

Machinery Useful for in-situ Paddy Straw Management

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Article History

Received: 14. 03.2021

Revised: 28. 03.2021

Accepted: 5. 04.2021

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INTRODUCTION

The “rice-wheat cropping system” is the dominant cropping system in South Asia (Hobbs and Morris, 1996). This system involves growing rice and wheat in rotation throughout the year. The organic matter in the form of crop residue serves as a major source for replenishing fertility status (Dhillon & Dhillon 1991) and provides beneficial effect on biological properties of soil (Mishra et al., 2001). Both rice and wheat are exhaustive feeders, and the double cropping system is heavily depleting the soil of its nutrient content. A rice-wheat sequence that yields 7 tons per ha of rice and 4 tons per ha of wheat removes more than 300 kg N, 30 kg P, and 300 kg K per ha from the soil (Singh & Singh, 2001). For sowing of wheat after harvesting of paddy, burning of rice residue is most common method used by farmers of India. The burning of rice crop residue results in substantial emissions of gases and particles and it pollutes the environment. This pollution can have effect human health adversely. The burning of paddy straw leads to loss of precious nutrients as nearly 25% nitrogen and phosphorous, 50% Sulphur, 75% of Potassium uptake from soil are retained in the crop residues (Dept. of Science, Technology & Environment, Govt. of Punjab). It was estimated that in Punjab alone, about 1.5 lakh tones of Nitrogen and Sulphur in the residues lost during burning, costing more than 150 crore Rupees at the prevailing prices. In, India effort has been made by government to reduce residue burning and it had moderate impact on burning. To avoid burning of crop residue, improved machinery may be used for sowing of wheat in standing stubbles of rice crop. The uses of these machines are also economical for farmers. The highest B: C of 6.79 was also recorded in the residue incorporation treatment followed by 6.19 and 3.86 in the burning and straw removal treatments, respectively (Khankhane et al., 2009).

These machine can save time, maintain soil health and remove the need of multiple operations to incorporate the paddy straw. The focus of this article is to spread awareness about the rice straw management machinery.

Double drum loose straw chopper

This machine was having two main components, loose paddy straw picking unit and two straw chopping cylinders having serrated blades. The loose paddy straw is picked up by the rotary picking unit having arrangement of straight 'I' blades in two rows mounted helically on rotor. The straight blades pick up the loose straw and feed it to chopping cylinders. Two chopping cylinders chop the loose straw into small piece and uniformly spread on the field without disturbing the standing stubbles. The power is transmitted from tractor PTO to straw picking unit and chopping cylinders through gear box and belt pulley arrangement. The working width of the machine is 1720 mm. The front chopping cylinder diameter was 760 mm and 10 number of rows of serrated blade was fixed on periphery of the cylinder. The rear chopping cylinder diameter was 440 mm and 6 number of rows of serrated blade was fixed on periphery of the cylinder. The gear ratio from PTO drive of tractor to main pulley was 5:9. A stationary view of the machine is shown in Fig. 1.

Table 1.1: Brief Specification of Double drum chopper for chopping of loose paddy straw

Particulars	Specification
Type of machine	Tractor PTO operated, trailed type
Power source	45 hp tractor
Overall dimension, L x W x H, mm	3480 x 2480 x 1200 mm
Number of loose straw picking unit & number of blade per row	2 & 13
Number of rows of loose straw picking blades	
Number of blade per row	13
Ground wheels	2
Ground wheel diameter	700 mm



Fig. 1: Operational view of double drum loose straw chopper

Happy seeder

The Happy seeder is used for direct drilling of wheat crop in to a combine harvested field (without straw removal/burning) in a single operational. The rotating blades cut only that part of straw which is coming just in front of furrow openers. These cutting blades are operated by PTO drive of tractor. It consists of two units- one straw management unit and other sowing unit. The happy seeder cuts, lifts and place the standing stubble & loose straw and sows the field in one operational pass of the machine. Brief specification of happy seeder is given in Table 2.

Table 2: Brief specification of Happy Seeder

Particulars	Specification
Number of rows	9
Row spacing, mm	200
Working width, mm	1600
Depth of operation, mm	35-50
Source of Power	PTO operated trailed type
Source of power for feed shaft	Ground wheel
Chopping unit	Cutting Blades



Fig. 2: Operational view of happy seeder

Double disc seeder

The double disc seeder is used for direct drilling of wheat crop in to a combine harvested field (without straw removal/burning) in a single operational. Two rotating discs open a slit for seed sowing in a row. Depth control wheels were provided to control the depth of sowing for each row. Seed and fertilizer boxes were provided separately. Fluted roller type metering unit was used to control the seed rate. Ground wheel was provided to rotate the feed shaft.

Table 3: Brief specification of double disc Seeder

Particulars	Specification
Number of rows	9
Row spacing, mm	225
Working width, mm	1800
Depth of operation, mm	10-20
Source of Power	trailed type
Source of power for feed shaft	Ground wheel
Depth adjustment	One wheel for each furrow opener



Fig. 3: Operational view of double disc seeder

Spatial till seed drill

The spatial till seed drill is used for direct drilling of wheat crop in to a combine harvested field (without straw removal/burning) in a single operational. The arrangement of furrow openers are set in three rows, in each row three furrow openers to increase the distance between furrow openers, so that straw don't choke in between the tines. The height of seed and fertilizer box need to be increased because the angle of seed tubes is

not adequate and seeds stop before dropping. This may also give non uniform seed delivery. The view of spatial till seed drill is given in fig. 4.

Table 4: Brief specification of spatial till seed drill

Particulars	Specification
Number of rows	9
Row spacing, mm	250
Working width, mm	2000
Depth of operation, mm	50-70
Source of Power	trailed type
Source of power for feed shaft	Ground wheel
Depth adjustment	One wheel for each furrow opener



Fig. 4: Operational view of Spatial till seed drill

CONCLUSIONS

For the rapid adoption of paddy straw management practices awareness generation among farmers and benefits of straw management machinery need to be highlighted. There is need to change the past mindset of farmers. The best solution to deal with the problem is to manage the straw on the farm itself which makes it more economical and convenient. Presently, the most beneficial and cost-effective way to manage paddy straw is to use happy Seeder and other machines. Government plays a major role in this issue and should offer various subsidies and incentives to farmers and other stakeholders to motivate them to manage paddy straw effectively.

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