

Design and Calculations of Pneumatic Controlled Seed Sowing Machine

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ABSTRACT: A lot of agricultural technologies and machineries have been in use in modern days, including automations. In case of seed sowing, although numbers of modern seed sowing machineries have come into the market, it has failed to embrace the small-scale farmers. The reason for this is that all those machineries are expensive, heavy and not so suitable for small farming. In small-scale farming, these are very inefficient in context of economy, time and resource. To overcome this problem, concept of pneumatic seed sowing machine has been put forward especially focusing small-scale farmers. Size and cost of manufacturing support for the same purpose. This technology in the farming system reduces the manual effort of farmers, saves time, energy and labour cost.

KEYWORDS: seed sowing machine, small scale farmers, seeding/fertilizing mechanism, pneumatic system

I. INTRODUCTION

Agriculture is the key to human survival as it is the only source of food and has been key development in rise of sedentary human civilization. For country like India where agriculture been the backbone of the country's economy, development of new techniques and technology in agricultural field is very vital for improving economy of country and people residing here. However, advancement on techniques and equipment had contributed very little for small scale farmers. Use of modern technique can certainly help them reduce time and effort but those machines are not cost efficient. With this understanding, totally new concept, pneumatic controlled seed sowing machine, has been put forward that solves out the problem like setting required depth of seed and required distance between two consecutive seed. Air controlling solenoid does a job for setting required depth of seed .it permits air that pushes furrow opener to a desired depth all at minimum cost and effort. The product is very simple and can be used as substitution for those heavy seed sowing machineries which are not suitable for small farming. Product comes very handy to the farmer. Depth of sow and seed distance can be adjusted as per requirement which support effective farming methodology. Manufacturing and use of product are easy such that remote farmers can also be benefitted. Some of the limitation with machine that are available at present is no control over depth of seeding, loss of seed, no uniformity in seeding, time and labour required is more. This problem is found to be eliminated with use of this concept where pneumatic control piston can help us gain desire depth of seed and seed regulating disc help us gain uniformity in seeding and fertilizing.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Traditional method of seed sowing

Agriculture is believed to be practicing since very long time ago, lot of techniques and technology got changes with time and need, and some of the most used traditional methods are:

Broadcasting: This method involves opening a furrow by a country plough and dropping seeds by hand. However, seeds are not uniformly distributed in the field. Germination of broadcast is relatively poor and the plant stand is often irregular.

Drilling: In this method seed is sown by seed drill. With the help of this implement seeds drop at uniform depth and results in uniform germination and regular stand. However, this method is found to be time consuming.

Dibbling: This method is used in case where supply of seed is limited. Sowing is done with the help of small implement known as dibbler. It is a wooden or iron frame with pegs. It is not a common method as it is very time consuming.

OBJECTIVES:

This machine is designed especially for small-scale farming and it is beneficial for that purpose. The benefits of the product over the large existing models in the market are:

- **Size:** The product is very compact in size and can be used in small farm lands where the large tractors and farming machineries cannot be taken.
- **Less complexity:** There is absolutely no complexity in this machine. Even farmers with no technical knowledge can operate it.
- **Automation:** Although it is not a complex machine, still simple automation mechanism shall be applied in the product. The seed shall automatically be planted along with fertilizers within fixed distances using simple relation between the relative revolution of wheels and seed circulating disc. More than that, pneumatic system is added to activate and deactivate the plough and leveller using simple mechanical solenoid.
- **Economical:** Spending a lot of money on large machineries for small-scale farming is very uneconomical. Small-scale farming runs on low budget. Hence the product has very low manufacturing cost. It can even be made at home with parts provided.
- **Ease of operation:** Apart from zero operation cost, it shall also be very easy to use. No special training or skill is required to operate the product.
- **Size:** The product is very compact in size and can be used in small farm lands where the large tractors and farming machineries cannot be taken.

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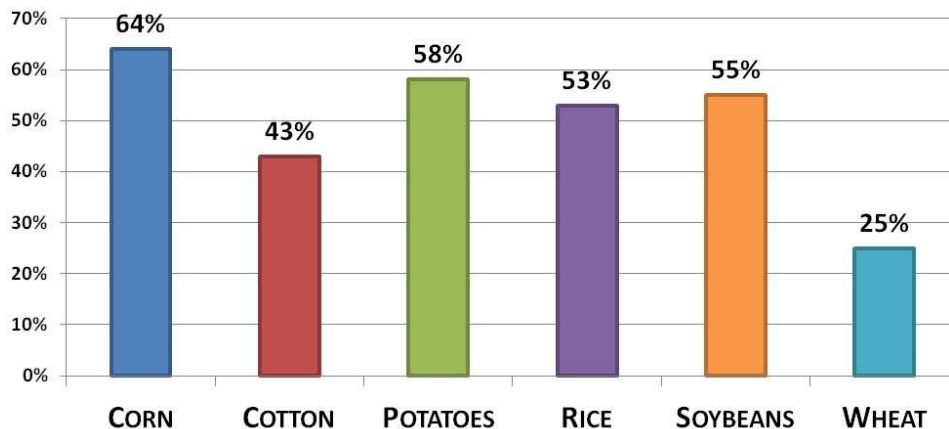
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Vol. 8, Issue 7, July 2019

Yield Increase By Crop Per Acre (1980-2011)

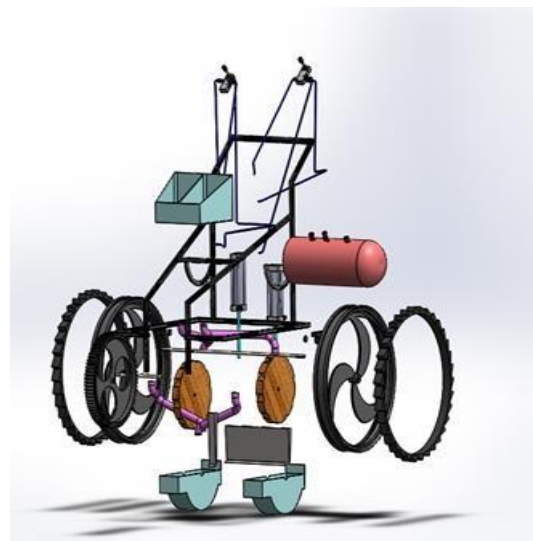
Data from The Keystone Alliance for Sustainable Agriculture, Summary Report July 2012



(fig 1. Yield increase with modern techniques integrated agricultural practices)

WORKING OF THE PRODUCT

The product has to be pushed by human power, not much effort is needed. Wheels are designed in a way, so that they can be easily moved through the soil. The seeds and fertilizers are planted under action of gravity. The seeds and fertilizers stored in container fall on a rotating disc which rotates along with the wheels. As wheels move, the disc rotates; carrying seeds along its circumference and throws them the ground directed through a pipe. Same mechanism is used for fertilizers too. The product can plant seeds and fertilizers simultaneously. The distance between each seed planted is fixed, calculated by relative revolution of wheel and disc. The furrow can be opened and closed using ploughs that are activated and deactivated through pneumatic system. The control valves for the pistons are located close by the handle so that the operator can easily control them. The pressure for the pneumatic system is stored in a compressed air tank.



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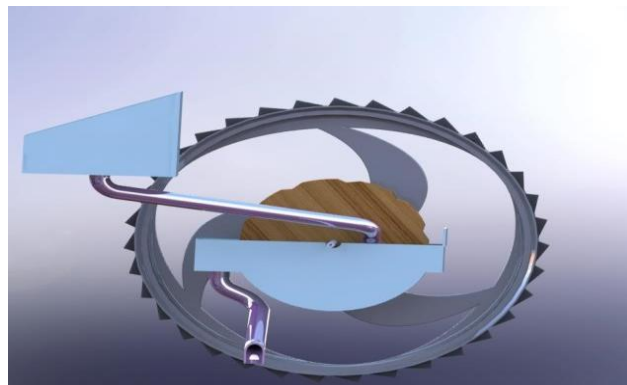
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Vol. 8, Issue 7, July 2019

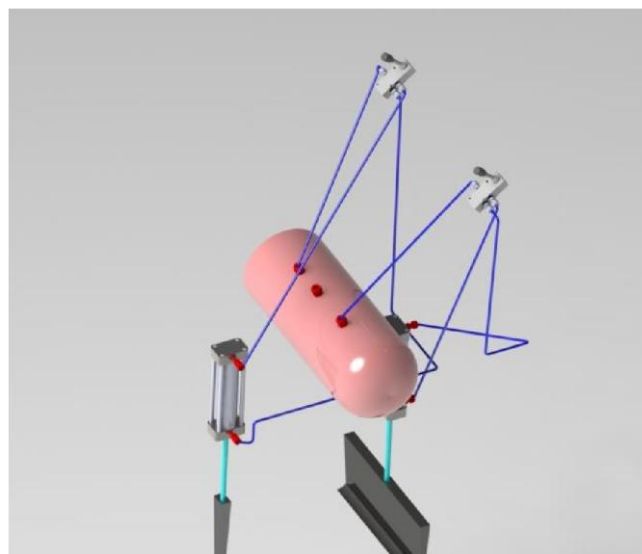
MECHANISM OF SEEDING/FERTILIZING

The seeds and fertilizers stored in container fall on a rotating disc which rotates along with the wheels. As wheels move, the disc rotates; carrying seeds along its circumference and throws them the ground directed through a pipe. Same mechanism is used for fertilizers too.



WORKING OF PNEUMATIC SYSTEM:

The furrow can be opened and closed using ploughs and leveller that can be activated and deactivated through actuator, where forward and backward stroke of actuator is regulated by solenoid. The control valves for the piston are located close by hand so that operator can easily control them. Air can be filled in cylinder with the help of simple hand pump.



International Journal of Innovative Research in Science, Engineering and Technology

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II. DESIGN CALCULATION

CALCULATION OF PRESSURE(EXPERIMENTALY)



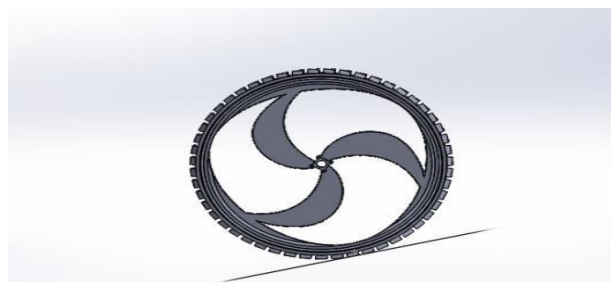
Maximum pressure cylinder can withstand=200 psi

Maximum pressure actuator can withstand=145psi

Piston operates of minimum pressure at 20psi

(after numbers of experiment we observed that cylinder can sustain air for 35 minutes after that air can be filled using simple hand pump for like 7-8 minutes)

CALCULATION OF TORQUE TRANSMITTED ON THE WHEEL



$$T_w = k_w + T_t + R_w$$

Where, k_w = coefficient of the rolling resistance(0.3)

W_t = Active weight on the machine(20kg)

R_w = Radius of the ground wheel(0.312)

$$T_w = 0.3 * 20 * 0.312 = 1.8 \text{ Nm}$$

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NUMBER OF DIVISION ON REGULATING DISC

A. WHEEL

$$\begin{aligned} \text{Radius} &= 12.81'' \\ \text{Perimeter} &= 2 \times 3.14 \times 12.81 \\ &= 80.44'' \\ &= \mathbf{204.3 \text{ cm}} \end{aligned}$$

B. SEED/FERTILIZER REGULATING DISC



$$\begin{aligned} \text{Radius} &= 12' \\ \text{Perimeter} &= 2 \times 3.14 \times 6 \\ &= 37.68'' \\ &= \mathbf{95.7 \text{ cm}} \end{aligned}$$

Standard distance between two consecutive seeds should be between 18cm to 24cm

To obtain seed/fertilizer distance = **20 cm**

Perimeter of wheel = **204 cm**

Seed/fertilizer distance of 20cm = perimeter of wheel/number of divisions in regulating disc

Number of divisions on regulating disc = **10**

(To get different consecutive seed/fertilizer distance, number of divisions on regulating disc can be varied)

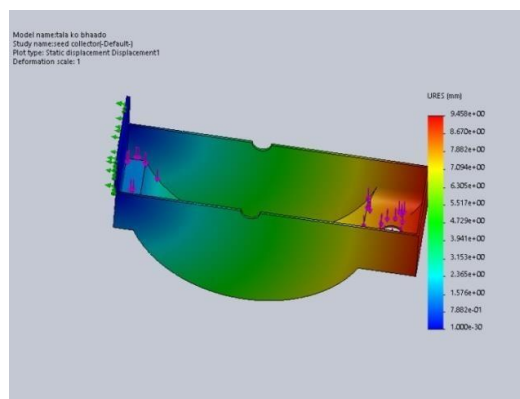
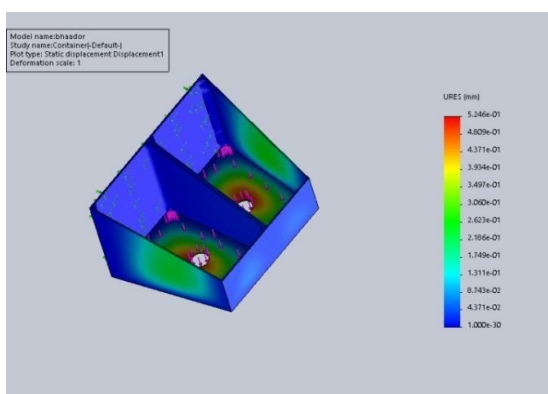
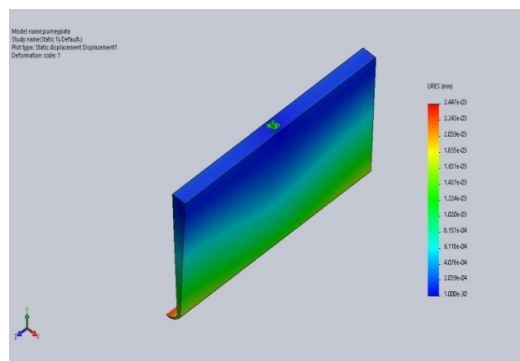
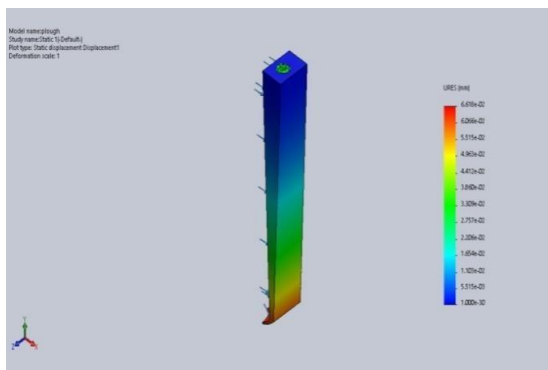
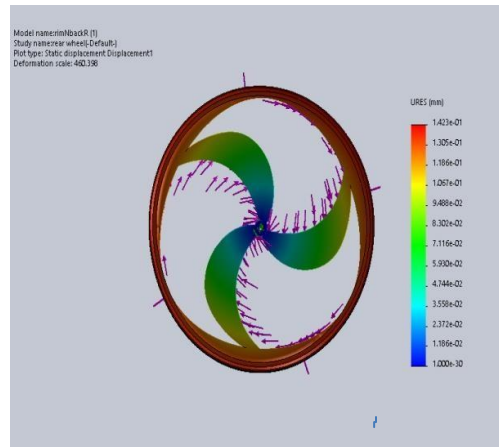
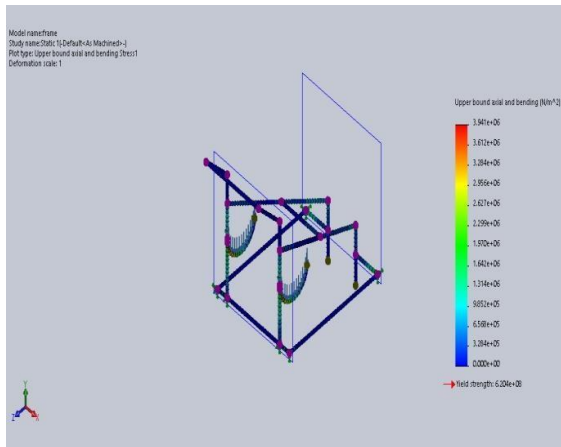
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Vol. 8, Issue 7, July 2019

DESIGN VALIDATION



(deflections were found negligible)

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III. CONCLUSION

This seed sowing machine has considerable potential to help small farmers in reducing cost, optimizing efforts, improve earning abilities thereby to earn sustainable livelihood. The Seed sowing machine can be readily made from local components in workshops. By using of this machine, achievement of flexibility of distance and depth variation for different seed plantation is possible.

REFERENCES

- [1] Pradip S. Gunavant, Sarfraj J. Mulani 'International Advanced Research Journal in Science, Engineering and Technology' on Farm Mechanization by using Seed Planting Machine.
- [2] Ms. Trupti A. Shinde, Dr. Jayashree. S. Awati 'International Journal of Electronics and Communication Engineering - (ICRTESTM)' on Design and Development of Automatic Seed Sowing Machine
- [3] Amol Aher, Ajay Chavan, Abhishek Fargade, Kallappa Birajdar, DR. F. B. Sayyed on development of seed sowing machine use in green house.
- [4] Roshan V Marode, Gajanan Tayade and Swapnil K Agrawal Design and Implementation of multi seed sowing machine.
- [5] D. Ramesh, H.P. Girish Kumar on Agriculture Seed Sowing Equipment's: A Review
- [6] Kyada, A. R, Patel, D. B. on h International & 26th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014) December 12th–14th, 2014, IIT Guwahati, Assam, India.