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Zero Tillage: A Boon for Soil Moisture Conservation

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INTRODUCTION

It is becoming increasingly clear that the task of feeding the population of tomorrow is to significantly increase water productivity in the sense of current land use, because new arable land is relatively small. In addition to large-scale soil and moisture management and water harvesting structures in the watershed, it is important to implement in-situ moisture management techniques to increase the accessibility of moisture to agricultural crops. The main goal of the conservation of soil moisture is to reduce the amount of water lost by evaporation (water loss directly from the soil) and transpiration (water loss occurring via the plants) or, combined, evapotranspiration. The preservation of soil moisture is an essential means of preserving the water needed for agricultural production, and it also helps to reduce crop irrigation needs. This is particularly important in areas where, due to climate change or other factors, rainwater and/or groundwater supplies for irrigation are limited or decreasing. There are various constraints under conventional agricultural practices like soil degradation, compaction, depletion of water resources and loss of biodiversity *etc.* In the western Indo-Gangetic Plains (IGP), water is increasingly becoming scarce because agriculture is facing rising competition from the urban and industrial sectors (Toung & Bhuiyan, 1994). In many parts of the region, over-exploitation and poor groundwater management has led to decreased water table and negative environmental impacts (Saharawat et al., 2010). Due to deteriorated soil condition in conventional tillage, plants are in more stress than the plant grown under zero tillage systems. Crop residues under zero tillage decreases direct loss of water from soil surface and it also reduces surface runoff. Infiltration rate increases due to more pores, pores being continuous and vertical under zero tillage (Scopel & Findeling, 2001).

Crop residues on soil surface under zero tillage reduce runoff (1.2 and 2.2 %) and increase infiltration than conventionally tilled soil (8.3 and 21.5 %) at 1 and 15% slope respectively (Rockwood and Lal, 1974). The zero tillage practices significantly improved the soil hydrological properties which affect water content in soil . Soil matric potential is the main driving force which causes the soil moisture to move from one point to other depending on its energy state (Bhatt et al., 2014b) and it is affected by divergent tillage methods (Bhatt, 2015). Zero tillage plots dried at a slower pace than that of the conventionally tilled (Bhatt, 2015). For the evaporation to occur, basic needs are Water to evaporate, energy to cause phase change and wind to create sufficient vapour pressure. Under zero tillage, crop residue load present over the bare soil surface lowered the rate of evaporation relative to conventionally tilled plots (Bhatt and Kukal, 2017). Ggreater the surface cover provided by residues, greater the moisture conservation because residue load cut off the direct contact between the hot sunrays and the bare soil. Arshad et al. (1999) coined higher water retention and infiltration rates under zero tilled plots which might be due to the redistribution of pore size classes into more small pores. Crop residues on surface of soil under zero tillage add more organic carbon to the soil which ultimately increases water holding capacity of soil. Therefore, zero tillage conserves soil moisture by increasing infiltration rate, reducing runoff, reducing evaporation and by increasing water holding capacity and storage due to crop residues load on surface of soil.

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