EVALUATION OF MANUALLY OPERATED WEEDER WITH REFERENCE TO FIELD PERFORMANCE

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ABSTRACT

For increase the productivity per unit area of small land holdings and considering the economic condition of Indian farmers, it is quite necessary to have suitable agricultural implements which farmers can use and also allow them to use for custom hiring. Weeding is an important agricultural unit operation. Present investigation was indertaken with an objective to evaluate different field performance of developed weeder. Present investigation was undertaken in Nagpur , Maharashtra state during the year 2010-2011. For this investigation farmers and farm workers are selected randomly from Nagpur district. The field performance of the developed weeder was evaluated in the field of cotton, soyabean and groundnut crops. The test conditions such as soil moisture content, soil type, bulk density of soil, root zone depth of weed, density of weed, etc. were taken into consideration. Speed of travel in km/h was calculated by using a stop watch. Present investigation conclude that the mean value of effective field capacity is higher in cotton crop than groundnut and soybean crops. Weeding by developed manually operated weeder increase the weeding index, effective field capacity, theoretical field capacity and field efficiency respectively while decrease the plant damage.

Key words: *Weeder, Field Performance, Evaluation.*

Note: This research is part of first authors Ph.D. work

INTRODUCTION:

Weeding is an important but equally labour intensive agricultural unit operation. Kharif crops are most affected due to weeds. Weeding accounts for about 25 % of the total labour requirement (900–1200 man-hours/hectare) during a cultivation . Delay and negligence in weeding operation affect the crop yield up to 40 to 50 per cent. In India about 4.2 billion rupees are spent every year for controlling weeds in the production of major crops. At least 40 million tones of major food grains are lost every year due to weeds alone (Singh and Sahay, 2001). The reduction of yield due to weed was 11.8 % of the total yield in India. Many research workers have reported a reduction of 50 to 60 per cent of crop yields. Obnoxious weeds like Carthamus oxycantha, Cyperus rotundus, Saccharum spontaneum, Cynodon dactylon, Avena fatua, Phalaris minor, Parthenium hysterophorus, etc. have infested large areas in various states of India. It reveals that one third of the cost of cultivation is being spent for weeding alone. In India, the weeding operation is carried out with indigenous hand tools like *'Khurapi'* and spade. Recently many improved hand tools have been introduced for weeding. Straight blade hoes and triangular blade hoes made by black smiths and village artisans are traditionally used. Use of rotary tools e.g. discs and rotating rods is limited. These tools vary in design from place to place. In Marashtra, the use of bullock drawn implements is very less for weeding purpose. In spite of tools available, the farmers are still practicing the manual uprooting of weeds, which is labour intensive and costly. Manually operated weeders available in India are not very common in Maharashtra and farmers are not using them either they are not suitable for them or requires modifications. 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 in both dry land and wet land. Present investigation was indertaken with the objective to evaluate different field performance of developed weeder.

METHODOLOGY:

Present investigation was undertaken in Nagpur , Maharashtra state during the year 2010-2011. For this investigation farmers and farm workers are selected randomly from Nagpur district. The field performance of the developed weeder was evaluated in the field of cotton, soyabean and groundnut crops. The test conditions such as soil moisture content, soil

type, bulk density of soil, root zone depth of weed, density of weed, etc. were taken into consideration. Speed of travel in km/h was calculated by using a stop watch.

For evaluating field performance by developed weeder following parameters were measured and calculated by the formulae's. For all the treatments the average actual field capacity, weeding index and plant damage was recorded and performance indices were calculated to compare the performance of weeders.

Weeding index:

Weeding index was calculated by using the following formula.

$e = [(W1 – W2)/W1] \times 100$

Where,

e = weeding Index, per cent

W1 =number of weeds/m2 before weeding

W2 = number of weeds/m2 after weeding

Plant damage:

Higher the value (e) means the weeder is more efficient to remove the weeds. Plant damage per cent is measured by using following frormula.

$q = \{1- (Q/P)\} \times 100$

Where,

q = plant damage per cent

Q = Number of plants in a 10 m row length after weeding

P= Number of plants in a 10 m row length before weeding

Soil moisture content :

Soil moisture content was calculated by following formula.

$$\text{Soil moisture content (\%)} = \frac{W1 - W2}{W2} \times 100$$

Where,

W1= Weight of wet sample

W2= Weight of oven dry sample

Bulk density:

The volume of undisturbed soil from the field during weeding shall be randomly taken and bulk density was calculated by following formula.

$$\text{Bulk density} = \frac{\text{Mass of the soil sample}}{\text{Volume of soil sample}}$$

Effective field capacity:

Effective field capacity of weeder was calculated by following formula.

$$\text{Effective field capacity (ha/h)} = \frac{\text{Area covered (ha)}}{\text{Time required (hr)}}$$

Theoratical field capacity:

Theoratical field capacity has been calculated by using the following formula.

$$\text{Theoratical field capacity (ha/h)} = \frac{Wt \times S}{100}$$

Where,

Wt = Theoratical width of operation, m

S = Speed of operation, km/h

Field efficiency:

Field efficiency has been calculated by using the following formula.

$$\text{Field efficiency} = \frac{\text{E.F.C.}}{\text{T.F.C.}} \times 100$$

Where,

E.F.C. = Effective field capacity, (ha/h)

T.F.C. = Theoratical field capacity, (ha/h)

RESULT AND DISCUSSION:

Table No. 1. Moisture Content of the Soil

Sr. No.	Moisture Content Percent		
	Field I	Field II	Field III
1.	13.52	16.85	14.70
2.	11.63	17.40	14.95
3.	9.52	18.25	15.50
Mean	11.55	17.25	15.05

Table shows that the mean soil moisture in field-I at the time of weeding was 13.34 percent. In field II the mean soil moisture level was 17.25 percent and in field III if was 15.06 percent.

Table No. 2. Bulk Density of Soil

Bulk density (gm cm)	Field I	Field II	Field III
Maximum	1.52	1.27	1.32
Minimum	1.38	1.14	1.20
Mean	1.45	1.21	1.26

Table shows that the mean bulk density in field-I 1.45 gm cm^3. In field - II the mean bulk density is 1.21 gm cm^3 were as in field - III the mean bulk density is 1.26 gm cm^3.

Observed Field Values of Manually Operated Weeder

The performance of developed manually operated weeder was carried out under different field parameters. The field performance of the manually operated weeder was presented as bellow.

Table No. 3. a) Field Evaluation of Cotton Crop

Sr. No.	Parameters	Field I	Field II	Field III	Mean
1.	Effective field capacity (ha/day)	2.50	1.90	2.10	2.16
2.	Theoretical field capacity (ha/day)	2.52	2.10	1.95	2.19
3.	Field efficiency (percent)	80.12	82.18	89.17	83.82
4.	Weeding index (percent)	85	90	92	89
5.	Plant Damage (percent)	03	04	02	3

Note : Values are means of 5 replications

Table No. 3 a) shows that field evaluation of cotton crop. The effective field capacity were found in the range of 1.90 to 2.50 whereas the mean effective field capacity was 2.16 ha/day. The speed of operation affects the effective field capacity. The effective field capacity was increased with increase in speed of operation and weeding efficiency of worker is increased accordingly.

The theoretical field capacity were found in the range of 1.95 ha/day to 2.52 ha/day whereas the mean theoretical field capacity was 2.19 ha/day. The field efficiency were found in the range of 80.12 to 89.17 whereas mean field efficiency was 83.82 percent. The weeding indexes were found in the range of 85 to 92 whereas mean weeding index was 89 percent. After weeding operation most of the weeds are cuted by blade of manually operated weeder that's why weeding index shows significant results. The plant damage were found in the range was 3 percent. Due to body parts of workers plants are damaged when workers were give precousion that time decrease the plant damage.

Table No. 3. b) Field Evaluation of Groundnut Crop

Sr. No.	Parameters	Field I	Field II	Field III	Mean
1.	Effective field capacity (ha/day)	1.80	1.75	2.10	1.88
2.	Theoretical field capacity (ha/day)	1.92	2.20	1.83	1.98
3.	Field efficiency (per cent)	92.85	85.23	80.10	86.06
4.	Weeding index (per cent)	89	78	85	84
5.	Plant Damage (per cent)	02	05	03	3.33

Note : Values are means of 5 replications.

Table No. 3 b) reveals that field evaluation of groundnut crop. Effective field capacity was depends on time required for specific area covered for weeding operation. The effective field capacity were found in the range of 1.75 to 2.10 whereas the mean effective field capacity was 1.88 ha/day in groundnut crop by manually operated weeder. The theoretical field capacity was depends on speed of operation. Manually operated weeder increase the speed of operation. The mean value of theoretical field capacity were found is 1.92 ha/day. Field efficiency is depends on effective field capacity and theoretical field capacity. The field efficiency were found in the range of 80.10 to 92.85 whereas the mean field efficiency was 86.06 percent for selected groundnut crop. The weeding index was found in the range of 78-89 whereas the mean weeding index was 84 percent in selected groundnut crop. The plant damage was found in the range of 2-4 whereas the mean plant damage was 3 percent. After

manually operated weeding by developed weeder some plants are damaged due to the operation of weeder and body parts of the workers.

Table No. 3. c) Field Evaluation of Soybean Crop

Sr. No.	Parameters	Field I	Field II	Field III	Mean
1.	Effective field capacity (ha/day)	1.90	1.98	2.10	1.99
2.	Theoretical field capacity (ha/day)	2.10	1.85	2.35	2.10
3.	Field efficiency (per cent)	82.10	85.35	83.20	83.55
4.	Weeding index (per cent)	92	85	93	90
5.	Plant Damage (per cent)	05	03	02	3.33

Note : Values are means of 5 replications.

Table No. 3. c) imply that field evaluation of soybean crop by developed manually operated weeder. The effective field capacity were found in the range of 1.90 to 2.10 whereas the mean effective field capacity was 1.99 ha/day. The effective field capacity is depends on speed of operation. The theoretical field capacity were found in the range of 1.85-2.35 whereas the mean theoretical field capacity was 2.10 ha/day in soybean crop. The field efficiency was found in the range of 82.10 to 85.35 whereas the mean value of field efficiency was 83.55 percent. The weeding indexes were found in the range of 85-93 whereas the mean value of weeding index was 90 percent. The plant damage was found in the range of 2.5 whereas the mean value of plant damage was 3.33 percent.

Table No. 3.a), 3.b), 3.c) concludes that the mean value of effective field capacity is higher in cotton crop than groundnut and soybean crops. The mean value of theoretical field capacity of groundnut crop is less than cotton and soybean crops field efficiency in groundnut nut crop is higher than soybean and cotton crops. The weeding index of soybean crop is higher than groundnut and cotton crops. Plant damage in cotton crop is less than groundnut and soybean crops.

Table No.4. ANOVA of weeding index and plant damage at various soil moisture content

Source of variation	Moisture content (13.52%)		Moisture Content (11.63%)		Moisture Content (9.52%)	
	Weeding index	Plant damage	Weeding index	Plant damage	Weeding index	Plant damage
Replications -5	2.85	1.87	2.92	0.98	0.87	1.34
Treatments -3	80.81**	12.40**	90.67**	10.39**	98.39**	98.67**
SEM ± CD = 0.05	0.924 ± 2.947	0.390 ± 1.326	0.840 ± 2.691	0.392 ± 1.315	0.845 ± 2.806	0.34 ± 1.830

Significant at 1% level of significance

SEM = Standard Error of Mean

CD = Critical Difference.

Table shows that ANOVA of weeding index and plant damage at various soil moisture content. The weeding index of the treatments varied significant at 1% level of significance whereas the replications were found to be non significant. Table shows that plant damage and weeding index in 13.52% moisture content soil is more than 11.63% and 9.55% moisture content soil. Goel et.al (2008) observed that the effect of treatment on plant damage was highly significant while replications had no significant effect on plant damage.

CONCLUSION:

Present investigation concludes that the mean value of effective field capacity is higher in cotton crop than groundnut and soybean crops. The mean value of theoretical field capacity of groundnut crop is less than cotton and soybean crops field efficiency in groundnut nut crop is higher than soybean and cotton crops. The weeding index of soybean crop is higher than groundnut and cotton crops. Plant damage in cotton crop is less than groundnut and soybean crops. Weeding by developed manually operated weeder increase the weeding index, effective field capacity, theoretical field capacity and field efficiency respectively

while decrease the plant damage. This shows that farm workers will do weeding activity by developed weeder with comfortable posture.

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