National Innovations on Climate Resilient Agriculture - Technology Demonstration Component (2019-20)

The climate change impacts on agriculture are being witnesses all over the world, but countries like India are more vulnerable in view of large population depending on agriculture and excessive pressure on natural resources. It has become an important area of concern for India to ensure food and nutritional security for growing population. Indian farmers have evolved various coping mechanisms over time, but these mechanisms are not enough to cope with the extreme weather aberrations witnessed in the recent years. Therefore, there is a need to use modern science combined with indigenous knowledge of farmers to enhance the resilience of Indian agriculture to climate change. In order to deal with climate change and its impacts, the Indian Council of Agricultural research (ICAR) initiated National Innovations in Climate Resilient Agriculture (NICRA), a multi-institutional, multi-disciplinary network project in 2011. The rationale for Technology Demonstration Component (TDC) is based on the premise that an array of technologies is available to cope with different types of climate related vulnerabilities in National Agricultural Research System. The component TDC of the project has been implemented through Krishi Vigyan Kendras at district level regionally coordinated by ICAR-Agricultural Technology Application Research Institutes (ATARIs).The overall focus of NICRA is on adaption to climate variability which entails appropriate response to contingency situations. The central objective of technology demonstrations in such regions is not on enhancing productivity but on interventions related to coping with vulnerability as well as improvement in natural resource use efficiency for sustaining the productivity gains. In the context of climate variability, farmers need to adapt quickly to increasing frequency of drought, flood and other extreme events to stabilize crop yields and farm income. Over the years, the National Agricultural Research System has developed an array of practices and technologies to foster stability in agriculture production against the onslaught of seasonal variations.

Climatic vulnerability of selected 9 KVK districts of West Bengal, Odisha and Union Territory of A & N Islands at district level regionally coordinated by ICAR-Agricultural Technology Application Research Institute Kolkata (ATARIs) 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. Enhancing the adaptive capacity and building resilience of the farming communities is important in the context of climate variability and to cope with these extreme events effectively. The NICRA village was selected based on vulnerability of agriculture to climatic variability. The multidisciplinary team of KVK analyzed the constraints related to climatic variability based on secondary weather data, resource situation, farming systems and agricultural yields in the past few years. Thus the interventions executed in NICRA villages by the NICRA-KVKs through the intervention like Natural Resource Management, Crop Production, Livestock, Institutional Intervention, Capacity Building and Extension Activities have not only enabled the farmers to cope up climatic vulnerability as well as it plays a key role in farmers' adaptive capacity along with sustainable agricultural production.

Natural Resource Management

Total 1117 numbers of farmers were benefited covering 247 ha land from this module. Different demonstration like summer ploughing, green manuring, zero tillage, organic mulching etc. under *In-situ* moisture conservation technologies have been demonstrated in 9 NICRA adopted villages covering 87.20 ha among 472 no. of farmers. The technologies followed mainly by zero tillage operation. More than 35 ha have been brought under Broad Bed and Furrow intervention with significant impact among the farmers in A&N Island. Ridge and furrow method sowing of maize to increase water use efficiency and to avoid water logging. Water harvesting and recycling for supplemental irrigation through renovation of pond, well and canal, sand check dam, making bund, 5% model etc. were demonstrated in adopted villages by the different KVKs involving 311 numbers of farmers. Zero tillage technology successfully implemented in more than 51.2 ha area of 157 numbers of farmers under wheat, lentil and chickpea as Resource Conservation means. Water saving irrigation methods like sprinkler irrigation, LEWA in rice, RBF in brinjal, micro-lift irrigation in rice demonstrated in NICRA adopted villages covering an area of 38 ha in 132 farmers fields. There were 25 new rainwater harvesting structures have been developed and 32 numbers renovated which could store 294565 cu m of water having protective irrigation potential 345 ha. This intervention increased the cropping intensity to the maximum extent upto 250%. Around 223 q compost prepared from solid wastes was added to the soil through which 34 thousand carbon sequestrations was done during 2019-20. Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in rice covering 29.1 ha area in 44 farmers' fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (53.5 q/ha) and benefit: cost ratio (2.25). Land shaping with *ail* cultivation and rain water harvesting structure have been constructed covering 2.51 ha area during post *kharif* to mitigate the scarcity of irrigation water, increase in soil carbon and reduce soil salinity.






Crop Production

Under Crop Production module different area specific intervention were taken by viz. demonstration of drought, salt and flood tolerant/ resistant varieties, advancement of planting dates of *rabi* crops to avoid terminal heat stress, water saving paddy cultivation methods like 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, low temperature tolerance, promotion of pulses utilizing post-monsoon rainfall, integrated crop/pest/disease management, growing vegetables as contingency crop, integrated crop management, integrated disease management, contingency crop, were covered which benefitted 2189 farmers. Drought tolerant rice varieties like *Sahbhagi*, *Anjali, Naveen* and *Abhishek* were demonstrated in 74.3 ha areas of 615 number of farmers' field. Salt tolerant varieties of paddy like *Gosaba 5*, *CARI Dhan-5, Usar Dhan-5, Jarava, Geetanjali, SR-26B* and *Amalmona* were demonstrated in 13.1 ha area in 116 farmers' fields. *Javarva, Geetanjali* and *Amalmona* varieties proved maximum salt tolerant potential by giving highest yield of 44.8 q/ha and more economic return (BC ratio of 2.23). Flood tolerant varieties of rice like *Swarna Sub 1, Sabita* and *Dudheswar* were demonstrated in 24 ha area in 119 farmers' field by giving yield of 44.0 q/ha with an economic return 2.33. To avoid terminal heat stress in crops like rice, wheat, lentil, mustard, potato, *etc.* were sown in 12 days advance during *rabi* season. These demonstrations were carried out in adopted villages involving 191 number of farmers' fields with an area of 31.6 ha land. An area of 34.3 ha was covered for staggered community nurseries of paddy, brinjal, cauliflower, tomato which benefitted 175 numbers farmers. Introducing different crops like ol (var. *HYV Gajendra*); cauliflower (var. *MSN-16*) rice (var. *Pusa Bold* and *Pusa 362*); tomato (var. *Param F1*) etc. in Kendrapara and Jharsaguda as less water requiring crop as contingent crop planning during deficit rainfall in *kharif*. An area of 138.2 ha was covered for crop diversification of paddy, brinjal, cauliflower, lentil, cabbage which benefitted 855 numbers of farmers. In Jharsuguda, Sonepur and Ganjam ridge and furrow practice is followed in large scale. Crop diversification by hybrid maize is carried out. Near about 118 farmers have adopted in those districts. Various intercropping systems were demonstrated in regions which are prone to drought. Intercropping systems are considered as one of the important adaptation mechanism for variable rainfall situations. Intervention on location specific intercropping was demonstrated in almost all adopted villages. Total 2189 numbers of farmers were benefitted covering 387.5 ha of land.



Livestock and Fisheries

Livestock and Fisheries module comprising various livestock centric interventions were carried out which include use of community lands for fodder production during drought/flood, improved fodder/feed storage methods, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water, breed up-gradation, balanced feed and fodder management through mineral mixture, feed blocks and silage making, azolla feeding, breed animal health management through deworming and vaccination, fish pond cleaning and fish farming, pig farming, clean milk and fodder production. These interventions benefitted 465 livestock owner with 4097 animals in vaccination programme. Adequate supply of fodder, either green or dry, is crucial to the livelihoods of livestock in rainfed areas. Delayed onset and deficit rainfall conditions were experienced in several states. There was reduction in area under millets and pulses, which are important to meet the fodder requirements in the 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 flow from animal husbandry Improved fodder of rice bean and silage making were demonstrated in farmers fields. Community lands of an area of 189.3 ha involving 363 number of farmers utilized for different fodder production were demonstrated in different adopted villages. Berseem, oat, sudan chari, maize, hybrid napier were the major fodder produced in the programme. Of all these demonstration legume Sudan grass showed maximum benefit return (B: C: 5.59). Silage making for 285 numbers and 7 ha of units showed very promising results. Vaccination camps were organized against FMD of cattle, PPR against goat, Ranikhet of poultry, BQ vaccine, deworming etc. in adopted villages. Mortality rate reduce up to the extent of 90% and average increase in cattle milk yield up to 40% have been recorded after the vaccination camps organized. Demonstration of rural backyard poultry (*Kuroiler, Nicobari fowl*), *Vanraja, Kadaknath*, *Khaki Campbell* duck, *T X D* breed of pig, mineral mixture and azolla as cattle feed were carried out. Improved ornamental bird was introduced through this intervention which also showed very promising results. 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.





Institutional Intervention

Institutional interventions including seed bank, fodder bank, commodity groups, custom hiring for timely operations, community nursery raising, irrigation, collective marketing climate literacy through a village level weather station and awareness developed in almost all NICRA villages. A total of 54 units have been developed covering of 198 ha area of 1785 number of farmers. Custom Hiring Centre has the provision of various farm implements like power tiller, thresher, reaper, water pump, zero-till drill, raised bed planter, sprayer, weeder etc. There is a provision of Mini Automatic Weather Station (AWS) through which farmers are provided weather forecasting data.




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 this programme. VCRMC became operational with opening of a bank account in their name being jointly handled by the President of VCRMC and the Head of the KVK concerned. VCRMC manages the custom hiring centre for farm implements and micro-irrigation systems, seed and fodder bank, community nurseries, collection of farmers share in planting material and inputs, establishment of small weather station in the village, participation of farmers in capacity development programs and exposure visits to learning sites. Institutional interventions including seed bank, fodder bank, commodity groups, custom hiring for timely operations, community nursery raising, irrigation, collective marketing climate literacy through a village level weather station and awareness developed among the farmers in the Zone.

Custom Hiring of Farm Implements and Machinery at NICRA Adopted Villages

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 have now become immensely popular among the farmers and substantial amount has also been generated. 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 of burning of residues and adds to the improvement of soil health and increases water use efficiency. The rates for hiring the machines /implements are decided by the members of 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 maintenance of the implements and 25% share is earmarked as a sustainability 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, mechanical weeder, chaff cutter, conoweeder, duster, sprayer, laveler, FIRB planter, sub-soiler, zero-till frti-seed, disc harrow, bucket laveler, reaper, thresher, cultivator, rotavator, pumpset etc. The status of custom hiring centres are given below.

Name of KVK	*Revenue generated (Rs.)*	
	From Custom Hiring Centres	*Total under VCRMC*
Cooch Behar	43900	62000
Malda	5235	57215
Port Blair	17500	54500
South 24 Parganas	23100	223000
Kendrapara	6800	6800
Sonepur	5000	33000
Jharsuguda	11000	47952
Ganjam	-	14620
Kalahandi	No CHC has been established yet	
Total	**112535**	**499087**





Capacity Building

A total 113 courses were conducted under Capacity Building on various thematic areas benefitting 3127 farmers and farmwomen (2514 males and 613 females) during 2019-20. Thematic areas cover on crop management, natural resource management, nutrient management, integrated crop management, crop diversification, resource conservation technology, pest and disease management, livestock and fishery management, nursery raising, employment generation, nutrient garden, repair and

maintenance of farm machineries and implements, integrated farming system, fodder and feed management, lac cultivation drudgery reduction with farm implements for woman, value addition, human nutrition and child care, rodent control *etc.*





Extension Activities

A total of 299 Extension Activities on various thematic areas benefiting 13134 practicing farmers (7854 males and 5280 females) during the reporting period. The extension activities were conducted on method demonstrations, agro advisory services, awareness animal health camp, Kishan Chaupal, Kishan Gosthi, resource conservation technologies, celebration field and farmers' days, diagnostic visits, school student visit, group discussion, World Earth Day, technology week, kishan mela etc. December 5, 2019 was observed as World Soil Day in the respective KVK and distributed a total of 645 soil health cards among the farmers of NICRA villages.




Convergence by NICRA with Ongoing Development Programmes

Resource Generation through Convergence with ongoing other development schemes is one of the most significant activities achieved by all the NICRA KVKs since the inception of the project. A good number of convergence programmes was carried out by each of the NICRA implementing KVK with ongoing development schemes. The prominent development schemes are MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram Sadak Yojana, Backward Rural Grant Fund, Sunderban Development Board, NFSM, IWMP, IVRI, ICAR-DWR, Forest Department etc. NICRA KVKs being a part of the different convergence programmes during the period of 2019-20.