DEVELOPMENT OF SEEDER FOR PLUG TRAY

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ABSTRACT

The objective of this project was to develop the seeder for plug tray to reduce the labor cost and the operation time for sowing in plug tray. Papaya seeds were used for testing on this machine. The plug tray used for testing have 60 cells per one tray. The dimensions of machine developed were 1,044 mm (width), 679 mm (length), 1,348 mm (height). The important components of machine consisted of the seed hopper, the seed metering device, the seed releasing units, the soil compressing units and the depth controlling units. The metering device was established by plastic sheet. The plastic rod cut into groove along its axis for keeping seeds were inserted into the seed metering device in order to move the seeds from the seed hopper to the flexible tube. The flexible tube brought the seeds into seed releasing units located under the part of seed metering device in order to drop the seeds 1-2 seeds per cell of plug tray. The seed metering device were set 3 units, 1 unit for releasing seeds on 20 cells of plug tray, on the seeder frame. Chain drive mechanism was set to drive the system for releasing seeds on plug tray. Testing the efficiency of releasing seed on plug tray of machine was equal to 79%. For operation time of sowing in plug tray, Comparing between this seeder and human-hand found that the sowing by the seeder was 7.88 times quicker than the sowing by human-hand.

Key words: seeder, plug tray, seed, pneumatic seeder

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INTRODUCTION

At present for planting in Thailand, Most farmers have sown the seeds on soil surface directly. This method certainly affects pre-germination of seed sown on soil due to unsuitable condition for germination that effect to the quantity of production after harvesting such as inconsistency of germinating seed on ground, the problems of pest and weed management and low germination rate. For solving these problems, the agricultural extension officers in Thailand try to suggest farmers another method for sowing in order to increase their agricultural product. Therefore, the seed sowing in plug tray is promoted to the farmers. Normally, the seed sowing in plug tray can be divided into 2 types. 1) Hand sown seed (the seeds are sown in plug tray by human hand) usually is used to prepare plug trays sown already in small scale farming because it have to spend a lot of time to drop seeds into each cell of plug tray by hand, but it is inexpensive to operate this way. 2) Machine sown seed (seeds are sown in plug tray by machine) is normally used for preparing plug trays in middle or big scale farming and also their operation time are quicker than hand sown seed method, but the cost of seeding machine are so expensive for local Thai farmers to buy them and the complexity of machine in working system is the main problem for maintenance by local Thai farmers. For many this reason as well, this machine were established to develop the seeder for plug tray in order to be newly alternative way of seeding machine for local Thai farmers.

MATERIAL AND METHODS

1. Types of seed used with this machine

The development of seeder was initially designed to sow the seeds which have quite spherical shape and are practically sown in plug tray. The seeds selected for using with this machine will be tested to study their physical properties in the following sequence. 1) The average size of seeds. 2) Angle of repose of seeds. 3) The coefficient of friction between seeds and materials used for design machine. All factors will be used to design this machine further.

2. Design consideration of seeder for plug tray

Dimension of plug tray is important to define the size of machine. The plug tray used for design machine must be easily purchased and generally used for sowing in local Thai farmer. The seeder developed would be mainly consisted of 1) Seed hopper, to keep seeds in suitable condition. 2) Seed metering device, to define the amount of seeds released into each cell of plug tray. 3) Soil compressing units and seed releasing units, to indent soil surface and release seeds in soil all cells of plug tray, respectively. 4) Depth controlling units, to be able to define the depth of released seed from soil surface. 5) Machine controlling unit, to control a machine for releasing seeds on the plug tray. However, the present study was undertaken to develop the seeder for plug tray, using indigenous materials, getting convenient operation and saving energy.

3. Testing of the seeder of plug tray

The efficiency evaluation of the seeder was carried out by sowing seeds selected in the plug tray selected are as follows.

3.1 The efficiency of seeder in term of released seed in the plug tray.

$$\text{The efficiency of seeder for releasing seeds (\%)} = \frac{\text{Amount of cells have seeds released}}{\text{Total cells of a plug tray}} \times 100$$

3.2 The operation time of seeder

$$\text{The operation time of seeder (trays/time)} = \frac{\text{Amount of plug trays were operated}}{\text{Operating duration}}$$

RESULTS AND DISCUSSION

1. Types of seed used with this machine

The seeds used for testing in this machine have to be quite spherical shape in order to be easy to design the prototype seeder. From study in this point found that papaya seeds were suitable to bring for design and testing of the seeder of plug tray because it was necessary to sow papaya seeds into plug tray before planting in the soil and also papaya seeds is cash crop in Thailand. The testing results of physical properties of papaya seeds were as follows.

1.1) Average size of papaya seeds were carried out by measuring of 100 samples of papaya seeds. The results of measured seeds found that the average width of papaya seed was equal to 4.5± 0.5 mm. and the average length was equal to 6.6 ± 0.82 mm.

1.2) Angle of repose of papaya seeds was carried out by specific instrument. This test was repeated of 5 times. Its result found that the papaya seeds tested had the angle of repose of 33.02 ± 2.1 degree.

1.3) Angle of friction, AOF, between papaya seeds and materials used for design this seeder were tested by specific instrument in order to be pre-data for design and development this seeder. This experiment was repeated to test of 3 times and the materials which were tested with papaya seeds for finding the AOF values were metal sheet, Acrylic sheet and Flexible tube. Their results found that AOF of each material with papaya seeds were equal to 35.7±3.27, 37.7±2.75 and 39.1±2.6 degree, respectively.

In the results of the above, Average size of papaya seeds, Angle of repose of papaya seeds and AOF of between papaya seeds and materials used for design this seeder. They would be important data to design and develop this seeder further.

2. Design results of seeder for plug tray

From studying plug tray which is suitable for using with this seeder found that the plug tray selected had a size of 60 cells (75x45cm.) because this plug tray is generally used by Thai farmer for preparing nursery plug tray in Thailand. The important components of seeder for plug tray developed is shown in figure 1.

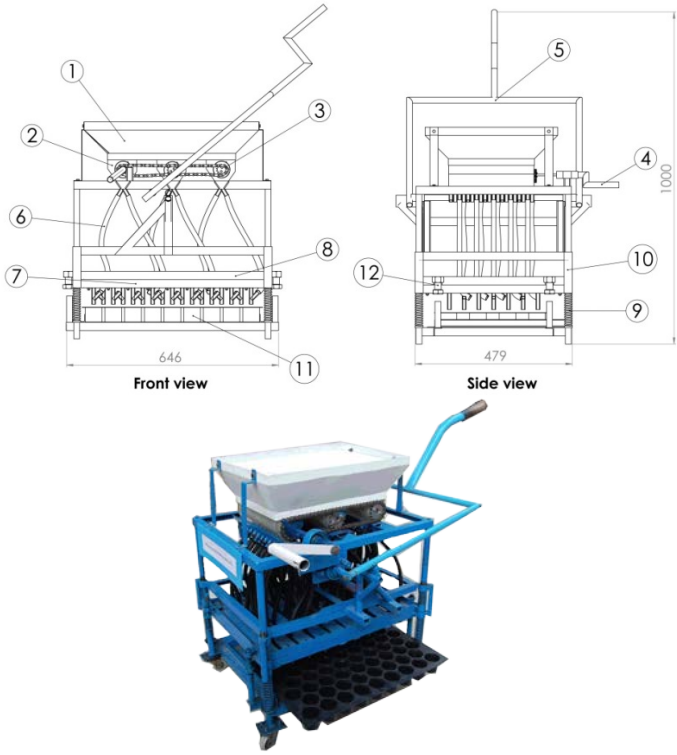

Fig. 1. Prototype seeder for plug tray.

Number	Part
1	Seed hopper
2	Seed metering device
3	Chain driven system
4	Handle-1
5	Handle-2
6	Flexible tube
7	Soil compression units
8	Seed releasing units
9	Compression spring units-1
10	Compression spring units-2
11	Plug tray
12	Depth controlling units

Tab. 1. Parts of prototype seeder for plug tray.

The operational sequence of seeder for plug tray began to place the plug tray into the tray receiving channel of prototype seeder. The seed hopper was filled by seed selected for sowing on plug tray.

The depth controlling units were adjusted to define the depth of released seed in the cell of plug tray. Hand-1 was rotated around 180 degrees clockwise by hand to control the seed metering device in order to move seeds from seed hopper to seed releasing units equipped below the seed metering device and then hand-1 had to be rotated around 180 degrees counterclockwise for keeping original position. Hand-2 was halfway pressed by hand to control the soil compression units to indent the soil on all cells of plug tray. Finally, pressing hand-2 all the way for controlling the seed releasing units to release seeds into all cells of plug tray. The hand-2 would be moved to initial position by compression spring units-1 automatically. Seeds would be completely released into all cells of plug tray in one operation cycle of seeder.

3. Test results of seeder for plug tray

The plug trays of 10 trays were conducted to test about the efficiency of seeder in term of released seed in plug tray and the operation time of seeder. Testing found that the efficiency of seeder in term of released seed in plug tray was equal to 79%, and the operation time of seeder was equal to 117 second (10 trays) or 11.7 second per tray. On other hand, the operation time of seed sown in plug tray by human hand was equal to 921.53 second (10 trays) or 92.15 second per tray.

CONCLUSIONS

The seeder for plug tray developed was initially tested in order to sow the papaya seed into the plug tray of 60 cells. Resulting found that their efficiency for releasing seeds on plug tray have a value of 79% . For operation time of sowing of seeder and human hand, Comparing the operation time of sowing in plug tray between this seeder and human-hand found that the sowing by the seeder was 7.88 times quicker than the sowing by human-hand.

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