

Design And Development of Poultry Plower Machine

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Abstract- Poultry technology is the process of applying the technology daily life and applying that to poultry sector, which improves the output of poultry industries and also develop mechanical machine to help the poultry field which reduces the amount and time of work spent on the folk. Hence in this work paper we decided to design a better mechanical machine which is available at poultry farmers at a cheaper rate and which can steer the litter and remove the trap gases from litter at same time. To design rotavator simulation process are carried out by using finite element analysis software. Various stresses are developed on rotavator are found by using Ansys software. This paper consists of a better design of the machine which is used specially for to stir litter layers. For various poultry implements and non-availability of sufficient farm labour, various automation are done in poultries. The success of poultry farms indirectly depends on timely stirring of litter with minimizing the requirement of labor. The success of poultry farms indirectly depends on timely stirring of litter with minimizing the requirement of labor. Our machine deals with stirring of litter with the help of rotary rotavator, driving mechanism provided with electric motor having less noise which is prime consideration while designing of mechanism.

Keywords- Poultry Plower, Rotavator, Poultry farm

I. INTRODUCTION

An odor impact from 'Broiler' farms, caked litter is a major issue facing the Indian and several other country meat Chicken industries. If litter is not kept at an acceptable moisture level, very high bacterial loads and unsanitary growing conditions may result producing odors (including ammonia), insect problems (particularly flies), solid feathers, footpad lesions and breast bruises or blisters. This can affect the health and mortality rate of the flock, and could result in quality issues when birds reared under such poor conditions reach the processing plant. In a well-managed broiler house, litter moisture normally average between 25 to 35 percent. Litter that is managed correctly with the moisture content kept within the acceptable range can be reused if no disease or other production problem occurs. On the other hand, caked litter must be removed between flocks and replaced with new litter. At present, there are three main categories which deal

with the treatment of the odor emissions, cake formation in broiler sheds:

- Using dispersion to dilute odor before reaching sensitive receptors
- Caked litter replaced with new litter and
- Prevention of cakes formation of litter

But replacing caked litter with new litter find somewhat difficult and costly in order to overcome this problem caked litter can be plough on its place, by using tractor rotavator but seem it is not possible to drive mini tractors in poultry, because of size consideration, safety of birds, etc. But by improving such special purpose mechanical equipment it is possible to avoid such problems. This equipment based on the principle of tractors rotavator generally used in farms to stir soil with the help of tractors.

It can be moved from caked litter so as to stir and to remove gases trapped in litter. It's sufficient to stir the caked litter with sharp blades. The Poultry Plower machine pulverizes hard caked litter and allows moisture to evaporate also releasing ammonia it also dries and levels the bedding. When it does become time for a shed cleanout the treated litter will have value as a valuable fertilizer and effective soil builder. The rotavator of Poultry Plower is propelled by electric motors which get electric supply. Cultivator is designed to disturb the litter in careful patterns.

II. LITERATURE REVIEW

HarshithPrabhu et.al.^[1] studied economic which shows that a labor involved in cleaning a poultry farm for a year will cost around 1,50,000 INR. An automated litter cleaner indulged in cleaning will cost around 40,000 INR. This saves around 3/4th the money, which will affect to the cost of production. N.S.Bolan et.al.^[2] observed that Poultry litter is a good organic source of nutrients for raising crops, such as maize. However, the loss of N through ammonia volatilization is a major issue during handling and land application of poultry litter. These losses can be minimized through proper composting process in the presence of organic amendments, such as cereal straw. The success of utilization of poultry litter as a valuable nutrient source and soil conditioner depends on developing technologies to produce uniform value-added products, and design of equipment for

uniform waste product field application. Response of pasture, arable and horticultural crops, and silviculture species to poultry waste applications and their beneficial effects on soil physical and chemical properties should be examined in order to maximize the utilization of poultry litter. The bioavailability of nutrient and heavy metals and their movement into surface water and groundwater as influenced by the loading rate of poultry litters need to be studied further, and site specific best management practices for safe and beneficial utilization of poultry manure for sustainable production with minimum impact on environment should be developed. This will allow technologies that provide alternative to land application of poultry wastes to be developed

Azharsayed et.al.^[3] worked is made to stir the litter in poultry farms. We chose this paper because there is not any machine available in a market to stir the litter present in poultry farm. Manual method is used to stir the litter. It can be adopted because of the advantage of time saving and reduction of human effort. Our designed mechanical machine is advantages in the following ways:

- Its costless and can be manufacture in various sizes.
- It enhances the output of poultry and it can affordable for small scale and large scale business of its cost.
- Due to adjustable position of rotavator it can be set at required height from floor.

A. A. Khalid et.al.^[4] soil management practices have large effects on runoff and infiltration. The two important aspects of soil management are protection of soil surface from raindrop impact and improving soil structure by addition of organic materials. In this study, the addition of Poultry manure served as good source of organic amendment for the improvement of hydrologic and hydraulic properties of a sandy soil. The highest poultry manure application resulted in the highest improvement in hydrologic and hydraulic properties of the sandy soil. The NPK fertilizer alone did not show any significant improvement. Poultry manure can therefore be used as amendment for the improvement of soil hydrologic properties of a sandy soil. Implicitly poultry manure may improve the water retention behavior of sandy soils. Further study is required to determine the effect of poultry manure additions on soil-water content and hydrological properties in fine-textured soils. Laukik P. Raut et.al.^[5] studied to meet the food requirement of the growing population and rapid industrialization, Modernization of agriculture is inescapable. Mechanization enables the conservation of inputs through precision in metering ensuring better distribution, reducing quantity needed for better response and prevention of losses or wastage of inputs

applied. Mechanization reduces the cost of production through the higher productivity and conservation.

Mahesh R. Pundkar et.al.^[6] worked on presented review provide brief information about the various types of innovations done in seed sowing machine available for plantation. seed sowing is a key component of agriculture field. W. J. Promersberger³ et.al.^[7] studied that the best method studied was the one using soil heating cable in the floor with about 4 inches of sand as litter. This system worked well, but was too expensive to operate to be practical at the present time.

The best practical solution to the wet litter problem seems to be one of careful management. Take into consideration all things that help to reduce moisture problems in poultry houses.

Jeevarathinam.A et.al.^[8] observed that the problems on the blade were identified and solved. The standard material used for blade is cast iron and it is producing high stress. In this paper, different material compositions and dimensions are taken for analysis and the load condition is applied for existing and modified design blades.

III. METHODOLOGY

In poultry farm we are facing so many difficulties for stirring litter and racking process so there is need to design machine that stir litter and make racking process so we design a machine. For a design machine we studied research papers and we studied poultry environment from that we recognize the problem of litter stirring and racking process in poultry farm. For that purpose we design shaft and tools. Tools are mounted on shaft called teeth of shaft and whole combination of teeth and shaft is called rotavator. For tool design we give it taper and sharp point at one end and other end weld on shaft periphery. We use 62 tools in zig-zag manner on shaft so all litter stir properly without clearance. To accommodate shaft in frame so we select frame for shaft and shaft is supported by two ball bearings. We need to make rectangular frame according shaft dimensions. We make fabrication of frame. For the manufacturing the machine first we make rotavator and select material for its shaft is mild steel and also select the material for the tool is mild steel and by using lathe operations like turning, facing after that we make tools as per requirement by using lathe machine operations such as turning facing and we weld the one end of tool to the shaft and other end made taper sharp point shape to tool for plowing the litter. Arc welding is used for welding the tool to the shaft. After manufacturing the rotavator we manufacture the frame for rotavator to accommodate rotavator in it. We mount motor on

frame to transmit power to rotavator shaft. By using belt arrangement power can transmit from motor shaft to rotavator shaft. To assemble all component in single assembly we made a frame support shaft and to mount motor on frame. To make rotavator various operations are carried out on it by using lathe machine and the operations are such as cutting, turning, facing etc. Tools are selected by using design of tools and on the tool lathe operations are carried out like turning, facing, cutting and the size of tools are selected by using ansys software results. Tools are fixed to rotavator by using arc welding operations. Ansys software is used to determine stresses on the tools by applying load on each tool and design comes safe so we go to fabrication and finally fabrication part is over and we take actual practical in poultry farm and machine will successfully work in poultry farms to make caked litter soft and free as we required. For the making of this machine only near the twelve thousand is expense on it.

IV. DESIGN OF MECHANISM

In design of mechanism use in Poultry plower machine need to consider design of components such as Motor selection, Pulley design based on strength, Shaft design based on Torque requirement and design of tool used to remove litter and number of tools used in pattern form.

For design select 1HP motor having 1500 rpm speed based on requirements.

4.1 Design Of pulley

Let us consider diameter of pulley which is mounted on motor shaft to be 40mm for required speed of 300 rpm

speed ratio (G) :

Let us suppose that we have require that rpm of shaft be 300rpm

$$G = \frac{\text{speed of motor shaft(Nm)}}{\text{speed of rotavator shaft(Nr)}} = \frac{\text{diameterofrotavatorshaftpulley(Dp)}}{\text{diamnterofmotorshaftpulley(Dm)}}$$

Diameter of pulley is selected Dp=200mm

4.2 Design of shaft

Shaft design is based on various criteria such as Torque applied, Speed and Power transmitted by shaft

Available power P = 1HP = 746W

So we select 1HP Motor

Motor speed 1500rpm,

We required 300rpm for rotavator rotation speed,

N=300rpm

So that

$$P = \frac{2\pi NT}{60}$$

$$746 = \frac{2\pi * 300 * T}{60}$$

$$T = 23745.91Nmm$$

Torque available at rotavator shaft is 23745.91N-mm

By loading conditions such as forces and moments acted on shaft, equivalent Torque developed is,

$$Te = 304676.76 Nmm$$

Now, for Mild steel shaft,

$$\tau = 0.75 * (0.3 * Syt) \tau = 55.75 N/mm^2$$

By ASME Code of design

$$\tau = \frac{16 * Te}{\pi * Do^3(1 - k^4)}$$

$$k = \frac{Do}{Di} = 0.8$$

$$\therefore \tau = \frac{16 * 304676.76}{\pi * Do^3(1 - 0.8^4)}$$

$$Do = 50mm$$

$$Di = 40mm$$

Diameters of hollow shaft are, Outer Do = 50mm , inner Di = 40mm

4.3 Tool Design

Now force on tool, mild steel material for tool is selected

$$T = F * \frac{D}{2}$$

$$23745.91 = F * \frac{50}{2}$$

$$F = 900N$$

We required 60N force on Per tool of rotavator. Therefore 15 tools are inline selected per stroke of rotavator shaft to remove litter per stroke.

V. SIMULATION OF ROTAVATOR

The simulation was done using the finite element analysis software. The material was for tool is Mild Steel. Tool is circular in cross section having length 12.5cm and 10mm in diameter one end of tool is weld to shaft and other end is made taper cross section for plowing the litter. Load on the per tool is 60N and yield strength is 247N/mm².

5.1 Loading diagram

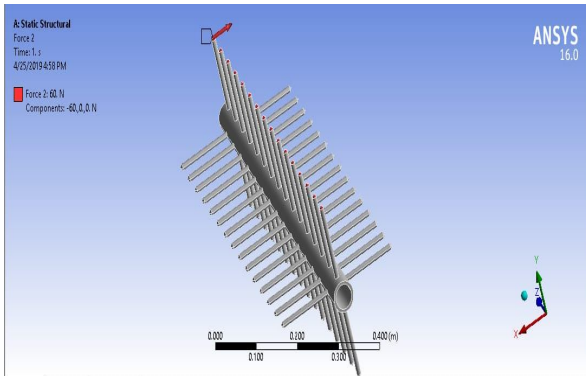


Fig.1. Loading diagram

In above loading diagram,60N load is acting on single tool while removing litter.

5.2 Total deformation

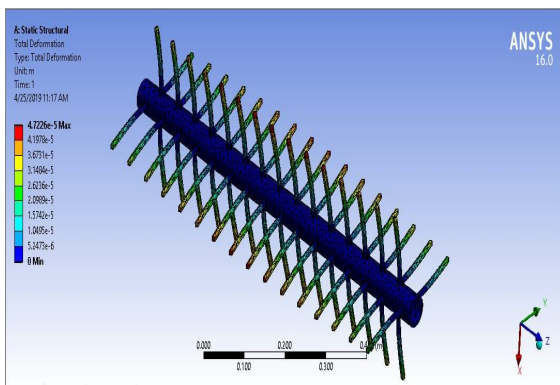


Fig.2. Deformation of tools

In above deformation diagram,60N load is acting on single tool while removing litter and deformation is obtained is 0.0472mm.

5.3 Equivalent von-misses stress

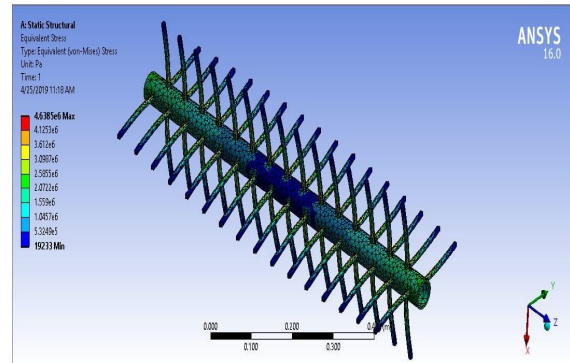


Fig. 3. Equivalent stress

In above loading diagram,60N load is acting on single tool while removing litter and equivalent stress are obtained is 4.63Mpa and which is less than allowable stress of material mild steel.

The von-misses stress value is 4.63Mpa is less than the allowable tensile strength is 247Mpa of tool material mild steel. Hence design of rotavator is safe.

VI. WORKING MECHANISM

A machine consists of four wheel two front and two rears. The wheels are connected to each other through the axles. Rotavator is mounted between the front and rear wheels. This consists of blade which rotates with the help of shaft provided with pulley. The whole equipment is moved with the help of handles provided on it.

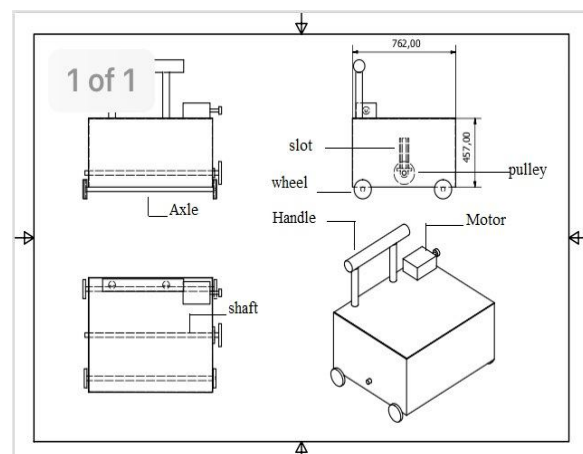


Fig.4. Schematic representation of working mechanism

The main power source in machine is AC power supply. This is given to the motor which is of 1 HP with 1440 rpm. The motor consists of pulley of 2 inch from which the drive is provided to the rotavator shaft with the help of belt drive. The rotavator shaft consists of pulley of diameter is 6 inch.

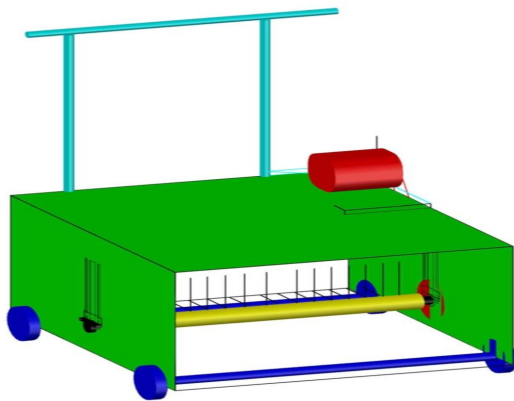


Fig. 5. 3-D model of working mechanism

A rotavator is any of several types of several implement used for secondary tillage. One sense of the name refers to frames with teeth (also called shanks) that pierce the soil as they are dragged through it linearly. Another sense refers to machines that use rotary motion of disks or teeth to accomplish a similar result. The rotary tiller is a principal example.

The rotavator consist of MS solid polish bar on which there is a hollow shaft of MS. The polish bar are cut in 13mm in length and welded on the hollow shaft. This polish bars are used as a teeth of a rotavator which plows the litter and helps to remove the gases. The rotavator is driven with the help of the motor connected to it through the belt pulley.

6.1 Working of machine



Fig. 6 PoultryPlowerMachine

The AC power supply is directly given to the motor. The motor is make adjustable as it is fixed with the help of nut and bots on the C – channel on which slotting is done. It is done to adjust the distance between the rotavator shaft and the motor.

The rotavator is mounted on the two plates from both the sides on which also slotting are done to maintain the distance between the rotavator blades and the floor. Rotavator is drive with the help of belt drive. The equipment is moved forward with the help of handle.

Above overall description is how the power is provided to the motor and finally to the rotavator with the help of pulley arrangements. Also, the slotting arrangement is mentioned which is an important part to safely complete the operation without any accidents.

The operation is to stir the litter properly. This operation is carried out with the help of blades of 5 inch mounted on the rotavator shaft. Due to this stir of litter the harmful gases trapped in this litter is removed.

The litter which is stir can also use as a fertilizer in farms. This equipment reduces the human efforts and a much valuable time.

6.2 Rotavator

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Fig. 7 Rotavator

VII. ADVANTAGES AND DISADVANTAGES

7.1 Advantages

1. This machine is simple in construction and can be handled by any one or unskilled labor also.
2. The rotavator of machine gives perfect stirring which increases the growth rate of birds and reduce the mortality rate of birds.
3. The area of about 10000 ft² is stirred within the time of 30 min to 60 min which saves three hour of labor daily and increases the productivity and output of poultry.
4. Stirring removes the gases trapped in the caked litter and also removes the moisture content trapped in litter which also increases the growth rate of folk.
5. Noise level in poultry farm is maintained due to use of electric motor which is prime consideration in poultry farms.
6. Due to use of electric motor there is no pollution around the poultry and this machine becomes eco-friendly.

7.2 Disadvantages

1. This machine required long wire to provide electric supply to motor..
2. This machine is not automated.

VIII. FUTURE SCOPE

1. Now this equipment runs on the AC supply but to save power it can be run on the solar panels.
2. By using strength of materials for rotavator blades the problem of breaking of blades can be reduced to zero.
3. This machine can be used in small scale farm which is economically to farmer. Only small modifications are to be done that the less noisy heat engines can be used against AC power supply.
4. Now this machine is working by using electric supply but to avoid long wiring it can be work by using electric charge batteries.

IX. CONCLUSION

1. Its cost is less and can be manufacture in various sizes.
2. It enhances the output of poultry and it can affordable for small scale and large scale business of its cost.
3. Due to adjustable position of rotavator it can be set at required height from floor.
4. Power is given to wheel so it reduces human effort required to push the equipment.
5. It reduces mortality rate and increases growth rate of birds because of fresh plower litter.
6. It removes moisture content as well as gases present in litter such as ammonia.

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