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FIELD EVALUATION OF SELF PROPELLED REAPER BINDER IN WHEAT CROP

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Abstract

Field performance of reaper-binder was assessed in wheat crop. The testing of self propelled Reaper binder was carried out for harvesting of wheat crop on the university farm, Dr. P D K V, Akola. The effective field capacity of the reaper-binder was found 0.716 ha h^{-1} with a field efficiency of 88 per cent at an average operating speed of 5.38 kmph. The fuel consumption was found 4.73 l ha^{-1}. The harvesting losses for mechanical harvesting were 1.70 per cent.

Key words : Wheat, reaper binder, harvesting.

Introduction

Wheat (*Triticum aestivum* L.) is the first important and strategic cereal crop for the majority of world's populations. It is the most important staple food of about two billion people (36% of the world population). Worldwide, wheat provides nearly 55% of the carbohydrates and 20% of the food calories consumed globally. It exceeds in acreage and production every other grain crop (including rice, maize, etc.) and is therefore, the most important cereal grain crop of the world, which is cultivated over a wide range of climatic conditions.

The harvesting of wheat is done traditionally by manually operated sickle, which demands considerable amount of labour, drudgery and more time to harvest. This reflects on the total cost of harvesting and the cost of production of the crop. It is estimated that harvesting of crops consumes about the 25-30 per cent of the total labour requirements of the crop production system. Timely harvest of the crop is vital to achieve to quality produce and reduced the loss. The shortage and unavailability of labour during harvesting results heavy losses to the farmers and at the same time the labour is shifting towards non-agricultural jobs, which needs an immediate attention.

Reaper binder is mainly used to harvest and bind low stem crops such as wheat, rice, grass, barley, oats etc. The machine has different structure and working rows to meet different requirements of customers. The reaper and binder machines can be divided into self-propelled and wheel tyre types. While according to the working rows of the machine, the reaper binder machine can be divided into three rows reaper binder and two rows reaper binder.

The cutting unit of of reaper binder may be disc type or cutter bar type. After cutting, the crop is conveyed vertically to the binding mechanism and released to the ground in the form of bundles.

Characteristics of Reaper and Binder

1. **Multi-functional** :- This reaper and binder machine can used for many kinds of low stem crops.
2. **High adaptation** :- The machine can used in many different kinds of land forms, such as hills, slops, mountains, etc.
3. **With high flexibility** :- The reaper-binder machine has a compact structure and small volume. It is more flexible and easier to operate on the field.
4. **User-friendly** :- The steer control handle bar can be freely adjusted to up, down, left or right. The handle can be adjusted around 180°, vertical

30°, which is more flexible to be handled in different environment.

5. Adopt shaft drive system which works more stable and safe.
6. **Optional working row** :- There are two kinds of machines with 2 or 3 working rows.

Detailed Technical Data of Reaper-binder

The reaper-binder is shown in plate 1 and the specifications of the machine are given in table 1.

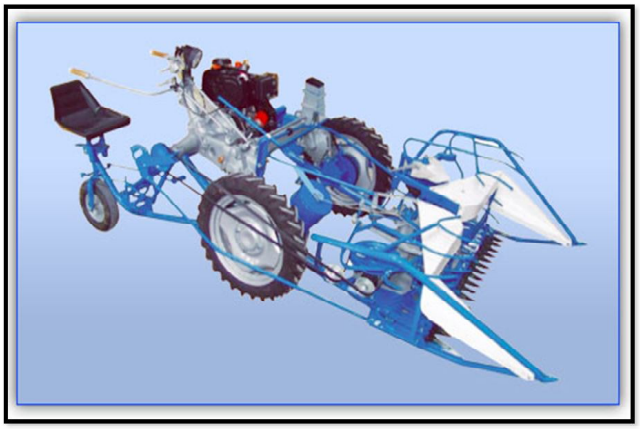

Plate 1 : Reaper binder.

Table 1 : Specifications of reaper-binder.

S. no.	Descriptions	Details
1.	Name of machine	Reaper-binder
2.	Manufacturer	M/s. BCS India Pvt. Ltd., Manngarh, Ludhiana
3.	Model	BCS Standard
4.	Overall dimensions (L x W x H), mm	3600 x 1850 x 1300
5.	Weight, kg	450
6.	Cost of equipment,RS.	2,80,000/-
7.	Power source	10 HP diesel engine
8.	Fuel used	Diesel
9.	Cutter bar width m	1.22
10.	Number of Strokes /min.	775

Methodology

The field evaluation of self propelled reaper binder has been carried out at Dr. P.D.K.V., Akola. The parameters that were measured during field test are as follows.

Plant Height (cm)

Cutting width(m)

Cutting Height

Speed of Operation(km/hr)

Theoretical Field Capacity (ha/hr)

Effective Field Capacity (ha/hr)

Field Efficiency (%)

Harvesting Losses (kg/ha)

Harvesting Losses (%)

Results

Field observations

Test Plot – 1

Area – 1.5 acre

Variety-10k-one

1) Crop Height and Cutting Height (cm)

Crop height (cm)	Cutting height (cm)
67	22
76	21
68	21.5
65	19
69	21
72	22
65	23

2) Time required traveling 10m distance (sec)

7.16	8.12	7.89	9.11	8.52

Average = 8.16 sec

3) Cutting Width- 1.5 m

4) Loss of Grain in 1m × 1m Plot

Plot	Number of grain	Weight of grain (gm)
Plot 1	35	1.5
Plot 2	14	0.71

Calculations

1) Speed of Operation

For travelling 10 m distance 8.16 second were required

8.16 sec ———————— 10 m

8.16/60 × 60 hr

0.00227 hr ———————— 10 m

10/0.00227 m/hr = 4.40 km/hr

2) Theoretical Field Capacity

The theoretical field capacity was calculated as follows :

$$\text{Theoretical field capacity, ha/h} = \frac{S \times W}{10}$$

Where,

S = Speed of travel, km/h

W = theoretical width, m

$$\text{Theoretical field capacity, ha/h} = \frac{4.40 \times 1.5}{10} = 0.66 \text{ ha/h}$$

3) Harvesting Losses

The average yield of a wheat is 1300 kg/ha

1300kg/ha ——————— 10,000 m^2

1.5 gm ——————— 1 m^2

1.5 × 10,000 = 15000 gm = 15 kg/ha

15/1300 × 100 = 1.15%

The harvesting loss by self propelled Reaper Binder for wheat crop was found 1.15%

Test Plot – 2

Area – 1.17 ha

Variety-10k-one

Field observations

1) Bed Width- 2m

2) Cutting Width-1.5m

3) Length of Plot-260m

4) Width of Plot-45m

5) Time required traveling 10m distance (sec):

5	6.57	7.48	8.50	6

Average – 6.71 sec

6) Time required for turning

12.33	8.34	10.63	9.23	9.68

7) Time required for travelling 260 m distance- 3min. 16 sec.

8) Crop height and cutting height (cm)

Crop height (cm)	Cutting height (cm)
79	32
67	21
83	17
63	19
60	24

9) Loss of grain in 1m × 1m plot

Plot	Number of grain	Weight of grain (gm)
Plot 1	23	1.02
Plot 2	41	2.21

Calculations

1) Speed of Operation

Time required for travelling 10m distance was 6.71 sec.

6.71sec ——————— 10m

6.71/60 X 60 = 0.00186 hr ——————— 10m

1 hr = 10/0.00186 = 5376.34 m/hr

= 5.38km/hr

2) Theoretical Field Capacity

The theoretical field capacity was calculated as follows :

$$\text{Theoretical field capacity, ha/h} = \frac{S \times W}{10}$$

Where,

S = Speed of travel, km/h

W = theoretical width, m

$$\text{Theoretical field capacity, ha/h} = \frac{5.38 \text{ X } 1.5}{10}$$

= 0.807 ha/hr

3) Effective field capacity

For calculating effective field capacity, the time taken for actual work and that lost for other activities such as turning.

Effective field capacity was calculated as,

$$S = \frac{A}{T_p + T_1}$$

Where,

S = Effective field capacity, ha/h

A = Area covered, ha

T_p = Productive time, h

T_1= Non productive time, h (time lost for turning)

Area covered = 260 × 1.5 m^2 = 390 m^2

Productive Time (T_p) = 3.16 min

Time for Turning (T_1) = 10 Sec

Total Time (T_p+ T_1) = 196 sec

$$S = \frac{390}{196} \times \frac{3600}{10,000}$$

= 0.716 ha/hr

4) Field efficiency

Field efficiency is the ratio of the effective field capacity and theoretical field capacity and expressed in percent as

$$\text{Field efficiency, \%} = \frac{\text{Effective field capacity, ha/h}}{\text{Theoretical field capacity, ha/h}} \times 100$$

$$= \frac{0.716}{0.807} \times 100$$

= 88.72%

5) Harvesting Losses

The average yield of a wheat is 1300 kg/ha

1300kg/ha ——————— 10,000 m^2

2.21 gm ——————— 1 m^2

2.21 × 10,000 = 22100 gm = 22.1 kg/ha

22.1/1300 × 100 = 1.70%

The testing of self propelled Reaper binder was carried out for harvesting of wheat crop on the Dr. P.D.K.V., Akola. The results of field performance summarized in table 2. The average plant height, row spacing, and height of cut were 70.4 cm, 45 cm and 22.6 cm, respectively. The mean values of forward speed, effective field capacity, field efficiency, fuel consumption and harvesting losses were observed 5.38 km/h, 0.716 km/h, 88.72%, 4.73 l/h and 1.70%, respectively.

Plate 2 : Field evaluation of reaper.

Table 2 : Performance evaluation of self propelled reaper binder.

S. no.	Parameter	Result
1	Row Spacing (cm)	45
2	Plant Spacing (cm)	15
3	Bed Width (m)	2.0
4	Plant Height (cm)	70.4
5	Cutting width (m)	1.5
6	Cutting Height (cm)	22.6
7	Speed of Operation (km/hr)	5.38
8	Fuel consumption (l/h)	4.73
9	Theoretical Field Capacity (ha/hr)	0.807
10	Effective Field Capacity (ha/hr)	0.716
11	Field Efficiency (%)	88.72
12	Harvesting Losses (kg/ha)	22.1
13	Harvesting Losses (%)	1.70

Plate 3 : Binding Bundles of wheat after harvesting.

Conclusion

Field evaluation of Self Propelled Reaper Binder in Wheat Crop has satisfactory effect on harvesting parameters. Self propelled reaper binder shows significant effect on field efficiency when it is been operated with the optimum speed of operation. It can also be concluded that it can minimize the harvesting losses when operated with optimum conditions as compare to other harvesting techniques. The average cutting height was recorded as 22.6 cm.

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