



## Design and fabrication of seed feeding attachment in power tiller for Agricultural purpose

<sup>1</sup> R Arularasan, <sup>2</sup> U Abdul kadar, <sup>3</sup> V Dinesh, <sup>4</sup> I Govindhan, <sup>5</sup> K Manikandan, <sup>6</sup> S Ulaganathan

<sup>1</sup> Associate Professor, Department of Mechanical Engineering, University College of Engineering Arni-Thatchur, A constituent college of Anna University Chennai, Tamil Nadu, India

<sup>2</sup> Teaching Fellow, Department of Mechanical Engineering, University College of Engineering Arni-Thatchur, A constituent college of Anna University Chennai, Tamil Nadu, India

<sup>3-6</sup> Final year Students, Department of Mechanical Engineering, University College of Engineering Arni-Thatchur, A constituent college of Anna University Chennai, Tamil Nadu, India

### Abstract

This paper consists, the design and fabrication of a seed feeding attachment in the power tiller machine. Seed feeding attachment is to feed the seeds in the agricultural land. Without additional linkages it is attached with the power tiller. This seed feeding attachment is working based on the vibrations created by the power tiller machine during its operation. This seed feeding attachment is specially designed and fabricated to seed groundnut in the agricultural fields.

**Keywords:** power tiller, seed feeder model. salient features, payback analysis of seed feeder

### 1. Introduction

The power tiller is a multipurpose hand tractor primarily used for rotary tilling and other operations on small farms. While in operations, an operator walks behind to maneuver the power tiller. It is also known as a garden tractor, hand tractor, walking tractor or a two wheel tractor. Non-availability of matching equipment for different farm operations limits the versatility of the power tillers. Implements initially offered with the power tillers included rotavator attachment, trailer and in some cases a plough and ridger <sup>[1]</sup>.

The main purpose of these tools is usually to lessen the tough physical labour involved in turning, aerating and cultivating the soil. They have many uses besides simply turning soil such as trench formation, top soil and weeding, fertilizer application and flower bed formation <sup>[2]</sup>. Fig 1.1 shows the photograph of a commercially available power tiller from the Indian manufacturer (VST shakthi– Mitsubishi).



Fig 1: VST Shakti Power tiller

### 2. Work flow process

Design and fabrication of seed feeder process flow is shown in below figure 2.

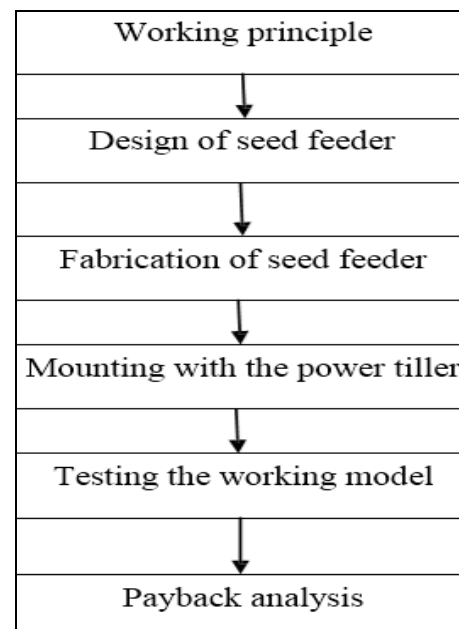


Fig 2: Design and fabrication of seed feeder work flow chart

### 3. Working principle of seed feeder

This seed feeder is working based on the vibrations created by the power tiller engine during operation time and the gravitational forces. The ground nut seeds are filled and stored in the top side of hopper and flow through the zigzag Baffles plates slowly and stored in the scoop region. Due to the vibrations created by the engine, the seeds flow through the hose pipes and deposited into the agricultural land. Working principle of seed feeder is shown in below figure 3.1.

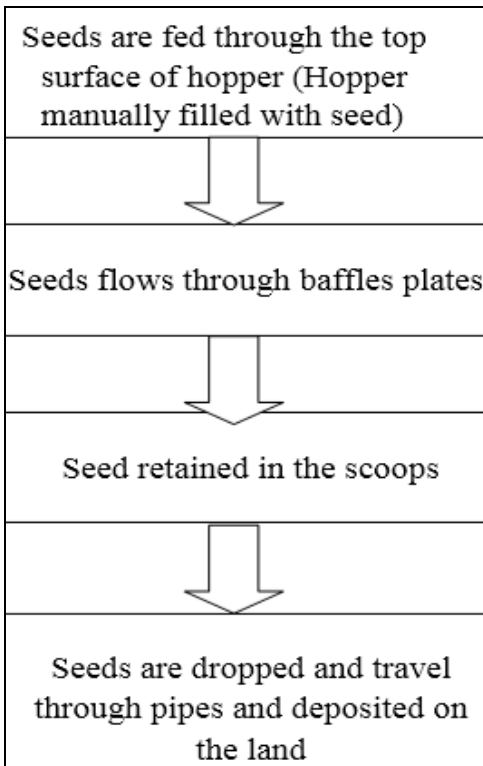


Fig 4: Working process of Seed feeder flow chart

#### 4. Design details of seed feeder

Seed feeder consists of four major parts. The seed feeder is fabricated with the following parts (i) Hopper (ii) Baffle plates (iii) Scooper arrangement (iv) Hose pipes.

##### 4.1 Details of Hopper

In a seed feeder hopper is a main part, Hopper is used to store the seeds in the given height. Based on the dimensions of the rotary tiller (rotovator) present in the power tiller equipment the size of the hopper is designed [3]. Sectional side view of Hopper with Baffles plates and scoop is shown in fig 5.

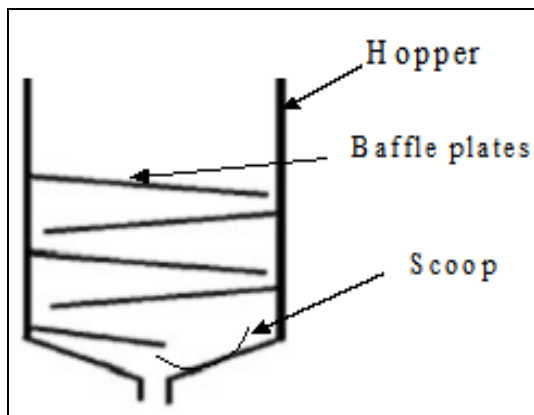


Fig 5: Sectional side view of Hopper with Baffles plates and scoop

##### 4.2 Details of Baffles

Rectangular Baffles plates in zigzag orientation are attached inside the hopper. Seed flow is regulated by these baffles arrangements. Five Baffles plates are arranged in zigzag position [4].

##### 4.3 Details of scoops

Hemi spherical Scoops are attached at inclined position in the bottom openings of hopper and aids in the control of seed droppings. It acts as a surge to reduce the over flow of seeds. Six individual scoops of 8cm diameter are inserted at the bottom side of hopper. Scoops are control the flow of seeds over the baffles as well through the hose pipes [5].

##### 4.4 Details of Hoses

A Size of 20mm diameter hose pipes is chosen, and it is based on:

- Size of the seeds.
- Distance between the ground level to hopper.

##### 5. Seed Feeder Fabrication Details

The feeder is to store about 10 Kg of groundnut seed designed and fabricated with the following specifications.

Hopper volume (length X breath X height) = (600X 315 X490) cm<sup>3</sup>

Size of scoops = 8cm dia in 6nos Hose Pipe diameter = 20 mm dia No of pipes = 6 nos

Total hose pipe length = 300 mm No of Baffle plates used = 5 nos

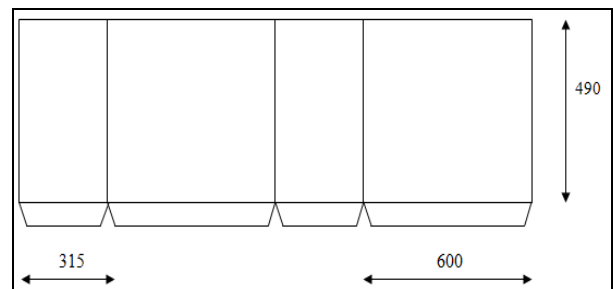


Fig 6

All dimensions are in cm Fig 6 Developed design of hopper Hopper is made of 3mm thick mild steel sheet metal plates. The sheet metal is cut to require size as shown in the figure 4.1. Sheet metal is bent and welded based on the size of hopper. Baffle plates are fixed, welding and finishing process are successfully completed.

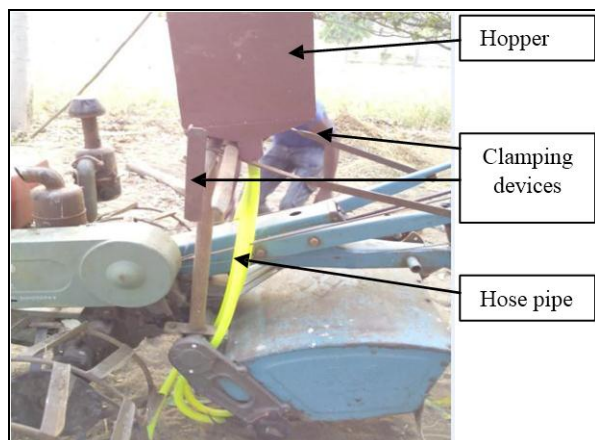
Openings for pipe inserts are created. The pipes are fixed in the bottom side of hopper openings. The photograph of hopper fabricated is shown in fig 7a



Fig 7a: Fabricated Hopper setup with hole arrangements at bottom side

## 6. Mounting the seed feeder on the Power tiller

Seed feeder is mounted with power tiller as shown in below figure 8. The feeder setup is mounted on channels already present in the power tiller machine. Hopper is positioned at the back side of the engine, before the handle using the clamping provisions present in the power tiller. Hose pipes are connected at the hopper bottom openings.



**Fig 8:** Seed feeder mounted with the power tiller

## 7. Features of seed feeder mounted with the power tiller

- Easy to attach / detach with the power tiller.
- Easier mode of operation because of there is no direct linkages and mechanisms are used.
- Low manufacturing cost, compared with the tractor plough mounted seed feeder device. Cost of the setup is around Rs.8000/- only. Tractor mounted seed feed cost is Rs.42000/-.
- No electric, hydraulic and pneumatic power is used to operate the attachment.
- Easy to handle and carry the device to anywhere.
- Low weight nearly around 12Kgs, where the tractor mounted device is around 500Kgs.
- Maintenance cost is low compared with tractor plough mounted seed feeder.

## 8. Economic and Pay back study in the seed feeder

- Operating cost is saved up to 40% in this seed feeder with respect to the seed feed in tractor mounted seed feeder mounted in the tractors.

### Example

1. Manual seed feed cost = Rs.1200/acre
2. Tractor mounted seed feed cost= Rs.3200/acre or Rs.1600/hr.
3. Power tiller seed feeder seeding cost =Rs.1000/ acre.
4. Manual seed feed requires Rs.1200/acre in 4hrs to complete the seeding process with 2 helpers.
5. Power tiller seed feed rent for Rs 1200 for 3hrs/acre with one labour.
6. One hrs saved and one labour is reduced for this seed feed process.

Payback period is maybe six month by own, however based on the equipment usages within one month is also possible.

### Example

- Total unit cost = Rs 8000.
- Rental collected: 6000/-
- (Assuming 15 hrs of utilization in a particular season)
- Labour consumed for 5 acres: 5 nos
- (Per labour wages 200 per day: Rs.1000)
- Power tiller running cost for 5 acres: Rs 1000/-
- Miscellaneous cost: Rs 1000/-.
- Total cost saved: Rs 5800/-.
- Payback Period =  $8000/5800 = 1.3 \approx 1.5$  Seasons. Allowing this setup for rent basis, with in 20hrs the amount spent to fabrication of the unit maybe recovered.
- A saving of 1hr/acre and 1 labour/acre may be achieved with seed feeder while compare with conventional seed feed in agricultural lands.

## 9. Conclusion

This work described a novel idea of developing a seed feeder attachment to mount on a power tiller machine at a cost of Rs.8000/- and to use in the agricultural works. It helps the farmers to reduce the amount spent towards seed feed process. A saving of 1hr/acre and 1 labour/acre may be achieved with seed feeder while compare with manual seed feed in agricultural lands. Without additional linkages the Seed feeder is mounted on the power tiller. The payback for the seed feeder is found to be less than two seasons.

## 10. Reference

1. Ademiluyi SY, Oladele OI. Field Performance of VST Shakti Power Tiller On sawah rice plots in Nigeria and Ghana Bulgarian Journal of Agricultural Science. 2008; 14(5):517-522.
2. Veerangouda M, Sushilendra ER, Anantachar M. Development and evaluation of multipurpose tool carrier for power tiller Karnataka J Agric. Sci. 2011; 24(5):704-705.
3. Kumar S, Mishra BP, Patel SK, Dave AK. Design and development of power tiller operated seed-cum-ferti till-drill machine African journal of agriculture and research. 2014; 9(51):3766-3781.
4. Hand book of Agricultural machinery terminology Indian standards ISBN. 81-7061-022-2.
5. Agricultural Engineering and Technology Dare/Icar Annual Report, 2006-2007, 124-144.