

School of Crop Health Policy-support Research (SCHPR)

Aim of the Crop Health Policy-support Research school is to develop policies for biotic stress management in Agriculture. The major thrust areas of the school include is to address contextual policy frameworks that the system demands in crop health research and to implement guidelines and recommendations under the auspices of Sanitary and Phytosanitary Measures (SPS measures) for plant health. Strategic crop health monitoring is required to gain information on pests and pathogens affecting agricultural crops and livestock to keep ahead of the biotic challenges in view of the changing climate and pathogen/pest scenario as well as transboundary invasions. Updating status on spatial and temporal distribution of important diseases/pests of major crops for precision in resistant gene deployment strategy, monitoring new variants of pests/pathogens arising as consequent upon climate change and breakdown of resistant genes for strategizing pre-emptive breeding of resistant cultivars and keeping track of foreign pests/pathogens invading into the country through natural dispersal, transboundary movements and quarantine procedures are the major objectives of the school. Pest risk analysis studies of potential transboundary pests is one of the areas where this school is working as PRA is an essential component of plant health policy, which has direct bearing on trade flow and extent of risk of introduction of plant pests.

Crop Health Policy-support Research school is also undertaking extension research and different projects to reach to farmers in the Chhattisgarh state to disseminate and demonstrate various agricultural technologies in the farmers' fields to enhance the agricultural productivity thereby increasing the income and livelihood of the farmers so that social issues like migration from villages and losing interest of youth in agriculture etc. can tackled. These outreach programmes have been instrumental in increasing awareness regarding scientific way of doing farming activities and capacity building of the farmers. It also aims to empower women farmers and youths.

Major achievements: (2016-2023)

A) Through Farmer FIRST Programme: (ICAR's PAN India and Flagship Programme):

Farmer FIRST project has been implemented in the year of 2016 by ICAR-NIBSM, Raipur to improve the tribal farmer's livelihood through implementing agricultural enterprises integration in rice fallow. The cluster of five tribal villages namely Bakla, Kharaha, Bamhani, Kurraha and Kharri in the Kasdol block of Baloda Bazar district, Chhattisgarh has been adopted for this programme. Total five modules were identified and implemented *viz.* crop based module, livestock-based module, enterprise-based module, horticulture-based module and NRM based module. More than, 500 tribal farm families benefitted under this programme. Under each module, interventions are selected based on the matrix ranking and agro-ecosystem analysis. As a result, the interventions such as goat farming with *Sirohi*, *Jamnapari* and *Barbari breeds*, backyard poultry farming with *Kadaknath* breed, oyster mushroom production, Farmer Communication Centre (FCCs), low cost *Azolla* production, nutritional home garden through IIHR/TNAU vegetable seed kit, drudgery reduction equipment for women farmers through Custom Hiring Centers (CHCs), Agro Processing Centers (APCs), low-cost poly house with drip and poly-

mulching for vegetable production and eco-friendly pest management technologies played vital role in the additional income generation and brought tangible changes in the socio-economic condition of tribal farming community. In economic terms, additional income of Rs. 12,054/- per farm family has been generated through the introduction of crop, livestock, horticulture, enterprise and NRM based modules respectively. In 2020, the sum of Rs. 97.74 lakhs have been generated by the farming community from different enterprises. As a social impact, nearly 26% of farmer's seasonal migration reduced from the adopted villages by this initiative. FFP initiatives attracted 34% of farm women and 20% of rural youth in agricultural activities in the adopted villages. Overall, 24 - 30% of knowledge gain observed among tribal farmers in the selected technologies by the intervention of FCCs, Agricultural Film Shows, Capacity building programmes and social media groups. Significant rate of skill acquisition observed in the adopted technologies such as scientific vegetable production, zero tillage, livestock production and eco-friendly plant protection measures. Woman farmer's drudgery reduced through village level CHCs. Tribal farm families' nutritional level enhanced through nutritional home gardening with IIHR/TNAU seed kits. Total 52 agricultural interventions introduced and sustained in the farmer's field. Cropping intensity has been increased by 120% in the adopted villages. Backward and forwarded production linkages established for crop, livestock and horticulture enterprises. Market linkages established for different commodities produced under this project for the sustainability of the disseminated technologies. In total, 347 capacity building programmes organised and 8417 tribal farmers benefitted under this initiative.

B) Through DBT's Biotech-KISAN Hub (DBT's PAN India Programme):

Establishment of Biotech-KISAN Hub at ICAR-NIBSM, Raipur was implemented in the month of January 2020. Under this project, three aspirational districts namely Korba, Rajnandgaon and Mahasamund are allotted to execute the contemplated project objectives. The main objectives of this project is to popularization of improved rice varieties such as drought tolerant, BPH resistant varieties, nutri-rich rice varieties (developed through biotechnology approaches), application/use of bioagents (like *Trichogramma spp*, NPV, BT, *Trichoderma viride* and *Pseudomonas*) along with complete package of practice at farmers' level in rice and pulses, demonstration of low-cost protected cultivation of vegetables such as coloured capsicum, cucumber and tomato and demonstration of scientific goat farming. In the first phase, we have covered 150 farm families from 15 cluster of villages and generated Rs. 18.79 lakhs of farmer's income through biofortified rice variety namely Zinco MS. Further, we have introduced 14 agricultural interventions in the Kharif season and farmers fully adopted the technologies as well. In addition, Lathyrus crop was demonstrated in the rice fallow to generate additional income with minimal input cost. As a capacity building initiative, we have conducted 150 field demonstration, 47 trainings and 55 farmer-scientist interfaces. Total 879 farmers benefitted under this programme. As an economic impact, additional income of Rs. 12,500 per farm family was generated in the Kharif season. Further, we have introduced and demonstrated the promising interventions such as line sowing, transplanting of rice, seedling/seed treatment with biofertilizers, IPM, IWM, IDM, INM and post-

harvest technology in the farmer's field. Total 60 hectares of farm land covered in the first phase. In the current *rabi* season, pulses and vegetable productions are planned and sowing was completed. Out of 150 farm families, 143 males and 7 female farmers are selected under this programme which includes 3 SC and 49 ST farmers.

C) Through Foldscope Microscopy (DST – SYST & DBT) projects:

The research work on “*surveillance and minimizing the risk of zoonotic diseases among tribal farmers through Foldscope microscopy*” was conceptualized during 2015 at ICAR-NIBSM, Raipur and the proposal submitted to Department of Biotechnology (DBT), Government of India for grant. Subsequently, the submitted proposal was approved by the DBT for one year on pilot basis (2017-18) with the sanctioned amount of Rs. 8.00 lakhs. Under this project, we have explored the socio-economic status, knowledge level of tribal farmers on zoonotic diseases and tribal farmer's attitude/perception towards foldscope microscopy. Total 279 samples collected from different sources to screen the zoonotic and other relevant pathogens. Further, the clinical samples were processed; Fungi (*Aspergillus fumigatus*, *Penicillin sp.*, and *Rhizopus spp.*), pathogenic yeast (*Candida spp.*), Bacteria (*E. coli*, *Pseudomonas spp.*, *Aeromonas spp.* and *Proteus spp.*) were isolated and observed through foldscope microscopy. The blood smear examination for screening of zoonotic hemoprotozoan infections not successful under foldscope microscopy due to low magnification (140x) lens. Therefore, we have diversified our plan of work and objectives to explore the possible utilities of foldscope in different aspects. As a field application, foldscope identified as a novel tool to test the semen quality in straw provided for Artificial Insemination (AI) of cattle at field level. This intervention has the significant scope to increase the conception rate in cattle; which will pave the way for successful grading up of indigenous cattle. Total 146 (images/videos) permanent slides from plant /animal /microorganism /insect samples observed and documented through foldscope. As a capacity building initiative, total number of 19 events organised on foldscope demonstration cum hands-on training, awareness campaign on personal hygiene and zoonotic diseases to tribal farmers and school students. Totally, 846 participants were benefitted from this initiative. Seven rural youths are trained at field level to demonstrate the foldscope microscopy to the needy people. More than 30 types of organisms observed under Foldscope microscopy. The research work on In-situ diagnosis and digital cataloging of plant-pathogenic fungi through Foldscope Microscopy - A frugal science approach was awarded by DST under Scheme for Young Scientists & Technologist (SYST) for three years (2020-23).

Major contribution to Agriculture and allied fields as below.

I. Under Farmer FIRST Project (2016-23):

- Total 634 tribal farmers covered which includes 215 (34%) women and 292 (46%) youth farmers.
- 02 Farmer Communication Center (FCCs) established
- 05 Custom Hiring Center (CHCs) established
- 01 Village Level Soil Testing unit established

- 05 Kadaknath farming cum hatchery units established
- 54 agricultural technological interventions introduced, monitored, evaluated, and sustained at farmer's field
- 07 agricultural enterprises units established
- More than 126 Capacity Building Programme organized and 9750 farmers benefited
- 122 hectare of rice fallow area covered with pulses
- 35% of farmer's migration reduced
- Cropping intensity increased by 122% (22% additional)
- Rs. 118.75 lakhs of additional income generated
- 06 structures (Polyhouse and Poultry shed) established
- 04 small scale Agro-processing Centers (APCs) established
- 11 technology inventories prepared
- 08 success stories documented
- 634 tribal farmer's feedback on recommended farm technologies has been reported to ICAR-NAARM, Hyderabad.

II. Under DBT's Biotech-KISAN Hub (2018-22):

- Total **72 hectares** of land covered under biofortified rice cultivation, rice fallow pulse and vegetable production with poly-mulch and drip system.
- Total **150** farm families (**80 additional**) covered during 2021-22 which includes 8 SC and 49 ST farm families.
- Total 29 technological interventions introduced at farmer's field.
- **Successful Intervention:** Scientific vegetable production with NRM techniques Rice-fallow pulse production with chick pea, lathyrus, linseed and Biofortified rice cultivation with Zinco MS and DRR Dhan 45.
- **Significant Yield increase:** Due to introduction of many promising intervention the yield of Chickpea, Linseed, Tomato, Cucumber, Bottle guard, and Bitter guard has been increased 18, 21, 128, 83.8, 84.6 and 45.5 percent than compared to farmer practices in Rabi. In other hand, Paddy (DRR Dhan - 42), and Pigeon pea (Rajeev Lochan) yield also increased by 20 and 36.65 percent respectively.
- As a tangible product, Biotech-KISAN **Tricho Card** produced at main hub.
- Total **1486 cc** (worth of 1.48 lakh) of native *Trichogramma spp.*, (*Trichogramma japonicum* and *Trichogramma chilonis*) has been produced and distributed to farmers under DBT Biotech KISAN project. About **297.76 ha** of crops covered during Rabi/Kharif under this initiative and 740 farm families benefitted.
- Total **9 units of Low-cost shade net house** established at Farmer's field to produce cucumber and tomato.
- Total income generated: Rs. 37.38 lakhs/- (Rs. 24,920/FF)
- **Three FPGs and One FIG** (Vegetable, Goat and Biopesticides) formed.

- Demonstrated the scientific goat farming with **Sirohi** breeds.
- As a capacity building programme initiatives, total **122 trainings, 57 demonstrations, 21 field day programme** etc organized. As a total, **9,622 farmers benefited** under various capacity building initiatives. Further, GEO-TAGGING photographs uploaded in the Biotech-KISAN portal (<https://icarbiotechkisanhub.in/>).
- A total of **60 farmers** will be benefitted under the Farmers Fellowship programme from three Aspirational Districts namely Korba, Mahasamund and Rajnangaon.
- **Eco-friendly technologies:** Biofertilizer such as *Azospirillum* and Phosphate Solubilizing Biofertilizers (PSB), bioagents *Trichoderma*, *Pseudomonas fluorescens* and *Trichogramma*; Biopesticides *Bacillus thuringnesis*, *Metarhizium anisoplae*, *Baveria bassiana* are popularised for mass adoption.
- **Improved varieties introduced:** Nutri-rich biofortified rice variety (Zinco rice MS & DRR Dhan - 42, 53 and 45), Indira aerobic -1 for drought tolerant, Rajeswari (IGKV R-1), Indira Maheshwari, MTU -1010 for Insect-pest and diseases resistant. In addition, Chickpea (RVG 201 & 202), Linseed (Deepika), Tomato (Arka Rakshak - IIHR), Drum stick (PKM-1, TNAU), Cucumber (Krish - VNR), Bottle guard (Kashi Kirti - IIVR), Bitter guard (Racer - BASF) and Ivy guard (Indira Kundru - 35) varieties also promoted.
- **Model quail farming unit** established at KVK, Mahasamund under Tinkering laboratory to promote quail farming in the aspirational districts of Chhattisgarh.
- As a success story, farmer Mr. Lakhan Lal Kolyare generated additional income of **Rs. 4,60,000** from 2.5 hectare of integrated farming unit established under Biotech-KISAN project.
- Total **16 (11 Men and 5 Women)** biotech-Kisan fellows trained to become master-trainers to help the fellow farmers to adopt productive technological interventions.
- About **57 migrant farmers** returned to villages during COVID-19 pandemic and benefitted under these initiatives.

III. Under DBT Foldscope Project (2018-19):

- Explored the socio-economic status, knowledge level of tribal farmers on zoonotic diseases and tribal farmer's attitude/perception towards foldscope microscopy.
- Total **279 samples** collected from different sources to screen the zoonotic and other relevant pathogens. Further, the clinical samples were processed; Fungi (*Aspergillus fumigatus*, *Penicillin sp.*, and *Rhizopus spp.*), pathogenic yeast (*Candida spp.*), Bacteria (*E. coli*, *Pseudomonas spp.*, *Aeromonas spp.* and *Proteus spp.*) were isolated and observed through foldscope microscopy.
- The blood smear examination for screening of zoonotic *hemoprotozoan* infections not successful under foldscope microscopy due to low magnification (140x) lens.
- As a field application, foldscope identified as a novel tool to test **the semen quality** in straw provided for Artificial Insemination (AI) of cattle at field level. This intervention has

the significant scope to increase the conception rate in cattle; which will pave the way for successful grading up of indigenous cattle.

- Total **146 (images/videos)** permanent slides from plant /animal /microorganism /insect samples observed and documented through foldscope.
- As a capacity building initiative, total number of **19 events** organised on foldscope demonstration cum hands-on training, awareness campaign on personal hygiene and zoonotic diseases to tribal farmers and school students. Totally, **846 participants** were benefitted from this initiative.
- **Seven rural youths** are trained at field level to demonstrate the foldscope microscopy to the needy people.
- More than **30 types of organisms** observed under Foldscope microscopy.

IV. Under DST - SYST Project (2020-23):

- As a field application, foldscope identified as a novel tool to identify plant pathogenic fungal diseases viz. powdery mildew, Leaf blight, Leaf spot and post-harvest diseases etc.
- Total **16 fungal diseases** and their organism were identified based on morphological structure of pathogen and host species. Such as *Golovinomyces cichoracearum*, *Erysiphe polygoni*, *Erysiphe cichoracearum*, *Leveillula taurica*, *Penicillium digitatum*, *Ustilago tritici*, *Albugo bliti*, *Fusarium oxysporum*, *Alterneria sp* and *Rhizophus sp*.
- As a capacity building initiative, **27 Foldscope demonstration cum hands on training** on diagnosis of plant pathogenic fungal diseases organized, and total 102 farmers benefitted including 39 women and 12 rural youth.
- **04 rural youth** trained as village level trainer to demonstrate the Foldscope microscopy as diagnosis tool at village level
- It is found that foldscope as useful tool to diagnose plant diseases at field level.

Extension Research and Outreach Programmes

Farmer FIRST Innovation
A role model for doubling of Chhattisgarh tribal farmers' income

2021

ICAR
NATIONAL INSTITUTE OF
BIOTIC STRESS
MANAGEMENT
Building capacity to build dreams

DBT Biotech-KISAN Hub
Connecting Science with the Farmers

2022

ICAR
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MANAGEMENT
Building capacity to build dreams

Foldscope Microscope
A Novel Tool from Frugal Science

2022

ICAR
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MANAGEMENT
Building capacity to build dreams

Linking
available science and
technology to the farm



Understanding
the location specific
problem of the farmer



Working together
in close conjunction
of scientists and farmers



Productivity
through scientific intervention
for small and marginal farmers






Achievements under Farmer FIRST Programme (2016-22)


Summary

Technology transferred			
Tribal farm families covered 634	Technology introduced 54	Crop varieties introduced 35	Rice fallow covered with pulses 122 ha
Alternative Crops Introduced 12	Area Covered under Horticulture 38 ha	Animal Breeds Introduced 04	Capacity building programmes 347
Farmer Interest Groups (FIGs) 08	Kadaknath Farming cum Hatchery Unit 04	Custom Hiring Centres (CHCs) 04	Model Agro Processing Centre (APC) 01
Small Scale Soil Testing Unit 01	Low-cost Shade Net and Poly House 04	Farmer Communication Centre (FCCs) 02	Model Mushroom Production Unit 02

Impact / Outcome



Additional Income Generated 118.75 Lakh	Income Generated ₹ 12054 (Family/year)
Cropping Intensity Increased by 120%	Migration Reduced by 35%
Women Farmers Empowered 34%	Youth Attracted in Agriculture 20%
ICT Agro Advisory Delivered 1650	Farmers Benefitted 8417



Achievements under DBT - Biotech- KISAN Hub (2020-22)

Summary

Major Achievements (2020-22)

Aspirational District covered 03	Village covered 15	Farm families covered 150	Technology introduced 29
Crop varieties introduced 18	Area Covered under Horticulture 20 ha	Animal Breeds Introduced 03	Capacity building programmes 374
Farmer Interest Groups (FIGs) 04	Area covered under Rice fallow pulses 100 ha	Bio-fortified rice varieties introduced 02	Azadi ka Amrit Mahotsav Organised 20
Model quail farming unit established 01	Low-cost Shade Net and Poly House 09	Alternative crops introduced 08	Tribal farm families covered 49

Impact / Outcome



Additional Income Generated
56.17 Lakh

Income Generated
₹ 37,420
(Per Family)

Cropping Intensity Increased by
130%

Media coverage of Project activities
55

Women Farmers Empowered
32%

Youth Attracted in Agriculture
43%

ICT Agro Advisory Delivered
1264

Farmers Benefitted
11279



Achievements under DBT – DST – SYST – Foldscope Projects (2018-22)

Summary

Major Achievements (2018-22)

District covered for Capacity Building Programme 08	District covered for sampling 15	Villages covered 22	Institutes covered 10
Schools covered 05	Samples collected 407	Diagnosed samples 171	Organisms covered 56
Significant achievement (Semen quality) 01	Capacity building events 42	Total participants 1470	Trainers created 31
Online published (Microcosmos) 297	Bio-agent viability test 02	Number of projects 02	Extension functionaries benefitted 93

