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Impact of climate resilient technologies

in Chittoor district of Andhra Pradesh

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Indian agriculture, heavily reliant on monsoons, faces climate sensitivity, with fluctuations in rainfall and temperature significantly impacting crop productivity and threatening food security. Recognizing this challenge, the Indian Council of Agricultural Research (ICAR) launched the National Innovations in Climate Resilient Agriculture (NICRA) programme in 2010-11. NICRA aims to make villages climate-proof by providing site-specific technological demonstrations to enhance farmers' adaptive capacity in climatically vulnerable districts. Implemented by KVK, Chittoor (RASS), the NICRA project in Chittecherla and Deendarlapalli villages in Andhra Pradesh from 2015 to 2021 focused on enhancing agriculture and allied sectors' resilience to climate vulnerabilities through improved production and risk management technologies. As part of this initiative, eleven community irrigation tanks in the villages were renovated to improve surface water storage and groundwater recharge, ensuring water availability for crops over a larger area. Recharging 129 bore wells near the tanks by 3 feet benefitted 242 farmers. The adoption of resilient technologies led to notable increases in yield: paddy by 11.5%, groundnut by 15.8-38%, tomato by 11.6-24.5%, and mango by 12.7%. These climate-resilient practices have played a significant role in mitigating the adverse effects of climatic aberrations in the NICRA cluster villages over the years.

Keywords: Climate, Irrigation, NICRA, Productivity, Resilience, Yield

Implementation of the project

NICRA project was implemented in Chittecherla and Deendarlaaplli villages in Chinnagottigallu mandal in the erstwhile Chittoor district during 2015-2021. The climate is hot at the time of summer season and moderate during winter season. The majority of the soils are red loam and red sands. About 350 farm families are in the village and most of them are small and marginal farmers. The agriculture mainly depend on rains and irrigation under tanks and bore wells. The major crops grown are paddy, groundnut, tomato and mango and farmers depend mostly on dairy activity. The cluster villages received less than normal rainfall, i.e. 770 mm and experiences severe drought situation. The main objective of NICRA project is to motivate the farming community to utilize the available resources effectively and efficiently through conservation of soil and water besides imparting technical skills to improve productivity and livestock management.

Natural resource management: Under this module, interventions related to rain water harvesting, soil and water conservation, green manuring, supplemental irrigation and recharge of bore wells were taken up in the cluster villages.

Renovation of community irrigation tanks

Clearing of unwanted vegetation and deepening of the tanks (11 nos.), strengthening of tank bunds and desilting activities were carried out under NRM activity with community participation. This helped in increasing the water storage capacity (8,721 cu.m) of the tanks and increased ground-water recharge in the bore wells (129 no.) in the vicinity and crops were cultivated in an area of 201 ha which benefited 242 farmers in the cluster villages. Feeder channels were also cleared of vegetation and deepened to improve flow of rain water to the tanks.

Direct sown rice in harvest stage

Govindarajula cheruvu filled with rain water after renovation

Conservation of soil moisture in tomato by using polythene mulch

The KVK conducted demonstrations on the use of polythene mulch with drip irrigation system in tomato for four years (2015-19) with an objective of soil moisture conservation, weed control at critical stages of crop growth and to improve productivity. Polythene mulch of 25 micron thickness was spread over a raised bed on which holes of 4-5 cm diameter were punched with recommended spacing of 90 x 30 cm of tomato (Sweekar 448 variety).

Polythene mulch was effective in conserving soil moisture as the number of irrigations used in farmers practice (without mulch) was 27 during entire crop period while it was only 17 in case of demonstration (with polythene mulch). Weed density was low (41.8/m^2) with polythene mulch in tomato than without mulch (59.5/m^2), since it prevents weed seed germination and physically suppress seedling emergence. About 24.5% increase in fruit yield (69,481 kg/ha) was recorded under polythene mulch when compared to without mulching (55,780 kg/ha). More cost of cultivation (₹20,875 per ha) in the demonstration was due to polythene mulch and it was compensated by achieving higher fruit yield. More net returns, ₹25,311 per ha was recorded with polythene mulch than without mulch (₹2,03,913 per ha). At present, this technology is used by the farmers not only in tomato but other crops also like musk melon, papaya, mango and other vegetable and flower crops in the district in an area of more than 500 ha.

Green manuring in mango for yield improvement

The existing practice is to keep mango orchard interspaces vacant, which resulted in more weed growth, loss of nutrients and fertile soil due to erosion. Hence RASS KVK motivated farmers to adopt green manuring in mango orchards and conducted 200 demonstrations in the cluster villages from 2015-16 to 2018-19. Sunhemp (*Crotalaria juncea*) seed was supplied to the farmers and the same was sown @ 50 kg per ha in the mango orchards. The sunhemp crop was ploughed into soil at flowering stage, which resulted in improved physical and chemical properties of the soil, thereby contributing to higher yield.

Green manuring resulted in 12.7% increase in mango fruit yield (8,605 kg/ha) when compared to farmers practice (7,570 kg/ha). Improvement in fruit yield may be due to balanced nutrient management as green manuring enriched soil with major and micro nutrients and also due to negligible weed growth. At present this technology is disseminated and adopted by farmers in an area of more than 600 ha.

Supplemental irrigation to groundnut using sprinklers

Groundnut is the major oilseed crop grown in the cluster villages in an area of 65 ha under rainfed conditions with low productivity and farmers often experience crop failures due to erratic rainfall at critical stages of crop growth. This adverse effect can be overcome by providing supplemental irrigation using

Mulching in tomato in large scale adoption at NICRA village

Demonstration of drought tolerant groundnut variety Dharani

sprinklers. KVK, Chittoor conducted demonstrations on yield improvement in groundnut by giving supplemental irrigation using sprinklers during *kharif* 2016 and 2017.

During *kharif* 2016, the groundnut crop suffered due to two dry spells (1 to 29 August: 29 days and 30 August to 30 September: 32 days) during cropping season. During *kharif* 2017 also, the groundnut crop faced two dry spells (25 June to 10 July: 15 days and 17 July to 30 July: 15 days) at vegetative phase of the cropping period. KVK supplied sprinklers to farmers through Custom Hiring Center to provide supplemental irrigation to groundnut crop to overcome drought situation. About 38% increase in yield was observed in groundnut with supplementary irrigation using sprinklers (2,140 kg/ha).

Demonstration of Arka Samrat tomato hybrid.

Drought tolerant 'Dharani' groundnut variety

RASS KVK conducted 40 demonstrations on improved, drought and bud necrosis tolerant Dharani groundnut variety from *kharif* 2015 to 2018. Yield potential of Dharani variety is 16-26 q/ha (*Kharif*-rainfed), with 75-77% shelling outturn and 50% oil content. Hundred seed weight is 40-43 g and it is of 100-105 days duration. The variety is drought tolerant (withstands up to 35 days dry spell), uniform in maturity, high SMK (Sound Mature Kernel-90%) and has attractive pods.

Dharani groundnut variety performed better and about 15.8% increase in yield (1,796 kg/ha) was recorded over Kadiri-6 (1,551 kg/ha). It was due to more number of pods, uniform pod maturity and high shelling percentage and drought resistance during dry spells, tolerance to bud necrosis . The technology disseminated to an area of around 1,000 ha in the mandal and nearby mandals.

Triple disease resistant tomato hybrid, Arka Samrat

Traditionally farmers in NICRA cluster villages cultivate private hybrids in tomato crop which are susceptible to diseases like tomato leaf curl virus, bacterial wilt and early blight causing considerable yield loss. Farmers are used to managing diseases by spraying combination of fungicides 8-10 times during cropping period by spending huge amount. Hence RASS KVK demonstrated triple disease resistant tomato hybrid, Arka Smarat during the years 2017-18 and 2018-19. It is resistant to tomato leaf curl, bacterial wilt and early blight with a yield potential of 80-85 t/ha in 140 days. Arka Samrat recorded about 11.6% increase in yield (58,520 kg/ha) when compared to Sweekar 448 (52,200 kg/ha). Cost of tomato production was more in Sweekar 448 due to more amount (₹6,000 per ha) incurred by the farmers for disease control. Disease incidence was not observed in Arka Samrat, whereas about 1-25% incidence was observed in Sweekar 448.

Resource conservation technology in paddy – Direct seeding using drum seeder

Manual transplanting is the most common method of crop establishment in paddy in the cluster villages. It involves nursery bed preparation, nursery growing, care of seedlings, uprooting of seedlings and transport to main field. All these operations requires more number of labour and hence increases the cost of cultivation and also often results in delay in transplanting because of shortage of labour. Increasing water scarcity is also becoming real threat for paddy cultivation. Direct seeding using drum seeder avoids raising of nursery, pulling of seedlings and transportation of the same to main field so that labour requirement for crop establishment is negligible. This method also requires less water as it avoids nursery and reduces crop duration. RASS KVK conducted demonstrations in NICRA cluster villages on direct seeding in rice using drum seeder during 2015 to 2018 during *rabi* season using the variety RNR-15048, which is a fine grain variety of 125 days duration and blast tolerant.

On an average, direct seeded paddy using drum seeder recorded 11.5% higher grain yield (6,442 kg/ha), 18.4% low cost of cultivation (₹47,586 per ha) and 64% higher net returns (₹50,817 per ha) as compared to manual transplanting method. Majority of the farmers in the district are practicing this technology as it overcomes labour shortage, reduces cost of cultivation, water requirement in addition to yield enhancement.

SUMMARY

The implementation of climate resilient technologies played a key role in transforming climate vulnerable agriculture to climate smart agriculture in drought prone villages of erstwhile Chittoor district in Andhra Pradesh. An integrated participatory approach through natural resource management, productivity enhancement in crops paid dividends in transforming this drought prone village into a climate resilient village.

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