National Innovations in Climate Resilient Agriculture-Technology Demonstration Component (2016-17)

A National Network Project, National Innovations in Climate Resilient Agriculture (NICRA) launched in the year 2011 to address the resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. Technology Demonstration Component (TDC) of NICRA offers great opportunity to work with farmers and apply such technologies under field conditions to address current climate variability. This will enhance the pace of adoption of these resilient technologies. On-farm participatory demonstrations for climate resilience are being implemented in village clusters through KVKs in 121 climatically vulnerable districts across the country and by 7 core research institutes of ICAR. The emphasis has been on capturing and improving the understanding on performance of technologies in different agro-ecologies and farming systems. This also facilitates identification of what constitutes climate resilience in different bio-physical and socio-economic contexts. NICRA KVKs prepared and implemented village level contingency crop plans and measures.

The Technology Demonstration Component (TDC) of NICRA offers a great opportunity to work with farmers to address current climate variability with matching responses. Getting existing technologies into the hands of small and marginal farmers and developing new technologies like drought or flood tolerant crops to meet the demands of a changing climate also come under the purview of NICRA programme. Climatic vulnerability of selected 17 KVK districts of Bihar, Jharkhand, West Bengal and union Territory of A & N Islands assessed during implementation of NICRA programme brought forward definite requirement in terms of technological support, human resource development and overall empowerment of farming community to enable them to cope up with climate vulnerabilities like droughts, erratic rainfall, heat wave, flood, cyclonic storm. Plan of action, accordingly, was prepared for its implementation through executing technological interventions to initiate crop production, resource conservation, livestock and fish rearing, water harvesting etc. in the vulnerable villages of KVK districts.

Natural Resource Management

In-situ moisture conservation, water harvesting and recycling for supplemental irrigation, improved drainage in flood prone areas, conservation tillage where appropriate, artificial ground water recharge and water saving irrigation methods and rainwater harvesting structure development. In-situ moisture conservation technologies have been demonstrated in 17 NICRA adopted villages covering 387 farmers in 85.5 ha area. Water harvesting and recycling forb supplemental irrigation were demonstrated in NICRA adopted villages involving 1017 numbers of farmers. Conservation tillage in wheat, paddy, lentil, pea and chickpea demonstrated in different adopted villages in an area of 188.5 ha of 312 numbers of farmers. The technologies followed mainly by zero tillage operation. Wheat with cultivation through ZTD showed maximum yield of 33- 42 q/ha. Zero tillage technology showed very promising results in pulse and oilseed cultivation. Pea (var. Arkel) gave highest economic return (B:C ratio:: 2.85) among the pulse demonstration through ZTD. Land shaping with ail cultivation and rain water harvesting structure have been constructed covering 1.07 ha area during post-kharif to mitigate the scarcity of irrigation

water and increase in soil salinity. Artificial ground water recharge done by field bunding, water management and through SRI by sub-soiler in paddy covering 67.0 ha area in 90 farmers' fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (55.5 q/ha) and benefit: cost ratio (2.24). Water saving irrigation methods like sprinkler irrigation, LEWA in rice, RBF in brinjal, micro-lift irrigation in paddy demonstrated in NICRA adopted villages covering an area of 78.0 ha in 325 farmers fields. There were 121 number of rainwater harvesting structures have been developed which could store 524446.0 cu m of water. This intervention increased the cropping intensity to the maximum extent up-to 250%. Around 450 q compost prepared from solid wastes was added to the soil through which 75 thousand carbon sequestrations was done during 2016-17.



Land shaping with Ail cultivation

Water harvesting through sand bag check dam



LEWA in Pulse

Zero tilled wheat

Crop Production

Introducing drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of *rabi* crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seedling), community nurseries for delayed monsoon, location specific intercropping systems with high sustainable yield index, introduction of new crops/ crop diversification, custom hiring centres for timely planting. Under crop production module introduction of drought resistant varieties of paddy, brinjal, niger, maize, pigeon pea, and ragi were demonstrated in 17 NICRA adopted villages involving 1899 number of farmers in 461.0 ha area. Drought tolerant paddy varieties like *Sahbhagi, Anjali, Naveen* and *Abhishek* were demonstrated in 218.0 ha areas of 607 number of farmers' field, among which

Sahbhagi with drum seeded showed highest yield potential (49.0 q/ha) and economic return 2.38 with maximum increase (58%) as compared to local check. Shorty duration variety of potato Pukkhraj gave maximum economic return (B:C ratio of 3.35). Salt tolerant varieties of paddy like CARI Dhan-5, Usar Dhan-5, Jarava, Geetanjali, SR-26B and Amalmona were introduced in 68.2 ha area in 158 farmers' fields. Javarva, Geetanjali and Amalmona varieties proved maximum salt tolerant potential by showing more economic return (B:C ratio of 2.54). Flood tolerant varieties of paddy like *Swarna sub 1* and *Sabita* were introduced through demonstration in 30.0 ha area in 122 farmers' fields. To avoid terminal heat stress in crops like rice, wheat, lentil, mustard, potato, etc. were sown in 13 days advance (average) during rabi season. These demonstrations were carried out in eight NICRA adopted villages involving 347 number of farmers' fields. Water saving paddy cultivation through SRI, short duration varieties, direct seeded rice, brown manuring etc. have been demonstrated in 219.0 ha area of 674 number of farmers' fields. These interventions were carried out in 14 NICRA adopted villages. Among all the interventions paddy cultivation with Sahbhagi variety showed highest increase in yield whereas paddy cultivation with variety Rajendra Sweta with ZTD gave maximum economic return in the tune of BC ratio of 2.95. To combat the situation of delayed monsoon intervention of staggered community nursery for paddy has become very popular in Bihar and Jharkhand. Seedlings of 25-30 days age are transplanted in July so as to complete flowering of photosensitive varieties before October and harvesting by mid-November to facilitate taking up of timely sowing of rabi crops. Such a practice ensures optimum performance of both kharif and rabi crops. However, Bihar experienced aberrant rainfall situations in 4 out of the previous 10 years impacting adversely rice production and livelihood of farmers. Delay in transplanting of paddy affects productivity as over aged seedlings suffer from low tillering ability various crops of different crop duration and varieties has been promoted. Besides paddy other crops like of cauliflower, brinjal, and tomato are followed for staggered nursery development. These intervention were demonstrated in 38.5 ha area of 220 numbers of farmers. These interventions were carried out in 10 NICRA adopted villages. Among all the demonstration the community nursery for cauliflower was the mostpromising one which showed highest increase in yield as well as economic return. Crop diversification through introducing new crops in prevailing cropping pattern was demonstrated in the different NICRA adopted villages. These demonstration were carried out in 140.5 ha area of 754 number of farmers' fields. Introduction of ol (var. Gajendra) in the cropping pattern showed the most promising one.



Direct seeded rice

Sunflower in saline soil



Swarna Sub 1

Organic mulching

Livestock and Fisheries

The use of community lands for fodder production during drought/flood, improved fodder/feed storage methods, preventive vaccination, improved livestock demonstration, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity or excess water.

Community lands of an area of 170.0 ha involving 987 number of farmers utilized for different fodder production were demonstrated in ten different NICRA adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration quality legume Sudan grass demonstrated showed maximum benefit return (B: C:: 5.15). Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. Short and medium duration fodder cultivars of several crops and fodder species both in *kharif* and *rabi* seasons were demonstrated in farmers' fields under rainfed and limited irrigation conditions to support income and cash flowfrom animal husbandry Improved fodder of rice beanand silage making were demonstrated in farmers fields. Silage making for 10 numbers and 1.6 ha of units showedvery promising results. Various vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry, BQ vaccine, deworming etc. in all the NICRA adopted villages. Mortality rate reduce up to the extent of 98% and average increase in cattle milk yield upto 42% have been recorded after the vaccination camps organized. Composite and cat fish rearing in the existing pond or in renovated pond were demonstrated in 122 farmers' fields of NICAR adopted villages. Khaki Campbell duck was also introduced through this intervention. Demonstration of rural backyard poultry (kuroiler and Nicobari fowl), Khaki Campbell duck, T X D breed of pig, mineral mixture and azolla as cattle feed were carried out in 421 number of farmers fields. Improved ornamental bird was introduced through this intervention which showed very promising results (B:C :: 4.90). Improved Poultry shed recorded low mortality rate and in shady area reduced heat stress. Standard spacing in improved shed resulted better performance in poultry and dairy animals. Interventions to reduce heat stress for higher survivability of backyard poultry and dairy animals were demonstrated of improved shelter.



Programme of Animal Vaccination



TxD Breed introduced

Fish cultivation in IFS

Institutional Intervention

Strengthening the existing institutional interventions or initiating new ones relating to seed bank, fodder bank, commodity groups, custom hiring centre, collective marketing group, and introduction of weather index based insurance and climate literacy through a village weather station and awareness developed of 2258 number of farmers in the zone.







Field operation by Power tiller





Soil test Kit

Village Climate Risk Management Committee (VCRMC)

The Village Climate Risk Management Committee (VCRMC) was constituted after in-depth discussion with the villagers about the mitigation of the climatic vulnerabilities of the villages and the strategies to be adopted under NICRA. The members of the committee were selected by the villagers under the facilitation of KVKs where NICRA was being implemented. VCRMC became operational with opening of a bank account in their name being jointly handled by the President of VCRMC and the Programme Coordinator of the KVK concerned. The custom hiring of various farm tools and implements was being supervised by VCRMC apart from taking important decisions on the technological interventions to be implemented at the village in consultation with the KVK.



Custom Hiring of Farm Implements and Machinery at NICRA Adopted Villages

Timeliness of agricultural operations is crucial to cope with climate variability, especially in case of sowing and intercultural operations. Access to implements for planting in ridge-furrow, broad bed furrow and raised beds is essential for widespread adoption of resilient practices for *in situ* soil moisture conservation and drainage of excess water in heavy soils. In rainfed areas, availability of such farm implements to small and marginal farmers is important. Similarly in irrigated areas, residue management of *kharif* crops through zero till cultivation of *rabi* crops reduces the problem ofburning of residues and adds to the improvement of soil health and increases water use efficiency. Custom hiring centres (CHCs) for farm implements were established inNICRA villages. A committee of farmers' manages thecustom hiring centre. The rates for hiring the machines /implements are decided by the VCRMC. This committee also uses the revenue generated from hiring charges and deposits in a bank account opened in the name of VCRMC. The revenue is used for repair and maintenanceof the implements and 25% share is earmarked as asustainability fund. Different types of farm machinery are stocked in the CHCs, the most popular being Zero till drill, Happy seeder, BBF planter, drum seeder, multi crop planter, power weeder and chaff cutter. Each CHC was provided an initial sum of Rs. 4.25 lakhs for its establishment under NICRA project. Revenue generated through custom hiring and under VCRMC in different KVKs were presented in the following table.







Farm implements in Custom Hiring centers

Revenue generated through Custom Hiring Centers and VCRMC in KVKs

Name of KVK	Revenue generated (Rs.)	
	From Custom Hiring Centres	Total under VCRMC
	(2016-17)	
Aurangabad	17250.00	92150.00
Buxar	3240.00	30597.00
Chatra	37922.00	59482.00
Cooch Behar	19354.00	67340.00
East Singhbhum	25500.00	64600.00
Gumla	27156.00	127156.00
Jehanabad	18500.00	91663.00
Koderma	20470.00	40100.00
Malda	17050.00	37500.00
Nawada	25250.00	327641.00
Palamu	6600.00	24000.00
Port Blair	2380.00	30304.00
Saran	7000.00	67000.00
Supaul	20473.00	87485.00
South 24 Parganas	31913.00	226159.00
Godda	15000.00	45000.00
Banka	16354.00	16354.00
Total	311412.00	1434531.00

Capacity Building

A total of 584 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 11425 farmers and farm women (8811 male and 2614 female) during 2016-17. Thematic areas covered on SRI, scientific crop management, crop diversification, land shaping, green manuring, natural resource management, resource conservation technology, animal feed management, nursery raising, pest and disease management, weed control, vermicompost, value addition, livestock management, oilseed and pulse demonstration, farm implements, drudgery reduction etc. The HRD programme conducted on the basis of priority area of farmers or farm women.



Capacity Building programme conducted in NICRA adopted villages

Extension Activities

NICRA implementing KVKs conducted a total of 1741 extension activities on various thematic areas benefitting 17121 practicing farmers and farm women (11584 males and 5537 females) during the year 2016-17. The extension activities were conductedon Method demonstrations, Agro advisory services, Awareness camp, Animal Health Camp, Krishak Chaupal, Kishan gosthi resource conservation technologies, celebration field and farmers' days, diagnostic visits, group discussion, technology week, Kisan mela *etc*.



Extension activities at NICRA adopted villages

Convergence by NICRA with Ongoing Development Programmes

A number of interventions were taken up by NICRA KVKs during the year in convergence with developmental programs which are operational at the village level. Support from these developmental programs was used for scaling up of proven interventions in the village. In case of NRM, support was mobilized for various water harvesting structures, recharge structures, micro irrigation systems, polythene lining of farm ponds, deepening of drainage channels, distribution of green manuring seed to large number of

farmers, tree planting including horticulture etc. In crop production, convergence with line departments was used for increasing the spread of HYV of food crops, promotion of cultivation practices such as SRI, Direct seeded Rice in various states. In case of animal husbandry, interventions such as animal vaccination camps, and health camps, timely availability of medicines, large scale production and availability of improved fodder crop seed, planting material and material for silage making were taken up in convergence. Capacity building of the farmers in NICRA villages was also taken up in convergence in the form of trainings and exposure visits as part of the ongoing programs. Efforts were made to enhance the coverage of the interventions in the village with the support of the line departments through convergence. Huge number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development programmes or schemes during 2016-17. The prominent development schemes are MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram Sadak Yojana, BASF, NABARD, Sunderban Development Board, IWMP, Forest Department, IAP Yojana, RKVY etc. The NICRA implementing KVKs were the part of the different convergence programmes from where they generated a handsome amount of Rs. 47720936/- during the year 2016-17.





Convergence Programme through NICRA Project