

Performance evaluation of self propelled walking type vertical conveyor reaper

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SUMMARY : Performance evaluation of vertical conveyor reaper was carried for wheat crop varieties WH 147 and HD 2189. Field performance test of reaper was carried out as per RNAM test code procedure. Cost estimation of harvesting was calculated by using straight line method. The tests were conducted to assess harvested area, operational speed, working speed, working width, stubble height achieved and losses. The average value of the header loss, conveying loss and total machine losses were 0.85 per cent, 3.1 per cent and 3.95 per cent, respectively. The cost of the harvesting by self propelled reaper was found to be Rs. 677.50 /ha. with field capacity 0.13 ha/hr , saving up to 44 per cent cost of harvesting.

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In a grain crop production system harvesting alone requires about 25 per cent of the total labour requirement. There is acute shortage of labour during harvesting season and also grain loss more during harvesting manually. It has been observed that more than 80 per cent of farmers used sickle for harvesting of wheat and remaining used combine harvester on custom hiring. Reapers which are in between sickle and combine is rarely used for harvesting by farmers.

The acceptance, in general, of the available harvesting equipments has been rather slow compared to the other farm operations like tillage, sowing, plant protection etc, owing to the factors involving crop, machine field accessibility and operator/operational parameters

For small size fields the self propelled vertical conveyor reaper can be used for harvesting of the cereal crops like wheat and paddy. It is driven by a 5-hp diesel engine and engine power is transmitted to cutterbar and conveyor belt through belt pulleys or by providing gearbox, which cut the crop and held in vertical position, is dropped in a windrow or unbound bunches. Reaper does not carry provision to bind

the crop into bundles. Bundling is always done through manual labour. It has high field capacity and farmers in the developing country for harvesting paddy and wheat crops have now adopted good quality of work. Marginal farmer can use reaper on custom hiring, as it is costly. Owing to all above facts vertical conveyor reaper was introduced to farmers and its performance was evaluated.

EXPERIMENTAL METHODS

The self propelled reaper was tested for wheat crop.

Knife register:

A knife is registered by rotating the knife driver manually keeping reaper the cutterbar in level cutting position.

Cutterbar lead:

The cutterbar lead of a mower is usually set 20 mm per meter of cutterbar length. Cutterbar is at right angles to the forward motion during operation when the lead is properly set.

Tension of lugged conveyor belts :

The tension of lugged conveyor belts is adjusted by suitably shafting the drive flat pulley using tension adjustment bolts.

Cost estimation:

The cost of harvesting was calculated by straight line method and by following assumptions:

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Table A : Specification of self propelled vertical conveyor reaper

Sr. No.	Particulars	
1.	Type of machine	Self propelled walking reaper
2.	Engine	
	Power	5 hp
	RPM	1800
	Fuel used	Diesel
3	Recommended	2.6 km/h
4.	Make	CIAE Bhopal
5.	Crops recommended for harvesting	Wheat, paddy, safflower
6.	Lifting and grafting unit	
	Row crop dividers (Number)	Three
	Length	940 mm
	Spacing	310 mm
	Method of mounting	Front mounting
7.	Cutter bar	
	Size	1000 mm
	Method of mounting the drive mechanism	V-belt drive, chain and sprocket drive
	Stroke length	75 mm
	Method of adjusting height of cut	Handle (operator)
8.	Star wheel	
	Numbers	Three
	Numbers of fingers on each wheel	Six
	Diameter	135mm
	Angle of inclination	25 ⁰
	Thickness	8 mm
9.	Lugged conveyor belts	
	Numbers	Two
	Width	50 mm
	Length	1200 mm
	Material of belt	Canvas
10.	Chain and sprocket drive	
	Type of chain	Standard pitch roller
	Length of chain	1100 mm
	Pitch	13mm
	Number of teeth in driving sprocket	14
	Number of teeth on driving sprocket	22
11.	V-belt drive	
	Number of belts	Two
	Type of belt	Nylon
	Length of belt	800 mm
	Number of idlers	Two
	Type of idlers	Flat, square groove

Sr. No.	Name of part	Material of construction
1.	Knife section	Carbon steel
2.	Guard	Forged steel
3.	Star Wheel	Aluminium
4.	Row crop dividers	M.S.Pipe
5.	Pressure spring	Spring steel
6.	Conveyor belts	Canvas
7.	Star wheel cover	M.S. Sheet
8.	Frame	M.S. Angle
9.	Crop supporting unit	M.S. Sheet

Life span of vertical conveyor reaper (L) = 10 yrs
 Working hours (H) = 250 hrs/yr
 Salvage value (S) = 10 %
 Interest rate (I) = 16%

To calculate the depreciation following formula is used:

$$D = C - S/L \times H$$

EXPERIMENTAL FINDINGS AND ANALYSIS

Self propelled walking type reaper was tested to evaluate the field performance for wheat crop.

Harvesting of wheat crop was carried out under the crop conditions. Average plant height and plant population were measured as 55.4 cm and 2800 kg/ha. The average area covered and fuel consumption were 0.13 ha/hr and 0.64 l/hr, respectively. The average value of the header loss, conveying loss and total machine loss were 0.85 per cent, 3.1 per cent and 3.95 per cent, respectively. The overall performance of the machine tested for the wheat crop was found satisfactory (Table 1).

Particulars	
Crop variety	HD 2189
Age of the crop at the time of harvesting (days)	116
Plant population (No./m ²)	80
Plant height (cm)	55.4
Moisture content	
Stem (d.b)	8.1
Grain (d.b)	11.22
Crop yield (kg/ha)	2800
Average travelling speed (km/hr.)	1.6-1.9
Average effective working width(mm)	910
Average area covered (ha/hr.)	0.13
Stubble height (mm)	95
Average fuel consumption (l/hr.)	0.64
Field efficiency (%)	74
Losses (%)	
Pre- harvest loss	Nil
Header loss	0.85
Conveyance loss	3.1
Total machine loss	3.95

The cost of harvesting by self propelled reaper was Rs. 677/ha, and by manual harvesting cost was Rs 1200/ha. The cost of harvesting of wheat crop by self propelled reaper was much less than the manual harvesting. It also reduced the time required for the harvesting. Murthy (1989) and Guruswamy *et al.* (1996) have also highlighted the importance working of reaper.

Conclusions:

Present research work was undertaken with the objective to evaluate the performance of vertical conveyor reaper for harvesting the wheat and to build up a test data for the farmers. Different observations such as plant height, effective cutter bar width, plant population, average crop yield and total machine loss were recorded. From the observation necessary calculation for field capacity, field efficiency, per cent grain losses and cost of operation were carried out. From the result obtained following conclusion was drawn.

- Field must be fairly leveled without undulations to facilitate smooth operation and uniform stubble length.
- Sowing must be carried out by mechanical seed drill to avoid choking due to bunch at a place.
- For wheat crop water control in field is essential to ensure that the fields are drained and are relatively dry at harvesting time.
- Skill labour is required for operation, to give more efficiency and reduce cost of harvesting and losses.
- Headland must be harvested manually to give passage for easy turning and avoiding losses.

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