Page 581 to 590

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Research Article

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Preliminary Assessment and Evaluation of Feedmill Machines in Oyo Metropolis, Oyo State, Nigeria

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Abstract

This study was conducted to determine the performance evaluation of feedmill machinery in Oyo Metropolis, Oyo State. To properly explored this topic, five (5) research design was adopted for the study and a total of one hundred (100) respondents were randomly selected from one hundred (100) feedmill industries in Oyo Metropolis, Oyo State. A self and well-structured questionnaire was used to collected information for the study. The findings of the study indicated that majority of the feedmillers were males within the age of 21-30years, single and were Christians. The feedmillers were all Nigerian and 45% of them engaged in milling and mixing operation. Majority of the feedmill industries hired labour, usually skilled. Engine generator and hydro-electricity were greatly used to operate the feedmill machines. Majority of the feedmill machines were fabricated locally to process solid feed ingredients. Hammer mill and vertical mixer were predominantly used and the mechanisms of these machines are usually driven by diesel engine. Feed mixer with the capacity of one tonne, milling machine with teh output of 150kg/hour and 10mm hammer mill screen were also commonly employed in feed processing operation. The study also noted that most of these feedmill machines were purchased by loan from the cooperative society. The milling machines were procured at the rate of N150, 000 while mixing machine at the rate of N200, 000. It can be concluded that feedmillers needs credit facilities, forming cooperative societies with the intervention of the government both in the financing and fabricating of machine for the use of the processors.

Keywords: *Feed mill; Grain; Cereal; Machines; Oyo Metropolis*

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Feed mill industry is involved in formulation of various feeds such as broiler starter, broiler finisher, grower mash, layer mash, chick mash and many others. The feed millers used different kinds of feed ingredients which include maize, wheat offal, blood meal, fish meal, bone meal, oyster shell, palm kernel cake (PKC), methionine, lysine, salt etc. These are mainly to satisfy the protein, energy, mineral and vitamin requirements of the various animals. These were against the old practice of leaving the animals to feed on only grains or tuber, as they might be accessible (Joana., *et al*. 2012).

Feed claims about 75% of cost of production. It is highly essential as the cost of procurement of the animal itself. The major ingredient used as a source of carbohydrate is noted to be maize, which constitutes about 60% of the total feed formulation. However, erratic production processes which lead to insufficient availability of finished feeds for livestock animals. This also lead to shortage in profitability of feedmill business due to frequent demand of processed feeds by livestock farmers who cannot do without feeding their livestock daily (Adiele., *et al*. 2011). The purpose of livestock feedmill is to produce a compact feed mixture that satisfy 90% of the livestock daily nutrient needs (Odunsi., *et al*. 2008). Obioha (2000) stated that, feed ingredients have to be combined in such a proportion as feed produced will contain the requirements for the different classes and ages of poultry without any waste and at the cheapest cost. This function is expected to be carried out by feedmill industry.

Feed for livestock composed largely of grains such as corn, wheat or barley, oilseeds, cake meal (originally mainly from oil production seeds such as soybeans), sunflower seeds, peanuts, cotton seed and protein products of animal origin such as fish meal and bone meal, slaughterhouse of fat and feather meals (Bale., *et al*. 2002). The important of feed ingredients (resources) utilized in feedmill industries cannot be overemphasized especially maize, which constitutes about 60% of the total feed formulation. However, unavailability of the resources affects production processes as well as outputs of the feedmill industry (Oriaku., *et al*. 2004).

However, feed production for livestock, poultry or aquatic life involves a range of activities or processes, which Include grinding, mixing, pelleting and drying operations. Grinding is mainly carried out in the feedmill industry especially maize, since most of the agricultural materials are often present in sizes that are too large to be used and it is necessary to reduce the size for different purposes (Walkelyn, 2006).

Grinding of agricultural materials is one of the oldest cultural techniques of humanity in all traditional civilizations, grinding is the domain of women. In prehistoric times, grain was crushed between two flat stone with a rounded end was used to grind grain in a cup-shaped stone. This led to the development of the mortar and pestle. More advanced peoples began to use the quern; a primitive mill in which the grain is placed on a flat, circular lower millstone and ground by revolving a similar upper millstone to which a handle is attached (FAO, 2009). Such a device operated at first by hand was adapted to use of animal, water or wind power. The industrial revolution initiated the use of steam power and of transportation facilities that resulted in the rise of large-scale milling centers (Donnell, 2001). The process of grinding grain could be described in two stages because of the peculiarity and attributes of grain. The first stage involves the milling of the grain into smaller sizes determines by the size of holes in the sieve used. The second stage is the crushing of the small sized grain particles into powdery form (FAO, 2012).

The cereal processing is complex. The principal process is milling; that is, the grinding of the grain so that it can be cooked and rendered into attractive foodstuff. Grinding is one of the most important and energy consuming processes in cereal industry. The process consumes about 70% of total power during the feed production (Donnell, 2001). The main purpose of milling animal feed is to prevent the grain passing straight through the animal without being fully digested (Bale., *et al*. 2005). Reducing the particle size of cereal grains through the process of grinding also improves animal performance (Walkelyn, 2006). According to Ensminger (2003), grain is grind prior to mixing to increase surface area for improved rate of digestion, decreased segregation and mixing problems and to facilitate further processes such as extrusion or pelleting. In the course of utilizing the feed formulations, the whole grains must be ground to reduce the particle size prior to mixing which is considered to be one of the most critical and essential operation in feed manufacturing regardless of whether it's on farm or in a commercial facility (McCoy., *et al*. 2007). Lack of proper mixing can lead to reduced diet uniformity, affecting not only animal performance but the mixing operation in particular is of great importance, since it is the means through which two or more ingredients that form the feed are interspersed in space with one another for the purpose of achieving a homogeneous mixture capable of meeting the nutritional requirements of the target livestock, poultry or aquatic life being raised (Earle, 2003). Essentially, feed mixing can be done either manually or mechanically. The manual method of mixing feed entails the use of shovel to intersperse the feed's constituents into one another on open concrete floors. The manual method of mixing feed ingredients is characterized by low output, less efficient, labour intensive and may prove unsafe. Thus, hazardous to the health of the animals, birds or fishes for which

the feed is prepared; The mechanical method of mixing is achieved by using mechanical mixers developed over the years to alleviate the shortcomings associated with the manual method (Adewumi, 2004). Brennan., *et al*. (2002) observed that, regardless of the type of mixer, the ultimate aim of using a mixing device is to achieve a uniform distribution of the components by means of flow, which is generated by mechanical means. The mechanical method of mixing is achieved by using mechanical mixers. A wide variety of mixers are available for use in mixing components, the selection of which depends mainly on the phase or Phases the components exhibits such as solid, liquid or gaseous phases. Some commonly used solid mixers as discussed by Brennan., *et al*. (2002) includes; Tumbler mixers, Horizontal trough mixers, Vertical screw mixers. These are quite quick and efficient particularly in mixing small quantities of additives into large masses of materials. However, these processing machines are powered by petrol or diesel engine or electric motor and are frequently used because of the complexity of their mechanism and area of application, adequate and efficient maintenance practices are to be strictly adhere to (Davies., *et al*. 2008). Therefore, the aim of the study was to have a baseline knowledge on accessibility, types and utilization of different feedmill machinery especially in Oyo metropolis.

Research Methodology

Study Site

This study was carried out in Oyo metropolis formerly Old Oyo (Oyo-ile). Oyo is a city in Oyo State, Nigeria, founded as the capital of Oyo Kingdom in the 1830's (Fabiyi, 2004).Oyo, Town, Oyo state, Southwestern Nigeria; is located on latitude 7°51'0" North and longitude 3°56'0"with altitude 304m. Oyo town was surrounded by some notable cities and towns in Oyo state which include Saki, Okeho, Otu, Iseyin, Kishi, Ogbomoso, Eruwa, Sepeteri, Ibadan, Ilero, Igbeti, Igboho and Igbo-Ora. Oyo city is on the A1 highway, north of Ibadan. It lies 32 miles (51km) north of Ibadan the state capital (Oladejo, 2012).

The city has an estimated population of 428,798 people and land area of approximately 2,427km^2 (937 square mile) with population density of 180/km^2 (460°/square mile). The city also has four local government areas: Atiba LGA, headquartered at Offa-meta; Oyo East LGA, headquartered at Kosobo; Oyo West LGA, headquartered at Ojongbodu and Afijo LGA (NPC, 2006).

Population of the Study

The population for this study was all the identified feedmillers in Oyo metropolis.

Sample and Sampling Procedure

One hundred (100) feedmill industries were selected at random and sampling is a procedure through which some elements are selected from the population to be representative for the whole group. Random sampling was done so as to get 100 samples (feedmill industries) from the major population (Twenty – five feed millers were identified from each local government area).

Data Collection

The main data collection tool was a structured questionnaires. A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Usually, a questionnaire consist of a number of questions that the respondent has to answer in a set format. The researcher administered questionnaires personally, made sure responses were obtained and ensured completeness, validity and reliability of the data.

Data Analysis

Data was analyzed using descriptive statistical methods. Descriptive statistics includes; percentage, simple frequency table.

Results

Table 1 shows the demographic information of the feedmillers. The result revealed that 82% of the respondents are males while 18% were females. The majority of the feedmillers (48%) were of age 21-30 years while the least age (2%) was between 41-50 years. Most of the respondents (54%) were single while the divorced (2%) has less passion for it. Larger percentages of Christians (56%) were

feedmillers while the Muslims are a little bit trivial. It was then confirmed that all the respondents (100%) are Nigerian. The power sources for the feedmill machines are shown in table 2. It was observed from the result that milling and mixing (48%) are Predominant among the feedmillers while pelleting only, milling and pelleting (2%) were inconsequential among the feedmillers. Majority of the feedmill industries employed skilled labour (60%) while the percentage of the feedmill industries that uses unskilled labour (40%) is a little bit minimal. Large number of feedmill industries makes use of mechanical power (54%) while few feedmill industries utilized electrical, petrol, human and diesel power (2%). Most of the feedmill industries hired labour (44%) while smaller percentage of the feedmill industries exploits family, hired labour and trainee (6%). It was then confirmed that all the feedmill industries uses diesel-engine generator (100%). Large number of the feedmill industries uses hydro-electricity (78%) while those feedmills that do not employed both hydro-electricity and therma-electricity (18%) are at minimal.

Variables	Frequency	Percentage
Sex		
Male	82	82
Female	18	18
Age		
Less than 20 years	14	14
Between 21-30 years	48	48
Between 31-40 years	36	36
Between 41-50 years	2	2
Marital Status		
Single	54	54
Married	44	44
Divorced	2	2
Religion		
Christianity	56	56
Islam	44	44
Nationality		
Nigerian	100	100
Non-Nigerian		

Source: Field Work 2017.

Table 1: *Demographic Information of the Feedmillers.*

Variable	Frequency	Percentage
Type of Feed Processing Operation		
Milling only	22	22
Mixing only	4	4
Pelleting only	2	2
Mixing and pelleting	4	4
Milling and mixing	48	48
Milling and pelleting	2	2
Milling, mixing, pelleting and consultancy	6	6

Milling, mixing and pelleting	12	12
Type of Labour		
Skilled labour	60	60
Unskilled labour	40	40
Type of Power Source		
Human power	12	12
Mechanical power	54	54
Electrical power	6	6
Petrol power	4	4
Human power and mechanical power	10	10
Mechanical power and electrical power	10	10
Electrical power and petrol power	2	2
Human power and diesel power	2	2
Type of Human Power		
Family labour	26	26
Hired labour	44	44
Family labour and hired labour	24	24
Family labour, hired labour and trainee	6	6
Type of Petrol Power		
Diesel-engine generator	100	100
Type of Electric Power		
Hydroelectricity	78	78
Therma- electricity	4	4
No hydro- electricity and therma-electricity	18	18

Source: Field Work 2017.

Table 2: *Power Sources of the Feedmill Machines.*

Table 3 indicates the various types of feedmill machines. The result shows that greater proportion of the feedmill industries uses locally-made machines (70%) while smaller percentage of the feedmill industries employed both locally-made and imported machines (12%). Large percentage of the feedmill industries utilized locally fabricated machines (60%) while few feedmill industries employed automated machines and manual implements and locally fabricated machines (12%). Majority of the feedmill industries uses diesel-engine (66%) while few of the feedmill industries employed other type of mechanical devices (2%). Large number of the feedmillers (92%) usually process solid feed ingredients while the fewest proportion of the feedmillers (2%) engaged in the processing of liquid feed ingredients. Larger percentage of the feedmill industries uses hammer mill (84%) while the most trivial proportion of the feedmill industries utilized roller mill (2%). Mass proportion of the feedmillers uses horizontal, vertical, stationary-type mixer and others (2%).

Table 4 revealed the capacity of the feedmill machines. The result clearly stated that 52% of the feed mixers have the capacity of one tonne while 48% of the feed mixer have the capacity of 500kg. Most of the feed milling machines (42%) has an output of 150kg/hour while few of the feed milling machines (6%) has an output of 50kg/hour. Larger number of the hammer mill has a screen size (62%) of 10mm while the number of the hammer mill with the screen size (2%) of 10 mm and 2 mm are at minimal. Majority of the feedmill industries do not have pelleting machine (56%) while a very trivial percentage of the feedmill industries have a pelleting machine (56%) that has an output of 50kg/hour. Large number of the feedmill industries do not have pelleting machine (52%) but a very little percentage of the feedmill industries are having a pelleting machine with a die plate of 2 mm and 6mm.

Variables	Frequency	Percentage
Type of Feed mill machines		
Locally-made machine	70	70
Imported feed mill machine	18	18
Locally-made and imported machine	12	12
Kind of Feed mill Machines		
Manual implements	16	16
Locally fabricated machines	60	60
Automated machine	12	12
Manual implements and locally fabricated machine	12	12
Type of Mechanical Device		
Electric motor	24	24
Petrol-engine generator	4	4
Diesel-engine	66	66
Human, Electric motor and diesel engine	2	2
Electric motor and diesel engine	4	4
Form of Feed Ingredients		
Liquid	2	2
Solid	92	92
Liquid and solid	6	6
Machines for Grinding Feed Ingredients		
Hammer mill	84	84
Roller mill	4	4
Hammer mill and roller mill	12	12
Type of Mixing Machine		
Vertical mixer	84	84
Horizontal mixer	2	2
Others	2	2
Vertical mixer and stationary – type mixer	6	6
Vertical and Horizontal mixer	2	2
Vertical mixer, stationary – mixer and others	2	2
Vertical mixer others	2	2

Source: Field work 2017

Table 3: *Types of feedmill machines around Oyo Metropolis.*

Variables	Frequency	Percentage
Capacity of Feed mixer		
500kg	48	48
1tonne	52	52
Output of milling machine		

50kg/hour	6	6
100kg/hour	34	34
150kg/hour	42	42
500kg/hour	18	18
Size of Holes in Hammer mill screen		
8mm	28	28
10mm	62	62
2mm	8	8
10mm and 2mm	2	2
Output of Pelleting machine		
20kg/hour	4	4
50kg/hour	2	2
100kg/hour	38	38
No pelleting machine	56	56
Size of Die Plate		
2mm	28	28
4mm	16	16
No pelleting machine	52	52
2mm and 6mm	4	4

Source: Field work 2017

Table 4: *Capacity of the Feed mill Machines.*

The cost of acquiring the feedmill machines are revealed in table 5. The result indicated that most of the feedmill machines were acquired through purchase (98%) while few of the feedmill machines were acquired through gift (2%). Majority of the feedmill machines were acquired by loan (68%) while the feedmill machines acquired by personal saving are a little bit trivial. Larger proportion of the feedmill machines were purchased from the cooperative society (68%) while a very little percentage are acquired from other source (2%). Larger number of the milling machines (70%) were procured at the rate of N1,50,000 while few of the milling machines (4%) were procured at the rate of N500,000. Greater percentage of mixing machines (46%) were procured at the rate of N200,000 while smaller proportion of the mixing machine (10%) are purchased at the rate of N250,000. Greater percentage of the feedmill industries do not have pelleting machines (50%) but a very trivial percentage of the feedmill industries (12%) have a pelleting machines that worth N150,000.

Variables	Frequency	Percentage
Method of Acquiring Feed mill		
Purchase	98	98
Gift	2	2
Source of Capital		
Personal saving	32	32
Loan	68	68
Source of Purchase		
Manufacturer of the machines	24	24

Cooperative society	68	68
Others	62	62
Cost of Milling Machine		
N 100,000	10	10
N 150,000	70	70
N 200,000	16	16
N 500,000	4	4
Cost of Mixing Machine		
N 150,000	44	44
N 200,000	46	46
N 250,000	10	10
Cost of Pelleting Machine		
N 150,000	12	12
N 200,000	38	38
No Pelleting Machine	50	50

Source: Field work 2017.

Table 5: *Cost of acquiring the feedmill machines.*

Discussion

The current results on demographic information of the feedmillers in the study area revealed that; male, age between 21-30 years, single, Christianity and Nigerian respectively were in-line with the reports made by Oladeji (2011) who reported the same ranged of values for sex, age, marital status, religion and Nationality in his study area. The results on the power sources for the feedmill machines found in the study area indicated that; milling and mixing operation, skilled labour, mechanical power, hired labour, diesel-engine generator and hydro-electricity respectively were in agreement with the study made by Samuel (2009). This author reported similar ranged of values for feed processing operation, labour, power source, human power, petrol power and electric power in his study area. The current results on the various types of feedmill machines found in the study area revealed that; locally-made machine, diesel engine, solid feed ingredients, hammer mill and vertical mixer respectively were in-line with the reports made by Omotayo (2012) who reported the same ranged of values for various type of feedmill machines, various kind of feedmill machines, mechanical devices, feed ingredients, grinding machines and mixing machines in his study area. The results on the capacity of the feedmill machines found in the study area revealed that; one tonne of feed mixer, milling machine of 150 kg/hour and 10mm screen size respectively were in agreement with the study made by Omotayo (2012). This author reported similar ranged of values for the capacity of feed mixer, output of milling machine and size of hammer mill screen in his study area.

The current results on the cost of acquiring the feedmill machines found in the study area indicated that; purchase, loan, cooperative society, N150,000 cost of milling machine and N200,000 cost of milling machine respectively were in-line with the reports made by Okunmadewa (2014) who reported similar ranged of values for methods of acquiring feedmill machines, sources of capital, sources of purchase, cost of milling machine and cost of mixing machine in his study area.

Conclusion

From the results of this study, it was concluded that, majority of the feedmillers in the study area were males of age 21-30 years, single, Christians and were all Nigerians. It was then, confirmed that most of these feedmillers are engaged in milling and mixing operation. It was also observed from the result this study that, majority of the feedmill industries hired labour which are usually skilled labour. Diesel-engine generator and hydro-electricity were greatly used to operate the feedmill machines.

The study also concluded that, majority of the feedmill machines found in the study area were locally made or locally fabricated to process solid feed ingredients. Hammer mill and vertical mixer were predominantly used in the study area and the mechanism of these machines are usually driven by Diesel engine. It was also established that, feed mixer with the capacity of one tonne, milling machine with the output of 150kg/hour and 10mm hammer mill screen were commonly used in the study area. Furthermore, most of these feed-mill machines were purchased by loan from the cooperative society. The milling machine were procured at the rate of N150,000 while mixing machine at the rate of N200,000.

Recommendations

Based on the results of this study, it was recommended that, government should provide credit facilities to the feedmillers in the study area. Also, feedmillers should be encouraged to form or join association or cooperative society as this will enable them to acquire loan and procure feedmill machines at cheaper price. Imported and automated feedmill machines with high efficiency should be used in-place of the locally fabricated machines in order to increase the operational and performance efficiency of the feedmill industries situated in the study area.

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