CROP RESIDUE MANAGEMENT- A KEY COMPONENT OF CONSERVATION AGRICULTURE IN DISTRICT SATNA, MADHYA PRADESH

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India produces about 500 million tons (Mt) of crop residues annually. Processing of agricultural produce through milling and packaging also produces substantial number of residues. Crop residues are natural resources with tremendous value to farmers. These residues are used as animal feed, composting, thatching for rural homes and fuel for domestic and industrial use. About 25% of nitrogen, 25% phosphorus, 50% of sulphur and 75% of potassium uptake by cereal crops are retained in residues, making them valuable sources of nutrients. However, a large portion of the residues, about 140 Mt, is burned in field primarily to clear the field from straw and stubble after the harvest of the preceding crop. The problem is severe in irrigated agriculture, particularly in the mechanized rice-wheat system. The main reasons for burning crop residues in field include unavailability of labour, high cost in removing the residues and use of combines in rice-wheat cropping system especially in the Indo-Gangetic plains (IGP). Primary crop types whose residues are typically burned include rice, wheat, cotton, maize, millet, sugarcane, jute, rapeseed-mustard and groundnut. Farmers in northwest India dispose a large part of rice straw by burning in situ. Burning of crop residue leads to release of soot particles and smoke causing human health problems, emission of greenhouse gases such as carbon dioxide, methane and nitrous oxide causing global warming, loss of plant nutrients such as N, P, K and S and adverse impact on soil properties. Crop residue management is a well-known and widely accepted practice for controlling various soil physical, chemical, and biological functions. Crop residues incorporate a large number of nutrients in the soil for crop production and affect soil water movement, runoff, and infiltration.
Key words: Crop, component, residue, field, nutrient, genetic plant

Crop Residues for Improving Input Use Efficiencies and methods and researchers' findings: -Farmers are often reluctant to adopt any remedial measures for sensible management of crop residues because these practices do not directly increase the farm income. So, the selection of suitable crop residue management strategies that are eco-friendly but also increase the farm income is of the utmost importance. In practical field conditions, numbers of potential crop residue management technologies like conservation tillage, cycling of nutrients, soil conversation practices, zero-tillage and residue mulching, use in animal feed, and preparation of vermicompost are being used in different parts of the area. Carlesso *et al*. reported that the application of crop residues obtained from ryegrass and straw residues as well as mixed litter can significantly improve the soil porosity and water-holding capacity, and can ultimately make the soil more productive. Application of crop residues along with conservation tillage was reported to improve the soil aggregate and carbon storage in rice-based cropping systems. Smitha *et al.* reported that application of cluster bean crop residue before transplanting of sacred basil (Ocimum sanctum Linn) significantly improved the SOC and availability of soil macronutrients. It has been reported that proper retention of crop residues has a significant impact on the regulation of the soil microbial biomass. The enhanced microbial activity in the top layer of soil by application of crop residue mulching was reported by Samui *et al.* Rusinamhodzi *et al*. reported that successful management of crop residue was not only beneficial for the improvement of soil productivity and nutritional status, but also helps to improve the overall health status of the farm animals. Long-term application of crop residues along with conservation tillage was reported to boost the soil productivity, C-pool, and earthworm population.

Fertility and Productivity of Soil are improved through crop residues: -Soil fertility is the inherent capacity of soil to sustain a satisfactory supply of nutrients for plants, and can be determined through chemical analysis of soil. Soil productivity is the integrated result of soil fertility and management factors in field conditions, and can be assessed from crop yield. These are well connected with the soil physical, chemical, and biological properties naturally linked with soil organic matter stock. Recently, more emphasis has been given to healthy food production, maintaining long-term soil fertility, and environmental sustainability, along with natural resource conservation and more productivity through appropriate soil and land management, residue recycling, precision technology, and the supply of plant nutrients more from organic sources instead of inorganic chemicals. Crop residue is gaining importance in global agriculture, and is considered as an excellent source of organic matter that helps to improve C stock in soil, as well as water conservation, nutrient recycling, and soil

qualities, and decreases the trends of residue burning and the consequent environmental hazards. It is reported that continuous residue incorporation for three years significantly increases the light carbon fraction in the soil, which has a great contribution to total soil organic carbon. The nutrient distribution is significantly increased by repeated residue decomposition, and previous researchers established the greater organic and inorganic phosphorus accumulation in the soil surface with the practice of conservation tillage compared to conventional tillage. Crop residues mostly influence the productivity in cereals compared to other crops. It has been predicted that more residues add additional soil C and improve the soil properties in terms of favourable temperature, water retention, microbial activities, and nutrient mobilization. Piccoli *et al.* established that, as a source of organic matter, incorporation of crop residues resulted in 12% and 16% higher yield in maize and sugar beet, respectively, than other sources.

Capacity building and awareness creation:-Capacity building through training and teaching in under-and post-graduate levels and also through training of farmers to use residue conservation practices and facilitate technology transfer. Establishing self-help groups and encouraging unemployed youth to take up custom hiring of CA machineries as profession.

The CA component should be included in soil health card for proper monitoring of crop residue retention/burning. Familiarization of CA technologies at each KVK and state agricultural departments-awareness and dissemination of these technologies at block level through demonstration. Govt. aided projects to attract villagers to follow such options such projects can be proposed under CDM and the money thus generated can be utilized for development of the community.

Development activities: -Each university, research instigates and NGOs committed to sustainable development should start working with some selected farmers in varying situations with the knowledge embedded in CA principles and observe what and how much can be achieved and what is needed to make CA a success. This experience should be used for improving the CA-technology and removing the constraints. The emphasis should be on recycling of any form of wastes in addition to crop residues. As the availability of such organic resources is site-specific, an inventory should be made of the potentially available materials for use in the target regions in a systematic way. Approximate composition of various residues/wastes would further help to target a proper use of these resources where crop residues have competing uses as fodder or fuel, recycling should be encouraged of the end product (dung, slurry, ash).

Conclusions: -The residues are of great economic value as livestock feed, fuel and industrial raw material. However, problems with the crop residues are different in different region and associated with the socio-economic needs. Crop residues are often considered as waste material in terms of their economic importance, but they provide elemental carbon in soil and offer a variety of mechanisms for nutrient recycling in soil. Crop residue management helps in maintaining soil moisture content by protecting the soil surface and increasing irrigation efficiency. Crop residues as natural resources help to develop soil stability and maintain soil fertility. Good management practices with crop residues reduce soil erosion. Growing more food for an ever-increasing population brings the opportunity for fast residue generation. Ecosystem services from crop residues improve soil health status and supplement necessary elements for plants.

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