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PERFORMANCE EVALUATION OF WEEDERS

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Abstract: An experiment was conducted to evaluate the field performance of different weeder namely khurpi, push type cycle weeder and power weeder were carried out in department of agricultural engineering, UAS, Bangalore. Various parameters such as weeding index, weeding efficiency and field capacity of the weeder were considered during the test. The highest field efficiency was obtained for khurpi (91.5 per cent) followed by cycle weeder (85.4) and power weeder (71.25 per cent). The field capacity of 0.065, 0.025 and 0.035 ha/hr respectively observed for power weeder, khurpi and push type cycle weeder. The maximum value of cost of operation was found for khurpi (1750/ha) while minimum was recorded for push type cycle weeder.
Keywords: Weeding, weeding efficiency, field capacity.

Introduction

A weed is essentially any plant which grows where it is unwanted. A weed can be thought of as any plant growing in the wrong place at the wrong time and doing more harm than good. Weeds waste excessive proportions of farmers' time, thereby acting as a brake on development. Weeding is one of the most important farm operations in crop production system. Weeding is an important but equally labour intensive agricultural unit operation. Weeding accounts for about 25 % of the total labour requirement (900–1200 man-hours/hectare) during a cultivation season (Yadav and Pund, 2007). In India this operation is mostly performed manually with khurpi or trench hoe that requires higher labour input and also very tedious and time consuming process. Moreover, the labour requirement for weeding depends on weed flora, weed intensity, time of weeding and soil moisture at the time of weeding and efficiency of worker.

Weeds compete with crop plants for nutrients and other growth factors and in the absence of an effective control measure, remove 30 to 40 per cent of applied nutrients resulting in significant yield reduction (Goel *et al*., 2008). There is an increasing concern over the intra row weeder because of environmental degradation and growing demand for the

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food. Today the agricultural sector requires non-chemical weed control that ensures food safety. Consumers demand high quality food products and pay special attention to food safety.

The most common methods of weed control are mechanical, chemical, biological and cultural methods. Out of these four methods, mechanical weeding either by hand tools or weeders are most effective (Manjunatha *et al*., 2014). But mechanical methods and intercultivation using agricultural implements are being practiced in many regions. But still the time spent in the field, the drudgery of the operator and the requirement of animal power are some of the points of concern in weed control (Veerangouda *et al*., 2010). As different methods of intercultivation are practiced in this region, there is a need to evaluate the performance of these weeders.

Materials and Methods

The constructional details of the different weeders namely hand khurpi, push type cycle weeder, and power weeder and the parameters involved in the field performance of the different weeders have been explained below.

The khurpi consists of a curved mild steel blade and a wooden handle. The blade has cutting edge on its outer surface and tong at the end. The tong is inserted firmly into the wooden handle. It is a manual push type of implement and has to be operated in the bending or sitting posture. The implement can be fabricated by the local village artisans.

Push type Cycle weeder consists of bicycle parts of front axle, wheel hub and wheel for transportation. The parts of cycle weeder is Hub, Sprocket, Front Fork and back fork, Cycle hand, Pipe, Blade. V- Shaped blade was used for weeding. The V- shaped weeding tool made from the hardened steel was attached to fork with help of U-clamp.

The power weeder consists of the following components namely weeding unit, power transmission system, main clutch, tiller clutch, turning clutch, hitch frame, safety cover etc.

The following field tests were carried out in the research fields to evaluate the performance of the different weeders for weeding operation. The field tests were carried out to ascertain the following performance parameters.

Weeding efficiency

The weeder is tested on the same field to determine weeding efficiency. It is calculated by using equation.

$$\Sigma = (W_1\text{-}W_2)/W_1 \text{ X } 100$$

Where,

W_1 = number of weeds before weeding

W_2 = number of weeds after weeding

Σ = weeding efficiency

Field efficiency

The field efficiency is the ratio of the effective field capacity to the theoretical field capacity and it is expressed in percent.

$$\text{Field efficiency} = \frac{\text{effective field capacity}}{\text{theoretical field capacity}} \times 100$$

Plant damage

Plant damage was calculated by counting the number of injured plants in sample plot and total number of plants in sample plot .The plant damage was calculated by following expression.

$$P_d(\%) = \frac{A}{B} \times 100$$

Where,

P_d = plant damage, %

A = No. of injured plants (cut or damaged) in sample plot

B = Total No. of plants in sample plot

RESULTS AND DISCUSSION

Weeding efficiency under different implements

The maximum weeding efficiency was observed with 'Khurpi' (95.05 per cent) followed by push type cycle weeder (92 per cent) and power weeder (89.5 per cent). Shekar et al., 2010 also reported that the weeding efficiency was highest for khurpi than other weeder. The maximum weeding efficiency with 'Khurpi' was observed because of the capability of this hand tools to work between plant to plant spaces in a row. However, push type cycle weeder and power weeder cannot be used for closer plants. This may be the reason for low weeding efficiency.

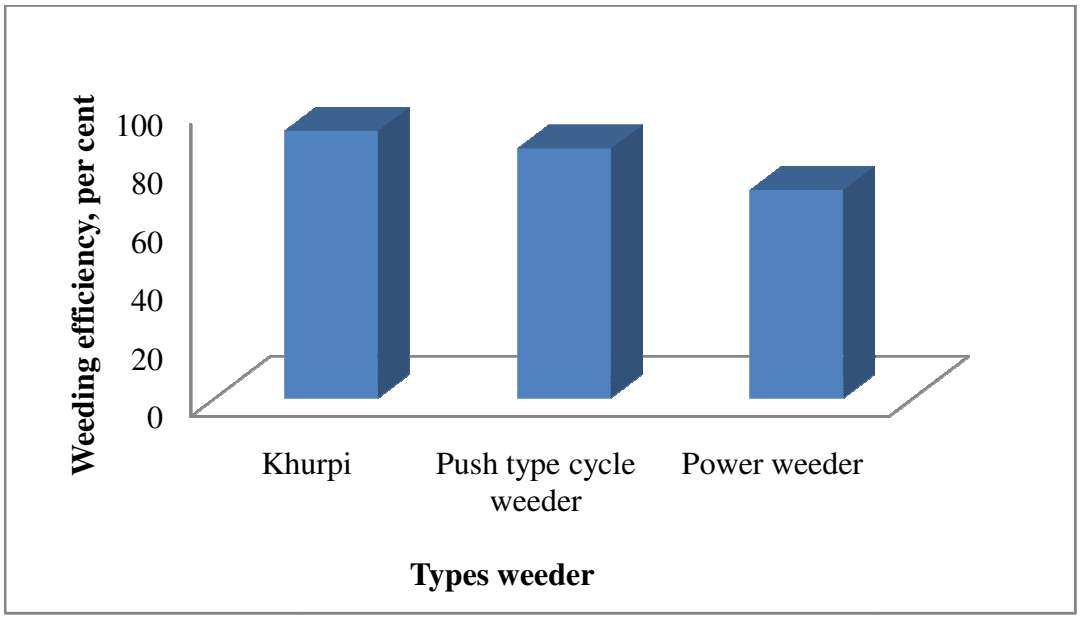

Fig.1. weeding efficiency of different weeder

Field efficiency under different implements

The average field capacity was found maximum for khurpi (91.5 per cent) followed by push type cycle weeder (85.4) and power weeder (71.25 per cent). Shekar et al. (2010) was also found similar readings. The difference in field capacity of different tools/implements is because of the width of soil cutting parts and forward speed. The power weeder due to its faster movement and its width it can cover larger field so that it has highest field efficiency compared to other weeder which are slow in speed. Interculturing operation with 'Khurpi' is usually done by the operator in sitting posture and the forward speed is quite less, which accounts the minimum field capacity of 'Khurpi' during weeding operation.

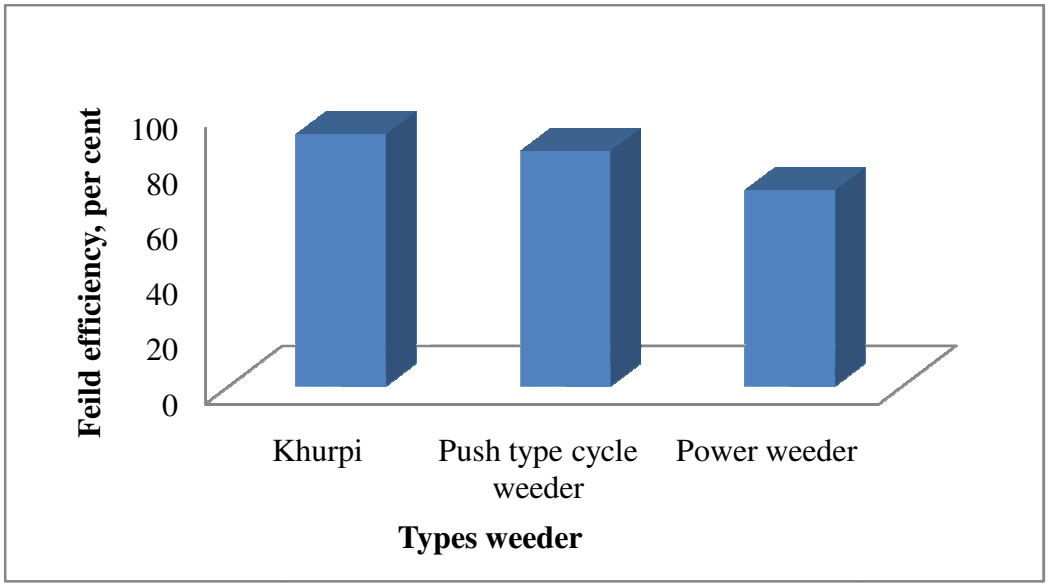

Fig. 2. Field efficiency of different weeder under different implements

Plant damage under different implements

Higher percentage of plant injury was found in case of power weeder (2.5 per cent) followed by push type cycle weeder (1.02 per cent), and khurpi (0.25 per cent). The maximum per cent of plant injury occur in power weeder due to higher speed of rotating blade, which when brought nearer to the plant during operation, caused injury to the plants by cutting either their roots or stem.

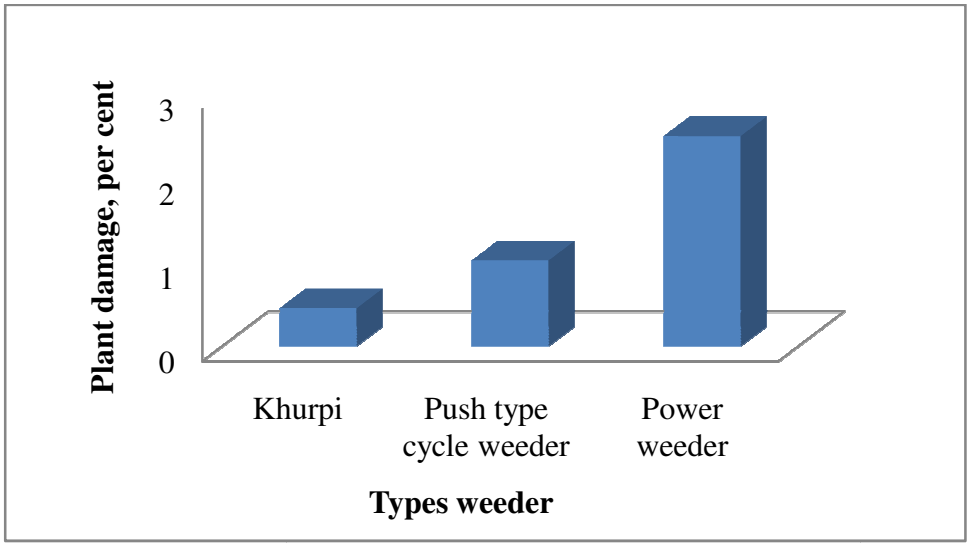

Fig. 3. Plant damage under different weeder

Cost of operation under different weeding tool

The cost of operation of khurpi was found maximum (Rs 1750/ha) followed by power weeder (Rs 1300/ha) and push type cycle weeder ((Rs 1120/ha). As weeding is a labour consuming process and because of minimum field capacity of 'khurpi' the cost of operation of 'khurpi' for weeding was maximum. The cost of operation of power weeder was found more than both wheel hoe and grubber which might be due to higher purchase cost of this implement and lower annual use which were responsible for increasing the fixed cost of power weeder in spite of having higher width of operation and speed of operation resulting in higher field capacity of this machine.

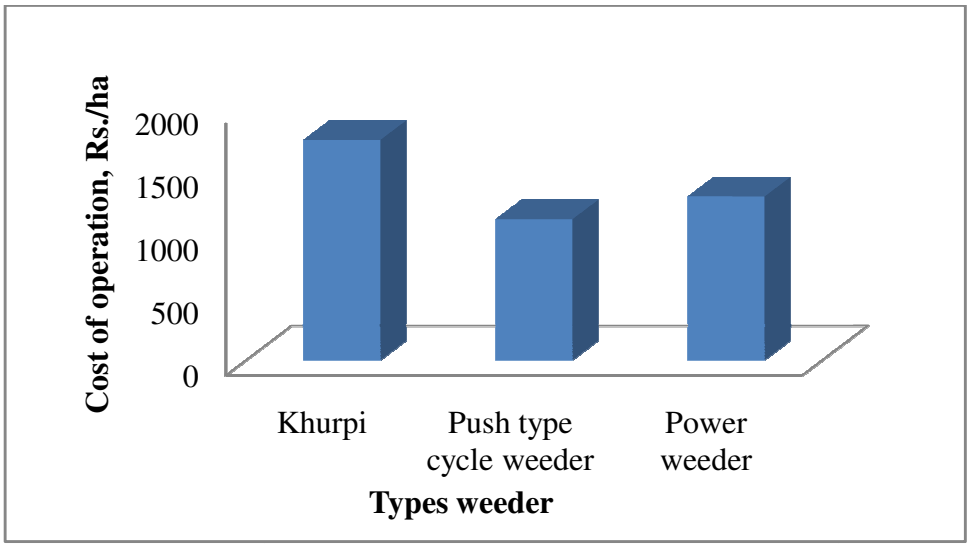

Fig. 4. Cost of operation under different weeding tool

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