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CROP RESIDUE BURNING IN NORTHERN INDIA : ENVIRONMENTAL CHALLENGES AND STRATEGIES FOR MITIGATING THE ENVIRONMENTAL IMPACT OF BIOMASS BURNING – A REVIEW

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ABSTRACT : With rapid urbanization and uncontrolled population growth, there has been an increase in the demand for food. Increased crop production is accompanied by the generation of large quantities of agricultural waste. In absence of adequate sustainable management practices, large quantities of crop residues are burnt by farmers. Biomass burning has posed worldwide challenges. Besides emitting greenhouse gases and aerosols, it adversely affects the soil fertility, loss of beneficial micro-organisms and leads to environmental deterioration. Burning of crop residue also results in the loss of valuable nutrients present in the crop residue. Air quality in India, particularly in northwestern parts, deteriorates during October -November, both due to climatic conditions and due to stubble burning. With suitable management practices, the deterioration of the air can be minimized and the nutrients in the agricultural residue can be returned back to the soil, to enhance the soil fertility. Several technologies which have been adopted for handling the crop residue are composting, biochar production, mushroom cultivation and valorization of biomass for generating different forms of energies. Efforts have been made by the Indian government and various measures have been adopted by different states, Central Administration and regulatory bodies like National Green Tribunal (NGT), Central Pollution Control Board (CPCB) etc. to curb the crop residue burning. The present review article aims to evaluate the potential environmental risks due to biomass burning, current approaches for recycling and valorization of agricultural waste. Need of the hour is to adopt sustainable management practices, which will minimize crop residue burning and thus preventing ecological crisis.

Key words : Crop residue burning, environmental deterioration, soil fertility, sustainable management practices.

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INTRODUCTION

To cope up with the growing food demand, vast wastelands were converted into arable lands and adoption of intensive farming methods have resulted in irreparable and irreversible changes in the environment. In 1960s, green revolution transformed the agricultural scenario in India. Varied adverse environmental conditions, lack of modern technologies and crop diseases were overcome by the introduction of new and high yielding varieties of seeds, unscientific deployment of fertilizers and pesticides, use of agricultural machinery like tractors, thrashers, seed drills etc. Intensive agricultural practices have increased the crop production but also has led to the generation of huge quantities of crop residues. India is one of the largest producers of food grains but cannot cope with the quantum of agricultural waste generated and faces environmental challenges. Indo-Gangetic plains, also called "breadbasket of India", have the most fertile land and farmers of this region prefer rice -wheat cropping system. To clear their land in a short and economical way, they burn huge quantities of stubble. Farmers burn voluminous stubble because of short window period of about 10-15 days between the harvesting of monsoon (*Kharif*) crop and sowing of winter (*Rabi*) crop, interference of stubble with tillage and sowing operations for the next crop. Other factors which contribute to crop residue burning include scarcity of manpower, lack of technological advancements and financial constraints.

Improper disposal of crop residue results, not only in environmental pollution but also loss of energy rich biomass. They are the potential natural resources that influences the soil microbial activity and nutrient transformation. The eco-friendly management practices crop residues can be used to enhance the carbon the

paddy straw.

CONCLUSION

Agricultural crop residue generation is increasing on account of agricultural intensification and farm mechanization. Burning of crop residue has emerged as an environmental challenge because of poisonous emissions and declining soil health. Main drivers of on-farm burning are quantum of crop residue generated, socio-economic conditions of farmers, short time interval between successive crops and lack of sustainable management practices. Crop residues are carbon-rich biomass, judicious use of which can be a boon for sustainable agriculture. The residue recycling has great potential to minimize harmful emissions due to burning of agricultural residue, protecting the soil against erosion, improving water retention capacity of the soil and enhance carbon sequestration potential. Several available crop residue management options are burning, incorporation in the soil and surface retention. In some case, surface retention provides a good option as compared to incorporation while in other cases residue incorporation is beneficial. Advantages and disadvantages of these practices varies with geographic location, soil type, crop type, available crop management technologies and socio-economic conditions of the farmers. Different alternative approaches are a good substitute for crop residue burning, for example, mulching, composting, conservation farming and conversion of agricultural waste to bio-energies. Lignocellulosic biomass can play an important role in achieving the goal of sustainable development. Lignocellulosic biomass is renewable and has potential to minimize the greenhouse gas emissions by adopting proper biochemical conversions to mitigate climate change. This article attempts to analyze the generation of agricultural waste and their impact on environment, different policies and approaches, which are required to be adopted for the valorization of agricultural waste to bio- energies. More research is required to be done to develop sustainable techniques to use biomass as renewable source of energy. The utilization of crop residue-based power generation will not only discourage in-field crop residue burning abating environmental pollution, but will also reduce carbon footprint of coal-based power plants.

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Conflict of interest

The author declares no competing interest.

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