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Best Practice 2: "Crop Residue Management"

Large quantities of residues from a wide variety of crops are left behind both on and off the farm after harvest. According to the Ministry of New and Renewable Energy, about 500 million metric tons per year of crop residues are produced. Uttar Pradesh produces 60 metric tons (Mt) of crop leftovers annually, followed by Punjab with 51 Mt and Maharashtra with 46 Mt. The majority of crop leftovers (352 Mt) come from cereals, followed by fibers (66 Mt), oilseeds (29 Mt), pulses (13 Mt), and sugarcane (12 Mt). Cereal crops (rice, wheat, maize, millets) account for 70% of the crop leftovers, with the rice crop accounting for 34% of the total. Twelve million metric tons, or two percent of India's total crop waste, come from sugarcane top and leaves.

Crop residues are an important source of organic matter and nutrients for soil. By properly managing crop residues, farmers can improve soil health and fertility, which can lead to better crop yields, reduced need for chemical fertilizers, and long-term sustainability of their land. There are several options for management of crop residues: mulching, incorporation in the soil and surface retention etc. Crop residues are primarily used as bedding material for animals, livestock feed, soil mulching, bio-gas generation, bio-manure/compost, thatching for rural homes, mushroom cultivation, biomass energy production, fuel for domestic and industrial use, etc. Crop residues can help to prevent soil erosion by acting as a protective layer on the soil surface. This is particularly important in areas with steep slopes or heavy rainfall, where erosion can be a major problem. By reducing soil erosion, farmers can preserve the quality and productivity of their land. Nevertheless, a significant proportion of agricultural residue is incinerated "on-site" principally with the intention of clearing the field in preparation for the subsequent cropping season. The issue of "on-farm" burning of crop residues has become increasingly prominent in recent years due to several factors. These include the limited time available between crop harvesting and sowing of the next crop, the additional labor costs associated with proper disposal of the residues, the lack of demand for crop residues such as

paddy straw as livestock fodder, a shortage of human labor, and the prevalence of mechanized crop harvesting methods. According to the currently available figures, the primary practice of burning crop leftovers is prevalent in four states, specifically Haryana, Punjab, Uttar Pradesh, and West Bengal. The combustion of crop leftovers has a detrimental impact on soil biodiversity. Crop residue burning is well recognized as a significant contributor to the exacerbation of air pollution, hence leading to the manifestation of various respiratory ailments such as asthma, coughing, and other related respiratory complications. The presence of elevated levels of air pollution has a detrimental impact on visibility. Challenges of crop residue management include huge amount of crop residues, problem in collection and storage, short time window between harvesting and sowing of two (next) crops, problem in utilization of crop residues and cost-effective mechanization, awareness and availability of appropriate machinery.

Keeping in view of increase in pollution due to stubble burning, the university has taken an initiative to aware the farmers about the disadvantages on the human as well as soil health. The university started the crop residue management (CRM) practices since 2018 with the budgetary allocation of Rs. 90.45 lac, 152.7 lac, 245.95 lac and 166.46 lac in 2018-19, 2019-20 and 2021-22, respectively. The university procured CRM farm machineries such as happy seeder (14), reversible MB plough (12), paddy straw chopper/shredder/mulcher (16), zero till drill (15), rotavator (9) and tractor (5) during 2018-2022. New Holland Company is supporting the university by providing two tractors and accessories free of cost to create awareness among the farmers for disposal of crop residues. The university is helping to the farmers for crop residue management through custom hiring centres and also took initiative to develop dwarf varieties of paddy to reduce the burden of crop residues.

Demonstrations at farmer's field were conducted by the university KVKs in which 9, 18, 29, 27 and 32 villages were covered, and 150, 862, 887, 1055 and 1175 demonstrations were conducted in 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23, respectively. The university organized training programmes on CRM at school/college level in which 796, 4823, 3974, 4554 and 5378 students participated in 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23, respectively. The university organized live training programmes on CRM at block/district level in which 1340, 3438, 2541, 3425 and 4384 farmers actively participated in 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23, respectively. Awareness programmes on CRM have also been

organized in 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23 in which 685, 4345, 6310, 7185 and 10294 farmers, respectively, participated in the programme.

A state level farmer's fair and Krishi Udyog Pradarshini on the theme of "Crop residue management" was organized in the university campus during December 7-8, 2018. This practice is being continued to dispose of the crop residues in proper manner and the university is creating awareness to the farmers through trainings and the school children are also being made aware about this practice so that they can spread this information to their family members.

The university is also practicing crop residue management by using biodecomposers. The recycling of crop residues has the great potential to return a considerable amount of plant nutrients to the soil. The crop residues are chopped and mixed in the field using this mechanized equipment which increases the organic matter and nutrients of the soil to increase its fertility by enhancing the nutrients availability to the crops. The university is utilizing residues of different crops as mulch on the surface of the soil to conserve the soil biodiversity and moisture content which reduces the water requirement of the crop. The university is also practicing and promoting utilization of crop residues for organic and natural farming and extending this practice to the farmers for doubling the farmer's income and reducing the input costs in the form of chemical fertilizers as well as reducing the atmospheric pollution. The university is carrying out the CRM practice in eastern Uttar Pradesh through its 8 Krishi Vigyan Kendras (KVKs) and managed 150 ha, 862 ha, 887 ha, 1055 ha and 1175 ha land in 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23, respectively.

The university started the CRM practices in 2018 through its eight KVKs viz., Varanasi, Chandauli, Mahrajganj, Azamgarh-1, Jaunpur-1, Bahraih-1, Barabanki and Siddharthnagar. More than 15,000 farmers are using crop residue management technology with the support of KVKs, and taking benefits of farm machinery bank and custom hire services. Government of UP is also promoting crop residue management practices through centrally funded Farm Machinery Bank Scheme to the farmers.

With the efforts of the university the farmers become aware about benefits of CRM practices which resulted into a rapid decline in the crop residue burning incidences. In CRM districts, total 1836, 495, 324, 601 and 28 crop residue burning incidences have been observed in 2017-18, 2018-19, 2019-20, 2020-21 and 2021-22, respectively. Due to implementation of this

practice, 43.62%, 72.69%, 47.53% and 90.08% crop residue burning control has been observed in 2018-19, 2019-20, 2020-21 and 2021-22, respectively.

By adopting and disseminating this practice to the farmers, the university has contributed in the overall reduction of atmospheric pollution occurring due to burning of crop residue in the field and conservation of soil biodiversity. This practice minimized the labour inputs for collecting and burning these materials on the crop field, protected the soil surface, restricted the water loss from the soil by evaporation and helped in preventing raindrop erosion. By adopting this practice, the university is generating employment and imparting in doubling the farmers income. As a result of significant contribution of the university in the area of "Crop Residue Management", the unit of the university: KVK, Kotwa, Azamgarh (U.P.) conferred Appreciation/Award from the ICAR in 2020.

Front line demonstration of crop residue management on farmer's field was conducted on 4129 hectare land during 20-22. Keeping in view of this valuable practice, 90% farmers have adopted and further recognized as reduction of atmospheric pollution occurring due to burning of crop residue in the field and conservation of soil biodiversity. Research work conducted by the M.Sc. (Ag.) and PhD. students of the university on in-situ crop residue management found that the application of 30 kg per hectare additional nitrogen at the time of preparation of land resulted into enhanced decomposition process.

Success story -1

Income Enhancement of Mr. Ram Prakash through Crop Residue Management



Mr. Ram Prakash Yadav son of Sri Daleep Yadav Mobile No. 9452083305 is resident of village Arajibagmati, block Rani Ki Sarai, district Azamgarh (U.P.). He owns 8.35 ha. of land and 6 pure breed of milch animals. He has six members in his family and all are totally dependent on his earnings.

Wheat is an important *rabi* season crop in eastern Uttar Pradesh. Earlier, Mr. Yadav used to sow his wheat through broadcasting method and mixed with the help of rotavator or cultivator. However, he always worried about burning of crop residue in field and think about a machine which can be utilize to cut the stubbles into a small pieces and mix in soil to improve the soil status. With all these thoughts, he came to Krishi Vigyan Kendra, Kotwa, Azamgarh and met with the scientists. He discussed all his problems in detail regarding burning of decomposable organic product of crop and higher cost involved for its management before wheat sowing. Scientists advised him about the benefits of crop residue management and their various options available under CRM and that can be applied according to the situation and present need. Among them happy seeder machine can be used immediately for sowing of wheat after paddy harvest while straw cutter cum spreader, mulcher & chopper is used to cut the stubbles in small pieces in whole field which facilitate smooth functioning of machines.

After getting technical information about happy seeder, Mr. Yadav learnt about the calibration of happy seeder in the field. He got fully satisfied that wheat sowing with happy seeder will certainly give him good output. He sown wheat in 9.0 acres area during 2019 with the help of happy seeder and reduced the cost up to half in comparison to conventional method of wheat sowing.

Success story -2


Doubling Farmer's Income through Crop Residue Management



Mr. Devendra Rai S/o Sri Ram Chandra Rai is a resident of village Sirwan, block Thekma, district Azamgarh (U.P.). Earlier, Mr. Rai used to sow the wheat through broadcasting method with the help of rotavator or cultivator, however, he always worried about burning of crop residues in field and started to think about a machine which can be utilized to cut the stubbles into small pieces and mix in soil to improve the status of soil fertility. With all these thoughts, he came to Krishi Vigyan Kendra, Kotwa, Azamgarh and met with the scientists. Mr. Rai discussed thoroughly about the crop residue burning and how to manage residues in field itself. Scientists were advised him to use happy seeder machine for sowing of wheat and motivate him for zero burning of crop residues. During 2018-19 in wheat crop, he experienced many benefits of happy seeder sown crop in comparison to conventional method viz., increase of soil fertility, less infestation of weeds, reduced number of ploughing, less irrigation requirement, more number of tillers, reduction in fertilizers load and significant increase in yield with reduced cost of cultivation.

Mr. Rai got district level award for highest productivity of wheat (74.3q/ha.) by the Hon'ble District Magistrate, Azamgarh on occasion of "Chaudhari Charan Singh Jayanti" on 23rd December, 2019 and National level award at Farm Machinery Expo at Chandigarh on 02 September 2021 by the Hon'ble MoS, MoA & FW, Govt. of India for his good services towards popularization of crop residue management technology among farmers on large scale.


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