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SHORT COMMUNICATION

Modification of Power Tiller as Power Operated Weeder for Sugarcane

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Sugarcane is one of the most important cash crops of our country. Sugarcane is planted in deep trenches or furrows. BSRI recommended furrow to furrow distance is one meter. Farmers make these trenches by spade or by country plough drawn by bullocks or buffaloes. In the Sugar mill's farm trenches are done by tractor drawn trencher. In our country weeding are done by spades in all Sugarcane fields. During land preparation and harvesting period required huge amount of labours but shortage of labours causes increasing demands for appropriate farm machinery (Alam, 2000). Presently power tillers are relatively cheaper then four wheel Tractor. There are about twenty thousand Tractor and 300 thousand power Tiller in Bangladesh. Those are being used for tilling 60 to 70% of the agricultural land (Satter, *et al.*, 2005).

Oni (1990) reported that 50 – 70% of yield reduction is caused by poor weed control. Estimate suggests that weeds are responsible for an aggregate reduction of more than 10% in the yield of world's major crops, representing huge loss of food (Douglas, 1992). Ramgasumy *et al.*, (1993) reported 16 to 42% yield loss due to weeds alone and one third of the total cost of cultivation is spent on weeding. Weeds can be mechanically destroyed either by uprooting or Soil covering (Parish, 1990, keener *et al.*, 1978). Samson and Goulmen (1989) showed that mechanical cultivation could be efficiently used for weed control in agriculture when both economical and environmental considerations are taken into account. As farmers have no power Tiller mounted weeder they can't use power Tiller for the purpose of weed control. During the year 2007-08 BSRI developed a new device for controlling weed in sugarcane field. For this purpose some modifications have been done in the power tiller operated rotavators.

The following considerations were taken during the modification of the power tiller operated weeder: i) Ease of width adjustment ii) Ease of operation iii) Locally available materials for manufacturing iv) Ease of trailing from home to field or field to home v) Cheaper and durable vi) Ease of turning of machine at the end of the field vii) The machine will be affordable to the farmer viii) The machine will not hamper the tillering and growth of sugarcane. Considering the above considerations, the following functional components were incorporated with the weeder. 1) A space adjustment mechanism was included to adjust the distance between two rows. 2) A cover was included around the rotavator of the weeder to protect the scattering of soil during weeding so that soil can't hamper the tillering of sugarcane. For the fabrication of the weeder locally available materials viz: rubber sheet, hubs of power tiller, nut-bolts were used. Eighteen numbers of tines were used for weeding. The machine was tested in 3 (three) fields of different sizes:34m × 50m, 34m × 13m, 70m × 13m respectively and row spacing was 1(one) mitre

for each field. Some modification was done to the power tiller for weeding sugarcane field which are described below: i) To increase the distance between two front wheels to run out side of two nearest rows of the sugarcane, axle length was increased. As the axle of the different length was not available in the market to increase the axle length hubs were used to serve the purposes because they were available in the market. ii) Depending on the row spacing width of weeding action of the machine can be adjusted by adding or subtracting the tines. iii) About one thousand taka is required to buy two extra hubs of power tiller and four pieces of rubber sheet (length 28 inch & width 10 inch).

To evaluate the performance of the machine in the field the weeder was run in the BSRI sugarcane fields. Figure.1 and Fig.2 shows the operating condition of the weeder in the field. The field capacity, field efficiency and fuel consumption of the machine was obtained from the field test are given in the table1 when row to row spacing was one meter. Theoretical field capacity (TFC) of the weeder was found 1 ha/day. TFC depend on the row spacing (width of coverage of the machine) of sugarcane field and forward speed of the weeder. So it does not depend on the field size but it will vary with row spacing of sugarcane. At the time of operation forward speed was 1.22 km/hr. Average actual field capacity (AFC) of the weeder was found 0.67 ha/day which ranged from 0.61 to 0.74 ha/day (Table 1). AFC largely depends on the field sizes unlike TFC. Running the machine along the longer direction of the field requires less numbers of turn to complete the field operation. Thus the AFC was higher when the machine was runs along the longer direction of the field than that of shorter direction. The field efficiency of the weeder was calculated 67.5% which was ranged from 61% to 74%. The lower field efficiency of the weeder indicates excessive time loss during operation. Mainly time loss occurred during turning at the ends. Field efficiency increased with increases length of the row. A diesel engine (8.8 kw) was used with the weeder, the average fuel consumption of the engine was measured 1.05 litre/hr and it was found that the requirement of fuel was 12.5 litre/ha. From the observation during and after weeding it was found that both shallow and deep rooted weed could be uprooted by adjusting the depth of the weeder. During the time of weeding, weeds were up rooted from the soil and mixed with soil so that weeds can't grow within the short time. Weeding performance of the weeder was shown better than the manually weeding. It performed two (weeding and mulching) at a time. But weed between plants to plant were not destroyed during weeding. It was observed that no clump of sugarcane was damaged at the time of weeding as well as during turning at the end of the row. Out of the three operators one was very skilled on driving power tiller and could successfully weeded the field without damaging any clump of sugarcane. Two other operators who had a little experience in driving power tiller and was not efficient as the first one. However, all of the operators expressed their opinions that after few days of operation they would be able to drive the weeder very efficiently in the sugarcane field. Though BSRI recommended row spacing of sugarcane field is 1(one) metre but usually it is 0.75m in the farmer's fields. Effective width of the rotavator can be increase or decrease by adding or subtracting the tines and hubs. So, the weeder may be capable and suitable for the field of different row spacing. For weeding, one hectare of sugarcane field by the power operated sugarcane weeder required TK. 1201.00 included all type of cost (Table 3) whereas 23 labours as well as Tk. 2760.00 are required in case of manually weeding. So using the BSRI modified power operated weeder, time and about 60% cost of weeding sugarcane field can be reduced.

Table 1. Field capacity, field efficiency and fuel consumption of the weeder, 2008.

Sl No.	Field size length×width (m × m)	Theoretical field capacity (ha/day)	Actual field capacity (ha/day)	Field efficiency (%)	Fuel consumption		Soil type
					l/hr.	l/ha.	
1.	34 × 13	1	0.61	61	1.0	13.1	clay
2.	50 × 13	1	0.67	67	1.05	12.5	clay .
3.	70 × 13	1	0.74	74	1.1	11.9	clay
Average		1	0.675	67	1.05	12.5	

Table2. Calculation of annual depreciation of power tiller and other materials to operate the power tiller for weeding.

Item	Purchase price	Economic life (year)	Salvage value	Percent considered	Annual depreciation (Taka)
Power tiller	90,000.00	10	10%	40%	3240.00
Other materials to operate the power tiller for weeding.	1000.00	10	10%	100%	90.00
				Total =	3,330.00

Table 3. Cost of weeding by power operated weeder for sugarcane, 2007-2008.

Item	Calculation	Total annual cost (Tk)	Cost per hector (Tk)
Depreciation	From Tabbe-2	3330.00	111.00
Interest @ 10%	0.1 90,000.00 0.4 + 1000 0.1	3700.00	123.00
Repair, maintenance and lubrication @ 3%	90,000.00 0.03 0.4	1000.00	36.00
Fuel @ Tk. 55 per litre.	12.5 55.00	-	688.00
Oil @ Tk. 170 per litre.	12.50 0.03 170	-	64.00
Operator @ Tk. 120 per day.	120/0.67	-	179.00
		Total =	1201.00

Figure1. Power operated sugarcane weeder in operation (front view)

Figure 2. Power operated sugarcane Weeder in operation (rear view)

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