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Development and Performance Evaluation of Raised Bed Preparator

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ABSTRACT:- Raised bed farming is recent phenomenon developed to overcome water logging and improve soil structure on cropping soils in the high rainfall zone. During the cool growing seasons, perched water tables can develop following rainfall due to the high clay content and low permeability of the subsoil, often resulting in complete crop failure when grown on flat or gently sloping ground without drainage. Raised Bed Farming is not a new idea. In Asia and other parts of the world, soil beds have been raised and furrows used for irrigation for centuries. In many countries including Australia, the technique has been used for many years by farmer and commercial vegetable and flower growers to assist with drainage. The development in the raised bed frame is undertaken to adjust spacing for different vegetable crops. The system has been widely adopted for grain and horticultural crop production.

Keywords:- Soil structure, Permeability, Raised bed farming, Water logging, Drainage.

I. INTRODUCTION

The Furrow Irrigated Ridge-till Bed-planting System is a method where cultivation of crops is done on raised beds. Typically, the soil is cultivated to depths of up to 30 cm and then formed into narrow beds of between 1.0 to 2.0 m in width. Soil from the furrows positioned down each side of the beds is thrown on the tops of the beds, resulting in an increase in the height of the soil of between 2 and 5 cm. The height of the bed above the furrow base is usually between 15-30 cm, depending on the depth of the prior cultivation. The furrows act as pathways for drainage, providing there is some slope in the paddock to allow water to run down them. In the system adopted crop is generally sown in the furrows without fertilizer, to minimize erosion and reduce nutrient loss in runoff. This system is suitable for the vegetable crop, wheat crop and groundnut etc. In the crop sequences where wheat follows soybean, maize or cotton, a system of reduced tillage can also be followed whereby sowing can be done directly on the same beds without field preparation. If wheat follows rice then it requires a fine seed bed preparation followed by sowing of wheat on raised beds. Where soil is of poor quality and drainage inadequate, raised bed makes it simple to create patches of fertile, well-drained soil. It is considerably cheaper and less effort than installing a drainage system.

Raised beds tend to drain away excess moisture better than ordinary beds. This is another advantage that helps the plant roots to breath. In areas that have saturated soil and many areas of the raised beds may be the only way to grow many types of plants. Soil conditions and types can be controlled more efficiently in a raised bed and they can be varied easily from bed to bed. Raised beds are the answer when topsoil is thin. Water, fertilizer, compost, mulch, etc. can be applied more carefully because they only need to be applied to the garden beds. Various studies have shown that raised garden beds produce 1.4 to 2 times as much vegetables and flowers per square foot as ordinary beds, mainly due to the above advantages.

II. IMPORTANT OF RAISED BED PREPARATOR

Good drainage is especially important in vegetable beds. Both the soil and the location determine how well a raise bed will drain.There are different types of raised bed preparators like row crop bed shapers,disc hillers, box blades which are beneficial to make raised beds. In view of this the present project was undertaken with objectives to modify the design of existing raised bed preparatory by adding one more furrow opener and to evaluate the performance of modified raised bed preparatory.

III. LITERATURE SURVEY

Tisdall and Adem, Tisdall and Adem, (1988)Stated Raised Bed Farming is not a new idea. In Asia and other parts of the world, soil beds have been raised and furrows used for irrigation for centuries. The overall cost of cultivation was reduced by 8.56 percent. D.K. Grover, Joginder Singh, Ranjeet Singh and S.S. Dhillon et al (PAU)(2002-03) Stated that during the last few years serious efforts have been made to evolve resource conservation technologies. Development of the bed planting system for increasing the yield and input use efficiencies under different cropping systems is one of these efforts.

Blackwell et.al., Ellis et.al., Tullberg, Tullberg et.al., 2003). Stated that by their very nature, raised beds encourage implements to travel down the furrows, which reduces the amount of soil compaction occurring where the plants are growing. Soils that aren't compacted have a greater ability to hold plant available water are less cloddy, allow for greater plant root growth and give higher plant yields. Raised beds offer a form of controlled traffic, the benefits of which have been proven in many areas and over many years.Bruce Wightman et. al, (2003)Stated although some people regard raised beds as just a method to reduce risk, it is believe that they provide a cropping system where the grower can have more control over a broad banner of variables. Rainfall use, water movement, soil health, crop health, crop growth and yield are all variables that the raised bed program can have a significant impact over. The whole process of development of raised beds has been a team effort including farmers, machinery manufacturers, agronomists and researchers.

IV. MATERIALS & METHODS

A. METHODOLOGY

Generally, seed beds are formed by manual labor with the help of spade.It is more time consuming method as well as requires more labor to form beds in the field which is costlier method. It means that traditional method is not economical for raised bed formation.

B. PROPOSED METHODOLOGY

This raised bed preparator is adaptable to all types of the soils, showing different results on black cotton soil, loamy soil, sandy soil, etc. For better result, it requires fine tilth soil prepared by ploughing and rotavator operations. The frame is attached to cultivator for support. It has tractor drawn and better raised beds are formed of fixed width & different depth by shifting the depth control lever.

C. COMPONENTS OF RAISED BED PREPARATOR**:** Main attachment angle bar, Angle bar, Furrow openers, Flat MS plat, Dimensions of raised bed preparatory, The overall dimension of the raised bed is given under the diagram:

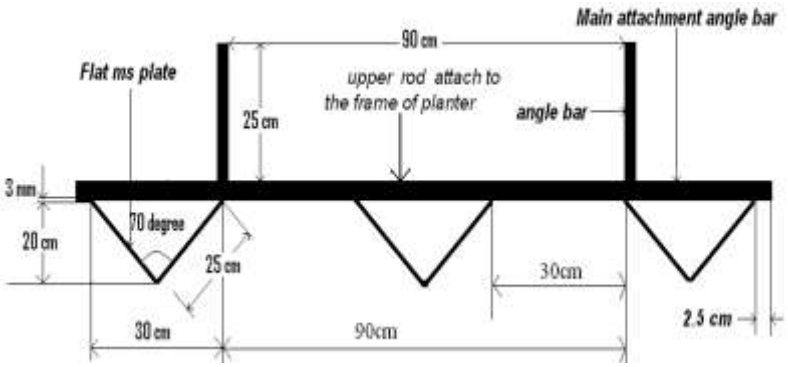

Fig. 1 Front view of raised bed preparatory

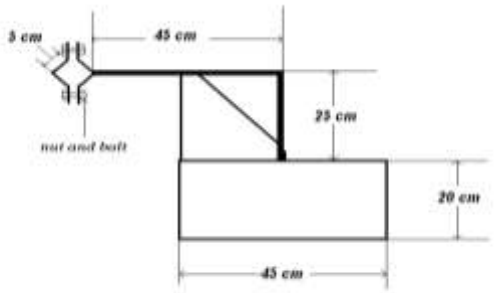

Fig.2 Side view of raised bed preparator

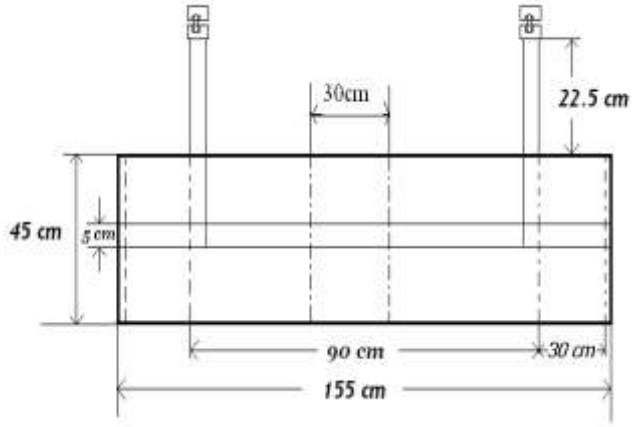

Fig.3Top view of raised bed preparator

Fig.4 Raised bed preparator frame

Fig. 5 Raised bed preparator attached with cultivator

Fig.6 Actual working of the raised bed preparator in field

Test condition data for performance evaluation

1. Machine parameter
1. Power source : Tractor (45 HP)
2. Name of implement : Raised bed preparator
3. Size of implement : 1.55x0.45 m
2. Field parametera. Type of soil : Black cotton soil b. Plot size: 2924m²

V. RESULT & DISCUSSION

Table I Performance report Raised Bed Preparator.

Sr. No	Parameter	Values
1	Size of plot	68 × 43 m
2	Number of Furrow openers	03
3	Number of bed formed	02
4	Area covered per pass	105.4 m²
5	Depth of Bed	20 cm
6	Width of bed	30 cm
7	Duration of test	0.70 hrs
8	Effective field capacity	0.42 ha/hr
9	Theoretical field capacity	0.47 ha/hr
10	Field efficiency	89.36%
11	Cost of operation	Rs 578.71 per hr

Table II Cost Analysis for preparation of Raised Bed.

Sr. No	Particulars	Traditional Method	Raised Bed Preparator Method
1	Width of Bed	30 cm	30 cm
2	Width of Furrow	30 cm	30 cm
3	Depth of Furrow	20 cm	20cm
4	Plot Area	2924 m^2	2924 m^2
5	Labor Requirement	10	11
6	Time required to cover 2924 m² (hrs)	20	13
7	Time required to cover 1ha	68	47
8	Cost of operation (Rs/hr)	6840	1978

The raised bed preparation method is highly efficient as compared to traditional method.

VI. DISCUSSION

The use of raised beds can have several advantages depending on the circumstances.

A. Better drainage:

Raised beds are primarily a field drainage structure aimed at decreasing water logging and increasing crop yields. When soil becomes saturated with water, as is the case for many 'texture contrast' soils anaerobic conditions result in poor plant root growth, and in some cases under prolonged water logging, plants will die. Where soil become saturated in monsoon due to high rainfall and/or poor drainage, and then soil drainage needs to be considered.

B. Better soil structure:

The raised beds encourage implements to travel down the furrows, which reduce the amount of soil compaction occurring where the plants are growing. Soils that aren't compacted have a greater ability to hold available plant water are less cloddy, allow for greater plant root growth and give higher plant yields.

C. Risk management:

The failure of crops due to water logging is eliminated.

D. Higher profits:

Due to more uniform and higher yielding crops under situations where waterlogging would normally be a problem, higher profits can be realized. An increasing of yields has meant considerably more profit for farmers using raised bed technology.

E. More Efficient Fertilizer and Water Use

With raised beds, fertilizers can be placed when and where the plant can use it most efficiently. If nitrogen is applied just when the plant starts to pull it rapidly from the soil, yields increase, protein content improves, and the grain's nutritional value is enhanced. Researchers have also determined that by applying nitrogen at certain times, the amount applied can be reduced and less nitrogen is wasted through "leakage" into the environment.

F. Lower Production Costs

Bed planting achieves cost savings by:

- reducing the amount of N applied;
- reducing nitrogen loss;
- Lowering the number of tillage operations;
- lowering seeding rates;
- reducing lodging;
- facilitating mechanical and manual weeding;

G. Environmental Benefits

- improving water use efficiency and conservation (important as water becomes scarcer);
- reducing the need for applying herbicides;
- helping to control erosion;
- providing environmentally friendly options for managing crop residues;

F. Modification Benefits

- Due to modification, the frame can be used to make raised beds for different vegetable crops like cabbage, cauliflower grain crops like wheat, pulses like green gram, black gram, oil seeds like groundnut etc.
- The middle furrow opener of modified raised bed preparator is attached by nut-bolt to the main frame. Therefore, the spacing can be adjusted easily using modified frame according to the requirement.

VI. SUMMARY

The project was undertaken to evaluate the performance of raised bed preparator. In view of objectives set for the study the relevant literature was referred and followed for methodology and to do operations of raised bed preparator. From the results obtained it is evident that the efficiency of raised bed is preparatory is 89.36%, the furrows and beds formed are of uniform width (30cm)and depth.(20cm)after spade work.

VII. CONCLUSION

1) From the result it is cleared that time required to cover 2924 m² area is 20 hrs for traditional method and for raised bed preparator time required to cover same area 13 hours. Which indicates that raised bed preparator methods saves time by 7 hours.

2) Labor required for preparation of beds by traditional method are 10 in number while on other hand labor required for raised bed preparator method are 11 including one tractor operator.

3) As well as time required to cover one hectare by traditional method is 68 hours, on other hand time required to cover one hectare by raised bed preparator method is 47 hrs which indicates that raised bed preparator saves time by 21 hours.

4) Cost of operation for traditional method of raised bed preparation is Rs 6840 per hectare and for raised bed preparator method cost of operation is Rs 1978 per hectare which saves money by Rs 4862 by adoption of raised preparator method.

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