Towards Viksit Bharat@2047
Technological Innovations and Policy Options for Eastern Region

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CONTENT

Sustainable Intensification of Rice-Fallow System of Eastern India

Period of development: 2016 - 2023

Developers :

Rakesh Kumar, JS Mishra, BK Jha, SK Naik, SS Mali, S Mondal, AK Biswas, Rachana Dubey, Sanjeev Kumar, Anup Das, BP Bhatt, KK Rao, SK Singh, Santosh Kumar, JS Choudhary

Background:

Rice-fallow, a rainfed mono-crop production system practiced over 22.3 M ha in South Asia, is gaining greater attention in the recent times for cropping intensification. Main challenges for sustainable intensification of rice-fallow systems are lack of irrigation facility, preponderance of long-duration rice varieties which delay the planting of succeeding winter crops, low residual soil moisture and poor-fiscal status of farmers. Rice-fallow areas of eastern India have the potential for crop intensification by inclusion of a second crop after rice through strategic crop management. Choices of the suitable winter crops are decisive, largely depend on adaptive nature of the crops to biotic and abiotic stresses. Grain pulses (e.g., lathyrus, chickpea, lentil) and oilseeds (safflower, mustard, linseed) have been identified and proposed as potential post-rainy crops for improving the productivity of rice-fallow production system in eastern India. Greening rice fallow areas with appropriate technological interventions, reducing C-footprints and improving energy use efficiency in rice-fallows of eastern India is also a great challenge.

Description of the technology:

Experiment was conducted for 05 consecutive years (2016-2020) with an aim to design most carbon-cum-energy efficient, cleaner/safer, and eco-friendly production systems for rice-fallows in eastern India. Split-plot experiment had crop establishment-cum-residue management treatments in main-plots and post-rainy/winter season crops in sub-plots. Production systems selected for analysis included 03-crop establishment methods [(1) zero-till-direct-seeded rice (ZTDSR), (2) conventional-till direct-seeded rice (CTDSR), and (3) transplanted puddled rice (TPR)], and two residue management practices [(1) with residue, (ii) without residue) in combination with five potential winter season crops i.e. Chickpea, lentil, safflower, linseed, and mustard. Short/medium duration rice varieties (115-120 days: Naveen/Swarna Shreya/Lalit) in *kharif* followed by *rabi* crops i.e., chickpea, lentil, and safflower have been identified as a potential cropping system. Crop productivity of ZT/CTDSR was less (25-30%) than TPR during *kharif* but yield of winter crops were markedly higher (16-30%) in ZT/CTDSR, thereby improved system productivity. ZTDSR increased the crop yields of chickpea by 31%, lentil by 34%, safflower by 50%, linseed by 19%, mustard by 15% as compared to TPR production system. Increase of 4.17–5.80, 0.27–4.07, 1.91–3.32, 0.85–1.83 and 2.04–3.16 Mg REY ha^{-1} noted with inclusion of chickpea, lentil, safflower, linseed and mustard in system mode. Rice-chickpea, rice-lentil and rice-safflower rotations led to higher economic returns (14.3%), reduced energy use (23.3%) and lower emission of GHGs (20-25%). Soil Crack volume was markedly higher (2.6-3.3 times) in TPR production system. More diversity of earthworms was noted with CA and *E. Fetida* was the most dominating *sp*.

Commercial potential:

The technology can be offered through consultancy services, licensed, or outsourced to the State Agricultural Department, Private Sector & Agri-Entrepreneurs, Development agencies, RKVY, NGOs and farmers' groups.

Experimental field of conservation agricultural practices under rice fallow system

Impact:

Short/medium duration rice varieties (115-120 days: Naveen/Swarna Shreya/Lalit) in kharif followed by *rabi* crops i.e., chickpea, lentil, and safflower have been identified as a potential cropping system. ZTDSR increased the crop yields of chickpea by 31%, lentil by 34%, safflower by 50%, linseed by 19%, mustard by 15% as compared to TPR production system.

Agro-eco region suitability:

Rice Fallow areas of Eastern Indian States

Reference :

Kumar Rakesh, Mishra JS, Mali SS, Mondal S, Meena RS, Lal R, Jha BK, Naik SK, Biswas AK, Hans H, Sundaram PK, Choudhary AK, Monobrullah M, Kumar S, Kumar S, Raman RK, Bhatt BP, Kumar U. 2022a.Comprehensive environmental impact assessment for designing carbon-cum-energy efficient, cleaner, and eco-friendly production system for rice-fallow agroecosystems of South Asia. *Journal of Cleaner Production* 331:129973. https://doi.org/10.1016/j.jclepro.2021.129973