The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT’s mission is to help empower 650 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT is supported by the Consultative Group on International Agricultural Research (CGIAR).

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About ICRISAT

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Order code: CPE 165
325-2009

Sustainable Productivity Enhancement Initiatives in India

Proceedings of Tata-ICRISAT-ICAR Projects’ Review and Planning Meeting

International Crops Research Institute for the Semi-Arid Tropics

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SD Kulkarni
Members: Somnath Roy
KL Sahrawat
KNV Satyanarayana

Local Organizing Committee

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D Damodar Reddy
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Sustainable Productivity Enhancement Initiatives in India

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Editors
SP Wani, P Pathak and KL Sahrawat

12-13 May 2009
Indian Institute of Soil Science (IISS)
Bhopal, Madhya Pradesh, India

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12-13 May 2009
Indian Institute of Soil Science (IISS)
Bhopal, Madhya Pradesh, India

The review and planning meeting was held for the SDTT-ICRISAT-ICAR and SRTT-ICRISAT-ICAR projects whose background, objectives and target regions are described in this report.

**SDTT-ICRISAT-ICAR Project:** Improving Rural Livelihoods and Minimizing Land Degradation through the Community Watershed Approach for Sustainable Development of Dryland Areas

**Background**

Out of the 852 million poor worldwide, 221 million are in India. The country must increase its food production to 250 million tons to feed a population of 1.2 billion people by 2010. Two-thirds of Indian agriculture is largely dependent on rainfall, and current productivity of the rain-fed agriculture is quite low (1 to 1.5 t ha\(^{-1}\)) as against a potential of 2.5 to 7.0 t ha\(^{-1}\). Rain-fed areas are also impacted by poverty, land degradation, malnutrition and water scarcity. The initiative of the Tata-ICRISAT-ICAR project during 2002 to 2007 demonstrated the power of science-led development model for improving agricultural productivity and incomes of the rural poor in India. To meet the millennium development goal (MDG) of halving the number of poor people by 2015, and to meet the challenges thrown by global warming by greenhouse gas emission, coordinated, effort is urgently needed to apply science for a sustainable development in rain-fed areas. Sir Dorabji Tata Trust (SDTT) provided support to ICRISAT to implement an innovative pilot project to develop and validate a farmer-centric community watershed development approach for combating land degradation, which has opened up new vistas for sustainable development in the rain-fed areas. The proposed approach to up-scale the benefits from the first phase of the SDTT-ICRISAT-ICAR project by consolidating the benefits at the nucleus
watersheds in three districts and through empowerment and capacity development to enable up-scaling of the model at the ecoregional level. The second phase for improving rural livelihoods and minimizing land degradation through the community watershed approach for sustainable development, is proposed here. The targeted ecoregion, with assured rainfall and with medium water-holding capacity soils, in the central highlands of Madhya Pradesh and eastern Rajasthan, is selected for upscaling the benefits.

**Workshop Objectives**

1. To consolidate the science-led farmer-centric community watershed approach at the nucleus benchmark watersheds to enhance productivity, and to reduce land degradation in these three districts and to use these sites as the centers of learning for scaling-out the benefits across the three target districts;

2. To scale-out the benefits of productivity enhancement and community watershed management with technical backstopping in the target agro-eco-region of Madhya Pradesh. (7+1 districts) and Rajasthan (7+1 districts); and

3. Capacity-building of lead farmers, development workers, and consortium partners in the target region, and provide technical support to the development agencies in the area of Community Watersheds.

**Target Ecoregions**

The target eco-region for this project is the dryland areas of Madhya Pradesh and eastern Rajasthan with assured rainfall, with medium water-holding capacity soils (Figure 1). The rainfall in Madhya Pradesh varies from 770 to 1690 mm per year; soils are predominantly black soils (Vertisols and Vertic Inceptisols) and loamy Alfisols varying in soil depth. The length of growing period (LGP) varies from 90-180 days and in some cases extends up to 210 days. Major crops grown in the region are soybean, sorghum, maize, rice, pigeonpea, wheat, and chickpea. In eastern Rajasthan covering the districts of Alwar, Banswara, Bhilwara, Jhalawar, Sawai Mathopur and Tonk, the soils are red and black with the rainfall varying from 660 to 1025 mm per annum. The LGP in eastern Rajasthan varies from 90 to 150 days and the main crops
Figure 1. Target ecoregion of Madhya Pradesh and eastern Rajasthan: agro-ecozones, soils and rainfall in the region.
grown are pearl millet, sorghum, maize, wheat, chickpea, mustard and sesame. The LGP in the central highland of Madhya Pradesh varies between 150-180 days, extending up to 210 days in some cases; soils are predominantly red and black. Proposed contiguous districts for scaling-out activities for productivity enhancement are Rajgarh, Shajapur, Sehore, Raisen, Vidisha, Indore and Badwani, in addition to Guna. This eco-region has the potential to grow two crops (200 per cent cropping intensity) with supplemental irrigation during the post-rainy season. However, irrespective of this only 120 to 130 per cent cropping intensity is achieved in Madhya Pradesh. The groundwater table is depleting every year and at the same time causing severe land degradation. In Madhya Pradesh due to perceived fear of waterlogging and risk of reduced yields of the post-rainy season crops, farmers leave two million ha land fallow during the rainy season.

**SRTT-ICRISAT-ICAR project:** Increasing Agricultural Productivity of the Farming Systems in parts of Central India through participatory Research-cum-Demonstrations and Knowledge Sharing Innovations.

**Introduction**

The problem of soil erosion and waterlogging due to high intensity and high rainfall is severe in Madhya Pradesh where black soils are predominant, large portions of the land are kept fallow during the rainy season and in some areas chickpea or wheat is grown during the post-rainy season on stored soil moisture with or without supplemental irrigation. In the rainy season, farmers keep their lands fallow – to the extent of 16456 ha in the two districts of Madhya Pradesh – in spite of fertile soils and assured rainfall. Similarly, after harvesting the rainy season rice crops, in one eastern district of Madhya Pradesh and other extensive areas of Jharkhand are kept fallow, although sufficient moisture remains in the soil for growing a post-rainy season crop. Nutrient depletion is a common problem across these rain-fed areas. Great potential, during the rainy season as well as during the post-rainy season, is left untapped due to the ignorance of farmers about new soil, water, nutrient, and crop management practices and due to lack of availability of seeds of improved cultivars. The resource-poor farmers are neither in a position to invest in NRM technologies, nor have the
capacity to invest in the long-term maintenance of soil fertility as they struggle to fulfill their short-term needs of food and clothing.

Therefore, efficient management and conservation of natural resources in the rain-fed areas of MP and Jharkhand assume much significance. The integrated livelihoods framework for increasing agricultural productivity, incomes, and sustainable use of natural resources by adopting the participatory and holistic farming system approach is essential. In target districts, the productivity enhancement measures available through the integrated water resource management (IWRM) approach (for increasing productivity of rain-fed systems), is quite feasible through participatory-cum-development research for fulfilling the goal of enhancing the overall productivity of farming systems.

**Target Ecoregions**

The target districts for pilot scale interventions are Saraikela Kharsaw and Gumla in Jharkhand and Jhabua and Mandla in Madhya Pradesh. Annual rainfall in Jharkhand varies from 1000-1600 mm, while in Madhya Pradesh it varies from 600 to 1600 mm. About 70-80 per cent of the annual rainfall is received during the southwest monsoon period (June-September). Soils are predominantly black (Vertisols, Vertic Inceptisols), as well as Entisols and Alfisols varying in soil depth. Jhabua and Mandla districts receive annual rainfall of 885 and 1580 mm, respectively, while Gumla and Saraikela Kharsaw receive 1100 and 1400 mm rainfall, respectively. These districts in general are dominated by an agrarian economy. Jamshedpur is also known for its industrial development. The major area in these four target districts falls in the AESRs i.e., 5.2, 10.4, 11, 12.1 and 12.3. Length of growing period (LGP) varies from 120 – 240 days in the target eco-region (Fig 2). Temperatures of above 45 °C are common in the summer months, while in winter, they could be as low as 10 °C.
Objectives

The overall objective of this project is to increase the impact of the development projects in central India through technical backstopping and empowerment of stakeholders to improve livelihoods through increased agricultural productivity and livelihood opportunities via sustainable use of natural resources.

The specific objectives of this technical assistance program are:

• To establish a holistic participatory IGNRM model for the convergence of activities in four nucleus clusters (five villages in each cluster) encompassing suitable technical, institutional, gender equity, and policy options for enhanced agricultural productivity and crop-livestock management systems to alleviate poverty; and
• To provide technical know-how to farmers, landless rural people in the target districts, and partner NGOs supported by the SRTT in the region through empowerment by bringing together learnings from national and international experience.
Dr KL Sahrawat welcomed the participants of the Sir Ratan Tata Trust (SRTT) and Sir Dorabji Tata Trust (SDTT) projects and also the Directors of IISS and CIAE for hosting the workshop. He described the objectives of the workshop as follows:

- to review the progress and synthesize the findings from the work done at different locations under SRTT and SDTT projects;
- to identify emerging issues, discuss up-scaling strategies, and prepare workplans for sustainable use of natural resources and increasing productivity in India.

Mr Kiran Petare presented the CInI initiative of SRTT for the sustainable management of natural resources and improved livelihoods. He mentioned that CInI is the result of an earlier IWMI-Tata project and has six thematic areas of the initiative. The two major crop-based/cropping systems viz. kharif paddy and kharif maize stabilization are more relevant to the current projects, which need to be pursued.

Dr S P Wani made presentation on increasing agricultural productivity of farming systems through participatory research and development and knowledge sharing. He discussed the emerging challenges to food security, physical and social environment and human health in the 21st century. He mentioned that two Tata-ICRISAT-ICAR projects are targeting hot spots of poverty in India with the Integrated Genetic Natural Resource Management (IGNRM) approach to address the problems of increasing productivity without degradation of the natural resources and environment. He described the role of farmer centered watersheds as the entry point for improving rural livelihoods in India. He discussed the role of various interventions made in the watersheds in Karnataka and Andhra Pradesh to enhance productivity and improving livelihoods of the people. Some of the key results presented from the various trials conducted during last cropping season in different states included:
• soil in most of the project target areas were found deficient in secondary and micronutrients viz. S, B and Zn;
• majority of the soils were also found low in organic matter and deficient in primary nutrients;
• in Madhya Pradesh, the improved system increased the soybean yields by 16-44% over the farmers’ practice;
• excellent response to micronutrients were obtained in several crops viz. soybean, chickpea groundnut, blackgram and others;
• seed priming of chickpea was found very effective in increasing the germination and establishment of the crop and reducing soil borne diseases in Saraikela district of Jharkhand;
• KAK-2 variety of chickpea performed best in Gumla district of Jharkhand and gave the highest yield of 1600 kg ha⁻¹;
• initial response to vermicompost application was found quite good in the project target regions;
• new broadbed and furrow maker was developed and tested in the farmers' fields. It was found acceptable by most of the farmers;
• a system of torpicultor operation with tractor was also found acceptable to farmers for BBF making.

He presented the various capacity building activities viz. trainings, exposure visits, farmers field days and others, which were conducted in various districts of Madhya Pradesh and Jharkhand. Finally, he thanked the donors for their support in implementing the watershed works.

Dr A Subba Rao briefly described the activities of IISS and presented its work experiences in the farmers’ fields. Some of the key results and their possible benefits in improving the agricultural productivity were highlighted. He discussed the various soil management options, which can be used to improve soil health and agricultural productivity. The use of some of the industrial wastes in increasing agricultural productivity was presented. He mentioned that his institute has developed soil based improved agricultural practices for different agroclimatic regions of India. He highlighted the need to use balanced nutrient management for increasing agricultural productivity. He mentioned that IISS can associate and complement the works of the Tata-ICRISAT-ICAR projects so that the IISS findings can be taken to the farmers’ fields.
Dr Wani thanked the IISS Director for offering his help and participation in the projects. He highlighted the power of consortium and joining hands to work together in improving the agricultural productivity and livelihoods of the farmers. He appreciated the help of Dr DLN Rao for agreeing to provide Rhizobium culture for the cultivation of 1000 ha of soybean. Dr Wani thanked Dr A Subba Rao and Mr Somnath Roy for their contribution in organizing this workshop at IISS, Bhopal.

**Technical Session I**

*Chair:* Dr DLN Rao  
*Rapporteur:* Dr DH Ranade

In this session three progress reports were presented by Mr JP Sharma BAIF, Mr AS Yadav, BYPASS and Mr Yaseen Khan, CARD.

**Steps towards agricultural development with assistance of Tata-ICRISAT-BAIF by Somnath Roy:** On behalf of BAIF, Madhya Pradesh, Mr JP Sharma made this presentation. He first gave the general information about the project sites viz. total number of villages, districts, participants and area. The baseline information of project villages/districts was also presented. The field level activities taken up during 2008-2009 were described in detail. The crop yield data from the INM and varietal trials were discussed for both *kharif* and *rabi* seasons. In addition to grain yields the data on plant population, the number of nodules per plant, plant height and other crop parameters were also presented and discussed. The exposure visit, farmers’ field days, farmers meetings and trainings were organized to improve the capacity of farmers and NGO staff.

**Sustainable livelihoods through community watershed approach in Raisen and Sagar districts of Madhya Pradesh by Mr Akhilesh Singh Yadav:** Mr Yadav presented the social and area profile of the project villages in Sagar and Raisen districts. He discussed various interventions, which were taken up during the *kharif* and *rabi* seasons. The yield data were presented and discussed for both districts. He also presented the farmers perceptions/observations about the various improved technologies. The capacity building activities viz. farmers’
trainings, exposure visit, and farmers’ meetings were taken up and presented. He also gave list of equipment viz. BBF maker, weighing machine and efficient irrigation equipments, which are needed to improve the effectiveness of scaling up of the technologies and data collections.

**CARD Progress report on productivity enhancement in Madhya Pradesh by Mr Vivek Sharma:** Mr Sharma first spoke about his organization CARD. He mentioned that his organization’s vision is “empowered communities and self sustained habitats”. Currently, his organization is working in several districts of Madhya Pradesh and Chhattisgarh. For the Tata-ICRISAT project, the baseline data have been collected. He mentioned that several activities viz. PRA and baseline survey of five villages, distribution of improved seeds, income generating activities, formation of seed bank, fodder production and capacity building activities were taken up. Good results have been obtained from these activities. The concept of vermicompost has been demonstrated to villagers. Several capacity building activities were taken up both for the farmers and project staff. Finally, he spoke about a few problems faced in the project execution during the first year. He also presented the application of advanced technology “GIS based planning and mapping of project area” with assistance from M/s Suzlon. Excellent baseline maps of the project area have been prepared and presented. This was highly appreciated by the participants.

These presentations were followed by good discussions. It was suggested that other component activities, which were not been covered should also be included in the 2009-10 workplans. It was also informed that BBF system brought new area under cultivation, which was otherwise left fallow during *kharif* due to waterlogging. It can be adopted without much problem.

In the end, Dr DLN Rao, Chairman, congratulated all the speakers for their presentations. He also suggested that all the partners should develop baseline/village maps as prepared by CARD.

Dr Wani proposed the vote of thanks.
Technical Session II

Chair: Dr PK Mishra  
Rapporteur: Mr Prabhakar Pathak

The key points from various presentations and the discussions held during this session are as follows:

**GVT progress report on productivity enhancement in Jhabua, Madhya Pradesh:** Mr Kumar Sharma presented the biophysical and social constraints of the Jhabua district. He explained the rainfall pattern, topography, soil type and major cropping systems of the area. He expressed that there is excellent scope of doubling the agricultural productivity in the district. He described the various activities, which were undertaken under the Tata-ICRISAT project during 2008–09. Results from the integrated nutrient management trials in the *kharif* and *rabi* seasons were discussed. Good response to nutrients was obtained in paddy, soybean and maize in the *kharif* season and gram and wheat in the *rabi* season. Other activities undertaken were also explained. The exposure visits, farmers field days and capacity building related activities were also undertaken. Results from some similar programs viz. NABARD Wadi, and Gregs watershed were also discussed.

**FES progress report on productivity enhancement in Mandla, Madhya Pradesh:** Mr Sanjay Kumar Chaudhary gave brief presentation about his organization, FES (Foundation for Ecological Security). He mentioned that his organization works towards the ecological restoration and conservation of the land and water resources. The activity by FES is in five eco-regions with 1200 village institutions in 24 districts of six states in India. The FES is currently working on watershed programs in seven *gram panchayats* covering about 700 ha of land. The watershed activity primarily includes construction of farm ponds, fodder production, field bunding, revegetation of the common lands and introduction of economically lucrative crops. The main focus has been on strengthening the livelihoods portfolio of farmers. He also presented progress of various activities under Tata-ICRISAT project in Mandla district. The exposure visit of farmers to ICRISAT and farmers field days were organized for the best agricultural practices. The soil testing of stratified farmers’ fields has been done. He expressed that in
the coming cropping season, more productivity enhancement activities will be undertaken under the Tata-ICRISAT project.

DEEP progress report on productivity enhancement in Rajasthan:
Mr Bachchu Singh Chaudhary presented the progress on various activities of the Tata-ICRISAT project during 2008-09. He described the key features of the two project districts viz. Tonk and Sawai Mathopur in Rajasthan. The major crops/cropping system, land use systems and other details were discussed. The results from the INM, improved crop varieties and fodder trials were highly encouraging, and about 9-30% increase in crop yields were obtained due to improved technologies. The use of sprinklers on vegetable cultivation in summer gave highly encouraging results. The exposure visits, farmers’ field days and other capacity-building activities were undertaken.

TSRDS progress report on productivity enhancement in Seraikela, Jharkhand:
Mr Abhishek Kashyap first presented about the SRTT-CInI project at Saraikela, Jharkhand, which was initiated in 2004 in 16 villages. He presented the objectives of the project and other details. The demographic details and other socio-economic features of the area were discussed. The high yielding varieties were introduced, which gave good results both in the kharif and rabi seasons. He also presented the Tata-ICRISAT initiative with TSRDS. Under this project, the improved varieties of black gram and pigeonpea gave good results. The experience with groundnut and chickpea was also highly encouraging. Other activities taken up under this project, were nursery raising of Gliricidia, installation of rain gauge, and growing three crops with irrigation. Exposure cum training programs were organized on improved agricultural practices.

BAIF Progress report on productivity enhancement in districts of Rajasthan:
Mr DP Tiwari, BAIF, Rajasthan, made the presentation. He first presented the demographic details of the new project districts in Rajasthan, which were taken under the Tata-ICRISAT project. He described the various activities to improve the productivity and rural livelihoods and their impacts in the various districts. The activities related to fodder production during the summer were highlighted. He discussed the various interventions, which were taken to improve the
animal productivity and their impact. The details of the exposure visits, trainings, and other capacity building activities were also presented. The project news coverage in newspapers and other media were also covered. Finally, the targets achieved during 2008-09, and the tentative workplans for 2009-10 were discussed.

These presentations were followed by good discussions. The issue of integrated approach was discussed in detail. The approach which needs to adopt in the tribal areas were also discussed. Low cost and simple interventions need to be emphasized for the poor farmers especially in the tribal areas.

**Technical Session III**

Chair: Dr SP Wani  
Rapporteur: Mr G Pardhasaradhi

In the absence of Dr Bhaskar Mitra, Dr SP Wani chaired this session and Mr G Pardhasaradhi was the rapporteur. In this session total three presentations were made.

**Scientific Interventions in Management of Vertisols for Enhanced Crop Productivity and Input Use Efficiency – IISS Experiences:**

Dr A Subba Rao spoke about strengthening the collaboration between IISS and Tata-ICRISAT-ICAR projects. He discussed about the Vertisols and its physical constraints. Then he discussed conservation tillage for soybean-wheat system and explained about the enhanced water use efficiency under limited water supply. He also discussed soil fertility constraints for various cropping systems. He mentioned the impact of FYM and fertilizer P and residual P management of Vertisols on production sustainability under soybean-wheat system. He also presented results on the use of balanced fertilization with broad-bed furrow system (BBF) in soybean fields prone to waterlogging. Finally, he discussed the integrated nutrient management technologies for pulses and cotton.

**Strengthening collaboration between JNKVV and Tata-ICRISAT-ICAR projects:** Dr DH Ranade described the up-scaling and out-scaling of various technologies for water harvesting and conservation.
Development of water harvesting tank/sunken tanks and its effect on crop productivity was discussed. He mentioned about the impact of improved cropping systems through introduction of new varieties in soybean and chickpea. He also presented the effectiveness of tanks under technical guidance. He explained the value addition to the farm produce and income through the introduction of various improved interventions. Finally, he mentioned that the water storage acts as a catalyst to win the hearts of farmers for their active and effective involvement and to increase crop production and decrease the soil erosion hazards.

**Agricultural drainage technologies for enhancing the productivity of temporary waterlogged Vertisols:** Drs Ramadhar Singh and KV Ramana Rao from CIAE, Bhopal, discussed about the waterlogged areas in India and the various drainage systems used for reducing waterlogging. They discussed the effect of sub-surface drainage on crop yields. It was mentioned that the drainage technology is ready for transfer to farmers’ fields. They also gave the cost-benefit ratio of the drainage system and highlighted that these were economically viable.

Dr SS Bhatnagar, Ex-Regional Manager, National Seed Corporation (NSC), discussed seed production and certification. He emphasized the need for vegetable and fruits seed production. For improving the incomes, village-level food processes units can be considered.

Mr BB Choudary, Indian Oil Corporation Ltd. (IOCL) discussed wasteland development and biofuels. He mentioned that the IOC is involved in increasing the biofuel production.

Dr SP Wani gave the guidelines for the location-wise finalization of the detailed workplans. Finally, he congratulated all the speakers for their good presentations.

These presentations were followed by good discussions. The key discussions were on the issue of sub-surface drainage vs. surface drainage system, the role of water harvesting in reducing risk and village-based seed system.
Technical Session IV

Work Plan Development 2009-10: SDTT-ICRISAT-ICAR Project

Improving Rural Livelihoods and Minimizing Land Degradation through the Community Watershed Approach for Sustainable Development of Dryland Areas

Specific Objectives

• To consolidate the science-led farmer-centric community watershed approach at nucleus benchmark watersheds for enhancing productivity and reducing land degradation in three districts and to use these sites as centers of learning for scaling-out the benefits across the three districts.
• To scale-out the benefits of productivity enhancement and community watershed management with technical backstopping in the target agro-eco-region of Madhya Pradesh and Rajasthan.
• Capacity-building of lead farmers, development workers, and consortium partners in the target region, and provide technical support to the development agency in the area of community watersheds.

Target Region

• Madhya Pradesh - Eight districts (Rajgarh, Sehore, Raisen, Vidisha, Indore, Shajapur, Barwani, and Guna)
• Rajasthan – Eight districts (Alwar, Banswada, Bhilwara, Jhalwar, Sawai Mathopur, Tonk, Dongarpur and Bundi)

Consortium partners for Madhya Pradesh sites

<table>
<thead>
<tr>
<th>Implementing partners</th>
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<tr>
<td>• BAIF</td>
<td>• Dept of Rural Development, Government of Madhya Pradesh</td>
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<td>• BYPASS</td>
<td>• Dept of Agriculture, Government of Madhya Pradesh</td>
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<td>• Indian Institute of Soil Science (IISS)</td>
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<td>• Central Institute of Agricultural Engineering (CIAE)</td>
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<td>• Zilla Panchayat</td>
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<td>• KVKs</td>
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## Consortium partners for Rajasthan sites

<table>
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<tr>
<th>Implementing partners</th>
<th>Other partners</th>
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<tr>
<td>• BAIF</td>
<td>• Dept of Watershed Management</td>
</tr>
<tr>
<td>• DEEP</td>
<td>• Dept of Agriculture and Extension</td>
</tr>
<tr>
<td></td>
<td>• Rajasthan Agricultural University and Maharana Pratap University of Agriculture and Technology</td>
</tr>
<tr>
<td></td>
<td>• Central Arid Zone Research Institute and Central Research Institute for Dryland Agriculture</td>
</tr>
<tr>
<td></td>
<td>• Zila Parishad</td>
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<td></td>
<td>• Krishi Vignana Kendra, National Bank for Agriculture and Rural Development</td>
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## SDTT-ICRISAT-ICAR Project Workplan 2009-10

### Main activities and sub activities proposed to undertake during 2009-10.

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<thead>
<tr>
<th>Activities</th>
<th>Main partner name</th>
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<tr>
<td></td>
<td>Rajasthan</td>
</tr>
<tr>
<td></td>
<td>BAIF (15 vill.)</td>
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<tr>
<td></td>
<td>DEEP (3 vill.)</td>
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<tr>
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<td>BAIF (26 vill.)</td>
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<tr>
<td>Soil fertility enhancement</td>
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<tr>
<td>Vermicompost</td>
<td>110(5)</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>27 vermi</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank silt application</td>
<td>5 tank</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Gliricidia</td>
<td>500 RMT in each</td>
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<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Increasing water use efficiency</td>
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<tr>
<td>BBF system</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>20 ha</td>
</tr>
<tr>
<td></td>
<td>20 ha</td>
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<tr>
<td></td>
<td>5 ha</td>
</tr>
<tr>
<td></td>
<td>200 ha</td>
</tr>
<tr>
<td>Contour cultivation with conservation furrow</td>
<td>25 ha</td>
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<tr>
<td></td>
<td>25 ha</td>
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<td>25 ha</td>
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<td>5 ha</td>
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<td>-</td>
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<td>Field bunding &amp; deep tillage</td>
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<td></td>
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<td></td>
<td>-</td>
</tr>
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<td>Crop intensification</td>
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<td>Rainy season fallow</td>
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<td></td>
<td>-</td>
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<tr>
<td></td>
<td>25 ha</td>
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<tr>
<td>High value crops</td>
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<tr>
<td>(Vegetable cultivation)</td>
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<tr>
<td></td>
<td>15 ha</td>
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Cont...
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<td>DEEP (3 vill.)</td>
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<tr>
<td><strong>Crop intensification</strong></td>
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<td><strong>Increasing crop yield</strong></td>
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<tr>
<td>Improved cultivars &amp; seed treatment viz.</td>
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<td>50 ha</td>
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<td>Rhizobium + PSB</td>
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<tr>
<td>INM</td>
<td>100 ha</td>
<td>100 ha</td>
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<tr>
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<td>5 nos</td>
<td>2 nos</td>
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<tr>
<td>IPM</td>
<td></td>
<td>10 ha</td>
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<td><strong>Income-generating activities</strong></td>
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<td>Goatry/breed improvement</td>
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<tr>
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<td>5 SHGs</td>
<td>2 SHGs</td>
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<td>AI</td>
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<td>30 ha</td>
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<td><strong>Others</strong></td>
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<tr>
<td>Afforestation</td>
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<td>-</td>
</tr>
<tr>
<td>Urea treatments fodder</td>
<td>2 demo</td>
<td>1 demo</td>
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</table>
Workplan Development 2009-10: SRTT-ICRISAT-ICAR Project

Increasing agricultural productivity of farming systems in parts of central India through participatory research-cum-demonstrations and knowledge-sharing innovations

Specific Objectives

• To establish a holistic participatory IGNRM model for the convergence of activities in four nucleus clusters (five villages in each cluster) encompassing suitable technical, institutional, gender equity, and policy options for enhanced agricultural productivity and crop-livestock management systems to alleviate poverty

• To provide technical know-how to farmers, landless rural people in the target districts, and partner NGOs supported by the SRTT in the region through empowerment by bringing together learnings from national and international experience

Target Districts

• Sariekela-Kharsawan and Gumla in Jharkhand
  1000-1600 mm y⁻¹ rainfall

• Jhabua and Mandla in Madhya Pradesh
  600-1450 mm y⁻¹ rainfall

• Soils  Vertisols, Vertic Inceptisols (Black and Entisols)

Implementing Partners

Jharkhand

• Sariekela- Kharsawan district - TSRDS
• Gumla district - PRADAN

Madhya Pradesh

• Jhabua district - GVT
• Mandla district - FES
**Kharif Plan and Some Key Points 2009-10**

**Rice-based System**

- Saraikela district - transplanting in 10 ha
- Gumla district - transplanting in 15 ha
- Raising common nursery
- Identify farmers with irrigation facility for nursery raising
- Use vermicompost + micronutrient in nursery raising
- Nursery should be sown by the 1st June
- Identify the demonstrations for the double cropping (farmers with land on down stream)
- Early transplanting
- Soil-test based nutrient management
- Nitrogen – Total 80 kg, basal 30 kg, at tillering 25 kg, at flowering 25 kg
- Basal N (30 kg) + P+K+Zn +B+S (mix together)

**Other Crops –Mid and Up Lands**

- Jhabua – Maize-based system (maize and soybean)
- Mandala – Maize and pigeonpea
- Gumla – Pigeonpea, finger millet and tomato
- Saraikela – Vegetables, groundnut, chickpea and greengram

**Tropicicultor:** Five trials in each district

**Varietals Trials (five trials for each crop, 50% cost recovery)**

**Crops**

**Jhabua** – Soybean JS 9305, JS 9560
- maize - hybrid, Chandan safed, JM 421
- groundnut
- Pigeonpea – early mature, perennial

**Mandala** – Pigeonpea – medium duration
- maize hybrid
- groundnut

**Saraikela** – Groundnut, pigeonpea, blackgram

**Gumla** – Groundnut, maize, finger millet
All these trials will be either on BBF or R&F with micronutrients.

**Village Seed Bank:** One seed bank with one crop will be established in each district

**Gliricidia:** 4000 running meters at each location

**Soil and Water Conservation:** Mainly in-situ moisture conservation

**Vermicomposting:** Surface model and four chambers commercial model to be established

**Field Days:** One field day at each location during rainy season

**Yield and Other Data:** Submission by first week of December 2009

**Training and Exposure Visit**
- 10 farmers from each location to ICRISAT exposure visit around September 2009
- Training and exposure visit in the local area institution

**Rabi Crops**
- Wheat and chickpea
- Maize (seed production)
- Mustard
- Greenpeas
- Potatoes

**Jhabua:** – Chickpea JG 410 and KAK 2 (5 trials each)
  – Maize seed production - JM 421 (5 trials)
  – Chickpea seed priming - 5 trials
  – With all best-bet practices

**Mandla:** – Chickpea ICCV 37, JG 11 and KAK 2 (30 trials)
  – With all best-bet practices

**Saraikela:** – Chickpea KAK 2, ICCV 2 (100 trials)
  – With all best-bet practices and seed priming
**Gumla:**
– Chickpea KAK 2, ICCV 2 (20 trials)
  – With all best-bet practices and seed priming

**Field Day:** One field day in a cropping season

**Seed Bank:** One seed bank in each district

**Yield and Other Data:** Yield data to be submitted by 15 April, 2010

**Summer Season**
- Low pressure drip irrigation
- Vegetable cultivation
  – Common nursery
  – Best-bet practices

**Some Other Key Points**
- Baseline survey data should be completed and submitted to ICRISAT on or before 31st May, 2009
- For state – Jharkhand rice-based system should be taken up
- Districts Gumla and Saraikela of Jharkhand and Mandla of Madhya Pradesh
- Fortnightly communication by e-mail to ICRISAT
- Detailed action plan for the year will be prepared by each partner and submitted by 7 June, 2009

**Concluding Session**

*Chair:* Mr Kiran Petare
*Rapporteur:* Dr KL Sahrawat

This session was chaired by Mr Kiran Petare and Dr KL Sahrawat was the rapporteur. In this session, the workplans of SDTT-ICRISAT-ICAR and SRTT-ICRISAT-ICAR projects were presented and discussed. Several suggestions were given to improve the workplans for both the projects. It was decided that individual organization should take this tentative workplan and modify it considering the comments and suggestions made. The final workplan for individual organization should be sent to ICRISAT at the earliest possible. Dr Wani gave the vote of thanks.
Tata-ICRISAT-ICAR Projects’ Review and Planning Meeting
Productivity Enhancement Initiatives in India

12–13 May 2009
Indian Institute of Soil Science (IISS)
Bhopal, Madhya Pradesh, India

Program

Tuesday, 12 May 2009

0930–1000 Registration

Session 1 Inaugural Session

Chair: A Subba Rao
Rapporteur: Piara Singh

1000–1010 Welcome and objectives of the workshopKL Sahrawat
1010–1025 SDTT’s role in improving livelihoods through sustainable management of natural resourcesBhaskar Mitra
1025–1040 CInI initiative for sustainable management of natural resources and improved livelihoodsKiran Petare
1040–1105 Increasing agricultural productivity of farming systems through PR&D and knowledge sharingSP Wani
1105–1120 Chair’s remarksA Subba Rao
1120–1150 Photograph and tea/coffee break
## Session 2  Technical Session I

*Chair:* RA Sharma  
*Rapporteur:* DH Ranade

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1150–1220</td>
<td>BAIF progress report on productivity enhancement in selected districts of Madhya Pradesh</td>
<td>Somnath Roy</td>
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<tr>
<td>1220–1240</td>
<td>BYPASS progress report on productivity enhancement in Madhya Pradesh</td>
<td>Akhilesh Singh Yadav</td>
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<tr>
<td>1240–1300</td>
<td>CARD progress report on productivity enhancement in Madhya Pradesh</td>
<td>Vivek Sharma</td>
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<tr>
<td>1300–1330</td>
<td>Discussions</td>
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<td>1330–1430</td>
<td>Lunch</td>
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## Session 3  Technical Session II

*Chair:* PK Mishra  
*Rapporteur:* P Pathak

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<td>1430–1450</td>
<td>GVT progress report on productivity enhancement in Jhabua, Madhya Pradesh</td>
<td>BS Raghuwanshi</td>
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<td>1450–1510</td>
<td>FES progress report on productivity enhancement in Mandla, Madhya Pradesh</td>
<td>Sanjay Kumar Choudhary</td>
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<tr>
<td>1510–1530</td>
<td>DEEP progress report on productivity enhancement in two districts of Rajasthan</td>
<td>BS Choudhary</td>
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<td>1530–1550</td>
<td>Tea/coffee break</td>
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<td>1550–1610</td>
<td>PRADAN progress report on productivity enhancement in Gumla, Jharkhand</td>
<td>Pankaj Das</td>
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<td>1610–1630</td>
<td>TSRDS progress report on productivity enhancement in Saraikela, Jharkhand</td>
<td>Abhishek Kashyap</td>
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<tr>
<td>1630–1650</td>
<td>BAIF progress report on productivity enhancement in districts of Rajasthan</td>
<td>AK Chourasia</td>
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<td>1650–1750</td>
<td>Discussions</td>
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<td>1900</td>
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Wednesday, 13 May 2009

Session 4  Technical Session III

Chair: Bhaskar Mitra  
Rapporteur: G Pardhasaradhi

0900–0920  Strengthening collaboration between CRIDA and Tata-ICRISAT-ICAR projects  
PK Mishra

0920–0940  Strengthening collaboration between IISS and Tata-ICRISAT-ICAR projects  
A Subba Rao

0940–1000  Strengthening collaboration between JNKVV and Tata-ICRISAT-ICAR projects  
RA Sharma/DH Ranade

1000–1020  Tea/coffee break

1020–1300  Review of day one and working groups for preparing workplans

1300–1400  Lunch

Session 5  Technical Session IV

1400–1545  Finalization of the detailed workplans – location-wise

1545–1600  Tea/coffee break

Session 6  Concluding Session

Co-Chairs: Kiran Petare and Bhaskar Mitra  
Rapporteur: KL Sahrawat

1600–1615  Presentations of the group plans – SDTT-ICRISAT-ICAR project

1615–1630  Presentations of the group plans – SRTT-ICRISAT-ICAR project
List of Participants

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<table>
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<th>Fax</th>
<th>Email</th>
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<td>Choudary B B</td>
<td>GM (Biofuels), IOCL</td>
<td>011-26859056</td>
<td>011-26859270</td>
<td><a href="mailto:bhartchoudhary@iocl.co.in">bhartchoudhary@iocl.co.in</a></td>
</tr>
<tr>
<td>Yusuf Saran</td>
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</tr>
<tr>
<td>Chourasia A Kumar</td>
<td>Chief Program Coordinator</td>
<td>0294-2640133 (O)</td>
<td>0294-2641559 (R)</td>
<td><a href="mailto:sridma@gmailmail.com">sridma@gmailmail.com</a></td>
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<tr>
<td>Dhirubhai D Pandit</td>
<td>PC, BAIF Divisional Office</td>
<td>0747 2447883/ 09460244168</td>
<td></td>
<td>baifbundi-97@rediffmail</td>
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<tr>
<td>Desarkar Pinaki</td>
<td>Programme Officer</td>
<td>0731 4202846/ 09406063457</td>
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<td>Dixit Santosh Kumar</td>
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<td>Gupta Dinesh Prasad</td>
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<td>Hakim Singh Rajput</td>
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**New Delhi 110 026**

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Glimpses of the Workshop

12–13 May 2009
Indian Institute of Soil Science (IISS)
Bhopal, Madhya Pradesh
Group Photograph
PowerPoint Presentations
Objectives

- To review the progress and synthesize the findings from the work done at different locations under SRTT and SDTT projects.
- To identify emerging issues, discuss up-scaling strategies, and prepare workplans for sustainable use of natural resources and increasing productivity in India.

Thank You.
Increasing Agricultural Productivity of Farming Systems through PR&D and Knowledge Sharing

Emerging Challenges in 21st Century

Why is There a Food Shortage?

- Green revolution areas are showing yield fatigue
- Sixty six per cent area is rainfed with hopelessly low productivity of 1 to 1.5 t ha⁻¹
- Increased incomes bringing shift in food choices
- In spite of sufficient FCRs importing food is not a viable option
- Low investments in agriculture by the government
- Farmers are shifting to high-value vegetable and fruit crops—food grain cultivation non-rentnerative
- Rundown of crucial extension system—lack of new knowledge for the farmers
- Weak link between research-extension and development
Tata-ICRISAT-ICAR
Projects: Novel Initiative

- Targeting hot spots of poverty
- Science-based development initiative
- Linking scientists-development agencies, government line departments – farmers –
  A consortium approach

- Process for minimizing land degradation,
  Increasing productivity and incomes while
  sustaining natural resources

Target Ecoregions

Where We Are?

- Project Planning Workshop

Objectives

- Consortium partners
- Objectives
- strategies
- Network of partners
- MOUs were signed

- Detailed workplans for each site were developed
## Convergence of Projects and Resources

- Productivity enhancement initiative thru enhanced WUE in MP and Rajasthan — Ministry of Water Resources, GoI
- A WUE Project for
- BAIF-MP was also facilitated
- Model watersheds with common guidelines in Rajasthan and MP — MoA Project

## Farmer Participatory Soil Sampling

Soil sampling training to farmers of Tajo village of Sarabha Khanna, Adilpur, Bhandara district, Nagpur and Shiyara village of Mahanagaon block, Bhandara district of Madhya Pradesh during May 2006

## Weather Monitoring

Dual purpose manual and recording type rain gauge with rainfall, Min & Max temp, Relative humidity high & low recording data logger installation at Sherbagh et Anarkaud and Hatrapet of Madhya Pradesh

## Summary of Soil Nutrient Status in SDTT-ICRISAT-ICAR Project Sites

<table>
<thead>
<tr>
<th>District</th>
<th>Available N (mg kg⁻¹ soil)</th>
<th>Available P (mg kg⁻¹ soil)</th>
<th>Available K (mg kg⁻¹ soil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhandara</td>
<td>15.8</td>
<td>6.4</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Indoors</td>
<td>12.0</td>
<td>6.4</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Mahoba</td>
<td>12.0</td>
<td>6.4</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Madhya</td>
<td>12.0</td>
<td>6.4</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Rajpura</td>
<td>12.0</td>
<td>6.4</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Bhopal</td>
<td>6.3</td>
<td>6.3</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Bikaner</td>
<td>6.3</td>
<td>6.3</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Bhopal</td>
<td>6.3</td>
<td>6.3</td>
<td>0.6</td>
</tr>
<tr>
<td>No Induced Farmers</td>
<td>20</td>
<td>8.0</td>
<td>2.7</td>
</tr>
</tbody>
</table>
### Summary of soil samples analysis results of chemical properties in SRTT-ICRISAT-ICAR Project Sites

<table>
<thead>
<tr>
<th>Location</th>
<th>Particulars</th>
<th>pH</th>
<th>EC</th>
<th>% org C</th>
<th>Ols. P</th>
<th>Exch-K</th>
<th>Avail-S</th>
<th>Avail-B</th>
<th>Avail-Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarikela-Kharwani District</td>
<td>Average</td>
<td>5.7</td>
<td>0.1</td>
<td>0.4</td>
<td>0.9</td>
<td>36.0</td>
<td>6.0</td>
<td>0.1</td>
<td>0.5</td>
</tr>
<tr>
<td>4% Deficient farmers</td>
<td></td>
<td>77</td>
<td>97</td>
<td>73</td>
<td>83</td>
<td>100</td>
<td>87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giridih</td>
<td>Average</td>
<td>5.8</td>
<td>0.1</td>
<td>0.6</td>
<td>13.0</td>
<td>84.4</td>
<td>4.2</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>4% Deficient farmers</td>
<td></td>
<td>47</td>
<td>23</td>
<td>27</td>
<td>100</td>
<td>100</td>
<td>73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jharkhand</td>
<td>Average</td>
<td>7.0</td>
<td>0.2</td>
<td>0.9</td>
<td>9.7</td>
<td>216.0</td>
<td>6.3</td>
<td>0.4</td>
<td>1.5</td>
</tr>
<tr>
<td>4% Deficient farmers</td>
<td></td>
<td>0</td>
<td>45</td>
<td>0</td>
<td>95</td>
<td>91</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandla</td>
<td>Average</td>
<td>6.6</td>
<td>0.1</td>
<td>0.7</td>
<td>2.8</td>
<td>146</td>
<td>4.8</td>
<td>0.20</td>
<td>0.79</td>
</tr>
<tr>
<td>4% Deficient farmers</td>
<td></td>
<td>14</td>
<td>90</td>
<td>0</td>
<td>90</td>
<td>100</td>
<td>52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Soybean crop yields in water use efficiency trial during kharif, 2008, Madhya Pradesh

<table>
<thead>
<tr>
<th>District</th>
<th>No. of Farmers</th>
<th>Grain Yield (t ha⁻¹)</th>
<th>Increase in WUE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bheria</td>
<td>20</td>
<td>1.46</td>
<td>1.26</td>
</tr>
<tr>
<td>Raisen</td>
<td>14</td>
<td>1.97</td>
<td>1.19</td>
</tr>
<tr>
<td>Gana</td>
<td>19</td>
<td>1.31</td>
<td>1.20</td>
</tr>
<tr>
<td>Sagar</td>
<td>9</td>
<td>1.61</td>
<td>1.13</td>
</tr>
<tr>
<td>Mean</td>
<td>62*</td>
<td>1.59</td>
<td>1.20</td>
</tr>
</tbody>
</table>

* * *

### Results of Integrated nutrient management trials conducted at Hatyadeli village of Meghanagar Block of Jharkhand district of Madhya Pradesh, during rainy season 2008

<table>
<thead>
<tr>
<th>Crop</th>
<th>No of Farmers</th>
<th>Grain yield kg ha⁻¹</th>
<th>% of Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean</td>
<td>15</td>
<td>1910</td>
<td>1560</td>
</tr>
<tr>
<td>Maize</td>
<td>7</td>
<td>5330</td>
<td>4240</td>
</tr>
<tr>
<td>Groundnut</td>
<td>3</td>
<td>2380</td>
<td>2060</td>
</tr>
<tr>
<td>Blackgram</td>
<td>2</td>
<td>1160</td>
<td>1000</td>
</tr>
</tbody>
</table>

### Grain/Pod yield kg ha⁻¹ for different treatment with groundnut and black gram crop rainy season 2008 at Teleya village, Ganti district Jharkhand

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No of Farmers</th>
<th>Crop</th>
<th>Varieties</th>
<th>Grain/seed yield kg ha⁻¹</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variety</td>
<td>10</td>
<td>Groundnut</td>
<td>ICMR1114</td>
<td>870</td>
<td>--</td>
</tr>
<tr>
<td>Variety +</td>
<td>9</td>
<td>Groundnut</td>
<td>ICMR1114</td>
<td>1140</td>
<td>17%</td>
</tr>
<tr>
<td>Variety +</td>
<td>8</td>
<td>Groundnut</td>
<td>ICMR1114</td>
<td>1140</td>
<td>17%</td>
</tr>
<tr>
<td>Variety +</td>
<td>4</td>
<td>Groundnut</td>
<td>ICMR1114</td>
<td>1450</td>
<td>30%</td>
</tr>
<tr>
<td>Variety</td>
<td>2</td>
<td>Black gram</td>
<td>79</td>
<td>710</td>
<td>--</td>
</tr>
<tr>
<td>Variety +</td>
<td>2</td>
<td>Black gram</td>
<td>79</td>
<td>900</td>
<td>27%</td>
</tr>
</tbody>
</table>

### Review and Rabi Planning Meeting in Madhya Pradesh

- Reviewed the progress of kharif trials
- Detailed planning for rabi trials with all the partners
Table 1: Chickpea yield with seed priming technique in rice fallow fields at Sherbida village of Sarikela - Karshaw district of Jharkand during winter 2008

<table>
<thead>
<tr>
<th>SI No</th>
<th>Chickpea Variety</th>
<th>No of Farmers</th>
<th>Area covered ha</th>
<th>Grain yield kg ha⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KAK 2-Kabuli</td>
<td>16</td>
<td>3.20</td>
<td>1610</td>
</tr>
<tr>
<td>2</td>
<td>JG 11-Desi</td>
<td>15</td>
<td>3.10</td>
<td>1165</td>
</tr>
</tbody>
</table>

Table 2: Chickpea yield with seed priming technique in rice fallow fields at Teleya village of Gumla district of Jharkand during winter 2008

<table>
<thead>
<tr>
<th>SI No</th>
<th>Chickpea Variety</th>
<th>No of Farmers</th>
<th>Area covered ha</th>
<th>Grain yield kg ha⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KAK 2-Kabuli</td>
<td>12</td>
<td>1.2</td>
<td>1600</td>
</tr>
<tr>
<td>2</td>
<td>JG 11-Desi</td>
<td>6</td>
<td>0.6</td>
<td>1020</td>
</tr>
<tr>
<td>3</td>
<td>ICC 37-Desi</td>
<td>10</td>
<td>1.0</td>
<td>1050</td>
</tr>
<tr>
<td>4</td>
<td>ICCV 2-Kabuli</td>
<td>8</td>
<td>0.4</td>
<td>1250</td>
</tr>
<tr>
<td>5</td>
<td>ICCV 10-Desi</td>
<td>4</td>
<td>0.2</td>
<td>905</td>
</tr>
</tbody>
</table>

Table 3: Chickpea yield planted after soybean crop at Katang sivini village of Mandla district of Madhya Pradesh during winter 2008

<table>
<thead>
<tr>
<th>SI No</th>
<th>Chickpea Variety</th>
<th>No of Farmers</th>
<th>Area covered ha</th>
<th>Grain yield kg ha⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ICCC 37-Desi</td>
<td>10</td>
<td>3.8</td>
<td>2050</td>
</tr>
<tr>
<td>2</td>
<td>JG 11-Desi</td>
<td>8</td>
<td>1.5</td>
<td>1100</td>
</tr>
</tbody>
</table>

Micronutrient Trials with Vegetable Crop

Tomato crop with micronutrient application at Sherbida village of Sarikela District of Jharkand
Vermicomposting

Vermicompost unit construction is in progress at Sherbida village of Sonlkela district of Jharkhand.

Objectives

1. Proper utilization of animal dung's, and maintain the nutrients and promoted to organic farming.
2. Reduce the dependency of chemical fertilizers.
3. Improve the soil as well as human health.

Training of Farmers

Capacity Building
### GENERAL INFORMATIONS

- **TOTAL AREA (IN ACRE)**: 132
- **TOTAL DISTRICTS**: 6
- **NO. OF VILLAGES**: 26
- **TOTAL PARTICIPANTS**: 132
- **MAJOR CROPS**: Soybean, Maize, Chick Pea
- **TECHNIQUE**: Participatory Integrated Nutrient Management
- **TOTAL BENEFICIARIES**: (UPTO 2008 RABI SEASON) 2900

### PRODUCTIVITY DURING BASE YEAR 2007

<table>
<thead>
<tr>
<th>CROPS</th>
<th>PRODUCTIVITY (in kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STATE</td>
</tr>
<tr>
<td>SOYBEAN</td>
<td></td>
</tr>
<tr>
<td>MAIZE</td>
<td></td>
</tr>
<tr>
<td>CHICKPEA</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Survey of Agriculture by Krishak Jagat*
### Level of Nutrients During Base Year 2007-08

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Nutrients</th>
<th>Critical Limits</th>
<th>Location-wise Findings</th>
<th>Average</th>
<th>Percentage of Deficient Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rabigat</td>
<td>Anandpur</td>
<td>Barnaul</td>
</tr>
<tr>
<td>1</td>
<td>P (ppm)</td>
<td>5.0</td>
<td>6.00</td>
<td>4.30</td>
<td>5.00</td>
</tr>
<tr>
<td>2</td>
<td>S (ppm)</td>
<td>90.0</td>
<td>42.30</td>
<td>55.90</td>
<td>11.50</td>
</tr>
<tr>
<td>3</td>
<td>K (ppm)</td>
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<td>0.00</td>
<td>0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>Zn (ppm)</td>
<td>0.75</td>
<td>1.10</td>
<td>2.40</td>
<td>0.82</td>
</tr>
<tr>
<td>5</td>
<td>Org. C (%)</td>
<td>0.50</td>
<td>0.78</td>
<td>0.52</td>
<td>0.81</td>
</tr>
<tr>
<td>6</td>
<td>H (ppm)</td>
<td>58</td>
<td>205.00</td>
<td>226.00</td>
<td>148.00</td>
</tr>
</tbody>
</table>

### Field Level Activities

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Activity</th>
<th>Unit</th>
<th>Nos.</th>
<th>Beneficiaries/Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil Sampling</td>
<td>Sample</td>
<td>109</td>
<td>109</td>
</tr>
<tr>
<td>2</td>
<td>Household Survey</td>
<td>Family</td>
<td>251</td>
<td>251</td>
</tr>
<tr>
<td>3</td>
<td>INM Plots</td>
<td>Acre</td>
<td>132</td>
<td>132</td>
</tr>
<tr>
<td>4</td>
<td>Farmers Meeting</td>
<td>Nos.</td>
<td>102</td>
<td>1000</td>
</tr>
<tr>
<td>5</td>
<td>Farmers Day</td>
<td>Nos.</td>
<td>7</td>
<td>520</td>
</tr>
<tr>
<td>6</td>
<td>Farmers Training</td>
<td>Nos.</td>
<td>4</td>
<td>390</td>
</tr>
<tr>
<td>7</td>
<td>Exposure Visit</td>
<td>Nos.</td>
<td>1</td>
<td>30</td>
</tr>
</tbody>
</table>

### Treatment of INM

<table>
<thead>
<tr>
<th>Control Plot</th>
<th>Treatment Plot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DAP - 14 kg.</td>
</tr>
<tr>
<td></td>
<td>Urea - 30 kg.</td>
</tr>
<tr>
<td>Farmers Practices</td>
<td>Zn Sulphate - 10 kg.</td>
</tr>
<tr>
<td></td>
<td>Zymosum - 40 kg.</td>
</tr>
<tr>
<td></td>
<td>Agrilbor - 0.5 kg.</td>
</tr>
</tbody>
</table>

Plot Size: 2000 sq.mtr.

### Growth Observation in Case of Soybean Year 2008-09

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Treatment Plot</th>
<th>Control Plot</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Population</td>
<td>41.96</td>
<td>32.64</td>
<td>11.47%</td>
</tr>
<tr>
<td>No. of Nodules per Plant</td>
<td>27.52</td>
<td>20.08</td>
<td>37.26%</td>
</tr>
<tr>
<td>Plant Height</td>
<td>56.20</td>
<td>48.76</td>
<td>15.42%</td>
</tr>
<tr>
<td>Branching</td>
<td>17.64</td>
<td>15.72</td>
<td>12.24%</td>
</tr>
<tr>
<td>Pest &amp; Diseases</td>
<td>26%</td>
<td>39%</td>
<td>28.2%</td>
</tr>
<tr>
<td>Grain Yield Per Plot (Q/Qt)</td>
<td>3.57</td>
<td>2.46</td>
<td>45.12%</td>
</tr>
</tbody>
</table>
### YIELD ANALYSIS UNDER INM

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Indicator</th>
<th>Kharif 2008-09</th>
<th>Rabi 2008-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Range of Grain Yield (in qtl/bag)</td>
<td>2.2 - 6.6</td>
<td>1.52 - 3.83</td>
</tr>
<tr>
<td>02</td>
<td>Avg. Grain Yield Per Plot (in qtl)</td>
<td>3.37</td>
<td>2.45</td>
</tr>
<tr>
<td>03</td>
<td>Additional Input Cost (Rs.)</td>
<td>946</td>
<td>946</td>
</tr>
<tr>
<td>04</td>
<td>Additional Yield (in qtl.)</td>
<td>1.12</td>
<td>1.12</td>
</tr>
<tr>
<td>05</td>
<td>Value of Input (Rs.)</td>
<td>1919.43</td>
<td>2240</td>
</tr>
<tr>
<td>06</td>
<td>Benefits through INM (in Rs.)</td>
<td>478.2</td>
<td></td>
</tr>
</tbody>
</table>

### VARIETAL PERFORMANCE

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Crop</th>
<th>Variety</th>
<th>Yield (qtl/ha.)</th>
<th>Farmers Perceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soybean</td>
<td>JS-335</td>
<td>17.23</td>
<td>Yield is same but 9385 is the early variety &amp; matured before 15 days</td>
</tr>
<tr>
<td>2</td>
<td>Maize</td>
<td>Local</td>
<td>10.00</td>
<td>Participants used hybrid variety for 1st time</td>
</tr>
<tr>
<td>3</td>
<td>Chickpea</td>
<td>ICC-37</td>
<td>11.43</td>
<td>In case of ICC-37 insect infestation is high comparative to JG-11</td>
</tr>
</tbody>
</table>

### YIELD ANALYSIS IN CASE OF MAIZE YEAR- 2008

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Indicator</th>
<th>T</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plant Height (ft)</td>
<td>2.00</td>
<td>2.85</td>
</tr>
<tr>
<td>2</td>
<td>Girth (cm)</td>
<td>15.10</td>
<td>13.3</td>
</tr>
<tr>
<td>3</td>
<td>No. of Cobbs</td>
<td>1.78</td>
<td>1.12</td>
</tr>
<tr>
<td>4</td>
<td>Length of Cobbs (cm)</td>
<td>24.76</td>
<td>23.13</td>
</tr>
<tr>
<td>5</td>
<td>Row of Grains</td>
<td>11.25</td>
<td>8.84</td>
</tr>
<tr>
<td>6</td>
<td>Weight per Cobbs (gm)</td>
<td>123.80</td>
<td>167.80</td>
</tr>
<tr>
<td>7</td>
<td>Pilot Yield (qt)</td>
<td>4.88</td>
<td>3.98</td>
</tr>
</tbody>
</table>

### ACTION PLAN 2009-2010

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Activity</th>
<th>Physical Unit</th>
<th>NOS.</th>
<th>Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INM</td>
<td>Hectare</td>
<td>176</td>
<td>2nd, 3rd, 4th</td>
</tr>
<tr>
<td>2</td>
<td>Kitchen Garden</td>
<td>Nos.</td>
<td>30</td>
<td>2nd, 3rd, 4th</td>
</tr>
<tr>
<td>3</td>
<td>Vermicompost</td>
<td>Nos.</td>
<td>27</td>
<td>2nd, 4th</td>
</tr>
<tr>
<td>4</td>
<td>Crop diversification</td>
<td>Hectare</td>
<td>3</td>
<td>2nd, 3rd, 4th</td>
</tr>
<tr>
<td>5</td>
<td>Forage Production</td>
<td>Hectare</td>
<td>5</td>
<td>2nd, 4th</td>
</tr>
<tr>
<td>6</td>
<td>Seed Bank</td>
<td>Nos.</td>
<td>12</td>
<td>2nd, 4th</td>
</tr>
<tr>
<td>7</td>
<td>Farmers Training</td>
<td>Nos.</td>
<td>12</td>
<td>2nd, 4th</td>
</tr>
<tr>
<td>8</td>
<td>Exposure Visit</td>
<td>Nos.</td>
<td>1</td>
<td>1st</td>
</tr>
<tr>
<td>9</td>
<td>S.J.G. Corpus</td>
<td>Nos.</td>
<td>19</td>
<td>In a year</td>
</tr>
</tbody>
</table>
THANKS
Sustainable Livelihoods through Community Watershed approach in Raisen & Sagar district of MP State

Implemented by -
TATA - COREST - ICRISAT Consortium

Consortium partner -
Bhopal Yuwa Paryavaran Shikshan & Samajik Sansthan (BYPASS)
83, Paraspar Colony, Chuna Bhatti, Bhopal 462016, Madhya Pradesh.
Ph: 0755 - 2428244; 4281638
Email: bypassindia@yahoo.com

Presentation by
Akshay Singh Yulav

VILLAGES SELECTED FOR PRODUCTIVITY ENHANCEMENT

District Sagar
VILLAGE       BLOCK
Chitoura       Sagar
Bannad (Barnawad) Sagar
Shobhapur      Jaisinagar
Chandoni       Jaisinagar
Bichhuwa      Jaisinagar
### Social Profile

<table>
<thead>
<tr>
<th>HH in project area</th>
<th>Population</th>
<th>ST</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1180</td>
<td>6477</td>
<td>358</td>
<td>1675</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.2%</td>
<td>25.9%</td>
</tr>
</tbody>
</table>

### Area Profile

<table>
<thead>
<tr>
<th>Total Area</th>
<th>Agriculture Land</th>
<th>Waste Land</th>
<th>Forest Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>3169 ha.</td>
<td>1740 ha.</td>
<td>878 ha.</td>
<td>360 ha.</td>
</tr>
<tr>
<td></td>
<td>54.9%</td>
<td>27.7%</td>
<td>11.3%</td>
</tr>
</tbody>
</table>

### Villages Selected for Productivity Enhancement

District RAISEN

<table>
<thead>
<tr>
<th>Village</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sehora jagir</td>
<td>Begumgunj</td>
</tr>
<tr>
<td>Khamariya</td>
<td>Begumgunj</td>
</tr>
<tr>
<td>Saajkheda</td>
<td>Begumgunj</td>
</tr>
<tr>
<td>Pahariya</td>
<td>Silwani</td>
</tr>
<tr>
<td>Bhainsra</td>
<td>Silwani</td>
</tr>
</tbody>
</table>

### Intervention in Kharif 2008

- No. of Trials 12
- Crop Soyabean
- Variety JS 9305
- Coverage 24 Acre
- No of beneficiaries 12 Farmers
- Micro Nutrient Supplement (Boron, Zinc, Zypsum)
- Intercropping (Soyabean + Pigeonpea)
Farmers observation:

- 3 Trials failed due to heavy Rains just after sowing
- Growth of plant good
- Pigeon Pea - Asha variety - Good Production
- Technical problem with BRF maker

Yield data Kharif 2008

<table>
<thead>
<tr>
<th>Variety in Treated plot</th>
<th>Yield in Treated Plot</th>
<th>Yield in Control Plot (Local Variety)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JS 9305</td>
<td>99.63 to 18.27</td>
<td>99.95 to 14.38</td>
</tr>
<tr>
<td>JS 9305</td>
<td>14.97 (Avg)</td>
<td>11.77 (Avg)</td>
</tr>
</tbody>
</table>

Yield in Quintals per Hectare.

Intervention in Rabi 2008-09

District Sagar
- Trials -31 No
- Villages -3 Beneficiaries -31
- Crop - Chickpea
- Variety - JAKI 9218, JKG 1, ICCCV 37
- Micronutrients - Zinc, Boron, Zypsum

Intervention in Rabi 2008-09

District Raisen
- Trials - 32
- Villages- 5 Beneficiaries -32
- Crop - Chickpea
- Variety - JAKI 9218, JG 16
- Micronutrients - Boron, Zinc, Zypsum
Farmers observations:
- Better growth of Plant
- Better greenery in plant
- Seed was of good quality
- Rains in Winter (Insect problem)
- “Soolka” disease affected production
- Rate for JKG1 was good

Yield data Rabi Sagar (Jasi Nagar)

<table>
<thead>
<tr>
<th>Variety in Treated plot</th>
<th>Yield in Treated Plot</th>
<th>Yield in Control Plot with local variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAKI 9218</td>
<td>13.59 to 15.86</td>
<td>09.98 to 13.08</td>
</tr>
<tr>
<td>JAKI 9218</td>
<td>14.93 (Avg.)</td>
<td>11.43 (Avg.)</td>
</tr>
</tbody>
</table>

Yield in Quintals per Hectare.

Yield data Rabi Sagar (Sagar Block)

<table>
<thead>
<tr>
<th>Variety in Treated plot</th>
<th>Yield in Treated Plot</th>
<th>Yield in Control Plot with local variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC 37</td>
<td>14.47 to 18.00</td>
<td>11.33 to 14.93</td>
</tr>
<tr>
<td>IC 37</td>
<td>15.95 (Avg.)</td>
<td>13.62 (Avg.)</td>
</tr>
<tr>
<td>JKG 1</td>
<td>15.00 to 16.86</td>
<td>10.67 to 16.35</td>
</tr>
<tr>
<td>JKG 1</td>
<td>15.12 (Avg.)</td>
<td>12.77 (Avg.)</td>
</tr>
</tbody>
</table>

Yield in Quintals per Hectare.

Yield Data Rabi Raisen

<table>
<thead>
<tr>
<th>Variety in Treated plot</th>
<th>Yield in Treated Plot</th>
<th>Yield in Control Plot with local variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAKI 9218</td>
<td>19.59 to 13.06</td>
<td>15.99 to 12.71</td>
</tr>
<tr>
<td>JAKI 9218</td>
<td>17.03 (Avg.)</td>
<td>14.54 (Avg.)</td>
</tr>
<tr>
<td>JG 16</td>
<td>15.76 to 12.13</td>
<td>15.03 to 09.54</td>
</tr>
<tr>
<td>JG 16</td>
<td>13.49 (Avg.)</td>
<td>12.38 (Avg.)</td>
</tr>
</tbody>
</table>

Yield in Quintals per Hectare.
**Field days**

- **Village Shoibapur - District Sagar**
  Date: 8th Jan 2009
  Participants: 190
  Issues: Suitable Crop variety for the area & Water Conservation

- **Village Pahariya - District Raisen**
  Date: 31st Jan 2009
  Participants: 145
  Issues: Application of Micro Nutrients, Demonstration of Low cost Irrigation system

**Plan for Kharif 2009**

- **Sagar District**
  - No of Farmers: 58
  - Area: 100.5 acre (40.2 Ha)

- **Raisen District**
  - No of Farmers: 86
  - Area: 167.5 acre (67Ha)

**Plan for Summer/Rainy season 2009**

- Promotion of Kitchen Garden/ Vegetable Cultivation (Sagar 12 farmers + Raisen 11 Farmers)
- Farmers in Chandoni village are ready to grow year round vegetable crops
- Promotion of Organic farming (Sagar 13 farmers + Raisen 13 Farmers)
- Horticulture Activities (Networking with NHM)
- Procurement of Gilericidia cuttings from Amardpur and grow in area

**Equipments Needed....**

- Bullock driven tropicultors
- BBF maker
- Macro nutrient test
- Water efficient irrigation techniques
- Weighing machines
**Project at a glance**

**Duration of Project**: Five Years (Sept 2008 to Aug 2013)

**Annual Budget of Project**

1. Total Budget of Project: Rs. 2,43,500\(^{+}\)
2. Total Annual Budget: Rs. 2,43,500\(^{+}\)
3. Total Fund Received: Rs. 2,43,500\(^{+}\)

**Implementation team structure**

- Dr. Yaseen Khan: Associate fellow
- Mr. Gajendra Singh: Project Coordinator
- Mr. Niranjan Gour: Research Assistant

---

**Geographical Area Coverage Under Project in District Shajapur**

**Five Villages of three blocks of Shajapur district**

<table>
<thead>
<tr>
<th>Block</th>
<th>Name of Village</th>
<th>Area (Hact)</th>
<th>Total HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burd</td>
<td>Barda</td>
<td>943</td>
<td>162</td>
</tr>
<tr>
<td><strong>---</strong></td>
<td><strong>---</strong></td>
<td><strong>---</strong></td>
<td><strong>---</strong></td>
</tr>
<tr>
<td>Burh</td>
<td>Barhoda</td>
<td>675</td>
<td>196</td>
</tr>
<tr>
<td>Sur</td>
<td>Sura</td>
<td>1045</td>
<td>199</td>
</tr>
<tr>
<td>Agar</td>
<td>Mahadyna</td>
<td>1365</td>
<td>164</td>
</tr>
<tr>
<td><strong>---</strong></td>
<td><strong>---</strong></td>
<td><strong>---</strong></td>
<td><strong>---</strong></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>3150</td>
<td>821</td>
</tr>
</tbody>
</table>

---

**CARD Presence in Field**

<table>
<thead>
<tr>
<th>District</th>
<th>Region</th>
<th>Professional Strength</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhopal</td>
<td>Vikhro Plateau</td>
<td>20</td>
<td>Madhya Pradesh &amp; CG</td>
</tr>
<tr>
<td>Anandia</td>
<td>Eastern Region</td>
<td>15 + 70</td>
<td>205 villages (Muncil)</td>
</tr>
<tr>
<td>Dindori</td>
<td>Eastern Region</td>
<td>0 + 20</td>
<td>100 villages in Shajapur</td>
</tr>
<tr>
<td>Shajapur</td>
<td>Midhwa Region</td>
<td>0 + 20</td>
<td>50 villages of Agar</td>
</tr>
<tr>
<td>Ujjain</td>
<td>Midhwa Region</td>
<td>30 + 15</td>
<td>40 villages, Ujjain</td>
</tr>
<tr>
<td>Jhabua</td>
<td>Western Region</td>
<td>26 + 10</td>
<td>19 villages, Thantra</td>
</tr>
<tr>
<td>Dhar</td>
<td>Western Region</td>
<td>10 + 20</td>
<td>28 villages in Talc</td>
</tr>
<tr>
<td>Rajpur</td>
<td>Chhadjagoh</td>
<td>50</td>
<td>Chhadjagoh Region</td>
</tr>
<tr>
<td>Korba</td>
<td>Chhadjagoh</td>
<td>50 + 80</td>
<td>120 villages</td>
</tr>
<tr>
<td>Dhamol</td>
<td>Chhadjagoh</td>
<td>6 + 20</td>
<td>28 villages in Agaraon</td>
</tr>
</tbody>
</table>

---

**Project Objectives**

1. To reduce intensity of Soil erosion on hilly tracks of the area.
2. To conserve the available surface water of the area.
3. To increase agricultural production and productivity.
4. To reduce the level surface runoff by land treatment.
5. To improve ground water resources in the region.
6. To conservation available vegetation and plantation of economic viable plants.
Caste wise Distribution of Households in Project Area

<table>
<thead>
<tr>
<th>Caste</th>
<th>General</th>
<th>OBC</th>
<th>SC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>154</td>
<td>155</td>
<td>152</td>
<td>461</td>
</tr>
<tr>
<td>% of total</td>
<td>33.87</td>
<td>33.38</td>
<td>12.99</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Activities of Project

5.1 PRA and Baseline Survey of Five Villages
5.2 Distribution of HYV Seeds (Gram)
5.3 Income Generating Activities
5.4 Formation of Seed Bank in Each Village
5.5 Demonstration and Introduction of Vermi-compost
5.6 Increasing Forage Production
5.7 Human Development Activities (Capacity Building of Farmers)
5.8 Dissemination of Information and Technology
5.9 Documentation and Photography

5.1 PRA and Baseline Survey of Five Villages

(A) Collection of Secondary Data
   1. Census Data
   2. Revenue Data
   3. Agricultural Data
   4. Revenue Maps

(B) PRA Exercise
   All the Five Villages

(C) Base Line Survey
   All the five villages

(D) Writing of Survey Report

Formation of Natural Resource Management Committees

<table>
<thead>
<tr>
<th>SN</th>
<th>Village</th>
<th>Name of President</th>
<th>No. of Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Berda</td>
<td>Aziz Khan</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Berkeda</td>
<td>Jagdish Lal</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Khamota</td>
<td>Vrikram Singh</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>Mahauliya</td>
<td>Parvati Singh</td>
<td>26</td>
</tr>
<tr>
<td>5</td>
<td>Mayskheda</td>
<td>Kail Ram</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>97</td>
</tr>
</tbody>
</table>
5.2 Distribution of HYV Seeds for Rabi Crop (Gram)

<table>
<thead>
<tr>
<th>SN</th>
<th>Village</th>
<th>No. of Beneficiaries</th>
<th>Total Area (Bigha)</th>
<th>Density of Seeds (GJ)</th>
<th>Total Production (CG)</th>
<th>Productivity (GJ/CG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baraha</td>
<td>4</td>
<td>3</td>
<td>100</td>
<td>13.00</td>
<td>1.30</td>
</tr>
<tr>
<td>2</td>
<td>Baraha</td>
<td>4</td>
<td>4</td>
<td>80</td>
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</tr>
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<td>3</td>
<td>Baraha</td>
<td>3</td>
<td>6</td>
<td>8</td>
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</tr>
<tr>
<td>4</td>
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<td>3</td>
<td>6</td>
<td>8</td>
<td>4.00</td>
<td>0.67</td>
</tr>
<tr>
<td>5</td>
<td>Bhagwada</td>
<td>3</td>
<td>10</td>
<td>260</td>
<td>26.00</td>
<td>1.60</td>
</tr>
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<td>Total</td>
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<td>28</td>
<td>88</td>
<td>1000</td>
<td>93.00</td>
<td>0.84</td>
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</tbody>
</table>

5.3 Income Generating Activities

(A) Details of Self Help Groups in the CRISAT Project Villages

<table>
<thead>
<tr>
<th>SN</th>
<th>Name of Village</th>
<th>Name of Self Help Group</th>
<th>Date of Formation</th>
<th>Total Members</th>
<th>Monthly Saving (Rs)</th>
<th>Total Saving (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baraha</td>
<td>Radha Swami</td>
<td>29.01.2009</td>
<td>11</td>
<td>20</td>
<td>600</td>
</tr>
<tr>
<td>2</td>
<td>Baraha</td>
<td>Jai Prakash</td>
<td>29.01.2009</td>
<td>11</td>
<td>20</td>
<td>600</td>
</tr>
<tr>
<td>3</td>
<td>Mahendriha</td>
<td>Jai Dev Narayan</td>
<td>30.01.2009</td>
<td>11</td>
<td>50</td>
<td>1650</td>
</tr>
<tr>
<td>4</td>
<td>Baraha</td>
<td>Ram Raju</td>
<td>01.04.2009</td>
<td>11</td>
<td>20</td>
<td>220</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>44</td>
<td></td>
<td>5150</td>
</tr>
</tbody>
</table>

(B) Development of Nursery

<table>
<thead>
<tr>
<th>SN</th>
<th>Name of Farmer</th>
<th>Village</th>
<th>Total Area (Bigha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nain Singh s/o Inder Singh</td>
<td>Baraha</td>
<td>1.0</td>
</tr>
</tbody>
</table>

5.4 Formation of Seed Bank in Villages

<table>
<thead>
<tr>
<th>SN</th>
<th>Village</th>
<th>Name of Person</th>
<th>Quantity of Seeds (GJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baraha</td>
<td>Rajendra Singh</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>Baraha</td>
<td>Sanjay Singh</td>
<td>1.50</td>
</tr>
<tr>
<td>3</td>
<td>Baraha</td>
<td>Rajeev Singh</td>
<td>1.00</td>
</tr>
<tr>
<td>4</td>
<td>Mahendriha</td>
<td>Kumar Singh</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>Bhagwada</td>
<td>Barse Lal</td>
<td>1.50</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>5.50</td>
</tr>
</tbody>
</table>

5.5 Demonstration and Introduction of Vermi Compost

<table>
<thead>
<tr>
<th>SN</th>
<th>Village</th>
<th>Name of Beneficiary</th>
<th>No. of Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baraha</td>
<td>Arvind Singh</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Baraha</td>
<td>Rajeev Singh</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Baraha</td>
<td>Sanjay Singh</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Mahendriha</td>
<td>Kumar Singh</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Bhagwada</td>
<td>Barse Lal</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Baraha</td>
<td>Arvind Singh</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
5.10 Documentation and Photography

1. Documentation of Each Village Meeting with proceedings
5. Report Writing of Exposure Visits.
6. Photography of Various Events.

5.11 Linkages developed with Other Departments

1. Agricultural Department, Agar.
2. Horticulture Department, Agar
5. International Development Enterprises (India), Bhopal.

5.12 Problems in the Project Execution

1. Lack of Proper and Timely Guidance and Instructions
2. Delay in Required Inputs i.e., Seeds, Fertilizers, Nutrients etc.
3. Non-Availability of Soil Testing Reports

5.13 Future Plan

- Regular meetings with villagers.
- Initiation for construction of vermin pits in the Villages.
- Preparation of GIS Maps of All the Villages for Detail Analysis and Interpretations
- Identification of Beneficiaries and Estimation of their Seed Requirements for Kharif Season.
- Arranging Animal Camps for Animal Health and Productivity Enhancement
- Detail Analysis of Integrated Nutrient Management.
- Introduction of Drip Irrigation among Selected Farmers.
- Establishment of Kitchen Gardens among Farmers.
- Initiation for Increase in Fodder Production by Induction of New Grass Varieties.
- Monitoring of Agricultural Research Activities under the ICRISAT guidance.
- Formulation of New Project According to Peoples Needs.
Application of Advanced Technology

GIS Based Planning and Mapping of Project Area
(Suzlon Support)
Biophysical and social constraints

1. Degraded soils with poor fertility.
2. Acute water scarcity for the farming.
3. Poor social economic base of the farmers.
4. One-two heads of cattle, several goats and some poultry borne.
5. Considerable mortality and early crop sanitation.
6. Lack of credit and marketing facilities.
7. Non-adoption of recommended practices.
8. Lack of marketing and credit facilities.

Rainfall (in mm)

<table>
<thead>
<tr>
<th>Year</th>
<th>Jharia Block</th>
<th>Jharia District</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>1137</td>
<td>1112</td>
</tr>
<tr>
<td>2004</td>
<td>1340</td>
<td>1134</td>
</tr>
<tr>
<td>2005</td>
<td>1340</td>
<td>1134</td>
</tr>
<tr>
<td>2006</td>
<td>1300</td>
<td>1200</td>
</tr>
<tr>
<td>2007</td>
<td>1300</td>
<td>1200</td>
</tr>
<tr>
<td>2008</td>
<td>696</td>
<td>696</td>
</tr>
<tr>
<td>2009</td>
<td>696</td>
<td>696</td>
</tr>
<tr>
<td>2010</td>
<td>696</td>
<td>696</td>
</tr>
</tbody>
</table>
Exposure Visits

NABARD WADI
We work towards the ecological restoration and conservation of land and water resources and setting in place the processes of coordinated human effort and governance towards that end.
Watershed Interventions

- Watershed interventions at 17 Panchayats over 700 ha of land
- Construction of farm ponds
- Fodder plot development
- Farm bunding 150 ha and 750 farm bunds
- Revegetation 500 m in 12 bunds
- 50 m of loose boulder checks to control drainage line
- Present days employment generation 13.02

Watershed Interventions

- Introduction of eco-friendly nutrient crop i.e. vegetables in the command area of 17 villages
- Improvement of soil and structure of farm bunds in 10 villages
- Improvement of weed suppression and better natural regeneration of forest species in 17 villages

Strengthening Livelihoods Portfolio

- 53 no. of SRI plots in 17 villages
- 55 no. of vegetable plots in 18 villages
- 12 acres of horticulture plots
- Dry irrigation in horticulture plots
Progress under TATA - ICRISAT Project

Exposure of farmers to IPM/ISF for best agricultural practices and techniques.

- Farmer's field day
- Soil testing
- Rain gauge of rainfall recording system

<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Area (in acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BM</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Integrated Disease Management</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Soil Testing</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Kitchen Garden</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Vegetable Records</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Gulma Records</td>
<td>10</td>
</tr>
</tbody>
</table>

Table of data:

<table>
<thead>
<tr>
<th>Name of Farmer</th>
<th>Date</th>
<th>Name of Village</th>
<th>Age</th>
<th>Gender</th>
<th>Land (Hect.)</th>
<th>Grain (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>1/1</td>
<td>Green Village</td>
<td>25</td>
<td>Male</td>
<td>2.5</td>
<td>100</td>
</tr>
<tr>
<td>Jane Smith</td>
<td>2/2</td>
<td>Red Village</td>
<td>30</td>
<td>Female</td>
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<td>120</td>
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</tbody>
</table>
Objective

To improve livelihoods through sustainable use of natural resources by undertaking science-led development in consortia mode with equity and inclusion in semi-arid and agro-ecofy regions.

Challenges in Semi-arid regions

- Water scarcity
- Land degradation
- Low productivity
- Poverty
- Reproductive health
Convergence of the programme

- Farmer's Participatory Action Research Project (CRISAT)
- Water saving technology with Department of Agriculture Extension
- Productivity enhancement programme with Pioneer seed company

Crop demonstration in Kharif 2008
- Fodder crops in Chorola village
- Maize crop with RPM Practice (Kaveri 297)

Crop Demonstration in Rabi 2008-2009
- ICCV-37 with RPM
- LDG-1 with RPM

Summer 2009
- Sprinkler irrigation system in Chorola village
- Vegetable trials in Chorola village
- Sudan grass in Chorola village
- Summer Maize in Chorola village
**Work Achieved**

<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Target</th>
<th>Achieved</th>
<th>No of Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Survey F11X and Satellite Data</td>
<td>9919</td>
<td>9919</td>
<td>Survey work in running</td>
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<tr>
<td>2</td>
<td>Establishment of Agriculture</td>
<td>4034</td>
<td>4034</td>
<td>4034</td>
</tr>
<tr>
<td></td>
<td>Producers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Formation of efficient irrigation</td>
<td>2.01m2</td>
<td>2.01m2</td>
<td>2.01m2</td>
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<td>Farmers' Association</td>
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<tr>
<td>4</td>
<td>Income Generation Activities</td>
<td>9.0</td>
<td>9.0</td>
<td>9.0</td>
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<tr>
<td></td>
<td>operated by TDC/RMGU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establishment of Seed Bank and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>extension bank</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(New Extending Unit)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>Refugia Protection</td>
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<td>05.0</td>
<td>05.0</td>
</tr>
<tr>
<td></td>
<td>Nutrients</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Antagonistic Health Programme</td>
<td>02.5</td>
<td>02.5</td>
<td>02.5</td>
</tr>
<tr>
<td></td>
<td>Distribution of seeds &amp; water testing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Formation of Vegetable Cultivation</td>
<td>01.5</td>
<td>01.5</td>
<td>01.5</td>
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<tr>
<td></td>
<td>5.2.1.1</td>
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**Conditions**

<table>
<thead>
<tr>
<th>No</th>
<th>Prevention of Organic</th>
<th>Target</th>
<th>Achieved</th>
<th>5 families in each district</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>Prevention of Organic</td>
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<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>Island</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental clean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Islandal capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Islandal capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Formation of Environmental</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>Islandal capacity</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Islandal capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Antagonistic Camp &amp; Rally</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>Antagonistic Camp &amp; Rally</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antagonistic Camp &amp; Rally</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antagonistic Camp &amp; Rally</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>11</td>
<td>Human Resource Development</td>
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<tr>
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<td>Human Resource Development</td>
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<td></td>
</tr>
</tbody>
</table>

**Thanks**
SRTT-ICRISAT-Project

PRADAN, Gumla
Professional Assistance for Development Action

About PRADAN

- Mission Statement: Impacting Livelihoods to Enable Rural Community
- Working in 8 states in Central India
- 400 Professionals from different technical backgrounds

Brief about Gumla

- AE Zone: VII
- Rainfall: 1200-1400mm
- Land terrain: Undulating
- Acidic soil: pH range 4-4.5
- Tribal population: 70%
- One of the poorest district of Jharkhand
- Agriculture is the primary source of income

PRADAN’S Presence in Gumla

- SHGs: 777
- Families: 13990
- Activities
  - Agriculture
  - Poultry
  - Goat rearing
  - Watershed
  - Horticulture
  - Lac
Objectives of the Project

- Enhancing productivity by using good quality seeds & application of macro and micro-nutrients
- Increase yield of the project-village by 150% after 5 years from initiation of the project
- Growing green manure: Glycicidia on field bunds
- Improving water use efficiency: Drip irrigation
- Increasing cropping intensity by using fellows low-lands after paddy harvesting
- Improving livelihood: Vermicomposting
- Monitoring rainfall, temperature & humidity

Why Teleya ???

- Completely tribal village, located centrally
- Agriculture – Primary source of livelihood
- Poor village with low agricultural productivity
- Low quality land (Degraded soil, mostly hilly)
- High aspiration to adopt new technology
- From mono-cropping to Multi-cropping
- Having PRADAN promoted SHG and Farmers club.
- Shifting the villagers from alcohol to agriculture
- Central location of village for replication in future.

TELEYA AT A GLANCE

- Total Land : 273.72 Ha
- Cultivable land : 127.2 Ha
- Total Households : 72
- Total Population : 382
- ST Population : 100%
- Community : Oraon
- Literacy : 29.58%
- No of SHGs : 4
- Farmer’s club : 1
Resources - Land

- 172.2 Ha is cultivable land.
- 65% of the total land is up and medium land.
- Undulating Acidic soil with high run off.
- Average land holding per family is 2.5 acre.
Human Resource

- Generally each family consist of 4-5 members.
- At least 2 people available to do agriculture in each family.
- Both male and female are equally potential for agricultural works.
- Potential Farmers' club
- Vibrant Youths club

Water Resources

- Lift Irrigation: 3
- Homestead Wells: 33
- Ponds: 2
- Check dams: 1

Resource - Forest

- Forest covers more than 30% land.
- Huge numbers of forest trees like Sakua, Sal, Mohua, Tamarind etc.
- People use forest trees as fire wood.
Livelihoods

- Agriculture is the prime source of livelihoods.
- People have started to take vegetables as a source of income.
- Forest based products (mohua, firewood) selling periodically.

Activities in 2008-09 under this Project

- Concept sharing
- Motivated 30 farmers to participate
- Soil testing
- Paddy intervention
- Khair cash crops: tomato, maize, black gram beans (ser), ground nut
- Rabi: Chickpea with 25 farmers in 5.4 acres
- Summer: Green gram with 18 farmers
- Quality seeds and nutrients assured
- Application of macronutrients & micronutrients Zinc sulphate
- Adopting seed priming techniques
- Regular technical training
- Vermicompost tanks for 30 farmers

Process

- Motivational trainings
- Selection of farmers and land for particular crop
- Analyzing soil test results
- Pre-nursery trainings
- Seed treatment trainings
- Regular follow ups
- Weekly Farmers club meetings
- Used ¼ of land for new approaches with recommendations and rest ¼ under control
- Exposures from neighboring villages
- Collection & Analysis of data and planning for next season

Soil test results

- Low Percentage of organic carbon
- Phosphorous deficiency
- Very low Sulphur, Zinc & Boron content
Output data

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Crops</th>
<th>Average land used</th>
<th>Seed</th>
<th>Under the project</th>
<th>Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tomato</td>
<td>20 decimal</td>
<td>18gm</td>
<td>5000 kg</td>
<td>2000 kg</td>
</tr>
<tr>
<td>2</td>
<td>Paddy</td>
<td>50 decimal</td>
<td>5 kg</td>
<td>1400 kg</td>
<td>1000 kg</td>
</tr>
<tr>
<td>3</td>
<td>Black gram</td>
<td>25 decimal</td>
<td>1 kg</td>
<td>80 kg</td>
<td>40 kg</td>
</tr>
<tr>
<td>4</td>
<td>Groundnut</td>
<td>20 decimal</td>
<td>6 kg</td>
<td>80 kg</td>
<td>40 kg</td>
</tr>
<tr>
<td>5</td>
<td>Chick pea</td>
<td>20 decimal</td>
<td>8 kg</td>
<td>50-150 kg</td>
<td>10 kg</td>
</tr>
</tbody>
</table>

Significant income data

- 10 farmers earned Rs 10,000-15,000 from tomato & sem in Kharif
- 8 farmers earned Rs 8,000-10,000 from tomato in Kharif
- 10 farmers earned more than Rs 5,000 from tomato in Kharif

What we couldn’t do?

- Maize and finger millet due to delay of receiving the seeds
- Unable to achieve the expected output in Chickpea due to water crisis (mostly small seeded var.)
- Use of trio cultivator

Snap-shots
Some interventions:

Plan for 09-10

- Include another 100 families
- Use of macro & micronutrients in all crops
- At least two co-crops in Rabi & creepers in Summer
- Seed storage
- Involving youth club
- Exposure of villagers to ICRISAT Centre

Plan for 09-10 contd

- Glycicidal cultivation
- Paddy (S), Tomato, Black Gram, Bean, Finger Millet, Chilly, Cabbage, Groundnut in Kharif
- Chick pea after harvesting paddy
- Focus on growing cash crops to give additional income
- Wire-staking in tomato
Objectives
- To consolidate the science-led farmer-centric conservation agricultural practice of Watershed based community area management (WBM) as an alternative to the forest-based watershed development approaches, and to evaluate the productivity and sustainability of the WBM approach.
- To scale-up the benefits of productivity enhancement and ecosystem conservation, and to use these sites as learning platforms, particularly for the local and national level, for scaling out benefits in the 3 targeted districts of Rajasthan.
- To address the policy and institutional impediments that are impeding the successful implementation of Watershed Management in the state of Rajasthan, and to provide technical support to develop a legal framework for the area-specific Watershed development projects.
Fodder production in Summer season

Fodder crop & Variables
- Grass
- legume
- other

<table>
<thead>
<tr>
<th>Fodder crop &amp; Variables</th>
<th>No. of day</th>
<th>Area Covered (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>legume</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>other</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Vermi compost practices

Objectives
1. To improve the soil health and increase the productivity on commercial farms.
2. To reduce the use of chemical fertilizers.

Commercial Model of Vermi compost

100
Achievement in Bundi Watershed

1. Increase the seed and fertilizer shops in the area

2. Micro nutrient in the local market

3. Nine per cent farmers use the improved variety of seeds & fertilizers in their field & near by villages.

Farmers perception

- Farmers adopted the technology for crop productivity & income
- Farmers expected the improved yield & productivity after results of demonstration & were satisfied
- Farmers selected the crop variety improved & used in their own field
- Farmers expressed their satisfaction in the form of improved yield & productivity
- Farmers expected the value addition in the form of improved variety in their field
- Farmers expected the reduced cost in their own field
- Farmers reported the increased productivity in their own field
Thanks

<table>
<thead>
<tr>
<th>No.</th>
<th>Product</th>
<th>Block</th>
<th>Total populations (2018-19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rice</td>
<td>Hindi</td>
<td>120,000</td>
</tr>
<tr>
<td>2</td>
<td>Wheat</td>
<td>English &amp; Urdu</td>
<td>150,000</td>
</tr>
<tr>
<td>3</td>
<td>Sugarcane</td>
<td>English</td>
<td>200,000</td>
</tr>
<tr>
<td>4</td>
<td>Mustard</td>
<td>Hindi</td>
<td>130,000</td>
</tr>
<tr>
<td>5</td>
<td>Cotton</td>
<td>English</td>
<td>110,000</td>
</tr>
</tbody>
</table>

Scale up of programme
Central India Initiative (CII) Objective

The CII envisages a series of livelihood projects across the region, addressing core issues related to sustainable poverty amongst tribals in a sustainable manner.

Central India Initiative: IWMI-Tata’s Recommendations

- The focus is on stabilizing Kharif crops, through the creation of decentralized water harvesting structures on farm lands.
- The focus is on promotion of Wadi (orchards) and creation of water harvesting structures such as nallah and cement bunds.
- The focus is on promotion of Wadi (orchards), developing and revival of irrigation systems in participatory approach and package of technologies for crops like cotton, soyabean etc.
- The focus is on Community Managed Natural Resources, large check dams and lift irrigation systems.

Initiative Background

- 18 to 25 degrees belt stretching from Gujarat to West Bengal - mostly undulating
- High rainfall - high runoff, reasonable forest cover
- 50 million tribal population (70% of tribal population of India)
- Low literacy, high poverty, land and water productivity far below potential
- Low use of modern technology in agriculture
**Diversion based Irrigation Management**
- To establish DBI as a supporting tool for ensuring food security in tribal dominated Central Indian States.
- Enables poor farmers living in difficult terrains to double their incomes by taking the second crop using diverted water flows.
- Reduces their need for migrating in search of work.
- Technically such schemes are feasible only in far-flung, remote, and tribal areas usually facing neglect by the State.
- Investments is less compared to other sources of irrigation.
- O & M cost is less.

**Non Timber Forest Produce**
Vision: Identify key regional NTFPs and promote them as a profitable and viable option for income generation, enhance tribal livelihood and conservation of forest resources.

**Financial services for supporting livelihood**
- Developing appropriate models around the existing themes such as Kharif Paddy, Kharif Maize and other agricultural interventions to promote livelihood interventions supported by proper financial services.
- Enhancing quality of financial services by improving the quality of the SHGs promoted by different partners.
- Building strong people's institution so that these institutions can take forward the program after initial support by Trust and ensure operational as well as financial sustainability.
- Increasing outreach to financially include the poorest through area saturation approach.
- Strategic Partnership with mainstream policies and financial service providers to facilitate a better financial environment for poorers.
Background

- Backward agriculture, unstable livelihoods
- Primarily rain-fed, broadcasting production
- Adherence to traditional technologies and modes of production
- High degree of dependence on forests and migration
- Non-farm employment options more common in nearby areas
- Less developed financial services
- Open grazing
- Debt

Demography

- Total Households: 11,130
- SC: 68.16%
- OBC: 30.99%
- ST: 2.44%
- Average Rainfall: 1200 to 1500 mm
- Total Cultivable Land: 3500 Acres
- Ploughable Land: 2500 Acres
- Current Practices:
  - Paddy (Boro/soon)
  - Jhum (Winter)
  - Commercial

SRTT - CII PROJECT

Senakele - Khonsuwan District
Physical Intervention

- Pond - 26 Nos.
- Irrigation - 82 Nos.
- Low Cost Check dam with intake well - 9 Nos.
- L.J. System - 4 Nos.

Total 606 acres irrigation capacity created in three years in different season.

Capacity Building

VILLAGE INSTITUTION
- 16 Village Development Committee
- 54 Water User Group
- 20 Self Help Group

Wasteland Development

Outcome / Impact

Agriculture Extension
- Increase in area under HYV Kharif paddy from 0% to 25% of total cultivable land.
- Approx. 30% of total household adopted HYV paddy cultivation. Increase in Transplanting of paddy from 0% to 25%
- Food security has increased from 7-8 months to whole of the year.
- Increase in yield of local paddy from 7-8 qtn/acre to 15 qtn/acre and HYV yield 15-20 qtn/acre.
- Cultivation of Summer paddy started.
- From Mono crop to cropping intensity to 1.33%.
- Increase in area under Rabi crop from 25 Acres (1.5%) to 350 Acres (22%) of total cultivable land.
- No. of household adopted Rabi cultivation - 364 household (32%).
- Increase in income through Rabi cultivation.
- 3764385 cft. Additional capacity created by Pond.
- 33 Irrigation wells created.
- 9 nos. Low cost check dam constructed.
- 606 acres irrigation capacity created in three years in different season.
Capacity Building

- Skill development of VDC in Physical work, In Engineering, organizing manpower
- Access to market
- Empowerment of women
- Confidence level increase
- Ownership feeling and more optimistic about their development
- They are more vocal
- Access to block and district for development work
- Working culture in group developed
- Economic activity at village level after paddy harvesting
- Accounting and book-keeping knowledge of VDC at village level help them to enable raise and manage the fund independently
- Saving habit developed
- Office bearer of VDC can be utilized as trainers (for record keeping, accounting, book-keeping) to water user group and SHGs as well as service provider to agriculture extension
- They are acquainted of cropping pattern of Kharif & Rabi
- Operational and mechanical knowledge of tractors, machines
- Checked migration

ICRISAT Initiatives with TSRDS(2008)

Kharif Cultivation (Black Gram)

Kharif Cultivation (Pigeon-Pea)
KHARIF CULTIVATION (Groundnut)

- Groundnut

Yield: 15 Quintal Per Hectare

CHICKPEA Details (17 Acres)

<table>
<thead>
<tr>
<th>Variety of Chickpea</th>
<th>Area (In Sq. Ft.)</th>
<th>Area (In acre)</th>
<th>Production (In Kg)</th>
<th>Production (In Kg Per Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.076</td>
<td>156.64</td>
<td>2,085</td>
</tr>
<tr>
<td>Desi White Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.154</td>
<td>261.32</td>
<td>1,695</td>
</tr>
<tr>
<td>Desi Red Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.250</td>
<td>392.56</td>
<td>1,570</td>
</tr>
<tr>
<td>Black Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.375</td>
<td>411.93</td>
<td>1,110</td>
</tr>
<tr>
<td>Yellow Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.465</td>
<td>475</td>
<td>1,020</td>
</tr>
<tr>
<td>Green Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.562</td>
<td>585</td>
<td>1,030</td>
</tr>
<tr>
<td>Black Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.657</td>
<td>605</td>
<td>918</td>
</tr>
<tr>
<td>Brown Chickpea</td>
<td>1075 x 1157 x 1647</td>
<td>0.767</td>
<td>675</td>
<td>880</td>
</tr>
</tbody>
</table>

Ripened Chick Pea

Vermicompost Unit in Progress
<table>
<thead>
<tr>
<th>No.</th>
<th>District</th>
<th>Size</th>
<th>Planned Activity</th>
<th>Soil cropping</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Villars</td>
<td>27</td>
<td>47.5</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Boras</td>
<td>78</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Bogos</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Kerem</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Borena</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Shire</td>
<td>45</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Shugnyar</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Rohya</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>Gherla</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Bikram</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>Aliyam</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total: 518.48

Total: 18
**Definition of Land Drainage**

**PREVAILING**
Land drainage is the removal of excess surface and subsurface water from the land including the removal of soluble salts, to enhance crop growth (M.D.)

**NEW**
Land and water management through the process of removing excess surface water and managing shallow water tables by retaining and removing water to achieve an optimal mix of economic and social benefits while safeguarding key economic functions. (The World Bank 2004)

**Global Drainage Scenario**

*It is estimated -*
- 50% of the world’s irrigated lands suffers from drainage problems
- 25 Mha of prime agril. land have become unproductive due to irrigation-induced waterlogging and salinity
- 250 Mha of rainfed crop land needs improved drainage
- 190 Mha are provided with drainage infrastructure
Kinds of waterlogged areas in India

1. Rainfall induced waterlogging: In inadequately drained lands during the monsoon period.
2. Irrigation induced waterlogging and salinity: Application of irrigation water in excess of crop needs.
3. Natural salinity: Prevalent in various locations in the semi-arid parts of north-west and central India.

State wise Waterlogged and Salt Affected Areas (Million hectares)

<table>
<thead>
<tr>
<th>State</th>
<th>Waterlogged area Mha</th>
<th>Salt Affected area Mha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>0.336</td>
<td>0.813</td>
</tr>
<tr>
<td>Bihar</td>
<td>0.263</td>
<td>0.402</td>
</tr>
<tr>
<td>Gujarat</td>
<td>0.494</td>
<td>0.466</td>
</tr>
<tr>
<td>Haryana</td>
<td>0.276</td>
<td>0.465</td>
</tr>
<tr>
<td>Karnataka</td>
<td>0.036</td>
<td>0.404</td>
</tr>
<tr>
<td>Kerala</td>
<td>0.012</td>
<td>0.028</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>0.007</td>
<td>0.342</td>
</tr>
<tr>
<td>Maharastra</td>
<td>0.011</td>
<td>0.354</td>
</tr>
<tr>
<td>Orissa</td>
<td>0.196</td>
<td>0.402</td>
</tr>
<tr>
<td>Punjab</td>
<td>0.459</td>
<td>0.460</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>0.348</td>
<td>1.122</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>0.196</td>
<td>0.342</td>
</tr>
<tr>
<td>Uttar Pradesh &amp; Uttaranchal</td>
<td>1.106</td>
<td>1.385</td>
</tr>
<tr>
<td>Total</td>
<td>4.928</td>
<td>1.966</td>
</tr>
</tbody>
</table>


Heavy Clayey Soils (Vertisols)

Global land area: 320 mha (2.5%)
About 83% Area: Semiarid and arid conditions

In India, 75 mha land is under vertisols.

Vertisols suffer from surface ponding and/or waterlogging due to poor soil physical parameters. Vertisols offer good prospects of production when adequately drained.

One of the most important challenges in agric. water management is the drainage of clay soils.
### Surface Drainage System Design

1. Average Annual Rainfall: 1070 mm
2. Rainfall for two cons. days: 465 mm at 10-year RI
3. Rainfall excess for two cons. days: 227.5 mm at 10-year RI
4. Average Annual Runoff: 300–350 mm
5. Rainfall intensity: 8.3 cm/hr for 1-year RI
6. Manning's roughness coeff. (n): 0.045 to 0.050
7. Channel side slope: 1:1
8. Channel bed gradient: 0.20 to 0.50
9. Permissible velocity: 1.5 m/s

### Draining Water Logged Areas

- Surface drainage
- Subsurface drainage
- Vertical drainage
- Mole drainage
- Bio-drainage

### Equipment and Machinery for Land Drainage

- Tractor
- Excavator
- Drill rig
- Suction machine

### Water Level Variance at C.I.A.E.

- Variance at C.I.A.E.
- Variance at Field Drainage Studies at C.I.A.E., Bhopal

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**Field experiment on Surface Drainage**

- **Crop/variety:** Maize (Vijay Composite)
- **Drain spacing:** 20 m
- **Plot sizes:** Drain spacing(m) x 65 m
- **Nutrients application:** Recommended doses of NPK @ 150, 50, & 30 kg/ha
- **Cultivation practices:** Standard recommended cultivation practices of mechanized farming

**Field experiment on Surface Drainage**

- **Crop/variety:** Pigeon Pea (Vijay)
- **Drain spacing:** 10 m, 15 m 20 m
- **Plot sizes:** Drain spacing(m) x 65 m
- **Nutrients application:** Standard Recommended doses of NPK
- **Cultivation practices:** Standard recommended cultivation practices of mechanized farming

**Field Experiment on Sub-Surface Drainage (SSD) System**

**(Kharif-2006 - 2007)**

- **SSD System:** Installed in June 2005 in 9.9 Ha field with automated water pumping and measuring system from drain line culvert
- **SSDliner:** Compressed Perforated PVC pipes 76 mm & 100 mm dia.
- **Filter medium:** Geotextile filter
- **Drain spacing (m):** 20 m
- **Drain depth (m):** 1.0 m
- **Drain slope:** 0.2 Per cent
- **Crop Variety:** Maize (Vijay Composite)

**DRAINAGE FILTER MATERIAL SELECTION**

Sedimentation in Lateral Drains

<table>
<thead>
<tr>
<th>Filter Material</th>
<th>Sediment Deposited (g/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td>240</td>
</tr>
<tr>
<td>Geotextile (G900)</td>
<td>122</td>
</tr>
<tr>
<td>Plastic Netting</td>
<td>200</td>
</tr>
<tr>
<td>Rock</td>
<td>954</td>
</tr>
<tr>
<td>Without Filter</td>
<td>4000</td>
</tr>
</tbody>
</table>

**Entrance Resistance of armour materials in Heavy Textured Soils**

<table>
<thead>
<tr>
<th>Armor Materials</th>
<th>Entrance Resistance (Pa/s)</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td>1.68</td>
<td>Moderate</td>
</tr>
<tr>
<td>Geotextile (G900)</td>
<td>2.02</td>
<td>Moderate</td>
</tr>
<tr>
<td>Plastic Netting</td>
<td>4.17</td>
<td>Poor</td>
</tr>
<tr>
<td>Rock</td>
<td>2.60</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

*Source: Drainage Manual No. 33, CSIR, Faridabad*
### Economics of Geo-Textile Fabric Envelope Use in SSD System

| Cost of SSD with envelope (Geo-textile fabric) | ₹ 6483/- |
| Cost of SSD without envelope | ₹ 5297/- |
| Additional cost of envelope use in SSD | ₹ 1187/- |
| Maize yield under SSD with envelope | 5.0 t/ha |
| Maize yield under SSD without envelope | 4.35 t/ha |
| Wheat yield under SSD with envelope | 4.89 t/ha |
| Wheat yield under SSD without envelope | 4.78 t/ha |
| Additional Net Annual Benefit in SSD with envelope | ₹ 4,043/year |
| Payback period for use of envelope in SSD system | 2.27 years |

### Pigeon pea and Maize yield under SSD systems

<table>
<thead>
<tr>
<th>Drainage system at 20 m drain spacing</th>
<th>% Increase over control</th>
<th>Maize</th>
<th>Pigeon Pea</th>
<th>Soybean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface drainage (SD)</td>
<td>21.5</td>
<td>20.7</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>Combined SSD and SD</td>
<td>90.5</td>
<td>64.2</td>
<td>66.8</td>
<td></td>
</tr>
<tr>
<td>SSD (Chimney with filter)</td>
<td>54.8</td>
<td>59.1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>SSD (with filter)</td>
<td>40.0</td>
<td>40.9</td>
<td>54.2</td>
<td></td>
</tr>
<tr>
<td>SSD (without filter)</td>
<td>33.4</td>
<td>39.1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

### Summary of Benefit Cost Analysis

<table>
<thead>
<tr>
<th>Cultivation Practice</th>
<th>Soybean B/C Ratio</th>
<th>Maize B/C Ratio</th>
<th>Pigeon Pea B/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfed - Drainage 30 cm</td>
<td>1.27</td>
<td>1.22</td>
<td>1.53</td>
</tr>
<tr>
<td>Rainfed - Drainage 60 cm</td>
<td>1.26</td>
<td>1.61</td>
<td>1.55</td>
</tr>
<tr>
<td>Irrigated - Drainage 30 cm</td>
<td>1.36</td>
<td>1.63</td>
<td>1.79</td>
</tr>
<tr>
<td>Irrigated - Drainage 60 cm</td>
<td>1.36</td>
<td>1.63</td>
<td>1.79</td>
</tr>
<tr>
<td>Control</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Effect of Sub-Surface Drainage on Sequential Crop

<table>
<thead>
<tr>
<th>Season</th>
<th>Crop Variety</th>
<th>SSD Field</th>
<th>Control</th>
<th>% Increase over control</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-06</td>
<td>Wheat (HI-B486)</td>
<td>5.50</td>
<td>4.92</td>
<td>11.70</td>
</tr>
</tbody>
</table>
**EFFECT OF SUB-SURFACE DRAINAGE ON SEQUENTIAL CROP**

<table>
<thead>
<tr>
<th>Region</th>
<th>Crop</th>
<th>SSD</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rahi</td>
<td>Chick Pea</td>
<td>1.96</td>
<td>1.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.30</td>
<td>13.30</td>
</tr>
<tr>
<td>Rahi</td>
<td>Chick Pea</td>
<td>1.96</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.31</td>
<td>14.31</td>
</tr>
</tbody>
</table>

**Transfer of Drainage Technology at Farmers’ Field**

**FARMERS’ VISIT TO DRAINAGE STUDY EXPERIMENTAL FIELD**

Major Constraints: Large scale adoption of SSD needs:

- A grid of surface drains in waterlogged areas to provide outlets for drainage systems.
- A policy decision on inclusion of drainage as component in on going watershed development programmes.
- Requirement of heavy machinery for large scale SSD adoption.
- The development and production of drainage machines and materials are based on demand. The production capacity of the drainage materials is to be enhanced.
- Continuous flow of funds needed for surface drain maintenance. Financial assistance to resource poor farmers, as SSD requires high initial investment.
- The people’s participation through community development programme.
CONCLUSIONS

Open drainage channels at 15 to 20 m interval and 0.5 m deep with side slopes of 1:1 and bed gradient less than 0.5% were found to be effective for providing enough relief to crop root zone for soybean crop.

SSD Coefficient was found to be 5.18 to 5.34 mm/day. The SSD system with 20 m drain spacing and 1.0 m drainage depth using corrugated perforated PVC pipe of 7200 mm diameter covered with geo-textile filter is required for effective drainage.

Surface drainage system resulted in 25-40% increase in yield over control and the SSD system resulted in 60-64% increase over control for soybean, maize and pigeon pea crops.

SSD also resulted in 12 - 51% increase in yield of subsequent rabi season wheat and chickpea crops over the control.

RECOMMENDATIONS

- The surface and sub surface drainage technologies are techno-economical feasible for soybean, maize & pigeon pea crops cultivation in temporarily waterlogged vertisols of Bhopal region.
- Under high water table condition, when natural outlet is available near the field, the combination of surface and sub surface drainage is recommended for draining vertisols effectively.
- For extensive adoption of this technology, drainage grid is necessary and it may be created with farmers’ participation in collaborative programmes of the State Governments.
- Awareness about the benefits of the drainage technology in the farmers need to be brought through demonstration and training programs.

CONCLUSIONS Contd.....

The cost of making surface drains may vary between Rs. 1250 – 1500/ha depending upon the field orientation and drain layout. The total cost of SSD systems is found to be Rs. 65,000/ha due to closer drain spacing in vertisols. The cost of mole drainage at 4 m mole spacing varies Rs. 2000 - 2500/ha

The drainage technologies are found to be techno-economical feasible for temporary waterlogged vertisols.

The payback period for sub-surface (pipe) drainage systems for crops sensitive to waterlogging is 5-7 years.

MOLE DRAINAGE TECHNOLOGY

By
Dr. KV Ramana Rao

Making of Mole Drain

Mole Plough Soybean in mole drained Field
Multiple Impacts of Drainage

- Increased agricultural production and productivity
- Positive impact on public health, drinking water supply and sanitation
- Less damage to buildings and other rural infrastructure, increases the value of the land
- Negative impacts on environmental functions (Disposal of drained water, dumping of untreated domestic and industrial wastewater and other pollutants into open drains)

Selection Criteria for Drainage Systems

Surface drainage systems are usually applied in relatively flat lands that have soils with a low or medium infiltration capacity, or in lands with high-intensity rainfalls and frequent water logging occurs on the soil surface.

Sub surface drainage (SSD) systems are used when the drainage problem is mainly that of shallow water tables or temporarily built shallow water tables.

When both surface and subsurface water logging occur, a combined surface and SSD system is required.

The choice between a SSD system by pipes, pipeless and ditches or by tube wells is more a matter of technical criteria and costs than of agricultural criteria.

Usually, pipe drains or ditches are preferable to wells. In absence of the main drainage systems or natural outlets, the installation of drainage systems is not recommended.

Quality of Sub Surface Drained Water

<table>
<thead>
<tr>
<th>Water quality parameters</th>
<th>Kieni 2004</th>
<th>Nyeri 2004</th>
<th>World Quality Standards</th>
<th>WHO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate</td>
<td>18</td>
<td>127</td>
<td>33.4</td>
<td>30</td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.47</td>
<td>0.42</td>
<td>0.84</td>
<td>0.5</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.79</td>
<td>0.96</td>
<td>1.23</td>
<td>1.0</td>
</tr>
<tr>
<td>Na</td>
<td>0.33</td>
<td>0.4</td>
<td>0.64</td>
<td>0.64</td>
</tr>
<tr>
<td>EC (dS/m)</td>
<td>1.76</td>
<td>1.71</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>TDS</td>
<td>1.86</td>
<td>1.94</td>
<td>186</td>
<td>150</td>
</tr>
<tr>
<td>Fluoride</td>
<td>0.07</td>
<td>0.06</td>
<td>0.19</td>
<td>1.0</td>
</tr>
<tr>
<td>S. Manganese</td>
<td>0.01</td>
<td>0.01</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Total Iron</td>
<td>0.03</td>
<td>0.02</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.31</td>
<td>0.32</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.36</td>
<td>0.35</td>
<td>28.9</td>
<td>25</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.01</td>
<td>0.01</td>
<td>102</td>
<td>100</td>
</tr>
<tr>
<td>Carbonate</td>
<td>10.2</td>
<td>10.3</td>
<td>102</td>
<td>100</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.01</td>
<td>0.01</td>
<td>102</td>
<td>100</td>
</tr>
</tbody>
</table>

All values are in mg/L except pH and EC.
Strengthening Collaboration between IISS and Tata-ICRISAT-ICAR Projects

VERTISOLS (Traditional Black Soils)
- The Vertisols and associated soils occupy 73 million hectares (77.5% of total geographical area) in sub-humid and semi-arid tropics of India.

Soil Physical Constraints
- Soil water deficits and excesses occur back to back.
- Narrow workable range of soil moisture.
- Poor permeability, low infiltration rate, hard-setting etc.
- Vulnerable to run-off and soil erosion losses.
- High energy input requirement for tillage operations.

Scientific Interventions in Management of Vertisols for Enhanced Crop Productivity and Input Use Efficiency – IISS Experiences

Dr. A. SUBBA RAO
Director
Indian Institute of Soil Science, Bhopal

Conservation tillage for soybean-wheat system
Conservation tillage practices viz., No-tillage (with crop residues retained on the surface and direct drilling of seed) and Reduced tillage (residue retained + 1 sweep tillage) were as effective as conventional tillage (residue removed + 1 summer tillage by sweep cultivator + 2 tillage by sweep cultivator) in terms of crop productivity under soybean and wheat.
**Suitable land configuration for rainfed Vertisols**

- Broad-bed and furrow (BBF) (1 m wide broad bed and 0.5 m furrow on 0.4-0.6 % slope) was found superior to flat-on grade (FOG) system of land configuration in terms of increased yields of soybean, maize and pigeon pea (11-18%), and decreased runoff and sediment losses.

---

**Enhanced water use efficiency under limited water supply**

- Synergistic interactions between water and nutrient were exploited to promote water and nutrient use efficiency of Indian mustard and wheat crops.

- Wheat yield obtained with three irrigations at CRI, active tillering and flowering stages along with recommended NPK (100: 21.5: 24.9 kg ha⁻¹) has not been different significantly from application of two irrigations at CRI and flowering stages along with recommended NPK + FYM (applied to preceding soybean).

- Results imply that conjunctive use of recommended NPK and 10 t FYM ha⁻¹ lead to a net saving of one irrigation in Rabi crops and enhanced water use efficiency.

---

**Best soil moisture conservation practice to support post-rainy season chickpea**

- Soil moisture conservation practice of late interculture
  - Of mustard cover in the inter-row spaces of standing maize (@ 5 t/ha fresh weight basis) + maize stover application (after sowing up to germination) improved the productivity of chickpea (932 kg/ha) grown in the post rainy season. The accrued benefit was primarily due to increased conserved soil moisture and less water-stress for chickpea.

- Thus, the practice is very useful in rainfed areas where even a single irrigation is not available for the rabi crops.

---

**Soil Fertility Constraints**

- Poor native fertility (low in SOC and available N, low to medium in available P, S and Zn, while the Fe, B deficiencies are on rise)

- Use efficiency of applied nutrients is low, particularly of P

---

**Graph**

- Organic C: 50, 97
- Available N: 52, 46
- Available P: 58, 53
- Available S: 40, 40
- Available Zn: 40, 40
- Available Fe: 40, 40
IPNS for Soybean-Wheat system on Vertisols

- The risk developed an integrated plant nutrient supply technology for enhancing and sustaining productivity and soil health under soybean-wheat system in Madras region. The technology has the flexibility of using different proportions of FYM and P contradict depending on the farmyard manure (FYM) availability with the farmer.

- For a yield target of 2 t soybean and 3.5 t wheat per ha, the IPNS variants are:

<table>
<thead>
<tr>
<th>FYM (t ha⁻¹)</th>
<th>Fertilizer Nutrient (kg ha⁻¹)</th>
<th>Soybean</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>P</td>
<td>S</td>
</tr>
<tr>
<td>0</td>
<td>35</td>
<td>39</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Low-cost Integrated Nutrient Management (INM) Technology for Soybean-Wheat System

The INM module comprising 50% NPK + 5% FYM /ha + Rhizobium to soybean and 75%NPK+P8B to wheat produced 11% higher soybean yield and 25% higher wheat yield as compared to Farmers' practice.

Impact of FYM and Fertilizer P on Production Sustainability under Soybean-wheat System

- Fertilizer-P applied to soybean showed residual effects in two succeeding crops while the P applied to wheat had a significant residual effect on only one succeeding crop.

- The P applied to soybean was more efficiently utilized than that applied to wheat in the system.

- Fertilizer P applied to soybean at the rate of 39 kg ha⁻¹ was adequate enough to meet the entire P requirement of soybean and 80% of the P required for the following wheat
Soil test maintenance P requirement of Vertisols

- A phosphorus fertilization technology for soil test maintenance and optimum crop yields under soybean-wheat system on Vertisol was developed.
- P input rate for soil test maintenance was equal to crop P removal if P was supplied through manure + fertilizer (1 + P basis) and 40% higher than the crop P removal when P was supplied as fertilizer alone.

<table>
<thead>
<tr>
<th>Fertilizer (P) Supply (PSSF)</th>
<th>Soil test maintenance P requirement (STMP) of soybean-wheat rotation (kg ha⁻¹ yr⁻¹)</th>
<th>Yield (kg ha⁻¹)</th>
<th>Total P removal at STMP (kg ha⁻¹ yr⁻¹)</th>
<th>STMP to P removal ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSSF-I 36.1 (22.2 + 13.9)</td>
<td>1.91</td>
<td>4.10</td>
<td>25.2</td>
<td>1.4</td>
</tr>
<tr>
<td>PSSF-II 26.3 (16.2 + 10.1)</td>
<td>1.88</td>
<td>4.06</td>
<td>23.4</td>
<td>1.1</td>
</tr>
<tr>
<td>PSSF-III 24.1 (14.3 + 9.8)</td>
<td>1.90</td>
<td>4.01</td>
<td>23.7</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Balanced Nutrient Management in Soybean

- Balanced application of all deficient nutrients (NPKS24) at recommended rates improved the soybean yield by 37% over the Farmers’ Practice (SP2 at lower rate).

Balanced Fertilization with Broad Bed Furrow (BBF) in Soybean on Waterlogged Fields

On waterlogged fields, planting soybean with balanced fertilization on BBF produced 50% higher yield than balanced fertilization with Farmers’ Practice of land configuration.

Mechanical Harvest-Borne Wheat Residue Management Under Soybean-Wheat System

- Wheat residue incorporation or retention coupled with application of 28 kg N ha⁻¹ through fertilizer or organic manures is more beneficial than burning in terms of enhanced crop productivity and soil fertility.
- Wheat residue incorporation resulted in 20-32% higher yields in soybean and 15-25% in wheat as compared to residue burning.

- Soil incorporation of wheat residue plus N supplementation through FYM at the rate of 28 kg N ha⁻¹ (approx. 4 t FYM ha⁻¹) along with 25 kg P ha⁻¹ for rainfed soybean and 60 kg N + 33 kg P ha⁻¹ for irrigated (1-2 irrigations) wheat was more effective and profitable.
**Balanced Fertilization Technology for Cotton**

- A balanced fertilization technology (BFT) for cotton (80-40-20 kg N-P2O5-K2O ha⁻¹ + Zn @ 25 kg ZnSO₄ ha⁻¹ + B @ 1 kg ha⁻¹ as 0.1% B foliar spray twice) was developed under the Technology Mission on Cotton (TMC) and demonstrated on 50 farmers’ fields.

- With balanced fertilization, the yield gain in cotton ranged from 13 to 41%, with the mean yield increase across all farms being 26%.

**Integrated Nutrient Management (INM) for Pulses**

- On-farm trials on INM for pulses (chickpea and lentil) conducted at 88 farmers’ fields in Bhopal, Rewa and Saifi districts in Madhya Pradesh not only resulted in higher yields but also saved fertilizer cost.

- Application of 75% NPK + 25% FYM + seed inoculation through Rhizobium + soil application of 3 kg P₂O₅ ha⁻¹ to the soybean during kharif and 50-75% NPK to rabi crops (chickpea/lentil) (based on residual moisture availability) produced 13-26% more chickpea and 15-24% more lentil yields as compared to traditional practice.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Bhopal &amp; Raisen</th>
<th>Rewa &amp; Satna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickpea</td>
<td>2.4 (25.9)</td>
<td>1.1 (20.7)</td>
</tr>
<tr>
<td>Lentil</td>
<td>1.1 (20.7)</td>
<td>3.3 (21.9)</td>
</tr>
<tr>
<td>INM</td>
<td>1.3 (13.5)</td>
<td>1.3 (20.3)</td>
</tr>
<tr>
<td>INM + Moisture Conservation</td>
<td>2.4 (25.9)</td>
<td>4.1 (42.7)</td>
</tr>
</tbody>
</table>

Yield advantage in pulses due to improved nutrient management and moisture conservation (ha⁻¹ A %)

**THANKS**
**Welcome**

**Dr. D.H. Ranade**
**Operational Research Project**
**College of Agriculture, Indore (M.P.)**

---

**O.R.P, College of Agriculture, Indore**
**Campus, R.V.S.K.V.V., Gwalior (M.P.)**

**ORP**
- Hingonia Pipliyatapha (86-98)
- Baroli (1999-2004)
- Jaitpura (2004-2006)
- Panod – 2007 Onward

**Adhoc Projects**
- Pipliyahana, Umariya Khurd – Till 2003
- Barlai, Panod and Dakachya

---

**Rainfall (mm) at Indore during 2005-08**

<table>
<thead>
<tr>
<th>Period</th>
<th>Normal</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>April-May (Summer)</td>
<td>13.72</td>
<td>0.0</td>
<td>47.5</td>
<td>46.2</td>
<td>0.0</td>
</tr>
<tr>
<td>June-October (Kharif)</td>
<td>927.8</td>
<td>733.0</td>
<td>1086.9</td>
<td>865.8</td>
<td>565.4</td>
</tr>
<tr>
<td>November-March (Rabi)</td>
<td>22.25</td>
<td>41.0</td>
<td>1.4</td>
<td>0.0</td>
<td>53.8</td>
</tr>
<tr>
<td>Total</td>
<td>963.8</td>
<td>774.0</td>
<td>1135.8</td>
<td>912.0</td>
<td>649.2</td>
</tr>
<tr>
<td>Rainy days during monsoon period</td>
<td>30</td>
<td>56</td>
<td>37</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

---

**To provide technical guidance to farmers for up scaling and out scaling of various technologies of water conservation.**
Development of water harvesting tank/sunken tanks and its effect on crop productivity.

To generate data on water availability and to observe its effect on increase in *Rabi* cropped area.
<table>
<thead>
<tr>
<th>CROPS</th>
<th>No. of irrigations</th>
<th>4 ha</th>
<th>2 ha</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEAT</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHICKPEA</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

**CROP VARIETAL TRIALS**

![Image of irrigation system]

![Image of field trials]

*Farmed: Rabi 2008*

*07-11-2008*

*5 ha* 45m x 2m
IMPACT OF CROPPING TECHNOLOGY

Introduction of varieties (2007-08)

<table>
<thead>
<tr>
<th>CROPS</th>
<th>Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOYBEAN</td>
<td></td>
</tr>
<tr>
<td>CHICKPEA</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>JS 9560</td>
<td>1750</td>
<td>2140-2260</td>
</tr>
<tr>
<td>JG 412</td>
<td>916</td>
<td>1929</td>
</tr>
</tbody>
</table>
IMPACT OF CROPPING TECHNOLOGY
Introduction of varietics (2008-09)

<table>
<thead>
<tr>
<th>CROPS</th>
<th>Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
</tr>
<tr>
<td>SOYBEAN</td>
<td>1683</td>
</tr>
<tr>
<td></td>
<td>2200 - 2500</td>
</tr>
<tr>
<td>CHICKPEA</td>
<td>850</td>
</tr>
<tr>
<td>Rainfed (12-15q)</td>
<td>1500</td>
</tr>
<tr>
<td>ADOPTION</td>
<td>60% (SOYBEAN)</td>
</tr>
<tr>
<td>ADOPTION</td>
<td>50% (GRAM)</td>
</tr>
</tbody>
</table>

INCORSEASE IN AREA (HA) UNDER IMPROVED VARIETIES OF DIFFERENT CROPS IN PANOD VILLAGE

<table>
<thead>
<tr>
<th>CROP</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAM (50% under improved variety in 2008)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VISHAL</td>
<td>-</td>
<td>200 kg (2.5 ha)</td>
<td>120 kg (1.5 ha)</td>
</tr>
<tr>
<td>JG 412</td>
<td>-</td>
<td>120 kg (1.5 ha)</td>
<td>120 kg (1.5 ha)</td>
</tr>
<tr>
<td>JG 130</td>
<td>-</td>
<td>-</td>
<td>120 kg (1.5 ha)</td>
</tr>
<tr>
<td>KAK 2</td>
<td>-</td>
<td>120 kg (1.5 ha)</td>
<td>120 kg (1.5 ha)</td>
</tr>
<tr>
<td>JGK 2</td>
<td>-</td>
<td>120 kg (1.5 ha)</td>
<td>120 kg (1.5 ha)</td>
</tr>
</tbody>
</table>

SAFFLOWER

<table>
<thead>
<tr>
<th>CROP</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSI 73</td>
<td>-</td>
<td>-</td>
<td>24 kg (1.0 ha)</td>
</tr>
</tbody>
</table>
### Number of Separators Purchased in 2008 in Panod

<table>
<thead>
<tr>
<th>Type of Separators</th>
<th>Quantity</th>
<th>Price per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Five Spirals</td>
<td>Two Nos.</td>
<td>5000/- Each</td>
</tr>
<tr>
<td>With Seven Spirals</td>
<td>Three Nos.</td>
<td>5500/- Each</td>
</tr>
</tbody>
</table>
बारोली में बिन बारिश मौज

PERCOLATION TANK

WELL RECHARGE

Faulty Design
In ORP it is experienced that water storage acts as a catalyst to win the hearts of farmers for active and effective involvement for manifold increase in crop production and decrease in erosion hazards.
Soil Fertility Enhancement
- Gliricidia planting
- Tank silt application
- Vermicomposting phosphocompost

Crop Intensification
- Rainy season fallow management
- Rice-fallows
- High-value crops
- Crop diversification

Baseline Survey - Timeline to Submit Final Report

Enhancing Water Use and Management
- BBF
- Contour cultivation
- Low cost drip irrigation
- R&F
Income-generating Activities
- Nursery establishment
- Village seed banks
- Poultry and goat rearing

Increasing Productivity
- Improved cultivars
- Village seed banks
- Micronutrient amendments
- Soil test-based fertilizer application
- IPM
- Weed management

Monitoring and Evaluation
- Data collection
- Report writing
- Reporting
- Documentation - photos and videos

Training and Technology
- Exposure visits
- Environment clubs
- Field Days
Thank You

Work Planning

Two Groups
- SDTT
- KL Shehrawat
- SRIT
- Sukh P Wani
The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT’s mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT is supported by the Consultative Group on International Agricultural Research (CGIAR).

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Order code: CPE 165
325-2009

Sustainable Productivity Enhancement Initiatives in India

Proceedings of Tata-ICRISAT-ICAR Projects’ Review and Planning Meeting

International Crops Research Institute for the Semi-Arid Tropics