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Crop Residue Burning and Its Relationship between Health, Agriculture Value Addition, and Regional Finance

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Abstract: Crop residue burning (CRB) poses a serious threat to the climate, soil fertility, human health and wellbeing, and air quality, which increases mortality rates and slumps agricultural productivity. This study conducts a pan-India analysis of CRB burning based on the spatial characteristic of crop residue management practices and analyzes the linkage among health, agriculture value addition, and regional finance using the simultaneous equation to find the causality and panel quantile regression for direct effect and intergroup difference. We discuss some of the alternative crop residue management practices and policy interventions. Along with in situ management, this paper discusses ex situ crop residue management (CRM) solutions. The ex situ effort to manage crop residue failed due to the scarcity of the supply chain ecosystem. Force of habit and time constrain coupled with risk aversion have made farmers reluctant to adopt these solutions. Our results show that financial viability and crop residue have bidirectional causality; therefore, both the central and state governments must provide a financial solution to lure farmers into adopting residue management practices. Our analysis shows that framers are likely to adopt the management solution (farmers have some economic benefits) and are reluctant to adopt the scientific solution because the scientific solution, such as "pusa decomposer", is constrained by the weather, temperature, and humidity, and these parameters vary throughout India.

Keywords: stubble-burning; crop residue management; carbon emission; environmental management

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1. Introduction

India is an agrarian country as 58% of its population depends on agriculture, and it is also the second largest producer of rice and wheat. Due to this reason, it generates a large number of agricultural wastes [1,2]. In most of the states in India, rice, wheat, and maize are the main food crops, mainly in the north Indian states of Gujrat, Maharashtra, Haryana, Rajasthan, Punjab, and Uttar Pradesh [3]. Crop residue burning (CRB) is the result of the mechanization of rice paddy harvesting, which leaves 8 to 10 inches of paddy stalk [4,5]. In some states, a huge quantity of crop residues is left over after harvest, and a large quantity of crop residue is burned across the regions. In the northern states of India, every acre of paddy yields approximately 2.5 tons of stubble [4]. However, in some states, crop residues are often used for biochar, fodder, biofuel production, mushroom cultivation, and energy generation [6].

Residue burning significantly causes an increased amount of particulate matter (e.g., PM2.5) [7]. CRB increases the amount of sulphur dioxide (SO_2), volatile organic compounds (VOCs), oxides of nitrogen (NOx), carbon monoxide (CO), and PM, which significantly affect the ambient air quality [8,9]. These particulate matters pose a higher

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