

# Fertilizer Delivery Kit

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## ABSTRACT

Agriculture being the backbone of Indian economy has several simple problems which are not yet solved even after the advent of globalization. It plays a critical role in growth and development of Indian economy [1]. One such simple problem which is to be eradicated is the delivery of fertilizer to the plants by labours. Fertilizer for a plant plays a major role because the crops which are cultivated these days must be harvested soon for a productive purpose. At first there has been a decline in the trend growth rate of production as well as productivity for all most all the crops from the mid nineties. Second there is an excessive dependence of a large section of the population on Agriculture [2]. Meanwhile it results in a raise in economy due to high yield and production rates which are the indirect factors of a crops yield. For any plant the fertilizer which is to be delivered must be kept on the stem-root junction for a greater effect. Nutrient management is the key issue in sustainable soil fertility [3]. This process is done by spending a high amount of human work by placing the fertilizer right at the spot by labours. A spark ignited us to solve this problem by introducing equipment which eliminates the physical pain caused to the labours by the

bending down process. The result is the 'Fertilizer Delivery Kit' which could be used as we move across and enables the user to deliver the right amount of fertilizer to the plant as per the user's wish.

**Key Words:** Agriculture, Fertilizer, High Yield, Root Stem Junction.

## 1. INTRODUCTION

Our economy mainly depends on agriculture. But we are lacking a lot of technologies in Indian agriculture. Nowadays many problems have been faced by Indian agriculture. The availability of labours is one of the main problem [4]. The farmers have adapted various strategies in agriculture such as use of family labour, increased use of machinery and hired labour from outside the villages [5]. 30 to 50% of crop yield is attributable to commercial fertilizer nutrient inputs [6]. Uniform and correct amount of fertilizer should be placed for vegetable plants, human energy is wasted at high level and more time consumption are the main problems faced while placing fertilizer for vegetable plants. The farmers need to bend down to keep the fertilizer at a right place. It leads to back pain. If the fertilizer is more than

the required amount, it leads to death of the plants. To reduce the burden of the farmers while we designed a kit that is used for placing fertilizer.

## 2. PRINCIPLE

i) A particle which is negligible (example: sand) tends to flow like a liquid and maintain continuum.

ii) Every action has equal and opposite reaction (e.g. Spring).

## 3. MAIN PARTS

### 3.1 Storage Bag

Fig. 1 shows the shoulder bag which is used for storing the fertilizer. The bag is completely made of rexin. The mass of the bag is 420g. About 5kg of fertilizer could be stored in the storage bag.



Figure 1: Storage Bag

### 3.2 Connecting tube

Connecting tube as shown in fig. 2 is used for connecting the storage bag and the ejector tube. The mass of the connecting tube is 180g (without fertilizer). It is made out of simple plastic hose.



Figure 2: Connecting Tube

### 3.3 Specially Designed Ejector Tube

It is the main part of the kit. The capillary tubes, short tube orifices, and expansion valves are used as robust and cost-effective solutions [7]. This ejector tube is designed for the purpose of delivering right amount of fertilizer for each plant at a right place. This tube is made out of poly vinyl chloride pipes (PVC). The tube is opened and closed by using spring action. It consists of two parts i) outer body ii) plunger [8].



Figure 3: Plunger

These are all the main parts present in the kit. There are many accessories things that are required they are:-

- i) Springs – 4 No's
- ii) Closure Caps – 2 No's
- iii) Washers – 2 No's



Figure 4: Ejector Tube

#### 4. BASIC DESIGN

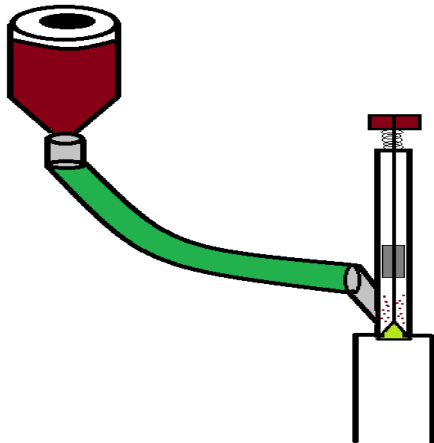


Figure 5: Basic Design

Fig.5 shows the basic design of the fertilizer delivery kit. The storage bag is connected to the ejector tube through the connecting tube. The ejector tube consists of plunger which is used for the opening and

closing of the ejector tube. The plunger consists of two stoppers. One is used to stop the loaded fertilizer in the ejector tube and the other one for stopping the fertilizer in the connecting tube when the fertilizer is being delivered to the plant. In order to prevent the spreading of fertilizer, a PVC pipe of larger diameter is connected to the ejector tube. We face a lot of problems while fabricating this kit. The first one is air flow. It is eliminated by perforating the lid of the container. The second one is friction. It is eliminated by coating a layer of special spongy material.

#### 5. WORKING

When the fertilizer is loaded in the bag, it falls through the connecting pipe by means of gravity. Gate valve is used which restricts the flow of fertilizer from connecting tube to the ejector tube. When the gate valve is opened, the required amount of fertilizer (say 14g according to the survey) is loaded in the ejector tube. When the handle is pressed, the conical shaped stopper gets down into the large diameter pipe creating a gap for the flow of fertilizer. At the same time, the cylindrical stopper which is attached to the tube leading from handle prevents continuous flow of fertilizer by blocking the connecting tube junction. When it is released, the conical stopper and cylindrical stopper get back to their original position due to spring action. Next loading in the ejector tube takes place and the whole process is repeated.

#### 6. AMOUNT DROPPED PER PRESS

$$\begin{aligned}
 &\text{Volume Dropped Per Press} \\
 &= (\text{volume of the pipe} - \text{volume of cone}) \\
 &= [(3.14/4) \times (31.75)^2 (21) - \\
 & (1/3)(3.14)(15.875)^2 (10)] \\
 &= 13980.146 \text{mm}^3
 \end{aligned}$$

Approximately 14g of fine sand (while preliminary testing)

## 7. FACTS ABOUT THE PRODUCT

- Amount taken for producing the Prototype - **Rs.640**
- Amount taken if produced in a large scale - **Rs.450**
- Quantity dropped for a single press - **14g**
- Maximum capacity of the fertilizer storage container - **5kg**
- 5kg of fertilizer could be used accurately (single press) for **~357plants**
- Total weight of the setup = **7kg**

## 8. PLANTS FOR WHICH THIS KIT IS SUITABLE FOR

{Most vegetable plants}

- Tomato
- Radish
- Brinjal
- Lady's Finger
- Tapioca

## 9. TYPES OF FERTILIZERS THAT ARE SUITABLE

(All solid grainy fertilizers)

- Urea
- Potash
- Compost
- Dry grainy manure (organic & inorganic)

## 10. CASE STUDY

- Plant surveyed = Bottle Guard
- Area = Sathyamangalam
- Fertilizer used = urea
- We used single press (14g)
- Fertilizer delivery rate = 12plants per minute
- Larger scale feeding =

- 357 plants fed 14g of fertilizer if 5kg is filled initially.
- Rate of Area covered = 20 minutes per acre
- (without kit 45 minutes per acre)

## 11. ADVANTAGES

- Right amount can be placed.
- High fertilizer placing rate
- Accurately placed.
- Even unskilled labour can do it.
- Cost efficient (Rs. 640).  
{Even lesser cost for mass production}
- Time Saving.
- Reduces man force.
- Portable(easily mantled and dismantled)
- Suitable for women too.

## 12. DISADVANTAGES

- Manually operated.

## 13. CONCLUSION

A machine which is loved and accepted by large no. of farmers (by our own survey) and gives them no worries by placing the right amount of fertilizers in plants.

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