

## PRODUCTIVITY OF WHITE FULANI CATTLE ON THE JOS PLATEAU, NIGERIA. II. NUTRITIONAL FACTORS

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### SUMMARY

*The influence of nutritional factors on the productivity of traditionally managed White Fulani cattle herds on the Jos plateau is described as part of a 2½ year study. The observations made point to the effects of the poor nutrition obtained from natural fodders during the dry season as well as to gross overgrazing. The effect of limited dry season supplementation on productivity is illustrated.*

### INTRODUCTION

The general procedures used for the study on the productivity of White Fulani cattle kept under traditional management on the Jos plateau have been described in the first of this series of articles (Pullan, 1979).

It has been noted that the Jos plateau is grossly overgrazed (Rains, 1975; FAO, 1975) and, because of this, lack of food is likely to be a limiting factor and is the subject of this paper.

### METHODS

The general methods of studying the 8 herds with owner identification (i.e. C1-C3 and A1-A5), have been detailed previously (Pullan, 1979) but those pertaining to the investigation of the nutritional constraints are given below.

#### **Weighing of cows**

On the government farm the weights were obtained by the use of a weighbridge but in the study herds a weighband (Dalton Ltd) was used. The direct conversion of heart girth in centimetres to weight in kilogrammes using this weighband is only valid for *Bos taurus* cattle and not for *Bos indicus*. However, Ross (1958) has constructed a conversion table for White Fulani and an estimate was made of body weight using this table.

#### **Weighing of calves**

One of the special aspects under study was calf mortality and it was thought that very sick calves would be bought and examined in detail. However the owners were very reluctant to sell such calves. The explanation given was that when the calf was taken away from the dam it could no longer obtain any milk. In view of this reluctance it was decided to weigh groups of calves in herds with different managements.

All weighing was done by lifting the calves on to a spring balance. Initially, the scale plus calf could be lifted by 2 people but later this scale was hooked on to a gibbet attached to the back of a Land Rover. When the calves weighed over about 70 kg it was found necessary to erect a stand near each owner's house where the calves were being weighed. This consisted of 2 upright poles, buried so that they stood approximately 2.44 m high and were about 1.83 m apart. These were initially made of wood but later, because of damage by white ants, 7.6 cm diameter water piping was

used. A crossbar of the same piping was put on top of the poles. A block and tackle was used to lift the calves to hang them on the scale. Although a mobile weighbridge might have been easier to use it would not have been possible to take it to the herds during the wet season, while, using the above method, calves up to 150 kg could be weighed.

### **Condition scoring**

At the start of the survey it was obvious that the dry season affected certain animals more than others (i.e. the effect seemed to be dependent on sex and age). Initially a semi-objective score of good, moderate, poor and very poor was given to each animal but this method was too subjective and a more objective measure had to be devised to describe the condition. It was thought that heart girth measurements could be used but unfortunately this suffered from the same problem as direct weighing in that weight was not necessarily a good indication of the actual condition of the animal. It was therefore decided to adapt a condition scoring technique, developed for temperate cattle by Lowman, Scott and Somerville (1973), for use on zebu cattle. Details of this modified method have been given by Pullan (1978).

Up to 10 animals were scored in the age groups: 1, 1½, 2, 3 to 4 years and both males and females in the age groups 6 to 7 and 8+ years. The scoring was done at the end of a wet season and at the end of a dry season.

### **Albumin measurements**

Blood samples were taken from both cows and calves using vacutainer tubes. This caused less concern to the owner than "open" needle bleeding. Five animals from each group of 10 that were condition scored were bled to get serum for the albumin determination. The bromocresol green dye binding technique (Doumas, Watson and Biggs, 1971) was used for the analyses.

## **RESULTS AND DISCUSSION**

### **Natural fodders**

During the study there was not much growth until mid-May and the grasses reached a peak in quality well before the end of the rains. By December the grasses had dried off and were little more than standing hay.

On the plateau, nutrition was based on natural fodder. Serious overgrazing (Rains, 1975; FAO, 1975) resulted in little grass left by the end of the rains to carry over for dry season nutrition.

Crop residues became available to the cattle after harvesting of the seed for human consumption. On the plateau these were available in December and were mostly finished by late December. The residues most commonly present were acha, guinea corn and millet. The thrashed heads of acha, maize, guinea corn and millet produced additional residues which were given at the same time.

Some river valleys, which were flooded during the rains (known locally as *fadamas*) and used for cropping (cassava, yams, etc.), became available for grazing in December and January. Where they were available they provided young growing grasses of relatively high nutritive value. However, many of these areas were irrigated and used for Irish potato production and market gardening during the dry season.

Nevertheless owners A4 and to a lesser extent C3 had access to such areas. This additional food in the dry season added to the crop residues and in the case of A4 resulted in a rising plane of nutrition leading to the slightly better than average

fertility in this herd. It had a calving interval of 22 months as opposed to the average for the study herds of 27 months (Pullan, 1979). In this herd most of the calving occurred in the October/November period because of this *fadama* grazing and the growth rate of these calves was as good as those born during the wet season.

Other sources of dry season food were scarce. Thus there were few trees available for the browsing which is used extensively on the lowlands further north (Raay, 1975) as dry season feed.

#### Dry season supplementation

Apart from the government farms, dry season supplementary feeding was regularly practised by only 3 of the herd owners (Table 1). The most readily available concentrates were undelinted cottonseed and groundnut cake.

TABLE I  
*Supplementary feed/head/day, December to April*

Owner	1974/75	1975/76	1976/77
A3	Cottonseed=1.0 kg Acha straw	Cottonseed=0.6 kg Groundnut cake=1.5 kg Acha straw	Cottonseed=0.4 kg Groundnut cake=0.25 kg Acha straw
C1	Cottonseed=0.05 kg	Cottonseed=0.2 kg	Cottonseed=0.17 kg
A5	Acha straw	Acha straw	Acha straw

By comparison the government farm herds were fed a balanced ration of roughage and concentrates.

Only 2 owners (C1 and A3) regularly provided dry season supplementary feed. Owner A5 did feed acha straw but this was not regarded as being of good nutritive value (Rains, 1975). From the quantities fed, only A3 gave appreciable amounts (which is one of the principal reasons for referring to this herd as "modified traditional"). He mostly used undelinted cottonseed and according to Carling (1965) it is quite a good concentrate feed by itself. This dry season feeding was probably the reason for the higher calving rate found in this herd (Pullan, 1979) and also for the much better condition scores at the end of the dry season and for the better growth rate of cows and calves.

#### Starvation

Starvation accounted for a third of the deaths of those under 1 year of age and just over half of the cattle over 3 years. The main reason for starvation in calves was that their dams were in such poor condition after the dry season that they had little or no milk. These calves commonly died within a few days of birth. With adults starvation usually occurred towards the end of the dry season.

#### Growth rate of cows

Figure 1 shows the growth rate of cows under different managements (the "modified traditional" being herd A3). The regressions of weight on age up to 4 years are all linear and the regression coefficients were significantly different both from zero and from each other ( $P < 0.01$ ). When the cows kept under traditional management reached 4 years the growth rate was markedly reduced, probably because of their reaching maturity and the resultant stresses of calving and lactation.



FIG. 1. Average growth rate of cows under different managements.

Recent work has pointed to the strong relationship between nutrition or, more precisely, body weight and fertility (McClure, 1970; Andrews, 1972; Broster, 1973; Boyd, 1977; Topps, 1977). In a review article on the effect of undernutrition on reproduction Topps (1977) adds emphasis to Lamond's (1970) concept of a "target" body weight for each cow for successful conception. Foster (1960), at the Shika Research Station<sup>1</sup> in northern Nigeria, used 230 kg as the weight to be attained before putting White Fulani heifers to the bull. From the figure on the growth rate of cows it can be seen that this weight was reached by 22 months for the government farm, 36 months for A3 and 44 months for the other study herds. If these were the ages for first conception cows should calve at about 31 months on the government farm, 45 months at A3 and 53 months in the other study herds. This agrees with the observed age for A3 and the other study herds (Pullan, 1979) but none of the government farms in northern Nigeria attained an age at first calving as low as 31 months (Wheat and Broadhurst, 1968; Knudsen and Sohael, 1970; Wheat, Leeuw and Kock, 1972). This may have been because heifers were not fed well enough as immatures or because they were left to attain a heavier weight before mating. Wheat and Broadhurst (1968) mated heifers at about 275 kg and at Vom they were mated at 300 kg (Dr A. Rogerson, personal communication).

### Lactation lengths

Table II gives the length of lactation found in 2 herds. It illustrates that most cows were still being milked after 1 year and that in 1 herd a quarter were still being milked 2 years after calving.

In the herds which rely on milk for a large portion of their food, animals were milked for 1 to 2 years and sometimes slightly longer. However where cattle are kept as a side-line the animals were milked between 6 and 9 months and some hardly milked at all. Although Topps (1977) stressed body weight *per se* as the most important factor in controlling conception and calving rate, he did mention that continued lactation may have a bearing though possibly through its effect on body weight. In the study, where lactation was commonly continued to between 1 and 2 years and

<sup>1</sup> Now called the National Animal Production Research Institute (NAPRI).

TABLE II  
Percentage of cows milked at selected periods after calving

Owner	Age of calves			
	6 months	1 year	18 months	2 years
C1	100%	67%	12%	26%
A4	100%	100%	8%	0%

there was no active weaning policy, continued lactation may have been having an effect. However in herd A5 where the cows were hardly milked at all the calving rate was no better than the average (Pullan, 1979).

### Birth weights

The constraints of the study made it impossible to obtain sufficient birth weights on the day of birth but it was considered that there would be only a negligible change in weight by the third day of life. In this way 83 observations were obtained. For males the average weight was 22 kg (37 calves) and for females 19.5 kg (45 calves).

Topps (1977) gives low birth weights as another effect of undernutrition of cows. The birth weights of the calves in the study herds were less than those obtained on government farms (Foster, 1960; Armour, Lee and Ross, 1961; Knudsen and Sohael, 1970; Rogerson, personal communication, 1977). The figures obtained in the study confirms the report of Roy (1970) that male calves are heavier than females. Roy also observed that the birth weight of a calf will be reduced if the dam has very poor nutritional conditions in late pregnancy. This was the case in the study.

### Weight gain of calves

In Fig. 2 weight gains under different forms of management are compared. At the end of 11 months there was no significant difference between the weights of the calves

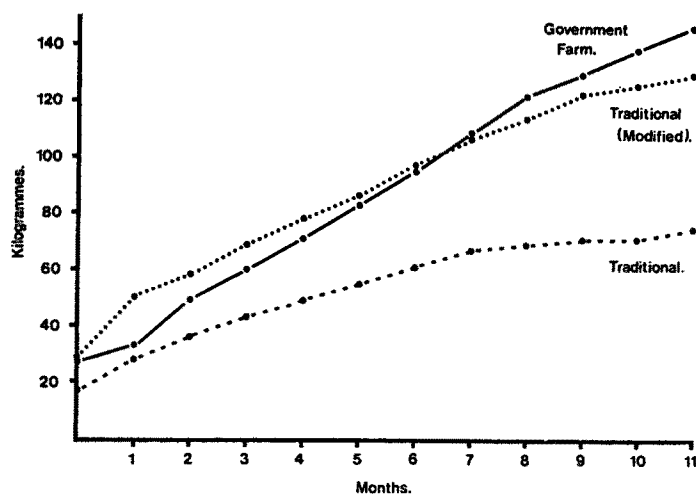


FIG. 2. Weight gain in calves under different management methods.

on the government farm (Vom) and those kept under the modified traditional system (A3) but these differed significantly ( $P < 0.01$ ) from traditionally managed calves (C3) when analysed by Duncan's multiple-range test (Montgomery, 1976).

The cumulative liveweight increase of traditionally managed calves born during March–May (wet season) in herd C1 and October–November (dry season) in herd A4 is illustrated in Fig. 3. The weight gains only differ significantly ( $P < 0.01$ ) after 8 months.

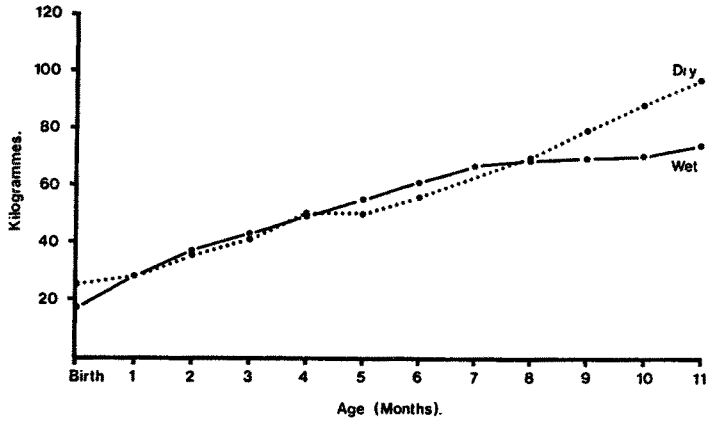


FIG. 3. Cumulative live weight increases of calves born during the wet and dry seasons.

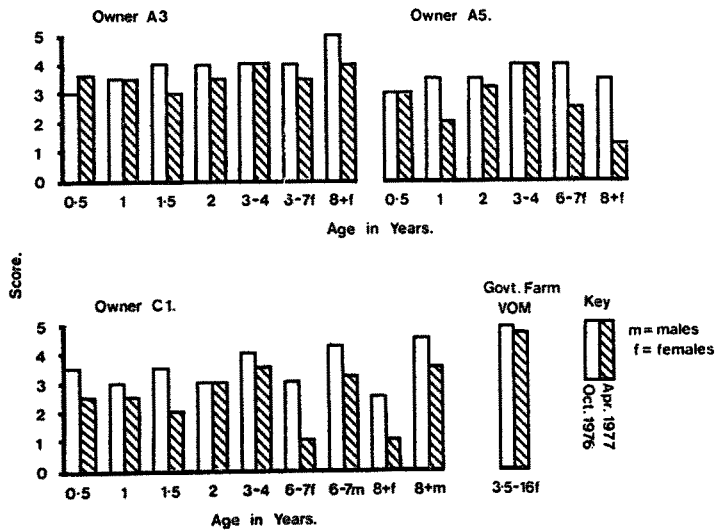


FIG. 4. Condition scoring

**Condition scoring**

Figure 4 shows the condition score of different ages and sexes of animals in 3 study herds compared with the government herd at Vom at the end of the rains in October 1976 and the end of the dry season in April 1977. With C1 the dry season had a greater effect on 6, 12, and 18 month old animals than with similarly aged animals in herd A3

the only one of these herds to practise dry season supplementation adequately. This effect showed to a similar extent in herd A5 in the 12 month old animals. The dry season did not affect the 2 to 4 year old animals so much as the 6 to 7 and 8+ year old females in either C1 or A5. There was less effect on the adult females in A3. It can also be seen that the adult males in C1 were not as badly affected as the lactating females.

The condition scoring revealed that, as would be expected, the dry season affected the young growing animals up to 18 months of age more than the 3 to 4 year old cattle. Also the lactating female was worst affected and the male and castrate hardly at all. In this comparison the herds practising adequate dry season supplementation, viz. the government farm at Vom and herd A3, did not suffer nearly as much from the dry season.

#### Albumin analysis

Ross (1960) stated that the serum albumin level was a useful guide to condition. There was a general drop in the level of albumin in the serum at the end of the dry season as compared to the wet season observations in all 3 study herds. However this drop was not as useful a guide to the individual drop in condition score, as indicated by Ross; indeed even though A3's animals did not lose as much condition their albumin level dropped just as much as the others.

#### CONCLUSIONS

All the observations carried out, viz. birth weight, the growth rate of calves and mature cattle and condition scores, point to the effects of the poor nutrition obtained from natural fodders during the dry season on the plateau. Starvation was considered to be a major factor in the mortality figures.

The position has been exacerbated by serious overgrazing on the plateau over many years as pointed out by Rains (1975). It is not likely that a reduction in the grazing pressure will be possible. The only alternative is the supply of dry season supplementation in some form. The performance of the modified traditional herd in the study illustrates the benefits from such supplementation. This would not need to be at the level practised on the government farms. The study is still continuing and attempting, *inter alia*, to evaluate the levels of supplementation necessary for improved production from traditionally managed herds on the plateau.

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#### PRODUCTIVITE DU BETAIL BLANC FULANI SUR LE PLATEAU DE JOS, AU NIGERIA II. FACTEURS NUTRITIONNELS

Résumé—L'influence des facteurs nutritionnels sur la productivité de troupeaux de bétail blanc Fulani, entretenus de façon traditionnelle sur le plateau de Jos est décrite à la suite de deux ans et demi d'étude. Les observations font le point sur les effets de l'alimentation rare obtenue sur des pâturages naturels durant la saison sèche aussi bien que de la surpâturation. Des exemples illustrent les effets d'une supplémentation limitée durant la saison sèche sur cette productivité.

#### PRODUCTIVIDAD DEL GANADO BLANCO FULANI EN LA MESETA DE JOS EN NIGERIA. II. FACTORES NUTRICIONALES

Resumen—Se describe la influencia de factores nutricionales, sobre la productividad de ganado Blanco Fulani bajo manejo tradicional en la meseta de Jos en Nigeria. La descripción hace parte de un estudio de dos años y medio. Las observaciones hacen énfasis sobre los efectos de la desnutrición, consecuencia de la alimentación del ganado con pasturas naturales pobres durante la época seca y el sobrepastoreo. Se ilustra también, el efecto de una suplementación limitada en la época seca sobre la productividad de los animales.