FEEDING LUPINS TO EWES FOR FOUR DAYS DURING THE LUTEAL PHASE CAN INCREASE OVULATION RATE

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SUMMARY

As little as six days of lupin intake can increase ovulation rate in ewes. The timing and length of previous successful lupin feeding regimes suggest that there is a critical period in the luteal phase of ewes when intake of lupins can increase ovulation rate. This hypothesis was tested by feeding lupins to ewes on days -8 to -5 or days -4 to -1 before ovulation (day 0). The ewes fed lupins on days -8 to -5 in January-February or April had a significantly higher ovulation rate than flockmates fed oats ($P < 0.05$). The results suggest that intake of lupins by ewes on days -8 to -5, but not days -4 to -1 of the ovulatory cycle can increase ovulation rate and that the response of ewes to intake of lupins on days -8 to -5 can be influenced by the season. (Key words: Lupins, ovulation rate, season).

INTRODUCTION

In recent years in Western Australia, Gherardi and Lindsay (1982) and Oldham and Lindsay (1984) have shown that only a short period of intake of lupins can increase the ovulation rate (OR) of ewes. Gherardi and Lindsay fed lupins to ewes for seven days, from approximately day -10 to day -4 before ovulation (day 0). In contrast, Oldham and Lindsay fed lupins to ewes for six days, from approximately day -7 to day -1. The small overlap between these two successful treatments suggests that there is a short critical period in the luteal phase of the ovulatory cycle of ewes when intake of lupins can increase their OR. We tested this hypothesis by feeding lupins to ewes for four days, day -8 to day -5 versus day -4 to day -1 of the ovulatory cycle, and then measuring their OR.

MATERIALS AND METHODS

The experiments used two flocks of cast-for-age Merino ewes purchased in November 1983 (Flock 1) and November 1984 (Flock 2). Both flocks of ewes were trained to eat lupins or oats from a bucket while tethered in a race. The ewes were held on bare ground and fed a basal ration of 750 g oats with oaten hay available ad libitum throughout all of the experiments.

During the experimental period the ewes were induced to have 15-day ovulatory cycles by fortnightly injections of synthetic prostaglandin $F_{2\alpha}$ (Estrumate, I.C.I.: 125 ug i.m.). In a preliminary experiment using 20 ewes from Flock 1 we found the time of ovulation after an injection of Estrumate was 3.8 ± 0.11 days (mean ± SEM). This estimate of the time of ovulation after prostaglandin is similar to others previously published (Driancourt and Cahill 1984; Wallace and McNeilly 1985). We used these results to assign the day of ovulation to the third day after the injection of Estrumate. In each experiment the ovaries of all the ewes were examined by endoscopy five days after ovulation. Any ewes which had not re-ovulated by this time were not included in future cycles. Ovulation rate was compared between treatments and cycles by chi-square (Snedecor and Cochran 1976).

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All ewes were weighed before and after a period of lupin feeding. The live weights of the ewes before and after feeding were compared by the students t-test (Snedecor and Cochran 1976).

EXPERIMENT 1

In April 1984, 158 ewes of Flock 1 were divided at random into two groups after stratification for live weight and history of multiple ovulations. The ewes in group 1 received the basal ration for three consecutive ovulatory cycles while the ewes in group 2 received 750 g lupins instead of oats in;

cycle 1 days -4 to -1,
cycle 2 days -8 to -5,
cycle 3 days -8 to -1 of the ovulatory cycle.

EXPERIMENT 2

In January 1985, 160 ewes of Flock 2 were divided at random into two groups after stratification for live weight and history of multiple ovulations. According to a crossover design the ewes received either the basal ration (cycle 1, group 2 and cycle 2, group 1) or 750 g lupins instead of oats (cycle 1, group 1 and cycle 2, group 2) on days -8 to -5.

RESULTS

The results of Experiment 1 are detailed in Table 1. The OR of the control ewes fed oats was constant over the three cycles despite a steady gain in mean live weight. The OR of the ewes receiving lupins was significantly increased relative to controls fed oats only when lupin intake commenced on day -8 and finished on day -5 of their ovulatory cycle ($P < 0.05$). The mean live weights of the two groups of ewes were always similar and were not significantly changed by any of the periods of lupin intake.

In Experiment 2 (Table 2), the OR of all the ewes fed lupins was significantly greater than that of the oat-fed ewes (1.49 vs 1.34; $P < 0.05$) and the difference in the OR of the oat and lupin-fed groups in cycles 1 and 2 approached significance. The mean total OR of cycle 1 was less than that for cycle 2 (1.31 vs 1.42; $P < 0.10$). As in Experiment 1, none of the treatments had any significant effect on live weight.

DISCUSSION

Lupin intake over four days in the late luteal phase of the ovulatory cycle (Experiment 1, cycle 2, and Experiment 2) increased the OR of ewes at their next ovulation relative to controls fed oats. These findings support our hypothesis that there is a critical period in the late luteal phase of ewes when lupin intake can increase OR. Our results also suggest that differential nutrition on days -8 to -5, but not days -4 to -1, can influence OR.

In Experiment 1, cycle 3, the intake of lupins by ewes over days -8 to -1 failed to change their OR relative to controls fed oats. The OR of the controls was similar to that in previous cycles (1.19 vs 1.15 and 1.14). Thus, failure of lupin intake to increase OR was not due to a chance increase in the OR of the controls blanketing a normal response among the ewes eating lupins. The variability in the response of ewes to lupin intake over days -8 to -5 of their ovulatory cycle may be due to confounding with the time within the breeding season of the lupin intake (season) or preceding nutritional treatment of the ewes.

Table 1 The effect of the timing of intake of lupins on the live weight (kg) and ovulation rate (OR) of the ewes in Experiment 1, cycle 1, 2 and 3

Cycle	Group	n	Days and date of lupin intake	n ovulating	Live weight mean ± SEM Before lupins	Live weight mean ± SEM After lupins	OR	χ^2 (prob)
1	1	79	-	74	43.9±0.42	42.0±0.44	1.15	0.08
	2	79	-4 to -1	67	43.9±0.46	42.6±0.51	1.21	(P<0.9)
			8-11 Apr 1984					
2	1	74	-	62	45.4±0.43	45.6±0.43	1.14	3.86
	2	67	-8 to -5	66	45.4±0.56	45.6±0.52	1.30	(P<0.05)
			18-21 Apr 1984					
3	1	62	-	57	45.4±0.44	45.4±0.44	1.14	1.06
	2	66	-8 to -1	63	46.0±0.57	46.0±0.52	1.19	(P<0.50)
			2-9 May 1984					

Table 2 The effect of the intake of lupins on the live weight (kg) and ovulation rate (OR) of the ewes in Experiment 2, cycles 1 and 2

Cycle	Group	n	Days and date of lupin intake	n ovulating	Live weight mean ± SEM Before lupins	Live weight mean ± SEM After lupins	OR	χ^2 (prob)
1	1	77	-8 to -5	74	47.8±0.50	47.9±0.50	1.36	2.24
	2	77	-	72	48.2±0.49	47.6±0.61	1.25	(P<0.25)
			29 Jan-1 Feb 1985					
2	1	74	-	73	50.2±0.50	48.9±0.50	1.34	3.34
	2	72	-8 to -5	71	49.1±0.51	48.2±0.49	1.49	(P<0.10)
			12-15 Feb 1985					
Total	Lupins			145			1.43	5.38
	Oats			145			1.29	(P<0.025)

Oldham (1980) reported that coincident with the beginning of the breeding season in January/February, the OR of ewes increased and was then maintained until May when it declined rapidly. In one experiment Oldham (1980) also found that the response of the OR of ewes-to lupin intake declined in May/June. However, in our data the OR of the control ewes fed oats was maintained throughout (Experiment 1) or increased (1.25 to 1.34) (Experiment 2). Therefore, it is not clear whether the season of lupin intake can influence the response of ewes to lupin intake but the results of Experiment 1, cycle 3, suggest that ewes fed lupins in April/May are less likely to show an increase in OR than ewes fed lupins in January/February and March/April.

Gherardi and Lindsay (1982) have reported that sometimes there is a significant carry-over effect on the OR of ewes due to lupin intake in the preceding ovulatory cycle. This carry-over effect could have affected the results of Experiments 1 and 2. In Experiment 1, cycle 1, lupin intake had no effect on OR, so a carry-over effect in cycle 2 is unlikely. In cycle 3, there is no evidence of an increase in OR due to either lupin intake in cycle 3 or lupin intake in the preceding cycle. Thus it is unlikely that carry-over has influenced the results of Experiment 1. In Experiment 2, the OR of the ewes fed lupins in cycle 1 (1.36) was maintained in cycle 2 (1.34) when they received oats, a possible carry-over effect. However this could just as easily reflect a general increase in OR due to an increase in live weight and/or season as the OR of the ewes fed lupins in cycle 2 was the highest seen in any of the experiments (1.49) and the mean total OR increased from cycle 1 to cycle 2. Therefore it is not clear whether carry-over has affected the results of Experiment 2.

In conclusion, our results suggest that there is a critical phase in the luteal phase of the ovulatory cycle (days -8 to -5) when lupin intake can increase OR. However the season of lupin intake, and lupin intake in the previous ovulatory cycle may influence the response of OR to lupin intake on' days -8 to -5 of the ovulatory cycle.

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