STRATEGIC RESEARCH PLATFORM

on

Developing portfolios for resource use efficient and climate smart future cropping systems in North West IGP

Year of Start: 2009 to continue

Collaborators: ICAR-CSSRI, CIMMYT and IRRI

Funding support: BMGF & USAID

Rationale:

The project aims to devise strategies to reorient rice-wheat cropping system in Indo-Gangetic Plains keeping into consideration the declining yields, declining natural resources, climatic changes besides water, labour and energy shortages being faced by the present day agriculture. The hypothesis is to design next generation of cereal systems that are highly productive, resource efficient, sustainable, and adapted to the expected changes in environmental and socioeconomic drivers. At ICAR-CSSRI research experiment, near-production scale long-term strategic research platform on conservation agriculture (CA) have been designed to assess the performance of different agricultural systems, using a wide range of indicators (crop rotation, tillage, crop establishment, crop, water and residue management). Looking to prevailed situations, 4-scenarios were planned in beginning (year 2009) under CSISA Cereal Systems Initiative for South Asia) with the collaboration of IRRI and CIMMYT and funding from BMGF and USAID. These scenarios were implemented in large-scale plots of 2000 m2 (100 m × 20 m) and replicated thrice in a randomized complete block design. All the project activities continued with funding from CIMMYT-Climate Change Agriculture and Food Security (CCAFS) from year 2015. In the year 2016, A new set of two scenarios in which included subsurface drip irrigation (SDI) was imposed in May 2016 by sub dividing the main plots of ScIII and ScIV into two sub plots {each sub plot size of 1000 m2 (50 m × 20 m)} and thus total scenarios were now six.

The project aims to provide an overall strategy and umbrella so that new developments in science and technology to contribute in short- and long-term cereal production growth on a sustainable basis in South Asia's most important grain baskets. To ensure the re-vitalization of sustainability in an ecologically viable, socially acceptable

and sustainable manner in intensive RW system of north-west (NW) India, the platform was started with specific **Objectives-**

- Generate science-based evidence to promote widespread adoption of CA-based resource-conserving practices, technologies and services that increase yields with lower water, labor and input costs.
- Generate and disseminate new knowledge of climate smart agriculture (CSA) on cropping system management practices that can withstand the impacts of climate change in South Asia.
- Develop and refine the resilient technologies/practices for intensive cereal systems adapted to climatic extremes and expected climate change.
- Improve the policy environment to facilitate the adoption of CA/CSA sustainable intensification technologies.
- Build strategic partnerships that can sustain and enhance the scale of benefits accrued through improving cereal system productivity.
- Generate new cadre of scientists/ researchers through capacity building of students, researchers, extension agents and other stakeholders

Treatments and Experiment Protocols:

Treatment notation and their description are presented in Table 1 using wide range of indicators (crop rotation, tillage, crop establishment, residue, water and nutrient management).

Table 1. Drivers of agricultural change, crop rotation, tillage, crop establishment method, and residue management of different scenarios

Scenario	Drivers of Change	Crop Rotations	Tillage	Crop Establishment Method	Residue Management	Nutrient Management (NPK, kg/ ha)	Water Management
1	Business as usual (Farmer's Practice)	Rice-Wheat-Fallow	CT-CT	Rice: Transplanting Wheat: Broadcast	All residue removed	Rice: 175+58+0 Wheat: 150+58+0	Rice: Continuous flooding of 5-cm depth for 1 month, followed by irrigation applied at hair-line crack Wheat: Need based irrigation or at critical crop growth stages
2	Increase food production, income & nutrition through intensification and best management practices	Rice-Wheat-Mungbean	CT-ZT-ZT	Rice: Transplanting Wheat: Drill seeding Mungbean: Drill/relay	Full (100%) rice and anchored wheat residue retained on soil surface; full mungbean residue incorporated	Rice: 151+58+60 Wheat: 151+64+32 Mungbean: o+o+o	Rice: Continuous flooding of 5-cm depth for first 15-20 days after transplanting 'fb' irrigation at -40 to -50 kPa matric potential at 15-cm depth till 1 wk before flowering 'fb' irrigation at -15 to -20 kPa Wheat: Flood irrigation at -40 to-50 kPa matric potential
3	Deal with rising scarcity of labor, water, energy,	Rice-Wheat-Mungbean	ZT-ZT-ZT	Rice: Drill seeding Wheat: Drill seeding	Full (100%) rice and Mungbean; anchored wheat	Rice: 162+64+62 Wheat: 151+64+32	Rice: Kept soil wet for first 20 days 'fb' irrigation at -20 to -30 kPa matric potential

	malnutrition, degrading soil health and emerging climatic variability			Mungbean: Drill/relay	residue retained on soil surface	Mungbean: o+o+o	Wheat: Flood irrigation at -40 to-50 kPa matric potential
4	Sustainable intensification (SI) with futuristic cropping system to deal with same issues as in scenario 3	Maize-wheat-Mungbean	ZT-ZT-ZT	Maize: Drill seeding Wheat: Drill seeding Mungbean: Drill/relay	Maize (65%) and full mungbean; anchored wheat residue retained on soil surface	Maize: 174+64+62 Wheat: 151+64+32 Mungbean: o+o+o	Flood Irrigation at -50 kPa in maize and -40 to-50 kPa matric potential
5	SI of RW system with CA+ to deal with same issues as in scenario 3	Rice-Wheat-Mungbean	ZT-ZT-ZT	Same as in scenario 3	Same as in scenario 3	Rice: 130+64+62 Wheat: 121+64+32 Mungbean: o+o+o N in rice- 8 splits & wheat- 4 splits through SSD Fertigation	Sub surface drip irrigation (SSD) at -20 to -30 kPa in rice and -40 to-50 kPa matric potential in wheat
6	SI of MW systems through CA+ to deal same issues as in scenario 3	Maize-wheat-Mungbean	ZT-ZT-ZT	Same as in scenario 4	Same as in scenario 4	Maize: 139+64+62 Wheat: 121+64+32 Mungbean: o+o+o N in maize- 3 splits & wheat- 4 splits through SSD Fertigation	Sub surface drip irrigation (SSD) at -50 kPa in maize and -40 to-50 kPa matric potential in wheat