

National Innovations on Climate Resilient Agriculture-Technology Demonstration Component (2020-21)

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. A nation-wide project, National Innovations on Climate Resilient Agriculture (NICRA), has been working since 2011 to address this challenge by application of science and technology. This project of ICAR aims to enhance 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 151 climatically vulnerable districts across the country. 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. 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 nine 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 754 numbers of farmers were benefited covering 145 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 53.2 ha among 54 no. of farmers. The technologies followed mainly by zero tillage operation. More than 15 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 102 numbers of farmers. Zero tillage technology successfully implemented in more than 35 ha area of 94 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 18 ha in 72 farmers fields. There were 15 new rainwater harvesting structures have been developed and 19 numbers renovated which could store 159565 cu m of water having protective irrigation potential 178 ha. This intervention increased the cropping intensity to the maximum extent upto 250%. Around 154 q compost prepared from solid wastes was added to the soil through which 19 thousand carbon sequestrations was done during 2020-21. Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in rice covering 17.1 ha area in 27 farmers' fields. Ground water recharge through SRI by sub-soiler recorded highest rice 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 2.54 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 1467 farmers. Drought tolerant rice varieties like *Sahbhagi*, *Anjali*, *Naveen* and *Abhishek* were demonstrated in 67.5 ha areas of 407 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 9.3 ha area in 87 farmers' fields. *Javarva*, *Geetanjali* and *Amalmona* varieties proved maximum salt tolerant potential by giving highest yield of 32.5 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 14 ha area in 71 farmers' field by giving yield of 36.0 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 114 number of farmers' fields with an area of 26.3 ha land. An area of 26.3 ha was covered for staggered community nurseries of rice, 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 rice, brinjal, cauliflower, lentil, cabbage which benefitted 657 numbers of farmers. In Jharsuguda, Sonapur and Ganjam ridge and furrow practice is followed in large scale. Cabbage, cauliflower, brinjal, tomato, chili, cowpea, bottle gourd in total areas around 50 ha with an high average annual income. Crop diversification by hybrid maize was carried out. Near about 64 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 1467 numbers of farmers were benefitted covering 251.8 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 312 livestock owner with 2665 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 112.3 ha involving 210 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 157 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* and *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 31 units have been developed covering of 154 ha area of 1288 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, disc harrow, bucket laveler, reaper, thresher, cultivator, rotavator, pumpset etc.



Capacity Building

A total 124 courses were conducted under Capacity Building on various thematic areas benefitting 2854 farmers and farmwomen (2596 males and 258 females) during 2020-21. 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 165 Extension Activities on various thematic areas benefiting 7548 practicing farmers (3525 males and 4023 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, 2020 was observed as World Soil Day in the respective KVK and distributed a total of 425 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. The NICRA KVKs were the part of the different convergence programmes during the period of 2020-21.

