Crop diversification with pulses for enhancing soil nutrient dynamics in conservation agriculture

Gunturi Alekhya[1], Sibananda Darjee[2], Gundreddy Rajareddy[3], Ankireddypalli Jayakishore Reddy[4] and Kadapa Sreenivasa Reddy[1,*]

[1]Division of Agronomy, ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India
[2]Division of Environmental Science, ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India
[3]Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India
[4]Division of Soil Science and Agricultural Chemistry, ICAR-Central Research Institute of Dryland Agriculture, Hyderabad 500 059, India

Continuous rice–wheat cultivation in the Indo-Gangetic Plains (IGPs) has resulted in declining soil health and resource inefficiencies. Diversifying these systems with pulses offers a sustainable alternative, particularly by utilising 1.0 million hectares of underutilised rice fallows. Pulses improve soil fertility through biological nitrogen fixation, enhance nutrient cycling via residue return, and increase water productivity while reducing input costs and pest pressures. This review article highlights the potential of pulse integration under conservation agriculture frameworks, emphasising nitrogen economy, improved nutrient use efficiency, and system sustainability. Integrating pulses is crucial for resilient, low-input and ecologically sound production systems in the IGPs.

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to the intensive conventional production systems[2]. To address the emerging challenges in intensive agricultural systems, there is an increasing emphasis on enhancing sustainability through the adoption of conservation agriculture (CA) practices. Globally practiced for over six decades, CA has demonstrated significant agronomic and environmental benefits across diverse agroecosystems where it has been implemented[3]. Nevertheless, CA involves complex and sometimes overlooked factors that contribute to soil quality, productivity, and ecosystem services[4]. The ill effects of continuous cereal cultivation in CA were not evident in the beginning as the soil had an adequate reserve of plant nutrients. Over time, continuous cultivation of R–W and maize–wheat (M–W) (cereal-based) cropping systems has resulted in depletion of soil nutrients[5]. These challenges can be addressed by transitioning cereal-based cropping areas to diversified systems involving crop rotation, particularly by introducing pulses.

Integration of pulses in conservation agriculture