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Recent Developments of No-Till and Organic Farming in India: Is a Combination of These Approaches Viable?

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The increase in crop production brought by the green revolution in India is now shadowed by new challenges related to soil degradation (e.g., erosion, decline of soil organic matter content, salinization) and scarcity of water resources. The present work particularly discusses the contribution of no-till and organic farming, which are increasingly being adopted in India, to meet the increasing food demand in a sustainable way. Under no-till, erosion is reduced to rates close to those found in natural ecosystems, provided enough mulch is retained at the surface which is usually not the case in India, because of competing uses, for example, fodder, fuel, construction material, and also crop residue burning for land preparation. No-till should therefore not be considered separately from complementary measures, aiming at retaining mulch on the soil surface. Efficient recycling of organic material needs to be implemented concomitantly with diversifying fodder and fuel sources which requires enhancing the multifunctionality of farming systems. These prerequisites make it difficult for farmers to adopt no-till, particularly the poorer ones for whom experimentation with new techniques often involve unbearable financial risks. Organic farming apprehends the farm as an organism, and is thus a good option to improve sustainability as introduced above, by e.g., closing nutrient cycling. However, organic farming typically implies tillage for weed control (no chemical herbicides). "Natural farming," *as promoted by Fukuoka (1978) combines no-till with organic farming. An overview of available literature on Indian experiences with* "natural farming," *most of it originating from*

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unconventional sources (i.e., reports available on Internet, but no peer reviewed literature) indicates that crop yields can compare well with the highest yields in a particular region. Increased productivity and environmental benefits are also often mentioned. The limited accuracy of these sources makes it necessary to pursue further investigations, and we conclude with propositions for future work in this context. This should start with a rigorous assessment of existing "natural farming" systems regarding their productivity and environmental benefits, in order to demonstrate its potential before starting projects that promote the system for broader adoption.

KEYWORDS India, tillage, no-till, organic farming, natural farming, Rishi Kheti, soil erosion

INTRODUCTION

Agriculture in India is practiced on 180 Mha, or 55% of the land area, and almost 60% of the labor force is involved in agriculture (FAOSTAT). Considerable achievements have been met since the 1960s with constant increases in cereal, root and tuber crop yields mainly through the use of green revolution technologies like irrigation, fertilizers, agro-chemicals, and high yielding varieties (Evenson & Gollin, 2003; FAOSTAT; Pingali & Shah, 2001). India is amongst the most intensively cultivated regions of the world ranking top with respect to human appropriation of net primary production (Haberl et al., 2007).

However, agricultural systems in the most intensive regions of India are now increasingly considered to be unsustainable, due to environmental degradation, e.g., soil salinization (Pingali and Shah, 2001), decline of ground water table (Ambast et al., 2006), or decrease in soil organic carbon (SOC) content (Lal, 2004a). Stagnating or decreasing yields under constant fertilizer input (Ladha et al., 2003; Timsina & Connor, 2001) and lower marginal returns with continuous intensification (Gupta & Seth, 2007) are further indications for the need of strategic redirection towards sustaining yield increase. In the less intensively used rainfed regions which account for two thirds of the cultivated area, severe soil degradation is also a concern (Sharma et al., 2009). Since the end of the 1990s, increased incidence of farmer suicides in India has been the most dramatic outcome of the hopelessness faced by many farmers, due to a combination of factors like high input prices, crop failure, indebtedness, etc. (Mishra, 2007).

From 6.8 billion in 2009, world population is expected to reach 8.9 billion in 2050 and to stabilize at about 10 billion by 2100, with most