

A Web Based Model for Effective Disposal of Paddy Residue

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ABSTRACT

Rice is the most vital food crop in India. The cultivation of rice produces two forms of residues which are called straw and husk. Crop residue is very useful resource of energy but unfortunately it is being burnt by farmers. Time duration for preparing the field for next seasonal crop like wheat is very limited and burning is the simplest option for the farmers to clear the field. Crop residue burning produces deep impacts on environment as well as on the farms. In this paper, problems arising out for not adopting the proper methods of disposing paddy residue are discussed. Also various methods which are being currently used by the farmers for using the crop residue effectively without causing any pollution are discussed. A web based model for effective disposal of paddy residue has also been proposed. This model provides on-line platform for three stakeholders viz., farmers (producer), straw buyer and the custom hiring center for dissemination of information related to paddy residue.

Keywords: Paddy Straw, Paddy Residue, Burning of Paddy Residue, Web based Model for effective disposal of Paddy Residue Management, Paddy Residue Management.

Rice is the most important food crop of India covering about one-fourth of the total cropped area and providing food to about half of the Indian population. This is one of the staple foods of the people living in India.

The cultivation of rice results in two types of residues i.e. straw and husk. Rice husk is the main by-product from rice milling which is roughly 33% of paddy weight, while rice straw and paddy are approximately equal in weight.

Crop residue is not a waste but rather a useful natural resource. About 25 % of Nitrogen (N) and Phosphorus (P), 50 % of Sulphur (S) and 75 % of potassium (K) are retained in crop residues, making them valuable nutrient sources^[5].

REASONS OF PADDY RESIDUE BURNING

The removal of the paddy straw that remains on the field is a labour-intensive work and another problem is time period. October-November is the time when farmers in North Indian state harvest their summer season crop paddy, and sow winter crop wheat. They have a short gap of 10 to 15 days to do this. A delay in sowing of wheat beyond mid November could affect its growth cycle. There is pressure on the farmer to sow the next crop in time for it to achieve a full yield. With labour being unavailable and the time window for preparing the field for wheat cultivation being limited, farmers has to either invest on expensive and rarely used agricultural implements, or burn the residue right on the field. Burning residue is both cheaper and easy, so most of the farmers adopt this.

SIDE EFFECTS OF PADDY RESIDUE BURNING

There are several side effects due to burning of paddy residue. Some are discussed below:

- ❖ Increase in the PM10 and PM2.5 concentrations is one of the problems of paddy residue burning. When the paddy residue is burnt in the field, it produces very dark poisonous smoke. Crop residue is contributing to atmospheric pollution that has serious effect on environment and human health. The emission of high levels of PM2.5 and PM10 in the air causes chronic diseases like cardiopulmonary disorders or asthma^[1].
- ❖ Burning of crop residue in open fields has adverse impact on the fertility of the soil. According to the Department of Soil, Punjab Agricultural University, Ludhiana, burning results in the soil organic carbon being lost to the atmosphere as CO₂, Nitrogen equilibrium in the soil changes rapidly and nitrogen is converted to nitrate. Burning also results in the loss of 27–73% of nitrogen present in the soil and reduces the bacterial and fungal populations on the top 2.5 cm of the soil. Furthermore, repeated burning can diminish the bacterial population by more than 50%. Long-term burning also reduces total nitrogen and carbon and potentially mineralized nitrogen in upper soil layer along with a loss in the soil organic matter^[4].

CURRENT SOLUTIONS FOR PREVENTING PADDY RESIDUE BURNING

The solutions in current use for utilizing rice residue can be divided into major and minor solutions.

Current minor solutions for preventing paddy residue burning

Some minor solutions which are used for preventing paddy residue burning are discussed.

(i) Use of rice residue as bedding material for cattle

Farmers can use paddy residue as bedding material for cross bred cows during winters. As per results of a study conducted by the Department of Livestock Production and Management, College of Veterinary Sciences, Punjab Agricultural University, Ludhiana It has been found that the use of paddy residue bedding during winter helped in improving the quality and quantity of milk. In the morning dunk cake can be made from the cattle dunk that is mixed with the paddy residue.

(ii) Use of crop residue for mushroom cultivation

Paddy residue can also be used as a raw material for mushroom culture. Using paddy residue for mushroom production can help the mushroom growers to save some money^[2].

Current major solutions for preventing paddy residue burning

Major solutions which are used for preventing paddy residue burning are given below. These solutions are used for consuming large amount of paddy straw as compared to minor solutions.

(i) Electricity generation

Generation of electricity is an attractive option. A 12 MW rice residue power plant requires 1.20 lakh tons of residues in a year^[3]. Haryana Government is establishing a plant at Karnal to generate electricity from crop residue. The plant would be set up at a cost of ₹ 1.15 crore^[6].

(ii) Bio fuel from paddy residue

Technologies to produce bio-fuel and gasification are still under research and development to make them economically viable. The PSFC (Punjab State Farmers' Commission) is coordinating a project for processing of farm residue to convert it into biogas based on the technology developed by Sardar Patel Renewable Energy Research Institute (SPRERI). A power plant of 1 MW is proposed to be set up at Ladhawal on pilot basis on land provided by PAU (Punjab Agriculture University). The new technology will generate 300 cubic meter of biogas from 1 ton of paddy straw^[4].

(iii) Use of paddy residue in paper production

The paddy straw is also being used in conjunction with wheat straw in 40:60 ratios for paper production. Paddy straw is also used as an ideal raw material for paper and pulp board manufacturing. As per information provided by Punjab Agricultural University, Ludhiana, more than 50 % pulp board mills are using paddy straw as their raw material.

(iv) Use of paddy residue as fodder for animals

Rice straw is fed to cattle and buffaloes in India from many centuries. Rice and wheat straw on average have a similar nutritive value according to laboratory analysis. In some states like Punjab, Haryana and Western Uttar Pradesh, wheat straw is preferred over rice straw. But when the prices of the wheat straw increases, most of the Gaushalas at that time uses paddy straw as a fodder for cattle's.

STEPS TAKEN BY GOVERNMENT FOR PREVENTING PADDY RESIDUE BURNING

There are several steps which are taken by Government for preventing paddy residue burning.

(i) Fine to land owners

NGT had fixed the environment compensation amounts per incident of crop burning to be paid by small

land owners having less than two acres of land at ₹ 2500, medium land owners holding over two acres and less than five acres at ₹ 5,000 and those owning over five acres at ₹ 15,000^[7].

(ii) Promotion of agricultural mechanisation for in-situ management of crop residue

The Cabinet Committee on Economic Affairs, has approved the promotion of Agricultural Mechanization for in-situ Management of Crop Residue in the States of Punjab, Haryana and Uttar Pradesh and NCT of Delhi.

Highlights of the *in-situ* management scheme are as under:

- ❖ Financial assistance of 80% of the project cost is provided to the cooperative societies of the farmers, FPOs (Farmer Producer Organization), Self-Help Groups, Registered Farmers Societies/ Farmers Group, Private Entrepreneurs, Group of Women Farmers.
- ❖ Financial assistance of 50% of the machinery/ equipment is provided to individual farmer for crop residue management.
- ❖ Financial assistance is provided to the State Government for the activities of information, education and communication. These activities include mass awareness campaigns through short and long films, TV programmes, demonstration camps at various levels, advertisement in print media, award for Village/ Gram Panchayat for achieving zero straw burning, etc.^[8].

PROPOSED WEB BASED MODEL FOR EFFECTIVE DISPOSAL OF PADDY RESIDUE

Problem formulation

- ❖ There are many farmers who are still burning their paddy residue which causes large pollution.
- ❖ The cost of machinery for paddy straw disposal is high which results in higher cost of cutting the straw. Due to which the number of farmers disposing off the crop residue effectively without causing any pollution is very less. There are various methods which are currently used by the farmers for disposing off the crop residue effectively without causing any pollution but quantity of disposed paddy residue is very less as compared to the total available straw.
- ❖ There are many custom hiring center and private agencies having straw cutting and bailer machine but their operation is limited to their nearby farmers due to lack of communication between custom hiring centers and farmers.
- ❖ There are many buyers of paddy straw who are willing to buy paddy straw but there is not contact between the farmer and buyer of paddy straw.

Key features of the proposed web based model

To solve the above discussed problem, a web based model is proposed to bring farmers, custom hiring center and paddy straw buyer on a single platform. By bringing all the above in single platform can solve many problems. Proposed web based model can also be called as portal.

- ❖ Farmers can sell their paddy straw residue to the interested paddy straw buyers by contacting them.
- ❖ Paddy straw buyers can also contact farmer for purchasing paddy straw.
- ❖ Farmers can contact the custom hiring center who cuts paddy straw and sell the paddy straw to the buyers.
- ❖ This results in the extra income to farmers from the paddy straw.

Phases in proposed web based model

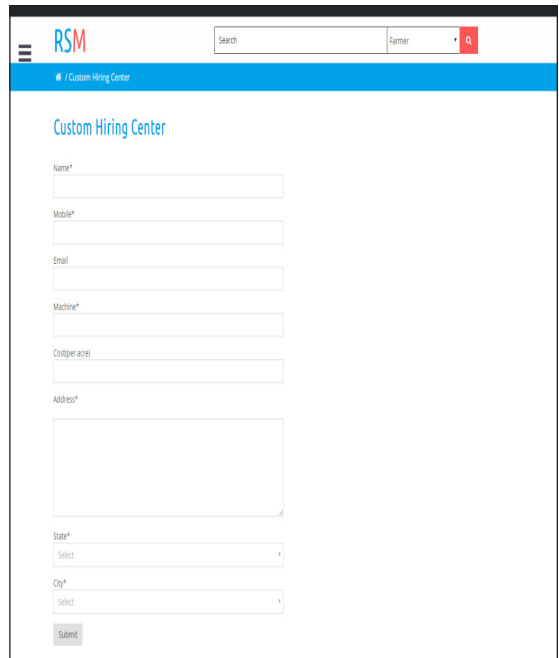
There are two phases in proposed model.

(i) Registration of farmer/custom hiring center/paddy straw buyer

Farmer/custom hiring center/paddy straw buyer should be registered on the platform. This can be done by reaching to the farmer/custom hiring center/paddy straw buyer at his doorstep or by allowing them to register on the portal.

Approaching doorstep of each farmer/custom hiring center/paddy straw buyer is very expensive and time consuming work. So, other method is good for registering farmer/custom hiring center/paddy straw buyer on the portal in which farmer/custom hiring center/paddy straw buyers can register themselves.

A form opens (as shown in Fig. 1) on the portal which contains the fields according to the user. If farmer want to register himself, his land and crop details is asked along with necessary details like name, address and contact. If custom hiring center want to register himself, his machine detail and rate is asked along with necessary details like name, address and contact. If paddy straw buyer wants to register himself, expected buying rate and how much quantity they require is asked along with necessary details like name, address and contact.



The screenshot shows a web browser interface for the RSM portal. At the top, there is a search bar and a dropdown menu set to 'Farmer'. Below this is a blue navigation bar with the text '# / Custom Hiring Center'. The main content area is titled 'Custom Hiring Center' and contains a registration form with the following fields: Name*, Mobile*, Email, Machine*, Cost per acre, Address*, State* (with a 'Select' dropdown), and City* (with a 'Select' dropdown). A 'Submit' button is located at the bottom of the form.

Fig. 1: Registration Form

(ii) Searching farmer/custom hiring center/paddy straw buyer

Searching is very important and crucial part on any model or portal. In our portal searching is very easy. Anyone can search farmer/custom hiring center/paddy straw buyer registered on the portal by just writing any keyword related to them.

Searching can be made by writing name, address, city, state. Search result (as shown in Fig. 2) will display all the search entity whose detail contains the keyword written for search.

Farmers can search paddy straw buyers and custom hiring center. Paddy straw buyers can also search farmer for purchasing paddy straw.

Farmers can contact the custom hiring center with the lowest cutting and baling rate for cutting and baling of paddy straw. Farmer can contact the paddy straw buyers who are giving maximum rate for their straw.

Benefits of proposed web based model

- ❖ Farmers can sell their paddy straw residue to the interested buyers by contacting them or buyers can also contact nearby farmers for purchasing paddy straw.
- ❖ Farmers can contact the custom hiring center who cuts paddy straw and sell the paddy straw to the buyers.
- ❖ Extra income to farmers from the paddy straw.
- ❖ Control in pollution and other problems caused by burning paddy straw.

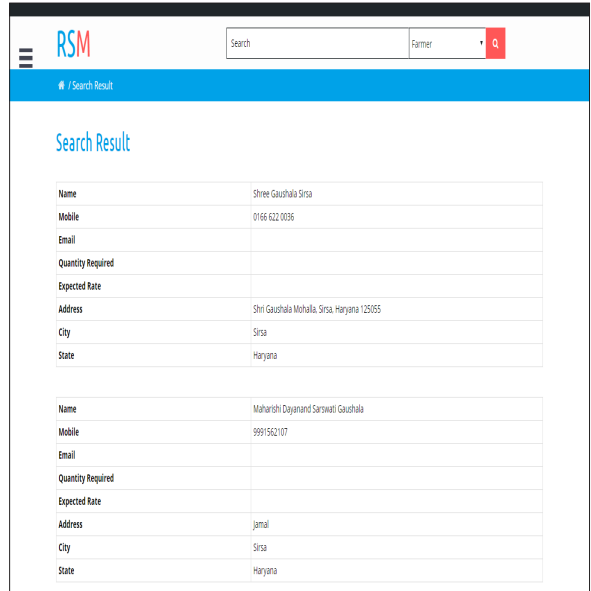


Fig. 2: Search Result

CONCLUSION

Rice is very important food crop for people living in India. Large population of India is dependent on rice crop. The production of rice also produces different types of residues. Reasons of burning of crop residue are discussed. Due to limited time for next crop and unavailability of labour, farmers have to burn crop residue in the fields, otherwise they have to invest in expensive machines. Burning of paddy straw causes severe air pollution and the emission of high levels of pm 2.5 and pm 10 in the air, which causes chronic diseases. Burning of paddy straw also results in the loss of soil nutrients and creates adverse impact on the fertility of the soil. Current minor and major solutions for disposing off the crop residue are discussed. Minor solutions include use of rice residue as bedding material for cattle and mushroom cultivation. Major solutions include use of rice straw in electricity generation, bio-oil and gasification, animal fodder, paper production. Steps taken by government and international solutions for disposing crop residue are also discussed in the paper. Proposed model can bring farmers, custom hiring centers and paddy straw buyers on the single platform, which results in the constructive use of the paddy straw and prevents the burning of paddy straw in open fields.

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