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SEASON AND SUPPLEMENTATION EFFECTS ON OVARIAN ACTIVITY IN FINE-WOOL EWES GRAZING NATIVE RANGE OR IN CONFINEMENT[1,2]

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Summary

Effects of season and supplementation on incidence and rate of ovulation in multiparous, non-lactating ewes were investigated under range and dry-lot conditions over a 1-year period. In the range trial, 45 ewes received one of three nutritional treatments, range forage alone (R) and range forage supplemented with either 0.33 kg·head^{-1}·d^{-1} pinto beans (RB) or 0.45 kg·head^{-1}·d^{-1} alfalfa pellets (RP). Another 45 ewes were maintained in dry lots and fed 1.33 kg·head^{-1}·d^{-1} prairie hay (H) and either pinto beans (HB) or alfalfa pellets (HP) at the same rates used in the range trial. Ovarian structures were observed by laparoscopy at monthly intervals, except during breeding season (September-January). Supplemented ewes in both trials were heavier ($P<.05$) than R and H ewes during most of the study. In the range trial, incidence of ovulation and ovulation rate tended to be higher in RB ewes in April ($P = .21$) and June ($P = .33$ and $P = .24$ respectively) compared to R and RP ewes. In the dry-lot trial, ovulation rate tended to be higher in HB ewes ($P = .21$) in February and in HP and HB ewes ($P = .13$) in March compared with H ewes. Except for those trends, seasonality of ovulation was not influenced by supplementation ($P>.40$). Incidence of ovulation approached zero in dry-lot ewes in April, May, June and July. In contrast 43%, 27%, 35% and 21% of range ewes were ovulating during those same months.

Introduction

Profitability and efficiency of lamb and wool production can be enhanced by improving reproductive efficiency. The seasonal nature of sexual activity imposes a major constraint towards improving reproductive efficiency of sheep (Hulet, 1978; Morley, 1981). Apart from the well-documented breed and latitude effects on onset and duration of breeding activity, there are modifying influences, mainly nutrition (Owen, 1976; Rattray, 1977). Adequate nutrition and good body condition can extend the breeding season (Smith, 1964; Hulet et al. 1986) and increase ovulation rates of ewes (Tassell, 1967; Thomas et al. 1987). Other studies reported lack of influence on nutrition and body weight on length of seasonal anestrus in ewes (Hafez, 1952; Lamond et al., 1972, Hall et al., 1986). Variations among responses to plane of nutrition may be related to type, quality, composition of the feed and duration of feeding (Smith, 1985). Research on the influence of chronic increase of feeding level on incidence of ovulation is limited. This study was conducted to investigate the effect of long-term supplementation with alfalfa pellets and pinto beans on ovarian cyclicity in fine-wool ewes grazing native range and in confinement.

Materials and Methods

In July, 1984, 45 non-pregnant, non-lactating Rambouillet ewes (5 to 6 yr of age) were randomly allotted under native range conditions to one of three nutritional treatments. One group was maintained on range forage (R) on the Jornada Experimental Range, an arid range typical of many millions acres in the Southwest. The other two groups were fed as described for the first group, plus either .33 kg·head^{-1}·d^{-1} of crushed pinto beans (RB) or .45 kg·head^{-1}·d^{-1} of alfalfa pellets (RP). The groups were kept on three large pastures (600 to 800 hectares) and rotated monthly to minimize pasture effects. Heavy predation losses occurred throughout the study (30 ewes) and were equally distributed across treatments, with 50% of the losses occurring during the last 3 months (April - July 1985).

Another 45 ewes were maintained under confinement and randomly allotted at two locations to one of three nutritional treatments. One group was maintained on 1.33 kg·head^{-1}·d^{-1} prairie hay (H), and two groups received either the hay plus the pinto beans (HB) or hay plus the alfalfa pellets (HP) at the same rates used in the range trial. Chemical composition of the hay and the two supplements are shown in table 1. All ewes underwent an adaptation period of 30 d on their respective diets, and had free access to salt and mineral blocks and water. Weights of all sheep were monitored at monthly intervals. Beginning August, 12 ewes from each group in both trials were examined by a laparoscopic technique (Hulet and Foote, 1968) and number of corpora lutea was recorded. Thereafter, ovaries were monitored in all ewes at monthly intervals, except during the breeding season (September, October, November, December and January). An earlier study conducted at the same location over a 2-year period indicated most ewes were cycling during that period (Hulet et al., 1986).

Body weight, total weight change and ovulation rate (number of corpus leuteum per ewe examined) of range ewes were analyzed by one-way analysis of variance with initial weight as covariate. Animal weights, total weight changes and ovulation rates in dry lot ewes were analyzed by two-way analysis of variance with initial weight as covariate, using a randomized complete block design with the two

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locations considered as blocks (Steele and Torrie, 1980). When significant F-values occurred, means were separated using least significance difference test. Categorical data, i.e. incidence of ovulation, were evaluated by Chi-square tests (SAS, 1982).

Results and Discussion

Body weight of ewes. In the range trial (table 2), supplemented animals were heavier (P<.05) in August, September, October, December, February, March, June and July. However, during November, April and May, RB ewes were heavier (P<.05) than R or RP ewes. Only in January, were RP ewes heavier (P<.05) than R or RB ewes. Ewes maintained on range forage alone lost only 2.2 kg during the study, indicating quantity and quality of range forage were adequate for body weight maintenance. In the dry-lot trial (table 3), supplemented ewes were heavier (P<.10) in all months except September and October. However, the magnitude of weight gain generated by the supplements (1.1 kg in HB ewes and 2.1 kg in HP ewes and 3.9 kg weight loss observed in H ewes) indicates the quality of prairie hay was barely adequate for body weight maintenance.

Ewes supplemented with cull pinto beans (both on range and dry lot) had satisfactory performance with no ill effects observed. Similar performance of adult ewes and finishing lambs fed dry, edible beans were reported by Blakeslee et al. (1941) and Doyle et al. (1978).

Incidence and rate of ovulation. Mean percentage of range ewes ovulating and mean ovulation rate ranged from 21% and 0.2 in July to 77% and 1.0 in August, respectively (tables 4 and 5). Seasonality of ovulation, in terms of incidence and rate of ovulation, was not affected (P>.40) by supplementation in range ewes in August, February, March, May and July. However, more RB ewes (67 and 60%) tended to ovulate in April (P = .21) and June (P = .33) compared to R (33 and 22%, respectively) and RP ewes (30 and 33%, respectively). In the dry-lot trial (tables 6 and 7), ovulation rate tended to be higher in HB ewes (P = .21) in February and in HP ewes (P = .13) in March compared with H ewes, but did not differ in other seasons (P>.40). Incidence of ovulation was similar (P>.40) in August, February and March, and decreased dramatically to approach zero in all groups in April, May, June and July. In contrast, 43%, 27%, 35% and 21% of range ewes were ovulating during the same months. Abundant forage and availability of green forbs on the range may be a possible explanation for the less pronounced anestrus in range ewes.

The proportion of ewes ovulating in both trials followed the seasonal pattern reported for Rambouillet ewes (Hulet et al., 1974; Hulet et al., 1986) and fine-wool ewes in general (Robertson, 1977), with an observed tendency towards nonseasonal breeding. The present study indicates the seasonal pattern of ovulation in fine-wool ewes may not be consistently altered by level of nutrition and the long-term static effect of nutrition on body weight.

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TABLE 1. CHEMICAL COMPOSITION OF PRAIRIE HAY (H), PINTO BEANS (B) AND ALFALFA PELLETS (P) FED TO EWES (DRY MATTER BASIS)

Component	H	B	P
Dry matter %	94.3	92.9	93.4
Crude protein %	7.4	24.6	17.4
Total nitrogen %	1.2	3.9	2.8
Insoluble unavailable nitrogen %	.4	.3	.3
Available nitrogen %	.8	3.6	2.5
Acid detergent fiber %	38.6	8.6	23.1
Gross energy, kcal/g	4.2	4.3	4.2

TABLE 2. BODY WEIGHTS (KG) OF EWES RECEIVING RANGE FORAGE ALONE (R), RANGE FORAGE SUPPLEMENTED WITH PINTO BEANS (RB) OR RANGE FORAGE PLUS ALFALFA PELLETS (RP)[a]

Month	Number of Animals	Treatment R	RB	RP	SE
July	45	48.6[b]	47.4[c]	48.7[c]	
August	43	48.7[b]	50.8[c]	50.8[c]	.4
September	39	49.8[d]	54.5[e]	52.9[e]	.7
October	37	48.0[b]	52.9[c]	54.5[c]	.8
November	36	48.6[d]	52.9[e]	50.1[d]	.9
December	36	46.4[d]	49.0[e]	48.6[e]	.9
January	36	45.4[d]	47.8[d]	49.0[e]	1.0
February	34	45.4[d]	48.3[e]	50.0[e]	.9
March	32	46.8[d]	50.3[e]	49.8[e]	1.0
April	29	50.6[d]	55.9[e]	52.2[d]	1.0
May	26	49.2[d]	55.6[e]	51.5[d]	1.1
June	20	47.2[b]	52.8[c]	52.6[c]	.8
July	15	46.0[d]	51.2[e]	53.4[e]	1.2
Overall body weight changes		-2.2[d]	2.9[e]	5.3[e]	1.2

[a]Least-square means, adjusted for initial weight.
[bc]Row means within month with different superscripts differ (P<.001); row means with same superscripts do not differ (P>.10).
[de]Row means within month with different superscripts differ (P<.05); row means with same superscripts do not differ (P>.10).

TABLE 3. BODY WEIGHTS (KG) OF EWES MAINTAINED ON PRAIRIE HAY (H), SUPPLEMENTED WITH PINTO BEANS (HB) OR ALFALFA PELLETS (HP)[a]

Month	Number of Animals	Treatment H	HB	HP	SE
July	45	51.2[b]	52.7[b]	53.7[c]	
August	45	52.8[b]	52.7[b]	53.9[c]	.4
September	45	52.0	51.9	52.2	1.1
October	45	52.1[b]	54.7[c]	53.7[c]	1.7
November	45	49.4[b]	51.5[c]	52.9[c]	.9
December	45	50.1[b]	53.3[c]	53.9[c]	1.3
January	45	49.7[d]	53.0[e]	54.0[e]	.9
February	45	49.2[d]	53.0[e]	54.0[e]	.4
March	45	49.0[d]	54.2[e]	55.5[e]	1.0
April	45	48.2[d]	54.1[e]	54.7[e]	.5
May	45	47.8[d]	52.8[e]	53.7[e]	.7
June	43	47.9[d]	52.9[e]	54.1[e]	.9
July	43	47.5[d]	53.3[e]	54.5[e]	.9
Overall body weight changes		-4.0[d]	1.1[e]	2.1[e]	.6

[a]Least-square means, adjusted for initial weight.
[bc]Row means within month with different superscripts differ (P<.10); row means with same superscripts do not differ (P>.10).
[de]Row means within month with different superscripts differ (P<.05); row means with same superscripts do not differ (P>.10).

TABLE 4. INCIDENCE OF OVULATION (%) IN RANGE EWES FED RANGE FORAGE (R), RANGE FORAGE SUPPLEMENTED WITH PINTO BEANS (RB) OR RANGE FORAGE PLUS ALFALFA PELLETS (RP)[a]

Month	Number of Animals	Treatment R	RB	RP
August	34	75	80	75
February	30	70	80	60
March	30	50	40	60
April	28	33	67	30
May	26	22	33	25
June	20	22	60	33
July	14	20	33	17

[a]Percent of ewes ovulating within rows do not differ (P>.10).

TABLE 5. OVULATION RATE IN RANGE EWES RECEIVING RANGE FORAGE (R) RANGE FORAGE SUPPLEMENTED WITH PINTO BEANS (RB) OR RANGE FORAGE PLUS ALFALFA PELLETS (RP)[a]

Month	Number of Animals	Treatment R	RB	RP	SE
August	34	1.0	1.0	1.1	.2
February	30	.8	1.0	.7	.2
March	30	.7	.6	.7	.2
April	28	.4	.7	.3	.2
May	26	.2	.3	.2	.2
June	20	.2	.8	.3	.2
July	14	.2	.2	.2	.2

[a]Least-square means within rows do not differ (P>.10).

TABLE 6. INCIDENCE OF OVULATION (%) IN DRY LOT EWES FED PRAIRIE HAY (H), PRAIRIE HAY SUPPLEMENTED WITH PINTO BEANS (HB) OR PRAIRIE HAY PLUS ALFALFA PELLETS (HP)[a]

Month	Number of Animals	Treatment H	HB	HP
August	38	92	92	77
February	38	55	73	67
March	45	13	27	27
April	45	7	7	0
May	43	0	7	0
June	43	0	0	0
July	43	0	7	13

[a]Percent of ewes ovulating within rows do not differ (P>.10).

TABLE 7. OVULATION RATE IN DRY LOT EWES FED PRAIRIE HAY (H), PRAIRIE HAY SUPPLEMENTED WITH PINTO BEANS (HB) OR PRAIRIE HAY PLUS ALFALFA PELLETS (HP)[a]

Month	Number of Animals	Treatment H	HB	HP	SE
August	38	1.0	1.2	1.0	.2
February	38	.5	1.0	.7	.2
March	45	.1	.3	.4	.1
April	45	.1	.1	.0	.05
May	43	.0	.1	.0	.04
June	43	.0	.0	.0	.0
July	43	.0	.1	.2	.05

[a]Least-square means within rows do not differ (P>.10).