

Surface seeding-cum-mulching technique

An emerging option to manage crop residue

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Surface seeding cum mulching of wheat is an emerging low-cost ecofriendly technique of managing paddy straw, where paddy harvesting and wheat sowing are done simultaneously. Compared to existing residue management options, this method has benefits with respect to weed control, soil health as well as crop productivity along with economic benefits as costly machines and high-power tractors are not required in this technique. Straw management and sowing operation of wheat can be completed with a meagre cost of ₹650-700 only compared to ₹2000-2500 per acre for conventional methods. This technique provides complete mulching, which keeps the soil profile moist and saves the crop from terminal heat stress. Moreover, crop resist to lodging as well as withstand against adverse conditions like torrential rain and hailstorms. Besides, this technique reduces dependence on costly herbicide inputs as it ensures mostly weed free crop.

Keywords: Crop residue, Mulching, Surface seeding, Wheat

THE Punjab, Haryana and Western Uttar Pradesh had a great contribution in 'Green Revolution' and still provide bulk of rice and wheat in the national food basket. Inclusion of high-yielding varieties of rice and wheat in cultivation practice results in production of bulk crop residues in above mentioned states. The wheat and basmati straw is generally managed by the farmers and utilized as animals feed, whereas paddy straw is mostly burned owing to several reasons. As we know, open field straw burning has harmful environmental effects including air pollution and greenhouse gases emissions besides, huge nutrient loss from soil as well as health deterioration of humans. The nutrient losses from soil and gases released owing to burning of paddy straw are highlighted in various reports by the experts. Moreover, rice straw burning is spreading rapidly at an alarming rate in other paddy growing Indian states, which is a matter of great concern.

Management of paddy straw has remained a big challenge for farmers especially for small and marginal farmers. Factors like short time window between paddy harvesting to wheat sowing, costly machinery, small and marginal farmers, non-availability of labour, high cost in removing residues, etc. forces the farmers to burn paddy straw. Therefore, it is necessary to develop appropriate strategies for *in-situ* crop residue management to achieve 'zero burning'. Though there are number of

machines available for crop residue management such as happy seeder, super seeder, mulcher, MB plough, zero till drill, baler (*ex-situ* option), etc., but these technologies are either not available everywhere or are costly to afford by every farmer. However, presently due to lack of economically viable options of paddy straw management, Indian farmers especially from the north-western states viz. Punjab, Haryana and western-Uttar Pradesh become compelled to burn straw in fields itself. So, proper management of crop residues especially paddy straw can improve agriculture waste management and reduce environmental pollution contributed through residue burning. Thus, there is a need for resource conservation, minimized cost production and maximized productivity with technologies that sustain a healthy environment. In this scenario, surface seeding is a novel technique that has potential to improve crop productivity on sustainable basis without causing environmental pollution. Hence, surface seeding-cum-mulching practice of crop residue management has emerged as an economical and viable option in present time. In present article, an attempt has been made to share the experiences of farmers on this emerging technology.

Surface seeding-cum-mulching

- Surface seeding-cum-mulching of wheat (developed

by Punjab Agricultural University, Ludhiana) is a low-cost ecofriendly technique, in which paddy harvesting and wheat sowing gets done simultaneously.

- An attachment fitted with combine harvester uniformly broadcasts wheat seed and basal fertilizer during paddy harvesting followed by manual operation of mulching with the help of cutter-cum-spreader and applying light irrigation.
- In this technique, stubbles are harvested at 3-4 inches above the soil surface.
- The PAU experts have recommended 45 kg wheat seed and 65 kg DAP fertilizer application per acre at the time of sowing.
- Where such option is not available, farmers also broadcast the recommended seed and fertilizer manually in the field after harvesting of paddy with combine followed by cutting of stubbles with cutter-cum-spreader and irrigation.
- The Punjab Agricultural University, Ludhiana scientists have also developed a machine 'Surface Seeder' for direct sowing of wheat. It uniformly distributes wheat seed and fertilizer while simultaneously cut and spread the entire straw harvested with Super SMS loaded combine.
- This technique is very economical in managing paddy straw.
- Compared to existing residue management options, this method has benefits with respect to weed control, soil health as well as crop productivity along with economic benefits as costly machines and high-power tractors are not required in this technique.



Wheat crop sown by surface seeding-cum-mulching technique in farmers field in Tarn Taran district

Benefits of surface seeding

As we know during 2022-23, thousands of farmers of Northern India including Punjab were affected with moderate to heavy lodging of wheat crop on large area due to torrential rain and hailstorms in the month of March. However, the farmers who opted for sowing of wheat by surface seeding method experienced less damage compared to other crop residue management practices and their crop resisted to lodging. As per scientists, this technique provides complete mulching, which keep the soil profile moist and saves the crop from terminal heat stress. Further, surface seeding of wheat develops fibrous root system on the upper layer of the soil. When plant is fully grown, fibrous root emerges from the ground a mat, thus holding the soil surface. These roots play pivotal role in stabilizing the plant to prevent lodging especially during adverse conditions like hailstorm, etc. The PAU scientists have listed several benefits of surface seeding over conventional methods of residue management, some of which are:

- With this technique, straw management and sowing operation of wheat can be completed with a merge cost of ₹650 only compared to ₹2000-2500 per acre for conventional methods.
- There is no need of costly machines and tractors with high 'horse power' for paddy straw management.
- It meets out the concept of *in-situ* crop residue management that ensure healthy and porous soil system.



S. Gurbachan Singh explaining about the root system on wheat plant sown by surface seeding method

[*You can watch this on link <https://www.facebook.com/share/v/oyyoDLboFowGYjx/?mibextid=oFDknk>]

- As this technique provides complete mulching over the soil surface, crop is saved from terminal heat stress especially during high temperature.
- This technique reduces dependence on costly herbicide inputs as it ensures weed free crop or very less incidence is reported.

Table 1. Comparison of economics of wheat crop sown through conventional farming and surface seeder method*

Operation	Cost of cultivation (₹/acre)	
	Conventional farming	Surface seeding
Field preparation	2500	650
Seed treatment	1650	1850
Fertilizer	2450	2450
Plant protection	2150	1750
Irrigation	350	350
Harvesting operation	2000	2000
Watch & ward	2000	2000
Transport and marketing	1000	1000
Total	14100.00	12050.00

*These are approximate cost and may vary with farmer to farmer based on practice followed or seed or fertilizer application rate

Farmers' experiences



S. Gurbachan Singh

Village – Burj Deva Singh
Land holding – 36 acres
CRM experience – 18 years
Surface seeding: For 5 years

- S. Gurbachan Singh is a known face from district Tarn Taran in the field of Agriculture, whose name was mentioned by Hon'ble Prime Minister of India in *Mann ki Baat* for crop residue management.
- He is adopting surface seeding-cum-mulching technique of wheat for 5 years (https://fb.watch/q0Fgf_Nl6r/?mibextid=RtaFA8).
- As per him, more fibrous roots are developed in surface seeded wheat that protects the plants from lodging (<https://fb.watch/q0EkpQ96KZ/?mibextid=RtaFA8>).
- Wheat sown by limesing surface seeding method was very less affected by the harsh weather conditions last year.
- He said that surface seeding technology keep field weed free and ensure healthy crop stand.
- The crop yield was registered at par with other crop residue management approaches.
- This innovative approach in paddy straw management and wheat sowing economizes input cost.

As per my experience (S. Gurbachan Singh), in this technique, fertilizer is placed (by broadcasting) at proper distance from seed and that is the reason more fibrous roots are developed to capture the nutrients. Moreover, in surface seeding, seed is placed over the soil surface that's why more fibrous roots are developed on and or near the soil surface, whereas in conventional methods or other crop residue management practices, the seed is placed at 4-6 cm deep in soil so fibrous roots are

developed at same depth and supporting roots develop near surface.



Fibrous roots development in wheat plant sown by surface seeding method



Fibrous roots development in wheat plant sown by Happy Seeder method



S. Jaskaran Singh

Village – Burj Deva Singh
Land holding – 35 acres
CRM experience – 18 years
Surface seeding: For 3 years

- S. Jaskaran Singh is also practising surface seeding-cum-mulching in wheat crop from last 3 years.
- He started with 3 acres about three years ago and expanded to 30 acres at present.
- He is very much convinced with the performance of this technology and gets yield up to 22.0 q/acre.
- He observed that this technique provides one quintal higher wheat grain yield per acre and saved irrigation as compared to the conventional sowing methods.
- He explained the benefits like low cost, weed free field and better yields.
- Besides, all paddy straw is managed *in-situ* without any expensive machines.



S. Balraj Singh Kulla

Village – Kulla, Patti
Land holding – 38 acres

- He also shared his experiences on surface seeding stating that by following surface seeding of wheat, it costs hardly ₹600-700 per acre for sowing operation, whereas conventional required ₹2500-3000 per acre for field preparation including straw management to sowing operation.
- This is also cheaper than other crop residue management practices/machinery such as Happy Seeder, Super Seeder, Mulcher, Incorporation, etc.

CRM experience: 10 years
Surface seeding: For 3 years

- He experienced that surface seeding is not much successful on very heavier soils or soils with low permeability. However, it is highly successful on comparatively lighter soils.
- Water management is an important factor in surface seeding of wheat.
- He gets 22.0 quintal per acre wheat yield through surface seeding-cum-mulching technique of wheat.

The wheat sown by this method take about one more week to mature and straw comparatively remain greener than other practices of wheat sown as soil profile remain moist owing to coverage of soil surface with mulch. This technique also saves at least one irrigation in whole season. Surface seeder plants get more nutrition because of more bunches of roots so plants are more vigorous than other practices.

SUMMARY

Surface seeding is a viable option for *in-situ* management of crop residue. As this technique does not require any costly machines and high-power tractors, it is much economical compared to other residue management

approaches. It could be proven as boon to resource poor small and marginal farmers who are otherwise not able to purchase costly machinery to manage crop residues. The adoption of surface seeding practices has the potential to increase the production of wheat and mitigation of heat stress as also registered by the farmers. Efforts are needed to motivate the farmers towards this technology through awareness programmes and demonstrations in farmers' field. As this is a very young technology, it needs further validation in term of seed rate, fertilizer application, type of soil suited for this technique and quantity of irrigation to be applied, etc.

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