. Putting two mature alpaca wethers in with ewes a few weeks before lambing and leaving them there until weaning can solve the problem of lamb losses to foxes (Bell, 2004).

An opposing view is presented by Martin Evans, the past President of the Alpaca and Llama Association of New Zealand; Evans (2004) suggests that alpacas have no guarding ability

whatsoever and have never been used for this purpose. Insley (2004) offers also opposing opinions regarding the use of camelids as lamb protectors stating that alpaca's instincts are similar to sheep and therefore are usually terrified of canines.

Limited research has been conducted into the use of alpacas as herd protectors with the majority being focused on American conditions specifically involving llamas rather than alpacas (Richardson, 2004 pers. comm.). A United States Department of Agriculture study found that in the first year of a llama trial, stock losses were halved. In the second year there was no statistical difference, but that was a low-stock loss year (Chester, 2004). Tumbarumba Shire Feral Animal Working Group has recently placed two alpacas on a property outside Tumbarumba as a part of a program tackling the wild dog and fox problem in the region (Chester, 2004). As a part of the trial the group will continue to carry out a trapping and baiting program in the region (Chester, 2004). 'Jandon Park' a property near Molong, NSW, has been using alpacas as lamb protectors since 2000, however the manager of 'Jandon Park' Gordon Blowes, is unconvinced as to the effectiveness of the alpacas (Balogh, 2004).

Alpacas are managed similarly to sheep. They need vaccination against clostridial disease and regular drenching, their toenails may require occasional trimming and they should be shorn annually (Jenkins, 2003). Alpacas are smaller than llamas weighing 50-70kg and reaching a height of 1.4 metres. They seem to be good guards for livestock especially against foxes but "their ability to chase canines may be hampered by their abundant fleece, and their wooly faces might partially obscure their vision", reducing their efficiency in early detection of canines advancing on a flock (Jenkins, 2003). Alpacas are normally gentle towards humans and other animals that are not seen as threatening (AAA, 2002).

The alpacas defence against attack by canines such as dogs and foxes is to chase them away or run the animal down and stamp on it with its forelegs (AAA, 2002). Alpacas are usually very quiet, however will emit a piercing alarm scream when aroused to potential danger (AAA, 2002). Alpacas bonded to sheep always keep their distance, they will only make physical contact if forced to e.g. during yarding (Richardson, 2002). Alpacas do not shed their fibre and so the risk of cross contamination into wool clips is very low (Richardson, 2002).

The risk of disease infection across from alpacas to sheep is also minimal (AAA, 2002). Alpacas need to receive a 5 in 1 chlostridial disease vaccination each year and when run with sheep should be given the same drenches for internal parasites (AAA, 2002). While alpacas are highly resistant, they can contract bovine Johne's disease (BJD), they do not contract ovine Johne's disease (OJD) (Richardson, 2002). Alpacas are environmentally friendly, in respect of damage to the surface of the ground because of their low hoof pressure (39kPa) compared with other live stock (sheep, 82kPa and cattle, 185 kPa) as per Charry, Kemp and Lawrie (2001).

The NSW Department of Primary Industries have conducted preliminary studies into the used of non-canine livestock guardian animals (LGA) (Jenkins, 2003). This preliminary study consisted of a producers' survey to determine the level of interest into the use of LGA's; however it did not focus on alpacas (Jenkins, 2003).

This issue of livestock production and protection is considered critical for the development and growth of both alpaca and sheep industries in Australia. A number of sources were consulted to complete an exhaustive review of prior knowledge, however the current research on this aspect of alpaca management is limited.

How the trial was organised

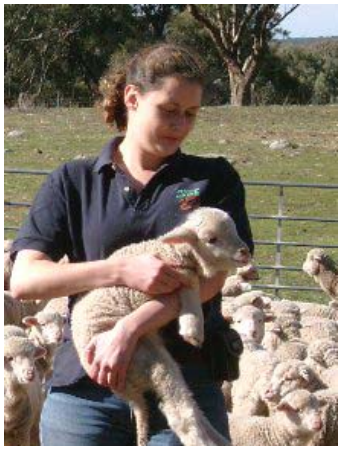
Two farms with breeding sheep enterprises were selected for this trial. Farm 1 was at Charles Sturt University – Orange farm in Orange NSW (33 23S, 149 08E). Farm 2 was "Mossgiel" located in Ivanhoe NSW (32 54S, 144 18E). Both properties splited their lambing ewes into flocks identified as control and experimental flocks. Farm 1 had two flocks of approximately 300 lambing ewes, Farm 2 had four flocks of approximately 1,500 lambing ewes. The flocks were not situated directly adjacent to each other, with at least a space of 2 ha in between each flock. Plate 1 shows the main author of this paper in one of the sheep farms where the trial was conducted.

Previous anecdotal evidence has suggested that having alpacas near each other is ineffective, as the alpacas tend to keep close to each other rather than staying with the sheep (Richardson, 2004 pers. comm.). Two male-wether alpacas were initially placed with the experimental flocks of lambing ewes though the number was reduced to one alpaca in the experimental flock on farm 1. B Richardson (2004 pers com), Clearview Alpacas Braidwood NSW, has suggested that if any more than two alpacas are used with each flock of sheep, the alpacas will stay together and ignore the

sheep. Six alpacas were provided for the purposes of this research project, (two from Charles Sturt University and four from the Southern Region Australian Alpaca Association).

At the end of the lambing time (October 2004) at lamb marking, both farmers recorded the number of lambs marked within each flock. These records were used to determine the overall lamb survival percentage for each flock of ewes. Using the data acquired during lamb marking, descriptive and inferential statistical techniques were applied to determine the efficiency of alpacas as newborn lamb protectors at the sites evaluated. The selected inferential statistic technique used was the t test for groups with unequal variances.

Plate 1. Observing new-born lambs in the experimental farm



Source: AAC personal file 2004

Discussion of the trial results

Tables 1 and 2 contain basic information from the experimental farms in terms of ewe inventories, lambs marked and survival percentages. An initial observation of these results indicates that there was a consistently higher survival rate on both farms in the flocks where the alpacas and ewes shared the paddocks.

Table 1. Experimental farm 1 - Charles Sturt University, Orange Campus NSW

Flock	Number of Ewes	Number of Lambs Marked	Survival Percentage
Control	239	178	74%
Experimental	251	198	78.8%

Table. 2 Experimental farm 2 – “Mossgiel”, Ivanhoe NSW

Flock	Number of Ewes	Number of Lambs Marked	Survival Percentage
Control	1,509	1,071	71%
Control	1,480	1,007	68%
Experimental	1,509	1,207	80%
Experimental	1,495	1,286	86%

Table 3 shows the computer results of the inferential statistic method, i.e. t-test for samples with unequal variances. The hypothesis being tested (i.e. H_1) is that *there is a difference between the means of the sample groups*. A two-tailed test has been used. Is simple terms, what it needs to be

proven is that there is a meaningful difference in statistical terms in terms of lamb surviving between the flocks patrolled by alpacas and the control flocks.

Table 3. t-test for differences in means for lamb survival rates

Hypothesised Difference	0%
Level of Significance	0.05
Experimental Group	
Sample Mean	81.33333333
Sample Size	3
Sample Standard Deviation	4.163331999
Control Group	
Sample Mean	71
Sample Size	3
Sample Standard Deviation	3
Population 1 Sample Degrees of Freedom	2
Population 2 Sample Degrees of Freedom	2
Total Degrees of Freedom	4
Pooled Variance	13.16666667
Difference in Sample Means	10.33333333
t-Test Statistic	3.487772493
Two-Tailed Test	
Lower Critical Value	**-2.776450856**
Upper Critical Value	**2.776450856**
***p*-Value**	**0.025173674**
Reject the null hypothesis at a confidence level of 97.5%	

The null hypothesis was that the mean lamb survival of the control groups equals the mean lamb survival of the experimental groups; or that the difference between means is equal to zero (i.e.H_0: $\mu_1 = \mu_2$ or $\mu_1 - \mu_2 = 0$). In simple terms, if this hypothesis were to be proven it would indicate that there were not meaningful differences in lamb survival between the flocks patrolled by alpacas and the control groups. Statistical results shown in Table 3 indicate that this hypothesis could not be supported.

Therefore the alternative hypothesis was accepted and/or proven indicating that the mean of control groups does not equal the mean of experimental groups or that the means difference does not equal zero (i.e. $\mu_1 \neq \mu_2$ or $\mu_1 - \mu_2 \neq 0$) confirming that there is a statistical meaningful difference in lamb survival between flocks patrolled by alpacas and flocks where alpacas were non-existent.

The t-tests have indicated that at a critical "t" value of ±2.7765 the means of the two sample groups are significantly different with $\alpha = 0.025$ or confidence level = 0.975 (i.e. 97.5%).

Based on the *t*-test for samples with unequal variances the null hypothesis can be rejected, indicating that the difference in mean lamb survival of the two sample groups is significant and therefore, it can be statistically supported that the alpacas are effective as newborn lamb protectors.

The allocation of breeding ewes between the trial and control groups was done entirely at random and throughout the lambing period both groups were located on similar pastures with similar paddock conditions. In this regard many external variables appear to be taken into consideration and the results can be deemed to be reasonable at a 97.5% confidence level. However other immeasurable external variables may be influencing the results and the limitation of the sample is recognized when comparing it to the overall sheep population, mainly grazing in different environments. These external variables may cause more lamb deaths that the alpacas have no impact on, these deaths could be caused by frosts, sickness or abandonment of the lamb by the ewe. The manager of the experimental farm 1 reported that over the period of the trial any lamb carcasses within the control flock were eaten or moved within a few days. Lamb carcasses in the experimental flock were left undisturbed. This observation indicates that there were lambs dieing due to external factors not considered in this analysis. In spite of having available carcasses for consumption the foxes were unable to invade the alpaca's territory.

The manager of the experimental farm 2 reported that one pair of alpacas stayed in one sector of the paddock for a quite noticeable period of time. At shearing time they were shorn and after this they tended to follow the lambing ewes more. Since the alpacas were not familiar to the territory this indicates that the alpacas might have been wool blind, so choosing to stay near the water source rather than with the flocks of sheep. This observation links to Jenkins' (2003) comments relating to the "wooly faces" obscuring the alpacas' vision.

Plates 2 and 3. A demonstration of the protective nature of alpacas

Source: Kurrawa Alpacas 2002 and AAC personal file 2004

What are the lessons from this exercise?

Using an aggregate marginal analysis as per data contained in Table 4 it is possible to indicate that this experiment produced a marginal increase in the flocks using alpacas of 12.83% more weaned lambs. In simple terms, translating this value to a real farm situation indicates that on the farms under study the foxes killed around 13 lambs out of each 100 lambs born. Alternatively the physical effect on weaning percentage because of the incorporation of alpacas to the sheep breeding system was +12.83%. Translating the foregone lamb income because of fox predation it may be said that the sheep breeding flocks without newborn lamb protecting means lose 13 x $price/lamb from each 100 breeding ewes. Using NOV-2005 lamb prices of the Orange weaner-market (i.e. $65) the marginal income for farmers using alpacas as newborn lamb protectors is approximately equal to $845 per each 100 breeding ewes

An issue that confirmed the effect on fox-predation was the observation of untouched newborn lamb carcasses in the alpaca paddocks. It is necessary to indicate that there is a need to study behavioural issues of the species as well as to test different ewe: alpaca ratios to gain a better overall understanding of the implications of alpacas as newborn-lamb protectors.

Table 4. Aggregate marginal analysis of weaning lamb rates

Group	No of ewes	Weighted weaning % and weaned numbers control groups	Weighted weaning % and weaned numbers experimental groups
Control Farm 1	239	239 x 0.74 = 178.86	
Control1 Farm 2	1509	1509 x 0.71 = 1071.4	
Control2 Farm 2	1480	1480 x 0.68 = 1006.4	
Totals for control groups	3228	2254.65	
Experimental Farm 1	251		251 x 0.78 = 198.3
Experimental1 Farm 2	1509		1509 x 0.80 = 1207.2
Experimental2 Farm 2	1495		1495 x 0.86 = 1285.7
Totals for experimental groups	3255		2691
Average weaning %		69.84%	82.67%
Marginal increase in weaning %			**+ 12.83%**

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