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Long-term effects of management systems on crop yield and soil physical properties of semi-arid tropics of Vertisols

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ABSTRACT

Long-term experiments can be used to assess management induced changes in soil properties and sustainability of the management system in terms of the productivity. Such data are scanty, especially in the semi-arid tropics (SAT) region. A long-term experiment established in 1976 at ICRISAT in India on Vertisols with two management treatments; improved management (IM), comprising semi-permanent broadbed and furrow (BBF) landform with minimum tillage and improved cropping practices; and traditional management (TM) system comprising keeping the land fallow during the rainy season and sowing on flat landform during post-rainy season with traditional cropping practices, was sampled after 24 and 34 years for soil physical and hydrological properties. Results showed that both in short-and long-term the management systems had profound effect on crop yields. Also in the long-term IM and TM management systems had significant effect on several soil physical and hydrological properties. Throughout the soil profile IM systems had significantly lower bulk density, significantly higher porosity, substantially lower penetration resistance both at 5 cm (1 and 8 MPa) and 15 cm depths (8 and 15 MPa), significantly higher infiltration and sorptivity and significantly larger mean weight diameter of 4.3 mm compared to 2.8 mm for soils under TM. However, management systems had no significant effect on moisture holding capacities both at 0.033 and 1.5 MPa. Significant differences between the improved and traditional systems were observed in the size and pattern of soil surface cracks. Over the long-term, the improved management systems has very favorable effects on soil physical and hydrological properties and on the soil surface cracking and its patterns, thereby contributing to higher productivity.

KEYWORDS

Broadbed and Furrow System; Minimum Tillage; Long-Term Experiment; Sustainability

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References

- [1] Michaels, G.H. (1982) The determinants of kharif following on the Vertisol in semi-arid tropical India. Ph.D. thesis, University of Minnesota, Minneapolis.
- [2] Pathak, P., Singh, S. and Sudi, R. (1986) Soil and water management alternatives for increased productivity on SAT Alfisols. Proceedings of the IV International Conference on Soil Conservation, Maracay, 3-9 November 1986, 533-550.
- [3] Pathak, P., Sudi, R. and Wani, S.P. (2011) Hydrological behaviour of Alfisols and Vertisols in the semi-arid zone: Implications for soil and water management. *Agricultural Water Management Journal*.
- [4] El-Swaify, S.A., Pathak, P., Rego, T.J. and Singh, S. (1985) Soil management for optimized productivity under rainfed conditions in the semi-arid tropics. *Advances in Soil Science*, 1, 1-64. doi: 10.1007/978-1-4612-5046-3_1
- [5] Pathak, P., Mishra, P.K., Rao, K.V., Wani, S.P. and Sudi, R. (2009) Best options on soil and water conservation. In: Wani, S.P., Venkateswarlu, B. Sahrawat, K.L., Rao, K.V. and Ramakrishna, Y.S.,

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Eds., Best Bet Options for Integrated Watershed Management, Proceedings of the Comprehensive Assessment of Watershed Programs in India, ICRISAT, Patancheru 502 324, Andhra Pradesh, 75-94.

- [6] Srivastava, K.L., Smith, G.D. and Jangawad, L.S. (1990) Zonal surface management for rainfed Vertisols. In: Challenges in Dryland Agriculture—A Global Perspective. Proceedings of the International Conference on Dryland Farming, Amarillo/Bushland, 15-19 August 1988, 584-585.
- [7] Virmani, S.M., Pathak, P. and Singh, R. (1991) Soil related constraints in dry land crop production in Vertisols, Alfisols and Entisols of India. *Bulletin of Indian Society of Soil Science*, 15, 80-95.
- [8] Wani, S.P., Pathak, P., Jangawad, L.S., Eshwaran, H. and Singh, P. (2003) Improved management of Vertisols in the semi-arid tropics for increased productivity and soil carbon sequestration. *Soil Use and Management*, 19, 217-222. doi:10.1111/j.1475-2743.2003.tb00307.x
- [9] Kampen, J. (1982) An approach to improved productivity on deep Vertisols. ICRISAT, Andhra Pradesh, ICRISAT Information Bulletin, 11.
- [10] Laryea, K.B., Pathak, P. and Klaij, M.C. (1991) Tillage systems and soils in the semi-arid tropics. *Soil and Tillage Research*, 20, 201-218. doi:10.1016/0167-1987(91)90040-5
- [11] Klute, A. (1986) *Methods of soil analysis. Part 1: Physical and mineralogical methods*. 2nd Edition, American Society of Agronomy and Soil Science Society of America, Madison, USA.
- [12] White, I. and Sully, M.J. (1987) *CSIRO disc-permeameter: Instruction manual*. CSIRO Division of Environmental Mechanics, Canberra.