

DRAFT

**Policy for Management and Utilization of  
Paddy Straw in Punjab  
2013**

**Approved by the State Cabinet on \_\_ October, 2013**

**Department of Science, Technology & Environment,  
Govt. of Punjab**

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## **Policy for Management and Utilization of Paddy Straw in Punjab, 2013**

### **1. Preamble**

Paddy is cultivated in 2.8 m ha area in Punjab resulting in generation of about 20 million tonnes of paddy straw (Source: PAU). Except for Basmati rice which is generally harvested manually and straw thereof is used as cattle feed and for rope making, other varieties of paddy are harvested mechanically, leaving considerable stubble in the field which is burnt by farmers to prepare their farms for sowing of next Rabi crop.

The most preferable solution for the State is of course to diversify its cropping pattern, reducing the area under paddy cultivation. However, it can possibly happen only when the State is able to offer some other economically viable options to its farmers. Therefore, till such time diversification of cropping pattern to reduce the area under paddy becomes reality, an effective policy for management and utilization of paddy straw needs to be put in place.

The burning of paddy straw leads to loss of precious nutrients as nearly 25% nitrogen and phosphorus, 50% sulfur and 75% of potassium uptake from soil are retained in the crop residues. It has been estimated that burning of 1 tonne of paddy straw accounts for loss of 5.5 kg nitrogen, 2.3 kg phosphorus, 25 kg potassium and 1.2 kg sulfur, besides

organic carbon (Source: PAU). Further, heat generated by paddy straw burning penetrates into the soil, leading to loss of moisture and useful microbes, thus, adversely affecting soil properties. High cost of collection and lack of economically viable options to utilize this valuable bio-resource are identified as major factors, compelling the farmers to burn it.

## **2. Utilization Options :**

Paddy straw has multiple uses, some of which are identified as following:-

**2.1 Power from Paddy Straw:** The State Government has already approved “Biomass to Energy” projects to ensure utilization of 1 million tonnes of paddy straw for use as fuel to generate 200 MW of energy by 2017 in PPP mode. The Punjab Energy Development Agency is the Nodal Agency. The State Government has already notified “New and Renewable Sources of Energy Policy – 2012 (26.12.2012)”. Presently most boilers in the State are able to use only 25-30% paddy straw mixed with 70-75% other biomass to produce power. This is primarily due to high silica content in paddy straw which leads to clinkerisation in boilers. However, a few industries have started power generation using 100% paddy straw. In the State, the Biomass power project of capacity 52.5 MW have been already commissioned which are using rice straw, Cotton Stalk, Wheat Straw, Mustard Husk, etc as fuel.

**2.2 Paddy Straw as a Fuel in Brick kilns:** There are 3000 brick kilns spread all over the State, which consume 20

lakh tonnes of coal per annum as fuel. Use of biomass (other than rice straw) as fuel in brick kilns is well established. However, the use of paddy straw biomass in briquetted form needs extensive R&D for evaluating the combustion behaviour and the likely effects of high silica on increased wear and tear of briquetting machines.

**2.3 Paddy Straw as a Raw Material for Ethanol Production:** It is estimated that 0.25 million KL of alcohol can be produced from one million tonnes of paddy straw. Laboratory scale studies have been completed in this regard but these need to be upscaled to commercial scale. It may be projected that the State can achieve establishment of 0.75 KLD ethanol pilot plant (utilizing 3 tonnes paddy straw) by 2014 in PPP mode with financial assistance of Rs. 6.00 crore. Further up-scaling to produce 25 KLD of ethanol (utilizing 100 tonnes / day of paddy straw) can be achieved by 2017 with an estimated investment of Rs.70-75 crore. Considering the present consumption of petroleum products (diesel and petrol) in Punjab, which is estimated at 3 million tonnes, there is a possibility of utilizing 0.3 million tonnes (about 0.37 million KL) of ethanol (with 10-15% blend) per annum by promoting about 45 such plants (utilizing approximately 1.5 million tonnes/annum of paddy straw). This can also help in generating more employment.

**2.4 Paddy Straw for Paper/ Board making:** Already around 0.1 million tonnes of paddy straw is being used by paper industry for paper making in the state. There is not only

a need to continue this but also to enhance its utilization to 0.2 million tonnes by 2017.

**2.5 Paddy Straw as a Packing Material :** The advent of new packing material like thermocole has its adverse environmental implications including disposal problem. Use of paddy straw as a packing and filling material as an alternative to thermocole and other materials such as plastic or paper needs to be promoted, wherever feasible.

**2.6 Paddy Straw Fodder and Animal Hay Bedding :** Natural fermentation of paddy straw makes it rich in protein which is useful for cattle. The State Animal Husbandry Department is making efforts to popularize this. However, demand from within the State is low due to sufficient availability of wheat straw and green fodder, therefore possibility of treatment and export to other States such as Rajasthan needs to be explored. Further, paddy straw can be effectively used as bedding material for cattle. Extensive designs have been developed for effective collection of urine and dung from hay bedding and composting/ biomethanization of used hay bedding for manure production. PAU has developed technology for anaerobic digestion of paddy straw for biogas production, the efficacy of which needs to be assessed in the fields. Besides extension programmes, the State Government also needs to promote private entrepreneurs for the purpose.

**2.7 Paddy Straw for Mushroom Cultivation:** There is some potential to use paddy straw as a medium for growing mushrooms. At present, it is not being used in the State for this purpose. PAU has recommended use of paddy straw (with/without wheat straw) for cultivation of button mushrooms (*Agaricus bisporus*) and oyster mushrooms (*Pleurotus* spp.) in winters and paddy-straw mushroom (*Volvariella volvacea*, *V. diplasia*) in summers. The State Government should mobilize farmers to adopt mushroom cultivation for additional income generation. The market of mushrooms is already established and it can be further enhanced through subsidies/incentives/soft loans for making mushroom huts. The leftover of paddy straw after harvesting mushroom can be used as manure (after composting) in other crops which would save expenses on chemical fertilizers.

### **3. Challenges :**

**3.1 Collection and Storage :** For the proposed industrial and on-farm uses of paddy straw, its collection, chopping and baling are issues which need to be addressed from the economic angle (due to shortage of farm labour). Further, storage of such large quantities of paddy straw without degradation due to bacterial/fungal attacks (and/or fire) also needs to be taken care of. Some biomass based power plants are promoting storage under vacuum conditions in temporary silos using large inflatable bags. There is thus a need to encourage collection and storage of Paddy straw in catchment areas of relevant industries.

**3.2 Cost Effective Mechanization:** Agriculture in Punjab is highly mechanized and the concept of hiring large and costly farm equipment for limited period use (like combine harvesters) is well established. The State Agriculture Department has initiated setting up of Agriculture Service Centres in the cooperative sector for providing machinery like Happy Seeders, rotavators etc. on rent. The numbers of such centres need to be increased with regard to land holdings in an area. There is need to provide subsidies on other technologies/machinery related to paddy straw management such as Paddy straw chopper-cum-spreader, Straw baler, etc.

**3.3 Promotion of R&D, Technology Dissemination and Capacity Building:** The Departments of Agronomy and Crop Science, Farm Machinery, Soil Sciences, School of Energy Studies, Biotechnology and Extension Education of Punjab Agricultural University play a major role in paddy straw management through need based R&D. PAU has successfully developed Happy Seeder machines which facilitate sowing of wheat in the standing paddy stubble, while retaining the straw as surface mulch. The State Government is already encouraging adoption of this technology by offering subsidy. Further, for incorporation of paddy straw in soil, PAU has developed a tractor operated straw chopping-cum-spreading machine which can chop and spread combine harvested paddy in a single operation. The chopped and spread straw can easily be buried in soil by using rotavator. Subsequently wheat



sowing can be carried out by using strip-till drill or no-till drill after 2-3 weeks. Thus the presence of straw in the field does not affect the sowing of the next crop. Rather, it allows incorporation of nitrogen and other minerals into the soil, thus improves soil properties.

PAU is also promoting straw balers which can recover about 200-250 bales of 15 to 30 kg weight from combine harvested fields. The bales can be easily transported for use in power generation, briquette formation, other industrial uses and composting.

**3.4 Genomic Studies:** In order to promote research in Biotechnology, the National Agri-Biotechnology Institute has been set up as a joint endeavour of the Government of India and Government of Punjab. There is a need to develop cultivars with low silica content without compromising its quality to resist lodging, availing the benefit of this joint endeavour.

#### **4. Objectives :**

Given the aforesaid background and possible options, the major objectives of the policy for management and utilization of paddy straw in Punjab are identified as following:

- i) Protect environment from air pollution and prevent loss of soil micro-organisms caused by *in situ* burning of rice straw.

ii) Prevent loss of invaluable biomass, and with it, nutrients and minerals.

iii) Promote utilization of paddy straw as a resource for the following gainful purposes :

- Energy from biomass :
  - Power generation from paddy straw.
  - Briquettes from paddy straw for decentralized utilization in brick kilns and to meet other fuel requirements.
- Use as industrial raw material :
  - For production of bio-ethanol
  - For Packing Material
  - For Paper/ Board Industry
- Use as food, fodder and manure
  - as animal hay bedding
  - as fodder after nutrient enrichment.
  - as medium for mushroom cultivation
  - composting
- *In-situ* management by retention and incorporation in soil through use of Happy Seeder and Rotavator.

iv) Promotion of Research and Development:

- Optimizing existing technologies and developing novel technologies for use of paddy straw as industrial raw material (as fuel or processing for new products).

- Scale-up of innovative technologies from lab to pilot to commercial scale and promotion of demonstration projects.
  - Developing and upgrading agricultural machinery which facilitates collection/utilization/incorporation of paddy straw in soil.
  - Developing suitable agricultural technologies for paddy straw management without affecting productivity.
  - Promoting genomic studies and biotechnological interventions for reduction of silica in paddy biomass and for hastening its degradation in natural environment.
  - Identification of dwarf rice varieties with low silica content and their promotion.
- v) Promote private-public participation through extension activities and capacity building programmes and effective utilization and management of paddy straw.

## **5. Strategies and Actions:**

In its endeavour to achieve the above said objectives, the Government of Punjab lays down the policy with regard to management and utilization of paddy straw in the State as following:-

- 5.1 The Government of Punjab has prohibited indiscriminate burning of left over paddy and wheat straw/stubble in whole of the state vide Notification No. 3/162/2006-STE(4)/946 dated 22.10.2013.
- 5.2 The State would endeavour to promote R&D for development of boilers based on use of 100% paddy straw as fuel. It would plan to ensure utilization of 1 million tonnes of paddy straw as fuel for generation of 200 MW of generation capacity biomass power plants by 2017 in the BOO mode and 3 million tonnes of paddy straw for 600 MW generation capacity of Biomass Power Plant by 2022 as per state NRSE Policy 2012.
- 5.3 The State would promote R&D for study of combustion behaviour, development of appropriate briquetting machines and likely impacts of silica on wear and tear of these machines, so as to implement and popularize the technology by 2017.
- 5.4 The State would promote R&D for production of cellulosic ethanol from paddy straw by establishing a pilot plant of 0.75 KLD (from 3 tonnes paddy straw) by 2014, upscale the same to 25 KLD (from 100 tonnes paddy straw) by 2017, and promote further replication of the same in the state for ultimate utilization of 1.5

million tonnes of paddy straw per annum by 2027 (assuming 45 such plants shall be established, each consuming 30,000-35,000 tonnes of paddy straw per annum) to produce 0.37 million KL of ethanol for use as blend in fuel (based on 10% blending in current requirement of petroleum products in the State).

- 5.5 The State would promote and encourage continued use of paddy straw in paper/board and packing industry.
- 5.6 The State would promote and encourage development of storage facilities in PPP mode in command area of industries using paddy straw.
- 5.7 The State would promote utilization of upto 0.1 million tonnes paddy straw through public participation as animal hay bedding, use as fodder, composting, biogas generation through anaerobic digestion and mushroom cultivation.
- 5.8 The State would incentivise by 2017 incorporation of atleast 50% of present generation of paddy straw, in the field through use of Happy Seeders & Rotavators or disc harrows, provided through Agricultural Service Centres set up at block level to promote optimum utilization of the said farm machinery (as it is uneconomical for farmers to procure at individual level) and other appropriate agricultural practices and build capacities through awareness and extension education.

5.9 The State would promote agricultural mechanization through R&D on the following farm machinery :

- (a) Improve machines for reaping, raking, collection and baling of paddy straw in the fields.
- (b) Improve machines for chopping of paddy straw to facilitate briquetting or incorporation into the soil.
- (c) Enhance composting/ biomethanization of paddy straw by hastening its digestion to facilitate use as manure.

5.10 The State would promote R&D for biotechnological approaches to reduce silica and enhance decomposition of paddy straw so that the biomass can be utilized as fuel as well as for other industrial applications.

5.11 The State would endeavour to approve projects aimed at utilization of paddy straw as raw material in keeping with the existing industrial policy of the State, meaning thereby that the project developer using paddy straw would be entitled to all incentives and benefits as permissible under the Industrial Policy.

5.12 The State would endeavour to facilitate signing of Power Purchase Agreement between the project developers who aim to produce electrical energy using paddy straw as raw material, with the Punjab State Power Corporation Ltd.

5.13 The State would endeavour to define catchment area for each of the project developer who proposes to set up an industrial unit in the State based on paddy straw as raw material for all the production purposes or uses identified in this document or otherwise.

## **6. Implementation of Policy**

While the Department of Science Technology and Environment, Punjab would be the Nodal Department to facilitate proper implementation, the following Departments/ Organization/ Agencies would be partners in implementation of the Policy: -

- Department of Agriculture, Punjab
- Department of Industries, Punjab
- Department of Animal Husbandry
- Punjab Pollution Control Board, Patiala
- Punjab State Council for Science & Technology
- Punjab Energy Development Agency
- Punjab Agricultural University, Ludhiana
- National Agri-Biotechnology Institute, Mohali.

## **7. Amendments/Relaxation/Interpretation of Provisions of the Policy**

The Government of Punjab in the Department of Science, Technology & Environment shall take up all issues for clarification, interpretation, amendment and relaxation of provisions contained in this policy.

## **8. Arbitration**

In the event of dispute in interpretation/ implementation of the policy, the Secretary, Science, Technology and Environment would be the sole arbitrator.

Secretary to Govt. of Punjab  
Department of Science, Technology & Environment

No. -----

Dated: -----