SEASONAL EFFECTS ON LAMB PRODUCTION UNDER TROPICAL CONDITIONS

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Observations were made over a period of three years on a total of 336 West African Dwarf (WAD) ewes that were mated to four rams in rotation. Out of a total of 753 lambs obtained, 459 (61%) were produced in the wet season as compared to 294 (39%) produced in the dry season. More lambs were produced as a result of multiple birth (twins and triplets) in the wet than in the dry season. Consequently, the average birth weight of the wet season lambs (1.58kg) was lower than the average birth weight (1.66 kg) of the dry season lambs. Despite this initial disadvantage, the wet season lambs had a higher average weaning weight (9.11 kg) than the dry season lambs (7.83 kg). The effects of season on pre-weaning lamb mortality was minimal while the effects of type of birth were quite apparent. Lowest pre-weaning lamb mortality values were recorded for single lambs, followed by twins and triplets, in ascending order. The data also showed that a slightly higher proportion of the male lambs reached weaning age than female lambs. This observation could be associated with reported invesrse relationship between lamb birth weight and mortality found in literature.

INTRODUCTION

The mechanism by which breeding season is brought about in sheep has been shown to be caused by changes in the rhythym of daylight-darkness hours (Hammond Jnr., 1944; Yeates, 1949). But the period of the year at which oestrus occurs under different climatic conditions has been evolved through natural selection, so as to ensure that the offspring are born at the time of the year which will give them their best chance of survival. Temperate breeds of sheep have a short breeding season (Hafez, 1952). Breeds that have originated nearer the equator have a much more extended breeding season, with the result that some tropical breeds of sheep are capable of producing offspring all year round (Hill, 1960; Lasley, 1968).

The West African Dwarf (WAD) sheep occurs in the whole area of West Africa South of Latitude 14°N (Nason, 1951) and is confined almost entirely to the coastal areas. Starting with the first oestrus at about nine months of age (Willimason & Payne, 1959), the WAD ewe has been reported to cycle and ovulate throughout the year (Jollans, 1960; Orji, 1976). Apart from the narrow variations in the daylight-darkness hours in the tropics, other factors such as season, type of birth (single or multiple), birth weight, weaning weight and mortality also affect lamb production.

In this study, observations are made on the number of lambs produced by a fleak of WAD sheep at different seasons of the year in Ibadan and the proportion that reach weaning age.

MATERIALS AND METHODS

Source of data

The material for this study was obtained from the production records of the WAD sheep flock on the University of Ibadan Teaching and Research farm. The flock was established in 1950 from a foundation stock (20 in number) that was donated to the University by the Lieutenant Governor of Western Region of Nigeria — Sir Chandos Hoskins-Abrahall. The animals have increased in number over the years and have been used continuously for the purpose of obtaining basic data on growth, nutrition, reproduction and carcass quality.

The production ration is made up of 65% maize/guinea corn, 20% groundnut cake and 15% palm kernel meal

Climatic conditions in Ibadan

Ibadan is situated at an elevation of 200 m above sea level and lies about 7°26′N and 3°54′ E. Keay (1959) grouped Ibadan under the lowland rain forest vegetation zone, which enjoys a two-peaked rainfall pattern with a dry season of three to five months duration (November to March), during which vegetation growth is retarded. Although there is very little variation in temperature throughout the year, the range between the maximum and nimimum temperature is greatest during the dry season, especially in the months of November to February (Table 1).

Management of the sheep flock

The animals are housed in groups of 20 to 30 in pens measuring about 16.5 square metres of floor space. The roof is of corrugated iron sheet supported on teak poles to provide adequate ventilation. Wood shavings or sawdust are used as bedding materials. Feeding of the flock is based on cultivated pastures, and the nutritive status of the animals is maintained at a fairly constant level throughout the year. The animals are grazed from 08.00 to 12.00 hrs on Giant Star grass *(Cynodon nlemfuensis)* containing a few stands of *Centrosema pubescens.* In addition, each animal receives about 0.25 kg of a production ration[1] daily. Salt licks containing trace minerals and fresh water are available to all animals. All sheep above the age of weaning are dewormed every three months using lead arsenate solution. Ectoparasites such as tick and lice are controlled by dipping the animals in benzene hexachloride preparations mixed at standard concentrations.

Breeding of the sheep flock

Breeding rams are allowed to run with the ewes in rotation, for periods not exceeding three months in the year for each ram in order to maintain their fertility. Ewes that have just lambed are kept with their lambs indoors for a period of two weeks. During this period, wilted pasture

TABLE 1

Summary of Climatic Parameters at Ibadan (Average of 3 years, 1973—75) +

Month	*Total Rainfall (mm)*	*Mean Max. Temperature (oC)*	*Mean Min. Temperature (oC)*	*Mean Relative Humidity at 4 p.m. (%)*
January	4.6	33	21	42
February	14.7	36	23	39
March	62.7	35	23	46
April	145.9	33	23	63
May	118.6	32	22	66
June	207.5	31	21	72
July	183.6	29	22	75
August	105.4	29	22	75
September	210.8	29	21	75
October	128.8	31	22	70
November	5.3	33	21	50
December	22.6	33	20	46

+ Date obtained from the Department of Geography, University of Ibadan.

is fed *ad libitum* along with the production ration at approximately 0.5 kg per head daily. The young are weaned at about 100± 10 days of age. Following weaning, the lambs are separated into age groups, keeping males and females apart.

During the period of this study (January 1973 to December 1975), observations were made on a total of 336 WAD ewes. In 1973, 110 ewes between two and six years of age and of good health were exposed to breeding rams, while 136 and 90 ewes of similar condition were exposed to breeding rams in 1974 and 1975, respectively. Four mature rams were allowed to run with the ewes in rotation. Records of lambing were kept, and for each offspring, information on the date of birth, types of birth (single or multiple), sex and birth weight were recorded. The lambs with their dams are managed by the usual management system already discussed. Records of lambs that died and the weaning wieght of those that survived were also kept. The data were subjected to the analysis of variance and the means compared using the t-test (Steel and Torrie, 1960).

RESULTS AND DISCUSSION

Number of lambs

Notwithstanding the capability of the WAD sheep of producing offspring all the year round (Orji, 1976), significantly ($P < 0.01$) more lambs were produced in the wet than in the dry season over the period of this study (Table 2). Of a total of 753 lambs produced, 459 (61%) lambs were produced in the wet season, as against 294 (39%) lambs produced in the dry season. An examination of the lambings on a yearly basis similarly showed that more lambs were consistently produced during the wet seasons. This observation could be attributed to natural adjustment in the animals in order that lambings could coincide with the period of available grazing. Apart from the sharp decline in the quantity of pasture during the dry season, the nutritive value is generally very low, causing severe animal body weight losses due to an inadequate supply of utilizable energy (Oyenuga, 1960). From the results obtained, it follows that more pregnancies occurred during the dry season, since the gestation length is about five months. This shows

TABLE 2

Seasonal Influence on the Number of Lambs Produced by a Flock of WAD Ewes at Ibadan (1973—75)

		Number lambs born	
Year	*No. Ewes*	*Wet season*+	*Dry season*++
1973	110	164 (58.6)	116 (41.4)
1974	136	167 (59.6)	113 (40.4)
1975	90	128 (66.3)	65 (33.7)
1973—75	336	459 (61.0)	294 (39.0)

WAD = West African Dwarf
+ Wet season (April — September)
++ Dry season (October — March)
( ) = percentage

TABLE 3
Seasonal Effect on the Pattern of Lamb Production

	Total No. Lambs	*Wet season*	*Dry season*
All lambs	*753*	*459*	*294*
Mature ewes+	*411*	*244*	*167*
Gimmers++	*342*	*215*	*127*
Singles	*302*	*174 (37.9)*	*128 (43.6)*
Twins	*424*	*261 (56.9)*	*163 (55.4)*
Triplets	*27*	*24 (5.2)*	*3 (1.0)*
Male lambs	*360*	*223 (48.6)*	*137 (46.6)*
Female lambs	*393*	*236 (51.4)*	*157 (53.4)*

+ 171 mature ewes (over 4 yrsof age)
++ 165 gimmers (2—3 yrs of age)

that more matings occurred during the dry season which corresponds to the period of short daylight north of the equator (Hammond, 1944; Yeates, 1949). This situation is further enhanced by the semi-intensive management system in practice on the University farm, which allows adequate feeding of the breeding ewes during mating and pregnancy periods, resulting in the production of healthy lambs (Harris, 1974).

Lamb production pattern

Apart from the number of lambs produced in each season over the period of study, records were also kept regarding the type of dam (gimmers or mature ewes), type of birth, and sex of lambs. Data clariyfing this are presented in Table 3. The lambing percent calculated from the total number of ewes (336) and the lambs produced (953) was 224%. This value is higher than those reported by Dettmers *et al.* (1976) of 146% and Orji *et al.* (1976) of 123.7% for the first lambing. This discrepancy is brought about by the different methods of calculating lambing percent. While Dettmers *et al.* (1976) and Orji *et al.* (1976) based their calculation on all ewes exposed for breeding, the present study made use of the number of ewes that became pregnant and lambed. Seasonal effects on lambing percent was hard to determine since lambing occurred all year round. Nevertheless, significantly ($P < 0.05$) more lambs were produced from multiple births in the wet than in the dry season. And since a high lambing percent is associated with mutilple births, it could be inferred that the wet season would be accompanied with a higher lambing percent than the dry season. Twins and triplets combined, accounted for 62% of wet season lambs which is significantly ($P < 0.05$) higher than 56% obtained in the dry season. The ratio of ram to ewe lambs was not significantly ($P > 0.05$) affected by season. However, there was a tendency towards a larger number of females than males.

Birth weight of lambs

Data on the birth weight of lambs as affected by season, age of ewe, type of birth and sex are presented in Table 4. The overall mean of the birth weight of all lambs produced over the period of study was 1.61 ± 0.15 kg. This value is slightly lower than the mean of 1.66 ± 0.09 kg obtained for all the dry season lambs, and higher than the mean of 1.58 ± 0.13 kg for the wet season lambs. The dry season lambs were significantly ($P < 0.05$) heavier at birth than the wet season lambs. This observation could be explained by the greater number of multiple births in the

TABLE 4

Seasonal Effects on Birth Weight of Lambs as Related to Age of Ewe, Type of Birth and Sex of Lambs

	Wet season		*Dry season*	
Tye/sex	*No. lambs*	*Mean birth wt. (kg)*	*No. lambs*	*Mean birth wt. (kg)*
All lambs	459	1.58 ± 0.13	294	1.66 ± 0.09
Mature ewes	244	1.66 ± 0.09	167	1.74 ± 0.09
Gimmers	215	1.53 ± 0.10	127	1.57 ± 0.11
Singles	174	1.79 ± 0.08	128	1.80 ± 0.10
Twins	261	1.45 ± 0.09	163	1.56 ± 0.09
Triplets	24	1.40 ± 0.07	3	1.46 ± 0.08
Single male	85	1.88 ± 0.09	60	1.91 ± 0.09
Single female	89	1.70 ± 010	88	1.70 ± 0.08
Twin male	128	1.55 ± 0.10	76	1.59 ± 0.11
Twin female	133	1.35 ± 0.08	87	1.49 ± 0.10
Triplet male	10	1.46 ± 0.07	1	—
Triplet female	14	1.33 ± 0.08	2	1.36 ± 0.07
Male lambs	223	1.67 ± 0.11	137	1.81 ± 0.09
Female lambs	236	1.48 ± 0.09	157	1.53 ± 0.08

± = standard error

wet season, which were accompanied by lower birth weight of individual lambs. The average birth weight of lambs resulting from multiple birth was significantly ($P < 0.05$) lower for the wet season lambs. Heavier lambs were obtained from mature ewes as compared with gimmers, irrespective of season. Similarly, male lambs were consistently heavier at birth than female lambs.

Weaning weight of lambs

The summary of the weight of lambs that survived to weaning age is given in Table 5. The overall mean weaning weight of all surviving lambs over the period of study was 8.26 ± 1.47 kg. Despite the initial lower average birth weight of the wet season lambs, they grew faster and had a significantly ($P < 0.05$) higher weaning weight than the dry season lambs. Average weaning weights of 9.11 ± 1.34 kg and 7.83 ± 0.95 kg were recorded for the wet and dry season lambs, respectively. The faster growth rate and the subsequent higher weaning weight of the wet season lambs could be related to the availability of nutritious fodder during the wet season, as a result of which the ewes were able to produce a sufficient amount of milk to suckle their lambs. It has been reported (Williamson and Payne, 1959) that postnatal growth rate of lambs up to weaning is an indication of the milking ability of the ewe. Some variation in the weaning weight could be seen within each season. Single lambs had the highest weaning weight, followed by the twins and the triplets in descending order. Similarly, the male lambs which were heavier at birth grew faster than the females, irrespective of season, thus attaining higher weight at weaning than the females.

Pre-weaning mortality of lambs

Over the period of study, 496 lambs (65.9%) out of a total of 753 lambs pro-

TABLE 5

Seasonal Effects on the Weaning Weight of Lambs as Related to Age of Ewe, Type of Birth and Sex of Lambs

Type/sex	Wet season		Dry season	
	No. lambs	*Mean weaning wt. (kg)*	*No. lambs*	*Mean weaning wt. (kg)*
All lambs	297	9.11 ± 1.34	199	7.83 ± 0.95
Mature ewes	175	9.97 ± 1.09	117	8.36 ± 1.14
Gimmers	122	7.88 ± 1.47	82	7.07 ± 1.21
Singles	126	10.57 ± 0.98	95	8.98 ± 1.07
Twins	161	8.07 ± 1.01	104	6.78 ± 1.22
Triplets	10	7.45 ± 0.73	0	—
Single male	57	11.12 ± 0.92	51	9.11 ± 0.91
Single female	69	10.11 ± 1.11	44	8.82 ± 0.84
Twin male	84	8.43 ± 1.32	49	7.32 ± 0.95
Twin female	77	7.68 ± 1.04	55	6.29 ± 0.81
Triple male	6	7.51 ± 0.92	0	—
Triplet female	4	7.35 ± 0.63	0	—
Male lambs	147	9.43 ± 1.27	100	8.23 ± 1.17
Female lambs	150	8.79 ± 1.18	99	7.41 ± 1.06

+ = standard error

duced, reached weaning age (Table 6). A breakdown of the data into wet and dry season did not show any significant difference ($P > 0.05$) in the percent lamb mortality. However, lamb mortality appears to be slightly higher in the wet than in the dry season. A further breakdown of the data revealed that lamb mortality within a season was more pronounced than between seasons, especially with regard to type of birth. The lowest lamb mortality was recorded for the single lambs, followed by the twins and triplets in ascending order. This observation is in contrast to the reports of Hill (1960) that parasite buildup during the wet season was usually considerable and that losses in lambs from internal parasites were about 50%. While the parasite buildup aspect might be true, in the present study, it appears that the good nutrition available to the animals in the wet season gave them sufficient ability to withstand the worm burden. The data also revealed that slight-

TABLE 6

Seasonal Effects on the Pre-weaning Lamb Mortality as Related to Type of Birth of Lambs

Criteria	*Wet season*	*Dry season*
No. lambs born	459	294
No. dead to 3 months	162	95
Percent dead (all lambs)	35.3	32.3
Singles	27.6	25.8
Twins	38.3	36.2
Triplets	58.3	100.0
Males	34.1	27.0
Females	36.4	35.3

ly but not significantly ($P > 0.05$) more female lambs died prior to weaning. This is most probably related to the lower birth weight of female lambs earlier mentioned and the inverse relationship between mortality and birth generally (Wallace, 1948a).

A number of authors, including Yeates (1949) and Orji (1976) have reported on the reproductive processes and oestrus synchronization of breeding female animals. This synchronization has been made possible hitherto by the use of progesterone (a female sex hormone) and synthetic progesterone-like hormones. From the results of this study, it could be inferred that the season of the year could similarly play important roles in the breeding of the WAD sheep. Such a method could result in greater uniformity in the age of offspring, more efficient utilization of labour and facilities, and the satisfaction of market demands generally.

REFERENCES

DETTMERS, ALMUT, IGOCHE, C.A. and AKINKUOLIE, KIKELOMO. 1976. The West African Dwarf sheep.I. Reproductive performance and growth. *Niger. J. Anim. Prod.* 3(1): 139 — 147.

HAFEZ, E.S.E. 1952. Studies on the breeding season and reproduction in the ewe. *J. Agric. Sci.* 42. 189—265.

HAMMOND, J., Jnr. 1944. On the breeding season in the sheep. *J. Agric. Sci.* 34: 97—105.

HARRIS, LORIN, 1974. Management of sheep and other fibre-producing animals. In *Animal Agriculture* (ed. H.H. Cole and Magnar Rouning), W.H. Freeman and Co., San Francisco.

HILL, D.H. 1960. West African Dwarf sheep. Third Ann. Conf. Sci. Assoc. of Nigeria, Ibadan.

JOLLANS, J.L. 1960. A study of West African Dwarf sheep in the closed forest zone of Ashanti. *W. Afri. J. Biol. Chem.* 3: 77.

KEAY, R.W.J. 1959. *An Outline of Nigerian Vegetation.* 3rd ed. Lagos. Federal Government Printer.

LASLEY, J.F. 1968. *Reproduction in Farm Animals* (ed. E.S.E. Hafez), Lea and Febiger, Philadelphia.

MASON, I.L. 1951. *The Classification of West African Livestock.* Technical Communication 7. Commonwealth Bureau of Animal Breeding and Genetics. Edinburgh, C.A.B.

ORJI, B.I. 1976. Studies on the biology of reproduction of the Nigerian Dwarf sheep. Ph.D. Thesis, University of Ibadan, Nigeria.

ORJI, B.I., STEINBACH, J., OLALOKU, E.A. and ADELEYE, I.O.A. 1976. The reproductive performance of the Nigerian Dwarf sheep. *Niger. J. Anim. Prod.* 3(2): 124—130.

OYENUGA, V.A. 1960. Effect of stage of growth and and frequency of cutting on the yield and chemical compsotion of some Nigerian fodder grasses — *Paniarm maximum Jacq. J. Agric. Sci. (Comb.)* 55: 339—350.

STEEL, R.G.D. and TORRIE, J.H. 1860. *Principles and Procedures of Statistics. McGraw-Hill Book Co. Inc., New York.*

WALLAGE, L.R. 1948a. The growth of lamb before and after birth in relation to the level of nutrition. J. Agric. Sci. 38: 243—302.

WILLIAMSON, C and PAYNE, W.J.A. 1959. *An Introduction to Animal Husbandry in the Tropics.* Longmans Green and Co. Ltd., London.

YEATES, N.T.M. 1949. The breeding season of the sheep with particular reference to its modification by artificial means using light. *J. Agric. Sci.* 39: 1—43.