

# Looking for Solution to Parali Burning: An Overview

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**Abstract - Agricultural burning helps farmers remove the remnants of remaining crops in the field after harvesting grains, such as straw and rice. Burning helps control pests, kills weeds including those resistant to herbicides and can reduce nitrogen association.**

**In India, in northern parts of the country, in order to quickly prepare their fields for wheat crops, many farmers simply burn the remains of plant debris after harvesting rice. This practice is known as burning rice stubble or burning parali (in the local dialect). This emits large amounts of toxic pollutants in the atmosphere containing harmful gases such as methane (CH<sub>4</sub>), carbon monoxide (CO), volatile organic compounds (VOCs) and carcinogenic polycyclic aromatic hydrocarbons (CPAH), which may eventually cause smog. Moreover, the soil loses its fertility and humidity.**

**Thus, burning has a very harmful effect on the environment along with the health risks of organisms. Although farmers across the region find it the most economical way to prepare their fields for the next wheat crop given the time available for the next seeding. There are many alternative solutions to burning parali that need to be proposed and implemented with strict regulations as well as assistance has to be provided to farmers through incentives or other methods.**

**Index terms - Parali burning, Toxic gases, Volatile organic compounds, Soil fertility, Health risks, Alternative methods to burning parali.**

## I. INTRODUCTION

The stubble or parali is the remaining part left after harvesting the paddy crop. When rice crops are fully ripe, the top is harvested only, and the bottom is left behind. This remaining part of the crop is of no use to farmers and remains in the field with roots beneath it. Farmers have been burning crusts for decades, but with modern mechanical tools for harvesting, the crop is cut in such a way that a one-to-two-foot stubble is left behind that takes about 1 to 1.5 months to decompose on its own. However, farmers do not have enough time because they need the farm

prepared for the next wheat crop, so instead of waiting for the residue to decompose they burn it. The remaining rice residues are also difficult to leave behind as they contain a high percentage of silica, making them unusable as animal feed. Therefore, to clear the field for the next seeding season, farmers usually burn these dry crusts, which in turn becomes the cause for pollution.

With burning, a thick layer of smog consisting of soot, dust and other particles makes it difficult for people to breathe in the Indian capital city of Delhi especially from October to November. Every year around October, the landscape of Delhi and other northern regions of the country turns into a health disaster.

Besides health risks, farmers are also at a loss from an economic perspective because it affects the soil quality as important nutrients of the soil are destroyed.

In this article, various ways to address this problem have been proposed in addition to the incentives provided by the government to deal with this parali burning problem.



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## II. WHY BURN PARALI?

Farmers find it difficult to deal with straw in natural ways. For example, a bumper crop can leave a huge amount of straw, which can be very difficult to deal with. Rainy weather after harvest can leave fields too wet to plough. [1]

Burning is one way to get rid of the remaining straw after harvest so that the fields can be made ready for sowing the following spring.

In some areas, the soil contains a high percentage of clay. This type of soil is prone to drainage and compaction problems, which may make burning a more attractive option than tillage. Some areas produce high-yield crops, which means that a lot of hay is produced as well. This makes it difficult to integrate straw into the soil. For this reason, it has become a traditional practice for farmers to burn in some areas. However, new technology and innovations can make it possible to integrate all residues into the soil. [2]

The main reason for burning the rice stubble (rice crop) is the short time available between harvesting rice and sowing wheat. [3] Delays in wheat cultivation negatively affect the wheat crop. The short time frame available between rice and wheat crops can also be attributed in part to the Punjab Preservation of Subsoil Act of 2009[4], where the date of rice cultivation is set in mid-June, pushing forward the harvest of the rice crop. As a result, farmers get less than 20-25 days between two crops, so the quickest and easiest solution is to burn crop residue. It is estimated that 20 million tons of rice stubble are produced each year in Punjab, 80% of which are burned on the farm.

It is a low-cost alternative to tilling in straws. Under these circumstances, farmers may feel they have no choice but to burn the hay.

### III. THE OUTCOME OF PARALI BURNING

Burning crusts (orparali) releases gases such as carbon monoxide and carbon dioxide leading to severe air pollution. It also has a negative impact on human health.

During the harvest season, the harvest of rice fields generates a huge amount of stubble that needs immediate dumping. Farmers usually collect the stubble and put it on fire because it is the easiest way to dump it without leaving any trace of waste on the soil horizon. However, doing so creates a serious problem that is directly linked to our environment.

Researchers have shown that burning agricultural biomass residues poses a significant health risk. It not only affects organic carbon levels in the soil but also produces an uncontrollable amount of harmful smoke that causes air pollution to the immediate vicinity. [5]

#### *A. Contribution to atmospheric pollution*

Burning parali is a major contributor to atmospheric pollution, ranking third only to industrial emissions and vehicles.

The terrible fog surrounding India's national capital region was directly associated with stubble burning, coinciding with burning periods in October and November.

A large number of toxic pollutants are emitted into our atmosphere due to the open burning of the parali. These pollutants also contain harmful gases such as methane, carbon monoxide, volatile organic compound and carcinogenic polycyclic aromatic hydrocarbons. [6]

Studies have shown that burning parali has caused a significant deterioration in the air quality surrounding Punjab and Haryana. These harmful gasses are also transmitted through other parts of northern India, posing a serious threat to biological life. [7]

These toxic gases build a cloud of ash and turn into a smog formed by the intense amount of smoke in the atmosphere. These harmful gases create a dangerous casing that has the ability to travel thousands of kilometers, increasing the level of air pollution in connected cities by destroying the entire Air Quality Index (AQI) and becoming a cause of many health problems.

The significant increase in particulate matter 2.5 and 10 can be directly attributed to the burning of stubble during peak seasons in October and November. Besides the stubble burning, entrainment of husk particles in the air from the threshing and shattering process of rice and wheat seeds also contribute to the gradual increase in the magnitude of the pollutant level. [8]

The burning of husk contributes to the frequent formation of brown clouds that have a negative impact on local air quality, hindering atmospheric visibility and further affecting the causes of climate change.

Smoke from this burn produces a cloud of particles visible from space and produces what has been described as a "toxic cloud" in New Delhi, leading to the declaration of an air pollution emergency. [9]

#### *B. Human health implications*

Multiple health effects on humans have been observed from the resulting air pollution, ranging from skin and eye irritation to severe

neurological, cardiovascular, and respiratory diseases.

Prolonged exposure to elevated pollution levels also increases mortality rates - according to research, Delhi's resident life expectancy has fallen by about 6.4 years due to exposure to elevated levels of pollution. [10]

The burning of parali emits fine particles (PM<sub>2.5</sub>), an air pollutant that is a concern for people's health when levels in the air are high; particles can attach to the lungs and increase the risk of lung cancer by 36%.

#### *C. Impact on soil and plant health*

Strips the soil of essential nutrients such as nitrogen, phosphorus, and potassium.

It raises the soil temperature to about 42°C, thus killing important microorganisms up to a depth of about 2.5 cm. It hinders agricultural productivity because pollutants in the atmosphere lead to acid rain and prolonged exposure to particle pollution favors the growth of pests or diseases. [11]

Ground-level ozone caused by burning parali affects the plant's metabolism, penetrates and destroys its leaves, causing serious damage to crops in northern parts of India. [12]

Burning parali leads to the loss of key nutrients of soil, approximately 50% of sulfur, 75% of potassium and 25% of nitrogen and phosphorus are lost.

#### *D. Cost to the economy*

According to reports, the flow of tourists in Delhi decreased by about 25-30% due to the increase in air pollution.

Burning parali creates disruptions in economic activity (cancellation/delay in flights and trains, slow road traffic and accidents). The cost of air pollution due to the burning of parali in India is estimated at \$30 billion annually. [13].

### IV. SOLUTION TO PROBLEM OF STUBBLE BURNING

One way to approach this issue is to think about alternatives to deal with it. Instead of burning the stubble, it can be used in multiple ways such as livestock feed, compost fertilizer, roofing in rural areas, biomass energy, mushroom cultivation, packing materials, fuel, paper, bioethanol, industrial production, etc. [14]

Straw returning is a promising approach to improve soil fertility and to mitigate the negative effects of chemical fertilizers on soil quality. However, straw degradation is a slow and multifactorial-controlled process. [15]

The establishment of biomass fuel stations to generate fuel using rice husk or the manufacture of livestock feed from collected stubble could also be a key step in reducing the negative impact of crop residues that find their way into the environment while burning crops meaninglessly. Turning stubble into energy is an innovative way to address this issue. The construction of biomass power plants in villages can help meet the energy needs of villagers. [16].

For this purpose, straw must be collected from the fields preferably in a mechanical way.

A machine called straw baler to compress crop residue into compact bales – to bale rice stubbles and moving them out of the field. But it flopped because the machine takes an hour per acre, usually producing 12-15 quintals of bales. [17]

Earlier, bale owners provided their services free of charge and compensated for their time and work by selling bales to nearby biomass plants. The state government may arrange for the purchase of stubble, along with rice grains, by renting a baler to work free of charge for farmers. stubble can then be sold to biomass-based power plants, paper factories and cardboard factories.



*Straw bales*

Another machine is the paddy straw chopper-cum-spreader – to chop paddy straw left behind on mechanically harvested paddy fields. It chops the straws into pieces and spreads it around the field in a single operation, so wheat-sowing becomes easy. It is a mounted-type machine and can be operated by a tractor with 45-50 HP or more. [18]

Another option is to convert stubble into biochar, which can be used as fertilizer, by burning them in a kiln. [19]

The straw can decompose in the field itself, but it is a slow process. However, another alternative is the accelerated hay decomposition process. The Indian Agricultural Research Institute has provided a solution to this problem through a decomposing development, called "PUSA Decomposer" which can decompose crop residues into fertilizer by accelerating the decomposition process. This decomposer is manufactured by extracting fungus strains that work on straw to make them soft and able to plough, destroying their molecular components and releasing nutrients into the field, thereby enriching the soil. As a result, it may reduce the use and cost of fertilizers and can help increase the yield of the subsequent crop. It costs less than Rs. 1,000 per acre. [20]

Another radical solution to burning stubble was devised by the Indian Institute of Agricultural Research in the form of a bioinducence called PUSA.

When sprayed, this enzyme decomposes stubble within 20-25 days, turning it into fertilizer, further improving soil quality.



*PUSA treatment of fields - (Image rights Theprint.com)*

It leads to an increase in organic carbon and soil health while significantly reducing fertilizer expenditures for the next crop cycle.

Being a sustainable agricultural practice, it also reduces greenhouse gas emissions and prevents the release of toxins and soot into the air. When exercised over a period of time, they significantly increase nutrient health in soil and microbial activity, both of which ensure better yields at low input costs for farmers as well as organic products for consumers. [21]

Regardless of all these options, the state government needs to generalize the traditional use of rice straw as fodder and as part of feed mixture preparations.

## V. ENTREPRENEURIAL APPROACH

### A. *By products from Parali*

Entrepreneurs are now testing technologies that can convert agricultural fiber into reusable and biodegradable products. If farmers get a financial incentive to sell biomass, they may not burn stubble, thus reducing one of the ingredients that add to the smog in northern India every winter.

### B. *Turning crops into plates*

BIO-LUTIONS India, a Hamburg-based company with operations in Ramanagaram, near Bengaluru, purchases agricultural waste from farmers and manufactures biodegradable packaging and tableware from it. Patented technology converts Agro-Waste into self-binding fibers simply by moving it with water in huge machines. Finished products are sustainable packaging and cutlery that takes only three months for biodegradation.

The task is to create practical options to reduce the use of plastic that suffocates the planet. [23]

### C. *Turning crops into fabric*

Kriya Labs provides a solution to convert 15-20 million tons per year of crop straw, consisting of rice straw, which has no market compared to other forms of agricultural waste such as wheat straw and bagasse.

They turn rice straw into pulp using their own operation. This pulp can be used as an intermediate product for industries such as paper (and its derivatives), bioethanol (biofuels in general), fabrics and other specialized chemicals such as cellulose acetate, and cellulose carboxy methyl. The process is environmentally friendly. Pulp quality depends on its final application and can be changed accordingly. [24]

### B. *Alternative to fossil fuels*

Farm2Energy, a startup from Punjab, helps farmers by removing stubble from the fields for free. Founded in July 2016, the company provides biomass supply solutions to a range of customers from farmers to landowners and biomass users.

The company processes rice straw, corn dung, sugar cane garbage, wheat straw and supplies it with biofuels, bioenergy and bioindustries through integrated supply systems. In addition, it also helps farmers manage and use biomass. [25]

## VI. CONCLUSIONS

Stubble burning, especially in Northern India has been considered as an easiest and most widely used process to get rid of the crop residue. However, it has had a disastrous impact on the environment and with each passing year the condition is becoming worse. It contributes to the frequent formation of brown clouds that have an adverse effect on the local air quality, hampers atmospheric visibility and further impacts the reasons for climate change.

There are multiple alternatives to stubble burning and farmers can choose between the technologies and machines most suited to their particular local conditions, with the objective of 'no burning'.

The government should play the part of an enabler by spreading awareness about the pros and cons of each option, so as to eliminate confusion and ease the adoption of new technologies by removing socio-economic barriers.

Parali burning has impacted the environment in such an alarming level that it cannot be ignored anymore.

Only banning and punishing the farmers, the prevention of stubble burning is not guaranteed. There needs to be a permanent and effective solution for this issue to stop from happening in the future.

Supreme Court of India has also intervened in this grave issue and accordingly has observed that:

- 1 Incentives could be provided to those who are not burning the stubble and disincentives for those who continue the practice.
- 2 The existing Minimum Support Price (MSP) Scheme must be so interpreted as to enable the States concerned to deny the benefit of MSP wholly or partly to those who continue to burn the crop residue.
- 3 To create practical options of collecting and transforming the husk to more reusable end products in collaboration with entrepreneur companies willing to offer the services.

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