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Production & Management of Crop Residues

[1]Monalisa Das, [2]Ashok K Das

Abstract--- *Due to change in climatic conditions and an ever-increasing global population, public is constantly seeking more efficient management of agriculture -ecosystems. The existence of crops residue is an important element of management under consideration, because it represents an overwhelming amount of organic matter that can be retained in or extracted from the agriculture-ecosystem. It is important to address the effect of crop residues management on the agriculture-ecosystem linked to local climatic conditions.Crop residues, contains huge amounts of assimilated C and minerals such as NPK (nitrogen, phospohorus, potassium) that should undergo process of recycling for developing sustainable agriculture. The management of crop residues is required to serve a dual purpose, both in the face of global warming as well as food security through increased carbon sequestration. In this study, especial focus is given on the major challenges faced by agriculture sectors, the factors affecting high productivity, surplus crop density, harmful effects related to the wastage of crops, effect of temperature on crop residues, in-situ incorporation, and management techniques like water saving, increasing crop productivity, and recommendations for managing crop residues.*

Index Terms--- *Agriculture-ecosystem, Crop productivity, Crop residues, Management, Sustainable agriculture.*

I. INTRODUCTION

India's gross geographical area is approx. 328 million hectares "(m ha)", of which 194 and 141 "m ha" are cropped area and cumulative sown area respectively. Total irrigated land, however, is only about 80 m ha[1]. Approximately 50% of India's overall agricultural land is successfully irrigated. The farming area accounts for about 51 percent of India's overall geographic area over 11 percent of the world[1], [2]. India has grown in context of cropping intensity by 30% after independence. Overall cultivating area in drylands is approx. 67%.*Oriza sativa, Triticumaestivum* cropping system is cultivated all over the world region.Such crops are cultivated on 14 mha and are recognised in South Asia as essential food safety crops[3]–[5].Rice and wheat is produced in Bangladesh, India, Nepal and South Asia's Indo-Gangetic Plains (IGP), with rich alluvial soils in this region.Crop rotation is vastly exercised in states of "U.P., Bihar, Haryana and West Bengal"[6]. These states are well known as "Indian Green Revolution region", and have about 16% of registered geographical area.Rotating *Orizasativa, Triticumaestivum* nearly occupies 55% of net area and approx. 45% of overall farming areas in India[7]. India ranks second largest producer of rice & wheat, worldwide in producing large amounts of residues. In areas of high cropping system, rice-wheat, rice-rye, and rice-fallow are widely grown. Out of them, rice- wheat is most

Department of Agriculture, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, monalisadas@soa.ac.in and ashokdas@soa.ac.in

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widely rotated in crop production with 75% of net arable area. Figure 1 illustrates farmers working in the field during harvesting crops.

Figure 1: Crop harvesting practice

II. FACTORS AFFECTING RICE-WHEAT SPREADING SYSTEM

- They have greater production potential than different kind of cropping system;
- Increased cultivar quality;
- Systematic grain cultivation.

III. FACTORS AFFECTING INCREASED PRODUCTIVITY OF THE SYSTEM

- Improved growth conditions e.g. soil types (Alluvial soil) etc.
- Improved irrigation conditions
- Favourable temperature conditions for cultivating crops.

It is also recorded that farmers of plain region are widely adopting the growth, of *Orizasativa Triticumaestivum* program. Rice-based crop production processes govern the "western (Haryana, Punjab, parts of the southern, western & northern) and eastern (Eastern UP, Bihar and West Bengal) portions[8]."

IV. CHALLENGES FACED BY CROP PRODUCTION AREA

- Climatic changes are the major environmental issue that affects crop production, soil-based natural resources, availability of freshwater, and public health.
- Long-term production of the same crops
- Massive irrigation
- urbanization i.e. movement of population from one place to another
- Increased insect-pest
- Nutrient mismatch
- Rice and wheat residues burning
- Water depletion
- Climate change
- Rapid population increase
- Degradation of soil health

- Increase in soil salinity
- Deteriorate of underground water
- Natural calamities like floods, landslides etc.

V. RESIDUE GENERATION AND CONSUMPTION

It is reported that residues of rice and wheat that are burnt on lands are approx. 35% and 25% respectively. It is estimated that approx. 600 million tons of crop residues are produced per year[9]. Out of this, maximum of crop residues are employed in various industrial productions like paper production, alcohol production or utilized as "fuel and fodder" for domestic purpose. Crop residues such as leftovers from rice, jowar etc. are employed as feed & fodder for cattles or utilized as household fuels, for example, rice husk is usually employed as boiler fuels[10].

SURPLUS RESIDUES

The quantity of excess crop residues available in India is approx. 140 million tons per annum, of which 95 mt is burnt down every year. In India, large quantities of residues are generated in both crops i.e. rice and wheat. Overall, agricultural biomass generation is tied to 144 billion metric tons recorded in February 2019.Sorghum tops are typically excess residues that are burned in the land after harvesting crops. Certain crops, such as oilseeds, peas, chilli or cotton, contain excess residue that is utilized as fuel.

After harvesting crops, residues are burned in the land or utilized by farmers as fuels at home.Bamboo plant production of 4.5 million metric tons are also available. No excess residue are available that is employee as cattles feed in the form of fodder. Density of crops residues per sq. km is maximum in U.P., Haryana and states of south India such as Tamil Nadu.

VI. MANANGEMENT OF CROP RESIDUES

- Residues burning on lands
- In-situ incorporation
- Residual surface management
- Agricultural residues baling for industrial use
- *Residues burning on lands*

Problems related to cardio-vascular and respiration are caused due to burning of air by:

- CO_2 content increasing by 70%
- CO content increasing by 8 percent
- 2.1 percent increasing in NO2 shoots

Problems are caused in the air by burning of the straw which are caused by release of:

- Particulates present in the straw
- CO
- CO_2
- Ash
- SO

Burning of straw in the air, causes loss of varieties of mineral nutrients such as:

- Nitrogen by 9-10 kg
- Phosphorus by 3-4 kg

- Potassium by 15-16 kg
- Sulphur by 5-6 kg

Figure 2 illustrates NASA satellite images showing intensity of rice residues burning in North –West India.

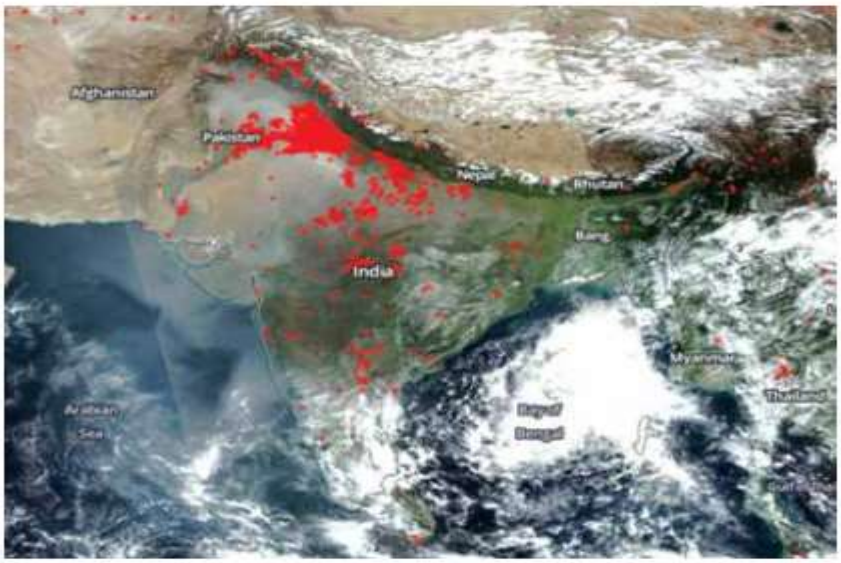

Fig. 2: NASA Satellite Images Showing Intensity of Rice Residues Burning in North – West India

- *In-situ incorporation*

In-situ management of residues present in soil can be done by using technologies involved in sowing one crop after another i.e. wheat after rice since traditional practices are unaffordable. Rotavator is involved in - situ rice management. Next technology is chopper to introduce the residue into the soil that is used in Punjab to sow wheat. Incorporation by in situ method increases soil nutrients such as nitrogen, phosphorus, potassium. Residue absorption allows inorganic N to be immobilized. It is observed that the integration of straw with 20-25 kg ha-1 starting dose improves the production of wheat and rice compared to burning.

- *Surface retention*

Management of surface retention may be managed by "happy seeder and zero tillage" technology. "Happy seeder" is utilized in filed where heat is planted. "Zero tillage" is utilized in rice fields.It has also been found that with activity of surface residues retention, soil NO3 increases by 47%, N absorption by 28% and output by 38% compared to burning physical properties like soil moisture, aggregate development, are most affected by residues managing practices.

- *Bailing practices*

The process of removal or bailing consists of using as cattle feed, packaging preparation, electricity, compost and lowering manual harvesting earnings. Grow new crops type that produce less residues. This method often produces less residues during harvesting.

It is recorded that surplus residues are used in power processing i.e. about 1195 MW / annum in Punjab, which helps to reduce environmental pollution by residues burning, but still continues to burn paddy straws in the fields.Scientific managing of residual crops and energy production would be advantageous in reducing the utilization of fossil fuels, coals, woods, saving foreign exchange, creating jobs and also helping farmers incomes.

- *Water management*

Residual management plays an important role in maintaining soil surface, as well as in reducing evaporation losses and conserving water by employing crops. The residues on soil surface decreases the falling of sun rays and air exchange resulting in low energy utilization for water losses from the soil surfaces (evaporation). Saving water by residual is further utilized for transipartion process. Table 1 shows water management from different sources.

Table 1: Water Management From Different Sources

Water Saving Source	Water Saving
Evaporation reduction	5.5-10 cm
Tillage elimination	0.8-2 cm
Increased winter storage	3-6cm

- *Crop productivity*

Rice residues management practices have an impact on soil physiochemical properties and crops productivity. Studies disclosed that rice-wheat series yielded 8 t ha-1 of grain rice and 5 t ha-1 of grain wheat that resulted in eradication of N 300, Phosphorus 30 and potassium 300 kg ha-1 from soils and generated the residual in the work area of about 8-11 "t ha-1 yr-1." of rice as well as wheat.Rice crops are grown in South Asia with residues of 8-10 "t ha-1" and these area's farmers are required to control the residues while sowing the wheat.

VII. IMPORTANCE OF RESIDUAL MANAGEMENT

- Reduces cultivation costs by encouraging farmers for using rice residues.
- Improves soil fertility by awaring farmers about various advantages of crop residual management.
- Conducts training programmes for farmers in managing crop residues.
- Include methods of cultivation at affordable prices.
- Raising awareness programs for farmers addressing about pollution caused from burning straw.
- Check crop residues burning in lands.

VIII. CONCLUSION

The activity of crop residue alteration in agriculture starts the benign carbon cycling and nutrients cycling like Nitrogen, phosphorus and potassium. In the intervening years, crop residues in poverty prone areas has been utilized as household fuels, cattle fodder and bedding, SOC rates have been low in comparison to that in natural soils.Managing crop residues is the best step towards enhancing the standards of agro-ecosystems that have degraded as a consequence of previous management practices.Managing crop residues is a valuable practice that provides undeniable services, stating that crop residues management will serve as important management practices in the coming years.

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