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Performance evaluation of modified power weeder for dry field condition

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Abstract
An experiment was conducted to evaluate the field performance of modified power weeder for dry field condition were carried out in department of Department of Farm Machinery and Power Engineering, IGKV, Raipur (C.G.). Various parameters such as effective working depth, weeding efficiency and field capacity of the weeder were considered during the test. The highest field efficiency was obtained for modified power weeder in 8 blade (75.07 per cent) followed by 6 blade (70.35%) and 4 blade (65.15%). The effective field capacity of 0.033, 0.031, and 0.032 ha/hr respectively observed for eight, Six and four blade of modified power weeder. The maximum value of cost of operation was found for modified weeder 1800/ha.

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.

Materials and Methods
The Modificational details of modified power weeder for dry field condition and the parameters involved in the field performance of modified power weeder have been explained below.
The prime mover used for weeding operation was calculated as 2hp with all major factors taken into account as speed, soil resistance etc. (Sirmour *et al*, 2016) [1]. The power required for weeding condition is about 2 hp per row. The engine to be used for modification of power weeder therefore can cope with the draft requirement for one row. Hence, a single cylinder, 2-stroke petrol engine of 2 hp, with side valve and air cooled engine was used as a prime mover in modified power weeder.
In the dry field condition the transport wheel is better for preventing the jerking in undulated fields and smooth field operation, traction wheels was made by using nylon of 180×23 mm diameter as inner and outer ring diameter. It is bolted to rear brackets. The wheel provides better traction and stability during dry field operation.
The rotary blades work under uneven miscellaneous forces of cyclic loading effect of soil parts at the cutting edge (Jeevarathinam *et al*, 2014). Due to the cyclic loading condition the fatigue strength and life of the blade will be affected. In order to improve the fatigue strength of the blade the design of the blade will be modified. There are 8 rotor blades on either sides of rotor flange is bolted on each sides made up of EN 24 APA having thickness of 2.2 mm.
The removable extention shaft is fixed to the main axle shaft. The two extention shaft are joined on both side by means of nut and bolt for setting of complete cutting unit and are fixed to the rotary shaft as depend upon the field condition and row spacing.
The modified 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.

$W= (W_1-W_2)/W1 \times 100$

Where,

W_1 = number of weeds before weeding

W_2 = number of weeds after weeding

W= 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.

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

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,

Pd = 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

The weeding Efficiency of modify power weeder was maximum in 8 blade with 73.25%, followed by 68.21% and 65.46% with 6 and 4 blade respectively due to large no. of blade and the minimum as the compared to 6 and 4 blade. In wet field condition weeding efficiency was maximum in 8 blade with 70.12%, followed by 66.28% and 62.1% with 6 blade and 4 blade respectively as shown in graph.

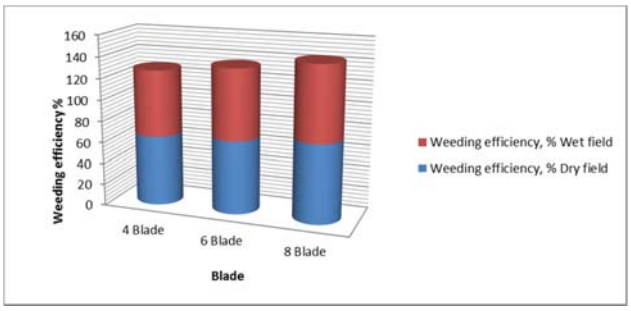

Fig. Weeding eff. of modified weeder in dry and wet field with different blade

Field efficiency

Field efficiency of the modified power weeder was 75.07% at 8 blade followed by 70.35% and 65.15 of 6 blade and 4 blade respectively. At wet field condition, field efficiency was more as compared to dry field condition due to the low resistant force of soil, loose soil, friction in wet field. Maximum field efficiency was observed 85.17 in 8 blade, which followed by 78.42% and 75.32% of 6 blade and blade respectively.

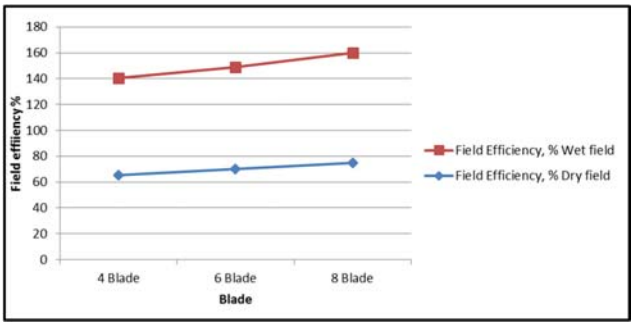

Fig. Field efficiency of modified weeder in dry and wet field with different blade

Plane damage

The plant damage caused by the modified power weeder was minimum observed in 1.85% in 4 blade while maximum plant damage was 4.74% in 8 blade weeder as given in table. In wet field condition maximum plant damage was observed in 6.18 in 8 blade while minimum was 1.65%.

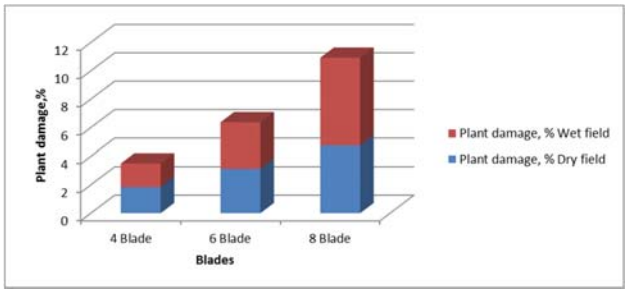

Fig. Graph shows plant damage of modified weeder in dry and wet field with different blade.

Cost of operation

The cost of operation of modified power weeder was found maximum (Rs 1800/ha) 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 power weeder in spite of having higher width of operation and speed of operation resulting in higher field capacity of this machine.

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