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Analyzing Disposal Methods of Crop Residue (Parali)

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Abstract:- We know India is a second largest agro-based economy. Thus obviously producing the agricultural waste, (in local terms parali). Deliberately burning down of the straw stubble, the remaining sections after grain, similar to paddy, wheat, and so on, have been harvested, has become a big natural phenomenon that causes medical issues almost as much as it adds for global warming. There are various possibilities of turning a 'squander' object (parali) into an important thing. It could be achieved by generating power from biomass, a feed hotspot for domesticated animals, helping to manage disintegration, or even essential final results such as health products, drugs, and composts. The goal of this paper is to explore elective eco-friendly disposal technique to be adopted in India.

Keywords:- *Parali, Parali Burning, Effects, Pollution, Pyrolysis.*

I. INTRODUCTION

Parali is the lower part of the paddy crop which is left after harvesting the upper part of the crop, which is not of any use for the farmers. The farmers have to evacuate the fields to plant the next crop, so the farmers set fire to the rest of the crop i. e. dry parali. It is known as “straw”. It is used as feed for ruminants and for others, various uses such as excrement, covering, paper mash, liquor, mats, poultry litter and production of mushrooms. In addition, rice produces rice clean, rice wheat and rice husk alongside the paralytics. On a regular course. There are 20% husks, 10% straw, 3% polishings, 1-17% split rice and 50-66% washed rice.

II. OBJECTIVE

There are many ways to turn a' waste' commodity (i.e. straw) into something worthwhile.

The objectives of this paper are to:

- Investigate alternative uses of parali
- Identify the best likely alternative to be adopted around the world
- Investigate alternative disposal method of parali
- Identify eco-friendly disposal mode of parali
- Reduce the rate of pollution

III. COMPOSITION OF PARALI

Table-1 below shows mainly crop residuals due to production of cereal crops and sugar cane. This is conventional practice to use these residuals i.e. parali for soil stabilization along with the fertility of the soil. But due to hug amount, to burn surplus crops is a normal practice in some of countries especially in Asia. But burning these residuals have its environmental issues and require some technical assistance for burning safely in the environment.

Source	Composition
Rice	Husk, Bran
Wheat	Bran, Straw
Maize	Strover, Husk, Skins
Millet	Strover
Sugarcane	Sugarcane tops, bagasse, molasses

Table-1: Waste Produced By Main Crops

Plant biomass consists primarily of cellulose, hemicellulose, and lignin with lesser quantities of pectin, protein extractives, carbohydrates, and phosphorus, chlorophyll, and inorganic waste. Lignin provides the structural protection relative to cellulose and hemicellulose and is nearly impermeable. Lignin prevents fermentation, since it is extremely chemical resistant and biodegradation. Some components of crops like stalks, straw and husk had been categorized as lignocellulosic biomass. Most of the lignocellulosic biomass is compensated for by large agricultural crops cultivated around the world— maize, wheat, corn, and sugarcane, respectively. Hemicellulose and lignin are considered as valuable commodity due to its ample abundance as a raw material for biofuel processing.

IV. BURNING OF CROP RESIDUES IN INDIA

India being the second major populated country in the world also having history in agriculture, produces vast quantities of food grains such as rice and wheat for domestic consumption and export. According to data provided by government agencies, production of major crops in 2012-13 is shown in table 2. Among the various crops cultivated, majority crop residue of rice, wheat, and sugarcane are burnt. These crops have significant returns on investment which makes it extremely difficult for farmers to find alternative crops that yield lower residues from crops.

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Crop	Production(Mt)
Sugarcane	361
Rice	105
Wheat	94
Cotton	35
Oil seeds	30
Pulses	17
Jute	11

Table-2: Production Major Crops In India

NPMCR provides data of crop residual statistics (state-wise) produced and excess residue burned out. On the basis of NPMCR, it has been seen that crop residue production is the highest in Uttar Pradesh state (60 Mt) followed by Punjab (51 Mt) and Maharashtra (46 Mt) with a total of 500 Mt per year of which 92 Mt was burnt. Rice and wheat make up about 70% of crop residues. Some amount of the accumulated waste is burnt and the remaining amount are left in the field. In crop residual, major contribution was of rice (approx.43%) after that wheat (approx.21%), sugarcane (19%) and oil seed crops (approx. 5%).

For air pollution in Delhi, burning of parali (in Punjab and Haryana) has been considered as responsible. In the above mentioned states, every year at the end of September and October, generally farmers burn tonnes of grain waste after harvesting a low-cost straw disposal method to minimize the processing period between harvesting and seeding. Smoke produced after this burning creates a haze of contaminants which create a 'toxic atmosphere' in Delhi causing an emergency from air pollution. One research estimated that 149 million tons of CO_2, 9 million tons of CO, 0.25 million tons of SOx and 1.28 million tons of PM were emitted by crop residue burning. Figure 1 shows the air pollution map of India on 04 November, 2019.

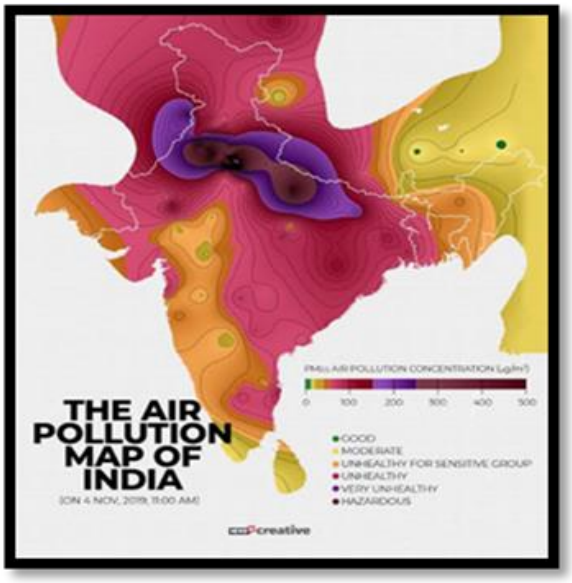

Fig.1:- The Air Pollution Map of India

V. POSSIBLE PROBLEMS DUE TO BURNING OF PARALI

Some of the possible problems raised due to burning of parali are:

- Pollution and greenhouse gases emission.
- Nutritional deficiency e.g. N, P, K, S.
- Hardness of soil and degradation with no shelter.
- Smoke and soot particles.
- Death of beneficial bacteria found in soil.

VI. HARM ON HEALTH

Ozone layer is bursting with carbon monoxide and carbon dioxide gases in the smoke that comes out of the burn, due to which the ultraviolet rays, which can prove fatal to the skin, reach the ground directly. Its smoke causes irritation in the eyes. There is a problem of breathing and lung diseases are also occurring. The time period of burning parali is also the time of Diwali which increases the level of pollution and hence results in severe air quality. Figure 2 shows the air quality index on Diwali night i.e. 27 October 2019, in Delhi.

Fig. 2:- Pollution level in Delhi on Diwali night

VII. METHODS AND MATERIALS

- R.B.Singh et al, (1995) identified that the quantity of rice straw supplied per hectare was largely dependent on the variety used and the rehearsals obtained from administration. Despite these factors, the quality of rice straw is profoundly influenced by the storage technique. Rice straw has historically been a significant source of feed for cows and wild oxen in low-and high-info cultivation systems throughout its numerous applications.

- Ruihong Zhang et al (1999) used a high-rate anaerobic absorption system, anaerobic-staged solids digester system (APS-digester framework) to turn rice straw into biogas. Smelling salts are used as an add-on nitrogen hotspot for assimilation of rice straw. The impacts of the specific pretreatment approaches, Physical (mechanical),

warm and synthetic (smelling salts) therapy, a mesophilic temperature of 35ºC for rice straw assimilation was investigated. The most notable biogas yield was a combination of granulating (IO-mm length), warming (ll0ºC) and smelling salt treatment (2%), 0.47 1 ggl VS-' has been taken care of, which is 17.5 percent higher than the untreated whole straw biogas yield. Temperature of pretreatment greatly impacts straw edibility.

- Olivier C. Devevre, William R Howarth, (2000) portrayed that anaerobes reused aging waste items during the long haul hatching bringing about a lower net buildup C mineralization in overflowed frameworks contrasted with non-overwhelmed conditions. Accordingly, we watched comparative microbial creation under overwhelmed and non-overflowed conditions despite the fact that anaerobes decayed less straw-C than aerobes. These outcomes show that a lot of disintegration happened under overwhelmed conditions, but since substrate use proficiency was higher, less straw-C was mineralized contrasted with high-impact conditions. Active examinations of C mineralization bends affirmed that the C mineralized in the overflowed treatment was primarily from labile pools with noteworthy sums originating from progressively stubborn pools, for example, cellulose and lignin relying upon temperature.

- Ayse E. Putun et al (2004) evaluated that when the warming rate was 5 K/min the impact of pyrolysis conditions on item yields and bio-oil organization. Pyrolysis temperature, molecule size, clearing gas stream rate and steam speed were the trial parameters. They also concluded that the temperature and atmosphere of pyrolysis had considerable effect on the bio-yield and composition, but the size of the molecule had a slight influence on the yields of products.

- W.T.Tsai et al. (2006) performed rapid pyrolysis in a fixed-bed acceptance warming system on three biomass squanders like rice straw, sugarcane bagasse, and coconut shell. The yield of fluid tar factor from sugarcane bagasse was found to be higher than that of rice straw and coconut shell. Using a higher pyrolysis temperature of > 500 8C, a quicker heating rate of > 200 8C / min, and a longer holding time of > 2 min, the pyrolysis tar yield was roughly half the limit.

- Yu-Fong Huang, Pei-Te Chiueh , Wen-Hui Kuan , Shang-Lien Lo (2013) stated that at higher microwave power levels, the products obtained are more gaseous and less solid residues while liquid production remained same i.e. 50% wt.

- Rob Bakker, et al, (2013) evaluated qualities, shortcoming, opportunities and danger investigation of different parts of rice straw and wheat straw, when utilized as a feedstock for the bio-based economy.

- Niveta Jain et al (2014) presented the state-wise estimates of air pollutants emitted from field burning of crop residues in India.

- R.R. Romasanta et al (2017) led two analyses straw consuming trial utilizing ignition chamber and field probe straw consolidation to dissect the effect of consuming of rice straw on CH_4 and N_2O discharges. The Emission Factor of CH_4 acquired with generally dry straw (10% dampness content) surpassed the IPCC default an incentive by a factor of 2.1. Despite the fact that the Emission Factor of N_2O was practically indistinguishable from the IPCC esteem, CH_4 was the fundamental supporter of the all outflows and GWP. This commitment will even be bothered given the normal increment in CH_4 Emission Factors as a component of dampness substance as detailed in different examinations.

- Camilia El-Dewany, et al, (2018) expected to archive the issues happen from rice straw consuming like possibly destructive consequences for individuals' wellbeing, particularly for those with touchy eyes and respiratory issues, ecological effects spoke to by expanding of worldwide methane discharge rates from rice fields and arrangements spoke to by best administration practices ought to be applied for rice straw every year delivered under national and universal scales.

- S. Bhuvaneshwari et al (2019) expressed that crop buildups are one part of horticultural squanders that have presented particular difficulties because of their immense volume and absence of abilities to oversee them. Large yield intake produces CO_2, CO, N_2O and NOx in the soil which has caused impressive visible changes around pollution. The Indian Government has endeavored numerous intercessions to abridge the measure of yield buildup consuming various battles. Be that as it may, there is little proof in the distribute writing to help the viable control of the circumstance, in all likelihood because of the absence of instruction, mindfulness projects, and partner commitment in the execution of the approaches and activities. The genuine purposes for the yield buildup consuming have more financial roots as opposed to horticultural or squander the executive ones. Not only is the issue associated with the horticultural component, but it is also a worrying concern in the fields of environment, culture, social angles and teaching.

- Niti Gupta (2019) led a study and installed minimal effort sensors across four regions in Punjab to screen $PM_{2.5}$ discharges; talked with ranchers to comprehend their difficulties and what they see as the arrangement; and gathered and broke down satellite data to comprehend the pattern of paddy buildup copying in Punjab.

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In view of conversations with ranchers and applicable partners, she made the accompanying key suggestions to address the paddy buildup consuming issue.

- Make paddy buildup the executives advancements accessible
- Promote brief term rice assortments
- Raise rancher mindfulness
- Monitor fire tallies and country air quality
- Give ranchers impetuses to move away from the rice-wheat development cycle
- Set up systems to gather paddy buildup
- Use paddy buildup to deliver biofuels
- Strengthen least help value tasks.

➢ Pratika Chawla, H.A.S. Sandhu (2020) stated that during 2014-18, the stubble burn area in Patiala and Ludhiana was reduced by 32% and 40% whereas the pollutant level slightly increases. The amount of SO_2 emitted was higher in comparison to RSPM and NOx.

➢ *National Schemes and Policies to reduce crop residue burning:*

- The Indian government has advised to National Thermal Power Corporation (NTPC) for mixing residual of crop (approx. 10%) with coal for generating power. The farmers got benefit of monetary return of approx. Rs 5500 for 1 ton of crop residual. Farmers can exploit profitably after these beneficial action.
- Similar type of measures are taken by the Indian government like Rashtriya Krishi Vikas Yogna (RKVY), State Plan Scheme of Additional Central Assistance which was launched in August 2007. Some useful training program demonstration and were arranged in some of villages of Uttar Pradesh. Many farmers have been given the required training of bio-conversion of agricultural wastage and bio-compost production which supported them in gaining economic benefits.
- Along with the above mentioned government steps, NPMCR(launched by Ministry of Agriculture of India) have the following purposes:

1. To develop the methods for optimum utilization and in-situ management of crop wastage, to restrict the losing of soil nutrients, and the uses of crop residual in commercial purposes.
2. Developing and promoting advanced crop machinery for farming. And to introduce various discount schemes and incentives to purchase various sowing machinery like the happy seeder, turbo seeder, etc.
3. To promote the satellite-based remote sensing technologies to monitor crop residual management with some of government agencies such as NRSA and CPCB.
4. To provide financial aid and fund mobilization for beneficial ideas and proposals to support above.

- Few policies to monitor and empowering the schemes provided by the central government along with the state government. We can see in Punjab in which efforts made for identifying and locating the correct locations of burning crop. Government agencies had used remote operating system for the same.
- With the beneficial steps taken by government, we can check reduction of crop stubble burning in Punjab (38%) and Haryana (25%). Many farmers were awarded and got rewards and subsidies for taking part in these type of government policies.

➢ *Equipments and Machines Identified for Promotion under the Scheme:-*

In the concept notice for the programme, the Sub-Committee of the Task Force under the chairmanship of the Secretary (Department of Agriculture Research and Education) and the Director General (Indian Council of Agricultural Research) separated the executives from the corresponding machines and gear forms for in-situ crop build-up.


Super Straw Management System


Happy Seeder


Hydraulic Reversible M. B. Plough


Rotary Mulcher


Shrub Master


Paddy Straw Chopper /Shredder


Rotavator


Zero Till Seed cum Fertilizer Drill

Fig.3:- Different machines for harvesting and seeding of crops

- According to the report of the Committee on Review of the Scheme-"Promotion of Agricultural Mechanisation for In-Situ Management of Crop Residue in States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi, subsidies provided by the government on these machines are shown in table 3.

S. No	Machine	Maximum price of subsidy including GST @ 12% (Rs)	Maximum permissible subsidy per machine (Rs)
1	Super Straw Management System (Super SMS) to be attached with Combine Harvester	1,12,000	56,000
2	Happy Seeder		
	a) 09 tine	1,45,600	72,800
	b)10 tine	1,51,200	75,600
	c)11 tine	1,56,800	78,400
3	Paddy Straw Chopper/Mulcher /Shredder		
	a) Mounted type (Straw Chopper & Mulcher)		
	i) 5 ft	1,34,400	67,200
	ii) 6 ft	1,45,600	72,800
	iii) 7 ft	1,56,800	78,400
	iv) 8 ft	1,68,000	84,000
	b) Trailed type	2,52,000	1,26,000
	c) Combo type	2,80,000	1,40,000
4	Shrub master/ cutter cum spreader	44,800	22,400
5	Hydraulic Reversible M.B. Plough		
	a) Two bottom	1,40,000	70,000
	b) Three bottom	1,79,000	89,500
6	Rotary Slasher	44,800	22,400
7	Zero Till Drill		
	9 tine	42,560	21,280
	11 tine	48,160	24,080
	13 tine	53,760	26,880
	15 tine	56,000	28,000
8	Rotavator		
	5 ft	84,000	42,000
	6 ft	89,600	44,800
	7 ft	95,200	47,600
	8 ft	1,00,800	50,400

Table 3:- Subsidies Available For Various Agricultural Equipments

VIII. CONCLUSION

From the above study, it can be concluded that different researchers have worked on crop residues management and its disposal. Various methods have been used for its disposal and making the best outcomes of residues. Bio-oil is produced from crop residues through the process of pyrolysis. Different types of pyrolysis such as fast pyrolysis, steam pyrolysis, microwave pyrolysis are performed to obtain bio-oil from crop residues at different temperatures and pressure. Emission of harmful gases like CO, CO_2, NO, particulate matter etc. are also recorded so their rate of emission can be reduced. By adopting various technologies and government schemes, the stubble burn area has been reduced by 32-40 % in the year 2014-18. The purpose of this study is to analyze various methods of producing bio-oil from crop residues and thus reducing the rate of air pollution and improving the quality of air.

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ABBREVIATIONS

CO	Carbon Monoxide
CO_2	Carbon dioxide
CPCB	Central Pollution Control Board
K	Potassium
N	Nitrogen
NOx	Oxides of Nitrogen
N_2O	Nitrogen dioxide
NPMCR	National Policy for Management of Crop Residue
NRSA	National Remote Sensing Agency
P	Phosphorus
PM	Particulate Matter
S	Sulphur
SOx	Oxides of Sulphur