SUCCESS STORIES

On

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8. Tractor Operated Laser Land Leveler

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5. Tractor Operated Straw Combine

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Introduction

Haryana is one of the important wheat growing State of the country and is contributing to the central pool of food by producing wheat over its own requirements. Wheat production in the state has also increased many folds since its inception through increase in area under the crop as well as improvement of crop yield through adoption of new crop production technology. Presently the area under wheat crop is 2300 thousands hectares.

In earlier time treading the crop under the feet of men or the hooves of the animals and striking the grains with sticks accomplished the threshing of wheat. Then the era of thresher came & farmers started using thresher for threshing the crops which not only separate the grains but also process the wheat stacks into a finely bruised form known as 'Bhusa' or wheat straw. These types of wheat threshers have closed concave which permits proper straw bruising and threshing making them integral function of threshing system in India.

Necessity of Promotion

The grain combines were introduced in India in the 1970's. The use of combines helped in timely harvesting of wheat but, it resulted in loss of Bhusa (cattle feed). The wheat straw is a valuable by product. The wheat straw is fed to the cattle in the form of Bhusa i.e. finely cut and crushed. The harvester combines were not becoming popular earlier in spite of timely harvesting because of loss of bhusa (Cattle feed). This resulted in wastage of around 40 million tones of wheat straw worth Rs.40 crores of rupees annually in Punjab alone (Ahuja et.al.1993) where as in Haryana it was estimated about 5 million tonnes. To collect and bruise the wheat straw and stubbles left behind after use of grain combine, a wheat straw combine have been devised. The straw combines cut the left over wheat stubbles and also collect the left over straw and ear-head bearing plants from the combine harvested field and do the threshing. Thus, it recovers the grain and loads the prepared Bhusa into the attached trailer. It is estimated that about 50% area under wheat crop is harvested by combine harvester in Haryana with the introduction of

Straw combine. A straw combine is a useful machine to recover the wheat straw, which is normally left in the field by a combine harvester. In majority of cases it was burnt. This practice not only leads to environmental pollution but also causes a considerable economic loss of precious biomass widely used as a cattle feed. So, there was a need to evaluate its economics and adoption level among farmers.

Salient features

A straw combine essentially consists of four main units viz., stubble cutting and collecting unit, feeding unit, straw bruising unit and "BHUSA" blowing unit Two different types of straw bruising mechanisms have been commonly used in the existing models of straw combines. These include a spike tooth cylinder and serrated saw type mechanisms. Serrated saw type cylinder are mostly used in the straw combines for bruising. Serrated plates are attached on the bars at specific spacing and the bars arranged parallel to drum axis. Straw combine is pulled by tractor (45 hp) with an attached trolley (Fig. 5.1). As soon as this trolley is completely filled with straw, it is unloaded near the dumping site normally located centrally or in the corner of the field.

Field performance of machine

The work on straw combine was started under the project since year 2001. The field capacity of the machine varies from 0.40 to 0.62 ha/h with an average of 0.52 ha/h. The average width of cut of the machine was 190.8cm. The straw recovery was 70-80%. The performance of the machine was found to be very good.

The test results of straw combine are reported in Table 5.1. The straw split percent varied from 89.3 to 95.2 and average straw split was 92.36 whereas the length of bhusa varied from 2.1 to 2.4 cm and average length of bhusa was 2.3 cm. The average heights of cut of stubbles varied from 6.04 to 9.8 cm. The straw recovery varied from 62.7 to 81.0 per cent and average straw recovery was 70.7 per cent. The straw recovery mainly depends upon the stubbles height remaining in the field after harvesting by combine harvester. Straw recovery rate varied from 23.5 to 31.8

q/ha and average straw recovery rate was 28.2 q/ha. The grain recovery varied from 42.6 to 50.0 per cent and average grain recovery was 45.9 per cent. The grain collected in pan ranged from 141-180 kg/ha and average grain collection was 141 kg/ha.

In year 2005, the farmers were motivated to buy straw combine for self-use and on custom hiring for increasing their income. Nine farmers purchased this machine. The area covered by these farmers was 199ha (own) and about 570 ha on custom hiring and on an average area covered by a farmer is about 85ha as reported in Table 5.2. The average rate of custom hiring was Rs. 1250/ha in 2004 and Rs. 1325/ha in year 2005 in Haryana. Average grain recovery was 100-120kg/ha and bhusa recovery was 25q/ha. The cost of machine is Rs. 90,000 to 1, 20,000 depending upon quality and capacity of machine.

Table 5.1. Performance results

The value in parenthesis is grain recovery in kg/ha

Test No.	Av. Weight of straw before straw Reaping (g/m^2)	Av. Wt. of straw left after straw Reaping (g/m^2)	Av. Wt. of straw collected by machine (g/m^2)	Straw recov-ery (q/ha)	Straw recov-ery (%)	Straw split (%)	Wt. of grain before reaping (g/m^2)	Wt. of Grain left After Reaping g/m^2	Av. Wt. of grain collected (g/m^2)	Grain Recov ery, (%)
1	470	162.2	303.5	30.3	62.7	93.2	31.4	16.7	14.7 (147)	46.8
2	394	75.6	318.4	31.8	81.0	90.4	29.8	14.9	14.9 (149)	50.0
3	447.7	139.4	308.2	30.8	68.8	89.3	30.6	16.5	14.1 (141)	46.0
4	353.7	111.4	242.2	24.2	68.5	93.7	30.4	12.4	18.0 (180)	59.2
5	332.8	97.2	235.6	23.5	70.7	95.2	31.4	17.7	13.7 (137)	43.6
Av.	**400**	**117.2**	**282.8**	**28.2**	**70.7**	**92.36**	**30.7**	**16.6**	**14.1 (141)**	**45.9**

Table 5.2. Custom hiring on Straw Combine 2004-05

Name & Address of Entrepreneur	Straw combine make and model	Tractor Used	Area covered (ha)	
			Own	Custom
Sh. Rattan Singh Sarpanch, VPO. Ruhnat, Distt. Bhiwani	Standard	HMT-5911	30	---
Ram Phal s/o Ajmer singh Hansi, Hisar	Do	Do	30	---
Satyawan, Village Rathera, Bhiwani	Guru Nanak	New Holland 3630	---	55
Arvinder singh Rathera, Bhiwani	Diraba Agril. Works	Sewraj 835	50	100
Late Sh. Ram Pal s/o Mansa Ram, village Dhatrath, Jind 01686-251072.	Kranti, Ludhiana	New Holland Ford-3630 (50hp)	20	80
Kulwant singh s/o darshan singh Vill. Umri, Distt. Kurukshetra	Dasmesh	Farm trac-60	29	40
Surinder singh s/o darshan singh Vill. Umri, Distt. Kurukshetra	Do	Mohindera -275	10	25
Jitender singh s/o Om Parkash Village Daryapur, Distt, Fatheabad	Standard	Mohindear265D1	30	70
Sardar Ajit singh village Dahtrath, Jind 01686-251466 M- 9355176067	Kranti, Ludhiana (two no.)	sonalika -760	nil	200
Total area covered (ha) **Average area covered by one farmer(ha) = 85**			199	570

Note: Cost of machine (Rs.) 90,000 to 1, 20,000
Rate of custom hiring during year 2004 (Rs. /ha)= 1250
Rate of custom hiring during year 2005 (Rs. /ha)= 1325
Average grain recovery (kg/ha) = 100-120
Average Bhusa recovery (q/ha) = 25.0

Economics of custom hiring

Studies conducted by the centre have shown that the machine gave a net return of Rs. 2400/- per hectare to the machine owning farmers and about Rs. 2100/- per hectare to one who gets the works done on custom basis. This machine has been widely accepted by the farmers of Haryana. No specific problem was observed in handling during operation of straw combine in wheat straw field. One skilled operator was required to operate the tractor and straw combine simultaneously. One labour was also required for unloading the trolley at suitable place.

The machine performance data is given in Table 5.3. The average field capacity of machine was 0.4 ha/h while operating at speed of 2.5 km/h. the average fuel consumption was 4.0l/h and two persons required for its operation. The cost of operation was Rs. 800/ha. A farmer can save on an average Rs. 66250-72625 while the annual expenditure is about Rs. 40,000 per year. The pay back period of machine is two year only.

Table 5.3. Economics of Straw combine during year 2004-05 on custom hiring

Average Field capacity (ha/h)	0.4
Average Fuel consumed (l/hr)	3.5-4.0
Operating speed, km/h	2.5
Labour required/ha	2 persons
Cost of operation (Rs/ha)	800
Average grain recovery (kg/ha)	100-120
Average Bhusa recovery (q/ha)	25.0
Area covered under FLD (ha) in year 2004	65
Area covered on custom hiring in year 2005 (ha), C Custom	199 570
Av.rate of custom hiring (Rs/ha)	1250-1325
Av. Work done on hiring by one farmer (ha)	85
Total turn out (Rs/year)	1,06,250- 1,12,625
Expenditure (Rs/ha) (Rs/year)	800 40,000
Net saving (Rs/year)	66250-72625

Cost of machine (Rs)	90,000-1,20,000
Pay back period :	Two years

Status of Technology

The total estimated area covered by straw combine is about 6.0 lakhs hectares. The estimated numbers of straw combines in Haryana are about 5050 (Table 5.4).

- The tractor use per year has been increased.
- There is saving of time, money and labour.
- Bhusa can be obtained as bi product in lesser time and less fatigue than manual threshing of wheat.
- Machine repays its cost with in two year if a farmer uses the machine on custom hiring.
- The tractor needs frequent service of air cleaner because of dust and bhusa during operation of straw combine.
- The operation can be accomplished in lesser time and crop can be saved from natural hazards.
- Straw combine is very economical and now days it is used extensively by the farmers because of high cost of bhusa.
- It helps to save environmental hazards.

Table 5.4. Estimated Number of straw combine sold in Haryana

Year	Number of straw combines
2001-02	50
2002-03	500
2003-04	1000
2004-05	1500
2005-06	2000
Total	5050

Source: Contact survey with manufacturers of Haryana and Punjab

Fig. 5.1. View of straw combine in operation at farmers fields

Appendix-I

Specification of Star combine

Type	Tractor operated PTO driven
Source of power	45 hp tractor
Overall dimension (L x W x H) without straw pipe, mm	3370 x 2450 x 2150
Length of cutter bar, mm	2134
Minimum height of cut, mm	25-50
Size of chopping drum (LxD), mm	1370 x 700
Rotational speed of chopping drum, rpm	530
Size of blower (diameter), mm	280
Speed of blower, rpm	1020
Field capacity, ha/h	0.4-0.8
Straw output, t/h	0.75-1.5
Weight, kg	1785
Unit price, Rs	75,000

Appendix-II

List of manufacturers

1. M/s Jitla Agro Industries,Mr. Bhagwan Singh, G.T Road, Dabwali, Distt. Sirsa. P: 223240
2. M/s Laxmi Straw Reaper, Mr. Sushil Bansal, Begu Road, Sirsa
3. M/s Bharat Agriculture Works,Mr. Loda singh, Jivan Nagar, Rania,Distt.Sirsa
4. M/s Zandu Steel Works, Hisar Road, Ambala City. Mr. Jaipal
   Ph. 0171-2530143

5. M/s Zandu Engineering Works, Hisar Road, Ambala City, Mr. Ramji Lal Ph. 0171- 25306566
6. Guru Nank Engg. & Foundary, Jind Road, Kaithal. Sh. Bajinder Singh Ph. 223923
7. Laxmi Agricultural Implements, New Karnal Road, Kaithal. S. Guru Baur Singh. Ph. 226791
8. M/s Aggarwal Agril. Works, Jind Road, Assandh Sh Kailash Aggarwal Ph. 278726
9. M/s Sarawati Krishi Udhyog, Karnal Road, Assandh Sh Satpal Ph. 278501
10. M/s Boota Siigh and Sons (J.M.H. Thresher), Begu Road, Sirsa. Ph: 245424
11. Mr. Santosh singh Raj Singh, Sirsa Road (Near bus stand), Rania, Distt. Sirsa
12. M/s Jitla Agro Industries,Mr. Bhagwan Singh, G.T Road, Dabwali, Distt. Sirsa. P:223240
13. Dayal Agro Engineering Works, Kaithal Road, Pehowa. S. Sukhvinder Singh Ph. 230528
14. Kamboj Krishi Udhyog, Kaithal Road, Pehowa. S. Malkiat Singh
15. Narendra & Mahendra Agril. Implements, Kaithal Road, Pehowa. Narinder Singh. Ph. 223227
16. Guru Nank Engineering Works, Kaithal Road, Pehowa. Mukhtiar Singh. Ph. 01741-220247
17. National Agro Industries, Link Road, Industrial area, Ludhiana-141003 (Punjab)
18 ASS foundry & Agril. Works, G.T.Road,jandiala Guru, Amritsar-143115, Punjab Near Police Station, Jandiala Guru, Amritsar-143115 (Punjab)
19 Guru Nanak Khalsa engineering works, Pehowa, Kurukeshtra, Haryana
20 Bharat Agril. Industries, Karnal, Haryana
21 Punni Agricultural Works, Punni Thresher Tohana, Haryana
22 Panishar Agricultural Works, Amargarh, Punjab

23 Malwa Agro Industries, Ludhiana, Punjab

24 Amar Agricultural Implements works, Amar Street, Janta nagar Gill road, Ludhiana-141003, Punjab

25 Bharat Industrial corporation, Akalsar Road, Faridkot, Moga-142001, Punjab

26 Madho Mechanical works, B-49, Focal point, G.T. Road, District Faridkot, Moga-142001, Punjab

27 Kalsi Mechanical works, Majestic Road, District Faridkot, Moga-142001, Punjab

28 Punjab Engineering Works. Talwandi Bhai, Ferojepur, Punjab

29 M/s Indian Hadamba Thresher, Barara Byepass, Ambala City

30 M/s Punjab Agro Sales (India), Delhi Bye-pass, G.T Road, Karnal Sh. Ajit Dawar Ph. 2220113, 22220957 (O), 2282063, 2283063

31 M/s Bharat Industries/ M/s Bharat Steel Discs, Delhi Bye-pass , G.T Road, Karnal

32 Mr. J.M.L Patni, Mr. Rakesh Patni, Deepak Ph. 2220262,2221555(O), 2200804, 2201918

33 Engineering Sales Corporation, 55/3, HSIDC, Karnal, Sh. D.N Bhardawaj, Ph. 2272922, 2221355,(O), 2387536