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INFLUENCE OF BREED OF SIRE AND SEASON OF BREEDING ON LAMB PRODUCTION UNDER INTEGRATED FARMING SYSTEMS

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West African Long-legged (WL) and Nungua Blackhead (N) rams were compared for their reproductive efficiency over three (3) mating seasons (May, January and September) during a four-year period. Reproductive parameters studied included conception rate, prolificacy, lamb survival rate, lamb birth weight, weaning weight, pre-weaning growth rate and lamb liveweight weaned per ewe exposed. WL was superior to N in all parameters measured but conception rate. Prolificacy and lamb birth weight were higher for the mating in the wet season (May) than for the mating in the dry season (January) but lamb survival rate was highest for the lambings in the dry season (September mating). It is argued that if rams and their lambs were to be reared indoors for some time it should be possible to raise more of the heavy lambs from large litters to weaning. It is also suggested that under integrated farming systems equal emphasis could be placed on both WL and N rams during matings in May and September while greater importance should be placed on WL rams during mating in January.

Key words: Sheep, reproduction, West African Long-legged sheep, Nungua Blackhead sheep, season.

The sire has more influence on herd improvement than any one female. Significant differences as well as similarities in reproductive performance between different sire groups have been reported (Fhamy et al 1972; Ngere 1973; O'Ferral 1974; Carter and Kirton 1975; Hohenboken et al 1976). This suggests that the results of sire performance obtained under one set of environmental conditions may not readily by applicable under another set of environmental conditions, even for the same breed. It is therefore imperative that sire performance records be established locally.

In the West African Sub-Sahelian region there are two major indigenous breeds of meat-type sheep, namely West African Dwarf (WAD) and West African Long-Legged (WL). WAD, which is more adapted to the forest areas, is a small breed (March 1951) and would require upgrading by larger breeds before any meaningful quantity of mutton could be obtained from it. The heavier WL is naturally at home in the savannah and semi arid zones. Various grades of the WL breed and WAD are found among the flocks of the small scale farmer. Nevertheless there is a paucity of information on the potential of WL as a sire in the rain forest zone.

In the early nineteen sixties, Nungua Blackhead (N), another breed of meat-type sheep was developed at the University of Ghana Agricultural Research Station, Legon, from WAD and Blackhead Persian of South Africa. Developed on the coastal savannah, this breed has not been critically

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tested in the forest area. The experiment described below was therefore designed to shed some light on the value of WL and N as breeder sires.

It is accepted that tropical breeds of sheep do not show seasonal anoestrus and are thus capable of breeding anytime during the year. Indeed it has been demonstrated that where feed is not limiting West African sheep can be successfully bred twice in a year (Asiedu and Appiah 1983). Despite this it might still be possible to discern a time of the year when the productivity of sheep of tropical origin is at its optimum level. In this study, three mating seasons, covering the wet and dry periods, were therefore superimposed on the sire treatments.

Materials and Methods

Experimental site: Data were collected on some reproductive parameters for the two rams over a four-year period (May/June 1976 - May/June 1980) at the University of Ghana plantation crops farm. The station is sited at Kade (6°'N, 0°49'W) in the rain forest zone of Ghana. Rainfall distribution in the area is bimodal. The major wet season spans March - June, while the minor wet season is September - October. The climatic data during the experimental period is summarized in Table 1.

Table 1:

Rainfall, temperature, relative humidity and hours of sunshine during experimental period

	Rainfall (mm/2 Mo)	Mean daily temperature (°C)	Mean daily relative humidity %		Mean daily sunshine (hours)
			0900h	1500h	
May/June	413.5	26.0	87.6	72.1	5.03
January/ February	105.0	26.6	87.2	53.3	6.15
September/ October	220.5	25.3	88.3	70.3	3.78

Experimental design: Forty 2 to 3 year-old ewes representing equal numbers of two crossbreeds, West African Long-legged x West African Dwarf (WL X WAD) and Nungua Blackhead X West African Dwarf (N X WAD), were divided into two groups of twenty each and randomly assigned to the two rams in a two - replicate randomized complete block design.

N X WAD ewes and N ram were obtained from a sister station on the Accra Plains, WL ram from a suburb of Accra and WL X WAD ewes were procured from private farmers around Kade. Both rams were mature but WL was heavier (38 kg vs 32 kg) which is in keeping with the characteristics of the breeds (Mason 1951; F K Fianu - personal communication). The rams were tested over three mating seasons, May/June, January/February and September/October, to provide a 3 x 2 factorial arrangement.

Husbandry practices: The rams and the ewes maintained in separate groups and grazed under oil palm, kola or citrus plantations for about eight hours (0800 - 1600 h) each day and then shepherded into paddocks under avocado pear or mango plantations for the night. Forage consisted primarily of *Pueraria phaseoloides* and *Centrosema pubescens* seeded as cover crops under the trees. During the mating season each group of ewes, and its appropriate ram were held in a separate paddock during the nights. Each mating season lasted six weeks.

Lambing occurred in the night paddocks or at pastures in which case the lamb(s) and the dam were taken to the paddock and retained for some 48 hours before returning them to the ewe flock. Lambs were given numbers and weighed within 24 hours of birth. There was no supplementary feeding for either the lambs or the ewes but water was freely available at pastures and in the paddocks. The male lambs were castrated three weeks after birth and all lambs were weaned at 12 weeks of age.

All experimental animals were drenched and dipped fortnightly during the wet season and monthly during the dry season.

Statistical analysis: Reproductive parameters measured were conception rate (ewes lambing per ewe exposed), prolificacy (number of lambs born per ewe lambing. Lamb survival rate, lamb birth weight, weaning weight, preweaning growth rate and lamb liveweight weaned per ewe exposed. The data were subjected to analysis of variance and the treatment sums of squares partitioned for orthogonal comparisons (John and Quenouille 1977).

Results

A significantly ($P < 0.01$) higher proportions of ewes exposed to breed N conceived than those exposed to WL (Table 2). Conception rate of ewes however, had significantly ($P < 0.05$) linear and quadratic effects (Table 4) on the conception rate of ewes exposed to WL; conception rate being lowest for the mating in May.

The number of lambs sired by the two rams was not significantly different. Mating the sheep in May tended to produce larger ($P<0.05$) litter size, on the average, than mating in January, but not in September.

The proportion of lambs sired by WL that was raised to weaning was 15% higher ($P < 0.01$) than that sired by N. There was a significant ($P < 0.05$) linear response of lamb survival rate to mating season. Lamb survival rate was highest for the mating in September and lowest for the mating in May for both rams.

No significant interaction between season of mating and sire breeds was observed for lamb birth weight but, on average, lamb birth weight declined linearly ($P < 0.01$) from May mating to September mating (Table 4). Lambs sired by WL were 35.4 percent heavier ($P < 0.01$) than those sired by N (Table 3).

Lamb pre-weaning growth rate was significant ($P < 0.05$) for only sire effect, with lambs produced by WL gaining some 20 g each per day more than those of N.

Table 2:

Mean effects of sire breed and mating season on ewe conception rate, prolificacy and lamb survival rate

Sire	Mating season May	January	September	Mean
	CONCEPTION RATE (%)			
WL	72.7	92.2	87.2	84.0
N	98.9	93.8	95.9	96.2
Mean	85.8	93.0	91.6	90.1
	SE* ±: (a) 1.61	(b) 1.97	(c) 2.79	
	PROLIFICACY			
WL	1.61	1.50	1.39	1.50
N	1.53	1.11	1.33	1.32
Mean	1.57	1.31	1.36	1.41
	SE* ± : (a) 0.055	(b) 0.067	(c) 0.095	
	LAMB SURVIVAL (%)			
WL	82.1	92.7	96.2	90.3
N	61.4	74.6	90.5	75.5
Mean	71.8	83.7	93.4	82.9
	SE* ± : (a) 1.104	(b) 1.35	(c) 1.91	

*SE of (a) Sire means; (b) season means; (c) means in the body of table

Lamb weaning weight followed similar trends as the pre-weaning growth rate. Lambs sired by WL were weaned, on average, one and a quarter times heavier ($P < 0.05$) than those sired by N.

There was a significant interaction (quadratic, $P < 0.01$) between season of mating and sire breed with respect to lamb liveweight weaned per ewe exposed. For N, lamb liveweight weaned declined from May mating to January mating and then went up again. But for WL, lamb liveweight weaned increased from May to January and apparently declined again. On average lamb liveweight weaned to WL was about 15 kg ($P < 0.01$) for every 10 kg weaned to N.

Table 3:

Mean effects of sire breed and mating season on lamb birth weight, pre-weaning growth rate, weaning weight and lamb, liveweight weaned per ewe exposed per mating season

	Mating season			
Sire	May	January	September	Mean
	LAMB BIRTH WEIGHT (kg)			
WL	2.81	2.38	1.93	2.37
N	2.01	1.70	1.54	1.75
Mean	2.41	2.04	1.74	2.06
	SE* ± : (a) 0.080	(b) 0.098	(c) 0.138	
	LAMB PRE-WEANING GROWTH RATE (g/d)			
WL	90.4	102.4	98.7	97.2
N	75.1	79.3	83.1	79.2
Mean	82.8	90.9	90.2	88.2
	SE* ± : (a) 3.40	(b) 4.16	(c) 5.89	
	LAMB WEANING WEIGHT (kg)			
WL	9.97	11.41	10.22	10.53
N	8.01	8.67	8.52	8.40
Mean	8.99	10.04	9.37	9.47
	SE* ± : (a) 0.403	(b) 0.494	(c) 0.699	
	LAMB LIVEWEIGHT WEANED PER EWE EXPOSED PER MATING SEASON (kg)			
WL	9.58	14.63	11.92	12.04
N	9.04	5.54	9.84	8.14
Mean	9.31	10.09	10.88	10.09
	SE* : (a) 0.474	(b) 0.580	(c) 0.820	

*SE of (a) Sire means; (b) Season means; (c) Means in the body of table.

Table 4:

Significance level about orthogonal components of treatment means

	Conception	Prolificacy	Lamb survival	Lamb birth	Pre-weaning growth rate	Weaning weight	Lamb live-weight
Sire	**	NS	**	**	*	*	**
Season							
Linear	NS	*	**	**	NS	NS	NS
Quadratic	NS	NS	NS	NS	NS	NS	NS
Sire X Season							
Linear	*	NS	*	NS	NS	NS	NS
Quadratic	*	NS	NS	NS	NS	NS	**

* and ** denote P < 0.05 and P < 0.01 respectively. NS denotes Not Significant

Discussion

There were significant differences between seasons for some of the parameters measured. Sheep breeds of tropical origin can be successfully bred during anytime of the year. However, environmental factors such as temperature, rainfall, feed availability and nutritional quality could hamper the expression of the full reproductive potential of such sheep. In Colombia the criollo sheep has been observed to have relatively higher lambing percentage, lamb birth weight and lamb weight at three months of age for lambi-gs in December-April than for lambings in June-December or in December-June (Naranjo and Sabogal 1978). In the present study prolificacy and lamb birth weight were higher during the major wet season (May mating) than during the major dry season (January mating). The nutritional quality of forage under the tree crops is usually quite high during the wet season (Asiedu et al 1978) and possibly contributed to better reproductive performance through increased number of ova shed,ova survival and more rapid development in utero.

Lamb survival rate was highest for the mating in September and lowest for the mating in May. Lambs born in the dry month of February (September mating) were subjected to less stress from wetness and the attendant cold, pneumonia and high incidence of gastro enteritis and so had greater chance of survival than lambs born in the wet season.

The season of mating did not have any real effect on the lamb liveweight weaned, which does not seem to give practical importance to the observed significant effect of season on the last two parameters could be regarded as negative results in the final analysis. These results, however, have to be considered in relation to the management of the sheep under the plantation crops. The animals in a livestock-plantation crops integrated farming system are normally considered as only a supplementary unit and therefore do not receive the optimum attention. If management practices for the period immediately following lambing were to be improved by rearing the dams and their lambs indoors it should be possible to raise some more of the heavy lambs from large litters to weaning. This could improve significantly the lamb liveweight weaned from matings in the wet season.

WL was inferior to N in respect of conception rate. The natural habitat of WL is the savannah and the semi-arid regions. In the forest area its libido might have been reduced by the high relative humidity (Av 87.7% at 0900 hr and 65.2% at 1500 h). WL, however, compensated for this deficiency in conception rate with higher lamb survival rate and a marginally higher litter size. It is not very easy to explain the low death rate of lambs sired by WL but the high vigour of these lambs, as measured by high birth weight, might have been a contributory factor. Furthermore, the high neonatal death rate associated with the lambs of N is consistent with earlier observations when N was used as a breeding ram (Asiedu and Appiah 1983).

Heavy breed rams tend to produce heavy lambs that grow fast, apparently because of the relatively high heritabilities of body weight traits such as mature weight, weaning weight and birth weight (Bowman 1974; Dalton 1980). It is therefore, not surprising that the heavier ram, WL, sired heavier lambs that grew faster and weaned heavier at 12 weeks of age than those sired by N. Ngere (1973) and Goonewardene et al (1981) have similarly observed that breeds of sheep that have variable body weights sire lambs that also have variable body weight and growth rates.

The economic value of a breeding ram is ultimately determined by the lamb liveweight that reaches the market as well as the potential replacement sires that it produces. Lamb liveweight weaned by WL was about 15 kg for every 10 kg of N and since the weight of lamb weaned is highly heritable (Dalton 1980) WL could be considered as having a better economic value than N. The better productivity of WL than N was attributable to higher lamb survival rate and higher weaning weight per lamb which offset its poorer conception capacity. Ngere (1973) has shown that N is superior to WAD in respect of progeny body weight characteristics. If this observation is taken in conjunction with the results of the present study then a ranking order, as premium sires, for the three common breeds of West African meat-type sheep could be developed as WL, N, WAD. This is not suggesting that N should be discarded entirely when WL is available. Table 3 shows that the lamb liveweight weaned per ewe exposed to N was quite high for the matings in May and September. Thus under practical integrated farming system where both rams are available it should be worth while to place equal emphasis on both rams during mating in May or September while greater weight should be placed on the service of WL during mating in January.

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