DEVELOPMENT OF PULLING TYPE MANUALLY OPERTED WEEDER

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ABSTRACT

The yield of crop can be increased by using quality seeds of high yielding varieties, using proper agricultural practices and by preventing yield loss due to natural factors like weeds, insects, rodents, etc. Out of these natural factors, weed is one of the most important factor. The qualitative and quantitative crop protection depends upon the effectiveness and timeliness of weeding. Weeding operation mainly done by following different methods such as chemical, mulching, crop rotation and mechanical methods, for which various tools are to be used. Moreover, the interculturing is also an important operation for removing the weeds and to prevent their growth 2 to 4 inter-culturing operation are being performed depending upon soil and plant condition. Keeping in view along with the problems of fragmented land and cropping pattern, pulling type manually operated weeder has been developed with specific features by Junagadh Agricultural University, Junagadh. The developed weeder can work up to 4.0 cm depth of operation with field capacity of 0.0104 ha/h and power input 0.042 hp. Higher weeding efficiency (up to 81.72 %) was obtained by the use of this weeder. The performance index of the developed weeder was obtained up to 2050. The developed weeder was tested in 24 % soil moisture content at working depth of 4.0 cm at a speed of 16.37 m/min.

KEY WORDS: Pulling type manually operated weeder, weed

INTRODUCTION

India is a vast country having agriculture sector as the backbone of its economy. India has total land acquisition of about 329 million ha, out of which 166 milion ha of land is under cultivation. The population of India is more than 120 crore and is increasing day by day at an alarming rate. Hence, it is required to produce more food to meet the needs of growing population. This can be achieved only by either increasing the land under cultivation or by adopting the farming techniques which would increase the crop yields. As it is not possible to increase the land under cultivation, the left option is to increase the crop yield. The yield of crop can be increased by using quality seeds of high yielding varieties, using proper agricultural practices and by preventing yield loss due to natural factors like weeds, insects, rodents, etc. Out of these natural factors, weed is one of the most and quite important factor. As per the available estimates, weeds cause up to one–third of the total losses in yield, besides impairing produce quality and various kinds of health and environmental hazards. In their response to the survey carried out for the present chapter, Indian weed scientists estimated losses due to weeds from 10–80 per cent. Even the lowest estimate of 10 per cent loss would amount to a loss of about 25 M t of food grains, currently valued at approximately US$ 13 billion (Yaduraju, 2012).

Moreover, the inter-culturing is an important operation for removing the weeds and to prevent their growth. Generally, 2 to

4 interculturing operations are performed depending upon soil and plant conditions. Manually operated weeders are available in India are not used in Gujarat at great extent, as they are not suitable for the region or requires modifications. Keeping in views the problem of farmers such as fragmented land and cropping pattern, it was necessary to develop pulling type manually operated weeder with specific objectives like to study the existing practices of weeding, to design and develop manual operated weeder and to evaluate the performance of the weeder.

MATERIALS AND METHODS

Blade

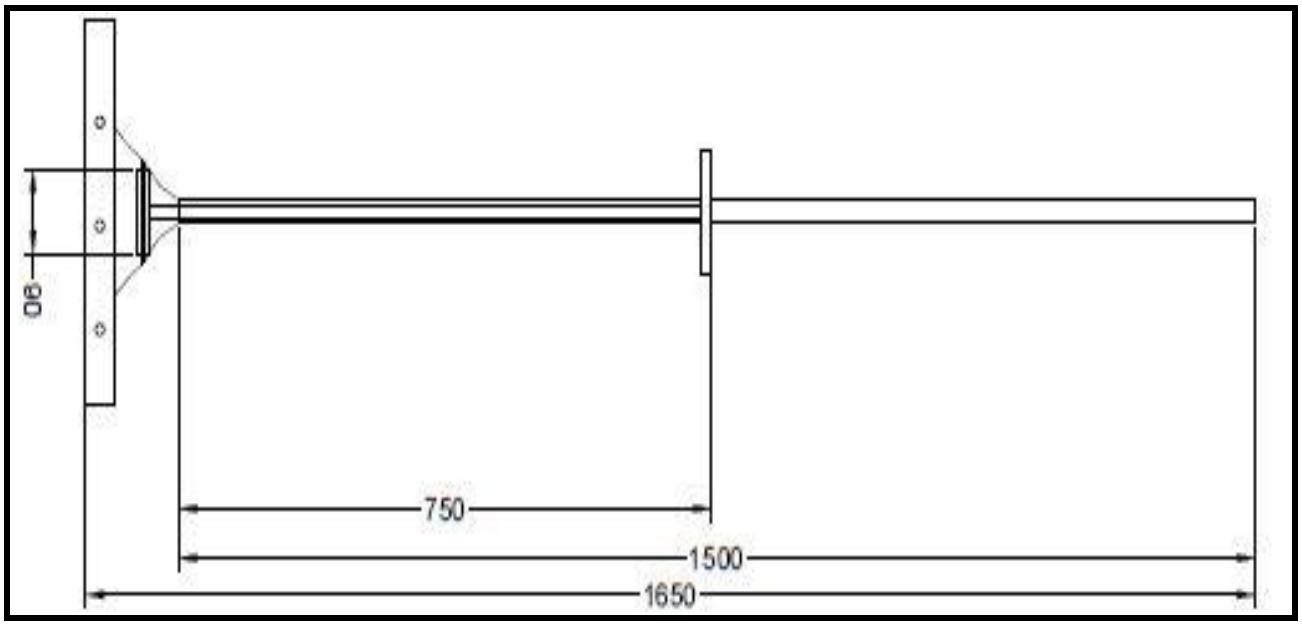
It is made of high carbon steel know as "Charkha blade". It serves two purposes first to minimize the root damage and second to provide sliding action so root may not stick to the blade. The width and length of the blade are 40 mm and 410 mm, respectively. It is designed to work in the soil under the interaction of different soil forces. Therefore, the metal selected is strong enough to sustain the prevailing forces as well as to support the load of the implement. The blade is sharpen at the lower end, so it can penetrate into the soil at proper angle and desired depth.

Main Frame

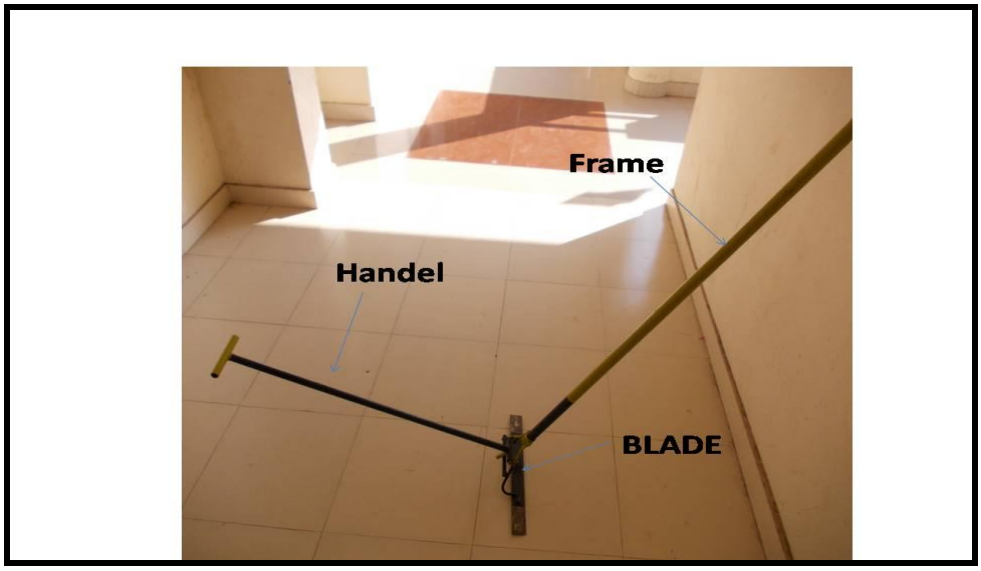
It is fabricated from galvanized iron pipe, 1500 mm long and 25 mm diameter. One end is welded with blade assembly. It has also provision for pulling weeder. Its main function is to pull the implement. Its outer diameter is 15 mm. It is light in weight for easy handling and transporting. Its height is depends on the worker age and ergonomic point of view.

Handle

It is most important part of the weeder. It is fabricated from the galvanized iron pipe of 750 mm length and 15 mm outer diameter. The desired height of the handle from the ground surface is obtained with the adjusting support. The handle is joined to the main frame with the help of handle pipe. As far as ergonomic consideration the average weight and stature of weeder operator was 55.25 kg and 163.12 cm, respectively (Yadav and Pund, 2007).



Schematic View of Pulling Type Manually Operated Weeder



Pulling Type Manually Operated Weeder

RESULTS AND DISCUSSION

Verma and Bhardwaj (1958) compared the hand weeding to digging by spade. They suggested that inter cultivation by bullock drawn implements is successful. Bemacki *et al.* (1972) suggested that various types of cutting blades are used in manually operated weeder, where weeders are continuously pushed; V-shape sweep is preferred. The tool geometry of these cutting blades is based on soil-tool-plant interactions. They also reported that the specific soil resistance (R_s) for shallow weeding up to a depth of 150 mm is encountered 0.2 kg/cm^2 for heavy soil, was taken for the computation of width of the sweep. In manual weeding this depth seldom exceeds 25-30 mm. Keeping all these idea in view, pulling type manually operated weeder was developed.

The results on the performance of pulling type manually operated weeder are described as under:

1) ***Speed of operation:*** The developed weeder was tested in 24 % soil moisture content at working depth of 4.0 cm at a speed of 16.37 m/min.
2) ***Theoretical field capacity:*** During field test, the theoretical field capacity was observed as 0.0104 ha/hr.
3) ***Effective field capacity:*** By considering the time loss, the effective field capacity was observed as 0.0089 ha/hr.
4) ***Field efficiency:*** Field efficiency was obtained as 86.25% in vegetable crop.
5) ***Weeding efficiency:*** weeding efficiency was calculated by following formula:

   E = (W1-W2/ W1) x 100
   E = Weeding efficiency (%)
   W1 = Number of weeds before weeding
   W2 = Number of weeds after weeding.
   E = (93-17/93) x 100
   = 81.72 %
6) ***Draft requirement:*** Draft was measured with the help of spring type dynamometer and it was calculated by following formula:

   $D = P \times \cos^0$
   $= 15 \times \cos 45^0$
   = 10.605 kg
7) ***Power requirement:*** to operate the manually operated weeder, the power requirement was observed as 0.042 hp.
8) ***Performance index:*** Performance index measured as 2050.
9) ***Suitability of developed weeder:*** The developed manually operated weeder is easy to operate and suitable for shallow weeding up to the depth of 4.0 cm. The

developed weeder is not only suitable for wider row spacing, but alos suitable for narrow row spacing. As far as physiological aspect is concern, one can operate it easily as handle height and angle can be adjusted as per requirement. There is also a provision of blade replacement according to row spacing.

CONCLUSION

From the results, it can be stated that the developed manually operated weeder is easy to operate and suitable for shallow weeding up to the depth of 4.0 cm. The developed weeder is not only suitable for wider row spacing, but alos suitable for narrow row spacing. As far as physiological aspect is concern, one can operate it easily as handle height and angle can be adjusted as per requirement. There is also a provision of blade replacement according to row spacing.

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