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Happy Seeder – An Effort for Rice Residues Management*

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Rice-wheat is a major crop rotation in the Indo-Gangatic region. About 26 lakh Ha area is under this rotation in the State of Punjab alone. Tillage is one of the major crop production operations and is an important contributor to the total cost of production. It is estimated that tillage and sowing almost consumes 25% of the total operational energy in wheat production. There is an urgent need to reduce the cost of cultivation and increase the productivity per unit area to meet the present global market challenge and help the farmer and the nation by developing and adopting conservation tillage practices.

It is a common observation that direct drilling of any crop into combine-harvested rice stubbles from a reasonable rice yield is not possible without prior burning or removal of straw. Therefore, presently crop residues in combine-harvested rice fields are being burnt causing a serious problem of atmospheric pollution. Experiments conducted in the recent past have shown that no-tillage and minimum tillage technologies are showing their edge over the conventional practices in terms of economics, water saving and eco-friendly.

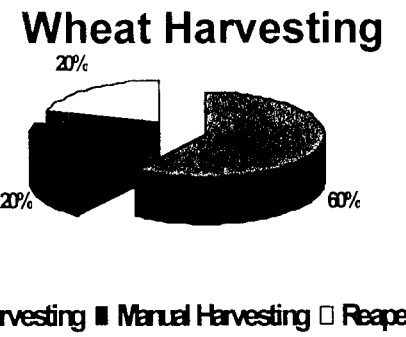
To solve the problem of straw management, continuous developments carried out in the Department of Farm Power and Machinery of Punjab Agriculture University have resulted in the development of a machine called "Happy Seeder". This work has been done in collaboration with CSIRO Land and Water Resources, Australia, under financial assistance from ACIAR (Australian Center for International Agricultural Research). The machine is compact and lightweight, and is tractor mounted. It consists of two separate units, a straw management unit and a sowing unit. The Happy Seeder cuts, lifts and throws the standing stubble and loose straw and sows in one operational pass of the field while retaining the rice residue as surface mulch. It has thus the capability of managing the total loose straw and cutting rice residue in strips, which are just thrown in front of each furrow opener. To reduce the straw load over the seed row, the straw managing rotor was modified to cut standing stubbles for 7.5 cm width (just in front of the furrow openers) and leave them in another 12.5 cm strip between the two furrow openers. It was observed that with the above modification nearly 30 % of the total straw load was reduced. This PTO driven machine can be operated with 45 HP Tractor and can cover 0.2-0.3 Ha/hr. A strip tillage rotor was placed in one version between the straw managing unit and furrow openers to provide better soil pulverization to enhance the soil seed contact.

There are a few added advantages of mulching the crop residue in the field, namely:

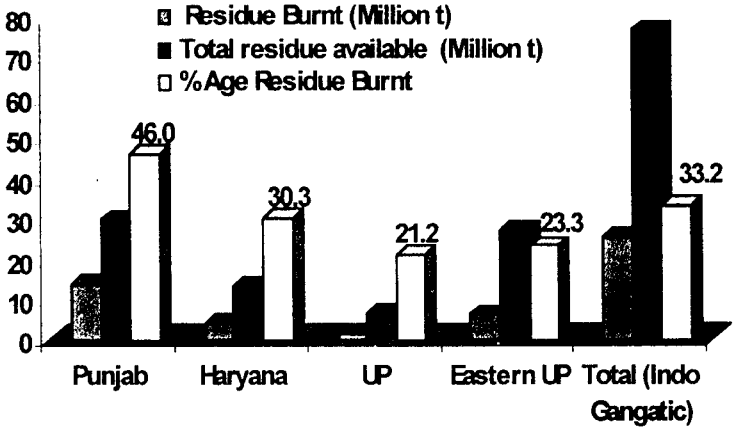
- Possibility of sowing wheat crop just after rice harvesting ie option for long duration wheat and rice varieties;
- Possibility of sowing wheat in the residual moisture ie saving of one irrigation;
- Timely sowing wheat even after long duration basmati rice varieties;
- Crop residue as mulch helps in moisture and temperature conservation;
- Less weed growth;
- Improved soil health; and
- Environment friendly technology to check air pollution.

The detailed research trials of the machine conducted at PAU have been very encouraging and thus for large scale adoption of Happy Seeder, wheat sowing trails on farmer's fields were carried out on nearly 40 acres of land at different (15) locations in Punjab State during 2005-06 wheat season. It was observed that Wheat yield in case of Happy Seeder was either at par or more than Conventional sowing practice. Further investigations are in progress to observe the effect of mulch on irrigation schedule for Wheat in Rice residue and Moong in Wheat residue. Punjab Agricultural University, Ludhiana has already recommended the use of above said technology for the farmers for direct drilling of wheat in combine-harvested rice residues without prior burning / removal. The cost of the machine is Rs 60,000/- and this service should be available on custom hiring bases to small and medium farmers of the state. This eco-friendly technology will prove a boon to the farmer's community and the State by providing them a tool for improving soil health and environment for sustainable agriculture.

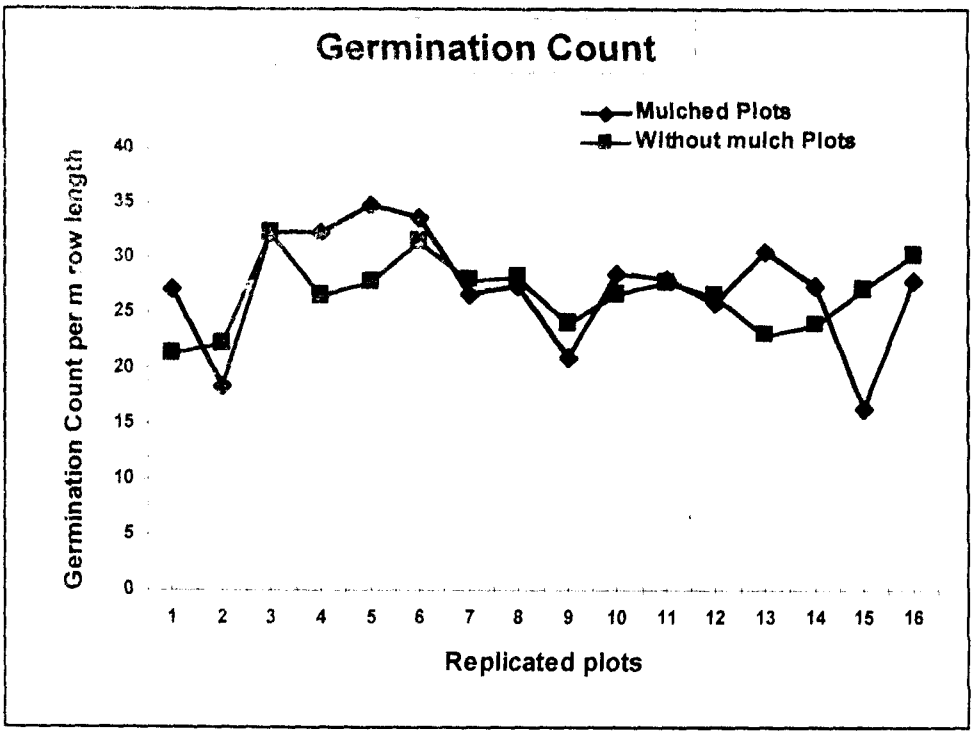
** Paper presented in the workshop on Agricultural Waste Burning held at PAU, Ludhiana on 29/07/2006*

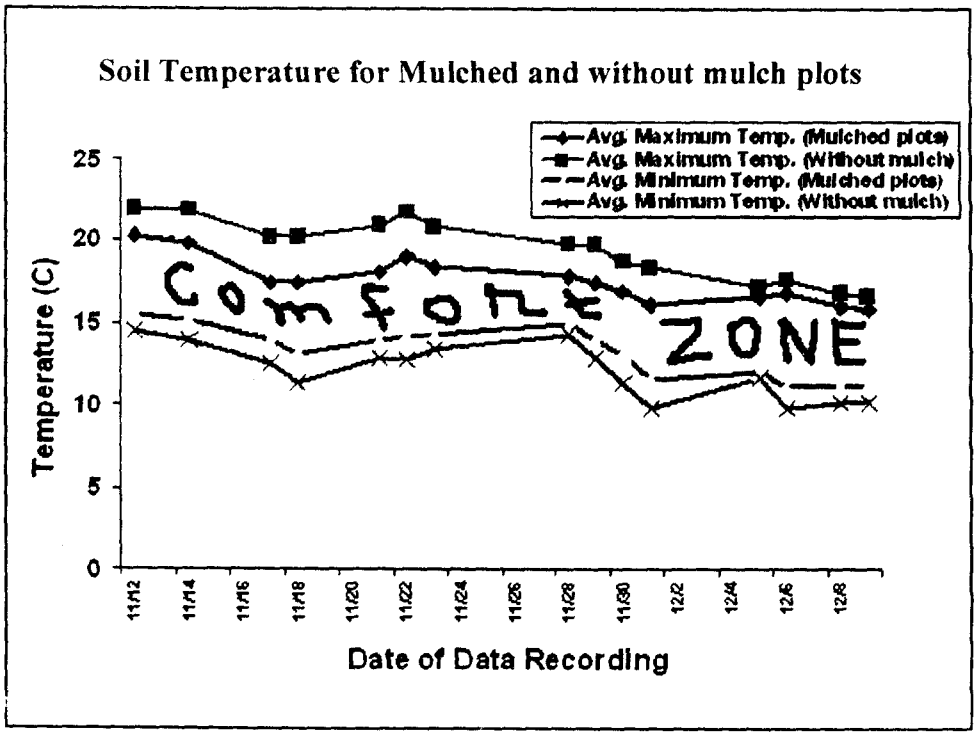


Crop Residue In Rice-Wheat system in Indo-Gangetic Plains *

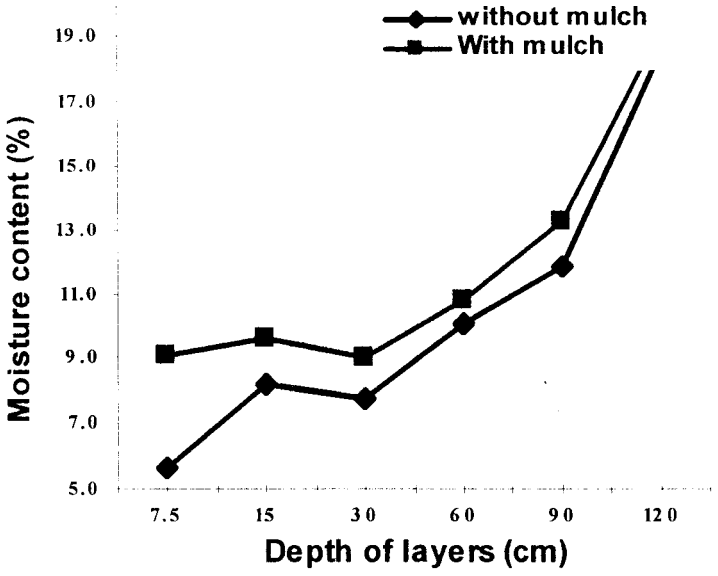


* Gajri P R, *et al* (2002)

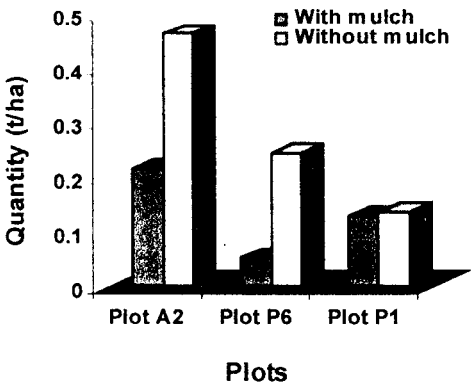

Germination Count
Mulched Plots
Without mulch Plots
Germination Count per m row length
40
35
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Replicated plots


Soil Temperature for Mulched and without mulch plots
Avg. Maximum Temp. (Mulched plots)
Avg. Maximum Temp. (Without mulch)
Avg. Minimum Temp. (Mulched plots)
Avg. Minimum Temp. (Without mulch)
Temperature (C)
25
20
15
10
5
0
COMFORT ZONE
11/12 11/14 11/16 11/18 11/20 11/22 11/24 11/26 11/28 11/30 12/2 12/4 12/6 12/8
Date of Data Recording

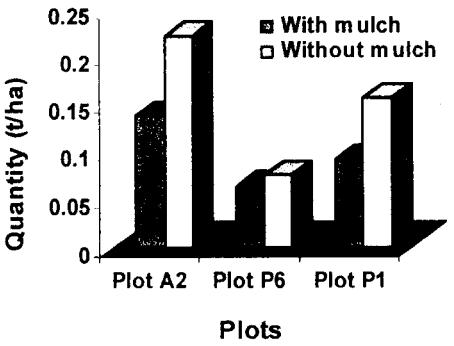
Moisture conservation at different layers for mulched and un-mulched plots



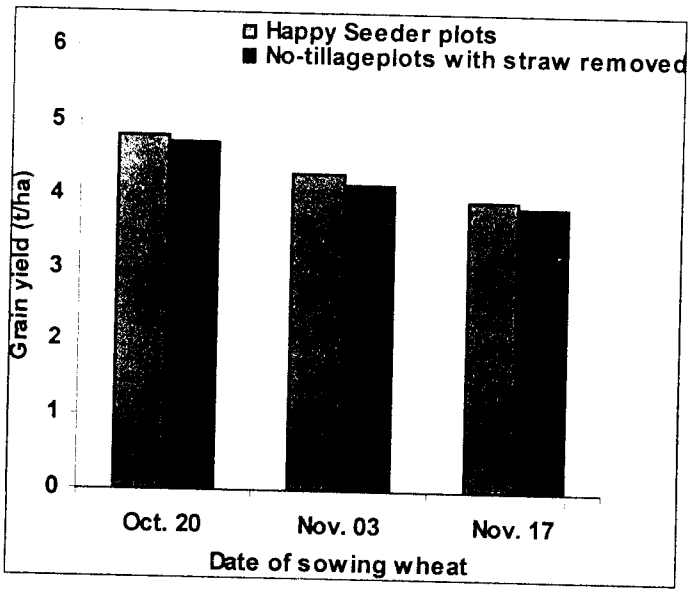
Weed matter growth in mulched and un-mulched plots



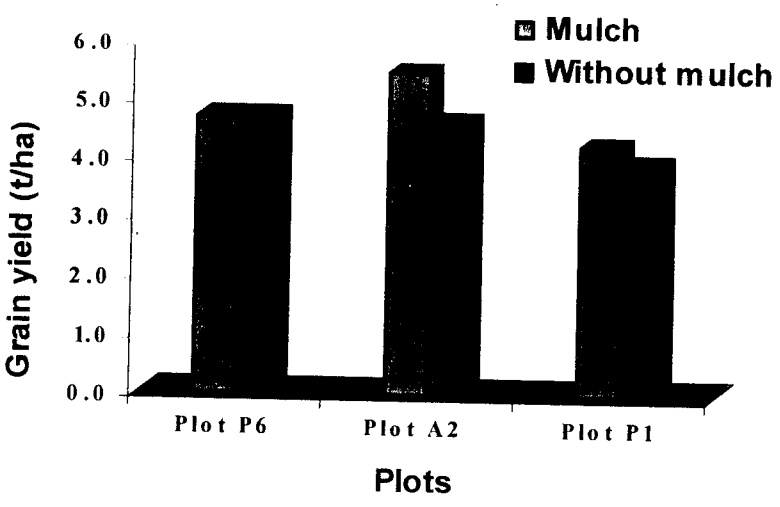
Weed matter after 45 days of sowing



Weed matter after 90 days of sowing



Grain yield for replicated field trails 2003-04



Location	Area	Sowing date	Soil	Straw load	Grain yield (t/ha)		Yield increment
	(ha)			(t/ha)	Happy Seeder	Farmer practice	(%)
2004/5							
Jhal Kalan	0.4	22-Oct	sandy loam	8.0	3.8	-	
Ladhowal	0.9	28-Oct	silty loam	7.1	4.0	3.6	11
Pabbian	0.5	4-Nov	loam	8.5	5.4	5.0	8
Sudhar	0.3	6-Nov	clay loam	7.5	5.2	4.9	6
Langrian			loam	4.4	4.4	3.9	13
Mean					*5.0*	*4.6*	*9*

Location1	Area	Sowing date	Soil	Straw load	Grain yield (t/ha)		Yield increment
2005-06	(ha)			(t/ha)	Happy Seeder	Farmer practice	(%)
Ramdass 1	0.4	16-Oct	clay loam	8.0	5.2	5.2	1
Ramdass 2	0.4	16-Oct	clay loam	7.5	5.1	4.7	8
Ramdass 3	0.4	17-Oct	loam	7.4	4.5	4.4	1
Lopoan 1	0.4	26-Oct	loam	8.0	5.2	4.6	15
Lopoan 2	0.4	26-Oct	silty loam	8.5	5.8	4.7	24
Bhundri	0.4	28-Oct	silty loam	8.1	5.5	4.9	11
Ladhowal 1	3.6	29-Oct	silty loam	7.3	5.3	4.5	18
Sudhar	1.4	31-Oct	clay loam	7.9	5.2	4.9	6
Pabbian 1	0.8	3-Nov	sandy loam	8.6	4.7	4.7	0
Pabbian 2	0.6	3-Nov	silty loam	8.4	4.5	4.7	-4
Bhamian	3.4	5-Nov	sandy loam	6.9	5.4	4.4	21
Shkhanand	0.2	6-Nov	loam	8.2	5.6	4.4	26
Mean					*5.2*	*4.7*	*11*

S.No	Happy Seeder	Zero-till drill	Conventional seed drill	Conventional seed drill
1.	Combine harvested paddy field	Combine harvested paddy field	Combine harvested paddy field	Combine harvested paddy field
2.	------	Burning of residues (time loss 1 day)	Burning of residues (time loss 1 day)	Incorporation (Disking 4 times)
3.	------	Irrigation	Irrigation	Tiller (2 times)
4.	------	Wait for 7 days (time loss)	Wait for 7 days (time loss)	Leveling (2 times)
5.	------	------	Disking (2 times)	Irrigation
6.	------	------	Tiller (2 times)	Time loss (20 days)
7.	------	------	Leveling (2 times)	-----
8.	Sowing (Happy Seeder)	Sowing (Zero-till drill) + leveller	Sowing (Conventional seed drill)	Sowing (Conventional seed drill)
Cost/ acre (Rs.)	650	(400+75) = 475	(2*250+2*150+2*75)+250 = 1200	(4*250+2*150+2*75)+250 = 1700
Time/ acre	1.5 hr	= 8 days + 1 hr	= 9 days + 1 hr	= 22 days + 1 hr

	Happy Seeder	Zero-till drill	Conventional seed drill	Conventional seed drill
Resource conservation	Low cost	Low cost	-----	-----
Resource conservation	One irrigation water saving	-----	-----	-----
Resource conservation	Timely sowing (approx 1 month)	-----	-----	-----
Resource conservation	Weed control (at least 50% less)	-----	-----	-----
Resource conservation	Improved soil health	-----	-----	-----
Resource conservation	Less air pollution	-----	-----	-----
Resource conservation	Temperature conservation	-----	-----	-----