



Performance Analysis Of I.C. Engine Operated Mini Baler Machine

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Abstract: Baler machine is used to make bales of hay/straw to transport, store and handling it in easy and efficient way in agriculture. There are many types of advance and automatic baling machine available, but those machine neither affordable nor big machines require for small scale use. Another side there are some manual type homemade machines also available for small scale use but they are requiring so much time, manpower and hard work. So, it is needed to develop a mini baler machine using internal combustion engine and study its performance. In this Dissertation we are going to develop a mini baler machine using internal combustion engine and study its performance

Keywords - Baler Machine, Bale, I.C. Engine, Square Bale, Bale weight, Baling Time

1. INTRODUCTION

Before 19th century, hay was cut by hand and is typically stored in haystacks using hay forks to rake and gather grasses into optimal sized heaps - neither too large nor too small. These haystacks lifted most of the plant fibres up off the ground, letting the air in and water is to be drain out, so the grasses could dry and cure to retain nutrition for livestock feed.

In 1860s, mechanical cutting devices were developed; from these came the modern devices including mechanical mowers and balers. In 1872 Charles Withington invented a reaper which uses a knotter device to bind hay and in 1874 this was commercialized by Cyrus McCormick. In 1936, an automatic baler was invented by Innes that tied bales with twine using Appleby-type knotters used from a John Deere grain binder. And in 1938, the patent was filed for an improved version which was more reliable by Edwin Nolt.

The first round baler was firstly shown in Paris by Pilter and was probably invented in 19th century by him.

Baler machine that is used to compress materials to make bales of hay/straw for easy and efficient transportation, handling and storage. Several types of baling machines are designed for this purpose.

In industry, bailing of large square of wasted paper or scrap is currently recognized. It is done in a proper way so at the time of transportation quantity of waste material will be increased and it will be easy and efficient for transportation. Baling machine is used to compress materials to make bales of hay/straw for bale collecting, easy and efficient transportation, handling and storing at an industry.

Using hydraulic power machinery like Hydraulic scrap baling press are used to compress different types of scraps into the form of bales. These types of hydraulic presses are used in the different ways for compressing light, thin, as well as soft, hard materials.

1.1 Types of bales:

- A. Small bales: - Small bales are popular in use because they are easy to handle and simple produce. They are still produced today. People who keep small numbers of animals may prefer small bales that can be handled by one person small bales are generally in square shape.
- B. Large bales: - Farmers likely to choose balers to produce much larger bales to make large amounts of hay, to maximize the amount of hay which is protected from the elements. There are two types of large bales, round and square bales.
- C. Haylage: - For animals that eat silage, a bale wrapper may be used to seal a round bale completely and trigger the fermentation process. It is a technique used as a money-saving process by producers who do not have access to a silo, and for producing silage that is transported to other locations.

2. Literature Review

Adaptation and Evaluation of Manual Hay Baler (Abayineh Awgichew, Abulaseen Keberedin & Getachew Hailu), this research paper is about adaption and evaluation of manual hay baler. They consider that baling of straw by pressing helps to feed animals with little or no wastage, conserve its nutrient for a long time, simplifies the transport and storage condition. Their main point is that there are many types and models of powered and automatic baler machine available, but those machines which are not affordable to small scale farmers due to high in cost and in another side it's not require for small scale use. Therefore, the manual hay baler machines were adapted and evaluated in those areas. In the terms of density, mass, pressing rate and time required for making of bales the performance of the machine is evaluated. Vertical hay baler has better performance in baling rate than the others manual hay baler.

Experimental site: In this particular paper, attempt has been made to evaluate manual hay balers Based on extensive review, attempt on different existing manual hay baler of three models that is vertical screw type, horizontal metal body (m.b.) and horizontal wood (w.b.) body manual hay balers were selected but, these balers are not used by farmers due to unavailability and poor awareness of farmers. All the three balers were used to make bales or evaluated on barley and wheat straw separately.

Performance evaluation: All manual hay balers were tested and evaluated for their capacity and also compared their advantage over the traditional hay making using their bale weight and area. Tests were conducted in three sites with three replications a total of nine replications using single hay bale with a single operator. The required area and weight of baled and hay were determined. Generally, performance evaluation of all manual balers were made on the basis of the following parameters; density, mass, pressing rate and time required.

Conclusion: Based on the performance evaluation made and results obtained, the following conclusions can be drawn: (a) Vertical hay baler has better performance in baling rate than the others manual hay balers (b) Regarding to density it favours to horizontal metal body hay baler (c) All manual hay balers have better result on barley straw than wheat straw (d) All manual have no significance difference on mass in both wheat and barley straw.[1]

Improvement in Waste Handling System (Chandratre Varun, Rathod Pratik, Shaikh Mohammed Mohsin, Solanki Manish, Sheetal Parkar), this paper is discussed on improvement and efficiency of baling technique and machine. In industry, baling of large square of wasted paper or scrap is currently recognized. It is done in a proper way so at the time of transportation quantity of waste material will be increased and it will be easy and efficient for transportation. By making the large amount of bale of scrap, it will be easy and efficient for transportation of scrap and to store it in the company or industry. However, by using large square of bale the handling of scrap, transporting, and storage of bale will be efficient as compared to the current method which is used for waste handling in the company or industry. In this they discussed on various topics and baler machine i.e. horizontal manual baler, agricultural baler, baler machine and method of baling, horizontal baling apparatus, round baler machine, wind guard for round baler, method for compacting material using a horizontal baler with movable bottom support ejector, baler machine with a bale transfer conveyor. They conclude that large or small square bales are easy for handling and requires less space as compared

to current method. Currently this method is used more in agricultural field but by implementing this method in industries will be more convenient than any other waste handling system. This system of making bales can be used in paper recycling industries, packaging industries, plastics and glass industries, metal sheet industries, etc.[2]

Design of a manual fodder baling machine (Mohammed Babiker Abd-Elmoneim Abdallah, Monzir Khalid Mohammed Ali, Mubarak Mohammed Ahmed Yousuf), this paper studied for Sudan. Sudan is an agricultural country, with the increase in the development of technology and in green land expansion, the needs of balers is increasing. This project expressing a detailed design information of a manual fodder baling machine in which wheat bran is used, how the machine is working and the detailed cost estimation for manufacturing the machine and compare it with the machine imported from outside. It includes a practical test which describes the baling process on wheat bran. Main objective is Design baling machine with quality and available materials and reduce manufacturing cost. Their project is detailed and describe the design and cost estimation for the manual fodder baling machine and compare that cost with the cost of importing a machine from outside the country, and there was a high reduction in the cost. The capability of the machine and wheat bran compression was tested and it can be possible to use.[3]

Method of Baling & Baler Machine (by Roman Schmaltz, Robert J. Wolf and Enrich E. Salzmann) Roman, Robert and Enrich made a baller machine which had a charging chamber. Charging chamber used to receive material for baling purpose. The material is forced in the baling compression chamber through a charging chamber by compression ram to make a Bale. The compressed material is carried out from chamber by a ejection ram. To eject a oversized bale they put a power cylinder. The cylinder pushes the bale & in the mean time increases the volume of baling compressions chamber.

Round Baller Machine (by Werner Konekamp, Horst Harig & Henrich Isfort) Round baler is designed to windrow the agricultural material. In this machine the bales are formed in two parts of a frame i.e. cylindrical & roller zone. Material is picked up by the frame and it enters in the cylindrical baling zone. A cylindrical roller die is placed in the baler, which has supporting discs in between to distribute the roller members. Side walls are covered with seal members which seals the material & also prevents it from entering the roller members. As an modification we can insert Oscillating tines in the roller member to manage the material in clean way.

Compacting material Method with movable bottom support using a Horizontal Baler (by James K. Robbins) In this method the baler has a Rectangular & Longitudinally extending frame which includes two chambers one receiving & an adjacent aligned compaction chamber. The ram is installed in the receiving chamber to give the material for compaction & take it back in a rectangular bale. A cylindrical piston is longitudinally assembled within the frame to associate properly with the ram on process of compaction. To access the compaction chamber, a door is placed in one of its side.

2.1 Research Gap :

- From literature review it is clear that there is need to develop mini baler machine using I.C. engine for small scale.
- For small scale baler machine is almost manual type which is require so much time, manpower & hard work.
- Some research said that for small scale use, Square bale is easy in handling and transportation.
- There is no such research on mini baler machine for small scale use.

3. Methodology

- Develop manual baler machine
- Study performance in terms of (1) mass (2) time required
- Couple I.C. engine with manual baler machine
- Study performance in terms of (1) mass (2) time required

4. Experimental Site

4.1 Baler Machine Specification :

- Baler machine weight (without I.C.engine) : 33 kg
- Bale size : $20 \times 20 \times 35 \text{ cm}^3$
- Stroke length : 20 cm

4.2 Engine Specification :

- 20 kg weight , 1.5 hp ,3000 rpm

4.3 Schematic diagram of baler mechanism :

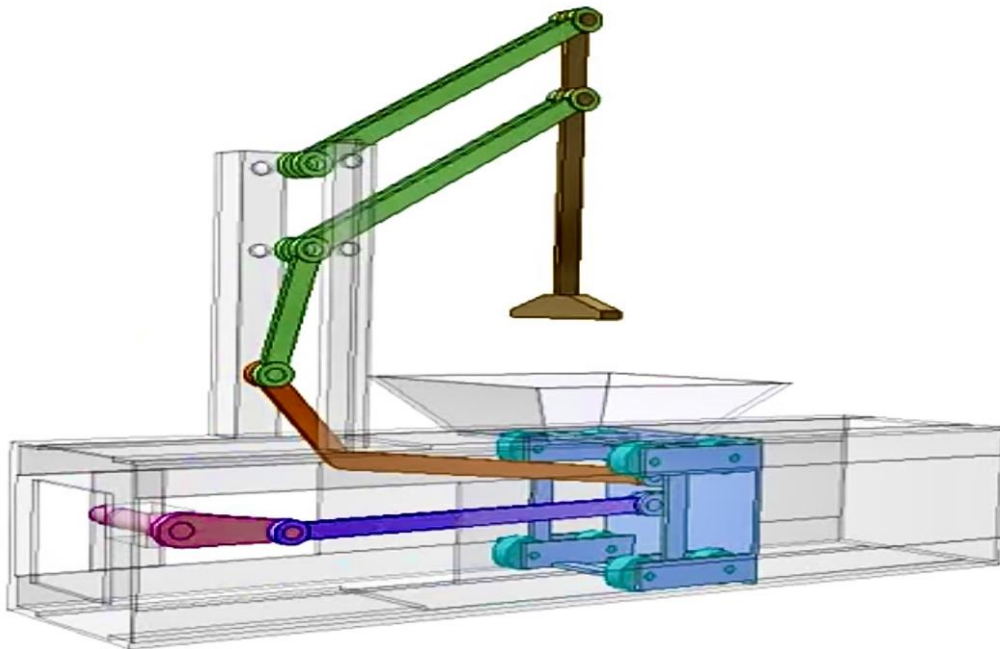


Figure 4.3 : Schematic diagram of baler mechanism

4.4 Baler machine prototype :



Figure 4.4 : Baler machine prototype

5. Performance Evaluation

❖ Performance Evaluation before coupling of I.C. Engine :

Average Mass of 20*20*35 cm ³ size bale	Time required
7 kg	5.5 min

❖ Performance Evaluation after coupling of I.C. Engine :

Average Mass of 20*20*35 cm ³ size bale	Time required
12.5 kg	3.4 min

6. Conclusion

- We analyze that manual baler require more time (5.5 min per bale) and give less dense bale (7 kg for 20*20*35cm³ bale size).
- Where , I.C. engine operated baler machine require less time (3.4 min per bale) and more dense bale (12.5 kg for 20*20*35 cm³ bale size).
- Hence , we have conclude that we can improve efficiency and performance in terms of mass , density and time required of bale using I.C. engine.

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