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Design Fabrication and Analysis of Multi-operation Agricultural Robot with Renawable Energy Source

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ABSTRACT

Agriculture has a significant role in the Indian Academy. Indian agriculture has experienced rapid expansion in recent decades. This has been implemented. Although a lot of effort has been done on large agricultural machines and robots for full yield, the multipurpose farming robot is a fundamental new idea in this industry. The traditional process of weeding, spreading seeds, and spraying pesticides is a time-consuming procedure. Many farmers in India still employ bullocks, horses, and buffalo for agricultural purposes. In comparison to other countries throughout the world, this would not suffice to meet agricultural energy needs. We believe that human and animal labour can be economically substituted by a sophisticated mechanism that is appropriate for small-scale farms. As a result, we're creating this prototype and assuming that it'll meet all of the requirements and solve all of the problems in real life. India is an agriculturally-oriented country where 70% of people rely on the fruits of their labour. However, as the population grows, the farm is distributed among the family, and as a result, on average, Indian farmers have only two acres of land However, as the population grows, the farm is distributed among the family, and as a result, on average, Indian farmers have only two acres of land. As a result, we're developing machinery to meet all of these requirements while also addressing the manpower shortage. The paper is about a multi-purpose agriculture machine that can feed seeds, spray insecticides, fungicides, and fertilizers, and trim grass. Thus, paving the way for more cost-effective and multi-use equipment for farmers that is also easy to clean and maintain, easy to handle, and does not require fuel, lowering costs and assisting farmers in their fields to a large extent.

Key words: Agricultural robot, Design of robot, Seed box, Feed shaft, Mass flow metering device, Ground wheel, Furrow opener

INTRODUCTION

Agriculture is India's most important source of revenue. Because the Indian economy is built on agriculture, there is a need for more improvement in the equipment used in the cultivation or agricultural process. The seed sowing step is the most important part of the farming process. The bullock-driven sowing equipment is used in the traditional seed sowing operation. Animals are considered the backbone of India's rural economy. Aside from manual labour, traditional farming in India was relied on the usage of animal power for 97.6% of farmers (land owners) who owned 77.2 percent of the country's land. Because the Indian economy is built on animals, their use in farming is limited due to their efficiency.

As a result, we must upgrade the bullock-driven sowing machines or equipment's, as well as the tractor-driven equipment's, in order to improve their effectiveness and, as a result, the cultivation capacity.

Most planters are unable to achieve equidistance spacing between crops, resulting in lower yielding crops with nutritional deficiencies. According to studies, equidistance planting or seeding in the right setting results in the highest potential yield, quality, and uniformity of crops. Seed sowing operations have the fundamental goal of planting seed and fertilizer in rows and at desired depths, taking into account different varieties of seed and their sizes. As a result, such seed sowing machine inventions, as well as future refinement and development in such development, are required. The Roller Seed Sowing Machine Design and Fabrication is a seed sowing machine that is a modification of a previous model. To pull a machine, a bull or tractor is utilised. We may not only sow the seeds but also the fertiliser with the customised machine. The redesigned seed sowing machine can spread seed at an identical distance and depth, and it can also sow fertilizer at an equal distance and depth.

Fig. 1 Working Model

The depth of sowing is controlled by the metering mechanism and the equidistance sowing is achieved by the mechanism which is run by belt drive driven by ground wheel. Because the machine is basic and has less sophisticated mechanisms, it is more efficient and useful to the farmer. Agriculture is and will continue to be the backbone of the Indian economy for a long time. As India's population grows, so will the demand for food, necessitating the use of more advanced farming techniques to improve crop productivity. Better seed planting and fertiliser placement procedures are required for this. Seed sowing's major goal is to plant seeds at the right depth, maintain proper spacing between seeds, and cover them with soil to ensure that they yield. Seed planting depth and seed-to-seed distance vary depending on the crop and the agricultural climate. This paper is for the purpose of designing a machine that will meet the aforementioned specifications while saving time and money. Traditional methods have numerous drawbacks, and tractors and other advanced sowing gear are expensive and beyond of reach for medium and small-scale farmers. The equipment we're building and developing is multipurpose, which means it can plant seed and place nutrients at the same time. This contraption can work with a bull cart or a small tractor.

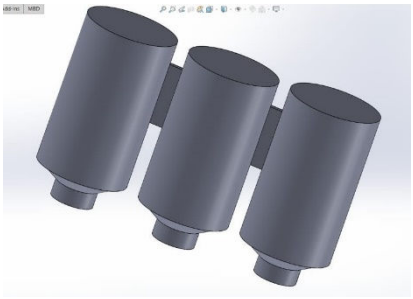

Fig. 2 Hopper

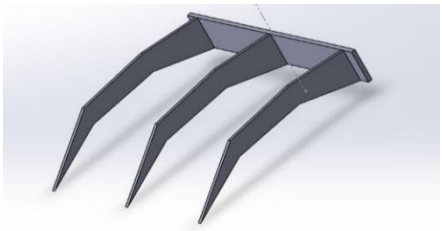

Fig. 3 Plough

PROBLEM IDENTIFIED

- It has no adjustment of depth and seed distance.
- No arrangement for fertilizers sawing.
- Due to less power self-propelled vehicle the depth of sawing is restricted.
- Continuous refill of seed hopper is needed

MATERIALS AND METHODS

The experiment was conducted at PCSIR laboratories, Quetta during the winter season 2005- 2006. In this regard land was given three ploughs for the purpose of good seed bed preparation. The experiment was laid out in Randomized Complete Block Design having four. were thoroughly irrigated 25 days interval. Data Recording: 100 plants were selected randomly from each treatment and subjected for recording data using standard methods Following two strategies were adopted for experiment. Crop Management: All the required agronomic practices were followed uniformly in all the plots throughout the growing period.

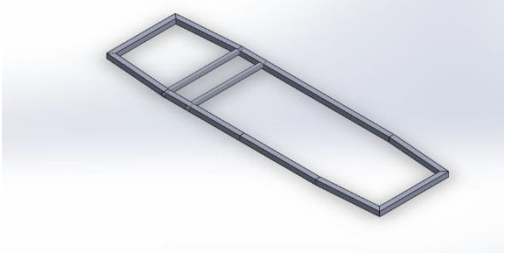

Fig. 4 Chassis

DESIGN CONCEPT

The main procedure of seed sowing is putting a seed in an appropriate row, taking into account different types of seed and their sizes. As a result, a seed sowing machine must be invented for continued development and improvement. The purpose of the design and manufacture of a roller type seed sowing machine is to sow seeds into the soil with the help of numerous teeth on the wheel's circumference, ensuring optimum soil penetration. Sowing is the process of planting seeds in the ground for enhanced germination in the field.

Seed sown refers to the components that include seeds that have been planted. We can plant seeds with the right distance between them thanks to this gadget. As a result, the amount of seed that must be sown every hector is fixed. This also aids in seed germination, as the seed to seed spacing is optimal, allowing the plant to flourish.

Reduce The most essential goal of this invention is to shorten the time it takes to plant seeds with fertiliser. The traditional method of sowing by hand (manually) takes far too long to accomplish the seeding across the entire land. Reduced time equals increased efficiency. The entire work done by the farmer for sowing has decreased as a result of this invention, because the farmer no longer has to carry the heavy bag of seeds and fertiliser during the sowing procedure, and the work of sowing by hand has also decreased.

Fig. 5 3D view of Wheel

EXPRIMENTATION OF CONCEPTUAL DESIGN

The roller seed sowing machine is a machine which is used for seed sowing process in agriculture works. This machine can be used for sowing various types off seeds having various size and diameter. The hopper of the machine is filled by the seed which is sowing into the soil the hopper is filled above 70% of its total volume. When the machine gets pulled

by using tractor or manually its first task is drill the soil by hollow knife edge tooth on the roller wheel at a depth of the tooth which is also known as soil drill. When the machine gets move the wheel start rotating and hollow tooth can drill the soil. By this drilling process get completed when machine is moved, due to gravitational force and certain vibration created in machine the seeds are dropped into the channel pipe. As the channel pipe is connected to the hollow axle rod of a machine which support to the wheel. From this hollow axle rod the seed are dropped into the roller wheel of the machine. The both wheels are rotated at a same speed due to bearing is mounted on wheel there are number of holes are drilled on the periphery of the wheel at equal pitch distance. The or teeth mounted on the wheel above this drill hole on this wheel due to this the seed drop inside the roller wheel is supply or drop into hole tool through this hole. So when tool is drill the soil at a same time the seed sowing into the soil.

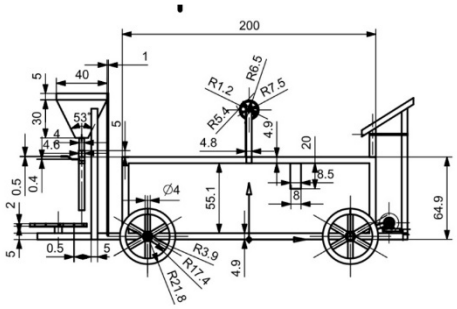

Fig. 6 Side view of model

DESIGN AND CALCULATION OF MACHINE

Total weight of machine = weight of machine + capacity of Hopper
The capacity of Hopper is 5kg but we will feel the hopper only 40%
Assume weight of seed in copper is 2kg W= 20+2= 22kg
W=22×9.81 = 215.82 N Rn = 215.82
Friction force F = u ×Rn
F = friction force, u= coefficient of friction, N = normal force Assume coefficient of friction u = 1
F= 1×215.82 =215.82

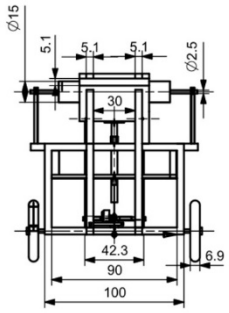

Fig. 7 Top view of model

DESIGN OF CHANNEL PIPE

Force = yield strength × Area Ap =
$\pi /4 (D^2+d^2)$
Assume yield strength = 276 Mpa 215.82 = 276 × /4 × (2.54 + d) D = 2.54 cm, d = 2.35 ,
t =0.20 cm

DESIGN OF BEARING

Design of Bearing Axial force = F = 215.82 N. Radial force = 2000 N
Equivalent load on bearing
Fe = [X.Fr + Y.Fa] . Ks. Ko Kp Kr
Fa/Fr = 0.085, e = 0.25for deep groove ball
bearing X = 1, Y = 0, Moderate shock Ks = 2

Non-constant rotational condition, Ko = 1
Non preloaded bearing Kp = 1 Fe =
(1×2000+0) ×2 × 1 × 1× 1)
Fe = 4000 N.
Average life of bearing:- L = (c/ Fe) × krel
For 50 % reliability
Krel = 5.0, C = 1100, n =3
for roller bearing Assume ball bearing 6204
L = (18000/4000) × 5.0
L = 7910 hours.

Fig. 8 3D view of bearing

CONCLUSION

The highest concentration of our design in the case of small farm units is the cost and operational ease. Therefore, this multipurpose equipment is intended to reduce the expense of processing, spraying, and feeding the seeds. We use past data and techniques in the production of multipurpose equipment. The design of multipurpose agricultural equipment is thus healthy. Such human-powered machine systems will make a major contribution to raising production per acre and to boosting the profitability of small and middle-class farmers. A new type of multipurpose mechanism that is distinct from other devices is manufactured and operates on a non-conventional energy source powered solely by humans. Such systems are of great importance in Asian countries, as almost all Asian countries face shortages of energy and electricity, resulting in the shedding of twelve to fourteen hours of cargo in rural areas, especially in India. Therefore, a multiple multipurpose agricultural robot needs to be created locally.

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