Indian Journal of Weed Science 42(1&2) : 95-97, 2010 **Short communication**

Performance evaluation of different weeding tools in maize

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ABSTRACT

An experiment was conducted to evaluate the field performance of power weeder for inter-culturing operation in maize crop (*Zea mays L.*) to compare the cost of operation of power weeder in maize *vis-a-vis* grubber, wheel hoe and 'Khurpi' as control treatment. Power weeder having the higher field capacity (0.067 ha/hr) was found most efficient tool for weeding, particularly in view of time taken in operation followed by the wheel hoe (0.009 ha/hr), grubber (0.008 ha/hr) and 'Khurpi' (0.002 ha/hr). The highest field efficiency was attained in case of 'Khurpi' (94.73%) followed by wheel hoe (90.54%), grubber (84.40%) and power weeder (76.39%). The highest weeding efficiency (99.44%) was recorded in treatment 'Khurpi' followed by grubber (96.8%), wheel hoe (94.64%) and power weeder (89.8%). The plant injury was highest under power weeder (1.94%) followed by wheel hoe (1.01%), grubber (0.76%) and 'Khurpi' (0.46%). The cost of operation of 'Khurpi' was maximum (Rs. 4051/ha) followed by power weeder (Rs. 1350/ha), grubber (Rs. 1158/ha) and wheel hoe (Rs. 1152/ha). In spite of the marginal higher cost of operation of power weeder over other tools, power weeder ensures timeliness weeding in operation than other weeding tools.

Key words : Power weeder, Maize, Field capacity, Field efficiency, Weeding efficiency, Cost of operation, Inter-culturing, Cross culturing.

One of the major losses in agricultural production is caused by weeds. The extent of losses depends upon types of weed, their intensity and time of their occurrence and rate of removal. Maize requires fertile, deep and well drained soil. In early stage, maize requires sufficient moisture, but it is highly susceptible to salinity and water logging. Due to sufficient moisture availability, the weed infestation is a major problem in maize crop. The mechanical control measures for weed control is very effective in maize due to the reason that it has more row to row and plant to plant distance, which facilitates the easy movement of mechanical tools. Mechanical weeding in maize may minimize the loss from 30% to 10% or even less. Kurstzens (2006) found that soil and residue manipulation can assist weed management by killing weeds mechanically, interfering in weed life cycle, facilitating operation and enhancing crop establishment and growth.

Keeping the above facts in view, the experiment was carried out to evaluate the field performance of power weeder for inter-culturing operation in maize crop and to compare the cost of operation of power weeder in maize *vis-a-vis* grubber, wheel hoe and Khurpi as control treatment.

The field experiment was conducted at Pusa farm (Bihar) in *kharif* 2009. The experimental plot was situated at the gangetic plain of north Bihar in humid tropical climate zone at 25^{0}85'16" latitude and 85^{0}40'16.4" east longitude at 54.4m above MSL (mean sea level). The plot size was 4 × 10m. The soil was sandy loam and its bulk density was 1380 kg/m^3. The maize variety was *Shaktiman-4*. The experiment was laid out in randomized block design. The weeding implements were selected on the basis of their field utility. It was thought to evaluate the field performance of mechanical tools for inter-culturing operation. Khurpi, grubber and wheel hoe are common tools used by the farmers for intercultural operation in row crops. The power weeder being an efficient machine for intercultural operation in row crops was evaluated in comparison to manual labour.

The actual field capacity, field efficiency, weeding efficiency and plant injury percentage were measured with standard formula and procedures given as follows :

$$\text{Field capacity} = \frac{W \times S}{10} \times \frac{E}{10}$$

Where, W = theoretical width of cut in meter
S = speed of travel in kilometer per hour
E = field efficiency in percent

$$\text{Field efficiency (\%)} = \frac{\text{Theoretical field capacity}}{\text{Actual field capacity}} \times 100$$

$$\text{Weeding efficiency (\%)} = \frac{W_1 - W_2}{W_2} \times 100$$

Where, W_1 = dry weight of weed in sample plot before weeding in gram

W_2 = dry weight of weed in sample plot after weeding in gram

$$\text{Plant injury (\%)} = \frac{A}{B} \times 100$$

Where

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

B - Total No. of plants in sample plot

RESULTS AND DISCUSSION

Field capacity (ha/hr) of different implements during weeding operations

Field capacity of power weeder was found maximum (0.67 ha/hr) followed by wheel hoe (0.009 ha/hr) and grubber (0.008 ha/hr) (Fig. 1). The field capacity of 'Khurpi' was found minimum (0.002 ha/hr). Garg and Sharma (1998) also reported that area coverage with wheel hand hoe in wheat crop was 0.36 ha/day which was much faster than 'Khurpi' 0.064 ha/day. Sharma *et al.* (1987) also found the similar results. The wide difference in field capacity of different tools/implements is because of the width of soil cutting parts i.e. blade of the implement as well as forward speed. The power weeder being a machine with engine moves much faster than the wheel hoe and grubber. Besides having the larger operating area, wheel hoe facilitates the worker to provide easy push and pull action to the implement as compare to the grubber. This might be a considerable factor for difference in field capacity between the wheel hoe and grubber. Inter-culturing 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.

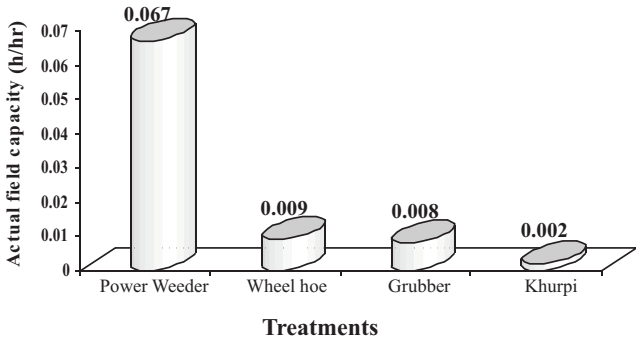

Fig. 1. Actual field capacity (ha/hr) of dif ferent weeding tools/ implements

Field efficiency

Field efficiency of 'Khurpi' was found to be maximum (94.73%) followed by wheel hoe (90.54%) and grubber (84.4%). The field efficiency of power weeder was found to be minimum i.e. 76.39% (Fig. 2).

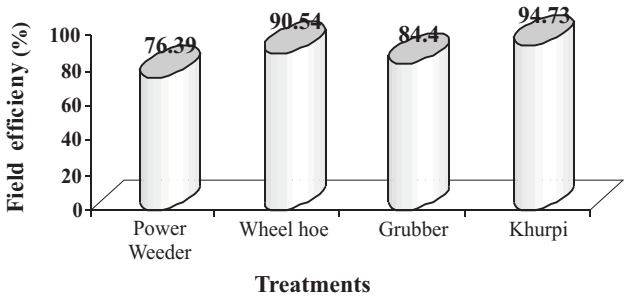

Fig. 2. Field Ef ficiency (%) of dif ferent weeding implements/tools

The higher field efficiency of hand tools were because of the minimum time loss such as turning time and other time during operation. Minimum field efficiency registered in case of power weeder indicate that the machine takes much more time in turning in rows as compared to the hand weeding tools. The field efficiency of wheel hoe and grubber being closer to 'Khurpi' and having higher field capacity than 'Khurpi' gives an indication that with respect to working capacity, wheel hoe and grubber are superior to the 'Khurpi'.

Weeding efficiency

The maximum weeding efficiency was observed with 'Khurpi' (99.4%) followed by grubber (96.8%), wheel hoe (94.65%) and power weeder (89.65%) (Fig. 3). Garg and Sharma (1998) also reported that the efficiency of 'Khurpi' was (82.95%) slightly higher than wheel hoe (76.91%). 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, wheel hoe and grubber can be used for cross-culturing but they can not be used for much closer to the plants. This might be the reason for lower weeding efficiency of these tools. The power weeder has the capacity to till the soil to the desired depth, therefore, it works much better between two rows for control of weeds. But the rotating blade of power weeder may cause damage to the plants if it is brought nearer to the rows. Because of this limitation of this implement, it gave lower weeding efficiency (89.65%) as compared to other weeding tools.

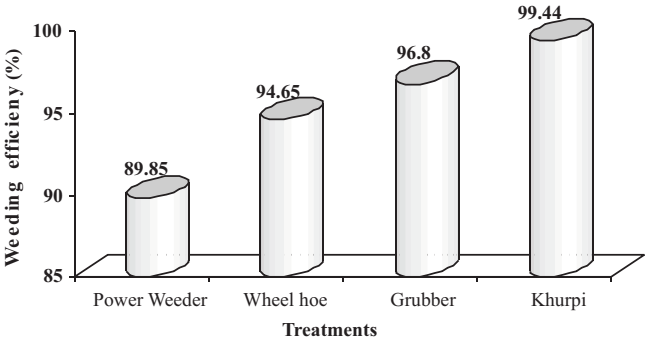

Fig. 3. Weeding Efficiency (%) of different weeding tools / implements

Percentage plant injury of different weeding tools/ implement under various operations

Higher percentage of plant injury was found in case of power weeder (1.94%) followed by wheel hoe (1.01%), grubber 0.76%) and 'khurpi' (0.46%). The higher recorded percentage of plant injury for power weeder and wheel hoe might be because of the higher speed of rotating blade in case of power weeder and large width of blade in case of wheel hoe, which when brought nearer to the plant during operation, caused injury to the plants by cutting either their roots or stem (Fig. 4).

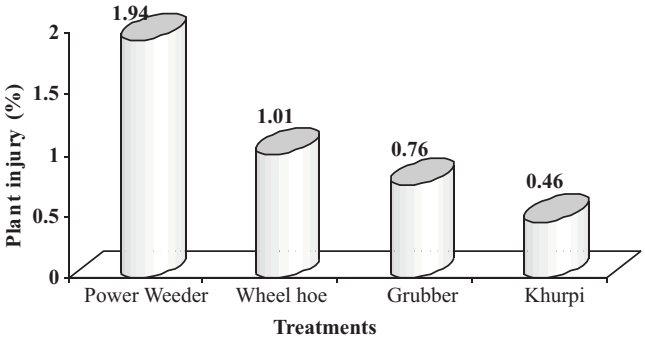

Fig. 4. Plant injury (%) for dif ferent weeding tools / implements

Cost of operation of different weeding tools

The cost of operation of 'khurpi' was found maximum (Rs 4051/ha) followed by power weeder (Rs 1350/ha), grubber (Rs 1158/ha) and wheel hoe (Rs 1152/ha) (Fig. 5). 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 reason may be similar for cost of operation of grubber which is at par with the wheel hoe. 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.

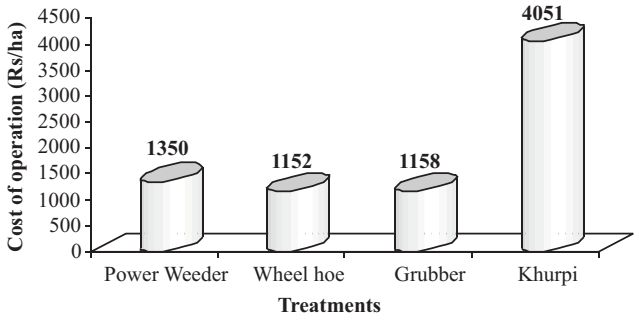

Fig. 5 Average cost of operation (Rs/ha) for dif ferent inter-culturing tools/implements

Power weeder was found to be most efficient in spite of highest weed injury percentage as compared to other treatments. Power weeder was economical to use as compared to Khurpi and its cost of operation was at par with wheel hoe and grubber.

REFERENCES

Garg IK and Sharma VK. 1998. Simple wheel hand hoe for inter-culturing in wheat crop. *Intelligence*. 324-325.

Kurstjens K. 2006. Study of weed management in different tillage system. *Agricultural Mechanization in Asia*, *Africa and Latin America* **39** (2) : 24-26.

Sharma VK, Garg IK, Singh S and Sodhi S. 1987. Performance evaluation of weeding equipment on wheat crop. *Journal of Agricultural Engineering* **24** (2) : 122-126.