

In-situ Crop Residue Management in INDIA

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Straw burning problem

- **Nearly 30 million tonnes of paddy straw are generated in Punjab and Haryana.**
 - about 7 million tonnes (from 0.8 million ha) was removed from the field for alternate uses like power generation, biofuel, feeding animals and for heat generation etc.
 - about 23 million tonnes of paddy straw (from 2.8 million ha) was burnt in the field as an easy and quick method of disposal.



Straw burning contd...



- Burning of straw causes phenomenal **pollution problems in the atmosphere and huge nutritional loss and physical health deterioration to the soil.**

Conventional Practices

- Time available between rice harvesting and wheat sowing is very narrow (20-30 days).
- At present, after harvesting rice by combine, the farmers sun-dry the straw for a few days (4-5 days) and then burn them in the field before preparing the field for next cropping
 - by using disc harrow, cultivator and planker and sow the wheat/potato by seed drill/planter.

Management of paddy stubble/straw

- Two alternate and safe methods for straw management.
 - In-situ
 - Ex-situ
- Baling and transporting straw from field, though appear to be an option for safe disposal,
- The ex-situ straw management options are **more capital intensive** and would require significant subsidy amounts for farmers and user industry to be sustainable.

In-situ straw management

- Financially most viable and workable option in the immediate short run.
- Mulching and incorporation are the two suggested methods of in-situ straw management.
- Mulching is practiced where rice is followed by wheat and incorporation is adopted when rice is followed by potato or other crops.

Viabile and scalable solutions

1. Machinery for retention of paddy straw as mulch on soil

- **Super SMS with Existing Combines + sowing with Happy Seeder**



Machinery for retention of paddy straw as mulch on soil

- **Combine with Super SMS**
- For uniform spreading of loose paddy straw left in the field after combine harvesting, the super straw management system (Super SMS) attachment has been developed.
- There are more than 35 manufacturers of the Super SMS, cost \$ 1500.



Machinery for paddy straw as mulch on soil contd....

- **Happy Seeder**

- It cuts and chops the straw in front of furrow openers and throws it over the sown crop which acts as mulch.
- Operated by 40 kW tractor, costs about \$ 2100 and covers 0.3-0.4 ha per hour.
- 35-40 manufacturers and more than 250 suppliers



Machinery for incorporation of paddy straw into the soil

Paddy straw Chopper/Mulcher + Reversible Mould Board Plough + Rotavator + Sowing of wheat, potato or other vegetables



Straw Chopper

- Harvests the stubbles, chops it into pieces and spreads in the field in a single operation
- Operated by a 35 kW tractor, costs \$ 1700 and covers about 4 ha/day.



Reversible Mould Board Plough

- For mixing chopped paddy residue left after combine harvesting into the soil for seedbed preparation before sowing wheat, potato or other vegetables.
- Consists of 2 bottoms, costs \$ 2800 and covers 0.3 ha area per hour.



Rotavator

- For field preparation, operated with 35 kW tractor.
- Rotating blades pulverise soil by breaking clods. After field preparation, sowing of the next crop by seed drill/planter.
- Costs \$ 1500 and covers 0.3-0.35 ha area per hour.



Comparison between In-situ straw management systems: Straw mulch and Straw incorporation systems

Practice 1: Combine + SMS + Happy Seeder

Advantages:

- Time saving and cheaper method of straw management system
- The mulch reduces field temperature by 4-5°C and saves one irrigation in wheat.

Practice 2: Combine + Straw Chopper + Incorporation (with Reversible MB Plough) + Rotavator + Seeder

Advantages:

- The field becomes clean and looks better
- The wheat, potato or any other vegetable crop can be sown/planted

Disadvantages:

- It requires one additional irrigation
- It is time consuming and costly

Economics of Straw Management Practices (straw mulch and straw incorporation systems)

Option		Practice (In addition to combine use)	Cost, \$/ha
Traditional system		Disc harrow (twice)+ Cultivator (twice)+ Planker + seeder	70
In-situ residue mulching	I	Super SMS + Happy Seeder	75
	II	Straw chopper + Happy seeder	90
In-situ residue incorporation		Straw chopper + Reversible MB Plough + Rotavator + Planker + Seed drill/ planter	140

- In order to curb burning, a Central Sector Scheme on “Promotion of Agricultural Mechanization for In-situ Management of Crop Residue in States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi” has been approved.
- Budget allocated to the scheme is \$ 165 million for two years
(for 2018-19: \$ 85 million and for 2019-2020; \$ 80 million).

- Under this scheme, there is financial assistance on purchase of eight straw management implements (**50% of the cost of the implement for individual farmers; and 80% of the cost of implements for Custom Hiring Centre (CHC) by Co-operative Societies of farmers, groups or SHGs, FPOs and Private Entrepreneurs**).

- **28,490 crop residue management implements/ machines (9373 Happy seeders, 4469 Straw choppers/Mulchers, 3623 reversible MB plough, 3672 rotavator and 3410 zero till drills) procured in Punjab by farmers/cooperatives/CHCs during 2018-19.**
- **Similarly 4500 and 16450 crop residue management implement/machines procured in Haryana and Uttar Pradesh respectively.**

- **3950, 1188 and 2344 custom hiring centres** established in Punjab, Haryana and U.P. for easy availability of equipments/ machines to small and marginal farmers on hire basis.
- The **mobile app**-based aggregator platform to facilitate hiring of farm machinery from the Custom Hiring Centres

IEC Activity

- **Large scale demonstrations and awareness campaign among the farmers**
 - 13260 demonstrations in about 23000 ha area with participation of more than 30,000 farmers.
 - Training of 30,170 farmers
 - 22890 Awareness programs at district Village Panchayat/ Block/ District Level.

IEC contd...

- 8910 hoardings and 2800 wall paintings placed at prominent locations such as Mandis, Panchayat, Markets and schools etc. Besides 17980 poster/banner displayed for awareness.
- 1254 advertisements in print media
- 2250 columns/articles in magazines / journals / newspapers.
- 24,94,500 leaflets/pamphlets distributed in villages.
- 710 schools mobilized with 69000 students.
- 127 panel discussions on TV channels

Results

- In Punjab, out of 2.3 million ha to be managed under paddy crop, about **1.03 million ha (44%)** has been covered under mechanized solutions of crop residue management during 2018.
- Out of 1.03 million ha, about 0.48 million ha was covered by Happy seeder.

Results contd..

- Similarly in Haryana, out of **0.681 million ha to be managed under paddy crop**, about 0.25 million ha (36%) has been covered under mechanized solutions of crop residue management in Haryana during 2018.
- Out of 0.25 million ha, about 0.023 million ha was covered by Happy seeder.

Results cond...

- Survey revealed that Happy seeder sown wheat farmers got the following advantages as compared to conventional system:
 - i) 2.7% higher wheat yield
 - ii) saving of 25% water for irrigation
 - iii) saving of 20 kg urea/ha.

Results cond..

- **1374 villages in Punjab (out of about 8000 villages where rice is being grown, which constitute about 17%) were declared as Zero Stubble Burning Villages during 2018.**

Results contd..

- The paddy residue burning was monitored by multiple satellites with thermal sensors- remote sensing
- With the result of tremendous effort put in for crop residue management in these states, there was **15% reduction observed in number of burning events in the 2018** (last season) as compared to that in 2017.
- About 11% reduction in burning events were observed in Punjab, whereas, reduction of 29.5% in Haryana and 24.6% in Uttar Pradesh was observed.

Thanks