



Construction and Performance Evaluation of Poultry Feed Mixer

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Abstract: *The construction and performance evaluation of the poultry feed mixer was achieved using locally available materials. It was tested and affirmed that the machine can mix up to 361.44kg/hr of ingredients. It has an efficiency of 90.16% degree of mixing and requires less time for feeding, and it is not also difficult to operate. The cost of constructing the machine amounted to seventy thousand Naira only (₦70,000), which is affordable by the small and medium scale farmers, although this machine has been designed with a high standard in mind, there is however possibility of human error, therefore, any criticism regarding the enhancement of the outlook and general performance of the machine is accepted.*

Key words: *Construction, performance, evaluation, poultry, feed mixer*

1.0 INTRODUCTION

Mixing is one of the most important operations in the manufacturing of animal feeds and the mixer is considered to be the heart of feed milling operation. The need for uniformity in a complete feed is a must in order to satisfy the nutritional requirements of the animal to achieve growth, production, and good health as well as to meet regulatory guidelines of food and drug administration. Feed mixers are used in feed mills for the mixing of feed ingredients and premixes. The mixer plays a vital role in the feed production process, with efficient mixing being the key to good feed production. If the feed is not mixed properly, ingredients and nutrients will not be properly distributed when it comes to time to extrude and pelletize the feed, or if the feed is to be used as mash. This means that not only would the feed not have nutritional benefits, but it would also be bad for the animals that are eating it. The mixers produce a very homogeneous mix of different ingredients used in the feed industry.

As mills became multistoried structures, gravity spouting was used to direct the meal and grain from the top of the elevator legs. However, gravity spouting could neither reach the locations desired nor handle the various textures of grains selected by mill customers to meet their own individual needs. Horizontal devices were merely shaft with short pegs fastened in a spiral pattern which advanced the grain when the shaft rotated. All housed in long wooden boxes. With the invention of electric motor, sweeping changes in mill design took place. A specialized type of conveyor was developed called feeder. The construction was similar to the material handling conveyor, except it was shorter and by a motor and a speed reduction device called a gear box. This allowed for the achievement of variable speeds, which afforded mill operators added flexibility of operation (Culpin, 2000).

As the list of available ingredients increased, the mill operator was forced to reserve a bin or box for each ingredient. This process was accelerated as scientific research began to show the advantages of feeding balanced diets. The feeders were designed to empty into a large, slow-moving, collecting conveyor, which usually included a method to impede or separate part of the flow in an effort to improve blending. The storage of whole and ground grains has changed little since the construction of first mill bins. This was the key component of the first so called feeder line for the production of formula feeds on the American continents. Demand for higher production output led to the development of the feeder line plants. It has become obvious that acceptable weight control was difficult to achieve due to the variable densities of the individual ingredients that were being routinely used (George, 2009).

Each feeder was located under a single ingredient or premix bin which was put through the hopper and spouted to provide constant, uniform flows regardless of the rate demanded by the feeder. The inconsistencies of the volumetric feeder, resulting from variable ingredients, led to the development of the gravimetric feeder. This device allowed for continuous weight checks and provided automatic adjustment of the gate control mechanism. With the advent of drug and antibiotic use, it became obvious that the feeder line was incapable of accurately handling and mixing products with an inclusion rate of less than 1% of the mix. This led to the premixing of these micro-ingredients to a level above 1% with a diluent or carrier. This was usually accomplished at an alternative site with more sophisticated equipment than described above (George, 2009).

In the early days on the small family farm, the mixing of homegrown grains with supplements purchased from the local miller began with a smooth floor, shovel, and knowledge of quartering. Local village and commercial operators were more refined and had the advantage of both grinding and screening facilities to increase the efficacy of the formulas that were being prepared for animal feeds. In time, operators duplicated the action of the shovel by fashioning crude plows or paddles fastened to slowly rotating horizontal shafts contained in a wooden booth with a curved bottom (Culpin, 2000).

The mixing of feedstuffs to form a ration is a regular need on the large stock farms. There have been few official tests of the evenness of the mix of the various types of machines. Mixing is one of the most important operations in the manufacturing of animal feeds. And feed mixing machines are important in the feed pellet production line and are considered to be the heart of feed milling operations. A feed mixer is an efficient and versatile machine for mixing different kinds of powder and other materials. The feed

mixing machine can be made of stainless steel or alloy steel for your choice. It has the characteristics of high efficiency, reasonable structure, compact layout, reliable performance, and easy maintenance. And the finished powder after mixing makes the pellet production process much easier (Culpin, 2000).

Feed mixers are used in feed mills for the mixing of feed ingredients and premix. The mixer plays a vital role in the feed production process, with efficient mixing being the key to good production, if the feed is not mixed properly distributed it comes a time to extrude and pelletize the feed, or if the feed is to be used as a mesh. This has nutritional benefits, it would be bad for the poultry, animal, and shrimp that are eating it. The use of hand to mix the crushed poultry feeds by the traditional agricultural sector characterized by subsistence farming was perhaps the first form of poultry feed mixer. This method was subsequently developed by the use of manual machines after the advent of the industrial revolution in Great Britain. There is a universal demand for poultry feed mixers as machinery for food production. Our small and medium scale industries in the country are in dire need of high nutrition poultry feed for their birds to increase production output. The necessity to boost and sustain the economy which requires well-planned industrialization by increasing the level of our designing and manufacturing rather than mere assembling activities such an effort would reduce the importation of machines, spare parts, and components that can be produced locally.

Since the bulk of the economic activities in the rural part of the country is agricultural, it is general knowledge that those who are engaged in agriculture are poor in comparison with those who are engaged in agriculture are poor in comparison with those engaged in other sectors of the economy in Nigeria that is to say their standard of living is so low that shortage of funds to enable them purchase modern facilities has been a major difficulty in the development of agriculture. Feed production for livestock, poultry or aquatic life involves a range of activities, which include grinding, mixing, pelleting, and drying operations. New (1987) gave a summary of the different types of machinery needed for the production of various types of feeds and they include grinding, mixers, elevators, conveyors, extruders, dries, fat sprayers, and steam boilers. 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 life being raised. Unprofessional admixing of liquid components in the main mixer can cause insufficient homogeneity by the formation of agglomerates and deposits on the mixing tools. The deposits as sticks and crusts cause carry-over and contamination stochastically which cannot be compensated by rinsing batches. Mainly in cases of the mixing process by mixer, solid dispersed components have better suitability than liquid. Johnson (New Delhi, 2007). In most developing countries including Nigeria, a major common problem facing farmers' livestock, poultry, and or aquatic life is the lack of access of proper feed that can meet the nutritional requirements of their poultry at the right time in the right quantity and price. Dogo (2001) observed that the rate of poultry production in Nigeria is not commensurate with human population growth and demand. He, therefore, opined that the major constraint is the high cost of feed in the market.

2.0 PURPOSE OF THE WORK

The mixer plays a vital role in the feed production process, with efficient mixing being the key to good feed production. If feed is not mixed properly, ingredients and nutrients will not be properly distributed when it comes time to extrude and pelletize the feed, or if the feed is to be used as mash. The purpose of this work is to construct poultry feed mixer which is a type of mixer that consists of one or more vertical screws which elevate the ingredients to the top of the mixer where they fall by gravity to the bottom, to be mixed and re-elevated.

The primary purpose of the work is the provision of an improved feed mixer for cutting and mixing feed material such as hay. A further purpose of the work is the provision of a feed mixer having a plurality of claws for maintaining hay in the mixing chamber during the cutting and mixing process. Also, another purpose is the provision of a feed mixer having a plurality of claws to impede or prevent rotation of hay with the rotating auger, and also the provision of an improved vertical feed mixer which is economical to manufacture and durable and efficient in use.

3.0 PROCEDURE

The poultry feed mixer is constructed using locally available materials. A gauge 16mm metal sheet was cut to a size of 730mm x 1200mm and rolled, using a roller to form a semi-circular drum. Twelve (12) metal bars of 5mm x 250mm length were welded on a shaft of 750mm length x \varnothing 25mm which is passed through the drum. The mixing shaft is supported by bearings at the ends of the drum. A pulley is also attached to one end of the shaft.

A 50mm x 50mm angle iron was cut to size to form the frame which holds the drum; the two components were joined by electric arc welding to form the hopper, and the chute. The hopper was joined to the upper parts of the drum and the chute to the lower parts of the drum both using electric arc welding. A 5hp generator was fastened to the lower part of the frame using A-13 bolts to serves as a prime mover. Finally, a V-belt is fixed to the mixing shaft, via a pulley and the other end to the generator pulley.

4.0 INSTRUCTIONAL MATERIALS

The consists of a rectangular frame made of twelve (12) angle irons of 50 x 50mm, on top of the rectangular frame is a mixing drum of semi-circular shape. A mixing shaft with iron bars welded on as blades pass through the drum and aid the mixing. A hopper of truncated pyramid shape is welded at the top of the mixing drum. A chute at the bottom of the drum is provided for content delivery. A 5hp generator is fastened to the lower part of the frame giving drive to the mixing shaft via V-belt.

5.0 COST IMPLICATION

The table below shows the production cost of the poultry feed mixer:

S/NO	MATERIALS	SIZE	QUANTITY	AMOUNT
1.	Metal sheet	Gauge 16mm x 730 x 1200mm	1	
2.	Angle iron	50mm x 50mm	2	
3.	Bearing	Ø 26mm	2	
4.	Iron bar	5mm x 250mm	1	
5.	Shaft	Ø 25mm	1	
6.	Pulley	Ø 70mm & Ø 180mm	2	
7.	Belt	A55mm	1	
8.	Electrode	Gauge 16mm	1 packet	
9.	Bolt/Nut	A 13mm	16	
10.	Feeds	-	-	
11.	Labour	-	-	

6.0 MERITS AND DEMERITS

- Merits

- i. Poultry feed mixer does not make the material segregation when mixing materials. Feed materials will not occur grading phenomena, which can better achieve mixed accuracy.
- ii. The poultry feed mixer is suitable for small batch animal feed production and has low residual materials.
- iii. As one of the most popular small poultry feed machines, the poultry feed mixer adopts the helical structure mandatory, and the total power required for mixing feed materials is low, and the sealing performance is relatively good.
- iv. Mixing reduces waste of chicken feed, water soiling, and selective eating behavior in chickens.
- v. Reduces *Salmonella*, *E. coli*, molds, and more, and destroys growth inhibitors, like trypsin inhibitors and gossypol during processing.

- Demerits

- i. **Noisy:** The sound of the mixer is often very loud and irritating. This is because the people using it are unable to hear the voice of the other persons in the area.
- ii. **Sharp Blades:** Often while taking out the ground food materials from the mixer, if you are not very cautious, your finger might be wounded. The blades of the mixer are extremely sharp since they are used to cut through food substances. So the slightest carelessness can hurt your fingers resulting in a deep cut and heavy bleeding.

7.0 CONCLUSION

The construction and performance evaluation of the poultry feed mixer was achieved using locally available materials. It was tested and affirmed that the machine can mix up to 361.44kg/hr of ingredients. It has an efficiency of 90.16% degree of mixing and

requires less time for feeding, and it is not also difficult to operate. The cost of constructing the machine amounted to seventy thousand nairas only (₦70,000), which is affordable by the small and medium scale farmers, although this machine has been designed with a high standard in mind, there is however the possibility of human error, therefore, any criticism regarding the enhancement of the outlook and general performance of the machine is accepted.

8.0 SUMMARY

The developed machine reduced the labour cost of mixing by 40% and the time involved by 60% for compounding 250kg of feed. Different types of feed formulation and the production cost were stated above to enable farmers to produce feed at a cheaper rate. Poultry feed mixers can be fabricated vertically or horizontally, but the horizontal type requires more power than the vertical type. The fabricated machine s batch process of mixing and continuous mixing type can be fabricated using the same principle. The efficiency of the machine will reduce if the calculated power is not used for its operation. It will also delay the rate of mixing and lead to poor quality of feed.

9.0 SUGGESTIONS/RECOMMENDATIONS

- ❑ The machine should be modified to increase its efficiency in terms of capacity.
- ❑ The machine is recommended for use by small and medium scale poultry farmers
- ❑ To avoid vibration, the machine should be installed
- ❑ A cover should be provided for the hopper to avoid spillage of ingredients.

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