



## PERFORMANCE EVALUATION OF RECIPROCATING TYPE POWER OPERATED CONO WEEDER

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### Abstract :

Indian majority of population depends on agriculture for their livelihood and India is second highest rice producing country in the world. Weeds are the major thread in production of rice. It's very difficult task to remove weeds manually as well as using manually operated cono weeder, it is time consuming operation. It required more labour and energy. To overcome the problem reciprocating type power operated cono weeder was developed. The developed reciprocating type power operated conoweeder consist of main frame, engine, gear box, roller, crank shaft, reciprocating linkage, pulley, chain drive, float and handle. The average actual field capacity and field efficiency were found to be 0.0193 ha/h to 0.0235 ha/h and 66.43 % to 81.03 % respectively. Weeding efficiency was found to be 87.45 %. The average plant damage was 1.28 %. The average fuel consumption was found to be 0.692 l/h.

Key Word : Weeding, Paddy, Cono weeder, Efficiency

### I. INTRODUCTION

Rice is most important food crop of the developing world and staple food of more than half of the world population. Rice is one of the most leading food crop in the world within world wide cultivated cereals. The annual global production of rice amounts to over 600 million tones of paddy rice, 90% of which is located in Asia. In Maharashtra, rice is the second important crop of the people, which is grown over an area of 14.99 Lakh hectares with an annual rough rice production of 32.37 lakh tones. The average productivity of the state is 2.01 t/ha. Rice is the main food grain crop of Konkan region which occupies an area of about 3.69 lakh ha with production 15.69 lakh ton and productivity 4.25 tones/ha (Anonymous 2022).

Weeds are one of the major biological threats to higher rice productivity worldwide. The weeds have always been problem in the cultivation of crop as they lower the yield and quality.

Traditional hand tools use for performing operation of weeding, due to bending posture, majority of labour inducing the back pain. Labour has to walk in puddle soil and his 30% of energy required for the weeding operation ( Suchitra, 2016). Labour has to operate manual cono weeder with pull and push action with remaining energy and operation is very tedious. All the commercially available manual cono weeder required more force and energy. Also it causes more human drudgery and risk and it take more time for weeding. To overcome the human drudgery, reducing time and energy and labour cost reciprocating type power operated cono weeder was developed.

## II. MATERIALS AND METHOD

The developed reciprocating type power operated cono weeder consists main frame is the structure where 2 hp engine (3600 rpm), gear reducer (21:1), wheel shaft and crank shaft are mounted. Two wheels were attached to main frame on shaft. The one end of reciprocation linkage was attached to crankshaft and other end to roller assembly. The power was transmitted from engine to gear reducer, from gear reducer to wheel shaft by belt pulley (3" and 4") and from chain sprocket (2.5" and 3") through crankshaft. Because of reciprocation motion, roller assembly resulted into forward and backward movement and due to this motion weeds were churn, uproot and buried in soil.

## IV. RESULT AND DISCUSSION

The developed reciprocating type power operated weeder was tested. And the weeding efficiency, plant damage, field capacity, field efficiency and fuel consumption was also calculated for operation of weeder after 35 DAT.

The performance of the developed reciprocating type power operated cono weeder is expressed in term of weeding efficiency, plant damage, actual field capacity, field efficiency and fuel consumption. The obtained data and their discussion are presented under following heading.

- 3.1 Laboratory test of developed reciprocating type power operated cono weeder
- 3.2 Field performance of developed reciprocating type power operated cono weeder
- 3.3 Comparative study between Manually operated cono weeder and Reciprocating type power operated cono weeder.
- 3.4 Cost of operation of developed reciprocating type power operated cono weeder

### 3.1 Laboratory test of developed reciprocating type power operated cono weeder

The developed reciprocating type power operated cono weeder consist of main frame, engine, gear box, roller, crank shaft, reciprocating linkage, pulley, chain drive, float and handle. The laboratory test was consisted of checking of specification and wear and tear measurement. Wear and tear of the soil engaging parts was measured. The specification detail of developed reciprocating type power operated cono weeder was given in Table 1.

**Table 1 Specification of developed reciprocating type power operated cono weeder**

Sr. No.	Description	Specification / Value		
1	Engine	Brush cutter, 2 stroke		
2	Power	2 hp @3600 rpm		
3	Fuel	Petrol		
4	Dimension , mm	1140 × 470 × 1030		
5	Handle	Width – 460 mm Diameter – 22 mm		
6	Weight, kg	35.9		
7	Gear box	Type – warm type Gear ratio – 21:1		
8	Wheel diameter, mm	450		
9	Crank	15 cm		
10	Reciprocating linkage, mm	600 × 120 × 40		
11	Cone	Hollow metal cone shaped drums with weeding blade		
	1) Type of weeding roller			
	2) Truncated cone Diameter, mm	135 to 85		
	3) Number of blade	Blade	Plain	Serrated
		No. of blades	6	6
		Height, mm	25	25
		Length, mm	100	90
		Material	Mild steel	Mild steel
4) Weight of roller with blades Kg (2 nos)	2.46 kg			
5) Cone center to center, mm	245			
6) Angle of blade, deg	60			
7) Apex angle of cone, deg	30			
12	Float	Width – 100 mm Length – 180 mm Inclination – 170-175 deg.		

In the laboratory, machine was run half an hour at different wheel speed. The throttle lever was adjusted to low and high position. The average speed of rotors are given in Table 2.

**Table 2 speed of reciprocation and wheel**

Sr. No.	Speed of reciprocation, rpm	Speed of wheel, rpm
1	131	128
2	33	30

**Table 3 Field, soil, weeds and crop conditions during field performance**

Sr. No.	Particulars	Description/ value
<b>1</b>	<b>Condition of field and soil</b>	
	i) Kind of field	Low land
	ii) Area, m <sup>2</sup>	1200
	iii) Shape of field	Rectangular
	iv) Type of soil	Red alluvial soil
	v) Depth of standing water, cm	4.6 (average)
<b>2</b>	<b>Condition of weeds</b>	
	i) Weed infestation	Low to medium
	ii) Height of weed, cm	7.5
<b>3</b>	<b>Condition of crop</b>	
	i) Crop Height, cm	35
	ii) Row spacing, cm	25
	iii) Hill distance, cm	15
	iv) No. of plants per hill	5



**Plate no. 1 Developed reciprocating type of power operated conoweeder**

### 3.2 Field performance of developed reciprocating type power operated cono weeder

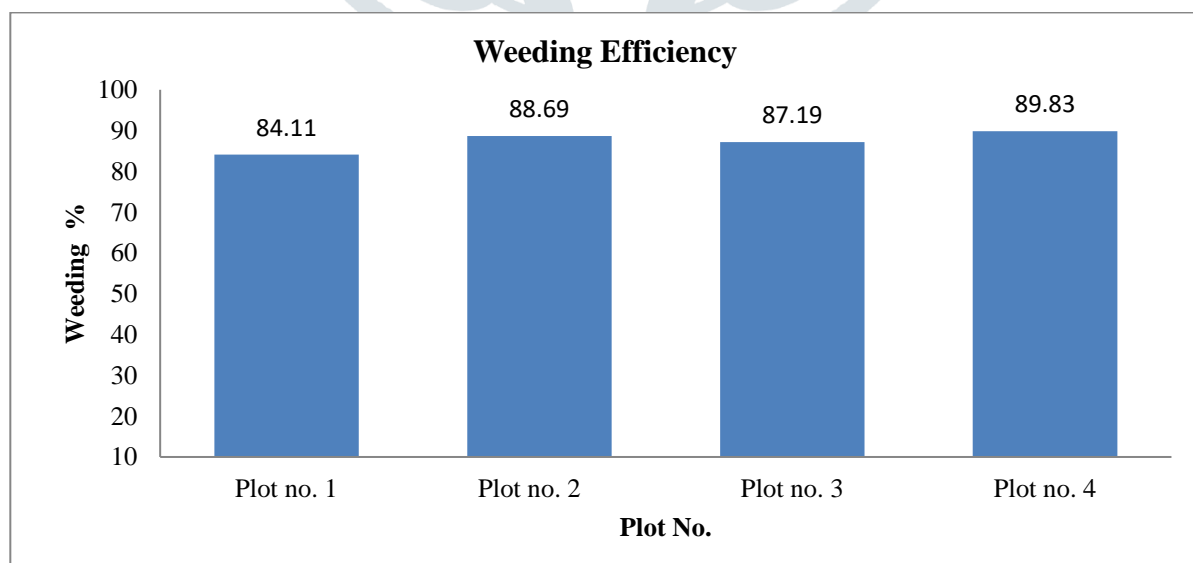
The performance of the reciprocating type power operated weeder with roller was tested at growth stages of paddy crop i.e. 35 DAT. The parameters viz. weeding efficiency, plant damage, field capacity, field efficiency and fuel consumption of the weeder was determined at growth stages. The results are discussed as given below.

#### 3.2.1 Weeding efficiency

The maximum weeding efficiency was 89.83 % and minimum weeding efficiency was found at 84.11 %. The average weeding efficiency was 87.45 %. The performance testing of developed reciprocating type power operated cono weeder for weeding efficiency is shown in Fig. 1. The test data of weeding efficiency is shown in Table 4

**Table 4 Weeding efficiency of developed reciprocating type power operated cono weeder**

Sr. No.	Observed weed count	No. of weeds before weeding	No. of weeds after weeding	Efficiency %	Average %	
1	Plot no. 1	L1	198	43	78.28	84.11
		L2	143	34	84.23	
		L3	237	24	89.87	
2	Plot no. 2	L1	143	12	91.60	88.69
		L2	179	18	89.94	
		L3	181	28	84.53	
3	Plot no. 3	L1	207	23	88.88	87.19
		L2	248	29	88.30	
		L3	186	17	84.40	
4	Plot no. 4	L1	167	14	91.61	89.83
		L2	147	16	89.11	
		L3	98	11	88.77	



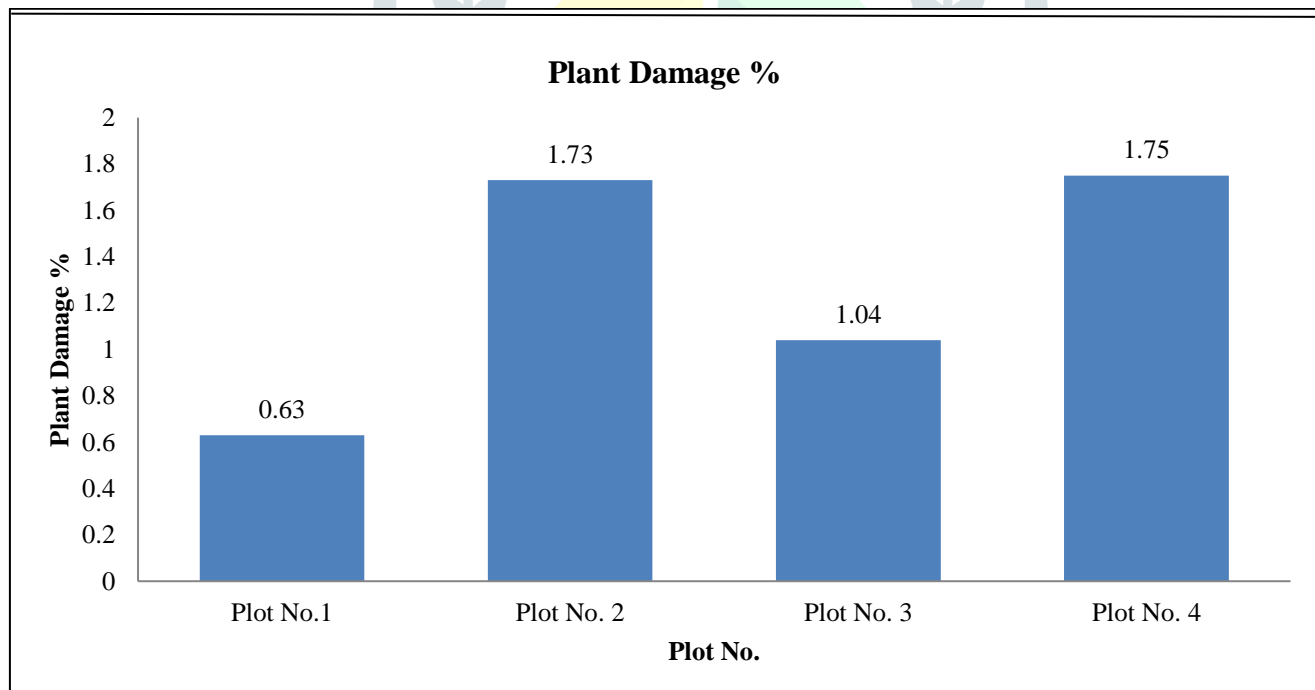
**Fig. 1 Weeding efficiency of developed reciprocating type power operated cono weeder**

### 3.2.2 Plant damage

The maximum plant damage was 2.898 % and minimum plant damage was found at 0.51%. The average plant damage was 1.28 %. The test data and graphical representation of plant damage percentage is shown in Table 5

**Table 5 Plant damage of the developed reciprocating type power operated cono weeder**

Sr. No.	Observed weed count	No. of plants before weeding	No. of plants after weeding	No. of plants damage	Efficiency %	Average %
1	L1	204	203	1	0.51	0.63
	L2	195	195	00	00	
	L3	211	208	3	1.4	
2	L1	230	225	5	2.17	1.73
	L2	192	188	4	2.08	
	L3	210	208	2	0.95	
3	L1	194	192	2	1.03	1.04
	L2	190	187	3	1.57	
	L3	204	203	1	0.53	
4	L1	207	201	6	2.89	1.75
	L2	226	223	3	1.32	
	L3	192	190	2	1.04	



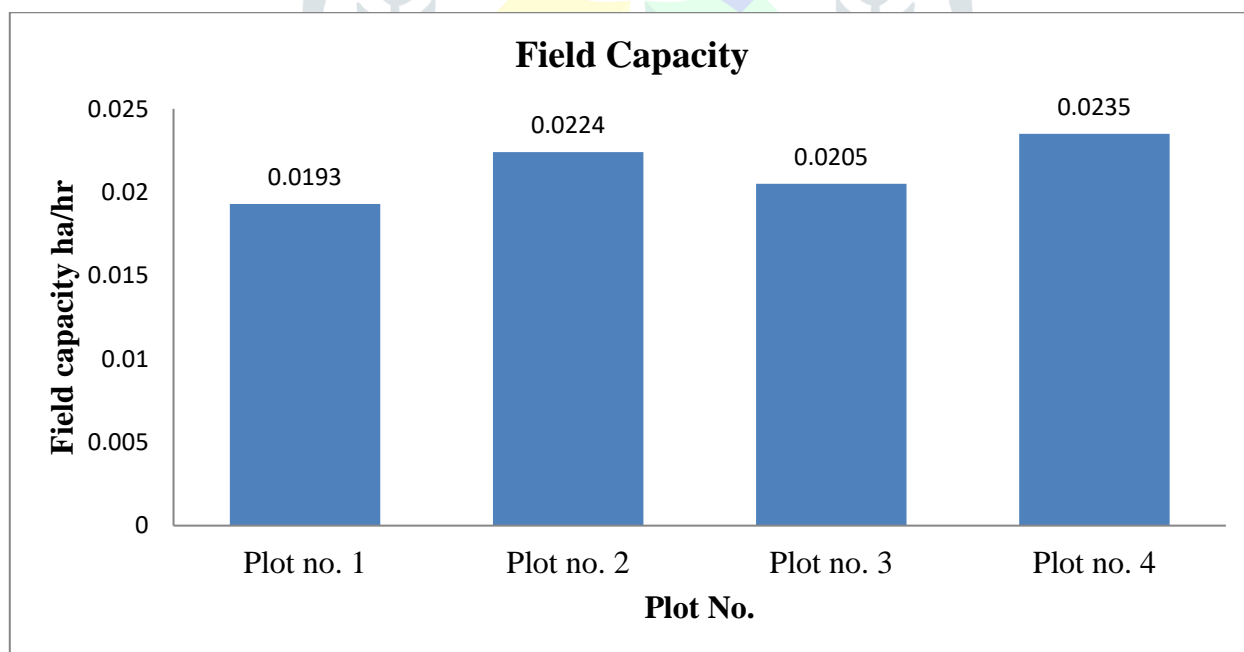
**Fig. 2 Plant damage percentage of developed reciprocating type power operated cono weeder**

### 3.2.3 Field capacity

The maximum field capacity was found to be 0.0235 ha/h and minimum field capacity was found to be 0.0193 ha/h. The average field capacity was found to be 0.0214 ha/h. The test data and graphical representation of field capacity is shown in Table 6 and Fig.3 respectively.

**Table 6 Field capacity of the developed reciprocating type power operated cono weeder**

Sr. No.	Length Of row, m	Plot	Plot size, m <sup>2</sup>	Loss time, min	Actual time required, min	Total time required, min	Actual field capacity, ha/h	Average, ha/h	
1	25	P <sub>1</sub>	L <sub>1</sub>	100	8.12	23.42	31.54	0.0190	0.0193
2	25		L <sub>2</sub>	100	9.8	23.49	33.29	0.0180	
3	25		L <sub>3</sub>	100	7.18	21.3	28.48	0.0210	
4	25	P <sub>2</sub>	L <sub>1</sub>	100	4.42	21.15	25.57	0.0234	0.0224
5	25		L <sub>2</sub>	100	7.25	20.28	27.53	0.0217	
6	25		L <sub>3</sub>	100	5.32	21.8	27.12	0.0221	
7	25	P <sub>3</sub>	L <sub>1</sub>	100	7.48	21.1	28.58	0.0209	0.0205
8	25		L <sub>2</sub>	100	8.28	20.35	28.23	0.0212	
9	25		L <sub>3</sub>	100	8.37	22.17	30.54	0.0196	
10	25	P <sub>4</sub>	L <sub>1</sub>	100	5.20	21.29	26.49	0.0226	0.0235
11	25		L <sub>2</sub>	100	4.23	20.35	24.58	0.0244	
12	25		L <sub>3</sub>	100	4.10	21.02	25.12	0.0236	



**Fig. 3 Field capacity of developed reciprocating type power operated cono weeder**

### 3.2.4 Field efficiency

The maximum field efficiency was found to be 81.03 % and minimum field efficiency was found to be 66.43 %. The average field efficiency was found to be 73.74 %. The test data and graphical representation of field capacity is shown in Table 7 and Fig. 4 respectively.

Table 7 Field efficiency of the developed reciprocating type power operated cono weeder

Sr. No.	Plot	Field capacity, ha/h	Field efficiency, %	Average, %
1	P <sub>1</sub>	L <sub>1</sub>	0.0190	65.23
2		L <sub>2</sub>	0.0180	61.85
3		L <sub>3</sub>	0.0210	72.16
4	P <sub>2</sub>	L <sub>1</sub>	0.0234	80.41
5		L <sub>2</sub>	0.0217	74.57
6		L <sub>3</sub>	0.0221	75.94
7	P <sub>3</sub>	L <sub>1</sub>	0.0209	71.82
8		L <sub>2</sub>	0.0212	72.85
9		L <sub>3</sub>	0.0196	67.35
10	P <sub>4</sub>	L <sub>1</sub>	0.0226	77.66
11		L <sub>2</sub>	0.0244	83.84
12		L <sub>3</sub>	0.0236	81.78

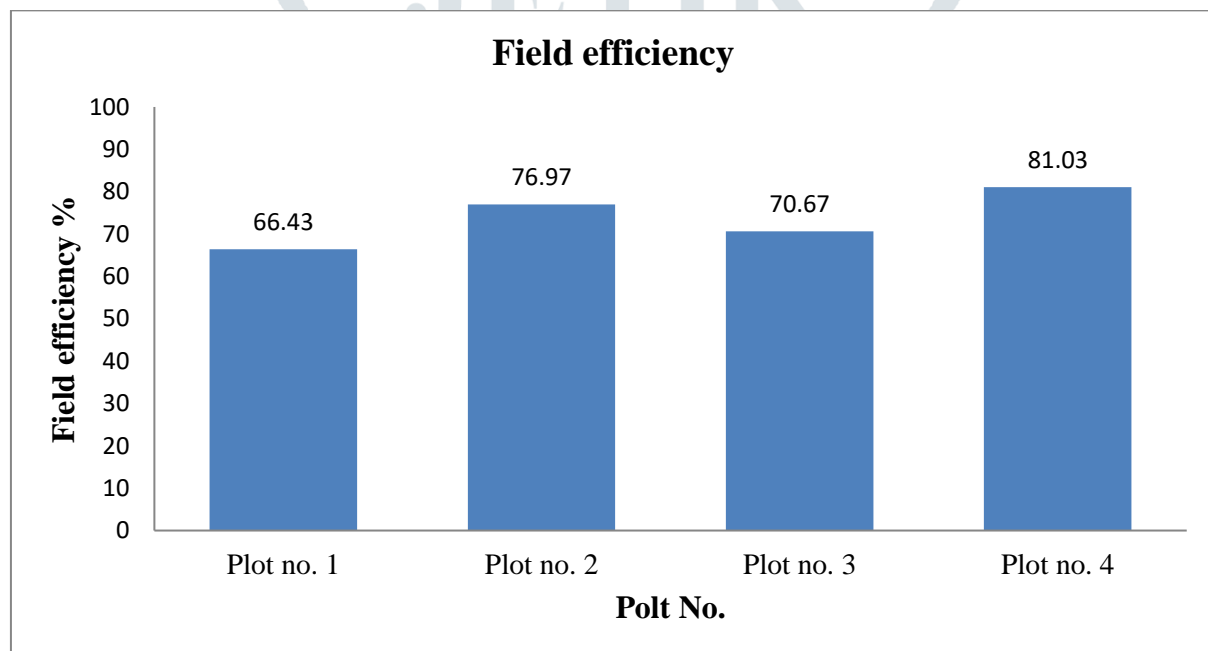


Fig. 4 Field efficiency of developed reciprocating type power operated cono weeder

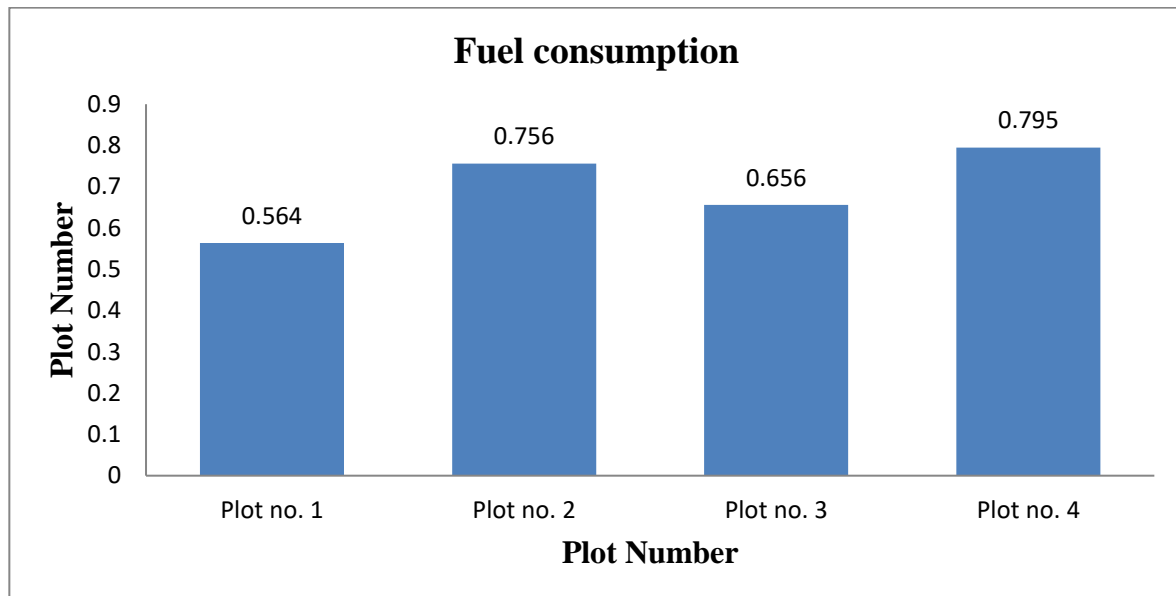
### 3.2.5 Fuel consumption

The maximum fuel consumption was observed as 0.795 l/h at Plot No. 4 while the minimum fuel consumption was observed as 0.564 l/h at Plot No. 1. The average fuel consumption was found to be 0.696 l/h. The graphical representation of performance testing of developed reciprocating type power operated cono weeder for fuel consumption is shown in Fig. 8. The test data of field efficiency is shown in Table 8

Table 8 Fuel consumption of the developed reciprocating type power operated cono weeder

Sr. No.	Plot	Field capacity, ha/h	Fuel consumption, l/h	Average fuel consumption, l/h
1	T <sub>1</sub>	R <sub>1</sub>	0.0190	0.524
2		R <sub>2</sub>	0.0180	0.478
3		R <sub>3</sub>	0.0210	0.692

4	T <sub>2</sub>	R <sub>1</sub>	0.0234	0.782	0.756
5		R <sub>2</sub>	0.0217	0.738	
6		R <sub>3</sub>	0.0221	0.750	
7	T <sub>3</sub>	R <sub>1</sub>	0.0209	0.680	0.656
8		R <sub>2</sub>	0.0212	0.714	
9		R <sub>3</sub>	0.0196	0.576	
10	T <sub>4</sub>	R <sub>1</sub>	0.0226	0.774	0.795
11		R <sub>2</sub>	0.0244	0.820	
12		R <sub>3</sub>	0.0236	0.792	



**Fig. 8 Fuel consumption of developed reciprocating type power operated cono weeder**

### 3.3 Comparative study between Manually operated cono weeder and Reciprocating type power operated cono weeder.

The parameters viz. weeding efficiency, field capacity, field efficiency was compared. The results are discussed as given below.

#### 3.3.1 Comparison of weeding efficiency between manually operated cono weeder and Reciprocating type power operated cono weeder

The weeding efficiency of reciprocating type power operated cono weeder and manual operated cono weeder was shown in Fig. 5, from Fig. 5 it was concluded that reciprocating type power operated cono weeder has 17.163 % more weeding efficiency than manually operated cono weeder.



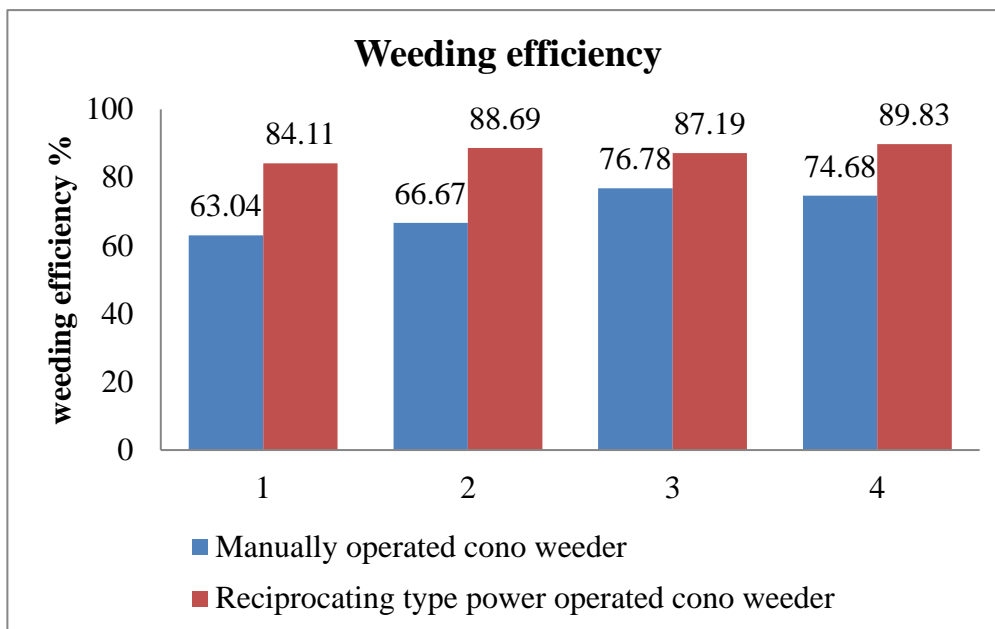


Fig. 5 comparison of weeding efficiency between manually operated cono weeder and Reciprocating type power operated cono weeder

3.3.2 Comparison of field capacity between manually operated cono weeder and Reciprocating type power operated cono weeder

The field capacity of reciprocating type power operated cono weeder and manual operated cono weeder was shows in Fig. 6, from Fig. 6 it was concluded that reciprocating type power operated cono weeder has 0.0115 ha/h more field capacity than manually operated cono weeder.

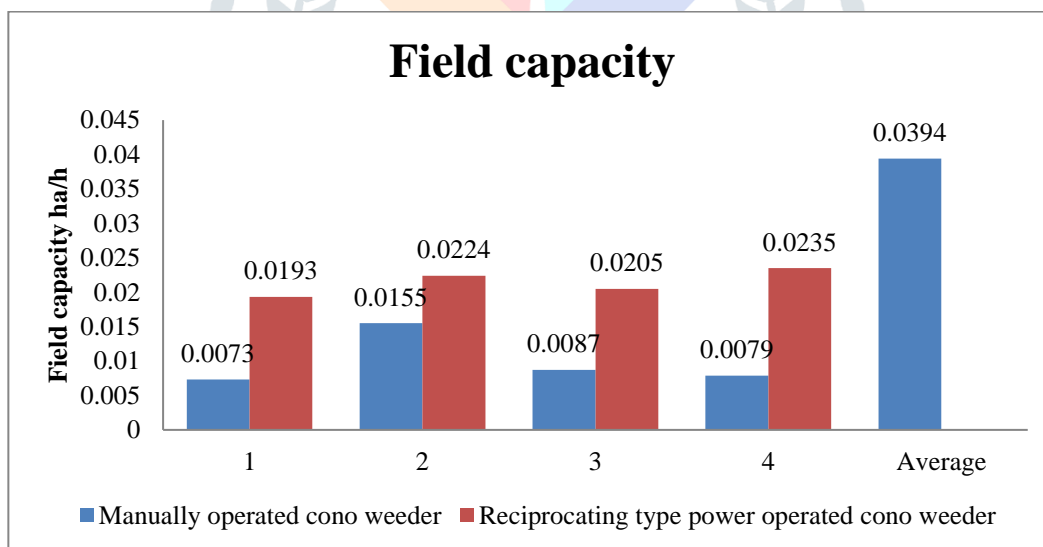
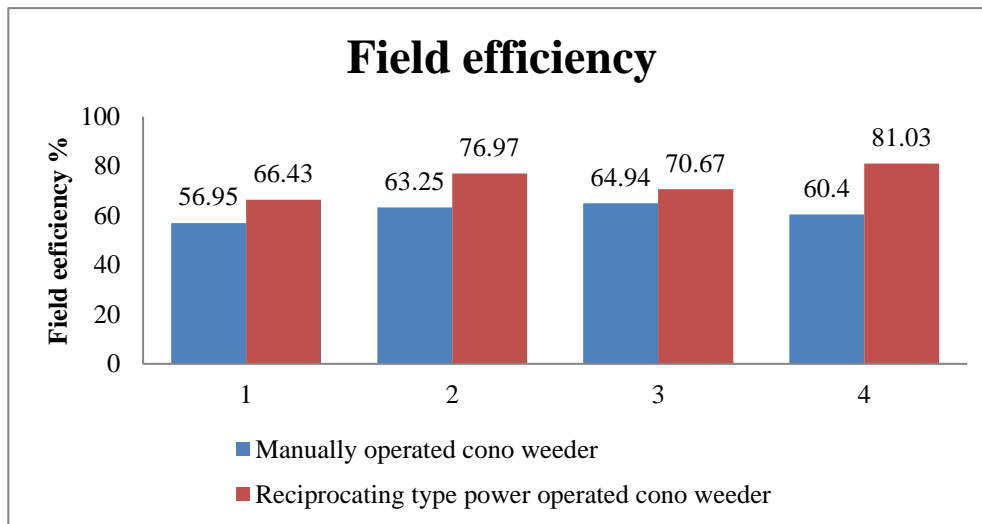


Fig. 6 comparison of field capacity between manually operated cono weeder and Reciprocating type power operated cono weeder

3.3.3 Comparison of field efficiency between manually operated cono weeder and Reciprocating type power operated cono weeder

The field efficiency of reciprocating type power operated cono weeder and manual operated cono weeder was shows in Fig. 7, from Fig. 7 it was concluded that reciprocating type power operated cono weeder has 12.36 % more field efficiency than manually operated cono weeder.



**Fig. 7 comparison of field efficiency between manually operated cono weeder and Reciprocating type power operated cono weeder**

### 3.4 Cost of operation

The cost of machine was estimated as is Rs. 14428/-.

The fixed cost of machine was calculated as Rs. 9.51 /h. The variable cost of machine was calculated as Rs. 131.36 /h.

The total cost of operation for developed reciprocating type power operated cono weeder was found to be Rs. 140 /h

### IV. CONCLUSION

1. The average actual field capacity and field efficiency were found to be 0.0193 ha/h to 0.0235 ha/h and 66.43 % to 81.03 % respectively.
2. The average weeding efficiency was found to be 87.45 %.
3. The average plant damage was 1.28 %.
4. The average fuel consumption was found to be 0.692 l/h.

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