**NATIONAL INNOVATIONS IN CLIMATE RESILIENT AGRICULTURE - TECHNOLOGY DEMONSTRATION COMPONENT**

A nation-wide project, National Innovations in Climate Resilient Agriculture (NICRA), has been launched in 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 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.

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 459 farmers in 95.2 ha area. Water harvesting and recycling forb supplemental irrigation were demonstrated in 17 NICRA adopted villages by the different KVKs involving 1106 numbers of farmers. Conservation tillage in wheat, paddy, lentil, pea and chickpea demonstrated in various NICRA adopted villages in an area of 244.7 ha of 447 numbers of farmers. The technologies followed mainly by zero tillage operation. Wheat with cultivation through ZTD showed maximum yield of 35- 43 q/ha. Zero tillage technology showed very promising results in pulse and oilseed cultivation. Pea (Var. Arkel) gave highest economic return (B:C ratio:: 2.72) amongthe pulse demonstration through ZTD. Artificial ground water recharge done by field bunding, water management and through SRI by sub soiler in paddy in various NICRA adopted villages covering 71.0 ha area in 100 farmers fields. Ground water recharge through SRI by sub-soiler recorded highest paddy yield (56 q/ha) and benefit: cost ratio (2.14). 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 81.0 ha in 358 farmers fields. There were 131number of rainwater harvesting structures have been developed which could store 602046.5 cu m of water. This intervention increased the cropping intensity to the maximum extent upto 300%.

 

Plastic Mulching Azolla cultural unit

 

Renovation of Canal

**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 2182 number of farmers in 557.0 ha area. Drought tolerant paddy varieties like Sahbhagi, Anjali, Naveen, Abhishek were demonstrated in 238.0 ha areas of 767 number of farmers’ field, among which Sahbhagi with drum seded showed highest yield potential (47.5 q/ha) and economic return 2.40 with maximum increase (60%) as compared to local check. Shorty duration variety of potato pukkhraj gave maximum economic return (B:C ratio of 3.41). Salt tolerant varieties of paddy like CARI Dhan-5, UsarDhan-5, Jarava, Geetanjali, SR-26B, Amalmona were introduced in 72.6 ha area in 162 farmers’ fields. Javarva, Geetanjali and Amalmona varieties proved maximum salt tolerant potential by giving highest yield of 49.0 q/haand more economic return (BC ratio of 2.35).Flood tolerant varieties of paddy like Swarna sub 1 and Sabita were introduced through demonstration in 32.0 ha area in 125 farmers’ fields.To avoid terminal heat stress in crops like rice, wheat, lentil, mustard, potato, *etc.* were sown in 12 days advance (avg) during rabi season. These demonstrations were carried out in seven NICRA adopted villages involving 393 number of farmers’ fields.Water saving paddy cultivation through SRI, short duration varieties, direct seeded rice, brown manuring *etc.* have been demonstrated in 229.6 ha area of 702 number of farmers’ fields. These interventions were carried out in 12NICRA adopted villages. Among all the interventions paddy cultivation with Sahbhagi variety showed highest increase in yield whereas paddy cultivation with variety RajendraSweta with ZTD gave maximum economic return in the tune of BC ratio of 2.97.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 rabicrops. However, Bihar experienced aberrant rainfall situations in 5 out of the previous 10 years impacting adversely rice production and livelihood of farmers. It appeared that failure of rain in July is responsible as transplanting of paddy is delayed with resultant adverse effect on productivity and a cascading negative impact on rabi crops. 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 40.5 ha area of 231 numbers of farmers. These interventions were carried out in 12NICRA 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 157.6 ha area of 916 number of farmers’ fields. Introduction of *ol*(var. Gajendra) in the cropping pattern.

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**LIVESTOCK AND FISHERIES**

Use of community lands for fodder production during drought/flood, improved fodder/feed storagemethods, preventive vaccination, improved livestockdemonstration, improved shelters for reducing heat stressin livestock, management of fish ponds/tanks duringwater scarcity and excess water.

Community lands of an area of 182.5 ha involving 1098 number of farmers utilized for different fodder production were demonstrated in ten different NICRA adopted villages. Berseem, oat, sudanchari, maize, hybrid napierwere the major fodder produced in the programme. Of all these demonstration quality legume Sudan grass demonstrated showed maximum benefit return (B:C:: 5.54).Adequate supply of fodder, either green or dry, is crucialto the livelihoods of livestock in rainfed areas. In 2015-16, delayed onset and deficit rainfall conditions wereexperienced in several states. There was reduction inarea under millets and pulses, which are important tomeet the fodder requirements in the rainfed areas. Shortand medium duration fodder cultivars of several cropsand fodder species both in *kharif*and *rabi*seasons weredemonstrated in farmers’ fields under rainfed and limitedirrigation conditions to support income and cash flowfrom animal husbandry Improved fodder of rice beanand silage making were demonstrated in farmers fields. Silage making for 18 numbers and 1.5 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 17 different NICRA adopted villages. Mortality rate reduce up to the extent of 100% and average increase in cattle milk yield upto 40% have been recorded after the vaccination camps organized.Composite and cat fish rearing in the existing pond or in renovated pond were demonstrated in 140 farmers fields of NICAR adopted villages. Khaki Campbell duck was also introduced through this intervention**.**Demonstration of rural backyard poultry (kuroiler, Nicobari fowl), khaki Campbell duck, T X D breed of pig, mineral mixture and azolla as cattle feed werecarried out in 480 number of farmers fields. Improvedornamental bird was introduced through this intervention which showed very promising results (B:C :: 5.94). 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.





Vaccination Programme of Animal Vaccination

**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, introduction of weather index based insurance and climate literacy through a village weather station and awareness developed of 3684 number of farmers in the zone.

 

Seed Bank

**VILLAGE CLIMATE RISK MANAGEMENT COMMITTEE (VCRMC)**

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 onthe technological interventions to be implemented at the village in consultation with the KVK.

 

Zonal Monitoring Committee interacting with VCRMC members of NICRA village

**CUSTOM HIRING OF FARM IMPLEMENTSAND 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 soilhealth and increases water use efficiency. Custom hiringcentres (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 committeealso uses the revenue generated from hiring charges and deposits in a bank account opened in the name ofVCRMC. The revenue is used for repair and maintenanceof the implements and 25% share is earmarked as asustainability fund. Different types of farm machineryare stocked in the CHCs, the most popular being zerotill drill, Happy seeder, BBF planter, drum seeder, multicropplanter, power weeder and chaff cutter. Each CHCwas provided an initial sum of Rs. 6.25 lakhs for itsestablishment under NICRA project. Revenue generatedthrough Custom hiring and under VCRMC in differentKVKs were presented in the following table.

**Table. Revenue generated through Custom hiring Centres and VCRMC in KVKs**

**Name of KV**

|  |  |  |
| --- | --- | --- |
| **Name of KVK** | **Revenue generated (Rs.)** | |
| **From Custom Hiring Centres** | **Total under VCRMC** |
| Aurangabad | 12253.00 | 69824.00 |
| Buxar | 2240.00 | 30597.00 |
| Chatra | 37922.00 | 59482.00 |
| Cooch Behar | 19354.00 | 67340.00 |
| East Singhbhum | 3500.00 | 36900.00 |
| Gumla | 22788.00 | 84899.00 |
| Jehanabad | 5500.00 | 53332.00 |
| Koderma | 4470.00 | 30110.00 |
| Malda | 7050.00 | 32000.00 |
| Nawada | 10250.00 | 299212.00 |
| Palamu | 6600.00 | 24000.00 |
| Port Blair | 2380.00 | 30304.00 |
| Saran | - | 60000.00 |
| Supaul | 4400.00 | 67012.00 |
| South 24 Parganas | 8070.00 | 199840.00 |
| Godda | 30000.00 | 30000.00 |
| **Total** | **176777.00** | **1174852.00** |

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**CAPACITY BUILDING**

A total of 672 courses were conducted by all NICRA implementing KVKs under Capacity Building Programme on various thematic areas benefitting 13538 farmers and farm women (10858 male and 2680 female) during the year 2015-16. 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.

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Capacity Building programme conducted in NICRA adopted villages

**EXTENSION ACTIVITIES**

NICRA implementing KVKs conducted a total of 1859 extension activities on various thematic areas benefitting 19067 practicing farmers andfarm women (13503 males and 5564 females) during2015-16. 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*.



NICRA 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 2015-16. The prominent development schemes are MGNREGA, National Micro and Minor Irrigation Scheme, Pradhan Mantri Gram SadakYojana, BASF, NABARD, Sunderban Development Board, IWMP, Forest Department, IAP Yojana, RKVY *etc*. NICRA implementing KVKs being part of the different convergence programmes generated a handsome amount of Rs. **50062711/-** during 2015-16.

 

Convergence Programme through NICRA Project

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