



Extinguishing the Spreading Farm Fire

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Abstract

The estimates for rice-straw generation indicates that the volume of residue generation has increased from 157 mt in 2012-13 to 169 mt in 2017-18 of which around 60% are burnt in open field in India. Despite remain concentrated in north western India in winter season, the farm fire incidences are being reported from other parts of India even during the summer season. The causes of crop residue burning are not only techno-economical but also social and political and can be attributed to non-convergence of policies too. Any strategy to address the menace should not overlook the social as well as policy and implementational convergence to be more holistic and pragmatic.

Keywords: Stubble Burning, Net Zero; Circular Economy; Convergence

After the devastating impact of The Bengal Famine (1943), India achieved splendid progress in agricultural production that transformed the Indian food security basket from being starved to a surplus one. Between 1951 to 2020, India witnessed a quantum jump in per capita availability of food grain and milk by more than 25% (144.1 kg/year to 187.1 kg/year) and more than 200% (130 g/day to 407 g/day), respectively. The latest estimates indicate that India has not only defied all the odds in the agricultural production front to become the largest producer of some of the commodities (like first in pulses and milk, second in fruits and vegetables, wheat and rice and sugar) but second in overall agricultural production worldwide. Further, in its journey, India has witnessed some coloured revolutions like green, white and blue revolutions etc. and still eyeing achieving the second green revolution and rainbow revolution in near future. Thanks to the investments in research and development (R and D) in agriculture and allied sector coupled with the strong political will to transform the sector and associated reforms in the sector. Further, the contribution of technologies and pro-active and responsive agricultural extension system cannot be neglected in the success of the green revolution which rapidly augmented crop production by promot-

ing crop intensification. However, the intensification has not turned into a panacea for holistically solving the farm distress. It is associated with some of the trade-offs.

Crop intensification: Input-Output trade-off

To strike the balance between rising demand for 3F's (food, fiber and fuel) and their supply, the entire food system across the world is working around four basic pillars. They are - area expansion, high crop productivity, increased land productivity and trade. However, the rapid embellishment of urbanization and inflated demand for land for habitat has put constraint on possibility of horizontal expansion of agriculture. The domain of trade is further not only regulated by fair interplay of demand and supply but is the function of a complex web of extraneous factors and policy environment which limits ones maneuvering capacity. Further, to augment crop productivity, basic and applied researches in biotechnology, genetics and plant breeding and molecular biology have helped the country in attaining self-sufficiency in food production. Futuristic research on regular basis by National Agricultural Research and Education System (NARES) in collaboration with the Consul-

tative Group on International Agricultural Research (CGIAR) is a win-win collaboration for India. However, crop intensification is a proven strategy advocated to enhance land productivity along with soil health (fertility, water and extent of pest and disease load in soil). However, the environmentalist evaluates the gains of crop intensification with the prism of the environment's cost. When crop intensification was first suggested as a means to augment land productivity, no one might have thought of its negative consequences. Researches have highlighted the incidences of increase socioeconomic inequality, exasperated resource depletion and environmental degradation as the flip side of the green revolution in which crop intensification has played a crucial role. Higher crop productivity in summer due to higher photosynthetic efficiency, coupled with easy access to energy inputs and irrigation and availability of inputs, farmers started cultivating rice in almost every part of India. As a result of it, more water is being pumped out of depleted groundwater table and the fire on the field due to stubble burning has crossed the agro-ecological as well as seasonal boundaries.

Estimates of crop residue burning in India suggests that about 17 % of total crop residues are burnt in India of which rice, wheat and sugarcane contribute the most. Further the large size of gross cultivable area than other countries make India one of the leading contributors of agricultural emission. As a result of which environmental and social externalities in the form of pollution (Soil and Air) and associated challenges like human, soil and microbial health balance gets disturbed which further put constraint on attainment of one health concept and have economic consequences on the life of farmers as well as society as a whole.

Why is the fire spreading?

In our recent article entitled "Turn the wheel from waste to wealth: Economic and environmental gain of sustainable rice straw management practices over field burning in reference to India" (doi.org/10.1016/j.scitotenv.2021.145896), we discussed whether the rice straw burning is a compulsion or choice with Indian farmers? Based on a primary survey conducted in Punjab and Haryana, we answered this question in the paper as- it is a compulsion for the farmers. However, the incidence of rice straw burning in Madhya Pradesh during the 2021 summer induced curiosity in us to interact with some of these farmers and ask them if they know its ill consequences and why they do it?

The answer was similar as reported by several earlier studies that limited time window between two seasons to prepare the

field for the next crop and minimal economic cost to the farmers in managing it by burning. However, further scratching the issues and transact walk to the village led me to understand some of the other causes of it. First, was the declining population of draught animal in villages (Ox and bull) that led to a reduction in the consumption demand of straw and hence the supply exceeded the demand. Second, the increasing farm mechanization is also one of the factors for the decline in draught animal population. Third, the labour deficit on the farm due to the coincidence of MGNREG works in the panchayats with crop harvesting season. Fourth, the cultivation of pulse crop like gram in between the Kharif and summer rice (i.e., crop intensification) further delayed the paddy transplantation leading to a limited time window between summer and Kharif season. Fifth, lack of awareness among the farmers about the alternative usage of straw and sixth the poor access to technologies for straw management. However, the government of India and states governments have taken steps to address the challenges.

Government initiatives in managing the issue

The National Green Tribunal (NGT) has banned crop residue burning in the states of Rajasthan, Uttar Pradesh, Punjab and Haryana. The government of India has formulated the National Policy on Management of Crop Residue (NPMCR) and advocated several technological interventions like the use of straw baller, happy seeder, mushroom cultivation etc. and suggested the diversified use of crop residue to address the challenges. Environment Pollution (Prevention and Control) Authority (EPCA) has directed Delhi, Haryana, Rajasthan and Uttar Pradesh to implement Graded Response Action Plan (GRAP), to combat air pollution in Delhi-NCR. Central Sector Scheme on Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue in the state of Punjab, Haryana, UP and NCT of Delhi. Further, ICAR-Indian Agricultural Research Institutes (IARI) has developed Pusa Decomposer technology for straw management and the Delhi government has promoted it in the farmer's field. ICAR-National Rice Research Institute (NRRI) has also, suggested rice straw biochar, animal feed block and conservation agriculture as additional strategies to manage the rice straw. Recently, Ministry of Power has launched Green Charcoal Hackathon to clean the air by eliminating the farm fire and produce renewable energy from crop residues. Punjab Govt. announced to incentivize the industries for using paddy straw as fuel in boilers. More recently, the Punjab Govt. has announced fiscal incentives of Rs. 25 crores to the industries to make use of paddy straw as a fuel. However, some studies reports that higher silica

content in the straw is making the paddy straw an unsuitable fuel for most of the boilers. Further, from environmental sustainability perspective, ex-situ management of straw by its use paddy as a fuel in industry may not a rational and sustainable choice when the world is aiming at net zero targets. Further, the ex-situ management of paddy straw as a fuel is against the much-popularized concept of circular economy. The issue lies with most of the strategies is that, they are end oriented rather than means oriented.

Crop residue management in other countries?

In-situ and ex-situ management are the two broad approaches deployed world-wide for management of crop residues. China utilizes around 80% of its crop residue through the improved technologies and processes like- in-situ decomposition, production of roughage, biomass fuels, biogas, straw-fired power/heat generation, straw board, and paper. Further, the bioenergy projects in China includes bioenergy firms, local government and partners. Vietnam burns about 28.5 % of rice residue on farm and utilize remaining via in-situ decomposition, animal feed, barn padding, mulching and as a fuel for cooking. Bangladesh and Pakistan also follow the in-situ and ex-situ management practices but the extent of utilization of straw is significantly less than that of China and Vietnam.

What can be done further?

The technological and legislative alternatives, to some extent added in mitigating the problem in northern India, However, the cases of field fire are being reported from other parts of India. The threat of climate change and global warming is looming over Indian agriculture and the food stocks position exceeds prescribed buffer stock norms. Therefore, what India can do at present is to reduce the rice cultivation from the unsuitable area and compensate for this production loss via gain in crop productivity by varietal development and further enhancing the productivity of land via improving soil health in a suitable area. This may lead to a reduction in the generation of straw from the unsuitable lands. Recent scheme of government of Chhattisgarh to incentivize farmers @ Rs. 10,000 per acre for crop diversification away from paddy is a welcome step in this direction. Research should be taken to strengthen the partitioning of photosynthates in grains rather than in straw. In this context, Department of Science and Technology (DST), Department of Biotechnology (DBT) along with National Agricultural Research and Education System (NARES) can play the pioneering role. Further, Council of Scientific and Industrial Research (CSIR) can ex-

plore the options to innovate or develop new products and processes where the rice straw can be consumed in large quantities. Policy level convergence between Ministry of Rural Development and Ministry of Agriculture and Farmers Welfare is also important to optimize the labour resources at the disposal of village to ensure life and livelihood. Panchayati Raj Institutions (PRIs) can play a key role in achieving this objective by scheduling the MGNREG works in lean seasons so that it doesn't hamper agricultural operations in the villages and interfere with the labour availability to farm operations. Rice straw-based entrepreneurship development programme in a rural can also be a viable option to engage the unemployed youth in addressing the menace. Further, behavioral change of the farmers can be a long-term solution for the problem and extension system, community groups and civil society organizations can take a lead role in it. Options can also be explored to link MGNREG work with farming work on cost sharing basis to create the win-win situation for all the stakeholders like the farmers, the labourers, the government and the planet. The challenge of extinguishing the stubble burning is multi-dimensional, which requires new methods and convergence of ideas; technologies; departments/institutions and policies in tackling it.

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