

## **National Innovations In Climate Resilient Agriculture - Technology Demonstration Component (2018-19)**

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. 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. The 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. The 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 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 Institutes (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 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. Climatic vulnerability of selected 9 KVK districts of Odisha, 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**

Total 2505 numbers of farmers were benefited covering 648.6 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 85.8 ha among 454 no. of farmers. The technologies followed mainly by zero tillage operation. More than 31 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 265 numbers of farmers. Zero tillage technology successfully implemented in more than 44 ha area of 124 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 paddy demonstrated in NICRA adopted villages covering an area of 36 ha in 124 farmers fields. There were 40 new rainwater harvesting structures have been developed and 38 numbers renovated which could store 393091 cu m of water having protective irrigation potential 352 ha. This intervention increased the cropping intensity to the maximum extent up-to 250%. Around 220 q compost prepared from solid wastes was added to the soil through which 37 thousand carbon sequestrations was done during 2017-18. Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in paddy covering 32 ha area in 41 farmers' fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (55.5 q/ha) and benefit: cost ratio (2.24). 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, 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 2904 farmers. Drought tolerant paddy varieties like *Sahbhagi*, *Anjali*, *Naveen* and *Abhishek* were demonstrated in 76.2 ha areas of 627 number of farmers' field. Salt tolerant varieties of paddy like *CARI Dhan-5*, *Usar Dhan-5*, *Jarava*, *Geetanjali*, *SR-26B* and *Amalmona* were demonstrated in 12.3 ha area in 130 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 paddy like *Swarna Sub 1*, *Sabita* and *Dudheswar* were demonstrated in 23 ha area in 114 farmers' field by giving yield of 45.0 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 180 number of farmers' fields with an area of 33.7 ha land. An area of 38.6 ha was covered for staggered community nurseries of paddy, brinjal, cauliflower, tomato which benefitted 187 numbers farmers. Introducing different crops like ol (var. *HYV Gajendra*); cauliflower (var. *MSN-16*); paddy (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 140.5 ha was covered for crop diversification of paddy, brinjal, cauliflower, lentil and cabbage which benefitted 855 numbers of farmers. In Jharsuguda, Sonapur and Ganjam ridge and furrow practice is followed in large scale. Crop diversification by hybrid maize is carried out. Near about 120 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 2904 numbers of farmers were benefitted covering 452.8 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 914 livestock owner with 1586 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 178 ha involving 908 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* and *Nicobari fowl*), *Vanraja*, *Kadakhnath*, *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. *Khaki Campbell* duck was also introduced through this intervention.





## 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 48 units have been developed covering of 191 ha area of 1455 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, 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	36600	55416
Malda	23570	55215
Port Blair	18500	44500
South 24 Parganas	52932	231661
Kendrapara	Nil	24800
Sonepur	33000	35000
Jharsuguda	34555	5200
Ganjam	12000	12000
Kalahandi	No CHC has been established yet	
<b>Total</b>	<b>211157</b>	<b>463792</b>





## Capacity Building

A total 175 courses were conducted under Capacity Building on various thematic areas benefitting 3388 farmers and farmwomen (2603 males and 785 females) during 2018-19. 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 874 Extension Activities on various thematic areas benefitting 8435 practicing farmers (5512 males and 2923 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, group discussion, World Earth Day, technology week, kishan mela etc. The December 5, 2018 was observed as World Soil Day in the respective KVK and distributed a total of 1555 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 were MGNREGA, National Micro and Minor Irrigation Scheme, *Pradhan Mantri Gram Sadak Yojana*, Backward Rural Grant Fund, Sunderban Development Board, NFSM, IWMP, IVRI, Forest Department etc. The NICRA KVKs worked a part of the different convergence programmes during the period of 2018 to 2019.

