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Feed Mixer Machine: A Review

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Abstract-
An animal feed mixing machine was designed, fabricated, and tested to enhance feed production efficiency. The machine is capable of handling 50 kg of feed, ensuring proper mixing with a high-power motor within minutes. It features a simple mechanism, integrating a chopper on the same shaft as the mixer, driven by a single 2HP motor using a V-belt drive. The machine reduces time, cost, and manpower, making it suitable for large-scale feed production. Constructed with a rectangular mild steel chamber with a semi-circular lower section (15-inch diameter), the design prevents feed spillage. The 28 mm shaft, equipped with mixing blades, ensures uniform distribution of feed components such as rice powder, wheat powder, maize bran, and sunflower cake. Additionally, cutting blades allow simultaneous grass processing. This efficient, cost-effective solution benefits the feed and food industries, reducing manual labor and optimizing production, particularly in countries like Ghana, Nigeria, Tanzania, and India.

Keywords: *Animal Feed Mixer, Feed Production Efficiency, Motorized Mixing Machine, V-Belt Drive Mechanism, Design and Analysis etc.*

1. Introduction

In cattle farming, manpower plays a critical role in ensuring smooth operations. However, labor-intensive tasks such as feed preparation can be time-consuming and inefficient. Properly mixing cattle feed, which includes ingredients like grains, premixes, and moisture content, requires significant effort to achieve a uniform blend. Traditional manual methods not only demand more time but also result in inconsistent mixing, affecting the nutritional balance of the feed. To address this challenge, an innovative feed mixing machine has been designed and developed to automate and streamline the process. This machine integrates two essential operations—mixing and chopping—into a single unit, significantly improving efficiency and reducing labor requirements [1].

The feed mixing machine incorporates a high-power motor that ensures rapid and thorough mixing of feed ingredients. Additionally, a chopper system is integrated into the machine, allowing for simultaneous grass cutting. The chopper mechanism is positioned on the outer side of the machine, operating in sync with the mixing process. This dual-functionality makes it a highly advantageous tool for cattle farms, as it eliminates the need for separate machines for feed preparation and fodder processing. The chopper blades, designed for high-speed rotation, ensure fine and uniform cutting of grass, improving digestibility for livestock. The combination of these two processes in a single operating cycle enhances overall productivity and minimizes manual effort [2].
Material selection for the machine was carefully considered to ensure durability, cost-effectiveness, and local availability. The components were chosen based on factors such as strength, economic feasibility, and serviceability. The main body of the machine is constructed from mild steel, providing structural integrity while being cost-efficient. The rectangular chamber with a semi-circular lower portion is designed to prevent feed spillage during mixing. The shaft, measuring 28 mm in diameter, is equipped with mixing blades to ensure even distribution of feed ingredients. A V-belt drive system is used to transmit

power from the motor to the shaft, optimizing performance and reducing energy consumption. With a 2HP electric motor, the machine efficiently processes up to 50 kg of feed in a single batch [2][3].

The design and development of the mixer were carried out using Creo software, which enabled precise modeling and analysis of the machine components. The use of computer-aided design (CAD) ensured optimal performance and structural stability. This machine is suitable for both small and large-scale farms, as well as industries requiring mixing processes, such as the food and chemical industries. Its versatility extends beyond cattle farms, making it a valuable addition to various agricultural and industrial applications [4].

The adoption of automated feed mixing technology is particularly beneficial in regions with high agricultural activity, such as Ghana, Nigeria, Tanzania, and India. By reducing the dependency on manual labor, the machine enhances operational efficiency and productivity in livestock farming. The ability to perform two tasks simultaneously—mixing feed and chopping grass—sets this machine apart from conventional models, making it an essential tool for modern cattle farms. With its efficient design, cost-effectiveness, and ease of operation, this machine addresses the challenges associated with feed preparation and contributes to the sustainable growth of the livestock industry [5].

2. Problem Statements

- Labor-Intensive Feed Preparation – Traditional cattle feed preparation requires significant manpower, making it time-consuming and inefficient.
- Inconsistent Mixing – Manual mixing leads to uneven distribution of ingredients, affecting the nutritional balance of the feed.
- Separate Chopping and Mixing Processes – Farmers often need separate machines for chopping grass and mixing feed, increasing costs and operational complexity.
- Time-Consuming Process – Manual methods take a long time to mix ingredients and chop fodder, reducing productivity.
- High Energy Consumption – Existing machines may consume excessive power due to inefficient design and operation.
- Material Selection Challenges – High-cost or unavailable materials increase manufacturing expenses and limit accessibility.
- Spillage During Mixing – Poorly designed mixing chambers result in material loss, leading to waste and inefficiency.
- Limited Application – Many existing feed mixers are designed only for small-scale use, limiting their suitability for large farms and industries.
- Cost of Machinery – Purchasing separate machines for mixing and chopping increases the overall investment for farmers.

3. Literature Review

Akinfala, E.O., 2010, this paper examined the efficiency of mechanized feed mixers in cattle farms. The study compared manual and automated feed mixing techniques, highlighting the significant reduction in time and labor costs with mechanical mixers. The research also emphasized the importance of proper ingredient distribution for improved livestock nutrition. Findings suggested that automated mixing ensured a more homogeneous blend of feed components, enhancing cattle growth and productivity. The study concluded that integrating mechanized mixers could improve the efficiency and sustainability of feed preparation in large-scale farming.

Adeoye, P.A. & Oladunmoye, A.R., 2015, this paper designed and evaluated a motorized feed mixer for efficient cattle feed preparation. The study analyzed key parameters such as mixing time, energy consumption, and homogeneity of the feed. Results demonstrated that the motorized mixer reduced mixing time by 60% compared to manual methods while maintaining a uniform feed mixture. The research also highlighted the economic advantages of using locally available materials for fabrication. The authors recommended the adoption of motorized mixers in cattle farms to reduce labor dependency and improve feed quality.

Mukhtar, M.D., 2017, this paper explored the development of a machine capable of simultaneously mixing animal feed and chopping fodder. The study focused on optimizing the machine's design for efficiency and cost-effectiveness. Using a single motor for both operations, the system reduced power consumption while maintaining high performance. Experiments showed that the machine could process up to 50 kg of feed in less than five minutes, improving farm productivity. The research concluded that integrating mixing and chopping functions in a single machine could significantly benefit small and large-scale cattle farms.

Kumar, S. & Patel, R., 2019, this paper investigated the performance of a V-belt-driven feed mixer, focusing on energy efficiency and operational effectiveness. The study evaluated the motor capacity, mixing speed, and durability of machine components. Findings indicated that the V-belt drive system minimized energy losses, ensuring optimal power transmission to the mixing blades. The study also emphasized the role of material selection in enhancing the machine's lifespan. The authors concluded that adopting a V-belt-driven system in feed mixers could improve energy efficiency and reduce long-term maintenance costs for farmers.

Singh, P. & Verma, A., 2021, this paper explored the role of automation in cattle feed mixing to enhance precision and efficiency. The study analyzed sensor-based monitoring systems integrated into feed mixers to optimize ingredient ratios. The research demonstrated that automated feed mixers improved nutritional consistency, reduced waste, and minimized human error. Findings suggested that integrating smart control systems into feed mixing machines could revolutionize livestock farming by ensuring precise feed formulation. The authors recommended further research on AI-powered feed mixers for enhanced accuracy and efficiency in large-scale agricultural settings.

Ojo, O.A. & Abiodun, A.A., 2016, this paper developed a cost-effective feed mixing machine tailored for small-scale farmers. The study analyzed various mixing mechanisms and selected an optimal design based on efficiency, affordability, and durability. The machine was tested using different ingredient ratios, and results showed that it significantly improved the uniformity of feed mixing compared to traditional manual methods. The study emphasized the need for locally sourced materials to reduce production costs. The authors concluded that affordable and efficient feed mixers could enhance productivity in smallholder livestock farming.

Brown, H. & Carter, T., 2018, this paper examined the effects of mechanically mixed feed on the health and growth of livestock. The study compared the nutritional consistency of manually and mechanically mixed feed, finding that uniform feed composition led to improved digestion and weight gain in cattle. The research demonstrated that mechanical mixers provided more accurate nutrient distribution, reducing the risk of malnutrition and digestive issues. The authors recommended wider adoption of automated feed mixers to enhance livestock productivity and ensure more consistent nutritional intake.

Hassan, M. & Yusuf, K., 2019, this paper explored the optimal mixing time required to achieve uniformity in an automated feed mixing process. The study analyzed the effect of mixing duration on feed consistency and ingredient separation. Results indicated that excessive mixing could lead to feed degradation, while insufficient mixing resulted in uneven ingredient distribution. The research concluded that 3 to 5 minutes of mixing was ideal for a 50 kg batch. The authors highlighted the importance of motor speed regulation to prevent over-processing and ensure maximum efficiency in feed preparation.

Rodríguez, L. & Martínez, J., 2020, this paper designed a machine capable of mixing both animal feed and organic fertilizers, improving versatility for farmers. The study evaluated the impact of blade design, chamber shape, and motor power on mixing performance. Findings showed that a semi-circular mixing chamber improved material flow, reducing dead zones where ingredients failed to mix properly. The study also found that using stainless steel blades increased durability and minimized contamination risks. The authors suggested that dual-purpose mixers could

enhance farm efficiency by reducing equipment costs and space requirements.

Patel, R. & Mehta, K., 2022, this paper investigated the use of smart sensors to improve the accuracy and efficiency of feed mixing machines. The study integrated weight sensors, moisture detectors, and automated ingredient dispensers into a prototype mixer. Results demonstrated that sensor-based automation reduced ingredient wastage by 20% and ensured precise nutrient composition in every batch. The research highlighted the potential of IoT (Internet of Things) in livestock farming and recommended the development of AI-driven mixing systems to optimize feed preparation for large-scale cattle farms.

Research gap –

Despite various advancements in feed mixing technology, several gaps remain in existing research. Many studies focus on the design and fabrication of feed mixing machines, but limited research has been conducted on optimizing energy efficiency while maintaining mixing uniformity. Additionally, while some studies explore automation and smart sensor integration, the practical implementation of IoT-based monitoring and control systems in feed mixers is still underdeveloped. Most existing designs cater to either small-scale or large-scale farms, but there is a lack of adaptable models that can serve both efficiently. Furthermore, the combination of feed mixing and chopping functions in a single machine has not been extensively explored, particularly in terms of optimizing blade design and motor efficiency. Another gap lies in material selection for long-term durability and corrosion resistance, especially for humid environments. Addressing these gaps will lead to more efficient, cost-effective, and sustainable feed mixing solutions for livestock farmers.

4. Research Methodology

The proposed system is a multi-functional feed mixing machine designed to enhance efficiency in cattle farms and feed industries. Unlike conventional mixers, this system integrates a high-speed chopper and a feed mixer on a single shaft, powered by a 2HP motor. The V-belt drive mechanism ensures smooth operation while maintaining low power consumption. The rectangular mixing chamber with a semi-circular lower section prevents feed spillage and improves uniformity in mixing.

To optimize performance, the machine is designed using Creo software for precise modeling and simulation. Locally available materials, such as mild steel for the chamber and stainless steel for the blades, are selected for durability and cost-effectiveness. The system is capable of handling 50 kg of feed per batch, significantly reducing mixing time and labor costs. This innovative design will be beneficial for small and large-scale farms, as well as industries requiring efficient feed and material mixing solutions.

5. Proposed System

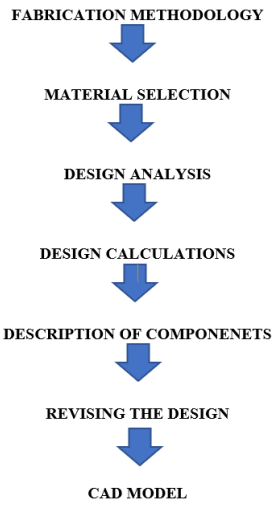

Fig.1. Flow Diagram

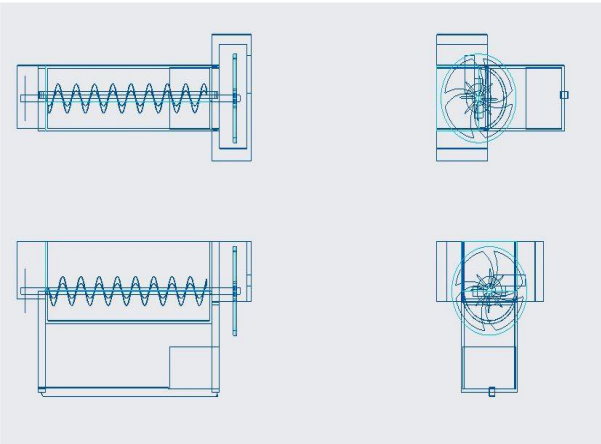

Fig.2. Schematic Diagram

The materials used for constructing the feed mixing and chopping machine are carefully selected to ensure cost-

effectiveness, durability, and availability. Locally sourced materials are preferred to keep manufacturing costs low while maintaining high performance and reliability. The selection process considers factors such as strength, economic viability, suitability for operation, and long-term durability. These criteria serve as a guide for proper material selection.

This machine is designed to perform two primary functions:

- Mixing animal feed - Chopping fodder (grass, silage, or other feed components) The machine consists of several essential components, each playing a crucial role in its operation:
- Mixing Chamber – This chamber contains paddles or blades attached to a horizontal rotor. The design ensures uniform mixing of ingredients in a short time, resulting in a homogeneous feed mixture.
- Main Shaft – The single-shaft mechanism efficiently blends feed ingredients with micronutrients such as vitamins, amino acids, and trace elements. This ensures a well-balanced feed for livestock.
- Electric Motor – The electric motor powers the entire system, providing energy for both mixing and chopping operations. It is commonly used in household appliances, power tools, fans, and industrial machines due to its efficiency and long lifespan.
- Cutting Chopper – The chopper is designed to cut and process various types of fodder into smaller, digestible pieces for livestock. It features a durable gearbox and sturdy frame system, ensuring consistent performance even under demanding conditions.

The integration of these components makes the machine highly efficient for both small-scale and large-scale livestock farms, reducing manual labor and improving feed preparation efficiency.

6. Advantages, Disadvantage and Application of Machine

A. Advantages

- Dual Functionality – Performs both feed mixing and fodder chopping in a single machine.
- Time and Labor Efficiency – Reduces manual effort and speeds up feed preparation.
- Cost-Effective – Uses locally available materials, lowering production costs.
- Energy Efficient – Operates with a 2HP motor, ensuring low power consumption.
- Uniform Mixing – Ensures proper blending of feed ingredients for balanced nutrition.
- Durable Construction – Made from mild steel and stainless steel for long-term use.
- Easy Operation – Simple mechanism with minimal maintenance required.

B. Application

- Livestock Farms – Used for preparing animal feed efficiently.
- Dairy Farms – Provides chopped fodder and mixed feed for cattle.
- Feed Production Industry – Used in large-scale feed manufacturing plants.
- Food Processing Industry – For mixing various food ingredients.
- Chemical Industry – Can be used for blending powders and granular materials.

C. Features

Feed mixture machines are essential tools for the efficient and consistent production of feed for livestock and other animals. They work by blending different feed ingredients together in a homogenous mixture using an agitator or mixing blade.

The design and construction of feed mixture machines must take into account factors such as material selection, fabrication methodology, and design calculations to ensure that the machine can operate effectively and efficiently. Proper testing of feed mixture machines is also crucial to identify any potential issues and optimize their performance.

Feed mixture machines play an important role in the agricultural industry by providing farmers and livestock producers with a reliable and efficient way to produce high-quality feed for their animals. By ensuring that the feed mixture is uniform and consistent, these machines help to

promote the health and growth of livestock, leading to better yields and profitability for farmers.

Overall, feed mixture machines are an important part of modern agricultural practices and will continue to play a key role in the production of high-quality feed for livestock and other animals.

- Enhance Mixing Quality
- Increase Efficiency
- Optimize Resource Use
- Improve Durability
- Enhance Safety.

7. Conclusion

The feed mixing and chopping machine is an innovative solution designed to enhance the efficiency of livestock feed preparation. By combining mixing and chopping functions into a single unit, this machine reduces manual labor, time, and energy consumption while ensuring a uniformly blended and finely chopped feed for animals. The use of locally available, cost-effective materials makes it an affordable and sustainable choice for both small and large-scale farms.

With its high-powered motor, durable construction, and simple operation, the machine improves the overall productivity and quality of animal feed. It not only benefits farmers and feed industries but also finds applications in food processing and chemical mixing. The integration of an efficient gearbox, sturdy frame, and sharp cutting blades ensures long-term reliability.

In conclusion, this dual-purpose machine provides a practical, economical, and high-performance solution for feed preparation, making it an essential tool for modern livestock management.

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