

ANIMAL PRODUCTION IN NIGERIA AND FEED SUPPLIES

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INTRODUCTION

The livestock sector in Nigeria has been characterised by a supply deficit in meat and other animal products, which has led to a widespread rise in prices for most of these products. Several factors such as inadequate and unbalanced nutrition, inherent adapted restricted growth, prevalence of disease, failure to harmonise crop and animal farming in agricultural practice and inadequate knowledge of sound herd management have been suggested to be responsible for this deficit problem. A most important factor however is the fluctuation in feed supplies leading to poor performance of livestock compared to the situation in the developed countries. The significant role that feedstuffs play in livestock improvement programmes is grossly underated in many areas of the tropics. Domestic livestock is essentially an organism utilized for converting feedstuffs into more nutritious animal products. The greatest proportional cost in livestock production is expended on animal feedingstuffs accounting for between 60 to 80% of total cost and the rapid expansion and success of the livestock industry therefore

depends largely upon the availability of good quality and cheap compound feeds. This is particularly true of the intensive livestock enterprises - poultry and pigs whose performance depends upon the use of concentrated balanced compound rations. Cattle, sheep and goats also require compound feeds at certain critical periods for efficient production as supplements to the herbage they receive.

In recent years, rate and level of performance in the livestock industry have fallen below expectation due among other factors to high feed cost arising largely from fluctuations in feed supplies, rising prices of ingredients, poor quality feeds, inefficiency in production and distribution in the feed industry. This paper attempts to examine some of the problems related to the supply and availability of livestock feeds and their significance in the present under development of intensive livestock enterprises in Nigeria.

Recent trends in Compound Livestock Feed Production in Nigeria

Perhaps a logical point to commence any meaningful look at the availability of feed supplies would be the Compound livestock feed industry itself. A recent survey (Ogunfowora *et. al.*, 1975) showed that there were 38 feed mills operating in Nigeria as at September 1975. Twenty-six of these were owned and operated by Private Commercial enterprises, while 12 were governmental and institutional mills. The distribution by states, installed capacity and capacity utilization are presented in table 1 below.

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Table 1. The distribution of Feed Mills by States, September 1975.

States	No. of Mills	Total installed capacity (tonnes)	Total utilized capacity (tonnes)	Percentage capacity utilization (tonnes)
Lagos	3	127,328	42,506	33.3
West	14	88,350	63,572	71.9
Mid-West	8	106,100	66,650	62.8
East Central	3	69,600	30,900	44.3
South-East	2	10,500	3,200	30.4
Rivers	1	2,400	1,200	50.0
North Central	2	21,780	14,520	66.7
Benue-Plateau	3	9,900	5,200	52.5
North Eastern	-	-	-	-
North Western	-	-	-	-
Kano State	-	-	-	-
Kwara State	2	11,300	4,000	35.3
TOTAL	38	447,258	231,748	51.8

As at September 1975, the total installed capacity stood at 447,258 tonnes, while utilized capacity stood at 231,748 tonnes giving a capacity utilisation of about 51.8 percent on average for the country. Execution of planned mills in the third national development plan period is expected to result in additional 269,100 metric tonnes installed capacity which could bring the total installed capacity to 721,758 metric tonnes by 1980. Table 2 gives an indication of the location and Capacities of feed mills under construction and Mills to be installed during the 1975/80 plan period. Projection of the capacity utilisation during this

Table 2. Location and Capacities of Feed Mills under construction and Mills to be installed during the 1975/80 plan period.

State	Location	Estimated Annual Capacity
<u>Under Construction</u>	M. A. N. R. Gombe	5,400
	M. A. N. R. Maiduguri	5,400
	Poultry Unit, Maiduguri	5,400
Plateau State	M. A. N. R. , Jos	5,400
Lagos State	M. A. N. R. , Ikeja	5,400
Rivers State	M. A. N. R. , Port-Harcourt	6,700
Kano State	Pfizer Franchise Operator, Kano	5,400
<u>Planned Construction 1975/80</u>		
Nigerian Livestock & Meat Authority - 2 in Northern States)		
	1 in Kwara State)230,000
	1 in Eastern States)
Former East Central State Project 6	Unspecified	Unspecified
Former South Eastern State Project 20	Unspecified	Unspecified
<u>Approximate Total</u>		<u>269,100</u>

* Capacity is underestimated to the tune of the total capacity of projects 6 and 20 planned for the former East Central State and South Eastern State by 1980.

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period would be difficult to make since capacity utilization would largely depend on the extent to which planned livestock development keeps pace with projected growth rates.

Livestock Feed Requirements and Installed Capacity of Mills, 1980

Having taken a look at the present and projected capacity for compound livestock feed manufacture in the country, it is pertinent to examine the relationship between existing mill capacity, planned installation of mills and projected livestock feed requirements during the period 1975/80. Table 3 gives an indication of the relationship between existing mills, planned mills and compound livestock feed requirements by regions:

Table 3. Estimated Regional Compound Feed Requirements by 1980 in relation to existing and planned mills (tonnes)

Region	Installed Capacity 1975	Total Planned Installed capacity 1980	Compound Feed requirements 1980	Difference	
				1975	1980
Northern States	42,980	305,380	131,250 - 88,270	+174,130	
West & Lagos States	215,678	221,078	169,500 + 46,178	+ 51,578	
Eastern States	82,500	89,200	101,390 - 18,890	- 12,190	
Mid-Western States	106,100	106,100	57,860 + 48,240	+ 48,240	
TOTAL,	447,258	721,758	460,000 - 12,742	+261,758	

It has been the general belief that the slow rate of expansion in livestock production has been due largely to inadequate number of feed mills to produce sufficient quantities for livestock farmers. While this may be so for some areas with capacity shortfall, the presence of capacity under utilization in the industry suggest that there are several important factors responsible for the low volume of feed available. If it is assumed that the projected feed requirement by 1980 is realistic, table 3 shows that additional capacity of 88,270 tonnes will be required in the Northern States by 1980 and 18,980 tonnes in the Eastern States, while West, Lagos and Mid-Western States will still have capacity in excess of their feed requirements by 1980. If all planned mills are executed within the plan period, the shortfall in the mill capacity in the Northern States would turn into capacity underutilisation of 85,860 tonnes by 1980, while there would still be a capacity shortfall of 12,190 tonnes in the Eastern States in 1980. This table suggests that there could be a total excess capacity of 261,758 tonnes or 36.3 percent capacity underutilization in the industry by 1980. The extent of capacity underutilization in the feed milling industry will be significantly increased by the extent to which the projected livestock development growth rate and therefore feed requirement fall short of the actual growth rate in the livestock industry. Also, the estimated installed capacity in all states may have an in-built overexaggeration since frequent breakdowns, poor maintenance and lack of spare parts as well as use of old and inefficient machinery usually prevent some mills from attaining full capacity utilization even if demand so dictates.

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Causes and Consequences of Capacity Underutilization in the Feed Industry.

Several factors are responsible for the underutilization of mill capacity in the livestock feed industry. These include high cost and poor quality of feed ingredients, inadequate grains and imported components such as fish meal and some additives and medicants; frequent breakdown in machinery and lack of spare parts, sporadic power cuts and the use of inefficient machines by several mills; inadequate information on the composition and processing requirement of local feed ingredients; lack of technical expertise in feed operations, poor purchasing and distribution channels and lack of adequate storage facilities in most mills. All of these factors interact to prevent efficient utilisation of installed capacity of the existing mills as well as significantly increased feed costs. Poor management and extension activities, all of which militate against production efficiency, reduce the profit margin and therefore the effective demands for feeds. Some of the factors enumerated perhaps deserve a closer study:

(a) High costs of feed ingredients.

Table 4, shows the changes in prices of some major feed ingredients as purchased in three mills of differing ownership between 1972 and early 1975. This shows increasing trends and that the commercial mill purchased its ingredients at lower prices compared to the other two which are institutional

Table 4. Changes in the prices of some major ingredients of 3 Feed Mills (1972 to early 1975) /Ton

Feed Ingredients	Y e a r s											
	1972			1973			1974			1975		
	A	B	C	A	B	C	A	B	C	A	B	C
Malze	76.0	60.0	75.0	100.0	130.0	100.0	110.0	160.0	110.0	120.0	190.0	120.0
Groundnut Cake	58.0	66.0	120.0	285.0	130.0	300.0	190.0	130.0	150.0	100.0	130.0	125.0
Fish Meal	207.0	270.0	252.0	400.0	710.0	450.0	260.0	710.0	450.0	260.0	710.0	550.0
Brewers' Grains	34.0	40.0	40.0	34.0	40.0	40.0	34.0	40.0	40.0	40.0	40.0	40.0
Brewers' Yeast	-	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Palm Kernel Cake	-	57.0	65.0	-	57.0	70.0	-	80.0	150.0	-	80.0	150.0
Wheat Middling	38.5	-	-	49.0	55.0	60.0	70.0	70.0	70.0	70.0	70.0	70.0
Rice Bran	-	12.0	12.0	-	12.0	12.0	-	12.0	12.0	-	12.0	12.0
Bone Meal	34.8	56.0	-	34.0	56.0	-	34.7	62.0	-	40.0	64.0	-
Blood Meal	-	80.0	-	-	80.0	-	-	100.0	-	-	100.0	-
Oyster Shell	36.0	50.0	50.0	38.8	50.0	50.0	38.8	50.0	50.0	55.0	60.0	55.0
Palm Oil	72.7	89.4	-	180.0	-	-	248.6	-	-	380.0	-	-
Salt	43.8	26.0	-	65.9	112.0	100.8	100.7	112.0	100.8	300.0	196.0	201.2

A = A commercial livestock company, Privately owned.
 B = University of Ibadan Teaching & Research Farm
 C = MANR, Moor Plantation, Ibadan.

mills. Differences in prices paid for feed ingredients are linked to differences in purchasing policy, use or otherwise of middlemen or contractors, possession of storage facilities which enable them to purchase grains and other feed components when abundant, taking advantage of price reduction at such times. The rising cost of feed ingredients has the overall effect of increasing production cost and results in high cost of finished feeds. The cost of different types of feeds have also followed an upward trend between 1973 and 1975. The high cost of feed is generally believed to be partly responsible for the reduced profit margin which in turn discourages scale expansion in the livestock industry. Limitation in production programmes result in a reduction in effective demand, a cut back in feed production and aggravate capacity underutilization in the feed industry.

(b) Quality of Raw Materials.

Considerable variability is encountered in the quality of rations available for sale to livestock producers due largely to seasonal variations in the supply of ingredients and poor quality. Poor quality of available ingredients arise mainly from bad or inadequate processing and storage, insect infestation and purposeful adulteration. The problems of fishmeal quality are complex by the prevalent ports congestion in the country during which consignments remain on board the ships for long periods and deteriorative changes

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set in. Excessive pest attack, adulteration with chaff and variable moisture content are common problems with grains. There is a tendency for the majority of feed compounders to adhere strictly to the proportions of ingredients recommended by the initial formulators of their rations irrespective of the variation in the nutrient levels of different batches of the same feedstuff. The resultant effect of all the above is the production of poor quality livestock feeds which invariably affect overall profitability of enterprise, dampens demands for feed and affects capacity utilisation.

(c) Inadequate information on the Composition and Processing of local Feed Ingredients.

Proper balancing of nutrients in compound feeds require a knowledge of the nutrient requirements of the different classes of stock under the conditions prevalent in any particular environment. Meeting these requirements from the available raw materials also requires a knowledge of the nutrient levels, their extent of utilisation and the processing requirements for such feeds to render them readily utilizable. Unfortunately information on these aspects is still fairly limited, and the information dearth has been a key factor in the production of expensive rations of extremely variable quality. Several feed manufacturers depend for their formulations on foreign expertise. Such dependence tends to result in the use of the same conventional raw materials

and such manufacturers cannot take advantage of cheaper ingredients which become available from time to time. They cannot easily substitute in the face of scarcity of certain ingredients. Such a situation results in escalating feed prices.

(d) Lack of Technical Expertise

The successful operation of a feed mill requires a blend of commercial skills in buying, financing, nutritional science, marketing and distribution. Most important of the essential pre-requisites in a successful feed manufacture is a clear understanding of the principles of least cost, but efficient ration formulation from the available raw materials. At present except for a few large feed manufacturers most others lack expertise in the areas, enumerated above and do not seem to be aware of the importance of technical know-how in their business. All these add up to inefficient production of poor quality feeds, the results of which are as usual, low profitability, a dampening in demand for feeds and a consequent excess capacity in such mills.

(e) Capacity underutilisation stemming from lack of demand from Livestock Producers.

The feed manufacturers in this country are at present faced with a lack of demand for several types of compound feeds. Table 5 shows the total production of compound feeds in Nigeria in the period 1973/74 and 1974/75.

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Table 5. Total Compound Feed Production in Nigeria (1973-1975)

Type	Metric tons	(% of total)	Metric tons	(% of total)
Poultry	168,454	81.80	155,730	82.30
Pigs	33,932	16.50	29,000	15.30
Cattle	1,065	0.52	1,532	0.81
Miscellaneous rations	2,549	1.18	2,983	1.59
Total	206,000	-	189,245	-

Since manufacturers in many cases stream-line the production schedules to meet the trend in demand, this may be taken as a fair index of the demand for the different types of feeds over this period. ^X It is clear from the table that there was an 8.1% drop in total compound feed production between 1973/74 and 1974/75, while there were 7.6 and 14.5 percentages drop in the production of poultry and pig feeds respectively; poultry feed production took up over 80% of total feed production in both periods, pig feeds accounting for about 15% and cattle feeds for less than 1%. ^{*} The low demand for cattle feeds is particularly important in capacity under utilisation since cattle takes up a very high proportion of the overall

livestock population. Many mills are forced to work below capacity because of this lack of demand for feeds with a consequent increase in the cost per unit of output. It is reasonable to assume that the high costs of feeds are also partly responsible for the present lack of demand for compound feeds. However, a look at the current high prices of livestock products such as milk, meat and eggs would give the impression that profit to the primary producer is of sufficient magnitude to stimulate demand for compound feeds. While this may be true for some large scale livestock producers in and around urban centres, it is not true for most producers situated at some considerable distances from such places. For such producers, the high costs of feeds and the insufficient market outlets for their products usually result in a significant reduction in the margin of profit. Middlemen travel considerable distances to sell feeds and buy products at very low price, thus creating a wide gap between producer and consumer prices for livestock products. This tends to dampen enthusiasm and business expansion and, consequently, results in reduced demand for compound feeds.

Some suggested measures to increase feed availability for the expansion of livestock development programmes

The enumerated problems suggest a need for immediate steps both at private and governmental levels aimed at improving the structure and performance of the feed industry so that it could effectively provide the present and future feed

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requirements at the cheapest cost and in the required quality. Such suggested measures would include:

- (a) Improving the supply of Ingredients: The problem of inadequacy of grain supply can be removed through concerted efforts aimed at increased production of grains so as to make them freely available for compounding livestock feeds after satisfying the demand for human consumption and industrial manufacture. Increased grain production will involve adoption of modern practices in agriculture such as breeding and distribution of high yielding grain varieties, fertilization, pest control, provision of adequate storage facilities and the establishment of efficient distribution channels to facilitate the transfer of grains from areas of production to areas of need. While the encouragement of increased production of cereals may be the most obvious solution, the use of alternative energy sources should be explored. Table 6 shows that roots and tubers abound in this country which yield energy for pigs and poultry comparable to the yields from the cereals, which are the traditional energy sources in compound livestock feeds in Nigeria. Cassava is perhaps the most promising of these tubers as alternative energy sources. Some reports (Oyenuga 1961; Fetuga and Oluyemi, 1976 and Oyenuga and Fetuga, 1975), have shown that the tubers are efficient energy sources and could replace

Table 6. Chemical Composition and the Energy Value of Some Cereals, and Roots and Tubers available in Nigeria

Ingredients	Dry matter %	% of Dry Matter						Digestible energy (pigs) (kcal/kg)	Metabolizable energy (pigs) (kcal/kg)	Metabolizable energy (poultry) (kcal/kg)
		Crude protein	Crude fibre	Ether extract	Ash	Carbohydrate	Metabolizable energy (pigs) (kcal/kg)			
Maize	91.8	9.8	2.2	3.8	1.6	82.6	4042	3731	3546	
Guinea Corn	89.7	11.2	2.9	3.4	2.4	80.1	3812	3627	3187	
Millet	92.4	9.3	2.4	4.1	1.4	82.6	3943	3666	3194	
White Yam	30.6	6.4	2.7	0.45	4.3	86.1	3351	3170	3284	
Water Yam	25.4	8.2	2.6	0.90	5.0	83.5	3419	3248	-	
Yellow Yam	22.4	6.3	2.7	0.40	3.3	87.6	3493	3315	-	
Chinese Yam	20.0	8.9	3.5	0.60	4.3	82.8	3369	3187	-	
Cocoyam (Taro)	35.6	6.3	2.4	0.72	2.2	88.4	3804	3604	2723	
Cocoyam (Tania)	36.3	5.9	2.6	0.82	1.7	89.0	3721	3524	2743	
Sweet Potato	40.0	5.8	1.2	0.54	3.9	88.6	3801	3596	3891	
Cassava	32.9	2.80	2.9	0.60	1.9	91.8	3914	3773	3664	

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between 20 and 25% of the cereal in diets for pigs and poultry. Sweet potato production should also be encouraged. Several other by-products such as molasses, brewers' grains, wheat offals and rice by-products have been found to be useful and can replace a fair amount of the cereals in compound livestock feed with a concomitant cost reduction.

The problem of scarcity of animal protein concentrates could be reduced through the effective management of abattoir by-products which would entail the installation of basic facilities for the economic recovery of available by-products in all large abattoirs. In rural areas, salvaging of such by-products could be achieved through the centralization of slaughtering operations at selected points provided with basic amenities for the handling, collection and primary preservation of by-products for transportation to larger abattoirs where they can be fully processed. Continued dependence on import for supply of fishmeal to the feed industry is not likely to improve the situation. Efforts should therefore be made to explore the possibilities for the local manufacture of fish meal.

Presently, the use of oilseed cakes and meals in compound feeds is restricted to groundnut cake and small quantities of palm kernel meal. Recent nutritional findings, (Fetuga, Babatunde and Oyenuga, 1973a & b; Babatunde, Fetuga, Odu-mosu and Oyenuga, 1976 and Fetuga, Babatunde and Oyenuga, 1977 a & b) have

indicated considerable potentials for the more rational use of palm-kernel meal in diets for monogastric animals. Based on recommended levels of inclusion in these studies, it is estimated that in fact about 45,000 metric tons of palm kernel meal could be used. This would reduce significantly the requirement for groundnut meal in animal feed compounding. If processing facilities for gossypol removal or destruction became available, cottonseed could be used at increasing levels of inclusion and could further reduce the present near reliance on groundnut cake as the major protein concentrate in livestock feeds. In terms of nutrient make up, the amino acid make-up of palm kernel and cotton seed compare quite favourably with the levels in groundnut. Local processing of soyabean and sesame oil seed is almost non-existent. Production shows a rapid decline in quantities produced.

Table 7. Recent trends in the Production and Export of Soyabean and Sesame Oilseed ('000 metric tons)

Year	SOYABEAN		SESAME OILSEED	
	Production	Export	Production	Export
66/67	17.7	15.3	18.0	17.6
67/68	8.7	8.9	13.3	13.3
68/69	4.2	4.1	13.2	12.8
69/70	10.8	9.5	17.4	20.6
70/71	4.8	4.4	6.1	5.7
71/72	0.9	0.9	3.2	2.2
72/73	-	1.7	-	3.1
73/74	-	0.6	-	3.2
74/75	1.5	-	-	-

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It is also apparent that most of the quantities produced have been exported, indicating that both these sources have had very little role to play as concentrates in livestock feeds up to date in Nigeria. This is unfortunate since in terms of nutritional contents, residual cakes from these sources have a big role to play in providing nutrients that have been found to be lacking in most compound feeds available for sale within the country. Reports by Fetuga et. al. (1973a & b) indicated lysine, methionine and cystine and perhaps threonine as the amino acids most likely to be limiting in feed mixtures in Nigeria, because of the limitations in the levels of these amino acids in most available alternative oilseed cakes which are the principal sources of amino acids in diets. Soybean is valued for its high lysine content while sesame seed would provide good quantities of the sulphur amino acids in compound livestock feeds. The wide availability of both these sources could lead to a huge reduction in the quantity of fishmeal required for compound feed manufacture.

(b) Stabilising raw material and Feed Prices:

The livestock feed industry is sensitive to instability in prices and supplies of feeds. Short and longer term strategies are necessary to insulate the industry from input price uncertainties. Two possible measures

could be adopted to eliminate this problem. First, attempts could be made to reduce the cost of imported feed ingredients and secondly attempts could be made to replace imported feed components by locally produced materials. Organisation of bulk purchasing of feed ingredients could be effective in cost reduction. Such an organisation could import items like soyabean, maize and fish meal tax-free and make them available at reasonable rates to feed compounders.

(c) Improving livestock Feed Marketing and Distribution.

Efficient distribution of feed can go a long way in reducing the costs of feeds to farmers as well as remove the problem of inadequate demand for feeds. If marketing is organised through governmental effort and involves cooperatives and marketing guilds, a decrease in price at the farmers level could be expected. A decrease in price of finished feeds, all other things being equal, will stimulate demand and increase the profit margin of the livestock producers. Feed marketing problems are also linked with the existing inefficient communication systems. Distribution by most feed manufacturers is by private hauliers being usually contracted on an individual basis. For several of the feed mills distribution is highly localised because of high transportation charges. Transportation charges are high because roads are bad in many places. The infrastructural factors hindering

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efficient distribution need very urgent attention. Provided that the railways in the country are properly reorganized, bulk transportation of feed by rail could be considered.

(d) Feed quality control

A survey of several commercial poultry units in all the states revealed that feed quality is a major factor implicated in the poor performance of these birds. While many feed manufacturers would normally declare the amount of crude protein and sometimes the amount of other nutrients in the compound feed, control of these declaration has not been possible due to the present lack of feed quality legislation. The success of any feed quality control measures depends on the existence of a clear understanding by the buyer of what he requires in a feed. It is the extension services that will have to undertake the education of livestock producers on what quality standards to insist upon. Success of quality control would also depend on existence of methods of verification of set standards which can be applied under practical operational conditions of trading. In this regard the feed manufacturers and government must always co-operate. Since it is the feed manufacturer that must necessarily acquire his raw materials, the control of raw material quality must rest at this point. On the other hand, stringent

government control of the quality of the finished product will force the manufacturers to insist on good quality raw materials.

Livestock Improvement and Extension Programmes.

The establishment and/or expansion of livestock feed industry does not automatically lead to the wider availability of livestock products to a greater proportion of the population. The feed industry cannot contribute to the improvement of livestock production unless there are appropriate breeds of livestock available which are able to economically convert the products of the feed industry into milk, meat and eggs. Efforts should, therefore, be made to make available to the farmers highly efficient broiler and layer chicks, piglets etc. as well as improve local livestock through well reasoned breeding programmes. The provision of adequate quantities and quality of livestock feed should be seen as part of the livestock production chain. Extension activities to popularise the use of livestock feeds would go a long way to remove the problem of demand for certain classes of livestock feeds. The wide availability of animals of the right kind would effectively increase the demand for compound livestock feeds.

In conclusion, I would wish to remark that the present state of availability of livestock feeds is far from sufficient to support the planned livestock development programmes. The answer to the problem of availability does not seem to rest with the expansion in the number or installed capacity of

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mills but in a careful reorganisation in the operational efficiency of existing mills to enhance utilization of installed facilities and thereby reduce feed cost to the livestock producer.

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EFFECTS OF SEASON AND LITTER SIZE ON GESTATION LENGTH IN SWINE

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SUMMARY

488 gestations (309 Large White and 179 Landrace) and the size of all litters resulting from services which occurred between January 1967 and March 1970 were analysed.

The mean gestation length was 113.96 days for the Large White and 113.74 days for the Landrace while the mean values for the litter size were 9.14 and 9.58 respectively. There was a significant negative correlation between these two traits in both breeds ($P < 0.01$).

A slight and non-significant seasonal effect ($P < 0.10$) was shown with the highest and lowest gestation lengths being recorded in July (114.38 days) and in January and February (113.40 days). Breed effect and interaction between breed and season were also not significant.

INTRODUCTION

Litter size exhibits considerable variability among individuals as well as

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between subsequent farrowings by the same sow. Gestation length, on the other hand, tends to be constant within species or strains. However, litter size and gestation length have been shown to be highly negatively correlated (Manresa, 1933; Biggers, Curnow, Fin and McLaren, 1963 and Cox, 1964). Thus, the smaller the litter size, the higher the incidence of longer gestation.

Environmental factors, especially day length changes, have been shown to exert a strong influence on many reproductive phenomena (Ulberg, 1958; Dutt, Ellington and Carlton, 1959; Hafez, 1968 and Waites, 1968). In a comparative study, Cohen (1970) has shown that the monthly variations in gestation length were similar in women, cattle, buffaloes and horses and were influenced by daylight changes. High temperatures have also been suspected to prolong gestation in rodents (Hafez, 1968). MacFarlane, Pennycuik, Yeates and Thrift (1959) have shown that high temperatures, with or without vitamin supplements, increase gestation length in rats. It has been claimed also that thyroid deficiency initiated before pregnancy prolongs gestation (Bruce and Sloviter, 1957 and Lucas, Brunstad and Fowler 1958) while Biggers et. al. (1963) demonstrated that some humoral factor from the placenta and/or foetuses was involved in the regulation of gestation length by litter size.

This investigation was undertaken to obtain more information about the effects of season and litter size on gestation length in the sow.

MATERIALS AND METHODS

The breeding records of 137 Large White and 78 Landrace sows in the University of Ibadan Breeding Stock, during a period of 39 months (January 1967 to March 1970) were studied and analysed.

The sows, which ranged from 10 to 36 months in age, were hand-fed twice daily, bred on their second estrus and farrowed two to four times during this period. The gestation length includes both the first day of service and the day of farrowing and was related to the month, and therefore season, of service since the exact time of mating was known. The litter size was represented by the total number of piglets farrowed.

All the climatic data were obtained from the Geography Department, University of Ibadan, Ibadan and the Physiologically-effective temperature was calculated by weighing the dry bulb and wet bulb temperatures by 0.6 and 0.4 respectively according to Ingram (1965) and Steinbach (1971). Each year was divided into four three-monthly seasons (Egbunike and Steinbach, 1970). All statistical analyses were made according to Steel and Torrie (1960).

RESULTS

The mean gestation lengths in days for both breeds were 113.96 (Large White) and 113.74 (Landrace) while their mean litter sizes were 9.14 and 9.58. The

differences between the two breeds were not significant. Table 1 shows the seasonal means of gestation length and litter size from the combined data of both breeds

Table 1. Seasonal means and standard errors of gestation length, litter size and physiologically-effective temperature.

Season of Service	n*	Gestation Length(days)	Litter size (numbers)	Physiologically effective temperature($^{\circ}$ C)
January - March	162	113.59 \pm 0.13	9.50 \pm 0.22	26.33 \pm 0.11
April - June	100	114.02 \pm 0.15	9.24 \pm 0.29	25.98 \pm 0.55
July - September	106	114.00 \pm 0.71	9.39 \pm 0.30	23.61 \pm 0.07
October - December	120	113.96 \pm 0.18	9.00 \pm 0.29	25.22 \pm 0.65

* Number of parturitions.

with the respective physiologically-effective temperatures. Throughout the period under investigation, a slight non-significant seasonal effect on gestation length was demonstrated (0.05 P 0.10). Season and breed interaction was also not significant. The longest and shortest gestations were recorded in July (late rainy season) and in January and February (late dry season) as 114.38 and 113.40 days respectively. Generally there was a greater incidence of prolonged gestation when sows were bred in the rainy season.

There was a significant negative correlation between litter size and gestation

Season and Litter Size on Gestation.

length ($P = 0.01$) in both breeds (Table 2) and the regression equations obtained are

$$Y = 114.94 - 0.125x$$

$$Y = 114.81 - 0.093x$$

$$Y = 114.87 - 0.106x$$

for Landrace, Large White and both breeds, where Y and X are respectively gestation length and litter size. A multiple regression analysis, in which the physiologically-effective temperature (X_1) ($^{\circ}\text{C}$) was kept constant, showed gestation length (Y) and litter size (X_2) to be less negatively correlated (-0.096) than was the case in the simple analysis (-0.20) (Table 2). The multiple regression equation is:

$$Y = 113.35 + 0.039X_1 - 0.046X_2$$

Table 2. Regression analysis of gestation length and litter size in pigs.

BREEDS	VARIABLES			r	P/	REGRESSION EQUATIONS
	Y	X	n*			
LANDRACE	GL	LS	179	-0.22	0.01	$Y = 114.94 - 0.125x$
LARGE WHITE	GL	LS	309	-0.18	0.01	$Y = 114.81 - 0.039x$
COMBINED	GL	LS	488	-0.20	0.01	$Y = 114.87 - 0.106x$

*n represents number of parturitions.

GL = Gestation length

LS = Litter size.