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Improvement of a Low-Cost Rice Weeder

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Abstract

Farmers of Jhinaigati, Sherpur have been using an indigenous weeder extensively for lowland rice field. Some prototypes of that indigenous low-cost weeder were collected and tested at BRRI farm, Gazipur. During the test some difficulties were found and further modification was needed. Then the indigenous weeder was modified and tested to the field. The experiments were conducted at BRRI farm for heavy soil and Kapasia for light soil conditions.The weeding capacity of modified weeder (called BRRI KISHAN) at farmers' field was found to be 74.0 decimal/man-day and 75.0 decimal/man-day at heavy and light soil conditions respectively at large plot. BRRI KISHAN weeder showed 90% weeding efficiency. By using BRRI-KISHAN weeder Tk.1436.00/ha could be saved over manual weeding. By using weeder a considerable number of labour requirement per ha as well as production cost could be reduced over manual weeding.

Keywords: Weeder, Weeding capacity, Weeding cost

1. Introduction

Rice is the most important food crop in developing countries, and accounts for 29% of the total calorie intake of these populations. In the tropics, rice is largely grown on small family farms, which are usually less than 4 ha, and in Asia, rice cultivation is the most important source of employment in rural areas. Throughout these smallholder systems, weeds are one of the major biological constraints to production. Due to ecological situation and crop establishment technique, the reported loss of rice grain yield due to weed infestation varied from 7 to 80% in aman season (Sattar, 1986). People are always trying to overcome this problem and for getting maximum yield. Hand-weeding is the most widely used weed control method, with availability of labour being the main limitation to its effectiveness. In Asia, weed control in upland rice has been reported to require 32 - 198 man days per ha, representing 17 - 57% of the total labour requirement for the crop (Johnson, 1996). Islam and Haq (1985) in their study found that in lowland rice manual weeding the cost was 21.6% of the total production cost and they also reported that the Khupri (traditional weeder equipment use in Bangladesh) had a very low field capacity of 6.5 decimal/man-day. In some areas, adoption of line planting in transplanted rice has allowed the introduction of rotary weeders for cultivation between rice rows, considerably reducing labour requirements for weed control. Sometimes peoples have tried to minimize the weeding cost as well as human drudgery, and they have developed some hand tools to control the weed easily. In developing countries and under developing countries, weeding is mainly done by using hand on hand tools having widely varying configuration. Long handled tools which effect weeding in a standing posture; have been claimed as ergonomically sound and to provide better field coverage (Kumar, 1983; Nwuda and Kaul, 1986). Japanese weeder is introduced in Bangladesh and several researches for further improvement of Japanese weeder were done. Islam and Haq (1991) found that the weight of Japanese weeder is 6 kg for which power requirement of the Japanese weeder was high as it has two sets of rotary spikes and it was almost inoperable in clay soil. The Japanese weeder is wider than the existing line spacing in paddy field causing difficulties in use of it in paddy field. Therefore, researcher is very keen regarding to reduce the weight of the weeder and BRRI has modified the Japanese weeder and developed single rotary spike weeder which is lighter (5 kg) than Japanese weeder. Farmers of Jhinaigati, Sherpur have been using an indigenous weeder (600 gm weight only) extensively for lowland rice field, research organizations might improve the design of the weeder (Haque, 1999). This study was undertaken with the objectives: i) to improve the indigenous low-cost weeder., ii) to find out weeding capacity in different soil condition, iii) to compare the performance with BRRI weeder, indigenous weeder and manual weeding method as well.

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2. Methodology

The low-cost rice weeder was collected and tested at BRRI farm, Gazipur. This weeder is made of wooden block and iron tyne (Fig. 1)

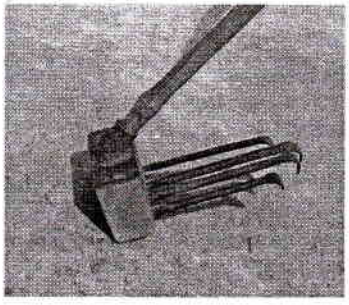

Fig. 1. Low-cost rice weeder collected from Jhinaigati, Sherpur in 2000.

The difficulties during weeding operation were observed and field condition also was observed. Based on the difficulties observed during weeding operation, the existing weeder was modified and fabricated in the FMPHT workshop.

BRRI-KISHAN weeder, BRRI weeder and indigenous weeder were selected to compare the performances with respect to manual weeding method. The experiment was conducted at BRRI farm (experimental plot and large plot) for heavy soil and Kapasia (large plot) for light soil conditions. Field capacity, weeding efficiency and cost of weeding were analyzed for the performance study. The crop yield was analyzed in the experimental plot. The size of plots were 20 m^2 and 884 m^2, respectively. The treatments were as follows with three replications:

T_1= BRRI-Kishan weeder
T_2= Indigeneous weeder
T_3= BRRI weeder
T_4= Hand weeding
T_5= Control

Field Capacity = A/T
A = area, decimal
T = Time, man-day
Weeding Cost (Tk/ha) = Depreciation cost + Labour Cost
Depreciation = CxT/t ;(Considering salvage value =0)
C = Purchase price, Tk
t = Total life, hr
T = time, hr/ha

Labor cost = $W \times L$
W = Wage rate Tk/labour
L = Labour require/ha

Weeding efficiency = (weed density after weeding)/(weed density before weeding) x 100%

3. Results and Discussion

During the operation of indigenous weeder some difficulties were observed, one of the major difficulties was clay barrier at front side of the weeder. To overcome this difficulty, the wooden block was replaced by mild steel frame and a skid was attached at front part of the weeder (Fig. 2).

Table 1. Comparative Specification of the indigenous and modified weeder

Item	Kishan Weeder (indigenous)	BRRI-KISHAN Weeder (after modification)
Width, cm	11 cm	12 cm
Wooden Block	11cm x 7cm x 4cm	None
Steel Frame	None	Yes
Skid	None	Yes(10cm)
Number of tyne	4	4
Length of handle, m	1.5	1.5
Weight, gm	600 gm	650 gm
Price, TK.	45.00	100.00

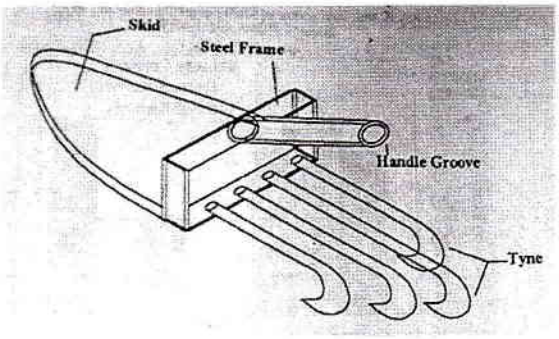

Fig. 2. The schematic diagram of modified weeder (BRRI-KISHAN weeder)

Then the weeder was tested again in field and was given a name BRRI-KISHAN WEEDER. The operation condition of BRRI-KISHAN weeder is shown in Fig.3. During test the weed density in the field was found to be 481 number per m^2 and the average plant height was 31.6 cm. Manual weeding was conducted as control and labour required by manual weeding was 29.4 man-day/ha. The field capacity of the original weeder was found to be 41.06 decimal/man-day (6 man-day/ha). The total weeding cost was found to be 340 Tk/ha (Table 2).

After modification of indigenous weeder, BRRI-KISHAN weeder was tested in field and the weeding capacity also found to be 53.44 decimal/man-day (4.62 man-day/ha) and was found lowest weeding cost (255.63 Tk/ha). The weeding cost by BRRI weeder and manual weeding were found 334.00 Tk/ha and 1617.00 Tk/ha, respectively at the same field condition. At this condition BRRI-KISHAN weeder showed better performance. By using BRRI-KISHAN weeder 1362.00 Tk/ha can be saved.

3.1 Weeder performance at heavy soil condition in Boro 2001

Weeding capacity 32 decimal/man-day of BRRI KISHAN weeder was found significantly greater than the capacity of indigenous weeder (25 decimal/man-day) and hand weeding (18.1 decimal/man-day). This result shows that the weeder reduces the number of labour requirement per ha. The weeding capacity of BRRI-KISHAN weeder was statistically identical with BRRI weeder (35.0 decimal/man-day). Weed density and dry matter during test were found non-significant for all treatments (Table 3). Plant height, hill per square meter and plant per hill were also found non-significant.

Table 2. Test Results of the Weeders in 2000

Weeder	Plant Height, cm	Field capacity, labour/ha (deci/man-day)	Labour Cost, Tk/ha	Depreciation cost, TK/ha	Weeding cost, Tk/ha
Indigenous	31.6	6(41.06)	330.00	10.80	340.80
BRRI-KISHAN	31.6	4.62(53.44)	254.00	9.86	263.86
BRRI WEEDER	31.6	5.46(45.23)	300.00	34.94	334.94

Note: Labour cost = @55 Tk/man-day; Manual Weeding cost 1617.00 Tk/ha

Table 3. Weeder performance at experimental plot in 2001

Weeding tools	Weeding capacity decimal/man-day			Weed density at		Weed dry matter, g/m^2		Plant height, cm	Hill /m^2	Plant /hill	Yield t/ha
	1ST	2ND	AV	1ST	2ND	1ST	2ND				
1. BRRI KISHAN weeder	35.0^{a}	29.0^{ab}	32.0a	44	26	10.53	6.22	90.67	40	17	7.17^{A}
2. Indigenous weeder	25.0^{a}	25.0^{bc}	25.0b	46	27	13.73	8.06	93.40	41	15	5.42^{AB}
3. BRRI weeder	34.0^{a}	36.7^{a}	35.0a	56	32	10.61	6.06	93.27	38	17	5.83^{A}
4. Hand weeding	17.5^{b}	18.7^{c}	18.1c	35	25	13.03	9.31	92.56	37	17	5.58^{A}
5. Control	-	-	-	36	28	9.81	7.63	86.87	44	14	3.67^{B}
LSD Value (0.01)	8.095	7.900	7.87	NS	NS	NS	NS	NS	NS	NS	1.803

NS =Non-Significant

3.2 Weeding capacity of weeder at large plot in Boro season 2001

At BRRI farm, the weeders were tested at 884 m^2 plot size. The capacity of BRRI-KISHAN weeder and BRRI weeders were 74.0 decimal/man-day and 65.0 decimal/man-day respectively. However, at Kapasia, the capacity were found 75.0 decimal/man-day and 59.0 decimal/man-day for BRRI-KISHAN weeder and BRRI weeder respectively (Table 4). Due to smaller plot size, number of turning for experimental plot was 13 times more than that of large plot. Therefore, more labour was required in smaller plot than larger plot.

3.3 Weeding efficiency

Weeding efficiency of BRRI KISHAN weeder and BBRI weeder were found to be 90% and 87% respectively (Table 4).

3.4 Cost of weeding

The weeding cost of different weeding were shown in Table 5. The average weeding cost by BRRI-KISHAN weeder was found to be Tk.1110.00/ha and Tk.474.00/ha for small and large plot respectively. However, the average weeding cost of BRRI weeder was found to be Tk.1009.00/ha and Tk.594.00/ha for small and large plot respectively, whereas, manual weeding cost was found Tk.1910.00/ha (Table 5). By using BRRI-KISHAN weeder Tk.1436.00/ha can be saved over manual weeding.

4. Conclusions

The modified weeder is light in weight (650 gram) and less power required for operation. Labor feels comfort to work with this weeder. The modified weeder even can be used in both with and without line transplanting field. It can perform better and economically viable compared to indigenous weeder. About 1300 Taka/ha could be saved using the weeder at reduced labor requirement. The weeding efficiency BRRI-KISHAN weeder was found to be 90%.

5. Recommendation

The modified weeder can be disseminated damong farmer around the country. Ergonomics study needs to be conducted for BRRI-KISHAN weeder and BRRI weeder for designing comfortable handle and angle of weeding posture.

Table 4. Comparison of weeding capacity at different plot size and different soil condition in 2001

Weeder	Field capacity, decimal/man-day			Weeding efficiency (%)
	Experimental plot	Large plot		
		BRRI Farm	Kapasia	
1.BRRI KISHAN weeder	32.0	74.0	75.0	90
2. BRRI weeder	35.35	65.0	59.0	87

*Plot length 5 m for experimental plot; 68 m for long-run test
** Turning time loss at experimental plot than long-run test = 13 times.

Table 5. Cost analysis of weeding in 2001

Weeding methods	Fixed cost, Tk/ha	Variable cost, Tk/ha			Total cost Tk/ha			
		Experimental plot (2 times weeding)	Large plot (2 times weeding)		Experimental plot (2 times weeding)	Large plot (2 times weeding)		
			BRRI Farm	Kapasia		BRRI Farm	Kapasia	Average
1. BRRI KISHAN weeder	10.00	1080.00	467.00	461.00	1090.00	477.00	471.00	474.00
2. Indigenous weeder	11.00	1383.00	-	-	1394.00	-	-	-
3. BRRI weeder	35.00	974.00	532.00	586.00	1009.00	567.00	621.00	594.0
4. Hand weeding	-	1910.00	-		1912.00	-	-	-

- Experimental Plot size : 20 m^2

Long-run test plot size : 410 m^2 at Kapasia; 884 m^2 at BRRI farm

Fig. 3. Field operation of BRRI-KISHAN Weeder

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