SUPPLEMENTAL FEEDING OF WEANED LAMBS WITH SILAGE AND VARIOUS CONCENTRATES

By

ANNA REYNOLDS ABBAN

B.Sc. (HONS.) AGRIC. SPECIAL DISSERTATION

FACULTY OF AGRICULTURE

UNIVERSITY OF GHANA

L E G O N

JUNE, 1970

A C K N O W L E D G E M E N T S

Acknowledgements are due to Professor C.W. Cameron, Head of Animal Science Department, under whose supervision this paper was produced, and to those members of the staff of the Agricultural Research Station, Nungua, for facilities for carrying out the experiment and who helped to make the experiment a success.

TABLE OF CONTENTS

	Page
INTRODUCTION	1
REVIEW OF LITERATURE	3
EXPERIMENTAL PROCEDURE	8
Location	8
Experimental design	8
Feeding and general management of lambs	9
Recordings	12
Bedding	13
Drenching and Dipping	13
Disease and Treatment	14
Castration	14
Proximate Chemical Analysis	15
Slaughtering	15
RESULTS AND DISCUSSIONS	16
Recommendation	26
SUMMARY	26
CONCLUSION	27
REFERENCES	29
APPENDIX	31

FIGURES IN TEXT

Figure		Page
1.	Diagram of lamb carcass showing where various cuts were taken for analysis	18
2.	Average weight gains/lamb/week ...	19
3.	Diagram of Eye-muscle measurement at the posterior cut surface of the 12th rib	37
4.	Diagram of Loin flesh depth measurement	38

TABLES IN TEXT

Table		Page
1.	Composition of grass silage and maize-sorghum silage	16
2.	Composition of concentrate mixture	17
3.	Feed consumption and growth data of the lambs ..	20
4.	Analysis of variance of weight gains of lambs ..	22
5.	Carcass data	23

APPENDIX TABLES

Table		Page
6	Average weight gain/lamb/week	31
7	Visual Appraisal Scores of Carcasses ...	32
8A	Rib Eye-Muscle Width	33
8B	Rib Eye-Muscle Depth	33
9	Loin Flesh Depth	34
10	Weights of Forequarter and Hindquarter ...	35
11A	Approximate Cost of Concentrates	36
12	Approximate Cost of Concentrate consumed/ lamb/week	36

INTRODUCTION

Conversation with the public indicates that mutton is one of the most favoured meats in Ghana. This preference for mutton tends to cause high prices for it because of relatively limited supply on the market.

The sheep population of Ghana is characterized by many people owning only a few animals each, as opposed to the possibility of a smaller number of people of which each owns a large group of animals. These small groups of animals are permitted to roam and forage for themselves about the countryside. This practice always results in inadequate feed intake, improper care at parturition and indiscriminate damage to farm crops. The lack of care of the new born lambs results in lowered rate of yearly increase in flock size, and the damage to farm crops tends to make sheep unpopular in farming areas. Unfortunately grazing over most of the country especially the Accra Plains is of very poor quality for a considerable part of the year. This is mainly the result of the erratic and seasonal distribution of rainfall which occurs almost entirely in the months of May-June and October to November. During the dry season, green grass is scarce except in marshy areas. The mature standing grass is very fibrous and has a very low protein content.

The apparent tolerance by these sheep of adverse nutritional conditions suggests that certain of their nutritive requirements may be abnormally low.

In particular, the low requirement for protein appears to be the most significant, because of the very low protein content of the natural herbage in the dry season of the year.

In view of these severe annual set backs involving loss of weights due to dry season, it has become necessary to think about how best sheep could be raised under improved management to reach market weight within the shortest possible time as against two or more years that our local sheep 'farmers' take.

Thus the present work, conducted between July 1969 and January, 1970 was to

a) determine the effect of various diets on growth or weight gains of weaned lambs under partial confinement;

b) determine the effect of diet on the carcasses of the lambs and

c) to compare the value of supplementary feeding and natural pasture only for growing lambs.

REVIEW OF LITERATURE

Feeding of silage to sheep is very popular with sheep farmers of well advanced countries. In Ghana however, no work has been done in assessing how best Ghanaian sheep could do on silage fed as part of the roughage portion of the diet especially during the dry seasons. This review summarizes reports relating to different classes of sheep fed on well prepared silage as part of their roughage fed.

Kammlade and Kammlade (1955) proved that fattening lambs do well on silage, and when its deficiencies are corrected through the use of suitable supplement, the silage may be fed as the only roughage to both fattening lambs and pregnant ewes.

Carman et al (1958) in a feeding trial using legume-grass silage as roughage for pregnant ewes observed (1) an increase in birth weight as the amount of silage in the ration decreased; (2) the number of lambs born full term did not appear to be affected by treatment; (3) there was a greater number of still-born lambs in the group which received all-silage; (4) the average percentage mortality in the silage group was about one and half times that of the hay-group; (5) the vigour of the lambs at birth was also affected by the feeding of the silage even when this was fed as part of the total roughage and that a relatively high percentage of the lambs from the silage-fed ewes needed prolonged assistance to suckle and an additional time in the lambing pens.

In addition, they observed that the ewes on silage were unable to supply milk for their lambs immediately after lambing, while ewes on the hay had adequate milk. Within two weeks of lambing and a return to the regular hay and grain ration, the silage-fed ewes appeared to be providing sufficient milk.

Garrigus (1949) found that ewes fed 12 lbs. per day of first cutting alfalfa silage containing just over 30% dry matter made 45% better gains and produced larger, stronger lambs than those fed 5 lbs. of good alfalfa hay daily. In a later work by Garrigus et al. (1949), comparison was made of alfalfa silage, blue grass silage, corn silage and alfalfa hay as roughages for wintering pregnant ewes. Each silage was fed to make up 50% of the dry matter of the roughage portion of the ration along with alfalfa hay. Corn silage consistently ranked last during the trial periods, while the ranking of the other roughages was inconsistent. All the rations, however, produced satisfactory results.

Bell (1945) of Ohio studied the use of grass-legume silage as a winter roughage for pregnant ewes. He found that grass silage of good quality was palatable and usable in sheep rations and may even be used as the sole roughage in the winter ration of ewes or growing ewe lambs.

Cunningham and Watson (1951) in a study of palatability of grass silage found that the taste of it had to be acquired.

Stewart (1949) suggested that a period of 15 days is necessary for the animals to get accustomed to the taste of a silage.

Sample et al. (1966) used "Digitaria decumbens" in preparing different forms of silage and later used the silages in feeding and metabolism trials using yearling ewes and wethers. The silages were of fresh grass; fresh grass plus molasses, and wilted grass plus molasses. Each group of lambs received one kind of the silage throughout the trials. From the feed intake and digestion trials, it was found that the silages were readily consumed from the beginning of the trial but there were marked differences in average daily consumption by sheep. Sheep fed fresh grass silage consumed 47% more dry matter per unit of *metabolic size* daily than those fed wilted grass plus molasses silage and 24% more than those fed on fresh grass plus molasses silage. Daily intake of fresh grass-molasses silage/unit of metabolic size was 18% greater than that of the wilted grass plus molasses silage.

Apparent digestion coefficient of crude protein and gross energy and total digestible nutrients were slightly higher when molasses were added. Greater daily consumption of silage without molasses by sheep resulted in a higher nutritive value index and greater intake of digestible crude protein and energy than molassed silage. They concluded that with well prepared silage, sheep would readily consume amounts that would provide for maintenance or near maintenance of sheep.

---

* Metabolic size* - Daily dry matter in grammes per liveweight of sheep in kilogrammes to the 0.75 power; as described by Crampton et al. (1960).

Rudyka et al. (1963) carried out an experiment on digestibility of nutrients for sheep on rations with different proportions of maize silage. Four wethers were used in each of the seven digestibility trials.

Rations were wheat-grass hay, barley meal in seven different proportions. The silage provided 0-86% of total nutrients in the seven trials.

Results indicated that digestibility of almost all nutrients rose with proportion of silage in the ration. The conclusion of experiment was that maize silage can supply up to $\frac{2}{3}$ of nutrient value of the ration of sheep, but urea should be added to compensate for its low protein content; the urea can be added either during ensiling or during feeding of the sheep.

In two trials carried on by Allanttery et al. (1960), Karakul ewes were divided into two groups. One group was fed with cotton seed hulls plus maize silage and cotton seed oil meal. The other group was also fed on chopped "Camel thorn" (albaji Came Iorum) and cotton seed oil meal. Intakes of feed were the same in all cases with respect to feed units. Gains were 112 grams to 209 grams per head per day and were 24% to 32% higher with silage than with Camel thorn. Gains were not affected by conformation.

On slaughtering the sheep, it was found that carcasses of sheep

given silage had more fat depot on the body. From results, Allantery et al. concluded that silage increased gains during fattening of karakul ewes.

Karr et al. (1965) conducted a series of metabolism experiments, a feeding experiment, and a fermentation study to compare urea and biuret as nitrogen sources in an ensiled diet and to determine the relative nutritive value of concentrate mixtures added to chopped corn plant at times of ensiling or to silage at feeding time. They found that addition of biuret to the basal silage significantly increased nitrogen retention. Dry matter digestibility coefficients were higher when either urea or biuret was added to the basal silage, but the difference was significant in only one of the three experiments. Addition of the non-protein nitrogen sources to the basal silage increased gains by 26% and decreased feed required/lb. of gain by 1.35 lb. Sources of the non-protein nitrogen had no significant effect on rate of gain. The concentrate mixtures added at ensiling time compared with their addition to silage at feeding time very significantly improved ($P < 01$) dry matter and percentage apparently digested nitrogen required. Rate of gain was not significantly affected but 13% less feed was required per 1 lb. of gain. Biuret was fairly stable during ensiling and the subsequent fermentation process; and it appeared to decrease or alter fermentation compared with the basal silage.

Approximately 28% to 57% of the added urea was hydrolysed, providing a possibility of losing nitrogen from the silage mixture.

They concluded that to make up a complete growing finishing ration with corn silage, it is necessary to supplement it with sources of energy, nitrogen and minerals.

EXPERIMENTAL PROCEDURE

Location

The experiment was conducted at the Nungua Agricultural Research Station of the Faculty of Agriculture, University of Ghana, between the months of July, 1969 and January, 1970.

Experimental design

The experiment was a factorial design with 2 replications of 4 treatments and 4 lambs in each replicate. 32 weaned ram and ewe lambs of average weight of 28 lbs. were divided on basis of age into 8 groups. Each group was of 2 different breeds namely the Nungua Black Head (N.B.H.) and the Nungua Sudan (N.S.). Each group had a male and a female lamb from each breed. The groups were then randomly assigned to one of 4 treatments as follows:-

Group	Treatment
1	Silage alone
2	Silage plus Wheat bran
3	Silage plus Maize
4	Silage plus Cassava
5	Silage plus Maize
6	Silage plus Cassava
7	Silage plus Wheat bran
8	Silage alone

Feeding and General Management of Lambs

On the morning of 15th July, 1969, all the experimental lambs, to be partially confined, and given supplements were taken out to graze. The control group of 4 lambs was included among the station lambs feeding only on the pasture without any supplement. The lambs were confined round about 2.30 p.m. always and fed with their respective supplement.

The lambs were housed in a closed shed which was divided into 8 pens. Each lamb had a floor space of about 7.5 sq. ft. and feeding space of 6.8 linear inches. Feeding troughs and waterers were scrupulously cleaned before the onset of experiment. The lambs had water and salt licks free-choice. The rations were compounded to contain at least 15% protein each. Compilations were as follows:-

Ingredient	Ration %		
	1	2	3
Wheat Bran	100	-	-
Maize (ground)	-	77	-
Groundnut cake	-	23	41
Dry ground cassava (konkonte)	-	-	59
Total	100	100	100

An adjustment period of seven days was given to enable the lambs to get accustomed to the silage. During that time only grass silage was fed. The silage was reluctantly accepted by the lambs, and this led to a considerable loss of weight in that seven days period.

By the 2nd week, the lambs ate as soon as the feed made up of the silage and the respective concentrate was offered them. Concentrate was added to the silage at the rate of 1.5 oz./group/day. This means that the concentrate level increased by 1.5 oz./group/day up to the time that each group was receiving 1 lb. at which time the concentrate level increased by 1.5 oz./group/week.

Anytime consumption of feed was not complete, the concentrate level remained at the previous day's level. The lambs were fed at 3 p.m. each day and let out to graze at 6.30 a.m. . Since there was a wide variation in consumption of feed, it was decided

not to use a uniform daily weight of feed for all groups but to feed each group according to what was left over the previous feed given. The two groups on the silage plus cassava treatment consumed almost all the feed offered each time while those on the silage plus maize treatment tried to separate the maize from the silage and thus ended up in licking almost all the concentrate from the silage, leaving most of the silage alone as left-over. Those on silage plus wheat bran treatment ate satisfactorily whereas one of the two groups receiving silage alone as supplement, ate appreciable amount of the feed offered from the 2nd week onwards.

On being really accustomed to the feed, some of the lambs started getting into the troughs to eat. In doing so, they soiled the feed with their feces and urine. Since sheep tend to be fastidious in their eating habits, the lambs stopped eating from the troughs anytime the feeds were soiled. Some also kicked feed out of the troughs to the ground so that it became necessary to modify the troughs a bit. Each feeding trough was therefore divided into four compartments by the use of wooden bars across the top of the trough. This was effective as each lamb ate from one compartment without getting into the trough. When the lambs became accustomed to their chore, as soon as they were brought in for confinement, each group rushed into its respective pen, thus saving some trouble of having to chase them around to carry them into their pens. On entering the pens, the lambs rushed to quench their

thirst and then lay down to ruminate until such time that their supplements were given to them; when they rushed to the troughs to eat. Grass silage got finished by the end of the third week so that maize-sorghum silage had to be used. Despite this change of the grass silage to maize-sorghum the lambs ate more than expected.

About the middle of December, it became necessary to feed the lambs early in the mornings for about one hour just before they were let out to graze. This was because round about that time, most of the forage was non nutritious owing to the dry season. The amount of food given them was recorded and added to the evening amounts. Each group had one pound concentrate and one and half pounds of silage. Those on silage alone treatment received two pounds of silage.

Recordings

The amounts of feed given to the lambs were recorded each day and also the left-overs. It became necessary to correct for the actual amount of the left-overs, since the feeds, especially the silage were always a bit dry in the mornings owing to the dry night winds.

Correction was made as follows: Sample of feed given to each group in evenings was taken and dried in the oven to determine the moisture content. The samples of left-overs were also taken each morning and dried to determine the percentage moisture content. The difference between the two moisture contents gave the percentage moisture lost in the feed over the night. This percentage moisture difference was then used in calculating the actual amounts of left-overs.

Initial weights of lambs were recorded and subsequently, the weights were recorded weekly on Tuesdays, early in the mornings just before they went out to graze.

Bedding

Straw bedding was provided in each pen. For the first three weeks, the bedding was changed only on Mondays. However it was found that the lambs passed out tape worm gravids more often through the feces dropped in the pens. As such the bedding was decided to be changed twice a week (Mondays and Thursdays) and that helped to cut down the infestation.

Drenching and Dipping

Lambs were initially drenched with (1)facestol. In the sixth week, few days after drenching the lambs, most of the Nungua Black Head lambs were seen to have developed bottle jaws. Clinical examination of sample of feces showed small round worms and their ova. Therefore all the experimental lambs were drenched with (2)phenothiazine. From then on it was thought necessary to drench the lambs using the facestol and phenothiazine drugs alternatively at three weeks interval. The facestol was known to be very effective on control of tape worms, while the phenothiazine very effective on control of small round worms in the stomach.

---

(1) Hexachlorophene

(2) Dispensible powder

The Nungua Black Head lambs occasionally developed the bottle jaws but the Nungua Sudan lambs never developed the bottle jaw throughout the experimental period. The bottle jaw was an indication of heavy infestation by internal worm parasites.

The lambs were dipped fort-nightly (Mondays) with (3)gamatox solution to control the external parasites on the body.

Disease and Treatment

Two weeks after starting the experiment, the Nungua Black Head lambs were seen to be suffering from orf disease which appeared in form of blisters on the two corner sides of the mouth. This disease did not appear to have affected their feed intake, for they continued to eat and behave in the same way as the Nungua Sudan lambs. They were treated with iodine solution. The scabs which formed dropped off.

From the first three days of experiment all the experimental lambs were injected with terramycin at 3 c.c./lamb to protect them from any possible bacterial infection.

Castration

During the fourth week of experiment, it was realized that the lambs consisted of both wethers and ram lambs. In order to have uniform males, the ram lambs had to be castrated. Eight ram lambs

---

(3) Benzene hexachloride 1 : 1600

were castrated but three had to be left out since they were needed for breeding on the station. These three lambs therefore had to be excluded from the experiment. The castration led to small decrease in weight during the first week after castration, but later on they began to show a slight advantage in the matter of rate of gain than the ewe lambs. One lamb from control group died about a week after the castration and on autopsy examination, it was found to have died from tetanus. Three others in the groups under partial confinement had some troubles with their wounds. The wounds were dressed every morning and in addition each lamb was given terramycin injections to prevent infection from bacteria. The wounds soon healed up.

Proximate Chemical Analysis

Samples of silage and concentrates were taken each week and analysed chemically for nutrient contents. The silage samples were dried and ground each time before being analysed. The analysis of variance of weight gain is presented in table 4.

Slaughtering

At the end of 25th week, all the experimental lambs were slaughtered. The lambs were then of average age of ten months. Two ewe lambs which were on silage plus maize treatment were found to be pregnant on being slaughtered. Their carcasses had to be discarded from the rest as far as measurements of carcasses were concerned. The fresh weights of carcasses were recorded. The carcasses

were hung in the cold room for about six hours after which they were reweighed. Visual appraisal of the "finish" "fullness of leg" and "fullness of loin" of each carcass was carried out. The scorer was to give marks ranging from 0 - 5 for the "finish", "fullness of leg" and "fullness of loin."

The carcasses were then cut into different parts. Figure 1 on page 18 shows jointing of lamb sides from which cuts were taken.

Statistical analysis was performed for the various cuts from carcasses. Statistical methods used were those by

(1) Snedecor G.W. (1956) "Statistical Methods"; 5th Ed. Iowa State Press, Ames, Iowa.

(2) Ostle, Bernard, (1963) "Statistics in Research" 2nd Ed., Iowa State University Press, Ames, Iowa.

RESULTS AND DISCUSSIONS

TABLE 1

COMPOSITION OF GRASS SILAGE AND MAIZE-SORGHUM SILAGE (All based on D.M.)

Nutrient Sample	Dry Matter %	Crude Protein %	Crude Fiber %	Ash %	C_a. %	P%	Ether Extract	Energy K. Cals./g
Grass	32.1	4.0	30.6	7.3	.25	.13	4.8	4.22
Maize-Sorghum	18.4	4.8	32.9	5.2	.13	.09	3.5	3.80

TABLE 2.

COMPOSITION OF CONCENTRATE MIXTURES

Nutrient Sample	Dry Matter %	Crude Protein %	Crude Fiber %	Ash %	Ca. %	P. %	Ether Extract %	Energy K.Cals./gm.
Wheat Bran	86.8	17.2	6.9	4.1	.5	.8	2.8	4.42
Maize + GNC*	85.8	19.7	3.6	3.1	.35	.3	3.5	3.53
Cassava + G.N.C.*	83.0	19.5	4.7	5.3	.02	.3	1.9	3.71

*G.N.C. = Groundnut cake.

It was assumed that the wheat bran obtained from Tema Feed Factory contained approximately 15% protein. Consequently the rest of diets were compounded to contain 15% protein approximately. The groundnut cake used was assumed to contain 43% protein also. However proximate chemical analysis done on the sample of diets showed that the protein content of each diet was higher slightly than the theoretical one computed for. Table 2 shows an average of 3.8% higher protein content than what was theoretically computed for each diet. This protein increment however was not all that significant to offset the objective of the feeding trials.

FIGURE 1.

DIAGRAM OF LAMB CARCASS SHOWING WHERE VARIOUS CUTS WERE TAKEN FOR ANALYSIS

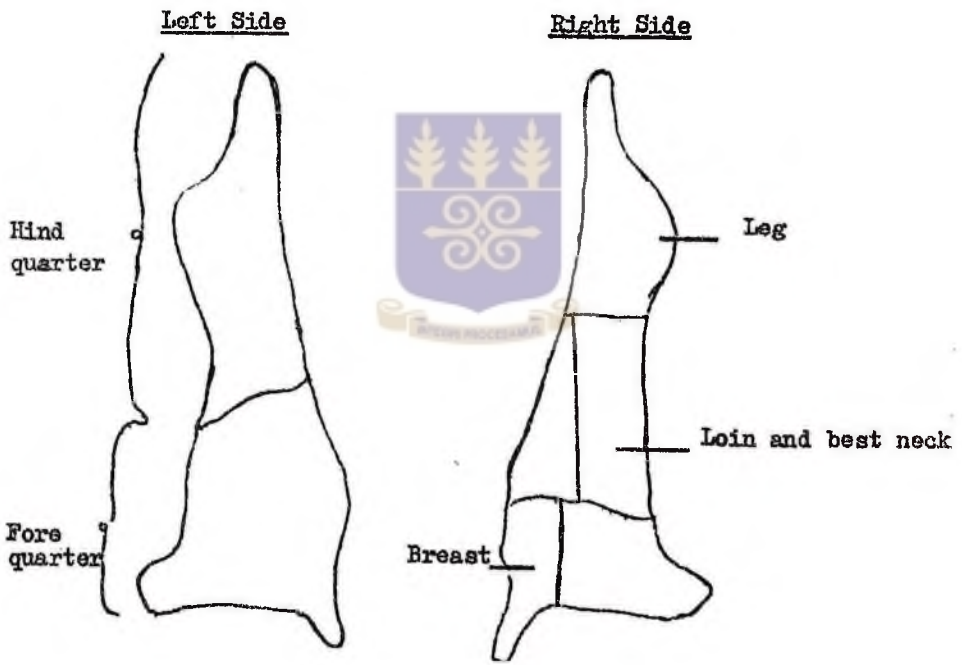


Figure 2.

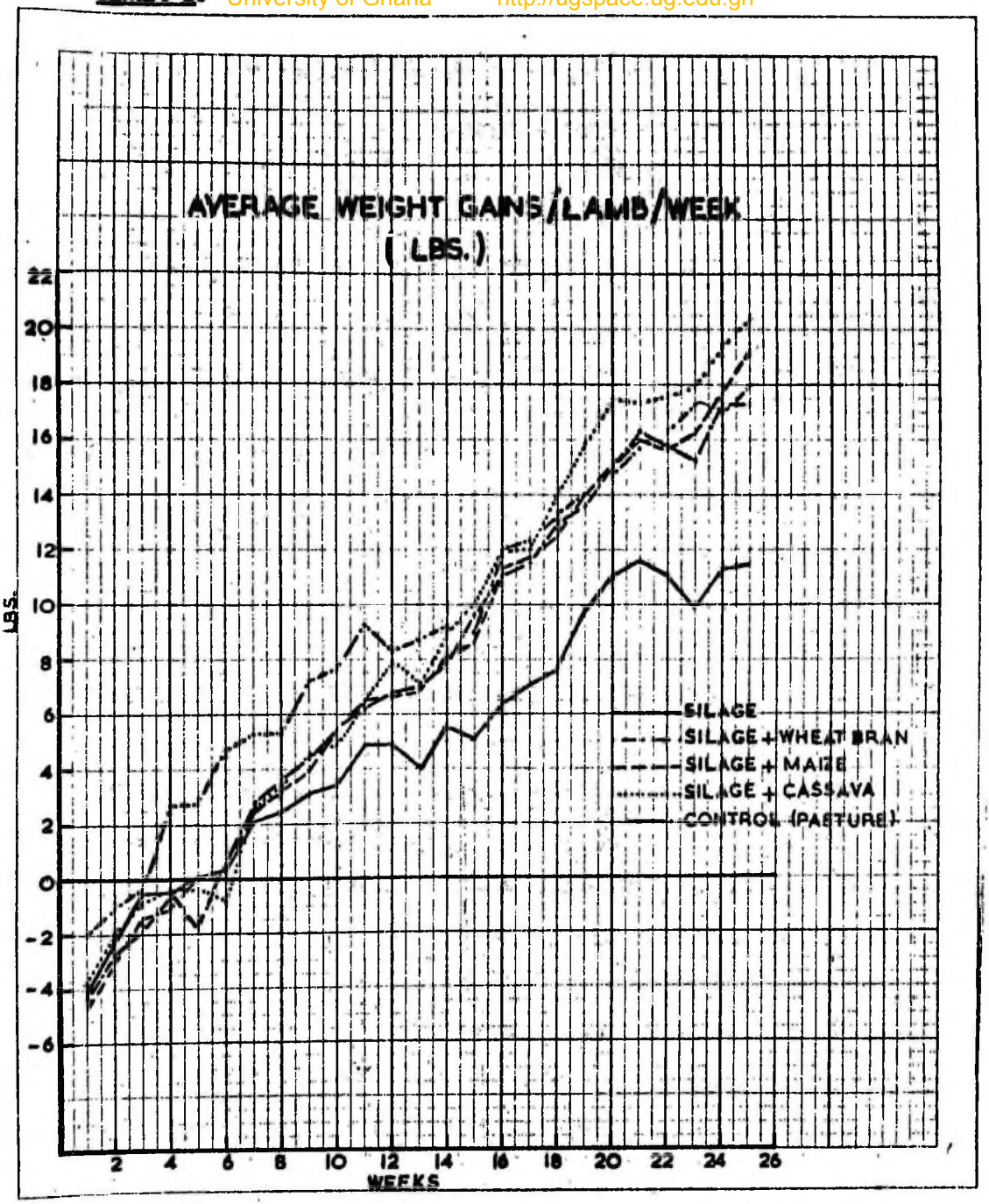


TABLE 3.

FEED CONSUMPTION AND GROWTH DATA OF THE LAMBS

Diet	Number of Lambs	Average Initial Weight (lbs.)	Average Days on Feed	Total Feed Consumed (lbs.) *	Average Final Weight (lbs.)	Average Gain (lbs.)	Average Daily Gain (lbs.)
Silage Alone	7	29.7	172	169.4	41.3	11.6	.06
Silage plus Wheat Bran	8	28.1	172	330.1	45.4	17.3	.10
Silage plus Maize	6	29.1	172	259.3	46.3	17.2	.10
Silage plus Cassava	8	26.9	172	349.4	47.4	20.5	.12
Control	3	29.6	172	Pasture	47.6	17.0	.10

* All based on D.M.

The number of lambs per treatment, average initial weight, average days on feed, total supplemental feed consumed, average final weight, gain and daily gain are contained in table 3. The highest average total weight gain/lamb (20.5 lbs.) and the highest average daily gain (0.12 lbs.)/ lamb were made by lambs in the silage plus cassava treatment. The depressing effect on daily gain that silage alone treatment seemed to have was shown by (0.06 lbs.)/lamb.

Figure 2 shows the graphic representation of average weekly weight gain/lamb. The graph shows a loss of weight by all groups at the first six weeks. Therefore results of first six weeks are questionable since all treatments except the control (only first 3 weeks) produced

negative weight gain. This may be due to various factors other than the treatments, which should be eliminated before any valid assessment of the treatments can be made. Some of the factors may be due to (1) restriction of lambs; (2) unfamiliarity with new feed; (3) castration, which was not expected to have been too important since it was done after the 3th week and negative weight gains were recorded for all lambs before the 7th week. From the 7th week, things should have been stable, with the assumption that there was no interaction between weeks (as blocks) and treatment.

After 14th week three ram lambs under treatments were removed from the rest of the experimental lambs because they were tupping the ewe lambs. Though the ram lambs were too young (six months) to have taken their tupping seriously, it was felt that their running around after the females would affect the feed intake and consequently weight gains of both lambs.

The graph on page 19 shows the control well ahead of the silage alone. The silage plus concentrate treatments are in between the two up to about the 13th week after which the silage plus cassava treatment started to show more gains than the control even. This shows that since the lambs were not used to the silage they had to eat less amount of the feed at the initial stages up to the 13th week. After that time however they seemed to have become really accustomed to the feed and therefore ate sufficient amounts to give good gains in body weights.

TABLE 4.

ANALYSIS OF VARIANCE OF WEIGHT GAINS OF LAMBS

Source of Variation	D.F.	S.S.	M.S.	Calculated F. 5%	Theoretical F. 5%	Theoretical F. 1%
Between Blocks	18	2024.7	-	-	-	-
Between Treatments	4	256.3	64.7	24.9	2.5	3.6
Error	72	184.7	2.5	-	-	-
Total	94	2465.7	26.2	-	-	-

Analysis of variance in table 4 above shows high significance at 1% level. In Fig. 2, page 19 the silage alone treatment proves to be far inferior to the control and the rest of the treatments. There seems to be not much significance in the silage plus maize, silage plus wheat bran, silage plus cassava and control treatments. To be more precise however as to the best of these treatments the author had to do at least two tests (orthogonal contrast), to establish the best of the treatments. From these tests, silage plus cassava treatment was found to be superior over the rest of the treatments, at about 15% significance level.

No statistical analysis was performed for the carcasses of the control group and those on silage alone treatment. This was because the lambs had higher average initial weights than those on the concentrate treatments, but reached somehow same final average weight as those on the concentrate treatments. This meant that the outs from the carcasses of all lambs as far as weights of the fore-quarter, hind-quarter and related measurements were concerned compared favourably, as seen in table 5.

Statistical analysis was performed for cuts from carcasses of the silage plus wheat bran and silage plus cassava treatments since they had same number of carcasses in each treatment. No significance however was obtained between them.

TABLE 5.

CARCASS DATA

Average	Control	Silage	Silage Plus Maize	Silage Plus Wheat Bran	Silage Plus Cassava
Liveweight prior to slaughter (lb.)	45.3	46.5	44.75	46.0	46.0
Carcass (Chilled) weight (lb.)	16.16	16.02	18.21	18.96	18.96
Dressing %	36.30	38.71	40.78	41.20	41.20
Fore quarter (lb.)	4.0	4.0	5.0	4.5	4.7
Hind quarter (lb.)	4.0	3.9	4.5	4.5	4.7
+Skin weight	20.7	20.5	19.3	17.8	17.8
+Empty stomach and Intestine	22.3	23.7	26.9	26.0	26.0
Left side length (c.m.)	52.0	56.4	63.5	63.6	63.6
Chest depth "	17.3	16.4	16.9	17.5	17.5
Leg length "	32.8	31.3	32.8	32.3	32.3
Eye muscle width "	4.6	4.5	4.6	4.3	4.3
Eye muscle depth "	2.4	2.1	2.0	2.2	2.2
Loin flesh depth "	2.0	1.9	2.3	2.3	2.3

+ As percentage of the chilled carcass weight.

In table 5 cuts from silage plus maize treatment seems to be superior over the silage plus cassava and silage plus wheat bran treatments. Owing to this, statistical analyses were performed for them, though the silage plus maize treatment carcasses were only four. No significant differences were again obtained.

From the visual appraisal scores, carcasses of those lambs which were on silage plus maize treatment gained more (4.1). Those on silage alone treatment scored the least (2.4). On the whole all the carcasses except those of the control and silage alone treatment were covered with smooth fat of proportionately uniform depth (2 mm) and reasonable amount of pelvic fat. The fat covering however was not all that much for trimming. No marbling was seen in any of the carcasses.

In general one would have expected the lambs fed with cassava concentrate to have given carcasses with well covered fat than the rest, since cassava is known to be wholly a carbohydrate diet. This was however not so. The reason might have been due to the ether extract content of the different concentrates. From the chemical composition of feeds, the ether extract of maize plus groundnut cake was 3.5% and that of cassava plus groundnut cake 1.9%. Wheat bran had 2.8%.

In the feeding experiment, the author could not determine the average feed consumed to gain one pound of body weight. This was because the lambs were not wholly confined and fed on different diets throughout the experimental period. Also were it to be determined

the group on silage alone treatment would have been seen to have eaten much less amount of silage to gain one pound body weight, while those on silage plus cassava treatment to have eaten much more to gain the one pound body weight. Thus to do so would have led to false conclusion that silage alone treatment was the best of the five treatments.

Strictly speaking it could be assumed that the lambs which were refusing the diet given them while under confinement might have consumed a lot more of the green forage during grazing. This then might have accounted for the relatively large increase in weight of the lambs, especially lambs on the silage alone treatment at a time during the experiment when herbage was available.

The author should have randomly changed the positions of the groups weekly so that each group would have had the chance of being in all the pens. This was however not practicable due to the labour involved. The two groups of each treatment were not confined at the same point. Thus differences in environment affecting intake of feed were more or less minimized. Locations of the pens were such that each pen had good ventilation.

Ideally the author should have used lambs which were as homogenous as possible but because this was not possible, change in weights instead of absolute weight gains were used. Also individual weight gain analysis should have been done but this is difficult in practical animal breeding programme. Thus average weight gains of

the individual group receiving the treatment were used in the analysis.

A plot in the experiment was made up of four lambs, two from each breed, one of which was a male and the other a female. It was thus hoped that the results of experiment would be applicable to both male and female lambs and also the breeds.

Recommendation

A recommendation could be made that a longer adjustment period or standardization be given to the lambs before the actual experiment starts. Stewart (1949) suggested that a period of at least 15 days is necessary for the lambs to get accustomed to a silage. It could be recommended for somebody else to carry on similar feeding experiment, using more homogenous lambs, high levels of concentrate.

S U M M A R Y

An account is given on a feeding trial experiment conducted at Agricultural Research Station, Nungua, using 36 weaned ewe and wether lambs fed on silage alone; silage plus cassava; silage plus maize; silage plus wheat bran as supplements whiles under partial confinement for 172 days. The experiment was conducted between the months of July and January. Average weight gains, 11.6 lbs. for silage alone treatment, 17.3 lbs. for silage plus wheat bran treatment; 19.3 lbs. for silage plus maize treatment; 20.4 lbs. for silage plus cassava treatment and 18.0 lbs. for control group were recorded. Visual appraisal of carcasses was also carried out and the scores recorded. Statistical analysis was performed for the forequarter, hindquarter, eye muscle area

of carcasses of lambs on silage plus maize, silage plus cassava and silage plus wheat bran treatments.

C O N C L U S I O N

On the basis of the results, it appears that:-

1. Silage plus cassava ration gave the best total weight gains.
2. Silage plus maize ration ranked second to silage plus cassava ration, with respect to the total weight gains; pasture alone treatment ranked third and then the silage plus wheat bran ration. The lambs on silage alone treatment gave the least total weight gains.
3. With the percentage carcass yield, silage plus cassava and silage plus wheat bran treatments gave the highest yield, 41.20%; followed by silage plus maize treatment, 40.78%; the silage alone and control treatments gave considerably lower dressing percentage, 38.71% and 36.30% respectively.
4. Lambs fed on silage plus maize gave better carcasses as far as fat covering, fullness of loin and legs were concerned. Lambs fed on silage plus cassava,

and silage plus wheat bran also showed improved carcass covering and 'fullness' over lambs on pasture alone and those on silage alone.

5. The Nungua Black Head Lambs gave better finished carcasses on the whole than the Nungua Sudan lambs

6. This trial indicates that with good management practices sheep will respond to limited feeding while under confinement.

7.(a) Average total cost of wheat bran consumed per lamb over the experimental period of 25 weeks was N¢1.00.

(b) N¢2.25 for maize plus greundnut cake ration.

(c) N¢2.00 for cassava plus groundnut cake ration.

8. From table 5, p.23 average dressing weight of control lambs was 16.2 lbs. and that of those on silage plus wheat bran 19.0 lbs. (supposing average live weight of the two groups was 46 lb). The market price of mutton is about N¢1.00/lb. On this basis, it will be profitable to supplement lambs with wheat bran since profit from above values was about N¢3.00/carcass. Supplementing lambs with cassava or maize ration is questionable owing to the high cost per bag of either cassava (konkonte) or maize.

REFERENCES

1. Carman, G.M., W.J. Pigden, S.R. Haskell and K.A. Winter, (1958) "Legume-grass silage as a roughage for the pregnant ewe." Canadian Journal of Animal Science. Vol. 38; p.200.

2. Bell, D.S.; (1945) "Sheep Legume-grass silage for roughage." Ohio Agricultural Experimental Station, Wooster, Ohio. Bulletin 659.

3. Stewart, J; (1949) "Grass silage for Sheep." Agriculture LV 1. (5).

4. Welch, J.A.; E.A. Livesay and W.R. Lewis, (1954) "Grass and Legume Silage for Sheep." West V. Univ. Agric. Sta.; Morgantown, West Va. Bulletin 363 Part 4 p.4.

5. Cunningham, J.M.M. and S.J. Watson (1951) "Grass Silage for Sheep and Fattening Cattle." Transactions of the Royal Highland and Agriculture Society of Scotland LXIII (1) p.1-8.

6. Carrigus, W.P. (1949) "Grass-Silage." Extension Div. Coll. Agric. Univ. Kentucky, Lexington; Kentucky. Circ. 361.

7. Semple, J.A., C.M. Grieve and D.F. Osbourn (1966) "The Preparation and Feeding Value of Pangola Grass Silage." Tropical Agriculture, No.33, P.251.

8. Budyka, I.H., A.G. Krasnoua and S.G. Leusin, (1963) "Digestibility of Nutrients for Sheep on rations with different proportions of Maize Silage." Nutritional Abstracts and Review Vol. 33 No.1 p.249.

9. Karr, M.R., U.S. Garrigus, E.E. Hatfield, H.W. Norton and B.B. Doane; (1965) "Nutritional and Chemical Evaluation of Urea and of Biuret in Complete ensiled finishing diets by Lambs." Journal of Animal Science, Vol.24 P.469.

10. Welch, J.A., E.A. Livesay and W.R. Lewis. (1954) "Grass and Legume Silage for Sheep." West Univ. Agric Sta. Morgan town, West Va. Bulletin 363, Part 4, p.4.

11. Kammlade and Kammlade (1947) in "Sheep Science." Lippincotts' Agricultural Science Series.

12. Prescott, J.H.D., and C.E. Hinks (1967) "Report No.7 on Investigation of the Carcass Quality of lambs and Hoggets with particular reference to the Cold-Storage of Home-bred Lambs." Univ. of Newcastle Upon Tyne.

APPENDIX

TABLE 6

AVERAGE WEIGHT GAIN/LAMB/WEEK (lb.)

Week	Silage Only	Silage plus Wheat Bran	Silage plus Maize	Silage plus Cassava	Control
1	- 4.1	- 4.2	- 4.6	- 3.8	- 2.0
2	- 2.3	- 2.8	- 2.6	- 2.0	- 1.0
3	- 0.5	- 1.9	- 1.4	- 0.8	- 0.3
4	- 0.5	- 0.5	- 1.0	- 0.4	- 2.7
5	0.1	- 0.9	-	- 0.3	2.7
6	0.3	0.5	0.4	0.8	4.7
7	2.1	2.8	2.5	2.6	5.3
8	2.4	3.6	3.3	3.4	5.3
9	3.1	4.4	3.9	4.5	7.3
10	3.4	5.5	5.5	4.9	7.7
11	4.9	6.2	6.5	6.5	9.3
12	4.9	6.8	6.7	7.9	8.3
13	4.0	7.0	6.8	7.2	8.7
14	5.5	7.9	8.1	8.9	9.3
15	5.1	9.6	8.6	10.1	9.0
16	6.3	11.0	11.4	11.9	12.0
17	7.1	11.5	11.7	12.0	12.3
18	7.6	13.0	12.5	14.1	13.3
19	9.9	13.6	14.0	15.9	14.0
20	11.1	15.1	15.1	17.5	14.7
21	11.6	16.3	16.0	17.4	15.7
22	11.0	15.8	15.7	17.6	16.3
23	9.9	15.3	16.2	17.9	17.3
24	11.3	17.3	17.7	19.4	17.0
25	11.4	17.3	19.3	20.4	18.0

TABLE 7.

VISUAL APPRAISAL SCORES OF CARCASSES (Score was from 0-5)

A. Fullness of Leg.

Breed of Lamb	Sex	Silage Only	Silage plus Wheat Bran	Silage plus Maize	Silage plus Cassava	Control
Nungua Black Head	Wether	3	3.7	3.7	4.3	2.8
Nungua Black Head	Female	2.5	4.2	4.2	4.2	3.9
Nungua Black Head	Female	3.5	4.1	-	4.2	-
Nungua Black Head	Wether	3.7	3.9	4.5	3.5	-
Nungua Sudan	Female	1.0	1.8	4.0	3.5	1.5
Nungua Sudan	Wether	2.5	3.2	-	3.2	-
Nungua Sudan	Female	1.2	3.8	-	2.4	-
Nungua Sudan	Wether	-	2.8	-	2.4	-
Average		2.4	3.4	4.1	3.4	2.7

B. Fullness of Loin

Breed of Lamb	Sex	Silage Only	Silage + Wheat Bran	Silage + Maize	Silage + Cassava	Control
Nungua B. Head	Wether	2.8	3.5	4.0	4.3	2.8
Nungua B. Head	Female	2.3	4.3	4.5	4.2	3.5
Nungua B. Head	Female	3.2	3.9	-	4.3	-
Nungua B. Head	Wether	3.5	4.0	3.8	3.6	-
Nungua Sudan	Female	1.0	1.3	4.3	3.2	1.0
Nungua Sudan	Wether	2.5	3.0	-	2.8	-
Nungua Sudan	Female	1.0	3.6	-	2.5	-
Nungua Sudan	Wether	-	2.5	-	1.8	-
Average		2.4	3.2	4.1	3.3	2.4

TABLE 8

A. RIB EYE-MUSCLE WIDTH (cm)

Silage Only	Silage plus Wheat Bran	Silage plus Maize	Silage plus Cassava	Control
4.6	4.6	4.8	5.0	4.4
4.0	5.2	4.8	4.4	4.5
4.1	4.8	4.4	4.5	4.8
4.2	4.1	4.4	5.3	-
5.2	4.5	-	4.4	-
4.5	4.4	-	4.6	-
4.4	4.5	-	4.1	-
-	4.3	-	4.4	-
Ave. 4.42	4.55	4.60	4.58	4.56

B. RIB EYE-MUSCLE DEPTH (cm)

Silage Only	Silage plus Wheat Bran	Silage plus Maize	Silage plus Cassava	Control
2.1	2.0	2.4	2.7	2.0
1.9	2.3	2.2	1.7	2.1
2.6	2.1	2.0	2.1	2.2
2.3	2.0	1.8	2.9	-
2.1	1.7	-	2.2	-
2.4	1.9	-	1.9	-
1.6	1.9	-	2.1	-
-	2.0	-	1.9	-
Ave. 2.14	1.97	2.10	2.18	2.1

TABLE 9.

LOIN FRESH DEPTH (cm)

Silage Only	Silage plus Wheat Bran	Silage plus Maize	Silage plus Cassava	Control
2.0	1.8	2.9	2.3	1.9
1.6	2.3	2.8	2.1	1.7
1.4	2.7	2.4	2.4	2.5
2.2	2.2	2.2	2.4	-
2.4	2.4	-	2.7	-
2.2	2.1	-	2.1	-
1.4	2.4	-	2.3	-
-	1.9	-	2.1	-
Ave. 1.88	2.21	2.57	2.30	2.03

TABLE 10.

WEIGHTS OF FOREQUARTER AND HINDQUARTER

A. Forequarter

Silage Only	Silage plus Wheat Bran	Silage plus Maize	Silage plus Cassava	Control
3.8	4.2	6.2	5.0	4.4
3.0	5.6	5.0	3.5	3.7
3.3	4.7	4.2	4.8	4.0
4.1	4.3	4.5	6.3	-
5.5	4.6	-	4.9	-
4.5	3.9	-	4.4	-
3.7	4.0	-	4.9	-
-	4.8	-	3.9	-
Ave. 3.98	4.51	4.97	4.7	4.0

B. Hindquarter

Silage Only	Silage plus Wheat Bran	Silage plus Maize	Silage plus Cassava	Control
3.8	4.1	5.4	4.8	4.1
2.9	5.4	5.0	3.7	3.5
3.3	4.5	4.2	4.8	4.3
4.0	4.5	4.6	6.3	-
5.5	4.7	-	4.9	-
4.4	3.8	-	4.3	-
3.6	4.2	-	4.9	-
-	4.7	-	4.1	-
Ave. 3.92	4.48	4.80	4.72	3.96

TABLE 11

APPROXIMATE COST OF CONCENTRATES

A.

Feed	Wt./Bag (lb)	Total Cost (N¢)	Cost/lb (NP)
Yellow Maize	200	5.00	2.5
Cassava Chips (Kontonte)	150	7.50	5.0
Wheat Bran	176	4.63	2.5
Groundnut Cake	176	9.81	5.5

B.

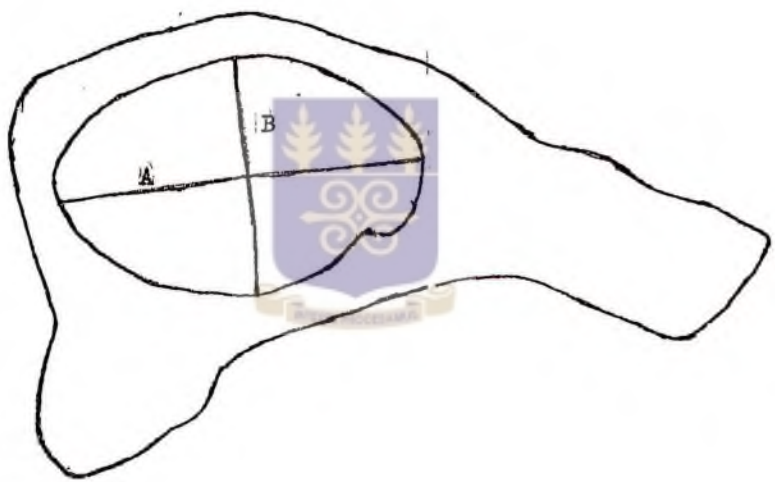
Feed	Cost/lb (NP)
Cassava Chips plus Groundnut cake	5.0
Maize plus Groundnut cake	3.0
Wheat Bran	2.5

TABLE 12. APPROXIMATE COST OF CONCENTRATE CONSUMED/LAMB/WEEK

Feed	Average Feed Consum/Lamb/ Week (lb)	Cost of Feed/ Lamb/week (NP)
Wheat Bran	1.51	4
Maize plus Groundnut cake	3.09	9
Cassava plus Groundnut cake	1.53	8

FIGURE 3.

DIAGRAM OF EYE-MUSCLE MEASUREMENT AT THE POSTERIOR CUT SURFACE OF THE 12TH RIB

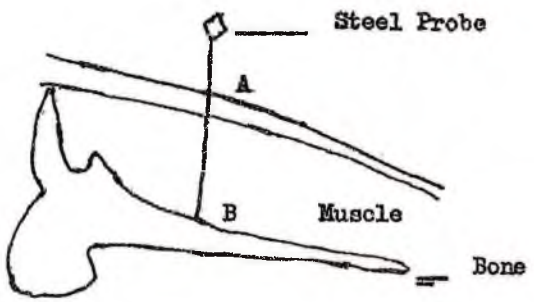


A = Eye Muscle Width

B = Eye Muscle Depth

FIGURE 4.

DIAGRAM OF LOIN FLESH DEPTH MEASUREMENT



Steel Probe is inserted at the 4th Lumbar Vetebra parrallel to the cut section of the Vetebra from dorsal surface of the flesh to the transverse process.