

Chapter 6

Policies for Restricting the Agriculture Residue Burning in Punjab

Abstract This chapter highlights policies of the Punjab government to address crop stubble burning. Various departments like Punjab Agricultural University, Punjab Farmers Commission etc., are all making efforts to devise some alternate economic uses of rice stubble. Punjab government is also providing subsidy to the farmers to promote the use of equipments which help in checking the burning of crop residues. Similarly, Punjab Energy Development Agency is promoting non-conventional and renewable energy projects in the state that use crop waste as raw material.

Keywords SPM/RSPM levels • Policies to control air pollution • Alternate uses of rice stubble

In Punjab, industrial pollution, agricultural pollution and vehicular pollution are recognized as the three major contributors to air pollution. The air quality in Punjab is believed to be affected by industrial growth, urban growth and agricultural practices. The Punjab Pollution Control Board (PPCB) (<http://www.ppcb.gov.in/index.aspx>) monitors the pollution levels at 20 different locations in Punjab; nine of these locations are in the residential areas and eleven in the industrial areas. In this study we mainly focus on the air pollution generated in the residential cum commercial areas.

In this chapter we try to analyze the contribution of crop stubble burning in the emission of harmful gases and particulate matter into the air. Based on the findings, the policies of the Punjab government to address this are highlighted. With the looming problem of crop stubble burning, there is an urgent need to refer to the existing policies of the Punjab Government in place to address agricultural pollution. There is also a dire need to analyze the effectiveness of these policies in preventing farmers from burning their crop residues. Furthermore if the existing policies are found to be ineffective, what all policy measures can be suggested to the Government to put an end to this evil practice?

The problem of crop stubble burning in Punjab is emerging as a major threat to not just the quality of air but also to the health of individuals in the state. The burning of crop stubble results in the emission of various harmful gases and particulate matter in the air. Burning of rice and wheat residue results in the emission of Suspended Particulate Matter (SPM), SO₂, NO_x and other harmful gases like Carbon monoxide (CO), CH₄ etc. As per an estimate by Gupta et al. (2004), one tonne of straw on burning releases 3 kg particulate matter, 60 kg of CO, 1,460 kg of CO₂, 199 kg of ash and 2 kg of SO₂. The objective of this chapter is to highlight the SPM, SO₂, NO₂ levels in Punjab with the National Ambient Air Quality Standards based on the existing data, projects undertaken by the Punjab Pollution Control Board. The study progresses further by looking into the existing policies of the Punjab government towards this and what suggestive measures can be made to abate this problem.

6.1 Monitoring and Recording the Levels of Pollution in Punjab

In Punjab at present as per the National Ambient Air Quality Monitoring program, three major pollutants are being monitored; these are the Suspended Particulate Matter (SPM) Respirable Suspended Particulate Matter (RSPM), Nitrogen Oxides (NO₂) and Sulphur Dioxide (SO₂). Other pollutants like Carbon Monoxide (CO), Ozone (O₃), Lead (Pb) and Green house gases like CO₂, CH₄ etc. are monitored depending on the availability of data. To assess the cumulative and overall impact of the three pollutants (SO₂, NO₂ and SPM) on air quality and also to assess the non cumulative non compliance of the standards, an Air Quality Index has been formulated. This index is measured as the sum of the ratios of the three major pollutant concentrations to their respective air quality standards (Table 6.1).

$$AQI = 1/3 * \left(\frac{SO_2}{(SSO_2)} + \frac{NO_2}{(SNO_2)} + \frac{SPM}{(SSPM)} \right)$$

The pollution levels in Punjab are also measured on the basis of the Exceedence Indicator. The Exceedence Indicator compares the pollutant concentrations in

Table 6.1 The rating scale for air quality index

Index value	Remarks
0–25	Clean air
26–50	Light air pollution
51–75	Moderate air pollution
76–100	Heavy air pollution
>100	Severe air pollution

Source Environment Indicators for Punjab (<http://www.pscst.gov.in/>)

different cities/towns with respective NAAQS and characterizes them into four broad categories based on the exceedance factor (Table 6.2).

As per guidelines by the Central Pollution Control Board (CPCB), the maximum concentration limit of SPM and RSPM in the residential, rural and other areas are 140 and 60 $\mu\text{g}/\text{m}^3$ respectively. However in Punjab SPM/RSPM are estimated as given in Fig. 6.1. The SPM level in Punjab at different residential cum commercial areas have always been above the maximum RSPM limits of 140 $\mu\text{g}/\text{m}^3$ for the years of study.

The SO_2 levels in Punjab at residential-cum-commercial areas have been below the maximum permissible limit set by the Central Pollution Control Board of 60 $\mu\text{g}/\text{m}^3$ in residential/rural and other areas in all the years of study (Fig. 6.2). Similarly the NO_2 levels from 1997 to 2007 have been below the maximum permissible limit of 60 $\mu\text{g}/\text{m}^3$ in residential/rural and other areas (Fig. 6.3).

The Central Pollution Control Board has set up National Ambient Air Quality Standards for all the states in India to follow. As per the Central Pollution Control Board (CPCB), all states in India have to abide by the National Ambient Air Quality Standards (Table 6.3). The National Ambient Air Quality Standards say that the levels of air quality in any region should be such so as to protect the public health, vegetation and property. Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be

Table 6.2 The descriptive categories for different exceedance indicator values

Exceedance factor E.F	Remarks
>1.5	Critical pollution (C)
1.0–1.5	High pollution (H)
0.5–1.0	Moderate pollution (M)
<0.5	Low pollution (L)

Source Central Pollution Control Board, New Delhi (<http://cpcb.nic.in/>)

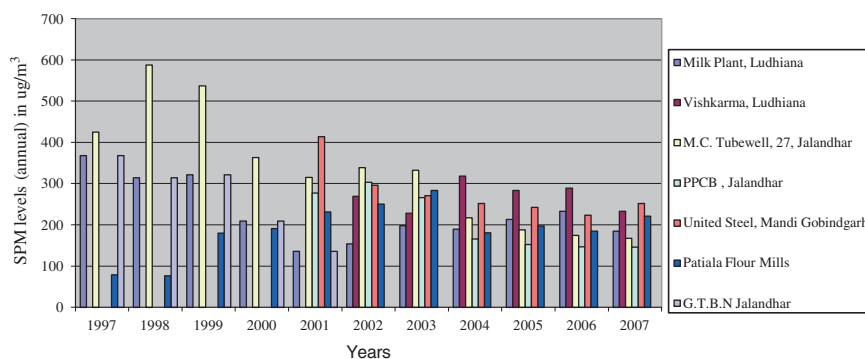


Fig. 6.1 SPM/RSPM levels at different residential cum commercial locations in Punjab.

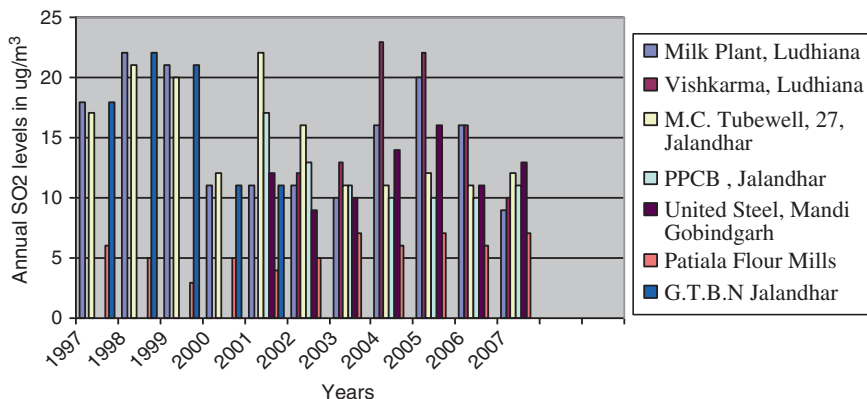


Fig. 6.2 SO₂ levels at different residential cum commercial areas in Punjab. Status of Environment and Related Issues

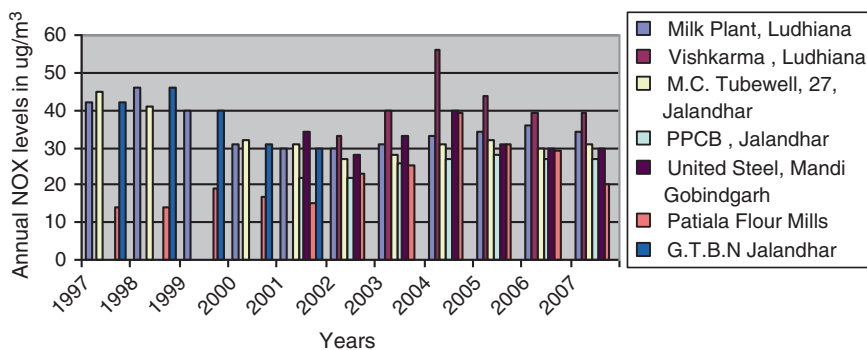


Fig. 6.3 NO₂ levels at different residential cum commercial areas in Punjab.

considered adequate reason to institute regular/continuous monitoring and further investigations. It is the responsibility of the State governments/State Board to intimate about the sensitive and other areas in the respective states within a period of 6 months from the date of the notification of the National Ambient Air Quality Standards.

The major activity under prevention of air and water pollution relates to grants to CPCB for fulfilling its objectives under Water Act, Air Act and Environment Pollution Act for strengthening air and water quality monitoring system. In 2008–2009, a total grant of Rs. 34.50 crore was planned for addition of water quality monitoring at 50 locations, ambient air quality monitoring at 75 stations, and automatic air quality monitoring in 11 cities. Financial assistance was provided to 15 SPCB/UTPCs for strengthening laboratory/other technical infrastructure under the scheme of abatement of pollution. To check environmental loss due to effluent

Table 6.3 National ambient air quality standards set by the CPCB

Pollutants	Time weighted average	Concentration in ambient air			Method of measurement
		Industrial areas	Residential, rural and other areas	Sensitive areas	
Sulphur dioxide (SO ₂)	Annual average	80 µg/m ³	60 µg/m ³	15 µg/m ³	Improved West and Gaeke method ultra-violet fluorescence
	24 h	120 µg/m ³	80 µg/m ³	30 µg/m ³	
Oxides of nitrogen (NO ₂)	Annual average	80 µg/m ³	60 µg/m ³	15 µg/m ³	Jacob and Hochheiser modified (Na-Arsenite) method
	24 h	120 µg/m ³	80 µg/m ³	30 µg/m ³	
Suspended particulate matter (SPM)	Annual average	360 µg/m ³	140 µg/nm ³	70 µg/m ³	High volume sampling (average flow rate not less than 1.1 m ³ /min)
	24 h	500 µg/m ³	200 µg/m ³	100 µg/m ³	
Respirable particulate matter (RPM)	Annual average	120 µg/m ³	60 µg/m ³	50 µg/m ³	Respirable particulate matter sampler
	24 h	150 µg/m ³	100 µg/m ³	75 µg/m ³	
Lead (Pb)	Annual average	1.0 µg/m ³	1.00 µg/m ³	0.75 µg/m ³	AAS method after sampling using EPM 2000 or equivalent filter paper
	24 h	1.5 µg/m ³	1.0 µg/m ³	0.75 µg/m ³	
Ammonia 1	Annual average	0.1 mg/m ³	0.1 mg/m ³	0.1 mg/m ³	
	24 h	0.4 mg/m ³	0.4 mg/m ³	0.4 mg/m ³	
Carbon monoxide (CO)	8 h	5.0 mg/m ³	2.0 mg/m ³	1.0 mg/m ³	Non dispersive infrared (NDIR)
	1 h	10.0 mg/m ³	4.0 mg/m ³		Spectroscopy

Source Punjab Envis Center (<http://punenvis.nic.in/>)

Note Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval

discharge, financial assistance was provided to 10 CETP to treat effluent emanating from the clusters of compatible small scale industries.

Furthermore the Ministry also in its 2008–2009 Budget provided outlay of Rs. 3.05 crores, for the development and promotion of clean technology. The total outlay of the Ministry in 2008–2009 against total pollution control and prevention was Rs. 95.17 crores and Rs. 389 crores of plan and non plan budget, respectively. In addition, another Rs. 5 crores of non plan Budget was sanctioned by the

Ministry for supporting State Pollution Control Boards and State Environmental Departments for infrastructure development etc.

6.2 Existing Policies to Control Air Pollution

The Punjab Pollution Control Board (PPCB), Punjab State Council for Science and Technology (PSCST), Punjab Energy Development Agency (PEDA) (<http://www.peda.gov.in/>) are the Institutions that have been vested with the task of controlling pollution in Punjab. It is mainly the Punjab Pollution Control Board in coordination with the Central Pollution Control Board that advises the government on pollution related matters. During the 10th Five Year Plan Government of Punjab provided a sum of Rs. 572 lakh to the PPCB and Rs. 85 lakh for Annual Plan 2004–2005. The PPCB is the main governing body in Punjab for ensuring that the ambient air quality standards are met (<http://www.punjabgovt.gov.in/>).

6.2.1 Punjab Pollution Control Board (PPCB)

The main objectives of the Punjab Pollution Control Board in controlling pollution include effective control of air and water pollution, controlling pollution at source and to ensure that the pollution control standards are met. The PPCB is entrusted with the functions of planning a comprehensive program for the prevention, control and abatement of pollution. PPCB has to support and encourage developments in the field of pollution control. It has to make sure that the information collected by means of reports, projects on the pollution levels in various sectors is disseminated timely so that the Punjab government can formulate policies accordingly. Furthermore it should also encourage the development of machineries for ensuring pollution control in Punjab.

The Punjab Pollution Control Board has been monitoring the pollution levels at 20 locations out of which nine are in the residential-cum-commercial areas and 11 are in the industrial areas. As per the statistics of the period from 1995 to 2005, both the 24 h and annual averages of SPM/RSPM at residential-cum-commercial monitoring locations exceeded the permissible limits for residential areas (24 hourly permissible limits for SPM and RSPM are 200 and 100 $\mu\text{g}/\text{m}^3$ respectively and for Annual average permissible limits are 140 and 60 $\mu\text{g}/\text{m}^3$) throughout the year, with the maximum values being observed in Ludhiana followed by Mandi Gobindgarh, Jalandhar and Amritsar.

The Punjab Pollution Control Board abides by the Air Act of 1981 and the Environment Act of 1986 to control pollution in the state of Punjab. The Air Act has been adopted by the Government of Punjab to control environmental pollution in Punjab. The Punjab Pollution Control Board is entrusted with the task of ensuring

that the above air laws are being followed in Punjab (<http://www.punjabgovt.gov.in/jsp/apps/work/MappingOfMinistersPunjab.pdf>).

6.2.2 Agriculture Councils

With the realization of the harmful effects of wheat and paddy monoculture on the ecology and environment, the Punjab government has been encouraging the diversification in agriculture, away from the rice-wheat cropping pattern towards other remunerative and less water intensive crops since the past few years. Basmati paddy, hyola, sunflower, pulses and vegetables are being promoted as alternative to paddy and wheat monoculture.

During the year 2005–2006, the Punjab state government in the wake of degradation of soil health, depletion of water reserves, faster erosion of the micronutrients reserves, caused due to the paddy wheat crop rotation, created the Agricultural Diversification Fund. Furthermore an outlay of 50.56 crores was provided in the Annual Plan of 2006–2007 to strengthen the agricultural infrastructure and speed up the process of agricultural diversification in the state. In the Annual Plan 2006–2007, a new programme, ‘Agriculture Production Pattern Adjustment Programme in Punjab for Productivity and Growth’ under the 12th Finance Commission was included with a budgetary provision of Rs. 24 crores per annum for four years till 2010.

During 2005–2006, the Punjab government devoted Rs. 10 crores for the creation of an ‘Agricultural Research and Development Fund’. The funds were used for the development of better quality of alternative agricultural crops, improved agricultural practices and improved post harvesting management practices. In order to encourage farmers to use the crop stubble as fodder for animals and to meet the fodder requirements during the scarcity period an outlay of Rs. 20 lakh was sanctioned for the scheme enrichment of straw and cellulose waste.

In addition the Punjab Government in order to intensify its diversification programme in the agriculture sector has set up four Special Purpose Vehicles (SPVs) to promote citrus and fruit juices, value-added horticulture, viticulture and organic farming. These are:

- Council for Citrus and Agri. Juicing
- Council for Value added Horticulture
- Organic Farming Council of Punjab
- Viticulture Council of Punjab

These Councils were set up in January 2006 under Financial Commissioner (Development). The main objective of these Councils is to take measures for shifting Punjab from primary agricultural and low value produce to high value processed products. The Government’s aim is that one-third of the State’s farm sector should diversify to citrus and high value horticulture, viticulture and organic farming in the next 10 years.

6.2.3 Punjab State Council for Science and Technology

The Punjab State Council for Science and Technology (PSCST) caters to the science and technology requirements of the state. As per a report by the Council on the State Environment of Punjab 2006, the burning of crop stubble is banned in the state. In order to address the problem of agricultural waste, PSCST constituted a Task Force under the chairmanship of its Executive Director in September 2006. As per the Task Force, there is a need to adopt new ways and methods for better utilization of agriculture waste, especially rice stubble to mitigate the problem of the pollution caused due to burning of these residues in the fields. These include: strengthening of crop diversification program, alternate uses of agriculture residues through incorporation of paddy straw in soil by promoting Happy Seeder Technology, zero till etc., use of agricultural residues for power generation, use of paddy straw as protein enriched fodder for livestock after fermentation and biomethanization of paddy straw. The following actions have been initiated by various departments/institutions in the State in response to the recommendations of the Task Force:

6.2.4 Department of Agriculture

During the year 2008–2009, a total number of 5,117 farmers training camps at district, block and village level were organized by department of agriculture to make the farmers aware about the benefits of reincorporation of the crop residues. Besides this, the department was organizing frontline demonstrations to encourage farmers to adopt zero-till-drills, Happy Seeders, Rotavators and distribution of new agricultural implements on subsidy. During 2007–2008 and 2008–2009, 760 and 1,290 frontline demonstrations were organized at farmers' fields, respectively. As a result of these demonstrations and supply of these equipments on subsidy, these techniques were adopted by the farmers of the state in 5.92 and 7.21 lakh hectares area, respectively during the sowing of wheat crop in 2007–2008 and 2008–2009. To promote the use of equipments which help in checking the burning of crop residues, Rotavators, Happy Seeders, Zero-till-drills and Straw Reapers were distributed to the farmers on subsidy. During the year 2007–2008 in all, 2,659 rotavators, 1,383 Zero-till-drills, 2 Happy Seeders and 448 straw Reapers were distributed to the farmers on subsidy.

Further, the Department is promoting diversification of cropping pattern in Punjab under which area under Basmati rice had been increased from 1.5 lakh hectares to 3.5 lakh hectares in the past 5 years whereby straw of basmati rice can be used as a fodder.

6.2.5 Punjab Energy Development Agency (PEDA)

PEDA has been facilitating the setting up of 29 power projects with total installed capacity of 330 MW on BOO basis to private developers. These projects are being set up by the private developers with state-of-art technologies such as

Biomethanation, Combustion etc. The plants are designed to receive mixed waste such as paddy straw, cotton stalks and other agro residues available in the state. Out of these, one project of 8 MW had been commissioned in March 2009 and another of 14.5 MW in September 2009.

6.2.6 Department of Animal Husbandry

A total number of 2,478 demonstrations for protein enrichment of paddy/wheat straw through urea treatment had been conducted up to October 2008. Awareness camps for providing information about straw as animal bedding was also organized by the Department.

6.2.7 Punjab Agricultural University

PAU had been according priority towards developing efficient agro-technologies for crop residue recycling in machine harvested areas as an alternative to burning. The major equipments developed by PAU are: (i) Happy Seeder Machine for planting in standing paddy stubbles; (ii) Tractor Operated Paddy Straw Chopper; (iii) Straw Collector and Baler; (iv) Residue Incorporation in Soil; (v) Compositing Techniques using Paddy Straw.

- (i) Happy Seeder Machine for planting in standing paddy stubbles: This technology, developed by PAU, has already been adopted by the government of Punjab and is being popularized by Department of Agriculture. Wheat was successfully sown in 200 acres area using Happy Seeder during 2007–2008 producing 5–10 % more yield (with 50–60 % less operational costs) compared to conventionally sown wheat. Financial analysis by PAU indicated that this machine is more profitable than other conventional alternatives like full stubble incorporation through direct drilling or rotary seeding.
- (ii) Tractor Operated Paddy Straw Chopper: For incorporation of paddy straw into soil, the University has also developed a Tractor Operated straw Chopping-cum-spreading machine. The Machine, in a single operation, harvests the left over paddy stubble after combining, chops it into pieces and spreads it on to the field. The chopped and spread stubble then can easily be incorporated in the soil after light irrigation by using a rotavator or disc harrow and is allowed to decay.
- (iii) Straw Collector and Baler: Baler is also another promising technology developed by PAU for collecting paddy straw. Balers make rectangular or round bales by collecting the loose straw from the ground. One operation of stubble shaver in a combine harvested paddy field, created favorable conditions for operating a baler, which in turn, results in smooth sowing of the next crop.
- (iv) Residue incorporation in Soil: In situ incorporation of paddy straw before sowing wheat, did not adversely affect the wheat crop. Rather the incorporation of the residues had a favorable effect on soil physical, chemical and biological properties.

- (v) Composting techniques using paddy straw: PAU has also been working on use of paddy straw as bedding material for animals and thereafter going in for its composting. A special machine has been acquired for the turnover of composting materials and its watering for a rapid generation of high value compost.

6.2.8 Punjab State Farmers' Commission

The Commission had approved the steps proposed by the Task Force. In order to reduce area under paddy without decreasing the income of the farmers, the commission has initiated the following programmes:

- Commercial dairy farming and increasing the area under fodder
- Production of vegetables under net house technology
- Encouraging cultivation of hybrid maize in kharif season
- Introduction of new high value crops such as banana cultivation in the state.

6.2.9 Department of Rural Development and Panchayats

The Department is popularizing technologies proposed by Department of Agriculture and PEDDA and is facilitating provision of panchayati land for setting up of Biomass based power plants in the state. It had already facilitated 33 years lease of panchayati land of five villages for setting up such units.

Furthermore the Punjab State Council for Science and Technology has also set up a Consultancy Cell to address the problem of Pollution in Punjab. However this mainly caters to the air pollution caused by the industries. There have been various technological responses undertaken for conservation of environment affected by agriculture. These include the following:

6.2.10 Agriculture Diversification

It has been increasingly felt by the Government of Punjab, to move the farmers away from the rice-wheat crop rotation into new areas like vegetables, fruits, oil seeds, pulses, etc. The importance of crop diversification to protect the natural resources and to stabilize farm income is increasingly felt. The Government of Punjab in 2002 launched a multi crop multi-year contract farming scheme to give boost to crop diversification. The Punjab Agro Food Corporation (PAFC) has been implementing the task and it is believed that more than 0.186 million ha is covered under crops other than wheat and paddy like hoyla, winter maize, sunflower, durum wheat, moong etc., with around 0.1 million farmers under this program.

6.2.11 Promotion of Zero Tillage

The department of Agriculture, Government of Punjab is promoting “Zero Tillage Technique” since 2001–2002 in areas of state where wheat is sown after harvesting of rice. Zero till system refers to planting crops with minimum of soil disturbance. The other novel approach with much promise is the use of “Happy Seeder”, which combines stubble mulching and seed drilling functions into one machine. The emphasis is on conserving moisture and residue management. Apart from benefits like proper mulching of paddy residue instead of burning, timely sowing, reducing run off and soil erosion, lesser deep percolation and improving soil health by incorporating plant nutrients, the zero tillage increases farmer’s profit by Rs. 2,200–3,000/- per hectare by saving 80 % of diesel as wheat is sown in one pass only. The area under zero tillage in Punjab has increased from 6.83 thousand hectares in 2001–2002 to 412.69 thousand hectares in 2005–2006. As per the information provided by Punjab Agricultural University, zero tillage sowing of wheat on 412 thousand hectares in the state during rabi 2005–2006 has reduced the consumption of diesel by 20.6–24.7 million liters and also reduced the emission of CO₂ to the tune of 53.6–64.2 million kilograms in the environment on the basis of conversion factor of 2.6 kg of CO₂ per litre of diesel burnt.

6.2.12 Management of Agricultural Waste

Keeping in view the increasing problems associated with crop stubble burning, many initiatives have been taken to manage agricultural waste including paddy and wheat straw, cotton sticks, bagasse and animal waste. At present large volumes of wastes are being burnt in the field or as fuel. Several initiatives for its proper management have been taken up. These include:

6.2.13 Utilization of Straw and Husk

Though on paper, various district administrations in the state have imposed a ban on the burning of paddy straw in the fields after its harvesting, the problem still persists. As a result various departments and institutions are promoting alternative uses of straw instead of burning. These include:

6.2.14 Use of Rice Residue as Fodder for Animals

The rice residue as fodder for animals is not a very popular practice among farmers. This is mainly because of the high silica content in the rice residue. It is believed that almost 40 % of the wheat straw produced in the state is used as

dry fodder for animals. However to encourage the use of rice residue as fodder for animals, a pilot project was taken up by PSCST at PAU under which trials on natural fermentation of paddy straw for use as protein enriched livestock feed were conducted. The cattle fed with this feed showed improvement in health and milk production. The technology was demonstrated in district Gurdaspur, Ludhiana, Hoshiarpur and Bathinda. The department of Animal Husbandry, Punjab has propagated the technology in the state.

6.2.15 Use of Crop Residue in Bio Thermal Power Plants

Another use of rice residue that is being encouraged by various institutions and departments is the use of rice residue for generation of electricity. The details of crop residue use in bio thermal plant is given in Chap. 4.

6.2.16 Use of Rice Residue as Bedding Material for Cattle

The farmers of the state have been advised to use paddy straw 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. It has been found that the use of paddy straw bedding during winter helped in improving the quality and quantity of milk as it contributed to animals' comfort, under health and leg health. Paddy straw bedding helped the animals keep themselves warm and maintain reasonable rates of heat loss from the body. It also provides clean, hygienic, dry, comfortable and non-slippery environment, which prevents the chances of injury and lameness. Healthy legs and hooves ensure enhancement of milk production and reproductive efficiency of animals. The paddy straw used for bedding could be subsequently used in biogas plants. The use of paddy straw was also found to result in increased net profit of Rs. 188–Rs. 971 per animal per month from the sale of additional amount of milk produced by cows provided with bedding. The PAU has been demonstrating this technology to farmers through training courses, radio/TV talks and by distributing leaflets.

6.2.17 Use of Crop Residue for Mushroom Cultivation

Paddy straw can be used for the cultivation of *Agaricus bisporus*, *Volvariella volvacea* and *Pleurotus spp.* One kg of paddy straw yields 300, 120–150 and 600 g of these mushrooms respectively. At present, about 20,000 MT of straw is being used for cultivation of mushrooms in the state.

6.2.18 Use of Rice Residue in Paper Production

The paddy straw is also being used in conjunction with wheat straw in 40:60 ratio for paper production. The sludge can be subjected to biomethanization for energy production. The technology is already operational in some paper mills, which are meeting 60 % of their energy requirement through this method. Paddy straw is also used as an ideal raw material for paper and pulp board manufacturing. As per information provided by PAU, more than 50 % pulp board mills are using paddy straw as their raw material.

6.2.19 Use of Rice Residue for Making Bio Gas

The PSFC has been coordinating a project for processing of farm residue 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. The new technology will generate 300 m³ of biogas from one tonne of paddy straw.

6.2.20 Other Measures

For agricultural diversification, the new strategy lays emphasis on production of fruits and vegetables under controlled conditions, using modern practices like net houses, plastic tunnels and green houses. For achieving the same objective, half a million acres of land has been brought under crops, other than wheat and paddy, through contract farming. Yet another step towards diversification of agriculture, taken by the state Government, is the establishment of a new University of Animal Sciences. This is likely to impart desired impetus to dairy and livestock development. Besides, an Agriculture Diversification, Research and Development Fund, with an initial corpus of Rs. 20 crore have also been created. However, there is a need for creating a Venture Capital Fund at the National level for promoting agri-businesses.

Provision of Rs. 500 crore earmarked for the National Horticulture Mission during 2005–2006 is very meager, which needs to be enhanced to fully accommodate the requirement of funds for shifting from the traditional to horticulture crops.

While on the one hand there is an urgent need to revitalize the research in agriculture and related activities, on the other hand to tackle the problem of soil degradation and water depletion, a dedicated programme for promoting resource conservation technologies, such as zero tillage, deep ploughing, raised bed planting, laser land leveling etc., should be undertaken. Heavy investments are required to be made for rejuvenation of these resources. The Rashtriya Krishi Vikas Yojana (RKVY) is a welcome initiative.

The Central Pollution Control Board in exercise of its powers conferred under Section. 16(2) (h) of the Air (Prevention and Control of Pollution) Act, 1981(14 of 1981) hereby notify the National Ambient Air Quality Standards with immediate effect. Furthermore it is believed that the Punjab Government regularly publishes the adverse impacts of crop stubble burning in local newspapers. As per a local newspaper, the Tribune dated 19th May 2009, the District Magistrate Bhagwant Singh has banned the burning of crop stubble in Amritsar. However the practice still continues in the rural belt of Amritsar district, including Attari, Ajnala and Majitha.

The problem of pollution caused by rice and wheat crop stubble burning has not received much attention by the policymakers and the various pollution authorities. This could be partially due to the fact that the rice and wheat burning taken place only during selected months of October, November and December. The pollution is restricted only during these months. However even during these months there is considerable loss to human health and environment degradation. In the local dailies of Punjab you might come across articles requesting farmers to stop burning the stubble or creating awareness among them about its ill effects. But the problem still remains more or less unresolved. Though the Punjab Pollution Control Board has taken various measures to limit the amount of industrial pollution in the state of Punjab, however not much has been done to address agricultural pollution.

6.3 Summary of the Chapter

Punjab Government, its various Departments and other institutions like Punjab Agricultural University, Punjab Farmers Commission etc., are all making efforts to devise some alternate economic uses of rice stubble. These include the stubble treated with urea as a fodder for animals, its use in biothermal energy production, paper manufacturing, mushroom cultivation, bedding for animals, etc. Punjab government is also providing subsidy to the farmers to promote the use of equipments which help in checking the burning of crop residues, like rotavators, happy seeders, zero-till-drills and straw reapers. The Punjab Pollution Control Board (PPCB) has taken various measures to limit the amount of industrial pollution in the state but needs to do more to address agricultural pollution. Punjab State Council for Science and Technology is one of the institutes for imparting training on pollution control, waste management, clean technologies, environment policies, health monitoring and assessment and solid waste management conducted by the Central Pollution Control Board under the Human resource development programme. The Punjab Energy Development Agency was established in the year 1991, for the promotion and development of non-conventional and renewable energy programs or projects in the state of Punjab. Thus, as far as the institutional setup is concerned, there is enough constitutional provisions made under the law of the land to control and abet pollution related to agricultural waste burning. However, what is requisite

to meet with this evil practice is strong will power among the governance and viable economic alternatives available to the farmers to keep the stubble burning practice at a bay.

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Reference

Gupta, Prabhat, K., Sahai, Shivraj, Singh, Nahar, Dixit, C. K., Singh, D. P., Sharma, C., Tiwari, M. K., Gupta, Raj, K., & Garg, S. C. (2004). Residue burning in rice-wheat cropping system: causes and implications. *Current Science*, 87(12), 1713–1715 (Dec 25).