Archives of Agronomy and Soil Science
2012, 1–18, i*First* article

Conservation tillage and optimal water supply enhance microbial enzyme (glucosidase, urease and phosphatase) activities in fields under wheat cultivation during various nitrogen management practices

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(*Received 17 July 2011; final version received 24 April 2012*)

Field experiments were conducted on sandy clay loam soil at New Delhi, during the winter season of 2007 and 2008 to investigate the effect of tillage, irrigation regimes, i.e. sub-optimal, optimal and supra-optimal water supply, and integrated nutrient management practices (INM) on soil enzymatic activities after cultivation of wheat (*Triticum aestivum*). Soil glucosidase (54.5%), urease (88.8%), acid phosphatase (97.4%) and alkaline phosphatase (85.3%) activities increased significantly under conservation tillage compared with conventional tillage fields. An optimal water supply (i.e. three irrigations) led to a significant increase in soil enzymatic activity over sub-optimal (i.e. two) and supra-optimal (five) irrigation. Urease activity was slightly lower in the sub-optimal irrigations, but higher in supra-optimal irrigations by 15.5% than in optimal irrigation in conventional tillage. This study suggests that inorganic and organic nutrient combinations with conservation tillage and optimal water supply significantly improved soil enzymatic activities.

Keywords: water management; optimal drainage; supra-optimal drainage; integrated nutrient management (INM); enzyme activities (glucosidase, urease, phosphatases)

Introduction

Wheat (*Triticum aestivum* L.) is a major staple food of many South Asian countries, including India. India contributes ~12% (80.28 Mt) of global wheat production (Government of India 2010). The crop is grown under a rice–wheat cropping system on 13.5 million hectares of the most productive land in the Indo-Gangetic plains of northern India, Pakistan, Nepal and Bangladesh (Gupta RK et al. 2003). The rice–wheat cropping system covers ~32% of the total rice area and 42% of the total wheat area in the four countries and accounts for up to one third of total rice and wheat production (Pal et al. 2009). The green revolution in India in the 1960s opted for the very high application of chemical fertilizers, tillage practices and irrigations (Bosede 2010). However, subsequent increases in these inputs could not be turned into high production. The stagnation of rice–wheat productivity called for new resource-conserving production techniques to meet the challenge of enhanced and

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ISSN 0365-0340 print/ISSN 1476-3567 online

http://dx.doi.org/10.1080/03650340.2012.690143
http://www.tandfonline.com