'Staggers' in Australian alpaca *(Vicugna pacos)*

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Abstract

In a random survey of 107 alpaca producers across Australia, 23% had observed staggers over the previous 3 years with signs usually persisting 3-4 months. Observations were mainly from south-eastern Australia. Staggers was largely associated with the presence of perennial ryegrass (P<0.01) and phalaris (P<0.02); not with annual ryegrass or paspalum. Depending on season, 9-12% of alpaca exposed to perennial ryegrass exhibited staggers. Significantly more of the herds that contained staggers-affected animals had alpaca that exhibited panting and crowding into dams or streams (P<0.01), ill-thrift (P<0.001), low fertility (P<0.02) and early death of cria (P<0.06) compared with unaffected herds. The number of herds showing signs of panting and crowding into dams were significantly higher where perennial ryegrass was present (P<0.001) but such differences were not significant for the other three grasses. Weanling alpaca were the more likely to stagger than adults (P<0.001). The annual cost to treat staggers was $96 per affected alpaca.

Keywords: *Neotyphodium lolii,* perennial ryegrass, perennial ryegrass toxicosis, phalaris staggers, heat stress, fertility

Introduction

Many plant species cause neurotoxic disorders in herbivores with signs such as staggers. In Australia, perennial ryegrass toxicosis (PRGT) is the most common cause of such problems. It can be fatal and is known to occur in sheep, cattle, horses, deer, alpaca and many other herbivores (Miles *et al*. 1998; Holmes *et al*. 1999). PRGT is commonly recognised as "ryegrass staggers" and is associated with ingestion of perennial ryegrass (PRG) (*Lolium perenne*) infected with the microscopic fungus *Neotyphodium lolii* (Mackintosh & Orr 1993; Miles *et al*. 1998). This symbiotic endophyte produces neurotoxins and ergot alkaloids, mainly during late spring to autumn (Reed *et al*. 2001). Other common grasses causing staggers include annual ryegrass (*Lolium rigidum*), paspalum (*Paspalum dilatatum*) and phalaris (*Phalaris aquatica*) (Miles *et al*. 1998). For dairy cattle grazing endophytic PRG, milk production was reduced by 14% in autumn relative to endophyte-free PRG, although only one cow exhibited staggers (Valentine *et al*. 1993). Other "sub-clinical" effects including heat stress, lowered fertility, ill-thrift and scouring have occurred in controlled experiments when sheep or cattle grazing on PRG

Table 1 Number of farms surveyed and reporting staggers in alpaca in different states of Australia.

State	No. of farms surveyed	No. reporting staggers	% of farms affected
Queensland	4	0	0
New South Wales	38	2	5
Victoria	35	15	43
Tasmania	3	2	66
South Australia	16	6v	38
Western Australia	11	0	0
Total	107	25	23

Table 2 Number (and percentage) of staggers-affected alpaca observed by respondents in New South Wales, Victoria and South Australia.

State	----- 2004 -----		----- 2005 -----		----- 2006* -----	
	Unaffected	Affected	Unaffected	Affected	Unaffected	Affected
New South Wales	1387	19 (1.4%)	1334	18 (1.3%)	1087	23 (2.1%)
Victoria	815	17 (2.0%)	774	35 (4.3%)	688	27 (3.8%)
South Australia	282	18 (6.0%)	355	34 (8.7%)	204	31 (13.2%)
Total	2484	54 (2.1%)	2463	87 (3.4%)	1979	81 (3.9%)

* survey ended, mid-January 2006

Table 3 Proportion of surveyed farms that recorded the presence of four species of grass in pasture, and the mean estimated contribution to pasture of each species.

Grass species	Farms with species present (%)		Contribution to pasture (%)	
	Affected	Unaffected	Affected	Unaffected
Perennial ryegrass	76	36	40	15
Annual ryegrass	24	23	18	19
Phalaris	48	19	29	11
Paspalum	24	26	5	9

Table 4 Age distribution of alpaca (cria (C), weanling (W) or adult (A)) on staggers-free farms (unaffected animals), exposed to toxins but not affected (alpaca on farms where at least one was affected) and exposed to toxins and affected (affected animals).

	---------- 2006 ----------				---------- 2005 ----------				---------- 2004 ----------			
Alpaca	Total	C1	W	A	Total	C	W	A	Total	C	W	A
Unaffected	3972		852	3120	3932		872	3060	2978		634	2344
		--	21.5%	78.5%		--	22.2%	78%		--	21.3%	78.7%
Exposed	929	75	162	692	927	81	172	674	1521	126	145	1250
		8.1%	17.4%	74.5%		8.7%	18.6%	72.7%		8.3%	9.5%	82.2%
Affected	55	4	31	20	88	5	36	47	99	24	32	43
		7.2%	56.4%	36.4%		5.7%	40.9%	53.4%		24.2%	32.3%	43.4%

[1] No data for unaffected farms.

with and without endophyte have been compared (eg. Easton *et al*. 1996; Fletcher *et al*. 1999; Keogh & Blackwell 2001).

Method

A survey of staggers was conducted by telephone of 107 of the 2 100 members of the Australian Alpaca Association (AAA), selected at random. The AAA represents over 70 000 registered alpaca. A sample size lower limit of 92 members was required to achieve a 95% confidence limit at a 10% confidence interval for the information sought. The number of alpaca and presence of sheep or cattle was recorded for 2004, 2005 and 2006. Alpaca were classified as Huacaya or Suri breeds and by age. The survey recorded possible signs of PRGT including staggers, crowding into dams, panting in cool weather, reduced fertility, neo-natal losses, ill-thrift and scouring. Information was collected on the onset and duration, remedial action, estimates of treatment costs as well as the presence and contribution of the four most likely staggers-inducing grass species in their pasture. Chi square, Pearson's correlation and t-test analyses of data were conducted using JMP (SAS Institute), SYSTAT and SPSS (SPSS) programs.

Results

Farms for which at least one animal exhibited staggers in any year were classified as 'affected'. Eighty-two respondents reported no staggers on their farms while 25 (23.4%) reported staggers (Table 1). The proportion of all alpaca surveyed that were observed with staggers was 3% (Table 2). Seventy-six percent of affected farms identified perennial ryegrass in their pastures compared with 36% of unaffected farms (Table 3). Pearson's test showed a significant correlation between the presence of perennial ryegrass (PRG) and the occurrence of staggers ($P<0.001$) (Table 3). In contrast to perennial ryegrass and phalaris, the incidence of staggers was not noticeably related to the presence of annual ryegrass and paspalum. The mean contribution of perennial ryegrass in the pasture was higher on affected farms than it was on unaffected farms. The next most common species present on affected farms was phalaris. The onset of signs in herds affected with staggers was reported in all months of the year, but mostly during January-March (Fig. 1). The mean duration of signs was 3.5 months (range 0.25-12.0) (Fig. 2).

For the 15 farms where other animal species were present, alpaca were considered more sensitive to the cause(s) of staggers than sheep or cattle - only two of these farms had other animals develop staggers – sheep in both cases. Occurrence of staggers differed among age groups (Table 4). In each of the 3 years of the survey, >30% of affected animals on farms where staggers was recorded were weanlings, although this age group represented less than 20% of the alpaca herd. Over 95% of alpaca were Huacaya and the Chi square test showed that the difference between these and Suri in susceptibility to staggers was not significant. In describing the signs of staggers, 100% of respondents with affected alpaca reported poor coordination, 92% head tremors, 84% tripping or staggering, 32% spasms and 28% stock down in the paddock. Pearson's correlation test showed that affected farms reported a markedly higher occurrence of sub-clinical signs compared with unaffected farms (Table 5). The average annual cost of treatment for an affected alpaca was AUD$96. For remedial action, 68% administered medication/nursing and 32% sought veterinary advice/action.

To examine the effect of climate on the occurrence of staggers, average annual rainfall at the nearest meteorological station was compared for affected and unaffected farms using the Student

t-test. The average rainfall was significantly higher on farms that were affected by staggers in both South Australia and New South Wales (Table 6). This probably reflects the increased ability of perennial grasses to persist and grow with higher rainfall. Similarly the presence of annual ryegrass was associated with a significantly lower average annual rainfall (Table 7).

Discussion

Results of this survey confirm that staggers occurs frequently in alpaca in Australia, with an average of 23% of national herds affected. On farms where staggers was reported, 9.3% of the animals developed signs. Victoria, where perennial ryegrass is widely naturalised, showed a high incidence of staggers. Tasmania and South Australia were also affected.

Of alpaca exposed to pasture containing PRG, 5.9% developed staggers (Table 4). This is consistent with reports from southern Victoria where 5–10% of alpaca exposed to PRG developed clinical signs of PRGT that persisted for up to 3 months of the year (Reed & Cummins 2003).

The month of onset and duration of staggers symptoms varied, but January, February and March were the most common. As shown by Barker *et al*. (1993), *N. lolii* produced more toxin when the host plant was moisture stressed (e.g. excessive heat or drought) than when it was not. The duration of the clinical signs most often lasted 3 to 4 months, although 5 of the 25 farms that were affected (two in SA and three in Victoria) reported symptoms

Table 5 Percentage of herds that demonstrated signs of possible sub-clinical effects of PRGT.

	Crowding into dams	Panting	Lowered fertility	Loss of pregnancy	Early death of cria	Ill-thrift	Scouring
Unaffected	3.7	3.7	9.9	23.5	18.5	12.3	6.2
Affected	20.0	20.0	28.0	44.0	36.0	52.0	12.0
P-value	0.006	0.006	0.020	0.039	0.059	0.000	0.326

Table 6 Mean annual rainfall (mm) for affected and unaffected farms by states.

State	Affected	Unaffected	P-value
New South Wales	1101	777	0.025
Victoria	814	802	0.873
Queensland	-	1321	-
South Australia	743	594	0.006
Western Australia	-	691	-

Table 7 Average rainfall (mm) for farms that recorded grass species as present or absent.

	Perennial ryegrass	Annual ryegrass	Phalaris	Paspalum
Absent	768	819	776	803
Present	821	708	842	761
Significance	NS	P=0.003	P=0.051	NS

Figure 1 Number of farms by month when onset of staggers was first noticed in 2004-06

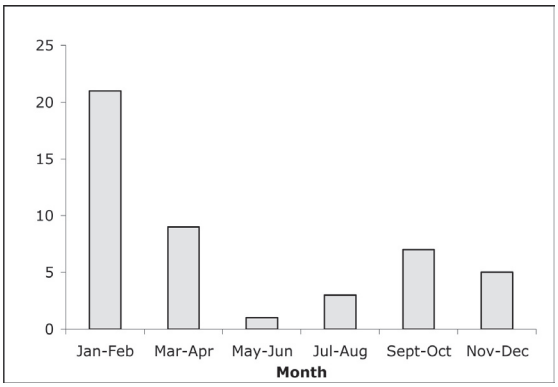
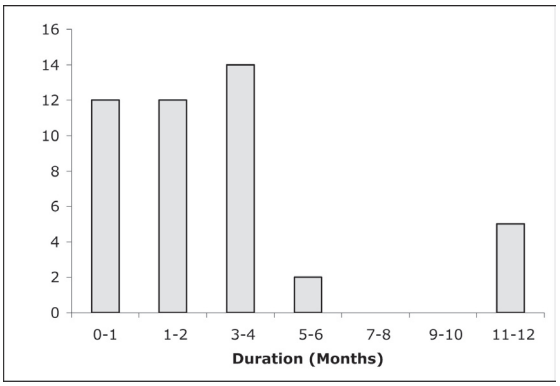


Figure 2 Number of farms by annual duration of staggers signs (months) in 2004-06.



lasting 12 months. Such poor reversibility was occasionally noted in the southern Victorian alpaca (Reed & Cummins 2003) and has not been observed in sheep and cattle. Alpaca may have low tolerance of PRG toxins. The greater susceptibility of young stock (Table 4) has often been noted in other species.

The most common signs associated with staggers were poor coordination; most producers also noted head tremors and tripping. Some reported animal spasms or having stock down in the paddock. These more serious symptoms were probably obviated in most cases, in contrast to extensively grazed sheep, by removing alpaca from the pasture and hand feeding them in yards at the onset of staggers. Most 'sub-clinical' signs were more prevalent in staggers-affected herds than in unaffected herds. This indicates that the loss of productivity and subsequent costs from staggers may be higher than can be estimated from the numbers of clinically affected animals. The estimated cost per head of sub-clinical and speculative effects in sheep is as high as 62% of the total cost of PRGT (Lean 2005). Credible measurement of the actual costs of PRGT awaits the conduct of carefully controlled experiments to measure performance of stock on pastures where perennial ryegrasses with and without toxin-producing endophytes are compared.

ACKNOWLEDGEMENTS

The Australian Alpaca Association for support and Kerryn Butler-Henderson for statistical advice.

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