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Performance of Improved Dairy Cattle Technologies Among Farmers in Northern Nigeria

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Abstract

This study evaluated the performance of different dairy cattle technologies adopted by dairy farmers in 16 States of Northern Nigeria. Purposive sampling procedure was used to select the study area due to the presence of improved dairy farms in the area. Questionnaire was used to collect data from 61 registered improved dairy farmers in the area. The data collected were analyzed using descriptive statistics, F-test and gross margin analysis. The majority of improved dairy cattle farmers were in

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*their middle age, majority of them (60%) have university degrees, had annual income of about ₦20, 000, 000.00. It also revealed low extension contact among dairy farmers. Dairy production was highly profitable with a gross margin of ₦11, 912.54, ₦6, 383.23 and ₦2, 547.99 per dairy cow for exotic, crossbred and Bunaji cattle. In terms of return per Naira invested, net gains of N10.20 was obtained for Frisian breed, crossbred (**F**riesian ×Bunaji) ₦2.70 and Bunaij, was ₦1.50. It was recommended that dairy farmers should be sensitized and encouraged to adopt exotic breed or crossbreed Bunaji cattle with Frisian bulls or artificially inseminate female Bunaji cattle. The study also recommended that extension workers should endeavour to link up farmers with sources of improved dairy cattle technologies.*

***Key words**: Performance, dairy cattle, Northern Nigeria.*

Introduction

Cattle are kept in most countries of the world for meat, dairy, hides and fibre production. FAO (2010) reported that dairy industry in Nigerian produces an estimate 450, 000 tons of milk per annum. This production has been found to be inadequate to satisfy the dairy demands of Nigerians (FAO, 2010) This is because the genotype of the African breeds of cattle can only produce an average milk of 1.27 litres per cow per day during the wet season and less than 0.36 during dry season (Yuan *et al*., 2010), whereas their counterparts in the European and American countries produce an average of 25 litres per day (Mallau-Aduli, *et al*., 2009). Consequently, protein deficiencies become a common phenomenon in Nigeria, especially among the poor segment of the society, which constituted majority of the population.

Local production of dairy supply in Nigeria is far below the annual demand which was estimated at 1.45 billion litres by 2010 (FAO, 2010), making milk consumption among Nigerians to be less than 10 litres per head, whereas the world standard was put at 40 litres per head Staal *et al*. (2008). Food and Agricultural Organisation (FAO, 2010) stated that Nigerian dairy sector is primarily conditioned by demand situation, not the supply constraint. Instead of taking advantage to invest in dairy farming, the gab is usually bridged by mass importation of dairy products into the country. In 2008 alone, Nigeria imported an average of 46, 853 metric tonnes of whole dried milk valued at $80, 000, 000; milk skimmed dried at 29, 267 metric tonnes, valued at $13, 827, 000 and milk whole evaporated was 8,053 metric tonnes, valued at $22,725,000 (FAO, 2010) *VS_GapAnalysisReport-Nigeria.pdf (application/pdf object)*. However, three dairy systems in Nigeria based on the use of farm inputs and outputs; they include pastoral, semi-intensive and intensive systems.

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In pastoral system dominated milk production in Nigeria, it still supplies considerable amounts (over 70%) of milk today (Olaloku and Debre, 1992). Semi- intensive system is common in peri-urban zones and it consist of dairy farms owned by business men, civil servants and private individuals who employ labour in the catering of their animals, with milk production as their major objective of the venture (Diop and Mazouz, 1995). Dairying is done with some degree of intensification by a combination of grazing and concentrate-feeding. Here, the use of graded cows or crossbreeding, usually between exotic bulls and local cows or through artificial insemination (AI) to upgrade local cows for better milk production (Bayemi *et al.,* 2005). Intensive farms are usually owned by rich individuals or the government. Investments are made on buildings and machinery with the use of hired labour. These systems concentrate on the supply of milk in large towns and in most cases have one or more guaranteed delivery sources. There is a higher market orientation in this systems and more emphasis is laid on feeding and breeding management to assure optimal production (Diop and Mazouz, 1995). In both intensive and semi-intensive systems AI plays a major role in breeding, as it is cheaper and less cumbersome than maintaining an exotic bull.

Understanding the short supply of dairy products is a key to overcoming the problem. Thus, adoption of improved dairy cattle technologies – genetic improvement, feeds and animal healthcare into the system could be the possible solution. Therefore, this study investigated the productive performance of three breeds of dairy cattle, namely *friesian*, crossbreed(*friesian*×*bunaji*) and *bunaji*, adopted by dairy farmers, costs and return of sales of dairy products and constraints encountered by dairy cattle farmers.

Methodology

The study was carried out in 16 States of the north, namely; Adamawa, Bauchi, Borno, Gombe, Jigawa, Kaduna, Kano, Katsina, Kebbi, Kwara, Nassarawa, Niger, Plateau, Sokoto, Taraba and Yobe. Data collection took place between 2010 and 2011. Questionnaire technique was used for data collection. The researcher and trained enumerators were involved in the data collection which lasted for about 18 months from 61 improved dairy farmers. Purposive sampling procedure was used to select the respondents in the study area.

Performance analysis of adopted improved dairy technologies requires a sequence of logical steps. However, the most appropriate approach in agriculture literature (Greene, 2004) is informed by the types and characteristics of the data set. Data collected for the study were analysed using descriptive statistics, mainly frequencies and percentage, gross margin analysis and F-test. Descriptive statistics were used to describe socio-economic characteristics of the respondents, breeds of dairy cattle kept,

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productive performance of the breeds and constraints of dairy farming. F-test was used to measure the differences of performance among the breeds of dairy cattle kept by dairy cattle farmers. Gross margin analysis was used to test and compare profitability of keeping the different breeds of dairy cattle by dairy farmers in the study area.

The Gross Margin (GM) analysis was used to measure profitability of the three breeds of dairy cattle. The GM is specified as follows:

$$GM = \sum Q_y P_y - \sum_{i-1}^{n} X_i P_{xi}$$

Where

Q_y = Total milk output (litre)
P_y = unit price of the milk products (Naira/litre)
$Q_y P_y$ = Total revenue derived from the sale of milk products (Naira)
X_i = Quantity of the i^{th} inputs used (value in Naira)
P_{xi} = Price per unit of the i^{th} input (Naira/litre)
$\sum$ = Summation of (input 1 to n i.e. total variable cost) (Naira)

Results and Discussion

Socio-economic Characteristics of the Respondents

The findings in relation to the socio-economic characteristics (Table 1) of improved dairy farmers and institutional factors in the area suggest that 23% of the respondents were between 46 – 55 years old, 60% of them had University degrees and were primarily dairy cattle farmers. Majority (60%) of them had between 5 and 15 years of herding experience. The distribution of annual income showed 34% of the respondents had less than ₦20, 000, 000. Extension services were generally low in the area with contacts of 3 to 4 visits per year. Water supply was quite accessible, 96% of the farmers live within the vicinity of all year round stream and 61% of them reported high market demand of dairy products. This finding agrees with that of Abubakar, S.Z. (2011) which reported that farmer's socio-economic background such as higher education, access to sources of portable water and social infrastructure were some of the necessities for adoption of improved dairy cattle technologies.

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Table 1: Socio-economic characteristics of the dairy farmers

Age	Percent
16-25	21
26-35	16
36-45	15
46-55	23
56-65	13
66 and above	12
Educational status	
No education	8
Adult education	2
Primary education	4
Secondary education	4
Tertiary education	22
University degree	60
Income (₦ = `000, 000)	
<10.0	18
10.0 – 19.9	16
20.0 – 29.9	11
30.0 – 39.9	10
40.0 – 49.9	12
50.0 – 59.9	4
60.0 – 69.9	13
70.0 – 79.9	10
80.0 – 89.9 and above	6
Dairy farming experience (years)	
5 and below	35
6-10	25
11-15	12
16-20	14
21-25	4
26-30	2
31 and above	8
Number of extension contacts (per year)	
No contact	15
3 – 4 contacts	59
Don't know	26
Proximity to water	
Located by all season stream	52
Located within vicinity of all season stream	41
Less than one kilometer to all season stream	5
One kilometer and above to all season stream	2
Market demand	
High demand	61
Low demand	39

Cattle breeds kept by the respondents

Table 2 shows the number of improved cattle breeds kept by the respondents. The result showed that 65% of the cattle kept by respondents were *friesian* cattle, 21% were crossbred and 14% were indigenous breed, which were

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mainly the *bunaji* (white Fulani). On the average, 86% of the cattle in herds of the respondents were improved dairy cows, which means that commercial dairy farmers utilize hybrid cattle and improved dairy more than indigenous cows in their dairy industries. This finding is consistent with Ehoche*et al.* (2000) who reported that majority of cattle on dairy farms the developing countries, such as Nigeria are improved dairy cattle. Similar finding has been reported by Heinrichs *et al.* (2009) who stated that one of the excellent ways to improve herd productivity is to cross local cows to the exotic bulls and/or the introduction of semen from exotic breed into the female organ of local cow through artificial insemination.

Table 2: Dairy cattle of respondents by the breed

Breed	Percent
Friesian	65.0
Crossbreed (*Friesian×Bunaji*)	21.0
Bunaji	14.0
	100.0

Productive Performance of the Breeds

Over the years, several local and improved breeds of dairy cattle have been identified and disseminated to farmers in the Northern States of Nigeria. The notable hybrid in the area is the *Friesian* and *bunaji* breeds. The *friesian* breed has been identified to have high milk output among the hybrid or exotic breeds, the same applies to *bunaji* among the indigenous breed of dairy cattle in Nigeria (Malau-Aduli *et al.,* 2009). Table 3 compares the production performance of *friesian*, crossbreed and *bunaji* in the study area. The study revealed that *friesian*, crossbreed *(Friesian×bunaji)* and *bunaji* breeds produced an average of 30.15, 22.54 and 1.57 litres per day respectively. This result showed that one *friesian* dairy cow produces as much milk as one and half crossbreed (*Friesian×bunaji*) or three and half *bunaji* breeds. This finding agrees with that of Nicholson *et al.* (2000) who reported that there was a great difference in milk production between hybrid and indigenous dairy cattle in Coast Province of Kenya. Also on-station experiment carried out by NAPRI, Zaria gave a consistent average of 1.70 litres for *bunaji* breed, 27 litres for crossbreed and 35 litres for *friesian* dairy cattle (Ehoche, *et al.,* 1999).

Table 3: Milk yield of the of three breeds of dairy cattle (litre)

Breed	Average Milk Yield of the Breed (Lit.)
Friesian	30.15
Crossbreed (*Friesian×Bunaji*)	22.54
Bunaji	1.57

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Analysis of Variation in Milk Yield of Cattle Breeds in the Study Area

The study investigated milk yield of different breeds of dairy cattle breeds in the study area. The result obtained from the study revealed that the average milk yield of indigenous *bunaji* breed, crossbreed and *friesian* breed were 4.03 litres, 8.83 litres and 15.22 litres respectively (Table 4). The coefficients of variation were less than 50% across the three different breeds reflecting stability in the quantities of milk yields of the breeds in the study area. The minimum quantity of milk yield was 1.5, 2 and 4 litres per day for *bunaji* breed, crossbreed and *friesian* breed respectively while the maximum quantities were 15, 25 and 60 litres respectively.

There is significant difference (F=11.75; P≤0.05) between the quantities of milk yields of different breeds (Table 5). The significant difference in the quantity of milk yield may be attributed to genetic composition and to some extent management practices by dairy cattle farmers. This finding agrees with that of Nicholson *et al.* (2000) which reported differences in milk yields among exotic, cross-bred and indigenous cows in Coast Province of Kenya.

Table 4: Milk yield of three breeds of dairy cattle in the study area

Estimates	Bunaji	Crossbreed	Friesian
Average (litre/cow/day)	4.03	8.83	15.22
St. Deviation	3.03	8.00	13.30
CV (%)	14.92	29.63	49.00
Maximum	1.50	2.00	4.00
Minimum	15.00	25.00	60.00

Table 5: Differences in milk yield of breeds of dairy cattle in the study area

Source of variation	SS	Df	MS	F
Between treatments 0.000	133.95	2	66.98	11.75*
Within groups	336.30	59	5.70	
Total 470.25 61				

*P≤0.05

Costs and Return Analysis of milk production among the Breeds

The gross margin analysis (Table 6) shows feeds accounted for about 83% of the total variable cost incurred by farmers, labour accounted for about 16% and medication had the least. The largest percentage of 62.6% for feeding was spent on concentrates - groundnut/cotton cake. Corn bran and crop

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residues accounted for 16.9% of the expenses. The result showed that improved dairy farmers spent less on mineral licks and animal healthcare which together accounted for 1.7% of the variable cost. The high percent of feed cost indicates the importance of feed in dairy enterprise. It also constitutes reasonable indirect costs in labour requirement for grazing, milking, selling, dung and tick removal.

Table 6 shows the revenue from the sale of dairy products of the three breeds of cattle. The result indicated that 77% (₦139, 713,846.15) of income realized from the sale of dairy products came from exotic cattle, 17% (₦30, 647,371.43) from crossbreed and 6% (₦10, 134,366.67) from indigenous breeds. This finding suggests that dairy production for commercial purposes is mainly carried out by commercial dairy farms. The wide variation in the revenue among the three groups reflects the variation in genotype of the breeds. This is in agreement with the findings of Dwaipayan, B. (2008) which stated that productions for nationwide circulation and export are usually carried out by modern commercial dairy plants.

The gross margin analysis shows that milk production in the study area was highly profitable with gross margin of ₦11, 912.54 for *friesian,* ₦6, 383.23 for crosses and ₦2, 547.99 for *bunaji* per head of cow. Returns for each breed showed that *friesian* dairy cattle were found to be most revenue yielding, followed by crossbreed and *bunaji*. In terms of the returns per Naira invested, in Frisian dairy cattle, for every one Naira invested on the management using improved dairy cattle technologies a net gain of ₦10.20 were obtained. In crossbreed *(friesian* × *bunaji)* dairy cattle, the returns per naira invested indicates that for every one naira invested, a net gain of ₦2.70 was obtained using improved dairy cattle management practices. Similarly, in *bunaji,* the result shows that for every one naira invested in the same practice a net gain of ₦1.50 was realized. Similar result was obtained in Kenya, for instance, Kenyan Agricultural Research Institute (KARI) reported that 1 percent cross-bred animals provided 40 percent milk demands of Kwale, Kili and Malindi districts (Nicholson *et al.,* 2000). On the average, the number of exotic and cross-bred dairy cattle was reported to be 30 percent of total dairy animals in Kenya but provided 60 percent of the national milk demand in the country (Karanja, 2003). This is against 70 percent local breeds which produced less than 40 percent. It is clear that dairy-cattle farmers in Nigeria can possibly meet the dairy needs of the population if these technologies are well understood and extended.

These results indicate that intensification of adopting Frisian dairy cattle generated more returns to farmers than crossbred and *bunaji* dairy cattle in Northern Nigeria. Therefore, farmers should be encouraged to invest their resources in *friesian* dairy cattle using improved dairy cattle management

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technologies such as improved feeds, healthcare system and genetic improvement using natural crossbreeding or artificial insemination for increase milk productivity which in turn will increase the farmers' income and improve their level of living.

Table 6: Estimated cost and return per dairy cattle breed in Northern Nigeria

Cost and Revenue	Friesian	Crossbreed	Bunaji
Feeding calves	407,845.58	273,565.00	133,589.42
Grazing	531,898.62	356,774.35	174,222.87
Milking	212,589.51	142,595.75	70,663.48
Removal of dung	492,133.67	330,101.76	161,197.90
Removal of ticks	318,119.56	213,380.70	104,199.75
Selling	64,104.32	42,998.38	996.35
Cost of corn bran	2,098,456.23	1,407,552.74	687,347.28
Cost of cotton seed cake	1,525,792.86	1,023,435.18	499,771.96
Cost of groundnut cake	6,255,839.53	4,196,143.79	2,049,094.10
Cost of mineral licks	140,519.07	94,254.05	46,026.88
Cost of sunseed cake	392,387.03	263,196.07	128,525.99
Cost of Medication	550.47	369.23	180.30
Total Variable Costs (TVC) (N)	**12,440,236.44**	**8,344,366.99**	**4,105,816.29**
Average yield (lit./cow)	15.22	8.83	4.03
Average price (Naira/lit)	175.00	175.00	175.00
Gross Revenue (Naira/lit.)	**139,713,846.15**	**30,647,371.43**	**10,134,366.67**
Gross Margin/head	**11,912.54**	**6,383.23**	**2,547.99**
Return per Naira invested	11.20	3.70	2.50

Constraints to Dairy Cattle Farming in the Area

The adoption of dairy production technology in the study area is not without problems. The major problems observed from the study were ranked and presented in Table 7. poor extension services, poor power supply, inadequate/lack of veterinary services, high costs of inputs, Low product prices, diseases and pests, lack of modern storage facilities, inadequate credit facilities and poor transportation facilities were the most prominent problems militating against dairy farming in the study area.

Table 7: Constraints faced by dairy farmers in the study area

Constraints	Ranking
Poor extension services	1
Poor power supply	2
Inadequate/lack of veterinary services	3
High cost of inputs	4
Low output prices	5

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Storage Problems	6
Inadequate Credit Facilities	7
Transportation Problems	8
Poor soil to grow fodder crops	9
Diseases and pests	10
Problems of feeding the animals in dry season	11
Input Scarcity	12

Conclusion and Recommendations

Therewere significant differences in the quantity of milk yield among the three groups of dairy cattle. Feed and labour accounted for greater expenditureof the total variable costs in dairy production and process. Dairy farming was still highly profitable venture in the area. However, farmers encountered problems of low prices for their products, poor power supply and inadequate extension contact.

To overcome the animal protein shortage in Nigeria, dairy farmers should be encouraged to used Frisian breed and crossbreed in dairy industry.
Dairy farmers should be sensitized and encouraged to adopt the use of improved quality feeds and veterinary prompt veterinary services for healthy and improved dairy and dairy products.
Poor extension services should be improved by training more extension workers specifically for livestock services.
Poor power supply, high costs of inputs and veterinary services should be addressed at the family farm level.

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