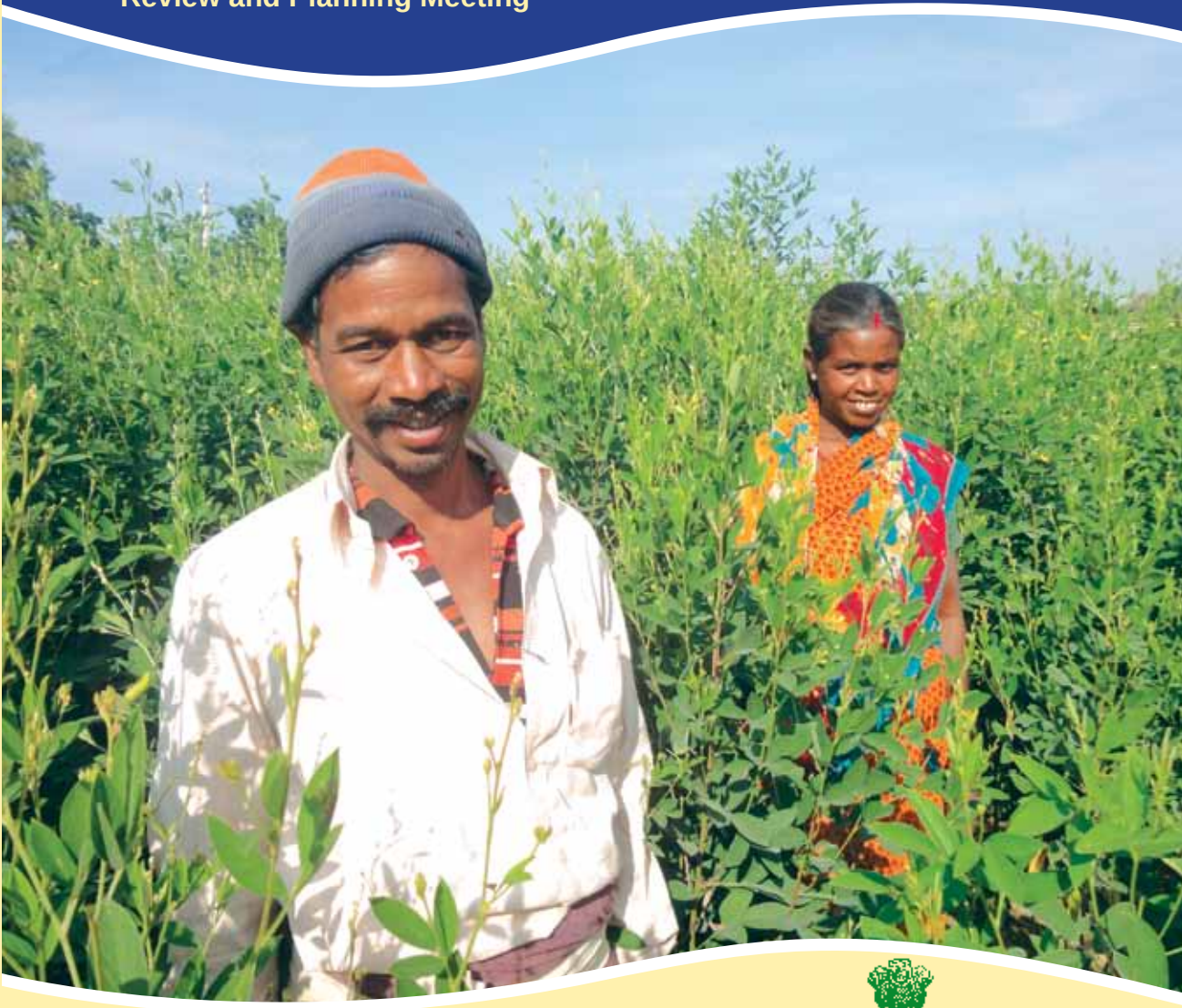
Sustainable Intensification of Rainfed Agriculture through Natural Resource Management

Proceedings of Tata-ICRISAT-ICAR and Model Watershed Projects' Review and Planning Meeting



Sir Dorabji Tata Trust (SDTT)
Mumbai, Maharashtra, India

ICRISAT
Science with a human face

International Crops Research Institute for the Semi-Arid Tropics
Patancheru 502 324,
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Citation: Suhas P Wani, Mukund D Patil and **KL Sahrawat** (eds.). 2012. Sustainable Intensification of Rainfed Agriculture through Natural Resource Management. Proceedings of Tata-ICRISAT-ICAR and Model Watershed Projects' Review and Planning Meeting, 23-25 May 2012. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India. ISBN 978-92-9066-551-9, CPE 170. 232 pp.

Acknowledgement

We sincerely thank our consortium partners namely, Central Research Institute of Dryland Agriculture (CRIDA), Rural Education and Agricultural Development (READ), Andhra Pradesh; BAIF Development Research Foundation (BAIF), Gujarat; Bijapur Integrated Rural Development Society (BIRDS), Karnataka; BYPASS Sansthan, Centre for Advanced Research & Development (CARD), BAIF Development Research Foundation (BAIF), Indian Institute of Soil Science (IISS), Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Maharana Pratap University of Agriculture and Technology (MPUAT), Madhya Pradesh; DEEP Development Research Foundation Institute (DEEP), Peoples Education and Development Organization (PEDO), Seva Mandir, BAIF Development Research Foundation (BAIF), Maharana Pratap University of Agriculture and Technology (MPUAT), Central Arid Zone Research Institute (CAZRI), Rajasthan; Watershed Organization Trust (WOTR), JalaSRI, Moolji Jaitha College, Maharashtra; SHRISTI, Orissa; Society for Development Alternatives (DA), National Research Centre for Agroforestry (NRCAF) Uttar Pradesh; Centre for Improved Rural Health and Environmental Protection (CIRHEP), TVS-Agri Science Research Institute (TVS-ASRI), Tamil Nadu; We also sincerely thank all the farmers, Project Scientists and Scientific Officers for their support.

We gratefully acknowledge the financial support provided by Sir Dorabji Tata Trust, Ministry of Agriculture, and Ministry of Rural Development, Government of India, for funding the projects of ICRISAT-led consortium. We thank Ms N Shalini for language editing; Mr KNV Satyanarayana and Ms N Srilakshmi for administrative, secretarial assistance, word processing and formatting; and communication office, ICRISAT for production of this report.

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Editors

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Inaugural Session

Rapporteur: MD Patil

Dr KH Anantha welcomed the delegates, especially Dr William Dar, Director General, ICRISAT, Dr Bhaskar Mittra from Sir Dorabji Tata Trust (SDTT), and all other dignitaries from state agricultural universities (SAUs) and Indian Council of Agricultural Research (ICAR) institutions. Dr Anantha presented the objectives of the two–day workshop which were:

1. to review the progress and synthesize the findings from the work done at different locations under the SDTT and Model Watershed Projects in India;
2. to identify emerging issues, discuss up-scaling strategies, and prepare work plans for the sustainable use of natural resources, and increasing productivity in India;
3. to plan strategic participatory research and development trials for enhancing productivity.

During the session, a compendium of the success stories coming out of the program based on the work done at different benchmark locations of the Sir Dorabji Tata Trust (SDTT) and Sir Ratan Tata Trust (SRTT), was released by Dr William D Dar and Dr Bhaskar Mittra. Dr Suhas P Wani, Project Coordinator, ICRISAT presented a brief snapshot report on the progress and prognosis of SDTT and model watershed projects. Dr Peter Q Craufurd, Program Director, Resilient Dryland Systems presented a brief talk on the CGIAR Research Program (CRP). Dr William D Dar delivered an inspiring inaugural address. The session concluded with a vote of thanks by Mr. Prabhakar Pathak.

In his inaugural address, Director General Dr William D Dar shared his valuable views and experience about ICRISAT's efforts to improve the livelihoods and reducing poverty of the rural poors. He recalled that when he joined the ICRISAT as a DG, the institute had done research work related to NRM, but most of the work was on-station. It was important and necessary to take the science from the on-station to the real world; and through the support of the donors including SDTT, SRTT, Government of India and state governments;

and following the Research for Development (R4D) approach, it was made possible to take the on-station results to farmers' fields. These livelihood improvement programs through a sustainable management of natural resources enabled the ICRISAT to improve the livelihoods of the poor in the SAT. He also added that one third of the population in India do not have enough money to buy sufficient food, and so only improvement in crop productivity is not enough for the small farm holders, landless and other vulnerable sections of the society; initiating income-generating activities is also important. Dr Dar also emphasized that working together is the key to success, and appreciated the efforts by all the partners in the project. Finally, he added that our efforts should be targeted to improve crop productivity, but at same time productivity increase should be profitable to farmers, and environmentally sustainable. The unholy nexus between poverty, land degradation and food security needs to be tackled. A huge opportunity to unlock the potential of rainfed agriculture exists which must be harnessed through operationalizing the Research for Development agenda; and by developing the scaling-up models to translate research into investment and impact.

Suhas P Wani in his presentation emphasized on the ways to improve livelihoods and achieve food security while coping with the impact of climate change in view of severe water scarcity, land degradation, increasing food demand, increasing competition for energy, and population explosion. He mentioned that we have to work not only to improve crop productivity, but also to translate these changes into improved income and livelihood for landless labor and women. He specially mentioned Dr William Dar, DG ICRISAT for initiating the livelihood improvement programs such as done through the SDTT project, the strategy to operationalize the Integrated Genetic Natural Resource Management (IGNRM) approach for implementing the motto of "Science with a Human Face". The ICRISAT always worked not only to improve agricultural productivity, but also to improve the livelihood and increase incomes of landless farmers and women. Through the SDTT projects, we have seen that science-led solutions are must to improve agricultural productivity, reduce poverty and minimize degradation of natural resources in order to achieve sustainable development in the SAT.

In all the 15 project districts of SDTT, a significant improvement in productivity using improved soil and crop management practices, has been observed during the scaling-up phase over the farmers' practice. For example, during the conduct of the balanced nutrient management trials based on soil analysis along with the use of improved variety, wheat productivity increased up to 28% and chickpea up to 39% in Madhya Pradesh. In Rajasthan, integrated nutrient

management trials using vermicompost along with mineral fertilizers showed increased crop productivity from 16 to 64% over farmers' practices. In case of rainy season fallow management trials, broad-bed and furrow (BBF) showed better performance over the conservation furrow treatment, and also over the farmers' practice. The residual effects of micronutrients applied during the rainy season were evident in wheat, chickpea, coriander, barley, lentil and mustard in terms of increased crop productivity and income. Scaling-up trials during post-rainy (*rabi*) season also showed increased crop yields from 16 to 23% in chickpea, 4 to 22% in wheat, and 17-20% in mustard over the farmers' practice. In his overview presentation, Dr. Suhas Wani highlighted the significant achievements of the ICAR-ICRISAT project since the first phase and during the current phase viz; reducing the rainy season fallows in Madhya Pradesh where 2.02 m ha are left fallow in spite of good black cotton soils and assured rainfall of 900 mm. Through this project on improved Vertisol management using summer cultivation, broad bed and furrow (BBF) to alleviate water logging, and the use of short duration soybean cultivars and minimum tillage for the post-rainy (*rabi*) season chickpea/wheat crops are being taken up. By scaling-up this initiative along with soil test-based nutrient management options, 2 t ha^{-1} of soybean could be produced, soil erosion could be reduced and rainwater use efficiency could be increased to 65-70% as compared to present 35%. Targeted activities for women benefitted the farmers in terms of increased vermicompost production – for example, 122 t vermicompost was produced from 31 vermicompost units in Rajasthan. In addition, the seed banks in Tonk and Sawai Madhopur in Rajasthan along with the livestock improvement activities in Bundi, Alwar, Banswara, Bhilwara and Jhalawar benefitted small farmers and landless through increased incomes. Planting of Gliricidia seedlings (5,000 in Madhya Pradesh) helped farmers to produce N-rich organic matter.

Model watersheds in different states also have made significant progress in terms of rainwater harvesting and soil conservation measures along with crop diversification, productivity enhancement and income-generating activities. At Jalgaon and Dharwad sites, postgraduate students have been conducting strategic research in the model watersheds. Model watersheds have demonstrated the benefits of new watershed guidelines wherein livelihood approach is engendered. However, the fund flow for the Ministry of Agriculture is creating difficulties for the full implementation of the model watersheds. The Ministry of Rural Development (MoRD) model watersheds are in full operation and remarkable progress is recorded in these watersheds.

Dr Wani emphasized the consortium-based approach to tackle the issues that cannot be tackled by adopting individual institute/disciplinary approach.

He focused on the importance of and the need to focus on spreading simple things convincingly to a large number of farmers through innovative scaling-up approaches. Dr Peter Q Craufurd briefly explained about the CRP system and the NRM related CRPs that are CRP 1.1, 5 and 7. An integrated agricultural production system for the poor and vulnerable in dry areas is included in CRP 1.1, and CRP 5 includes land, water, and ecosystems. All the projects being carried out will be associated with some of these CRPs. The main motive behind these reforms is to make collective and concentrated efforts by all the CG centers to work toward food security and environmental sustainability.

Technical Session I

Chair: **Pradip Dey**
Rapporteur: **GL Sawargaonkar**

AVR Kesava Rao made a presentation on 'Weather monitoring for integrated watershed management' in which he emphasized the importance of agro-meteorological data collection at various watershed sites to acquaint with weather vagaries. A clear message emerged from the presentation that full potential of climate as an agricultural resource has not been achieved or realized to make adjustments with the weather to derive the maximum benefit from this resource. To understand the weather of any location, Indian meteorological department, universities and research institutes are important sources to get long-term weather data. The calibration of automatic weather stations is an important activity to ensure that data recorded are of good quality, and that correct inferences are derived to benefit the farmers. The recording of data using the ICRISAT fabricated dual-type recording rain gauges was also discussed.

The characterization of agroclimate helps in selecting suitable crops and varieties and devising management practices in watersheds to conserve, harvest and efficiently use rainwater for enhancing agricultural production. Weather monitoring at watersheds helps in understanding the effects of weather elements on crop growth and production, assessing the impacts of interventions made during the development phase and bringing climate awareness among the community.

Long Range Forecast also provided by IMD on 26 April 2012 regarding Southwest Monsoon 2012 was presented, according to which southwest monsoon seasonal rainfall for the country as a whole is most likely to be normal (96-104% of LPA) this year with 47% probability. He focused that agroclimatic analysis coupled with crop-simulation models, and better seasonal and medium duration weather forecasts, help build resilience to climate variability/change.

P Pathak presented the results of 'Sustainable intensification of agriculture in Madhya Pradesh: Rainy season fallow management'. In Madhya Pradesh, the large areas (2.02 million ha) of deep black soils (Vertisols) in five districts of Madhya Pradesh viz. Vidisha, Guna, Raisen, Satna and Sagar are kept fallow during monsoon season.

The major reasons for the rainy season fallow in Vertisols are the difficulty in cultivation practices in wet conditions, sticky nature of the soil, poor infiltration,

impeded internal drainage of the soils, risk associated with water logging and flooding during rainy season, excessive hardness and difficult workability when dry and risk of losing post-rainy season crops. He discussed the superiority of improved practices with *kharif* sowing vs monsoon fallow system on Vertisols by highlighting the importance of broad bed and furrow (BBF) system with drains, which reduced serious water logging problem, resulting in good soybean crop at the Guna watershed. Technical aspects on the strategies for reducing monsoon fallow system on Vertisols were elaborated with focus on water harvesting and supplemental irrigation as a key for reducing rainy season fallow areas.

Mukund Patil discussed about enhancing rainwater use efficiency in Rajasthan and Madhya Pradesh and expressed concerns on efficient management and conservation of natural resources in the rainfed areas. Emphasis was given on participatory research and development and balance nutrient management (BN) based on soil test-based recommendations. Effects of soil test-based application of S+ B + Zn (BN) over the famers' practice (FP) were highlighted for different crops and cropping systems in Madhya Pradesh and Rajasthan. Similarly, increase in rainwater use efficiency in these two states with balanced nutrient application along with vermicomposting was brought to the notice with improvement in productivity in different crops by 18% to 39%.

Chidanand P Mansur, Professor of Agronomy, UAS, Dharwad, presented research work carried out by three students on the impact of *in situ* moisture conservation measures in different crop and cropping sequence in Singhanahalli (farmer's field, Dharwad); and Vertisol watershed in Dharwad district. Practice of broad bed and furrow (BBF) was found the best land form management system, resulting in significantly higher crop yield attributes, yield and thereby economic returns of all the crops and cropping systems are under study.

Technical Session II

Chair: **VS Gautam**
Rapporteur: **AVR Kesava Rao**

In the opening remarks, the Chairman said that activities under productivity enhancement play a major role in watershed management and acknowledged the excellent work being done by the NGOs in watershed management programs under the Tata-ICAR-ICRISAT Project.

BAIF's progress report on productivity enhancement in Madhya Pradesh (MP) was presented by Sri SK Pandey. He informed that under the SDTT-ICRISAT Project, BAIF is working in six districts namely Sehore, Rajgarh, Vidisha, Barwani, Guna and Indore. He said that the traditional farming systems practiced in the region included high seed rate, usage of major nutrients like N, P and K. Traditionally farmers were not aware of S, B and Zn, seed treatment and IPM methods. Activities taken up included productivity enhancement trials, efficient irrigation management, crop diversification, enhanced soil productivity, artificial insemination (AI), rainy season fallow management and forage production. The crop production increased by 3-9 quintals ha^{-1} and increased awareness of farmers in scientific crop cultivation methods like use of recommended seed rate, seed treatment, use of micro-nutrients and crop diversification benefitted the farmers. Significant impact has been observed, and the living standards of farmers have improved. Bhaskar Mittra enquired about the scaling-up activities undertaken and specific interventions taken up. He suggested that the benefit-cost ratios may be worked out for assessing impacts. Gautam wanted to know more about the farmers' practices and a comparison of the ridge-furrow system with BBF system and about the availability of implements. Pathak clarified that the improvements in the soil health are farmers' perceptions only and details about recommended practices and the yield enhancements achieved are all available in the report. Pardhasaradhi wanted to know as to why the yields in Vidisha were very low compared to Indore and Pandey answered that it could be due to heavy rainfall.

Akhilesh Singh Yadav from BYPASS presented the progress report on the productivity enhancement in Raisen and Sagar districts of Madhya Pradesh covering participatory trials on balanced nutrient management, water use efficiency and fallow management along with various other activities like crop diversification, self-help groups (SHGs) development, cattle health and capacity building of farmers. Fifteen villages in each district (total 30) were covered and based on focus group discussions constraints were identified.

Soil test-based balanced nutrient management practices were developed and adopted. As wilt disease is predominant in chickpea in both the districts, seed treatment was done.

Improved varieties of pigeonpea, groundnut, black gram and maize were introduced and the use of tropicultor was demonstrated. Special trials with Agribor sulphur + boron + zinc (SBZ) were also taken up. Soybean yields were affected by continuous rains and the yields were low, about 1.1 t ha^{-1} compared to the yields of 2.2–2.5 t ha^{-1} obtained in earlier years. Farmers opined that due to heavy rainfall and cloudy conditions, Yellow Magic disease adversely affected the soybean crop. In the *rabi* season, both chickpea and wheat performed well due to good rainfall in the *kharif* along with improved management practices. Almost 2.3 t ha^{-1} yield was obtained in chickpea under balanced nutrition trials, which was record grain yield in some villages as the average is about 1.5 t ha^{-1} in the district. Wheat yields were about 4.5 t ha^{-1}. Vegetable cultivation using crop diversification and micronutrient application produced not only higher yields by 30% over other farmers' practice, but also the quality of produce was better. Linkages with other departments and Krishi Vignan Kendras (KVKs) were developed to facilitate farmersfamiliarity with sprinkler system, seed procurement and others. Akhilesh Yadav concluded saying that aberrations in monsoon rainfall and prolonged cold wave conditions adversely affected crops. BYPASS is looking forward to intensifying various trials, intensifying fallow management in five villages, strengthening community-based institutions, cattle-breed improvement and capacity building of farmers, particularly women farmers. Suhas Wani wanted to know whether the interventions made really could realize higher productivity compared to non-project villages/farmers, and also what are the bottlenecks for reducing the rainy season fallows by 75% in some selected villages? Akhilesh Yadav mentioned that this year, chickpea yields were much higher and farmers are convinced about the seed treatment and the use of micronutrients. On fallow management, this year due to very heavy rainfall in the *kharif* season, germination was slightly affected; and it needs more time to convince farmers. However, the farmers with whom we are working are now appreciating the importance of rainy season fallow management, he pointed out. Wani suggested that five villages may be selected for intensive fallow management; and about 500 ha may be chosen for at least 70% rainy season fallow management. Wani said that this may be taken as a challenge and wanted the BYPASS team to work out the requirements for equipment and strategy. He mentioned that farmers always look forward to new technologies that give better benefit-cost ratios. Akhilesh was very enthusiastic and said that

they will try this in a mission mode and conduct a demonstration. BYPASS team will identify villages and farmers, and soon start building awareness and capacity building for conducting rainy season fallow management trials.

Yaseen Khan presented the progress of the work done by CARD in the Shajapur district, covering four blocks and in twelve villages. There are 365 families covered by the program with 212 trials in the *kharif* season and 153 trials in the *rabi* season. Achievement of trials conducted in the *kharif* season was 87% and in the *rabi* season, it was 74%. Khan reported on the trials with soybean, wheat and chickpea with application of vermicompost, FYM, zinc and boron. The results of the trials showed that yields increased by 15% in soybean, 23% in wheat and 19% in chickpea. Efficient irrigation water management through drip and sprinkler systems were demonstrated in farmers' fields. From 12 villages, 365 farmers were trained. A glimpse of activities undertaken under other projects in the area (ATMA, Suzlon and DST) was presented. Farmers are willing to adopt the new agricultural technologies including micronutrient application for enhancing productivity and realize that excess usage of fertilizers and pesticide is harmful. The non-availability of quality soybean seeds is one of the major constraints in the area.

RL Suwalka informed that Rajasthan, particularly Kota region imports soybean seed from Madhya Pradesh and sufficient quantities of quality seed of soybean is available in Madhya Pradesh. Suhas Wani enquired as to how the increase in the yields was calculated? What was the baseline? He suggested to develop village level seed banks for soybean. In Jhabua district under SRTT-ICRISAT project, village seed banks exist and they sell certified seed to the villagers, and suggested to take quick initiative for developing a village seed bank. Wani also offered to help in obtaining breeder's or foundation seeds of soybean from agricultural university, provide technical backstopping and revolving fund.

Bachchu Singh Choudhary presented DEEP's progress on productivity enhancement in Tonk and Sawai Madhopur districts of Rajasthan. About 48% of the area is un-irrigated in Tonk and 52% in Sawai Madhopur district. Major activities of the project include farmer-participatory selection and evaluation of crop varieties, micronutrient amendments, promoting water saving technologies, village level seed banks, capacity building, convergence of activities and soil water monitoring for irrigation scheduling. Beneficiaries in the project in 2011 were 960. Application of balanced nutrients increased yields over farmers' practices by 19.7% in *bajra* (pearl millet), 14.5% in maize and 13.7% in groundnut in Tonk district. In Sawai Madhopur district, increase in

yield was 9.5% in *bajra*, 16.2% in black gram and 16.1% in maize. Thanks to the efficient irrigation management systems adopted in the watershed area, there was considerable increase in irrigated area among five farmers. Usage of hybrid and high-yielding varieties increased along with crop diversification through vegetable cultivation. Green fodder availability with dry fodder has increased milk production and the residual effects of micronutrients on vegetables and fruit crops were observed by the farmers. Some of the challenges noticed are erratic rainfall, attack of blue bull and wild animals, non-availability of quality seed and micronutrients, market linkages and low literacy. He gave an account of the targets achieved and farmers' days organized. Ramesh Singh enquired about the lodging due to usage of rain gun.

JP Sharma presented the progress of work done by BAIF in Alwar, Bhilwara, Bundi, Jhalawar and Banswara. He said that Bhilwara, Bundi and Jhalawar are part of Hadoti, Banswara is a part of Mewar and Alwar is a part of Mewat region. About 5,354 families are associated with the program and 1,293 plots are covered under participatory research trials. About 850 artificial inseminations were done through BAIF door-step service in the project villages. Adoption of gypsum and other micronutrients increased considerably. About 1,022 families got benefits of productivity enhancement due to the application of micronutrients. Basal application of micronutrients was done in 158 ha and 2 to 7 quintals ha^{-1} production increased in the first year and 1.5 to 3.0 quintals in the next years as a residual benefit. Farmer invested an additional amount of ₹ 394/- for maize crop in the 2010 *kharif* season for micronutrients application and got an additional income of ₹ 700/- compared to the control plot. In the ₹ 2010 *rabi* chickpea crop, he could get further additional amount of ₹ 1,300/- per plot. In 2011 *kharif,* with no additional investment on micronutrients he could get an additional ₹ 300/- for his maize crop and in the subsequent 2011 *rabi* season, he obtained additional benefit of ₹ 1,300/- for wheat crop. Thus, application of micronutrients in the first year's *kharif* season could bring out an additional income of ₹ 3,600/- spread over two years and four seasons. Sale of zinc fertilizer and gypsum have picked up in recent years in the districts as there is high demand by farmers. Seven trainings for the farmers were organized. Pardhasaradhi pointed out that the correct amount of FYM application was 2,500 kg ha^{-1} and not 250 kg ha^{-1}.

During discussions, Suhas Wani suggested to all team members to identify four or five bottlenecks for scaling-up the technologies at their respective locations. He also suggested recording the way forward solutions to address those bottlenecks. He wanted to know how to translate the advice into actions. The

project is in its last year and we started with three districts and a few villages and now are operating in 15 districts and more than one hundred villages, with thousands of trials are being conducted. It is time now for us to ask ourselves what is the adoption percentage once we hand over to farmers. The answer will determine whether our initiatives are sustainable or not. He requested the team to look at the trajectory for the scaling-up strategy and identify the real bottlenecks with possible solutions to overcome them.

Technical Session III

Chair: **RL Suwalka**
Rapporteur: **Mukund Patil**

Mahantesh Agasimundin presented the progress report of model watershed at Dharwad. The salient activities in Dharwad watershed during last year included the trials for productivity enhancement by 10-15% due to improved nutrient management practices as compared to farmers' practices, increased water availability during post rainy season that allowed increase in cropped area, income-generating activities like preparing bamboo baskets and *aggarbatti* had increased the income of SHG member from ₹ 1,200 to ₹ 3,000, formation of joint liability group with cooperation with bank.

Gauri Rane presented detailed progress of Padmalaya model watershed, Jalgaon. Important points from the presentation were: productivity enhancement by 19 to 37%, construction of diversion canal along the foothill in the watershed which diverted runoff water to the percolation tank, diversion of water from Bahula reservoirs through the watershed area by local governing body, awareness programs, school children, and NSS camps by college students helped in watershed development activities.

Naveen Kumar presented progress report of Medak model watershed. He also indicated increased crop productivity due to adaption of balanced nutrient management practices. Farmers in the watershed area benefited due to increased availability of water, and thus crop area during post rainy season increased. Other activities such as tree plantation, clean environmental program, and vermicompost production were highlighted by Kumar.

SK Dixit presented progress report of Guna watershed. During the session, after his presentation, DK Pal highlighted the importance of chickpea crop for good soil health. Progress of the model watersheds from Jhansi was presented by Ramesh Singh. In the presentation, he indicated that abnormal climatic conditions during the season hampered the performance of improved varieties. This made the job difficult to convince farmers for adopting new varieties, though experimental trials showed significant improvement in yield. Multipurpose tree species were also planted in the watershed area through other schemes from the government. He also presented the progress of the watershed from the Bundelkhand region. The yield improvement in this watershed was about 21%. They also addressed the issue of equitable water distribution for irrigation. During the discussion, Pal raised a query about findings of the survey done in watershed in which the clarity of project has been indicated low. Responding

to the comments by the delegates from Jhansi, he said that there are many watershed programs being conducted in Bundelkhad region, and thus people know what the work is going to be when someone says watershed program. Akhilesh Singh presented progress report of Raisen model watershed. The yield improvement was from 8% – 22%. The unique problem faced in this region is invasion of the farm by wild animals. To tackle this problem thorny plants are planted on the boundary of farms. They also observed wilt disease in this watershed.

Technical Session IV

Chair: **Gauri Rane**
Rapporteur: **KH Anantha**

In this session seven presentations were scheduled to present progress report and the impact of implementing model watersheds in Gujarat, Rajasthan, Orissa, Maharashtra and Tamil Nadu states. First presentation was by Tushar Balani on model watershed in Jamnagar, Gujarat. Balani presented the progress under the model watershed and highlighted the soil testing results for undertaking suitable crops in this area. Farmers observed 13% increase in boll formation due to micronutrients application and 7 to 40% increase in seed cotton yield. They found that use of Zn and B containing fertilizers in medium black calcareous soils of Saurashtra region in cotton were found beneficial. They have undertaken trials to calibrate Water Impact Calculator (WIC) in wheat and chickpea system with different irrigation methods viz., BBF, drip; flat drip; and flat flood. The improved fodder variety seeds were introduced in the fallow land and encouraged farmers to grow fodder to support cattle population in the area. To minimize the fertilizer use they were going to try FYM or organic fertilizer also along with soil test-based recommendations. They felt that there are innovative farmers but it takes time to implement the same.

Ranjan Mahapatra, presented the progress of model watershed implemented by Shristi NGO in Nuagaon-Kunta, Orissa. During the last year, the rainfall was uneven and had more number of dry spells that affected paddy yield in the area. He revealed that agriculture in this region is very primitive and people mostly depend on forest products for their livelihood. There was a practice of mono-crop and shortage of drinking water which has triggered the implementation of watershed. He claimed that a systematic process was followed in the implementation of model watershed. In the first stage, community institutions have been created, and capacity building trainings were undertaken to train the members of these institutions. Further, alternative livelihood activities were started with market linkages. The productivity enhancement activities were also undertaken to bridge the large yield gap in the watershed. He noted that the major limitations for productivity enhancement are: limited farm mechanization, small size plots – difficulty of using implements, lack of willingness to adopt new technologies and scientific knowledge on agriculture. Mahapatra highlighted that the farmers' participation in the project villages had increased nearly three times from 126 farmers during 2009-10 to 328 farmers during 2011-12. This is positive impact of model watershed. However,

he opined that there is need to change the mindset of farmers to adopt new technologies to produce more. To overcome financial burden to implement both IGAs and productivity enhancement activities, convergence of major government programs with watershed program was facilitated.

Nand Kishor Trivedi presented progress of the Dungarpur model watershed in Rajasthan, highlighting changing crops and cropping systems in the watershed area. In *kharif* season, mainly maize was cultivated, while wheat was cultivated during the *rabi* season. Improved maize variety of JK 3672, JK 4212 and JK 175 were sown and improved wheat variety of RAJ 4037 was sown by majority of the farmers. Improved planting methods were followed such as intercropping. In addition to productivity enhancement, livestock improvement and income-generating activities such as nursery raising and vermicomopsting were promoted. Further during the presentation, the performance of self-help groups (SHGs) in the project area, was highlighted.

Prasant Kalaskar from WOTR, Ahmednagar presented the progress of model watershed in Ahmednagar, Maharashtra. Kalaskar highlighted the scarcity of rainfall during last year. He also presented the work done so far especially on soil and water conservation measures in the watershed and agricultural activities undertaken. *In-situ* water harvesting system, horticultural activities and agro-advisories are innovative activities in this watershed. In terms of impact, he claimed that the display of weather data leads to better participation of farmers and migration has come down by 20% due to watershed activities in the village. The model watershed has sent clear message that improved practices have significantly increased the yield compared to farmers' practices.

The progress of Deb Neval Atwal model watershed was presented by Shailendra Tiwari of Seva Mandir, Udaipur, Rajasthan. He started with explaining the land use pattern in the watershed and that the major area is covered by forest and about one-fifth of total land is rainfed which is significant in the watershed to improve the livelihoods of people. The soil testing results were presented and got the attention of scientists in the meeting. He presented major micro and macro nutrients deficiencies in the watershed. The hydrological monitoring is being done in the watershed, which is very critical to monitor the impact of watershed intervention. Income-generating activities such as nursery raising and livestock have been undertaken to support rural livelihood in the watershed area.

Prabhakar presented the progress of Ammaiyanaickanur Model watershed in Dindigul, Tamil Nadu. Various soil-water conservation activities have been

undertaken in the watershed viz., masonary check dam, loose boulder nala plug, well recharge through openwells, etc. He claimed that due to masonry check dam construction, the number of wells got recharged and irrigated area has increased. Productivity enhancement trials were undertaken and produced good results over farmers' practice. Vermicompost pits and *Gliricidia* nurseries were maintained by SHGs and they have benefited from these activities.

Rajesh from TVS presented progress of Melkarai model watershed, Tamil Nadu. He highlighted the activities undertaken in this watershed; and emphasized that income-generating activities for landless and women were the major focus; and moreover there has already been focus on the on-going activities rather than new ones. Convergence was achieved with other departments to sustain the program.

The session ended with a summary of the presentation by the Chair.

Technical Session IV (Working Groups)

Working Group for Model Watersheds

Facilitators: P Pathak and Sudi Raghavendra Rao

All the partners from ICAR institutes, state universities and NGO representatives involved in the model watersheds (nine MoA and four MoRD) discussed several issues relating to the model watershed activities. Some of the key points on researchable issues and major focus of work plan are mentioned here.

Researchable Issues

- A resilient system of integrated package of practice for region wise should be developed and provided.
- Optimization of water resource should be developed.
- The model watersheds were established to evaluate and assess the workability and to demonstrate as a learning center; any learning or outcome should help in future activities.
- Clear and workable withdrawal strategy needs to be worked out.
- Impact of watershed interventions on downstream area should be studied.

Table 1. Activities considered for each model watershed while preparing action plan for 2012-13.

Watershed	Highlighted points
Jalgoan, Maharashtra	• Productivity enhancement initiatives • Strengthen the SHG activities • Livestock development • Strengthen the capacity of watershed committee • Convergence • Soil and water conservation
Jhansi	• Deepening/desilting of WHS • Crop diversification • *Desi ber* budding • Seed bank establishment
Dharwad	• Fodder development activities • Livestock development • Convergence with on-going programs of line departments • Agro-forestry and horticulture

Continued

Watershed	Highlighted points
Medak, Andhra Pradesh	• Efficient irrigation system, improvement in water use efficiency • Crop diversification • Livelihood activities • Productivity enhancement • Micro credit plan
Guna, Madhya Pradesh	• Soil and water conservation and water harvesting structures • Productivity enhancement • CPR and silvipastrure • Fodder development • Livestock development
Jamnagar, Gujrat	• Expanding field demonstrations • Horticultural development • Strengthening vegetable cultivation • Livestock development
Mayurbhanj, Orissa	• Soil and water conservation and dug well development • Bamboo shoot planting (edible) • Develop drainage network • Productivity enhancement • Capacity building • Income-generating activities • Convergence
Dungarpur, Rajasthan	• Productivity enhancement • Processing and marketing • Convergence
Tirunelveli, Tamil Nadu	• Soil and water conservation • Productivity enhancement (particularly short duration crop varieties) • Drip irrigation for horticulture crops • Fodder development • Livelihood activities (specially for women) • Convergence
Ahmednagar, Maharashtra	• Soil and water conservation • Expand the productivity enhancement initiatives • Livelihood activities • Convergence with on-going programs of line departments • Dryland horticulture

Continued

Watershed	Highlighted points
Udaipur, Rajasthan	• Physical treatment will be developed based on opographic map • Strengthen the SHG activities • Upscale the PE trials • CPR and private wasteland development • Horticulture with efficient irrigation system • Nursery and commercial scale vegetable cultivation • Kitchen garden • Livestock development (introduction of improved goat breeds)
Raisen, Madhya Pradesh	• Monsoon fallow management • Soil and water conservation • Upscale the productivity enhancement trials • Livelihood activities • Livestock development
Dindigul, Tamil Nadu	• Soil and water conservation • Horticulture • Livelihood activities • Strengthen the SHG activities • Floriculture and vegetable cultivation

Working Group for SDTT Project

Facilitators: KL Sahrawat and DK Pal

Following points emerged during the discussion for consideration in the plan of action for 2012-13:

- Need for the farm facilitators
- Recording of soil depth and fertility map
- Economics of the cropping system
- Compilation of the data
- ICRISAT staff for monitoring the observations
- Exploring other livelihood options
- Recommendations for improving soil organic matter (green manure in rotation)
- Inclusion of improved varieties of crops
- Support by the subject matter specialist at KVKs
- Optimum utilization of available water
- Video documentation of trials
- Developing contingency plans

Concluding Session

Chair: **SP Wani**
Rapporteur: **Mukund Patil**

In this session, points to consider for the preparations of next year's action plan were put forward for discussion. Important points discussed in concluding session are: requirement of farm facilitators, suitability of BBF system, need for contingency plan, and video documentation. Responding to the experiences by delegates from Indore about better suitability of ridge and furrow system than BBF, Wani and Pathak explained the importance of BBF not only during rainy season but also in post rainy season. It may be difficult to convince farmers to follow BBF system, but once they see the benefits of the BBF, they will adopt the system. Regarding farm facilitators, Akhilesh Yadav indicated that farm facilitators may be from the farmers community, especially those who have already been working with the SDTT project, but it is necessary for them to know a good amount of capacity building program. Suwalka shared his experience about the farm facilitators while working in the KVK; and added that one farmer from the village can be hired on contract basis. Bhaskar Mittra mentioned other aspects of this issue that the farmers from project village may not take seriously to the suggestions made by the person for the farming committee. Bhaskar Mittra described the strategic role of the SDTT for addressing the challenges in Bundelkhand and Vidarbha regions in India. He suggested that Vidharba could be a priority region for consideration during the next phase covering six districts and 1,400 villages. Wani finally highlighted the ICRISAT experience in other projects in the South and supported the idea of farm facilitators. The session also collectively decided to have a video documentation of all the success stories from the project. Responding on contingency plan, Wani indicated that the weekly bulletins sent by IMD will be forwarded to all the partners. Suwalka also indicated that such contingency plans have to be available in the all the KVKs.

Relating to the researchable issues, it was decided that research activities should involve students. Scientific evidence would help to convince policy makers to go for reforms. Wani suggested to delegates from Dindigul model watershed that along with taking irrigated crops, they have to try to convince more farmers to take up growing rainfed crops. Towards the end, Wani and Mittra insisted that all the partners to share their experience among the whole group. Mittra also stressed upon that they should think of selected activities which will be really helpful to the objective of the project, while planning for next year.

The session and the two days' review and planning meeting concluded with a formal vote of thanks by P Pathak.

Tata-ICRISAT-ICAR and Model Watershed Projects' Review and Planning Meeting

Sustainable Intensification of Rainfed Agriculture through Natural Resource Management

23–25 May 2012
C F Bentley Conference Centre (212 Bldg.)
ICRISAT, Patancheru, India

Program

Wednesday 23 May 2012

0800–0900	Registration	

Session 1 Inaugural Session

Rapporteur: **Mukund D Patil**

0900–0910	Welcome and objectives of the workshop	KH Anantha
0910–0930	Introduction of participants	
0930–0955	Improved livelihoods and food security through sustainable intensification in rainfed areas	SP Wani
0955–1010	Natural Resource Management under new CRPs	Peter Q Craufurd
1010–1030	Inaugural address	WD Dar
1030–1035	Vote of thanks	P Pathak
1035–1105	*Photograph and Tea/coffee break*	

Session 2 Technical Session I

Chair: **Pradip Dey**
Rapporteur: **Gajanan Sawargaonkar**

1105–1125	Weather monitoring for integrated watershed management	AVR Kesava Rao
1125–1145	Sustainable intensification of agriculture in Madhya Pradesh: Rainy season fallow management	P Pathak
1145–1205	Enhancing rainwater use efficiency in Rajasthan and Madhya Pradesh	Kaushal K Garg/ Mukund Patil
1205–1230	Strategic research in Dharwad Model watershed, Karnataka	CP Mansur
1230–1300	Discussions	
1300–1400	*Lunch*	

Session 3 Technical Session II

Chair: **VS Gautam**
Rapporteur: **AVR Kesava Rao**

1400–1430	BAIF's Progress report on productivity enhancement in selected districts of Madhya Pradesh	SK Pandey
1430–1500	BYPASS's Progress report on productivity enhancement in Madhya Pradesh	Akhilesh Singh Yadav
1500–1530	CARD's Progress report on productivity enhancement in Madhya Pradesh	Yaseen Khan
1530–1600	*Tea/coffee break*	
1600–1630	DEEP's Progress report on productivity enhancement in districts of Rajasthan	Bachchu Singh Choudhary
1630–1700	BAIF's Progress report on productivity enhancement in districts of Rajasthan	JP Sharma
1700–1830	Discussions	
1830	*Workshop dinner*	

Thursday 24 May 2012

Session 4 Technical Session III

Chair: **RL Suwalka**
Rapporteur: **Mukund Patil**

0830–0845	Progress report on Model watershed in Dharwad, Karnataka	M Agasimundin
0845–0900	Progress report on Model watershed in Jalgaon, Maharashtra	Gauri Rane
0900–0915	Progress report on Model watershed in Medak, Andhra Pradesh	Naveen Kumar
0915–0930	Progress report on Model watershed in Guna, Madhya Pradesh	SK Dixit
0930–0945	Progress report on Model watershed in Jhansi, Uttar Pradesh	Ramesh Singh
0945–1000	Progress report on Model watershed in Raisen, Madhya Pradesh	Akhilesh Singh Yadav
1000–1030	*Tea/coffee break*	

Session 5 Technical Session IV

Chair: **Gauri Rane**
Rapporteur: **KH Anantha**

1030–1045	Progress report on Model Watershed in Jamnagar, Gujarat	Tushar Bhalani
1045–1100	Progress report on Model Watershed in Nuagaon-Kunta, Orissa	Ranjan Mahapatra
1100–1115	Progress report on Model Watershed in Dungarpur, Rajasthan	Nand Kishor Trivedi
1115–1130	Progress report on Model Watershed in Ahmednagar, Maharashtra	Prashant D Kalaskar
1130–1145	Progress report on Model Watershed in Udaipur, Rajasthan	Shailendra Tiwari
1145–1200	Progress report on Model watershed in Dindigul, Tamil Nadu	ID Prabhakar
1200–1215	Progress report on Model Watershed in Tirunelvelil, Tamil Nadu	P Rajesh
1215–1330	*Lunch*	
1330–1530	Working groups for preparing work plans & time for preparing work plans	
	Facilitators: (i) SDTT	KL Sahrawat & DK Pal
	(ii) Model Watersheds	P Pathak & R Sudi
1530–1545	*Tea/Coffee break*	

Session 6 Concluding Session

Chair: **SP Wani**
Rapporteur: **Mukund Patil**

1545–1600	Presentations of the work plans – SDTT-ICRISAT-ICAR Project	
1600–1615	Presentations of the work plans – Model Watersheds	
1615–1630	Concluding remarks	
1630–1640	Vote of thanks	P Pathak

Friday 25 May 2012

0800	Field visit	

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Workshop Events through Lens


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Sir Dorabji Tata Trust

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Ministry of Agriculture
Ministry of Rural Development
Govt. of India

Tata-ICRISAT-ICAR and Model Watershed Projects' Review and Planning Meeting

Sustainable Intensification of Rainfed Agriculture thru Natural Resource Management

23–25 May 2012
CF Bentley Conference Center
ICRISAT, Patancheru, AP, India

PowerPoint Presentations

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Tata-ICRISAT-ICAR and Model Watershed Projects' Review and Planning Meeting

Sustainable Intensification of Rainfed Agriculture thru Natural Resource Management

23–25 May 2012
CF Bentley Conference Center
ICRISAT, Patancheru, AP, India

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Objectives

- To review the progress and synthesize the findings from the work done at different locations under SDTT and Model Watershed projects in India
- To identify emerging issues, discuss up-scaling strategies, and prepare work plans for sustainable use of natural resources and increasing productivity in India
- To plan strategic participatory research and development trials for enhancing productivity.

Improved Livelihoods and Food Security thru Sustainable Intensification in Rainfed Areas

ICRISAT Science with a human face

Suhas P Wani and Team

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
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Interlinked Challenges—Trade-offs and consequences

ICRISAT Science with a human face

Finite Land and Water Resources

ICRISAT Science with a human face

1.5 billion ha arable land

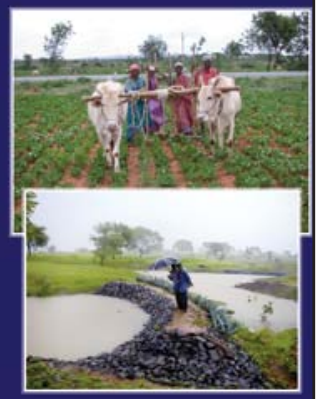
Sustainable Development

ICRISAT Science with a human face

- Holistic/system's approach
- Interdisciplinary thinking
- Science-based policymaking and interventions
- Long-term, cross cutting and complex approach
- Balanced and future-oriented interlinked challenges

Sustainable Intensification thru Increased Efficiency of Resources

- Land
- Water
- Energy
- Nutrients
- Labor
- Chemicals



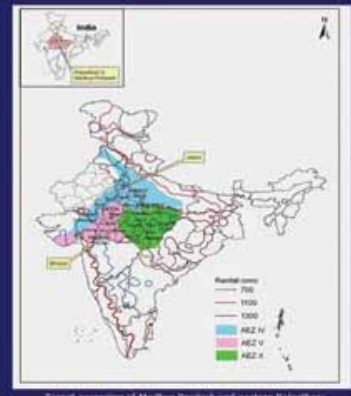
Goal

- Goal of the proposed initiative is to improve the livelihoods of rural people in the target agro-ecoregion through sustainable management of natural resources by adopting the science-led, holistic, community watershed management approach

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 sites of learning for scaling-out benefits in the three target districts
- To scale-out the benefits of productivity enhancement and community watershed management with technical backstopping in the target agro-ecoregion of M.P. (7+2 districts) and Rajasthan (6+1 districts)
- Capacity building of lead farmers, development workers, and consortium partners in the target region and provide technical support to development agencies in the area of Community Watersheds through establishment of a national support group for community watershed development (NSGCWD)

Target Ecoregions



Target ecoregion of Madhya Pradesh and eastern Rajasthan: agro-ecozones, soils and rainfall in the region

Our Consortium Partners

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DEEP Development Research Foundation Institute (DEEP)
BYPASS Sansthan (BYPASS)
Center for Advanced Research and Development (CARD)

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Maharana Pratap University of Agriculture & Technology, Udaipur
Rajasthan Agricultural University, Bikaner
Jawaharlal Nehru Krishi Vishva Vidyalaya, Jabalpur
M Ahilyabai Holkar Agricultural University
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior

National Research Institutes
Indian Institute of Soil Science, Bhopal
National Research Center for Soybean, Indore
Central Institute of Agricultural Engineering (CIAE), Bhopal
Central Arid Zone Research Institute (CAZRI), Jodhpur
Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad
National Research Centre for Agroforestry (NRCAF), Jhansi

Private sector
Jain Irrigation Ltd.

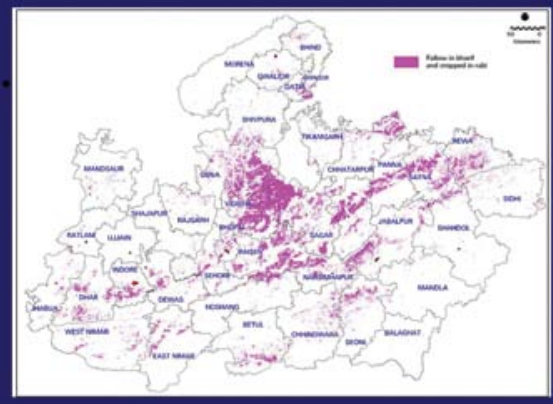
Convergence to Increase Impacts

• Model watershed-IWMP (Rajasthan and MP + seven other states)	MOA-GoI
• Enhanced water use efficiency – FPARTs (Rajasthan, Jharkhand, MP, Chattisgarh)	MoWR-GoI
• Water impact calculator	SAI Platform
• Model watersheds – IWMP (Rajasthan, MP and two other states)	MoRD-GoI
• Capacity building for state government officials – IWMP	MoRD-GoI
• Public private partnership (PPP)	Jain Irrigations

Hungry Soils: Low WUE, Low Crop Yields

State	No Of Farmers	% deficient OC	Av P	Av K	Av S	Av B	Av Zn		
Jharkhand	115	42	65	50	77	97	71		
Madhya Pradesh	341	22	74	1	74	79	66		
Rajasthan	423	38	45	15	71	56	48		
State	Farmers	pH	EC	OC	Av P	Av K	Av S	Av B	Av Zn
Jharkhand	115	5.6	0.15	0.51	5.3	63	7.6	0.17	0.68
Madhya Pradesh	341	7.8	0.25	0.65	5.0	190	9.6	0.43	0.72
Rajasthan	423	7.8	0.30	0.72	8.1	116	10.8	0.60	1.27
Jharkhand	115	4.9-7.4	0.03-0.90	0.19-1.13	0.6-72.4	8-247	1.3-50.0	0.06-0.80	0.24-2.95
Madhya Pradesh	341	5.9–8.7	0.02-1.56	0.29-2.19	0.1-68.0	46-718	1.8-134.4	0.06-2.20	0.19-3.82
Rajasthan	423	6.2–10.2	0.03-3.32	0.06-2.37	0.2-44.6	14-1,358	1.9-374.0	0.08-2.46	0.06-28.60

Sustainable Intensification thru Rainy Season Management in Madhya Pradesh



Rainy Season Fallow in Madhya Pradesh

- Large areas (2.02 million ha) of deep black soils (Vertisols) in Madhya Pradesh are kept monsoon fallow during the rainy season and the crops are sown during the post-rainy season
- Five districts of Madhya Pradesh viz. Vidisha, Guna, Raisen, Satna and Sagar have large percent of area under rainy season fallow

Serious Waterlogging Problem in Farmers Practice and a Good Soybean Crop in BBF System at Guna Watershed 2008

Water logging problem

Crop under BBF system

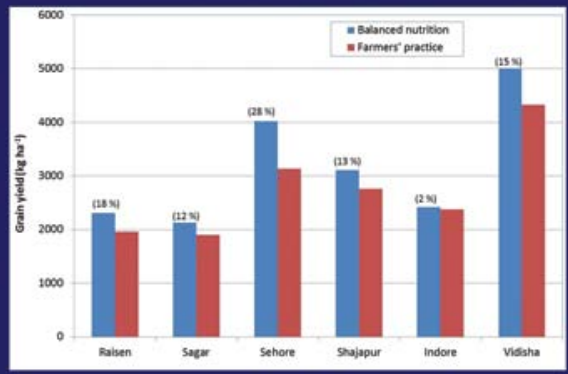
Various Improved Technologies Evaluated in the Field Trials during 2009-10 in Madhya Pradesh

S.No.	Description of Technology(ies)
1.	Double cropping or rainy season fallow management
2.	Broad-bed and furrow System (BBF) land form for moisture conservation and controlling water logging; and flat cultivation on grade
3.	Integrated nutrient management with micronutrients applications (borax, zinc sulfate and gypsum)
4.	Improved crop varieties soybean (JS 335, JS 9305) in the kharif and chickpea (ICCV 37 and ICCV 10) in the *rabi* season
5.	Improved implements viz. tractor mounted BBF maker cum seed drill; furrow openers attachment to existing seed drill

Potential Impact of Managing Rainy Season Fallow in Madhya Pradesh

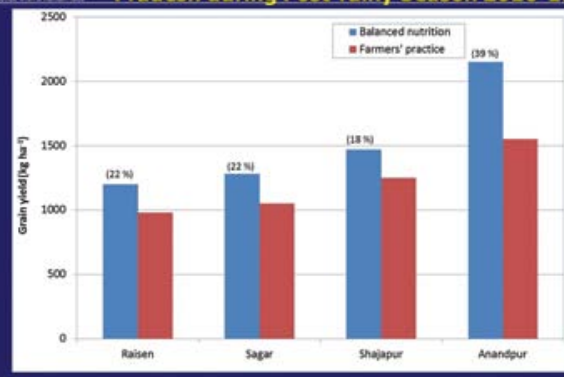
- Additional 4 million tones annual production of soybean
- Improved soil health
- Improved rainfall use efficiency 30 to 70%
- Annual soil loss reduced by 14 million tones
- Reduced area under downstream flooding and siltation

Yield of Wheat Increased by Balanced Nutrition in the Farmers' Fields of Madhya Pradesh during Post-rainy Season 2010-11



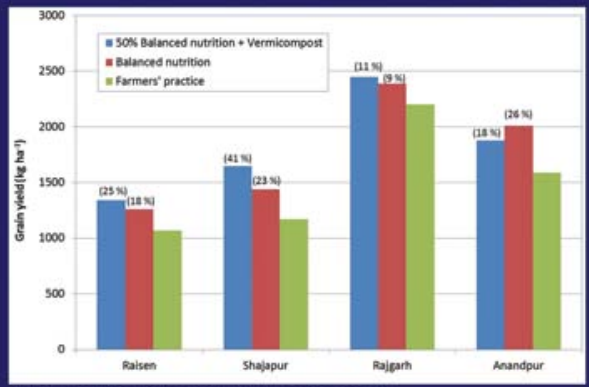
Figures in parenthesis show percent increase over farmers' practice

Yield of Chickpea Increased by Balanced Nutrition in the Farmers' Fields of Madhya Pradesh during Post-rainy Season 2010-11



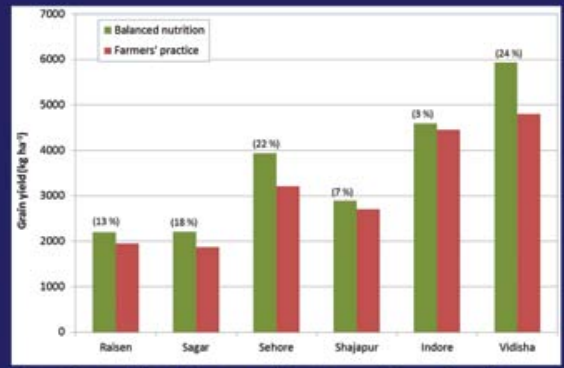
Figures in parenthesis show percent increase over farmers' practice

Yield of Chickpea Increased by Balanced Nutrition and Vermicomposting in the Farmers' Fields of Madhya Pradesh during Post-rainy Season 2010-11



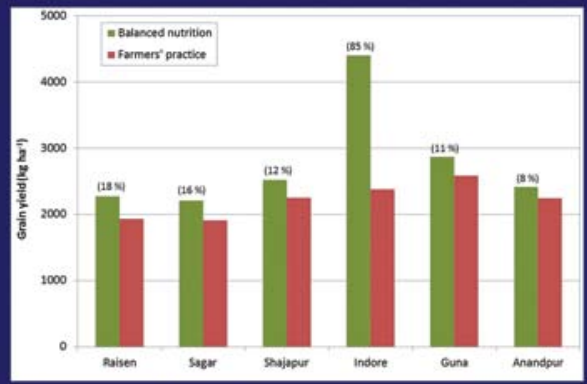
Figures in parenthesis show percent increase over farmers' practice

Residual Effect of S+B+Zn Applied in Rainy Season 2010 on Yield of Wheat in Post-rainy Season, 2010-11 in Madhya Pradesh



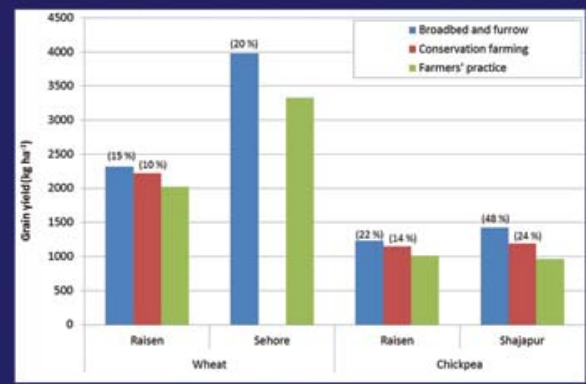
Figures in parenthesis show percent increase over farmers' practice

Increased Yield in Scaled-up Trials of Wheat in Post-rainy Season 2010-11 in Madhya Pradesh



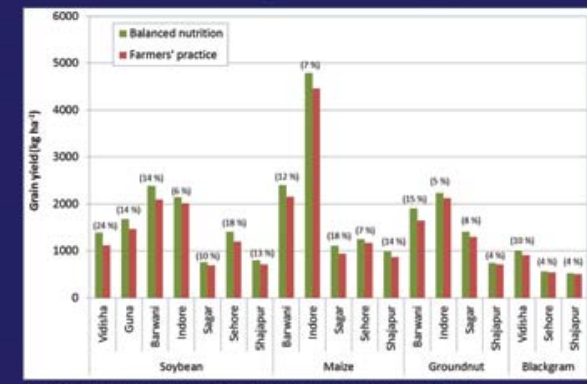
Figures in parenthesis show percent increase over farmers' practice

Effect of Land Management on Post-rainy Season Wheat and Chickpea in Rainy Season Fallow Regions of Madhya Pradesh during 2010-11



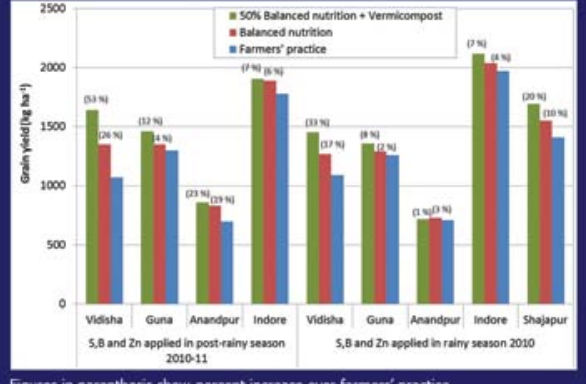
Figures in parenthesis show percent increase over farmers' practice

Increased Yields of Rainy Season Crops by Balanced Nutrition Application in Madhya Pradesh during 2010-11



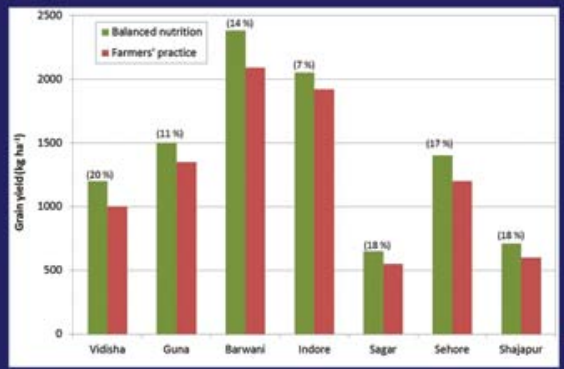
Figures in parenthesis show percent increase over farmers' practice

Residual Effect of S+B+Zn on Yield of Soybean in Rainy Season 2011 in Madhya Pradesh



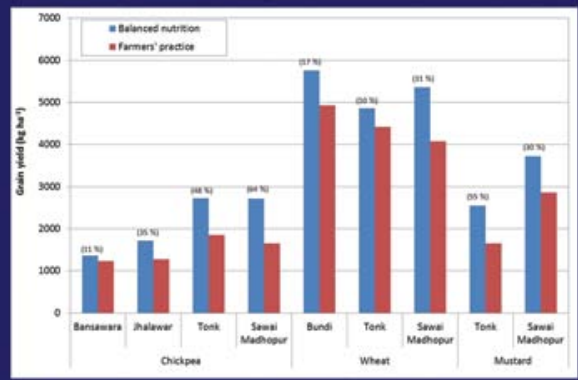
Figures in parenthesis show percent increase over farmers' practice

Increased Yield in Scaled-up trials of Soybean in Rainy Season, 2011 in Madhya Pradesh



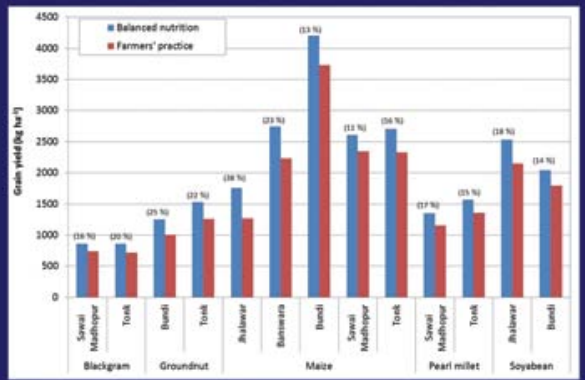
Figures in parenthesis show percent increase over farmers' practice

Increased Yield of Rabi Season Crops by Balanced Nutrition in the Farmers' Fields of Rajasthan during 2010-11



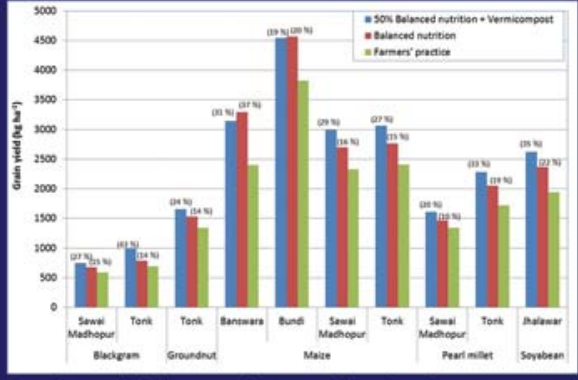
Figures in parenthesis show percent increase over farmers' practice

Yield of Kharif Season Crops Increased by Balanced Nutrition in the Farmers' Fields of Rajasthan during 2011



Figures in parenthesis show percent increase over farmers' practice

Yield of Kharif Season Crops Increased by Balanced Nutrition and INM in the Farmers' Fields of Rajasthan during 2011



Figures in parenthesis show percent increase over farmers' practice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Science with a human face
Micro-enterprises


ICRISAT
Science with a human face
Capacity Building


ICRISAT
Science with a human face
Responsible Young Citizens:
Environment Club Members


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Science with a human face
A View of the Farmers' Day

Model Watersheds Established in India

Seasonal Rainfall during 2011

Model watersheds – Ministry of Agriculture

State	District	Normal (mm)	Actual (mm)	Deviation (%)
Tamil Nadu	Tirunelveli	534	295	-45
AP	Medak	792	513	-35
Maharashtra	Jalgaon	730	569	-22
UP	Jhansi	882	754	-15
Karnataka	Dharwad	605	731	+21
Rajasthan	Dungarpur	696	905	+30
MP	Guna	1032	1650	+60
Gujarat	Jamnagar	458	1031	+125

Seasonal Rainfall during 2011 Contd..

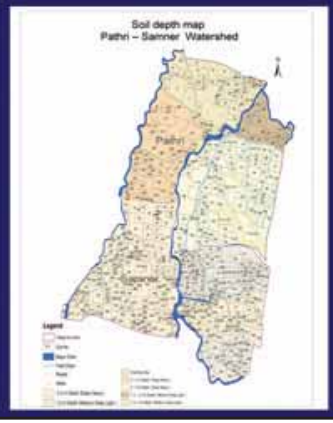
Model watersheds – Ministry of Rural Development

State	District	Normal (mm)	Actual (mm)	Deviation (%)
Maharashtra	Ahmednagar	542	340	-37
Tamil Nadu	Dindigul	585	439	-25
MP	Raisen	1163	1015	-13
Rajasthan	Udaipur	604	877	+45

Jalgaon Model Watershed

Pathri – Samner Watershed

Jalgaon Model Watershed
Pathri – Samner Watershed

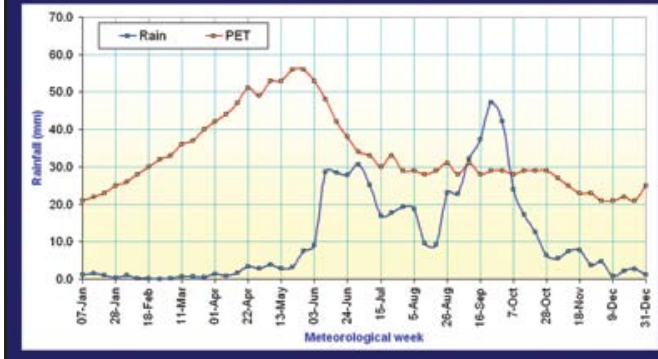


Simple and Reliable Hydrological Monitoring

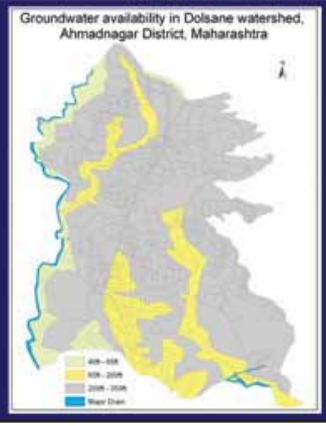
- Automatic runoff sample collection
- Samples at required time intervals
- Accurate and detail sediment flow data
- Suitable for small to medium size watersheds

Detailed Field Survey in Padmalaya Watershed

Sangamner – Water Balance



Dolasane-Bembalawade Model Watershed



Demonstration of Improved Implement Tropicultor

Thank you!

Natural Resource Management under the new CGIAR Research Programs (CRPs)

Peter Craufurd
Director, Resilient Dryland Systems,
ICRISAT

Today's presentation

- CRPs associated with NRM
- Where will CRPs work in India?
- Links between CRPs
- Some system type research questions

CRPs associated with NRM

- CRPs (CGIAR Research Programs)
  - new CGIAR global research programs
  - better integration of CG centre's research
  - greater emphasis on partnerships for impact
- 15 CRPs covering
  - Crop improvement (many)
  - Livestock & fish
  - Forests
  - Policy
  - Climate change
  - Systems (3: dryland, humid & coastal)
  - Nutrition
  - Land, water & ecosystems

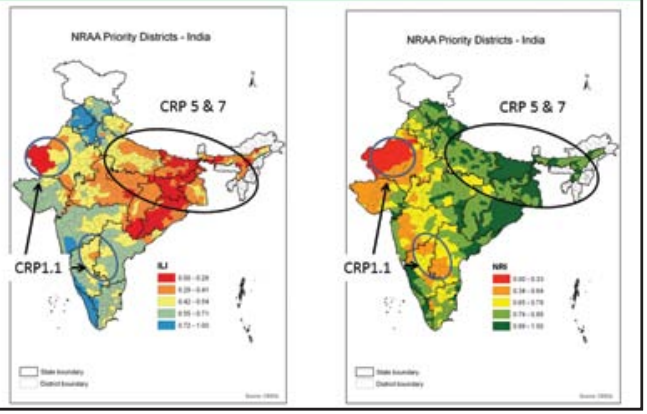
CRPs associated with NRM (cont.)

Resilient Dryland Systems contributes to 3 CRPs:

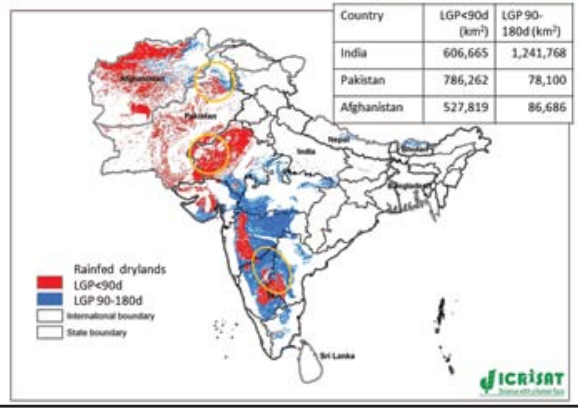
- CRP1.1 Dryland systems (in South Asia)
- CRP5 Water, land & ecosystems
- CRP7 Climate change (CCAFS)

All existing projects are mapped onto CRPs and their outputs reported under their respective CRP

Where will NRM CRPs work in India?

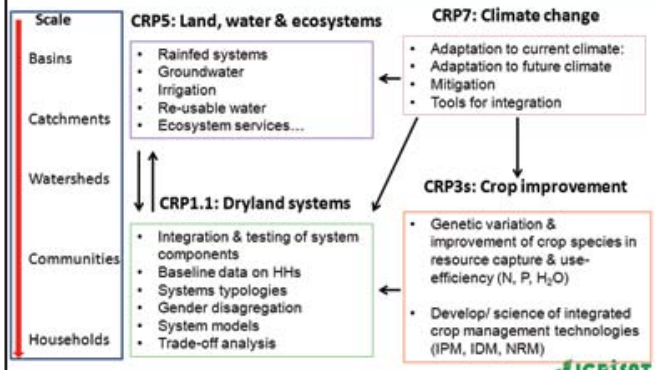


Target areas in S Asia for CRP 1.1



Country	LGP<90d (km²)	LGP 90-180d (km²)
India	606,665	1,241,768
Pakistan	786,262	78,100
Afghanistan	527,819	86,686

Links between NRM CRPs



Some CRP1.1 Research questions

- What are the trajectories of change for dryland systems?
- How does vulnerability and risk change spatially and temporally?
- Is vulnerability and risk aversion linked to agro-ecological potential?
- Is yield stability is the primary driver of decision-making in marginal areas?
- Can agricultural intensification reduce HH poverty without damaging the environment?
- How does the level of smallholder HH assets affect technology adoption?
- Do pastoral and agro-pastoral systems require different approaches and platforms?

and many questions linked to technology developed by other CRPs

Thank you

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Weather monitoring for Integrated Watershed Management

AVR Kesava Rao
Scientist (Agroclimatology), Resilient Dryland Systems, ICRISAT

Presented at the Tata-ICRISAT-ICAR and Model Watershed Projects' Review and Planning Meeting
ICRISAT, 23 May 2012

ICRISAT

Overview

- Agroclimatic datasets
- Weather monitoring in 2011
- Monsoon forecast for 2012
- Way forward

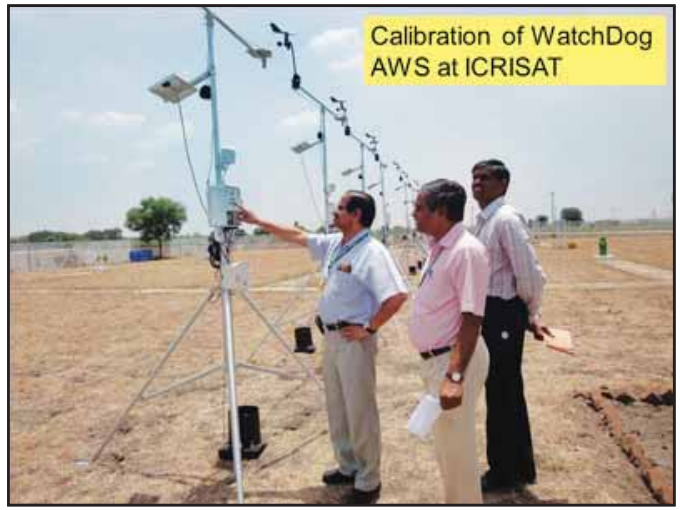
Agroclimatic characterization helps in

- Selecting suitable crops and varieties
- Devising management practices in watersheds to
  - conserve, harvest and efficiently use rainwater for enhancing agricultural production

Weather monitoring at watersheds helps in

- Understanding the effects of weather elements on crop growth and production
- Assessing the impacts of interventions made during the development phase and
- Bringing climate awareness among the community

WatchDog Automatic Weather Station



Datalogger Programming and data retrieval

- Setting preferences and properties
- Data retrieval using notebook computer
- Data reading using keyboard on logger
- Precautions and maintenance

Watershed locations

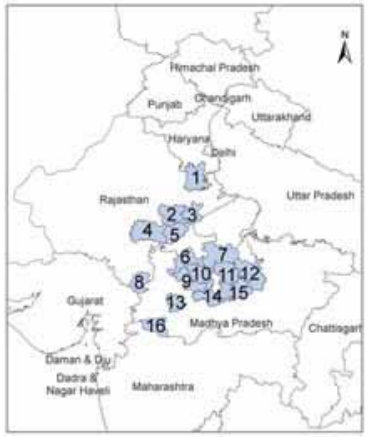
Dept of Land Resources

- 1 Udaipur
- 2 Raisen
- 3 Ahmednagar
- 4 Dindigul

Ministry of Agriculture

- 1 Jhansi
- 2 Guna
- 3 Dungarpur
- 4 Jamnagar
- 5 Jalgaon
- 6 Mayurbhanj
- 7 Medak
- 8 Dharwad
- 9 Tirunelveli

Watershed locations *Continued*



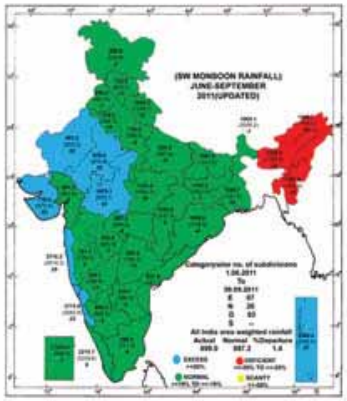
SDTT

1. Alwar
2. Tonk
3. Sawai Madhopur
4. Bhilwara
5. Bundi
6. Jhalawar
7. Guna
8. Banswara
9. Shajapur
10. Rajgarh
11. Vidisha
12. Sagar
13. Indore
14. Sehore
15. Raisen
16. Barwani

Monsoon 2011

Southwest Monsoon rainfall 2011

INDIA METEOROLOGICAL DEPARTMENT



- Southwest monsoon set in over Kerala on 29 May; 3 days earlier.
- Covered the entire country by 9 July (normal 15 July)
- For the country as a whole, monsoon rainfall (899.9 mm) was 101% of its LPA of 887.5 mm

Southwest Monsoon rainfall 2011

INDIA METEOROLOGICAL DEPARTMENT

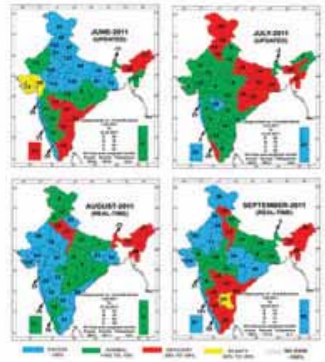


Fig.5: Sub-divisionwise monthly rainfall distribution over India during southwest monsoon season – 2011

- Withdrawal was delayed, commenced from west Rajasthan on 23 Sep
- Four depressions and ten low pressure areas have formed in the entire monsoon season

Northeast Monsoon 2011

- SW Monsoon withdrew from the entire India by 24 Oct 2011 and simultaneously NE Monsoon rains commenced over the south peninsula
- Post-Monsoon season 2011 was abnormally warmer. It was the second warmest (+0.85 °C anomaly) since 1901 after the year 2008 (+1.02 °C)
- Rainfall activity over the entire country was deficient (52% of the LPA)
- However, rainfall activity over the core region of south peninsula was normal (96% of the LPA)

Weather at watersheds in 2011

Seasonal rainfall situation

Period: Jun-Dec 2011

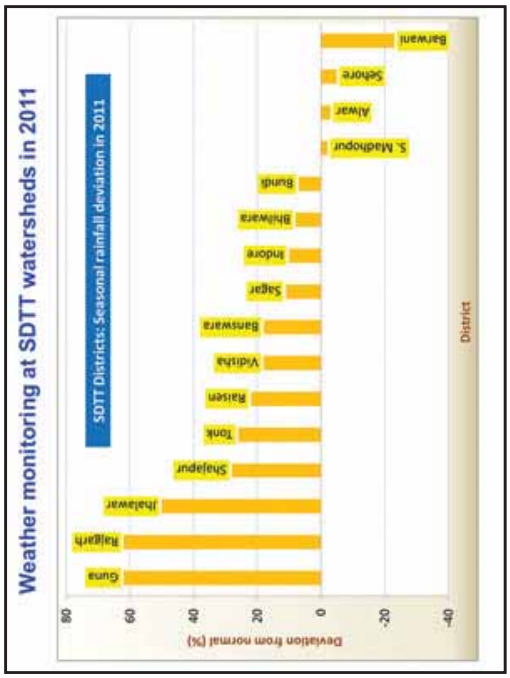
Watersheds	Actual rainfall range	Deviation range
Model watersheds – Ministry of Agriculture	295 mm (Venkatarangapuram, Tirunelveli) to 1650 mm (Barkhedakhurd, Guna)	-45% to +60%
Model watersheds – Ministry of Rural Developement	340 mm (Satichiwada, Ahmednagar) to 877 mm (Dob, Udaipur)	-37% to +45%
SDTT Watershed districts	559 mm (Barwani) to 1676 mm (Guna)	-23% to +62%

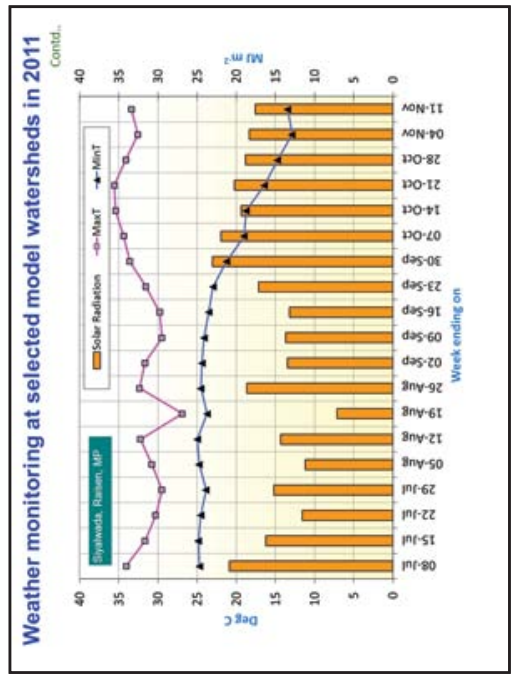
Rainfall during 2011

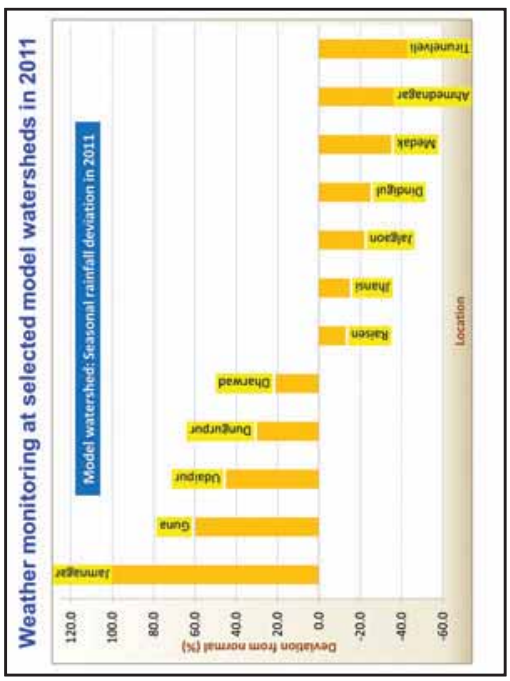
SDTT Watersheds

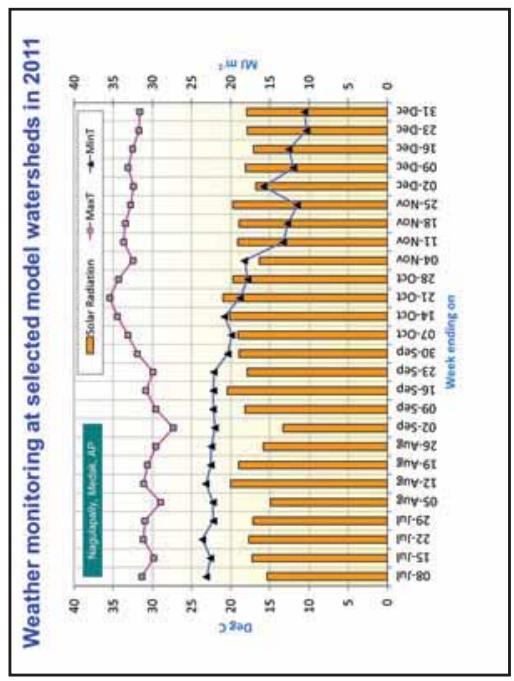
Rainfall in mm

State	District	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Season
Rajasthan	Jhalawar	392	339	346	157	0	0	0	1234
	Banswara	47	249	647	158	0	0	0	1101
	S. Madhopur	215	202	298	114	0	0	0	829
	Tonk	168	157	332	148	0	0	0	805
	Bundi	207	170	254	168	0	0	0	799
	Bhilwara	128	168	288	134	0	0	0	718
	Alwar	76	122	194	196	0	0	0	588
Madhya Pradesh	Guna	623	471	422	160	0	0	0	1676
	Raigarh	384	445	497	247	0	0	0	1573
	Raisen	384	433	301	301	0	0	0	1419
	Vidisha	510	381	318	157	0	0	0	1366
	Sagar	485	355	270	157	0	0	0	1267
	Shajapur	235	440	351	240	0	0	0	1266
	Sehore	196	333	381	217	0	0	0	1127
	Indore	71	316	474	152	3	0	0	1016
	Barwani	17	177	263	102	0	0	0	559


Weather monitoring at SDTT watersheds in 2011
SDTT Districts: Seasonal rainfall deviation in 2011
Deviation from normal (%)
District
Guna
Rajgarh
Jhalawar
Shajapur
Tonk
Raisen
Vidisha
Banswara
Sagar
Indore
Bhilwara
Bundi
S. Madhopur
Alwar
Sehore
Barwani

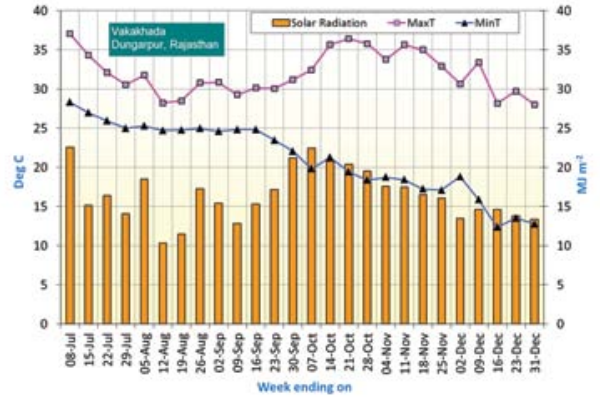

Weather monitoring at selected model watersheds in 2011
Contd..
Siyalwada, Raisen, MP
Solar Radiation
MaxT
MinT
Deg C
MJ m-2
Week ending on


Weather monitoring at selected model watersheds in 2011
Model watershed: Seasonal rainfall deviation in 2011
Deviation from normal (%)
Location
Jamnagar
Guna
Udaipur
Dungarpur
Dharwad
Raisen
Jhansi
Jalgaon
Dindigul
Medak
Ahmednagar
Tirunelveli


Weather monitoring at selected model watersheds in 2011
Nagulapally, Medak, AP
Solar Radiation
MaxT
MinT
Deg C
MJ m-2
Week ending on

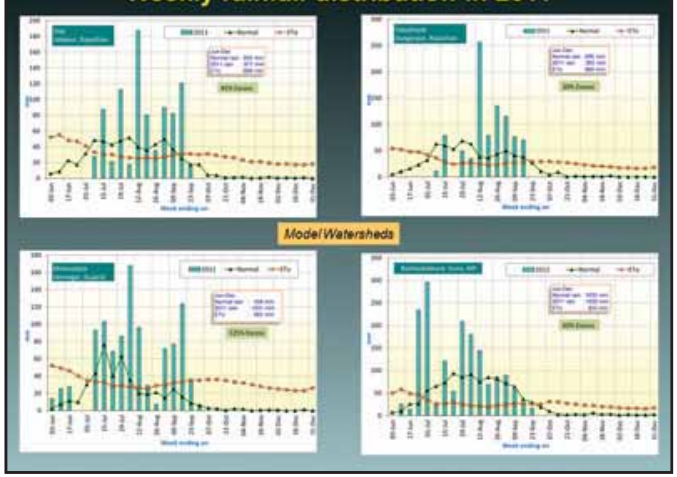
Weather monitoring at selected model watersheds in 2011

Contd..

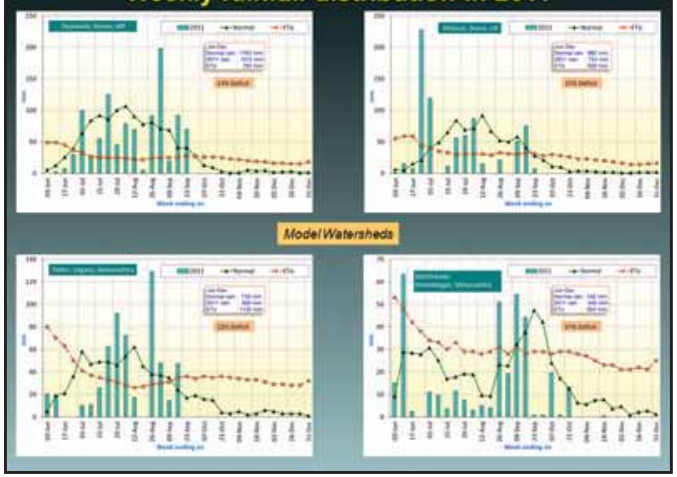


Rainfall at Model Watersheds in 2011

Weekly rainfall distribution in 2011



Weekly rainfall distribution in 2011



Weekly rainfall distribution in 2011

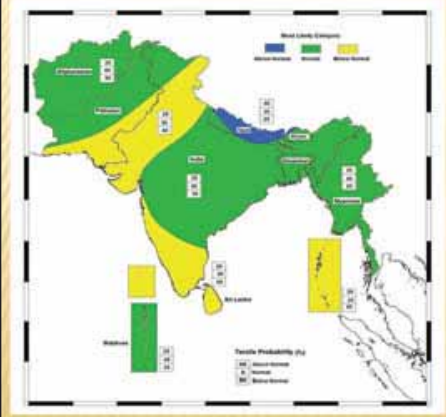
Model Watersheds

ICRISAT Southwest Monsoon 2012

- Southwest monsoon seasonal rainfall for the country as a whole is most likely to be Normal (96-104% of LPA) with the probability of 47%
- However, the probability of season rainfall to be deficient (below 90% of LPA) or excess (above 110% of LPA) is relatively low (less than 10%)
- Quantitatively, monsoon season rainfall is likely to be 99% of the LPA with a model error of ± 5%.
- The LPA of the season rainfall over the country as a whole for the period 1951-2000 is 89 cm

Long Range Forecast by IMD, 26 Apr 2012

ICRISAT Consensus outlook for SW Monsoon 2012



WMO Experts Meeting, 20 Apr 2012, New Delhi, The Hindu

ICRISAT Way forward

1. Climate data collection and database development
   - Gridded (1° and 0.5°) data on maxT, minT and rainfall
   - Station data
2. Agroclimatic water balance, climate shifts and climate risk analyses
3. Monitoring of weather at watersheds
4. Climate awareness programmes
5. Documenting the results


Thank You

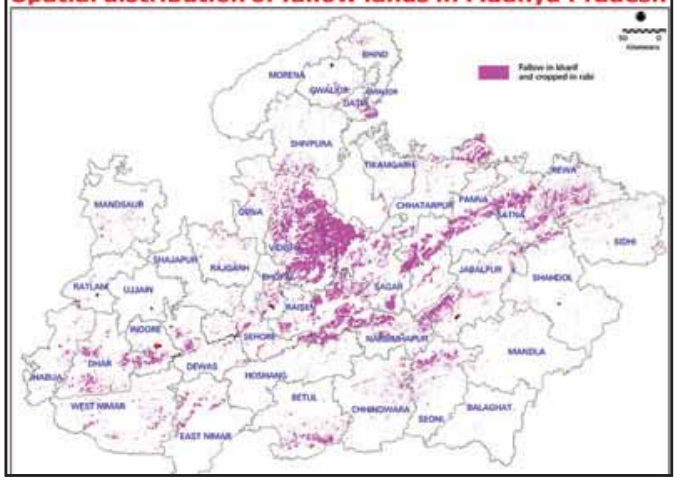
Sustainable intensification of agriculture in Madhya Pradesh: Rainy season fallow management

Prabhakar Pathak, S P Wani, R Sudi and Team
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh

Rainy season fallow in Madhya Pradesh

- Large areas (2.02 million ha) of deep black soils (Vertisols) in Madhya Pradesh are kept monsoon fallow during the rainy season and the crops are sown during the post-rainy season
- Five districts of Madhya Pradesh viz. Vidisha, Guna, Raisen, Satna and Sagar have large percent of area under rainy season fallow

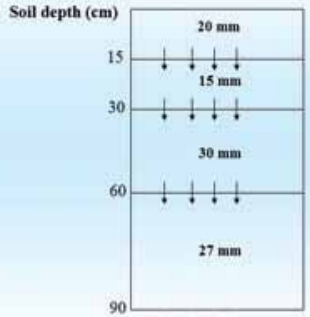
Spatial distribution of fallow lands in Madhya Pradesh



Major reasons for rainy season fallow in Vertisols

- Under wet conditions, cultivation practices are affected by the sticky nature, poor infiltration, impeded internal drainage of the soils
- Risk associated with water logging and flooding during rainy season
- Excessive hardness and difficult workability when dry
- Risk of losing post-rainy season crops

Movement of excess soil water in Vertisols

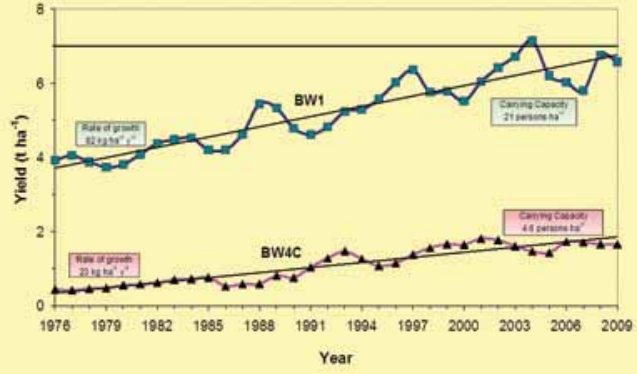


Rate of water movement in saturated condition: 5 mm/day

Runoff and soil loss from monsoon fallow black soil watershed, ICRISAT Center

Broad bed and furrow system with drains

Performance of improved Vs monsoon fallow system on Vertisols



Water balance and soil loss for traditional and improved technologies in Vertisol watersheds, ICRISAT Center

Farming system technology	Annual rainfall (mm)	Water-balance component: Water used by crops (mm)	Water lost as surface runoff (mm)	Water lost as bare-soil evaporation and deep percolation (mm)	Soil loss (t ha^{-1})
Improved system: Double cropping on broadbed and furrows	904	602 (67)[1]	130 (14)	172 (19)	1.5
Traditional system: Single crop in post-rainy season, and cultivation on flat	904	271 (30)	227 (25)	406 (45)	6.4

1. Figures in parentheses are amounts of water used or lost expressed as percentage of total rainfall.

Effect of improved and traditional watershed technologies

Parameters	Improved system (BW1)	Monsoon fallow system (BW4C)
Production per unit rainfall (kg mm^{-1})	5.6	1.2
Rainfall used by crops (%)	71	38
Total soil lost (t ha^{-1}) during last 35 years	53	226
Carbon lost through soil loss (kg ha^{-1}) during last 35 years	205	923

Tractor drawn BBF maker cum seed and fertilizer drill unit

Serious water logging problem in farmers practice and a good soybean crop in BBF system at Guna watershed 2008

Water logging problem

Crop under BBF system

A Chickpea field with BBF system at Chiroria, Vidisha district

Good soybean and chickpea crops on BBF system in Guna and Vidisha districts (2008-09)

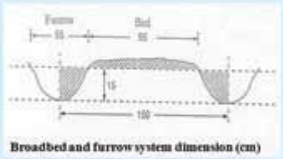
Field day at Mata Mundra, Guna district 2008-09

Strategies for reducing monsoon fallow system on Vertisols

Technical aspects

- Land smoothing
- Construction of field drains and establishment of drainage networks
- Improved land and water management system viz. BBF landform for in-situ soil and water conservation and safe disposal of excess runoff
- Land preparation before monsoon
- Runoff collection and supplemental irrigation
- Cropping in both rainy and post-rainy seasons with other improved practices
- Proper implement for making BBF and planting

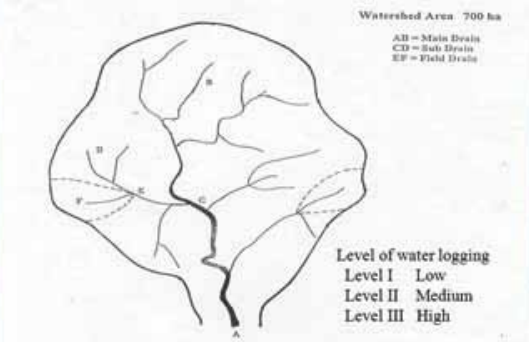
Layout of Broadbed and furrow system



Broadbed and furrow system dimension (cm)

Field layout based on topographic map

Effect of landscape on problem of water logging



Water harvesting and supplemental irrigation key for reducing rainy season fallow areas

Crops	Control	Two supplemental irrigation of 40 mm	% of increase
	Crop yield (t ha^{-1})		
Chickpea	0.55	1.25	127
Groundnut	0.82	1.30	59

Supplemental irrigation from a runoff storage structure at Lalatora watershed, Vidisha dist., M. P.

Strategies for reducing monsoon fallow system on Vertisols

Other key aspects

- Farmers participatory approach
- Regular meetings
- Focus group interactions
- Capacity building to project staff and farmers
- Farmers Days

Potential Impact of Managing Rainy Season Fallow in Madhya Pradesh

- Additional 4 million tones annual production of soybean
- Improved soil health
- Improved rainfall use efficiency 30 to 70%
- Annual soil loss reduced by 14 million tones
- Reduced area under downstream flooding and siltation

Conclusions

- Rainy season fallow can be reduced through appropriate technologies
- Substantial increase in crop yields
- Higher economic returns
- Higher rainfall use efficiency
- Reduced runoff, soil loss
- Reduced downstream flooding and siltation
- Win-win situation for farmers, natural resources and environment

Enhancing rainwater use efficiency in Madhya Pradesh and Rajasthan

Tata-ICRISAT-ICAR and Model Watershed Projects Review and Planning Meeting
Sustainable Intensification of Rain-fed Agriculture through Natural Resource Management

International Crops Research Institute for the Semi-Arid Tropics

Introduction

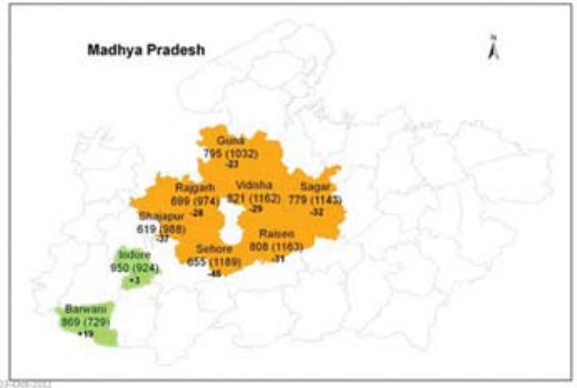
- The target eco-region: dryland areas of Madhya Pradesh and eastern Rajasthan
- Soils have medium moisture-holding capacity.
- Land degradation and depleting water table are major problems
  Climate change, as a result of global warming, may further degrade these lands leading to desertification.
- Soils are critically deficient in micronutrients along with macro-nutrients,
  Largely due to inappropriate nutrient management options adopted by the farmers.

Thus, efficient management and conservation of natural resources in the rain-fed areas are required.

Participatory research and development trials

- Balance nutrient management (BN)
  - Soil test based application of secondary and micro nutrients
- Integrated nutrients management (BNVC)
  - Soil test based application of nutrient, but 50% of recommended dose and vermicompost

Madhya Pradesh



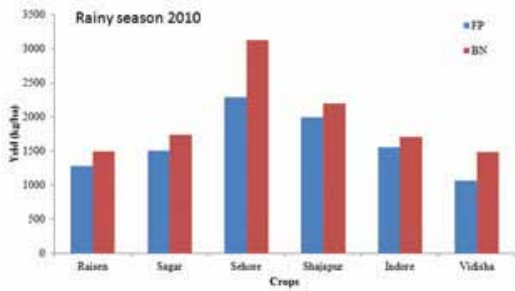
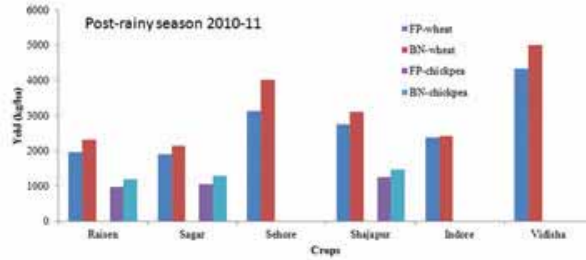


Figure: Effects of soil test based application of S+ B + Zn (BN) over the famer's practice (FP) treatment on crop yield in **Madhya Pradesh**



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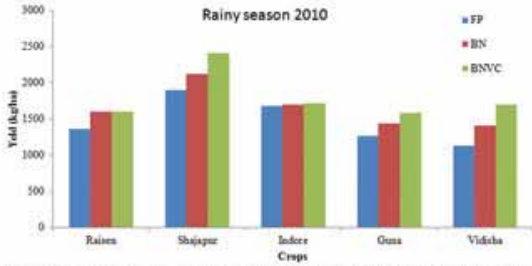


Figure: Effects of soil test based application of S+ B + Zn (BN) and INM (50%BN+VC) over the famer's practice (FP) treatment on crop yield in **Madhya Pradesh**

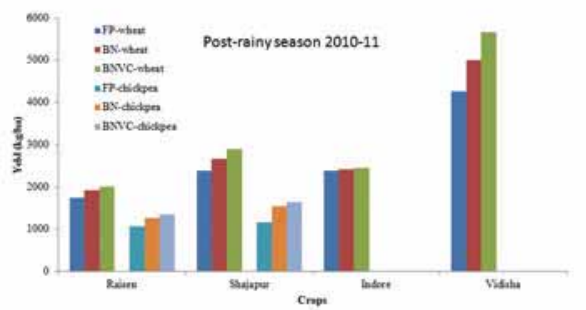


Figure: Effects of soil test based application of S+ B + Zn (BN) and INM (50%BN+VC) over the famer's practice (FP) treatment on crop yield in **Madhya Pradesh**

Estimation of rainwater use efficiency (MP)

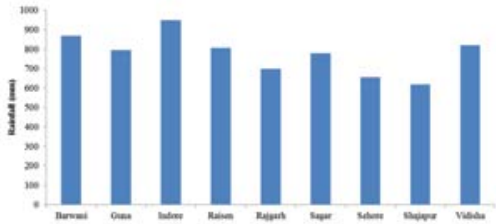


Figure: District wise rainfall received during June to December in Madhya Pradesh

- Minimum support prices during 2010-11:
  - Soybean= Rs.1440 per quintal
  - Wheat= Rs. 1170 per quintal
  - Chickpea= Rs. 2100 per quintal
- Cropping patterns
  - Soybean-Wheat
  - Soybean-chickpea

Rainwater use efficiency (MP)

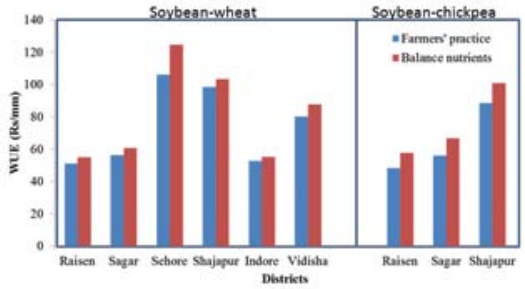


Figure: District wise rainwater use efficiency in **Madhya Pradesh**

Rainwater use efficiency (MP)

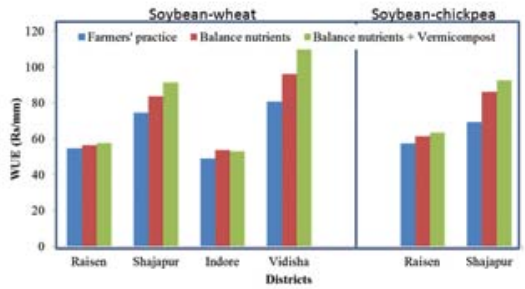
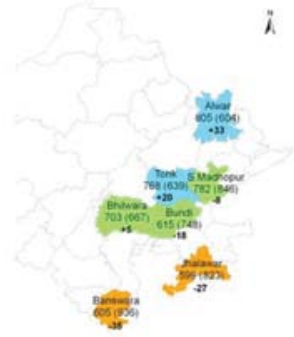


Figure: District wise rainwater use efficiency in **Madhya Pradesh**

Rajasthan



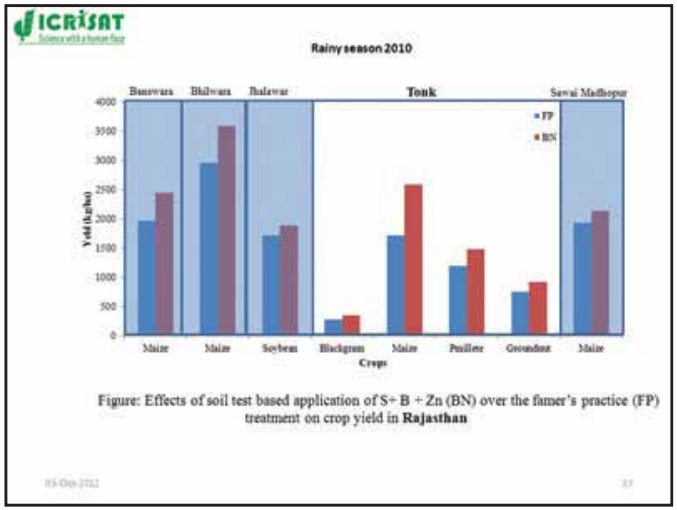


Figure: Effects of soil test based application of S+ B + Zn (BN) over the famer's practice (FP) treatment on crop yield in **Rajasthan**

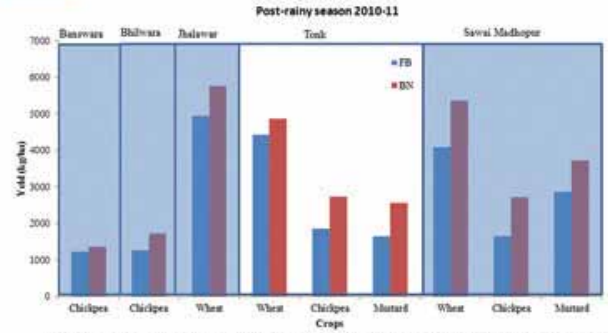


Figure: Effects of soil test based application of S+ B + Zn (BN) over the famer's practice (FP) treatment on crop yield in **Rajasthan**

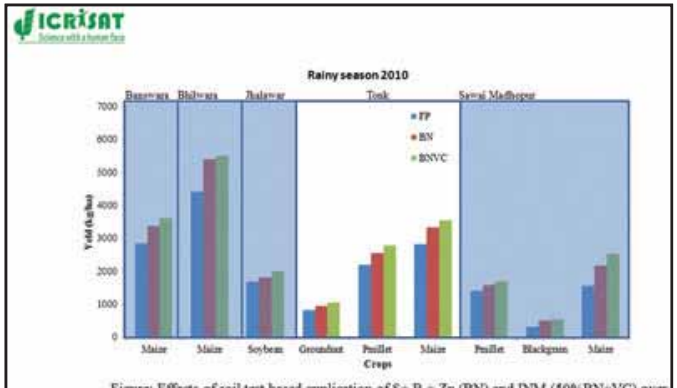


Figure: Effects of soil test based application of S+ B + Zn (BN) and INM (50%BN+VC) over the famer's practice (FP) treatment on crop yield in **Rajasthan**

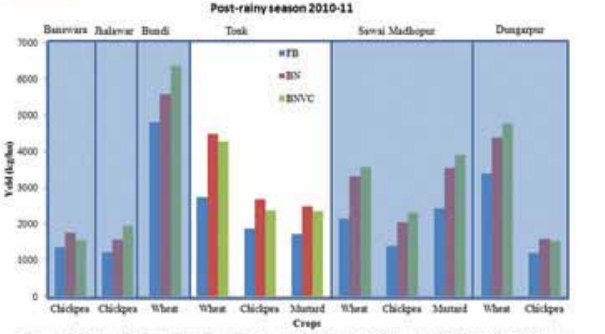


Figure: Effects of soil test based application of S+ B + Zn (BN) and INM (50%BN+VC) over the famer's practice (FP) treatment on crop yield in **Rajasthan**

Estimation of rainwater use efficiency (Rajasthan)

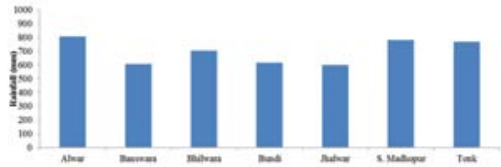


Figure: District wise rainfall received during June to December in Rajasthan

- Minimum support prices for 2010-11:
  - Blackgram=Rs. 2900 per quintal
  - Maize and pearl millet= Rs. 880 per quintal
  - Chickpea= Rs. 2100 per quintal
  - Soybean= Rs. 1440 per quintal
  - Groundnut= Rs. 2300 per quintal
  - Wheat= Rs. 1170 per quintal
  - Mustard= Rs. 1850 per quintal

Rainwater use efficiency

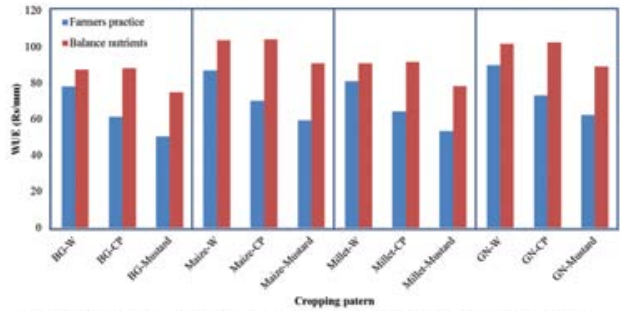


Figure: Effects of soil test based application of S+ B + Zn (BN) over the famer's practice (FP) treatment on rain water use efficiency in **Tonk district**

Rainwater use efficiency

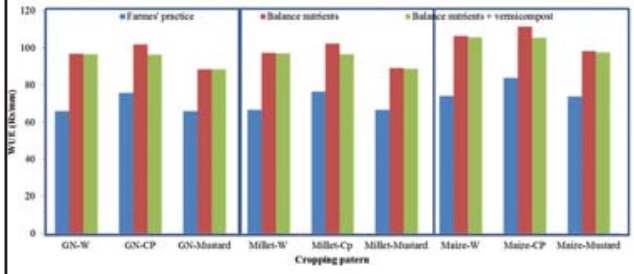


Figure: Effects of soil test based application of S+ B + Zn (BN) over the famer's practice (FP) treatment on rain water use efficiency in **Tonk district**

Summary

- Improvement in water use efficiency
  - For Madhya Pradesh
    - 12% increase for BN without vermicompost
    - 20% increase for BN with vermicompost
  - For Rajasthan
    - 33% increase for BN without vermicompost
    - 46% increase for BN with vermicompost

Summary

- Improvement in productivity
  - Maize: 28%
  - Soybean: 18%
  - Wheat: 24%
  - Chickpea: 39%
  - Groundnut:22%
- Possible improvement at country scale

Crop	Present (Mt)	Improved (Mt)
Chickpea	7.48	10.40
Groundnut	5.64	6.88
Maize	14.06	18.00
Soybeans	9.81	11.58
Wheat	80.71	100.08

Soil water balance simulation (Guna)

- Cropping Pattern
  - Maize – chickpea sequential
  - Maize + pegionpea intercropping
- Simulation duration
  - 2001 to 2004
- Soil parameters from NBSS & LUP

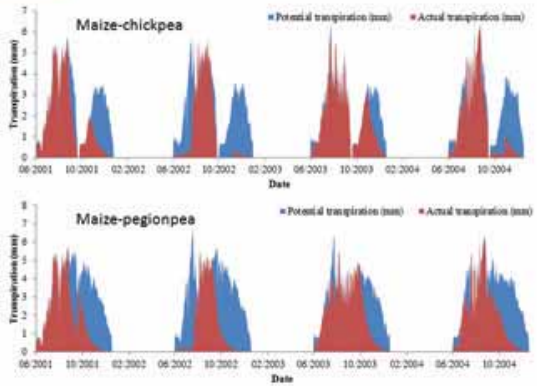


Figure: Simulated actual and potential transpiration for maize-chickpea sequential and maize-pegionpea intercropping system.

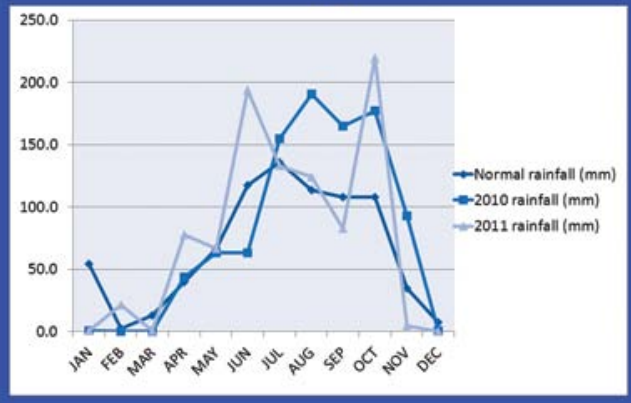
Thank you

Table: Mean monthly meteorological data for the experimental year (2010 and 2011) and the mean of past 25 years (1985-2010) of Main Agricultural Research Station, Dharwad

Months	Rainfall (mm)			Temperature (°C)						RH (%)		
				2010		2011		Mean				
	2010	2011	Mean*	T max	T min	T max	T min	T max	T min	2010	2011	Mean
January	0.8	1.0	54.14	28.24	15.38	29.20	12.60	29.85	14.83	63.48	60.13	67.24
February	0.4	21.6	2.492	32.50	17.24	30.80	13.97	32.52	16.12	50.39	48.46	62.17
March	0.0	0.8	12.8	35.82	20.35	35.16	18.57	35.41	19.18	49.02	43.94	58.41
April	43.8	78	39.63	37.62	22.05	34.89	20.20	36.62	20.81	53.02	55.72	60.01
May	63.1	66.6	66.46	35.88	22.44	34.71	21.27	35.22	21.21	62.98	61.60	64.61
June	63.4	194	117.34	31.23	21.76	27.52	21.27	29.64	21.09	76.53	83.82	79.94
July	155.0	133	135.85	34.30	20.82	26.88	20.59	27.33	20.71	84.87	85.81	86.13
August	190.7	124.2	113.80	27.67	20.75	26.65	20.71	26.77	20.37	84.19	86.68	86.23
September	164.9	82.8	108.09	23.50	20.25	28.09	19.86	28.42	20.01	84.67	79.70	81.52
October	177.0	219.7	107.77	27.16	19.47	29.94	19.54	29.63	19.42	77.73	73.56	75.85
November	92.8	4.6	34.64	27.27	19.04	29.84	15.84	29.48	16.64	77.95	55.87	71.59
December	0.6	0	7.21	27.50	14.72	29.53	13.76	28.74	13.99	65.12	56.26	69.32
Mean	952.5	926.3	800.22	30.72	19.52	30.27	18.18	30.80	18.70	69.16	65.96	71.92

*Mean of past 25 years (1985-2010)

Figure: Normal (rainfall of 27 years) and actual rainfall (mm) of Dharwad area of 2010 and 2011



Experiment - I

Impact of *in situ* moisture conservation measures in maize-chickpea sequence cropping in vertisol of watershed in Dharwad district under transitional tract of Dharwad

Researcher : Mr. Satish R. Chavan
M.Sc. (Agri.) in Agronomy
Thesis submitted (2011-12)

Experimental details

1. Design	: RCBD
2. Replication	: Three
3. Plot size	: 270 m²
Net plot maize	: 12.6 m x 17.2
Net plot chickpea	: 13.8 m x 17.6 m
4. Total experimental area	: 1.5 acres
5. Soil type	: Vertisol
6. Treatment combinations	: Seven
7. Gross plot	: 15 M x 18 M
8. Spacing maize of chickpea	: 60 cm x 20 cm, 30 cm x 10 cm
9. Location	: Farmer's field (Agasinahalla Model watershed)
10. Season/year	: *Kharif* and *rabi* 2010-2011
11. Situation	: Rainfed

Treatment details

T_1 – Broad bed and furrow
T_2 – Dead furrow
T_3 – Cultivation across the slope
T_4 – Graded border strips
T_5 – Compartment bunding
T_6 – Ridges and furrow
T_7 – Farmer's practice

Genotypes used

1. Maize - NK 6240
2. Chickpea - BGD 103

Table : Effect of *in situ* moisture conservation practices on growth and yield attributing characters of maize

Treatment	Plant height (cm) at harvest	Cob weight (g)	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})	Harvest index
T_1-Broad bed and furrow	205.7	240.45	65.3	101.26	0.392
T_2-Dead furrow	190.3	187.17	52.3	80.84	0.392
T_3-Cultivation across slope	189.3	195.07	53.3	81.16	0.396
T_4-Graded border strips	190.3	200.83	56.3	89.56	0.386
T_5-Compartmental bunding	**199.3**	**221.41**	**61.0**	**94.71**	0.392
T_6-Ridges and furrows	**191.0**	**206.91**	**59.3**	**93.09**	0.389
T_7-Farmers' practice	181.0	178.43	50.3	78.20	0.392
S.Em±	4.3	7.70	1.4	3.19	0.005
CD(P=0.05)	13.2	23.75	4.2	9.84	NS

Table : Effect of *in situ* moisture conservation practices on growth and yield attributing characters of chickpea

Treatments	Plant height (cm) at harvest	Number of pods plant^{-1}	Grain yield (q ha^{-1})	Haulm yield (q ha^{-1})	Harvest index
T_1-Broad bed and furrow	50.9	41.74	10.95	10.00	0.45
T_2-Dead furrow	45.1	35.75	7.53	7.82	0.42
T_3-Cultivation across slope	46.5	36.59	8.19	8.04	0.41
T_4-Graded border strips	48.1	37.49	8.27	8.26	0.42
T_5-Compartmental bunding	**49.9**	**41.17**	**9.03**	**9.50**	0.44
T_6-Ridges and furrows	**49.1**	**39.91**	**8.40**	**8.47**	**0.43**
T_7-Farmers' practice	43.8	34.51	7.27	7.48	0.41
S.Em±	1.4	0.88	0.54	0.12	0.02
CD(P=0.05)	4.4	2.72	1.65	0.38	NS

Table : Effect of *in situ* moisture conservation practices on soil moisture percentage at 30 days interval in maize

Treatments	30 DAS				60 DAS				90 DAS			
	0-15	15-30	30-45	45-60	0-15	15-30	30-45	45-60	0-15	15-30	30-45	45-60
T_1-Broad bed and furrow	26.22	28.83	27.24	24.33	30.00	31.67	27.87	26.00	34.63	32.35	24.66	23.72
T_2-Dead furrow	22.69	26.47	25.20	22.67	25.02	28.41	26.66	24.67	24.63	29.35	22.99	22.38
T_3-Cultivation across slope	22.67	25.73	24.87	22.67	25.00	27.67	26.33	24.67	24.30	29.68	22.97	22.38
T_4-Graded border strips	23.12	26.16	25.30	22.45	25.45	28.10	26.77	24.45	24.73	29.12	23.42	22.17
T_5Compartmental bunding	23.50	26.91	25.70	23.67	24.00	28.85	27.17	25.67	25.13	31.87	23.80	23.38
T_6-Ridges and furrows	23.43	26.03	24.30	23.36	25.77	27.97	25.77	25.36	23.73	30.95	23.73	23.08
T_7-Farmers' practice	22.08	23.67	23.00	23.30	24.61	23.00	25.74	25.30	23.04	30.17	23.71	23.01
S.Em±	0.63	0.83	0.74	0.34	1.12	1.23	0.79	0.31	1.94	0.55	0.47	0.31
CD(P=0.05)	1.94	2.57	2.27	1.06	3.47	3.78	NS	0.97	5.98	1.71	1.44	0.97

Table : Effect of *in situ* moisture conservation practices on soil moisture percentage at 30 days interval in chickpea

Treatments	30 DAS				60 DAS				90 DAS			
	0-15	15-30	30-45	45-60	0-15	15-30	30-45	45-60	0-15	15-30	30-45	45-60
T_1-Broad bed and furrow	35.08	30.44	22.14	18.04	30.08	26.14	19.14	16.54	22.02	19.74	19.42	17.14
T_2-Dead furrow	33.35	28.58	20.28	16.18	28.35	24.28	17.28	14.68	20.29	17.88	17.69	15.28
T_3-Cultivation across slope	34.21	29.80	21.50	17.40	29.21	25.50	18.50	15.90	21.15	19.10	18.55	16.50
T_4-Graded border strips	34.40	29.88	21.58	17.48	29.40	25.58	18.58	15.98	21.34	19.18	18.74	16.58
T_5-Compartmental bunding	34.78	30.22	21.92	17.82	29.78	25.92	18.92	16.32	21.72	19.52	19.12	16.92
T_6-Ridges and furrows	34.51	30.14	21.84	17.74	29.51	25.84	18.84	16.24	21.45	19.44	18.85	16.84
T_7-Farmers' practice	33.18	28.48	20.18	16.08	28.18	24.18	17.18	14.58	20.12	17.78	17.52	15.18
S.Em±	0.14	0.25	0.25	0.25	0.14	0.25	0.25	0.25	0.14	0.25	0.14	0.25
CD(P=0.05)	0.45	0.76	0.76	0.76	0.45	0.76	0.76	0.76	0.45	0.76	0.45	0.76

Table : Effect of *in situ* moisture conservation practices on economics of maize and chickpea

Treatments	Maize				Chickpea			
	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
T_1-Broad bed and furrow	23546	89996.5	66450.5	3.8	10678	27375	16697	2.6
T_2-Dead furrow	22846	72075.4	49229.4	3.2	10678	18833	8155	1.8
T_3-Cultivation across slope	22546	73391.2	50845.2	3.3	10678	20475	9797	1.9
T_4-Graded border strips	23346	77711.5	54365.5	3.3	10678	20666	9989	1.9
T_5-Compartmental bunding	23046	84035.3	60989.3	3.6	10678	22583	11905	2.1
T_6-Ridges and furrows	23146	81787.7	58641.7	3.5	10678	21000	10322	2.0
T_7-Farmers' practice	22346	69343.2	46997.2	3.1	10678	18166	7489	1.7
S.Em±		1779.89	1779.89	0.08		1341	1341	0.13
CD(P=0.05)		5484.39	5484.39	0.24		4132	4132	0.39

Title of experiments-II

INTEGRATED NUTRIENT MANAGEMENT IN MAIZE-CHICKPEA SEQUENCE CROPPING UNDER BBF LAND MANAGEMENT SYSTEM IN WATERSHED AREA IN DHARWAD DISRTRICT

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Details of experiment

Year of commencement	2010-11
Design	Split plot
Replication	Three
Plot size	18m X 18 m
Location	Singhanahalli (farmer's field, Dharwad)
Variety/Cultivar	Maize : All rounder Chickpea : Annigeri-1
Season	Kharif and Rabi
Date of sowing and harvesting of maize	01-07-2010 and 05-11-2010 (first year) 19-06-2011 and 29-10-2011 (second year)
Date of sowing and harvesting of chickpea	09-11-2010 and 18-02-2011 (first year) 16-11-2011 and 05-03-2012 (second year)

Details of treatment

Maize (Kharif)		Chickpea (Rabi)	
Main plot		**Main plot**	
M_1	Broad bed and furrow (BBF)	M_1	Broad bed and furrow (BBF)
M_2	Farmer's practices (Flat bed)	M_2	Farmer's practices (Flat bed)
Sub plot		**Sub plot**	
S_1	FYM (7.5 t/ha) + RDF (inorganics) + $ZnSo_4$ 10 kg/ha	S_1	10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha + *Rhizobium* @ 1250 g/ha
S_2	FYM (7.5 t/ha) + NPK and micronutrients through inorganics based on soil test result	S_2	10:25 kg NP/ha through inorganics only + *Rhizobium* @ 1250 g/ha
S_3	FYM (7.5 t/ha) + 30 % N through Glyricidia + 70 % balanced N, 100%PK and micronutrient through soil test result	S_3	10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha
S_4	Vermicompost (1.5 t/ha) + 30 % N through Glyricidia + 70 % balanced N, 100%PK and micronutrient through soil test result	S_4	10 kg N through in organics + 30% P through Glyricidia and 70% P through inorganics + PSB @ 1250 g/ha + *Rhizobium* @ 1250 g/ha
S_5	FYM (7.5 t/ha) + 30 % N through Vermicompost + 70 % N and 100 % P and K through inorganics (No micronutrient)	S_5	10 kg N through in organics + 30% P through Vermicompost + 70% P through inorganics + PSB @ 1250 g/ha + *Rhizobium* @ 1250 g/ha

RDF:100:50:25 kg N, P_2O_5 and K_2O Soil test result:100:37.5:25:0.5 kg N, P_2O_5 and K_2O, $ZnSO_4$ and Boron

Table1. Effect of *in situ* moisture conservation and integrated nutrient management practices on soil moisture content (cm) in 0-60cm soil depth in maize

Treatment	15 DAS			30 DAS			45 DAS		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	12.95	20.48	16.26	21.52	21.54	21.53	18.41	19.99	19.20
Farmer Practice (Flat bed)	9.75	17.79	13.77	18.28	17.25	17.76	15.59	15.91	16.25
S.Em±	0.20	0.13	0.08	0.24	0.09	0.08	0.10	0.12	0.04
CD (P=0.05)	1.24	0.81	0.48	1.47	0.57	0.46	0.61	0.72	0.24
INM plot (INM)									
RDF	11.79	18.78	14.78	19.55	18.80	19.22	17.41	18.14	17.78
INM_1	11.28	18.53	14.41	18.81	18.56	18.68	16.95	17.27	17.11
INM_2	10.93	19.30	15.07	19.77	19.30	19.53	17.69	17.70	17.69
INM_3	11.12	19.34	15.23	20.16	19.87	20.02	17.48	18.12	17.80
INM_4	11.30	19.81	15.58	20.11	20.42	20.27	18.00	18.52	18.26
S.Em±	0.25	0.22	0.18	0.31	0.22	0.18	0.23	0.17	0.14
CD (P=0.05)	NS	0.66	NS	NS	0.66	NS	NS	0.50	0.42
Interaction									
B X RDF	11.99	20.04	16.01	21.34	21.25	21.29	18.28	20.30	19.29
B X INM_1	13.24	19.73	15.49	20.38	20.83	20.60	17.79	19.02	18.40
B X INM_2	12.10	20.56	16.33	21.89	21.52	21.70	18.83	19.83	19.33
B X INM_3	12.33	20.75	16.54	21.65	21.87	21.76	18.20	20.33	19.27
B X INM_4	12.57	21.30	16.94	21.33	22.23	21.77	18.86	20.48	19.77
F X RDF	8.58	17.51	13.55	18.55	16.35	17.25	16.54	15.98	16.26
F X INM_1	8.32	17.32	13.11	17.23	16.30	16.77	16.10	15.52	15.81
F X INM_2	8.76	17.84	13.80	18.48	17.08	17.78	16.55	15.57	16.06
F X INM_3	9.32	17.93	13.92	18.67	17.87	18.27	16.75	15.92	16.33
F X INM_4	10.14	18.32	14.23	18.89	18.62	18.76	17.01	16.56	16.80
INM at same level of IMC									
S.Em±	0.36	0.309	0.26	0.47	0.309	0.25	0.323	0.234	0.203
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
INM at same or different level of IMC									
S.Em±	0.38	0.307	0.24	0.48	0.292	0.23	0.306	0.240	0.187
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table2. Effect of *in situ* moisture conservation and integrated nutrient management on soil moisture content (cm) in 0-60cm soil depth in maize

Treatment	60 DAS			75DAS			90 DAS		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	16.35	14.41	15.38	18.08	16.62	17.35	12.84	11.71	12.27
Farmer Practice (Flat bed)	13.45	10.78	12.11	15.68	13.21	14.49	10.74	9.38	10.06
S.Em±	0.12	0.09	0.07	0.06	0.16	0.11	0.27	0.10	0.16
CD (P=0.05)	0.73	0.56	0.40	0.34	0.99	0.66	1.62	0.61	0.95
INM plot (INM)									
RDF	14.64	12.40	13.52	16.48	14.70	15.59	11.74	10.30	11.02
INM_1	14.22	11.95	13.09	15.76	14.11	14.94	12.16	9.93	10.54
INM_2	14.88	12.34	13.61	17.05	14.83	15.94	11.68	10.61	11.14
INM_3	15.12	13.13	14.13	17.29	15.41	16.35	12.08	10.85	11.47
INM_4	15.58	13.17	14.38	17.83	15.76	16.80	12.30	11.05	11.67
S.Em±	0.16	0.18	0.13	0.25	0.21	0.20	0.11	0.13	0.08
CD (P=0.05)	0.49	0.53	0.39	0.73	0.64	NS	0.32	0.39	0.23
Interaction									
B X RDF	16.19	14.30	15.24	17.60	16.56	17.08	12.80	11.32	12.06
B X INM_1	15.53	13.84	14.68	16.85	15.73	16.29	12.02	11.09	11.55
B X INM_2	16.42	14.25	15.32	18.03	16.13	17.08	12.56	11.70	12.13
B X INM_3	16.64	14.96	15.80	18.86	17.08	17.97	13.29	12.12	12.70
B X INM_4	16.96	14.74	15.85	19.07	17.61	18.34	13.52	12.33	12.92
F X RDF	13.09	10.50	11.80	15.35	12.85	14.10	10.68	9.28	9.98
F X INM_1	12.90	10.07	11.49	14.67	12.50	13.59	10.29	8.78	9.55
F X INM_2	13.33	10.45	11.89	16.07	13.54	14.80	10.79	9.51	10.15
F X INM_3	13.60	11.31	12.46	15.71	13.74	14.72	10.88	9.59	10.23
F X INM_4	14.21	11.60	12.90	16.59	13.91	15.25	11.08	9.77	10.42
INM at same level of IMC									
S.Em±	0.222	0.248	0.182	0.354	0.300	0.286	0.153	0.186	0.109
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
INM at same or different level of IMC									
S.Em±	0.232	0.248	0.182	0.354	0.300	0.286	0.153	0.186	0.109
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table3. Effect of *in situ* moisture conservation and integrated nutrient management on grain yield, Stover yield and Harvest index of maize

Treatment	Main grain yield (kg ha^{-1})			Stover yield (t ha^{-1})			Harvest index		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	6722	6611	6667	8.50	8.47	8.49	0.442	0.439	0.440
Farmer Practice (Flat bed)	6533	6442	6488	8.43	8.33	8.38	0.437	0.436	0.436
S.Em±	13.7	24.5	14.2	0.01	0.01	0.01	0.001	0.001	0.0004
CD (P=0.05)	83.1	149.2	86.3	0.06	0.07	0.07	0.0047	ns	0.0026
INM plot (INM)									
RDF	7241	7123	7182	8.99	8.93	8.96	0.447	0.443	0.445
INM_1	6962	6822	6892	8.61	8.66	8.63	0.447	0.441	0.444
INM_2	6993	6890	6942	8.00	7.85	7.93	0.428	0.429	0.429
INM_3	6380	6257	6318	8.28	8.05	8.17	0.431	0.439	0.423
INM_4	6593	6602	6598	8.49	8.51	8.50	0.438	0.437	0.437
S.Em±	71.3	18.8	33.6	0.07	0.07	0.05	0.002	0.002	0.002
CD (P=0.05)	226.0	175.2	165.6	0.22	0.22	0.16	0.008	0.007	0.006
Interaction									
B X RDF	7292	7213	7322	9.15	8.96	9.05	0.445	0.446	0.445
B X INM_1	7081	6889	6985	8.56	8.69	8.62	0.453	0.452	0.452
B X INM_2	6400	6389	6045	8.02	7.97	7.99	0.432	0.429	0.431
B X INM_3	6473	6427	6450	8.25	8.16	8.20	0.440	0.441	0.440
B X INM_4	6617	6699	6658	8.52	8.59	8.56	0.438	0.438	0.438
F X RDF	7090	6993	7042	8.75	8.90	8.83	0.449	0.440	0.445
F X INM_1	6840	6755	6798	8.66	8.63	8.64	0.441	0.439	0.440
F X INM_2	6887	6790	6838	7.98	7.73	7.86	0.425	0.428	0.426
F X INM_3	6287	6187	6237	8.32	7.94	8.13	0.430	0.437	0.434
F X INM_4	6570	6506	6538	8.46	8.44	8.45	0.437	0.435	0.436
INM at same level of IMC									
S.Em±	106.8	82.6	75.4	0.10	0.10	0.08	0.004	0.003	0.003
CD (P=0.05)	320.3	247.8	227.1	0.31	0.21	0.23	ns	ns	ns
INM at same or different level of IMC									
S.Em±	66.52	77.9	59.2	0.09	0.09	0.07	0.003	0.003	0.02
CD (P=0.05)	290.3	257.3	214.5	0.28	0.28	0.21	ns	ns	ns

RDF: **FYM (7.5 t ha^{-1}) + RDF (inorganics) + ZnSo$_4$ 10 kg ha^{-1}** INM_1 : **FYM (7.5 t ha^{-1}) + NPK and micronutrients through inorganics based on soil test** INM_2 **FYM (7.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_3 **Vermicompost (1.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_4 **FYM (7.5 t/ha) + 30 % N through Vermicompost + 70 % N and 100 % P and K through inorganics (No micronutrient)**

Table 4. Effect of *in situ* moisture conservation and integrated nutrient management on cob weight, grain yield plant^{-1} and shelling percentage of maize

Treatment	Cob weight (g)			Grain yield plant^{-1}			Shelling percentage		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	215.7	210.3	213.0	186.61	181.91	184.26	80.61	80.46	80.53
Farmer Practice (Flat bed)	207.2	198.3	202.8	181.33	176.03	180.42	79.89	79.98	79.94
S.Em±	1.2	1.5	1.2	0.80	1.00	0.86	0.06	0.04	0.04
CD (P=0.05)	7.4	9.2	7.3	4.90	6.12	5.26	0.35	0.23	0.27
INM plot (INM)									
RDF	243.2	239.6	239.4	202.30	198.25	200.30	82.61	81.77	82.19
INM_1	219.4	219.0	219.2	196.37	193.78	195.08	81.43	80.77	81.10
INM_2	187.6	176.3	182.0	162.40	161.15	161.78	77.72	78.73	78.23
INM_3	198.4	190.0	194.2	173.40	174.83	174.12	79.10	79.66	79.35
INM_4	208.8	204.4	206.6	181.32	181.48	181.40	80.01	80.26	80.21
S.Em±	3.1	3.8	3.8	2.27	2.72	2.88	0.22	0.07	0.12
CD (P=0.05)	16.9	14.2	10.1	10.10	8.17	8.63	0.65	0.22	0.35
Interaction									
B X RDF	250.3	241.5	246.0	204.80	199.77	201.86	83.29	82.27	82.78
B X INM_1	223.2	223.7	223.4	197.90	194.70	196.30	81.67	80.93	81.30
B X INM_2	195.0	182.8	186.4	168.17	167.37	166.77	77.97	78.97	78.47
B X INM_3	202.1	194.1	198.1	175.41	178.63	177.03	79.63	79.71	79.67
B X INM_4	213.0	209.6	211.3	185.53	189.27	189.40	80.09	80.37	80.44
F X RDF	236.1	237.7	236.9	200.70	196.73	198.72	81.93	81.27	81.60
F X INM_1	215.5	214.3	214.9	194.83	192.87	193.85	81.20	80.60	80.90
F X INM_2	180.3	169.8	177.6	158.63	154.93	156.78	77.47	78.50	77.98
F X INM_3	194.8	185.8	190.3	171.37	171.03	171.20	78.57	79.40	79.03
F X INM_4	204.7	199.3	201.9	181.10	182.10	181.60	80.20	80.16	80.19
INM at same level of IMC									
S.Em±	7.99	6.7	4.76	4.76	3.85	4.07	0.30	0.10	0.16
CD (P=0.05)	24.0	20.2	14.2	14.28	11.55	12.21	0.91	0.31	0.49
INM at same or different level of IMC									
S.Em±	7.3	6.2	4.41	4.34	3.59	3.74	0.28	0.10	0.15
CD (P=0.05)	22.4	19.8	14.2	13.46	11.03	11.84	0.87	0.34	0.50

RDF: **FYM (7.5 t ha^{-1}) + RDF (inorganics) + ZnSo$_4$ 10 kg ha^{-1}** INM_1 : **FYM (7.5 t ha^{-1}) + NPK and micronutrients through inorganics based on soil test** INM_2 **FYM (7.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_3 **Vermicompost (1.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_4 **FYM (7.5 t/ha) + 30 % N through Vermicompost + 70 % N and 100 % P and K through inorganics (No micronutrient)**

Table5. Effect of *in situ* moisture conservation and integrated nutrient management on test weight and yield to rainfall ratio in maize

Treatment	Test weight (g)			Yield to rainfall ratio (kg ha^{-1}mm^{-1})		
	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)						
Broad Bed and Furrow (B)	28.81	29.03	28.92	9.49	10.90	10.20
Farmer Practice (Flat bed)	27.39	28.26	27.83	9.22	10.57	9.90
S.Em±	0.31	0.24	0.27	0.03	0.05	0.03
CD (P=0.05)	ns	ns	ns	0.18	0.29	0.18
INM plot (INM)						
RDF	32.18	31.74	31.96	10.19	11.86	10.93
INM_1	28.37	30.43	29.40	9.82	11.20	10.51
INM_2	25.73	25.78	25.76	8.45	9.67	9.06
INM_3	26.80	27.08	26.94	9.00	10.33	9.67
INM_4	27.42	28.25	27.82	9.32	10.84	10.08
S.Em±	1.06	0.33	0.54	0.14	0.10	0.10
CD (P=0.05)	3.17	0.98	1.67	0.41	0.29	0.29
Interaction						
B X RDF	33.82	32.30	33.06	10.34	11.84	11.09
B X INM_1	28.90	30.62	29.71	9.99	11.31	10.65
B X INM_2	26.63	26.32	26.48	8.60	9.83	9.22
B X INM_3	26.90	27.32	27.11	9.10	10.55	9.84
B X INM_4	27.80	28.67	28.24	9.38	10.99	10.19
F X RDF	30.55	31.18	30.87	10.04	11.88	10.76
F X INM_1	27.83	30.23	29.08	9.64	11.09	10.37
F X INM_2	24.83	25.25	25.04	8.30	9.50	8.90
F X INM_3	26.70	26.83	26.77	8.86	10.12	9.49
F X INM_4	27.03	27.76	27.41	9.26	10.68	9.97
INM at same level of IMC						
S.Em±	1.50	0.46	0.78	0.19	0.14	0.13
CD (P=0.05)	ns	ns	ns	ns	ns	ns
INM at same or different level of IMC						
S.Em±	1.39	0.50	0.80	0.18	0.15	0.12
CD (P=0.05)	ns	ns	ns	ns	ns	ns

RDF: **FYM (7.5 t ha^{-1}) + RDF (inorganics) + ZnSo$_4$ 10 kg ha^{-1}** INM_1 : **FYM (7.5 t ha^{-1}) + NPK and micronutrients through inorganics based on soil test** INM_2 **FYM (7.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_3 **Vermicompost (1.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_4 **FYM (7.5 t/ha) + 30 % N through Vermicompost + 70 % N and 100 % P and K through inorganics (No micronutrient)**

Table 6. Effect of *in situ* moisture conservation and integrated nutrient management on Gross return, net return and benefit cost ratio in maize

Treatment	Gross return (Rs. ha^{-1})			Net return (Rs. ha^{-1})			Benefit cost ratio		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	83500	78750	67125	57823	49076	41449	2.80	2.78	2.84
Farmer Practice (Flat bed)	61722	68585	65154	36423	43284	39852	2.46	2.73	2.60
S.Em±	124	251	143	124	251	145	0.01	0.01	0.01
CD (P=0.05)	755	1526	872	755	1526	872	NS	NS	NS
INM plot (INM)									
RDF	68197	70403	71844	43627	51134	47377	2.78	3.68	2.83
INM_1	65566	72492	69029	41399	48385	44892	2.73	3.00	2.86
INM_2	56742	62832	59782	32541	39422	35982	2.34	2.66	2.47
INM_3	60256	66901	63578	36488	43191	39839	2.53	2.81	2.67
INM_4	61268	70280	66273	31554	39570	35562	2.05	2.29	2.16
S.Em±	891	663	537	891	663	537	0.03	0.02	0.02
CD (P=0.05)	2672	1989	1545	2672	1989	1545	0.08	0.07	0.06
Interaction									
B X RDF	69621	77007	73313	44988	52253	48559	2.81	3.31	3.06
B X INM_1	66611	79237	66924	42287	48883	45570	2.74	3.01	2.87
B X INM_2	57690	63878	60784	33302	39490	36396	2.37	2.62	2.49
B X INM_3	61988	68548	64718	37100	44360	40730	2.55	2.89	2.72
B X INM_4	62489	71281	66885	31991	40581	35987	2.02	2.31	2.16
F X RDF	66768	63879	70073	42388	49999	46194	2.74	3.05	2.89
F X INM_1	64521	71967	68194	40542	47888	44215	2.69	2.99	2.84
F X INM_2	55793	61787	58790	31781	37354	34567	2.32	2.57	2.45
F X INM_3	59484	65610	62559	35871	42022	38947	2.52	2.78	2.65
F X INM_4	60264	69279	65661	31152	38756	35139	2.09	2.27	2.17
INM at same level of IMC									
S.Em±	977	853	729	977	853	729	0.038	0.035	0.030
CD (P=0.05)	2930	2558	2185	2930	2558	2185	NS	NS	NS
INM at same or different level of IMC									
S.Em±	883	803	667	883	803	667	0.035	0.033	0.027
CD (P=0.05)	2700	2650	2096	2700	2650	2096	NS	NS	NS

RDF: **FYM (7.5 t ha^{-1}) + RDF (inorganics) + ZnSo$_4$ 10 kg ha^{-1}** INM_1 : **FYM (7.5 t ha^{-1}) + NPK and micronutrients through inorganics based on soil test** INM_2 **FYM (7.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_3 **Vermicompost (1.5 t/ha) + 30 % N through Glyricidea + 70 % balanced N, 100%PK and micronutrient through soil test** INM_4 **FYM (7.5 t/ha) + 30 % N through Vermicompost + 70 % N and 100 % P and K through inorganics (No micronutrient)**

Table 7. Effect of *in situ* moisture conservation and integrated nutrient management on bulk density (g/cc), porosity (%) and infiltration rate (cm/hr) in the soil after harvest of Maize

Treatment	Bulk density			Porosity (%)			Infiltration rate (cm/hr)		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	1.16	1.15	1.16	56.1	57.0	56.6	0.85	0.89	0.88
Farmer Practice (Flat bed)	1.17	1.14	1.15	55.8	57.1	56.5	0.82	0.89	0.85
S.Em±	0.001	0.002	0.001	0.37	0.1	0.18	0.002	0.002	0.001
CD (P=0.05)	0.004	NS	NS	0.16	NS	0.2	0.013	NS	0.007
INM plot (INM)									
RDF	1.16	1.15	1.16	55.7	56.8	56.2	0.81	0.87	0.84
INM_1	1.16	1.15	1.16	55.8	56.8	56.2	0.83	0.87	0.85
INM_2	1.17	1.14	1.15	55.8	57.2	56.5	0.83	0.88	0.85
INM_3	1.17	1.12	1.14	56.0	57.7	56.9	0.85	0.88	0.86
INM_4	1.15	1.13	1.14	56.8	58.1	57.5	0.85	0.91	0.88
S.Em±	0.003	0.006	0.004	0.2	0.2	0.2	0.009	0.009	0.009
CD (P=0.05)	0.009	0.017	0.012	0.5	0.6	0.5	0.025	0.025	0.02
Interaction									
B X RDF	1.18	1.16	1.16	55.6	56.9	56.3	0.82	0.87	0.84
B X INM_1	1.18	1.16	1.16	55.6	57.0	56.3	0.82	0.87	0.84
B X INM_2	1.17	1.13	1.15	56.0	57.6	56.7	0.83	0.88	0.85
B X INM_3	1.16	1.12	1.14	56.1	57.9	57.0	0.84	0.89	0.86
B X INM_4	1.14	1.10	1.12	57.1	58.4	57.7	0.85	0.96	0.90
F X RDF	1.18	1.15	1.16	55.7	56.7	56.2	0.80	0.88	0.84
F X INM_1	1.18	1.15	1.17	55.5	56.5	55.9	0.79	0.88	0.83
F X INM_2	1.18	1.16	1.16	55.6	57.0	56.3	0.83	0.88	0.85
F X INM_3	1.17	1.12	1.15	55.8	57.6	56.7	0.83	0.89	0.85
F X INM_4	1.15	1.13	1.14	56.5	57.7	57.1	0.84	0.91	0.87
INM at same level of IMC									
S.Em±	0.007	0.004	0.006	0.20	0.00	0.24	0.01	0.01	0.006
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
INM at same or different level of IMC									
S.Em±	0.006	0.007	0.006	0.23	0.28	0.22	0.01	0.01	0.005
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

RDF: FYM (7.5 t ha^{-1}) + RDF (inorganics) + ZnSo$_4$ 10 kg ha^{-1} INM_1: FYM (7.5 t ha^{-1}) + RFK and micronutrients through inorganics based on soil test INM_2 FYM (7.5 t/ha) + 30 % N through Glyricidia + 70 % balanced N, 100%PK and micronutrient through soil test INM_3 Vermicompost (1.5 t/ha) + 30 % N through Glyricidia + 70 % balanced N, 100%PK and micronutrient through soil test INM_4 FYM (7.5 t/ha) + 30 % N through Vermicompost + 70 % N and 100 % P and K through inorganics (No micronutrient)

Table 8. Effect of *in situ* moisture conservation and integrated nutrient management on N content (%), protein content (%) and protein yield (kg ha^{-1}) in maize

Treatment	% Nitrogen			Protein content (%)			Protein yield (kg ha^{-1})		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	1.42	1.40	1.41	8.91	8.75	8.83	602.9	584.1	593.5
Farmer Practice (Flat bed)	1.39	1.37	1.38	8.70	8.56	8.63	570.5	553.4	562.0
S.Em±	0.001	0.002	0.001	0.008	0.012	0.008	1.0	2.3	1.5
CD (P=0.05)	0.004	0.012	0.008	0.047	0.073	0.051	6.2	15.0	8.8
INM plot (INM)									
RDF	1.36	1.31	1.33	8.74	8.44	8.58	701.5	671.6	686.5
INM_1	1.48	1.46	1.47	9.26	9.10	9.18	644.8	624.4	634.6
INM_2	1.27	1.25	1.26	7.94	7.81	7.89	475.6	461.2	468.4
INM_3	1.41	1.40	1.40	8.80	8.72	8.76	561.7	548.2	555.0
INM_4	1.32	1.30	1.31	8.28	8.15	8.21	546.1	537.2	541.6
S.Em±	0.01	0.007	0.008	0.06	0.05	0.048	5.5	5.8	4.9
CD (P=0.05)	0.03	0.022	0.023	0.17	0.14	0.143	19.8	16.3	14.7
Interaction									
B X RDF	1.39	1.32	1.36	9.02	8.22	8.72	732.9	690.6	711.8
B X INM_1	1.49	1.48	1.49	9.33	9.24	9.29	661.1	636.5	648.8
B X INM_2	1.28	1.26	1.27	7.98	7.88	7.93	486.7	471.6	479.2
B X INM_3	1.43	1.42	1.43	8.94	8.89	8.91	578.1	570.4	574.4
B X INM_4	1.34	1.32	1.33	8.40	8.23	8.31	555.4	541.2	552.3
F X RDF	1.33	1.49	1.31	8.46	9.33	8.45	670.0	652.6	661.3
F X INM_1	1.47	1.45	1.46	9.19	9.06	9.13	628.4	612.2	620.3
F X INM_2	1.26	1.25	1.26	7.90	7.79	7.84	464.5	451.0	457.8
F X INM_3	1.39	1.37	1.38	8.67	8.56	8.61	544.9	526.1	536.1
F X INM_4	1.31	1.29	1.30	8.17	8.04	8.10	536.5	503.2	519.9
INM at same level of IMC									
S.Em±	0.013	0.010	0.011	0.08	0.06	0.07	9.34	7.71	6.93
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
INM at same or different level of IMC									
S.Em±	0.013	0.009	0.010	0.07	0.06	0.06	8.41	7.32	6.39
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

RDF: FYM (7.5 t ha^{-1}) + RDF (inorganics) + ZnSo$_4$ 10 kg ha^{-1} INM_1: FYM (7.5 t ha^{-1}) + RFK and micronutrients through inorganics based on soil test INM_2 FYM (7.5 t/ha) + 30 % N through Glyricidia + 70 % balanced N, 100%PK and micronutrient through soil test INM_3 Vermicompost (1.5 t/ha) + 30 % N through Glyricidia + 70 % balanced N, 100%PK and micronutrient through soil test INM_4 FYM (7.5 t/ha) + 30 % N through Vermicompost + 70 % N and 100 % P and K through inorganics (No micronutrient)

Table 9. Effect of *in situ* moisture conservation and integrated nutrient management on soil moisture content (cm) in 0-60cm soil depth in chickpea

Treatment	30 DAS			60DAS			At harvest		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	13.09	10.12	11.61	9.62	6.72	8.17	5.79	3.52	4.65
Farmer Practice (Flat bed)	10.40	7.93	9.17	7.29	5.35	6.32	4.50	3.04	3.77
S.Em±	0.10	0.06	0.08	0.03	0.08	0.03	0.25	0.10	0.08
CD (P=0.05)	0.59	0.36	0.46	0.19	0.48	0.17	NS	NS	0.46
INM plot (INM)									
RDF	11.69	9.07	10.38	8.79	6.07	7.43	5.04	3.34	4.19
INM_1	11.36	8.68	10.02	8.56	6.06	7.31	5.08	3.29	4.19
INM_2	11.58	8.85	10.21	8.21	6.09	7.15	5.20	3.20	4.20
INM_3	12.05	9.22	10.64	8.38	5.93	7.15	5.27	3.28	4.27
INM_4	12.06	9.36	10.71	8.35	6.03	7.19	5.12	3.30	4.21
S.Em±	0.15	0.17	0.11	0.14	0.10	0.09	0.13	0.09	0.08
CD (P=0.05)	0.45	NS	0.32	NS	NS	NS	NS	NS	NS
Interaction									
B X RDF	13.01	10.19	11.60	9.81	6.66	8.23	5.40	3.67	4.53
B X INM_1	12.65	9.75	11.40	9.75	6.72	8.24	5.66	3.50	4.58
B X INM_2	12.89	9.96	11.43	9.43	6.78	8.10	5.91	3.45	4.68
B X INM_3	13.51	10.29	11.85	9.55	6.65	8.10	5.99	3.50	4.78
B X INM_4	13.48	10.41	11.94	9.58	6.81	8.20	6.06	3.49	4.78
F X RDF	10.36	7.95	9.15	7.78	5.49	6.63	4.68	3.02	3.85
F X INM_1	10.07	7.60	8.83	7.36	5.41	6.39	4.51	3.08	3.80
F X INM_2	10.26	7.73	8.99	7.00	5.40	6.20	4.50	2.96	3.73
F X INM_3	10.59	8.16	9.42	7.21	5.21	6.21	4.54	3.05	3.80
F X INM_4	10.63	8.31	9.47	7.12	5.26	6.19	4.18	3.10	3.64
INM at same level of IMC									
S.Em±	0.211	0.239	0.150	0.192	0.138	0.121	0.180	0.121	0.110
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
INM at same or different level of IMC									
S.Em±	0.148	0.169	0.106	0.136	0.098	0.086	0.127	0.086	0.078
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

RDF: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_1: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_3: 50 kg N through inorganics + 50% P through Vermicompost + 50% P through inorganics + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha

Table 10. Effect of *in situ* moisture conservation and integrated nutrient management on grain yield, haulm yield and harvest index of chickpea

Treatment	Grain yield (kg ha^{-1})			Haulm yield (kg ha^{-1})			Harvest Index		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	1690.7	1183.3	1437.0	1989	1457	1723	0.459	0.469	0.455
Farmer Practice (Flat bed)	1476.7	1036.0	1256.3	1732	1268	1500	0.460	0.450	0.456
S.Em±	14.7	16.2	10.4	7.3	18.3	11.0	0.001	0.003	0.001
CD (P=0.05)	89.6	98.7	63.5	44.5	111.1	66.7	NS	NS	NS
INM plot (INM)									
RDF	1733.3	1263.3	1498.3	2047	1587	1817	0.459	0.463	0.452
INM_1	1695.0	1176.7	1425.8	1992	1453	1723	0.460	0.448	0.453
INM_2	1451.7	1009.0	1228.3	1675	1212	1443	0.464	0.454	0.460
INM_3	1401.7	963.3	1182.5	1660	1185	1423	0.457	0.448	0.454
INM_4	1636.7	1140.0	1388.3	1928	1375	1652	0.459	0.453	0.457
S.Em±	17.4	21.9	15.8	17.6	30.2	20.9	0.002	0.004	0.002
CD (P=0.05)	52.1	63.5	47.2	52.7	90.5	62.6	NS	NS	NS
Interaction									
B X RDF	1883.3	1296.7	1640.0	2227	1747	1987	0.458	0.845	0.452
B X INM_1	1846.7	1253.3	1550.0	2173	1570	1872	0.459	0.444	0.453
B X INM_2	1583.3	1033.3	1258.3	1737	1257	1497	0.461	0.452	0.457
B X INM_3	1466.7	1023.3	1245.0	1723	1240	1482	0.459	0.452	0.456
B X INM_4	1773.3	1210.0	1491.7	2083	1470	1777	0.460	0.451	0.456
F X RDF	1583.3	1130.0	1356.7	1867	1427	1647	0.459	0.462	0.452
F X INM_1	1543.3	1100.0	1321.7	1810	1337	1573	0.460	0.452	0.457
F X INM_2	1320.0	976.7	1198.3	1613	1167	1390	0.468	0.456	0.463
F X INM_3	1336.7	903.3	1120.0	1597	1130	1363	0.456	0.444	0.451
F X INM_4	1500.0	1070.0	1285.0	1773	1280	1527	0.458	0.456	0.457
INM at same level of IMC									
S.Em±	24.6	30.9	22.3	24.9	42.7	29.5	0.0027	0.0052	0.0027
CD (P=0.05)	73.6	92.7	66.8	74.6	85	88.6	NS	NS	NS
INM at same or different level of IMC									
S.Em±	26.4	32.1	22.3	23.4	42.3	28.6	0.0028	0.0054	0.0027
CD (P=0.05)	104.6	121.4	82.4	77.3	85	98.7	NS	NS	NS

RDF: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_1: 10:25 kg NP/ha through inorganics only + Rhizobium @ 1250 g/ha INM_2: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_3: 50 kg N through inorganics + 50% P through Vermicompost + 50% P through inorganics + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_4: 50 kg N through inorganics + 50% P through Glyricidia and 50% P through inorganics + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha

Table 11. Effect of in situ moisture conservation and integrated nutrient management on Number of pods plant⁻¹, Seed weight plant⁻¹ (g), Test weight (g) in chickpea

Treatment	Number of pods plant⁻¹ 2010	2011	Pooled	Seed weight plant⁻¹ (g) 2010	2011	Pooled	Test weight (g) 2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	47.95	38.27	43.11	8.07	6.50	7.29	20.32	19.83	20.08
Farmer Practice (Flat bed)	42.17	33.64	37.90	7.43	6.06	6.74	19.11	18.60	18.85
S.Em±	0.38	0.34	0.13	0.04	0.05	0.03	0.13	0.01	0.07
CD (P=0.05)	2.29	2.10	0.82	0.27	0.30	0.19	0.79	0.07	0.43
INM plot (INM)									
RDF	50.95	40.12	45.53	8.20	6.74	7.47	20.98	20.60	20.79
INM_1	49.57	39.00	44.28	8.09	6.48	7.28	20.55	20.15	20.35
INM_2	39.55	32.38	35.97	7.36	5.97	6.66	18.60	17.98	18.29
INM_3	37.82	30.82	34.32	7.21	5.84	6.52	18.28	17.56	17.92
INM_4	47.40	37.45	42.43	7.91	6.37	7.14	20.17	19.78	19.97
S.Em±	0.41	0.31	0.20	0.05	0.07	0.05	0.16	0.08	0.08
CD (P=0.05)	1.23	0.92	0.59	0.16	0.20	0.14	0.48	0.23	0.24
Interaction									
B X RDF	54.50	43.10	48.80	8.65	7.14	7.90	21.70	21.27	21.48
B X INM_1	53.10	41.90	47.50	8.54	6.71	7.63	21.17	20.80	20.98
B X INM_2	41.40	34.23	37.82	7.45	6.05	6.75	19.10	18.52	18.81
B X INM_3	39.07	32.07	35.57	7.40	6.02	6.71	18.83	18.10	18.47
B X INM_4	51.67	40.03	45.85	8.32	6.58	7.45	20.80	20.47	20.63
F X RDF	47.40	37.13	42.27	7.75	6.34	7.05	20.27	19.92	20.10
F X INM_1	46.03	36.10	41.07	7.63	6.25	6.94	19.93	19.50	19.72
F X INM_2	37.70	30.53	34.12	7.26	5.88	6.57	18.10	17.43	17.77
F X INM_3	36.57	29.57	33.07	7.01	5.66	6.34	17.73	17.02	17.38
F X INM_4	43.13	34.87	39.00	7.50	6.16	6.83	19.53	19.09	19.11
INM at same level of IMC									
S.Em±	0.38	0.44	0.280	0.074	0.093	0.066	0.226	0.107	0.112
CD (P=0.05)	1.74	1.31	0.84	0.22	0.278	0.2	NS	NS	NS
INM at same or different level of IMC									
S.Em±	0.58	0.38	0.284	0.078	0.096	0.067	0.240	0.097	0.123
CD (P=0.05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NS	NS	NS

[illegible footnote]

Table 12. Effect of in situ moisture conservation and integrated nutrient management on Gross return, net return and benefit cost ratio in Chickpea

Treatment	Gross return (Rs ha⁻¹) 2010	2011	Pooled	Net return (Rs ha⁻¹) 2010	2011	Pooled	Benefit cost ratio 2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	37791	44338	41066	28016	32556	29286	3.23	3.79	3.51
Farmer Practice (Flat bed)	32967	38796	35887	21223	27022	24122	2.82	3.31	3.06
S.Em±	308	594	326	308	594	326	0.03	0.05	0.03
CD (P=0.05)	1876	3614	1983	1876	3614	1983	0.16	0.32	0.18
INM plot (INM)									
RDF	38746	47396	43071	27534	36184	31859	3.45	4.22	3.84
INM_1	37883	44090	40987	26608	32004	29905	3.28	3.94	3.66
INM_2	32343	37998	34991	21199	26413	23805	2.90	3.36	3.13
INM_3	31353	36087	33720	19024	23787	21420	2.55	2.93	2.74
INM_4	36599	42659	39629	23613	29675	26645	2.82	3.29	3.05
S.Em±	373	818	497	373	818	497	0.03	0.07	0.04
CD (P=0.05)	1124	2429	1489	1124	2429	1489	0.10	0.21	0.13
Interaction									
B X RDF	42133	52377	47255	30894	41151	36023	3.75	4.67	4.21
B X INM_1	41290	47687	44487	30094	35821	32958	3.69	4.20	3.95
B X INM_2	33140	38688	35914	21884	27484	24734	2.96	3.46	3.21
B X INM_3	32798	38287	35558	20486	25097	23239	2.67	3.11	2.89
B X INM_4	39655	45299	42461	28659	32315	29487	3.05	3.49	3.27
F X RDF	35400	42403	38902	24174	31179	27676	3.15	3.78	3.47
F X INM_1	34487	41175	37830	23301	28988	26644	3.08	3.68	3.38
F X INM_2	31427	36517	34072	20441	25351	22886	2.83	3.26	3.05
F X INM_3	29927	33877	31882	17627	21477	19602	2.43	2.75	2.59
F X INM_4	33547	40018	36778	20872	27035	23804	2.59	3.08	2.83
INM at same level of IMC									
S.Em±	530	1146	702	530	1146	702	0.045	0.100	0.062
CD (P=0.05)	1590	3436	2105	1590	3436	2105	0.136	0.301	0.185
INM at same or different level of IMC									
S.Em±	566	1185	708	566	1185	708	0.048	0.104	0.063
CD (P=0.05)	2214	4471	2584	2214	4471	2584	0.190	0.393	0.229

RDF: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_1: 10:25 kg NP/ha through inorganics only + Rhizobium @ 1250 g/ha INM_2: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha INM_3: 10 kg N through in organics + 30% P through Glyricidia and 70% P through inorganics + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_4: 10 kg N through in organics + 30% P through Vermicompost + 70% P through inorganics + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha

Table 13. Effect of in situ moisture conservation and integrated nutrient management on bulk density (g/cc), porosity (%) and infiltration rate (cm/hr) in the soil after harvest of chickpea

Treatment	Bulk density 2010	2011	Pooled	Porosity (%) 2010	2011	Pooled	Infiltration rate (cm/hr) 2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	1.15	1.11	1.13	56.6	58.1	57.3	0.86	0.91	0.89
Farmer Practice (Flat bed)	1.16	1.12	1.14	56.3	57.7	57.0	0.85	0.90	0.88
S.Em±	0.001	0.001	0.001	0.05	0.04	0.04	0.001	0.001	0.001
CD (P=0.05)	0.007	0.007	0.006	0.3	0.2	0.23	0.007	NS	0.007
INM plot (INM)									
RDF	1.17	1.14	1.15	55.9	57.1	56.5	0.84	0.90	0.87
INM_1	1.17	1.14	1.15	55.8	57.2	56.5	0.85	0.89	0.87
INM_2	1.17	1.12	1.14	56.0	57.9	56.9	0.85	0.89	0.87
INM_3	1.15	1.10	1.12	57.0	58.6	57.8	0.86	0.91	0.88
INM_4	1.13	1.09	1.11	57.5	58.7	58.1	0.89	0.96	0.92
S.Em±	0.004	0.006	0.004	0.2	0.2	0.16	0.005	0.005	0.004
CD (P=0.05)	0.013	0.018	0.013	0.5	0.7	0.47	0.014	0.015	0.012
Interaction									
B X RDF	1.17	1.14	1.15	55.9	57.2	56.5	0.85	0.89	0.87
B X INM_1	1.17	1.13	1.15	56.0	57.5	56.7	0.88	0.89	0.86
B X INM_2	1.16	1.12	1.14	56.3	57.9	57.1	0.86	0.90	0.88
B X INM_3	1.14	1.09	1.11	57.1	58.9	58.0	0.87	0.91	0.89
B X INM_4	1.12	1.09	1.10	57.7	59.0	58.4	0.90	0.98	0.94
F X RDF	1.17	1.14	1.15	55.8	57.1	56.5	0.84	0.90	0.87
F X INM_1	1.18	1.14	1.16	55.7	56.9	56.3	0.85	0.89	0.87
F X INM_2	1.17	1.12	1.14	55.8	57.9	56.8	0.85	0.89	0.87
F X INM_3	1.14	1.10	1.12	56.9	58.4	57.6	0.85	0.91	0.88
F X INM_4	1.13	1.10	1.12	57.4	58.5	57.9	0.87	0.94	0.90
INM at same level of IMC									
S.Em±	0.006	0.008	0.006	0.27	0.32	0.22	0.01	0.007	0.01
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	0.02
INM at same or different level of IMC									
S.Em±	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CD (P=0.05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible footnote]

Table 14. Effect of in situ moisture conservation and integrated nutrient management on N content (%), protein content (%) and protein yield (kg ha⁻¹) in Chickpea

Treatment	% Nitrogen 2010	2011	Pooled	Protein content (%) 2010	2011	Pooled	Protein yield (kg ha⁻¹) 2010	2011	Pooled
Main plot (IMC)									
Broad Bed and Furrow (B)	3.41	2.93	3.17	21.3	18.3	19.8	361.6	218.3	290.0
Farmer Practice (Flat bed)	3.27	2.77	3.02	20.4	17.3	18.9	302.8	180.1	241.4
S.Em±	0.01	0.01	0.01	0.04	0.06	0.04	3.4	3.4	2.9
CD (P=0.05)	0.04	0.06	0.08	0.25	0.38	0.26	20.9	20.8	17.8
INM plot (INM)									
RDF	3.52	3.04	3.28	22.0	19.0	20.5	382.0	241.3	311.6
INM_1	3.49	2.95	3.22	21.8	18.4	20.1	369.6	216.9	293.2
INM_2	3.17	2.73	2.95	19.8	17.0	18.4	287.8	171.4	229.6
INM_3	3.05	2.67	2.86	19.1	16.7	17.9	267.7	160.8	214.2
INM_4	3.46	2.88	3.17	21.6	18.0	19.8	354.1	205.5	279.8
S.Em±	0.01	0.02	0.01	0.06	0.12	0.07	3.8	5.7	4.1
CD (P=0.05)	0.03	0.06	0.03	0.19	0.36	0.21	11.4	17.0	12.3
Interaction									
B X RDF	3.57	3.17	3.37	22.3	19.8	21.1	420.2	277.8	349.0
B X INM_1	3.52	3.02	3.27	22.0	18.9	20.5	406.3	236.5	321.4
B X INM_2	3.32	2.81	3.06	20.7	17.5	19.1	307.4	181.2	244.3
B X INM_3	3.13	2.72	2.93	19.5	17.0	18.3	286.7	174.2	230.5
B X INM_4	3.50	2.93	3.22	21.9	18.3	20.1	387.5	221.9	304.7
F X RDF	3.47	2.90	3.19	21.7	18.1	19.9	343.8	204.8	274.3
F X INM_1	3.45	2.87	3.16	21.6	17.9	19.8	332.8	197.4	265.1
F X INM_2	3.02	2.65	2.84	18.9	16.6	17.7	268.2	161.7	214.9
F X INM_3	2.98	2.61	2.79	18.6	16.3	17.5	248.7	147.3	198.0
F X INM_4	3.42	2.83	3.12	21.4	17.7	19.5	320.6	189.1	254.9
INM at same level of IMC									
S.Em±	0.01	0.03	0.02	0.09	0.17	0.10	5.38	8.03	5.78
CD (P=0.05)	0.04	0.08	0.05	0.27	0.51	0.29	16.14	24.06	17.33
INM at same or different level of IMC									
S.Em±	0.01	0.03	0.02	0.09	0.16	0.10	5.91	7.95	5.94
CD (P=0.05)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RDF: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_1: 10:25 kg NP/ha through inorganics only + Rhizobium @ 1250 g/ha INM_2: 10:25 kg NP/ha through inorganics only + PSB @ 1250 g/ha INM_3: 10 kg N through in organics + 30% P through Glyricidia and 70% P through inorganics + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha INM_4: 10 kg N through in organics + 30% P through Vermicompost + 70% P through inorganics + PSB @ 1250 g/ha + Rhizobium @ 1250 g/ha

Title of experiment-III

Effect of soil and moisture conservation measures in watershed on productivity of different cropping systems in Northern Transition Zone of Karnataka

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Details of experiment

Year of commencement	2010-11
Design	Split plot
Replication	Three
Plot size	16m X 18m
Location	Singhanahalli (farmer's field, Dharwad)
Variety/Cultivar	Maize : Cargill M 900 Chickpea :JG-11 Soybean : JS-335 Sorghum : M-35-1 Groundnut: TAG-24 Wheat: DWR-2006 Pigeonpea : Asha
Soil type	Vertisols
Fertilizer Application	Based on Soil test results
Season	*Kharif* and *Rabi*

Details of treatment

Cropping systems	
Main plot	
M1	Broad bed and furrow (BBF)
M2	Conservation furrow (CF)
M3	Farmers' practices (FP)
Sub plot	
CS1	Maize –Chickpea
CS2	Soybean- Sorghum
CS3	Groundnut- Wheat
CS4	Maize + Pigeonpea

Table 1. Effect of soil and moisture conservation measures on different cropping systems on soil moisture and available water at 45 and 60 DAS (pooled data of 2 years) on *Kharif* crops

Treatment	45 DAS				60DAS			
	0-15cm		15-30cm		0-15cm		15-30cm	
	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)
Main plot: Soil and moisture conservation measures								
M1-BBF	27.50	46.18	27.46	51.99	24.5	32.91	26.01	35.89
M2-CF	23.01	40.34	23.54	45.50	19.96	22.83	20.97	24.68
M3-FP	21.25	38.58	21.47	36.78	18.22	25.22	19	26.39
S.Em±	0.43		0.42		0.45		0.39	
CD (P=0.05)	1.70		1.65		1.77		1.54	
Sub plot: Cropping systems								
CS1-Maize	24.27	51.90	24.48	49.45	21.11	37.96	22.32	40.36
CS2-Soybean	24.05	50.93	24.31	48.74	20.88	37.39	22.12	39.52
CS3-Groundnut	23.82	49.91	24.07	47.72	20.76	36.42	21.87	38.47
CS4-Maize	23.53	48.63	23.77	46.46	20.73	36.29	21.66	37.58
S.Em±	0.24		0.26		0.42		0.29	
CD (P=0.05)	NS		NS		NS		NS	
Interaction								
BBF x CS1	27.90	67.90	27.75	63.22	24.86	54.50	26.32	57.20
BBF xCS2	27.63	66.71	27.63	62.71	24.63	53.48	26.12	56.26
BBF x CS3	27.40	65.70	27.45	61.95	24.33	52.16	25.92	55.51
BBF x CS4	27.05	64.15	27.02	60.14	24.18	51.50	25.68	54.50
CF x CS1	23.40	48.06	23.85	46.80	20.2	33.95	21.21	36.11
CF x CS2	23.18	47.09	23.70	46.17	20.05	33.29	21.08	35.14
CF x CS3	22.87	45.72	23.42	44.99	19.9	32.63	20.88	34.36
CF x CS4	22.60	44.53	23.18	43.98	19.68	31.66	20.6	33.12
FP x CS1	21.52	39.77	21.83	38.30	18.27	25.44	19.34	27.83
FP x CS2	21.33	38.93	21.58	37.25	18.25	25.35	19.17	27.10
FP x CS3	21.19	38.32	21.35	36.28	18.03	24.38	18.8	25.55
FP x CS4	20.95	37.36	21.10	35.23	18.33	25.71	18.68	25.04
S.Em±	0.86		0.83		1.00		0.81	
CD (P=0.05)	NS		NS		NS		NS	

Note: BBF: Broad bed and furrow, CF: Conservation furrow and FP: Farmers' practice

Table 2. Effect of soil and moisture conservation practices on different cropping systems on soil moisture (%) and available water at 75 and 90 DAS (pooled data of 2 years) on kharif crops

Treatment	75 DAS				90DAS			
	0-15cm		15-30cm		0-15cm		15-30cm	
	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)
Main plot: Soil and moisture conservation measure								
M1-BBF	27.46	65.96	29.54	70.75	19.95	32.85	21.96	38.85
M2-CF	24.5	52.91	26.3	57.11	17.33	21.20	19.98	30.51
M3-FP	21.36	39.07	24.03	47.56	15.55	13.45	16.5	15.87
S.Em±	0.31		0.48		0.35		0.32	
CD (P=0.05)	1.51		1.87		1.38		1.26	
Sub plot: Cropping systems								
CS1-Maize	24.76	54.06	26.95	59.85	17.94	23.99	19.83	29.88
CS2-Soybean	24.57	53.22	26.78	59.13	17.69	22.88	19.61	28.96
CS3-Groundnut	24.38	52.38	26.52	58.04	17.58	22.40	19.38	27.99
CS4-Maize	24.06	50.97	26.24	56.86	17.22	20.91	19.11	26.85
S.Em±	0.27		0.73		0.43		0.36	
CD (P=0.05)	NS		NS		NS		NS	
Interaction								
BBF x CS1	27.75	67.24	29.92	72.35	20.32	34.48	22.27	40.15
BBF xCS2	27.58	66.49	29.7	71.42	20.04	33.25	22.07	39.31
BBF x CS3	27.37	65.56	29.42	70.24	19.93	32.76	21.9	38.59
BBF x CS4	27.15	64.59	29.13	69.02	19.5	30.86	21.6	37.33
CF x CS1	24.82	54.32	26.63	58.50	17.67	22.30	20.35	32.07
CF x CS2	24.63	53.48	26.45	57.74	17.35	21.38	20.1	31.02
CF x CS3	24.42	52.56	26.22	56.78	17.27	21.03	19.85	29.97
CF x CS4	24.13	51.28	25.92	55.51	17.03	19.97	19.6	28.91
FP x CS1	21.71	40.61	24.3	48.70	15.85	14.77	16.87	17.42
FP x CS2	21.48	39.59	24.2	48.27	15.68	14.02	16.65	16.50
FP x CS3	21.36	39.02	23.92	47.10	15.53	13.36	16.38	15.36
FP x CS4	20.9	37.04	23.68	46.09	15.13	11.60	16.12	14.27
S.Em±	0.78		1.37		0.89		0.78	
CD (P=0.05)	NS		NS		NS		NS	

Note: BBF: Broad bed and furrow, CF: Conservation furrow and FP: Farmers' practice
CS1: Maize – Chickpea, CS2: Soybean- Sorghum, CS3: Groundnut – Wheat and CS4: Maize + Pigeonpea

Table 3. Effect of soil and moisture conservation practices on different cropping systems on soil moisture (%) and available water at 30 and 60 DAS (pooled data of 2 years) on rabi crops

Treatment	30 DAS				60DAS			
	0-15cm		15-30cm		0-15cm		15-30cm	
	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)	Soil moisture (%)	Available water (%)
Main plot: Soil and moisture conservation measure								
M1-BBF	18.4	26.01	20.79	33.92	15.9	14.99	17.6	20.08
M2-CF	15.37	12.45	17.31	19.23	13.37	3.64	14.44	7.20
M3-FP	13.95	6.39	15.34	10.98	11.47	-4.54	12.43	-1.26
S.Em±	0.36		0.36		0.21		0.29	
CD (P=0.05)	1.42		1.42		0.84		1.13	
Sub plot: Cropping systems								
CS1-Chickpea	16.21	16.36	18.11	22.64	13.89	6.13	15.07	9.85
CS2-Sorghum	15.99	15.39	17.91	21.80	13.69	5.25	14.87	9.01
CS3-Wheat	15.81	14.59	17.71	20.96	13.46	4.23	14.76	8.54
CS4-Pigeonpea	15.63	13.80	17.51	20.12	13.28	3.44	14.47	7.32
S.Em±	0.26		0.33		0.41		0.30	
CD (P=0.05)	NS		NS		NS		NS	
Interaction								
BBF x CS1	18.65	27.12	21.12	35.31	16.23	16.45	17.8	21.34
BBF xCS2	18.48	26.37	20.88	34.30	16.07	15.74	17.65	20.71
BBF x CS3	18.3	25.57	20.72	33.63	15.75	14.33	17.42	19.74
BBF x CS4	18.17	25.00	20.45	32.49	15.55	13.45	17.15	18.60
CF x CS1	15.68	14.02	17.6	20.50	13.65	5.07	14.72	8.38
CF x CS2	15.47	13.10	17.43	19.78	13.45	4.19	14.5	7.45
CF x CS3	15.27	12.21	17.17	18.69	13.27	3.40	14.36	6.94
CF x CS4	15.07	11.33	17.03	18.10	13.12	2.73	14.15	5.98
FP x CS1	14.28	7.85	15.62	12.16	11.8	-3.09	12.7	-0.13
FP x CS2	14.02	6.70	15.42	11.32	11.55	-4.19	12.47	-1.09
FP x CS3	13.85	5.95	15.25	10.61	11.35	-5.07	12.47	-1.09
FP x CS4	13.65	5.07	15.06	9.81	11.17	-5.86	12.1	-2.65
S.Em±	0.74		0.80		0.49		0.67	
CD (P=0.05)	NS		NS		NS		NS	

Note: BBF: Broad bed and furrow, CF: Conservation furrow and FP: Farmers' practice
CS1: Maize – Chickpea, CS2: Soybean- Sorghum, CS3: Groundnut – Wheat and CS4: Maize + Pigeonpea

Table 4. Maize equivalent yield of kharif crops as influenced by soil and moisture conservation measures and cropping system

Treatment	Maize equivalent yield (kg ha⁻¹)		
	2010-11	2011-12	Pooled
Main plot: soil and moisture conservation measures			
M1-BBF	7088	5397	6243
M2-CF	6414	4305	5359
M3-FP	5035	3621	4332
S. Em±	140.81	100.17	51.42
CD (P=0.05)	582.90	393.33	201.88
Sub plot: Cropping systems			
CS1-Maize	5822	5318	5576
CS2-Soybean	4205	4078	4141
CS3-Groundnut	10763	4763	7763
CS4-Maize	3926	3605	3765
S. Em±	76.38	45.13	49.93
CD (P=0.05)	226.94	134.10	148.34
Interaction			
BBF x CS1	6500	6300	6400
BBF xCS2	4743	4676	4709
BBF x CS3	12724	6360	9542
BBF x C S4	4388	4253	4320
CF x CS1	6100	5020	5560
CF x CS2	4142	4052	4097
CF x CS3	11331	4757	8044
CF x CS4	4084	3389	3736
FP x CS1	4900	4633	4767
FP x CS2	3731	3505	3618
FP x CS3	8235	3171	5703
FP x CS4	3308	3173	3240
S.Em±	269.47	186.25	116.36
CD (P=0.05)	800.62	553.36	345.71

Note: BBF: Broad bed and furrow, CF: Conservation furrow and FP: Farmers' practice
CS1: Maize - Chickpea, CS2: Soybean- Sorghum, CS3: Groundnut - Wheat and CS4: Maize + Pigeonpea

Table 5. Maize equivalent yields of rabi crops as influenced by soil and moisture conservation measures and cropping system

Treatment	Maize equivalent yield (kg ha⁻¹)		
	2010-11	2011-12	Pooled
Main plot: soil and moisture conservation measures			
M1-BBF	3796	2806	3301
M2-CF	3055	2149	2602
M3-FP	2154	1329	1741
S. Em±	49.98	71.54	38.64
CD (P=0.05)	196.25	280.91	151.71
Sub plot: Cropping systems			
CS1-Chickpea	2780	2525	2653
CS2-Sorghum	4479	2405	3442
CS3-Wheat	2095	1186	1641
CS4-Pigeonpea	2653	2260	2457
S. Em±	48.72	65.28	36.33
CD (P=0.05)	144.74	193.97	107.93
Interaction			
BBF x CS1	3529	3400	3465
BBF xCS2	5559	3217	4388
BBF x CS3	2524	1520	2022
BBF x C S4	3572	3086	3329
CF x CS1	3059	2800	2929
CF x CS2	4638	2514	3576
CF x CS3	2154	1263	1709
CF x CS4	2368	2019	2194
FP x CS1	1751	1376	1564
FP x CS2	3240	1486	2363
FP x CS3	1607	776	1191
FP x CS4	2019	1676	1847
S.Em±	113.29	157.94	86.30
CD (P=0.05)	336.60	469.26	256.42

Note: BBF: Broad bed and furrow, CF: Conservation furrow and FP: Farmers' practice
CS1: Maize - Chickpea, CS2: Soybean- Sorghum, CS3: Groundnut - Wheat and CS4: Maize + Pigeonpea

Table 6: Economics of cropping systems for 2010-11

Treatment	Gross return (Rs.ha⁻¹)	Cost of cultivation (Rs.ha⁻¹)	Net returns (Rs.ha⁻¹)	B:C Ratio
Main plot: soil and moisture conservation measures				
M1-BBF	101086	35266	65820	2.87
M2-CF	88446	35914	52533	2.49
M3-FP	66507	31135	35373	2.16
S. Em±	833.33	-	833.33	0.07
CD (P=0.05)	3272	-	3272	0.29
Sub plot: Cropping systems				
CS1-M-C	90325	34811	55514	2.57
CS2-S-S	77964	31615	46350	2.46
CS3-G-W	113606	33951	79656	3.32
CS4-M+Ppea	59490	36042	23447	1.68
S. Em±	962.25	-	962.25	0.04
CD (P=0.05)	2859	-	2859	0.11
Interaction				
BBF x CS1	106274	36976	69298	2.87
BBF xCS2	92223	32760	59463	2.82
BBF x CS3	134292	35212	99080	3.81
BBF x C S4	71553	36115	35437	1.98
CF x CS1	96656	37716	58940	2.56
CF x CS2	79035	33249	45786	2.38
CF x CS3	119462	35662	83800	3.35
CF x CS4	58631	37027	21604	1.68
FP x CS1	68044	29740	38303	2.29
FP x CS2	62635	28835	33800	2.17
FP x CS3	87065	30978	56088	2.81
FP x CS4	48285	34985	13299	1.38
S.Em±	2041.24	-	2041.24	0.14
CD (P=0.05)	6065	-	6065	0.42

Note: BBF: Broad bed and furrow, CF: Conservation furrow and FP: Farmers' practice
CS1: Maize - Chickpea, CS2: Soybean- Sorghum, CS3: Groundnut - Wheat and CS4: Maize + Pigeonpea

Table 7: Economics of cropping systems for 2011-12

Treatment	Gross return (Rs.ha⁻¹)	Cost of cultivation (Rs.ha⁻¹)	Net returns (Rs.ha⁻¹)	B:C Ratio
Main plot: soil and moisture conservation measures				
M1-BBF	90186	33901	56353	2.67
M2-CF	70916	34280	36636	2.05
M3-FP	54855	30436	24420	1.80
S. Em±	642.80	-	642.80	0.05
CD (P=0.05)	2524		2524	0.20
Sub plot: Cropping systems				
CS1-M-C	87283	35881	51403	2.42
CS2-S-S	71500	32761	38829	2.17
CS3-G-W	64506	33525	30981	1.90
CS4-M+Ppea	64854	29321	35332	2.21
S. Em±	717.94	-	717.94	0.03
CD (P=0.05)	2133	-	2133	0.10
Interaction				
BBF x CS1	107134	37265	69869	2.87
BBF xCS2	87367	34121	53516	2.57
BBF x CS3	85578	34756	50823	2.46
BBF x C S4	80665	29461	51204	2.77
CF x CS1	86844	37547	49297	2.31
CF x CS2	72320	34331	37989	2.11
CF x CS3	64823	35201	29622	1.84
CF x CS4	59678	30041	29637	1.99
FP x CS1	67872	32831	35042	2.07
FP x CS2	54812	29830	24982	1.84
FP x CS3	43117	30619	12498	1.41
FP x CS4	[illegible]	[illegible]	[illegible]	1.88
[illegible]	[illegible]		[illegible]	[illegible]

Note: BBF: Broad bed and furrow, CF: Conservation furrow and FP: Farmers' practice
CS1: Maize - Chickpea, CS2: Soybean- Sorghum, CS3: Groundnut - Wheat and CS4: Maize + Pigeonpea

Thanks

SDTT-ICRISAT/BAIF PROJECT BHOPAL M.P.

Project Title :

Improving Rural Livelihoods and Minimizing land degradation through the Community Watershed Approach for Sustinable Development of Dryland Areas.

OBJECTIVES:

1. To consolidate the science-led farmer-centrec community watershed approach at nucleus benchmark watersheds for enhancing productivity and reducing land degradation in 6 districts and to use theese sites as sites of learning for scaling-out benfits in the 6 target districts.
2. To scale out the benefits of productivity enhancement and community watershed management with techinical backstopping in the target agro-ecoregion of mp.
3. Capacity building of lead farmers, development workers and consortium partners in the target regions and provide technical support to development agencies in the area of community Watershed.

BACKGROUND

I) Under SDTT-ICRISAT Project, BAIF is working in 6 districts of M.P. covering 1745 farmers

II) Generally farmers grow JS 335, JS 9305 variety of soybean, Lok-1, C-306 Wheat Variety

III) Traditional farming system includes-Use of High seed rate, use of major Nutrients such as Nitrogen, Phosphorus and Potassium

IV) Avoiding Sulphur, Boron and Zink, seed treatment,IPM.

CONTD.

IV) Soybean Avg. Yield(Qt/Ha.) 11.5 Qtl.

V) Soil type — Black soil

VI) Major Crops — Soybean, Maize, Pegionpea, Wheat,Chickpea

VII) Rain fall (Avg.) — 850 mm.

LOCATION: Sehore, Rajgarh, Vidisha, Barwani, Guna, Indore

ACITIVITIES :

1. PRODUCTIVITY ENHANCEMENT TRIALS
   - I. Nucleus Vermicompost Trials
   - II. Satellite Balance Nutrition Trials
   - III. Scale Up Trails
2. Efficient Irrigation Management
   1. Lowcost drip
   2. Sprinkler
3. Diversification Including with High Value Vegetables With Micro Nutrients & Land Treatments
4. Increase Forage Production

CONTD.

5. Enhancing Soil Fertility
   1. Glyricidia Plantation
   2. Vermicomposting
6. Artificial Insemination
7. Rainy season fallow Management Trials
8. Human Resource Development activity for skill enhancement
   1. Farmers training
   2. Farmers Awareness Meeting
9. Farmers Day

Soil Test Based Fertilizer Recommendations (kg /Hac.)

SL. NO.	Districts	Gypsum	Zink Sulphate	Agribor
1	GUNA, BADAWANI, VIDISHA, SEHORE	200	50	2.5
2.	RAJGARH	200	25	2.5
3.	INDORE	100	25	1.25

NUMBER OF TRIALS CONDUCTED 2012-12

Sr.NO.	Types of Trails	NO. OF PLOTS		
		Kharif	Rabi	Total
1.	NUCLEUS V/C	60	09	69
2.	SATELLITE BALANCE NUTRITION.	250	111	361
3.	SCALE–UP	285	113	398
4.	RESIDUAL NUC. V/C	173	45	218
5.	RESIDUAL SATELLITE BLN.	86	10	96
6	RESIDUAL BOROMAG	13	15	28

PHOTO OF TRIALS

Nucleous v/c Trial Soybean

Soy Sample Collection

BL Nutrition Trial in Wheat Crop

IPM in Chickpea Crop

Fertilizer Mixing

Measuring the roots length of Soybean in Nucleous V/C Trial

Measuring Root modules in Soybean

Difference in number of pods and pods size of Ground Nut

Sr. Official Visit

CAPACITY BUILDING

Meeting – 60

- **Farmers Day –** 07

- **Livestock Development**
  - Artificial Insemination – 682
  - Vaccination(HSBQ) - 200

NUCLEOUS V/C TRIALS (SOYBEAN) AVG. YIELD Qtl./Ha. KHARIF 2011

Districts	Avg. Yield Qtl. /Hac		
	Farmer Practice	100 %Balance Nutrition	50% Balance Nutrition + 50 % Vermicompost/FYM
Guna	13.70	15.58	15.96
Indore	21.91	23.71	23.72
Vidisha	11.91	13.83	14.58
Sehore	12.15	14.03	15.10
Barwani	21.11	23.80	24.37

SATELLITE TRIALS (SOYBEAN) AVG. YIELD Qtl./Ha. KHARIF 2011

Districts	Avg. Yield Qtl. /Hac	
	Farmer Practice	100 %Balance Nutrition
Guna	14.68	16.75
Indore	20.11	21.37
Vidisha	11.16	13.91
Sehore	12.06	14.10
Barwani	20.93	23.84

YIELD Qtl./Ha. RABI 2012 NUCLEUS –V/C WHEAT

Districts	Avg. Yield Qtl. /Hac		
	Farmer Practice	100 %Balance Nutrition	50% Balance Nutrition + 50 % Vermicompost/FYM
Guna	-	-	-
Indore	-	-	-
Vidisha	34.50	38.25	39.60
Sehore	34.50	39.20	43.70
Barwani	-	-	-
Rajgarh	-	-	-

SATELLITE TRIALS AVG. YIELD Qtl./Ha. Rabi 2011-2012

Districts	Avg. Yield kg. /Hac	
	Farmer Practice	100 %Balance Nutrition
Guna	35.43 (W) 13.12 (C)	36.93 (W) 14.25 (C)
Indore	-	-
Vidisha	35.10 (W)	38.36 (W)
Sehore	39.92 (W)	42.09 (W)
Barwani	-	-
Rajgarh	-	-

W- Wheat C-Chickpea

IMPACT

1. Quality of soil improved by using organic matter and micro nutrients.
2. Production is increased 3-9 qtl. per Ha.
3. Awareness in farmers increased by Good agriculter practices BBF, Balance Nutrition, Seed Treatment, Fallow Management , FYM / VC, IPM, crop observation in different stages, e.g. no of root nodules, no of pods, Branches.
4. Traditional practices are shifting towords scientific methods of crop cultivation e.g. Use of recommended seed rate, Seed Treatment, use of bio-Fertilizer & use of micro-nutrients.

5. Crop diversification is observed through adoption of new crop cultivativars like ground nut, piegion pea by the farmers.
6. Fallow Area reduced because of BBF, short duration variety.
7. Farmers purchase Zink Sulphate and Gypsum from Agriculture Departments and Market and use in fields.
7. Through loivestock development program cattle breed is improved which will increase the milk production in the project villages.
8. Socio-economic condition of farmers and the living standard is upgrading.

ISSUES & CHALLENGES

1. Moving of manpower to other sectors
2. Lack of awareness about Good agriculture practices among the farmers
3. Timely planning is very important for implementation of activity on time.
4. Non availability improved variety at local level
5. For more effective implementation of the project budget Enhencement is essential.

LEARING

1. Interest in agriculture activities is increased among the community.
2. Capacity building of farmers and our staff
3. At organizational level our agro-baesd livelihood activities got a succesfull achievement through this Project.
4. Demonstration base interventions incresases adoption by farmers.

THANKS

SDTT-ICRISAT/BAIF PROJECT BHOPAL M.P.

Project Title : Improving Rural Livelihoods and Minimizing land degradation through the Community Watershed Approach for Sustinable Development of Dryland Areas.

OBJECTIVES : productivity enhancement

Trail name : Satellite Balance Nutrition

- Location : Vidisha
- Plot Size: 1000 mt2
- Trial details: Znso4 5kg,Gypsum 20 kg, Agribore 0.25kg

Yield Qtl. /Hac Treatment 15.5 Control 7.60

Difference in number of pods and pods size of Ground Nut

Trial name : Nucleus Vermicompost.

- Location : Sehore
- No.of Trials : 05
- Plot Size: 2000 mt2
- Trial details: Znso4 5kg,Gypsum 20 kg, Agribore 0.5kg FYM 10 Qt.
- Yield Qtl. /Ha Treatment 43.70 Control 34.5

Yield Increase by Nucl./VC. In wheat Crop

Project Title : Improving Rural Livelihoods through breed improvement of local non descript breeds

Objective:Breed improvement

Location – LDC Regnodiya (Indore)

No of village 10

Avarege Milk Production per cross breed cow 8 Litter per day

No. of Milking Animals 323

Average Increase in Milk Production per day 2584 Lit. Inc in Project Area

34 Family have got self Employment through Milk Production.

cross breed

Milk Production

Sustainable Livelihoods through Community Watershed approach in Raisen & Sagar districts of MP State

Implemented by

SDTT – ICRISAT- ICAR Consortium

Consortium partner

Bhopal Yuwa Paryavaran Shikshan & Samajik Sansthan (BYPASS)

83, Paraspar Colony, Chuna Bhatti, Bhopal 462016. Madhya Pradesh.

Ph: 0755 – 4281638

Email: bypassindia@yahoo.com

Presentation by

Akhilesh Singh Yadav

Coverage of the project

Nucleus villages

Bamhori, Pahariya, Siyalwada, Gaganwada (Raisen District) Karaiya, Shobhapur (District Sagar)

Satellite Villages

Gundrai, Ramgarha, Jalgarh, Dilhari, Kundali, Khamariya (District Raisen)

Hinotha, Talguhari, Narayanoanj, Agariya (District Sagar)

Plan for 2011-12

- Information sharing
- Participatory trials on balanced Nutrient, Water use efficiency, Fallow management
- Promotion of efficient irrigation systems
- Crop Diversification
- Forage development
- SHG development
- Cattle health
- Capacity building of farmers

Farmers Capacity Building

Season	Participants	Issues
KHARIF 2011	15 villages – 512 Farmers	Why ?? How?? Seed treatment, Balanced nutrient, Water use efficiency & BBF, Improved Variety, Use of FYM, Risk management etc.
RABI 2011	15 villages- 425 Farmers	

Recommended package of practice

Gypsum	200 kg/ ha.
Agribor	2.5 kg/ ha
Zinc	50 kg/ ha
Urea	50 kg/ ha
DAP/ Super phosphate	100 kg/ ha
Seed treatment	Thyrum Rhyzobium PSB Tricoderma
Improved variety (Short duration variety according to need) , For sowing Soybean and Chickpea – seed quantity 75 - 80 kg/ ha. and Wheat seed 120 kg/ ha	

Improved variety

CROP	VARIETY
PIGEON PEA	ICPL 871119
GROUND NUT	ICGV 91114
BLACK GRAM	T-9
MAIZE	KAVERI 235
	DHM 117

Tropicultors

- 2 No Tropicultors were provided One in each district
- Demonstration was also done in Karaiya and Pahariya village

Kharif 2011- RAISEN Dist

- Balanced Nutrient - Nucleus Trials – 15 Trials
- Balanced Nutrient - Satellite Trials –
  - Soybean 29 Trials
  - Maize 07 Trials
  - Black gram 08 Trials
  - Pigeonpea 11 Trials
  - Groundnut 04 Trials
- Balanced Nutrient - Scale Up Trials - 125 Trials
- Fallow Management- Nucleus Trials- 15 Trials
- Fallow Management- Satellite Trials – 18 Trials
- Wateruse efficiency – 16 Trials

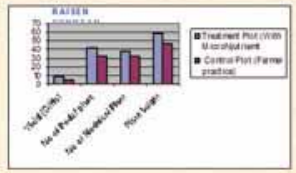
- Balanced Nutrient – Residual Nucleus Trials – 15 Trials
- Balanced Nutrient – Residual satellite Trials – 30 Trials
- Special Trials on Agribor SBZ application – 25 Trials
- Kitchen gardens – 40 farmers/ Women
- Commercial vegetable cultivation – 5 ha
- Fodder development – 2 ha

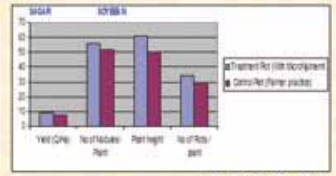
Kharif 2011- SAGAR Dist.

- Balanced Nutrient - Nucleus Trials – 15 Trials
- Balanced Nutrient - Satellite Trials –
  - Soybean 45 Trials
  - Maize 08 Trials
  - Black gram 08 Trials
  - Pigeon pea 35 Trials
  - Groundnut 04 Trials
- Balanced Nutrient - Scale Up Trials - 99 Trials
- Fallow Management- Nucleus Trials- 10 Trials
- Fallow Management- Satellite Trials – 15 Trials
- Wateruse Efficiency – 15 Trials

Yield of Soybean

Soybean		
Farmers practice	Balanced Nutrient	50% Vermi compost+ 50% BN
500-882	650-950	800-1075



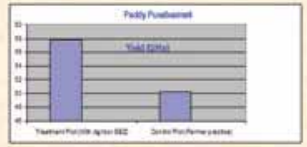


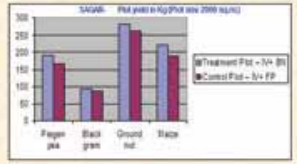
Yield in Kg/ ha.

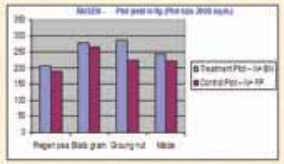
Farmers Observations

- Germination was better (10 to 15 % more) in Balance Nutrient plot.
- Through micro nutrient application & BBF the soil texture is improving which strengthens the root system of plant.
- Reason for low yield-
  - Land is low to medium sloppy
  - Medium to deep BC Soil
  - Due to continuous rains Moisture content was much more in Soil for long tome
  - Water logging condition in various farms
  - Due to Cloudy weather proper Sun light didn't come
  - Disease YELLOW MAGIC comes to Soybean
  - Plants dried suddenly, Flowers and Pods fall down

Yield of various crops – Kharif 2011







Rabi 2011 – RAISEN DIST

- Balanced Nutrient - Nucleus Trials – 15 Trials
- Balanced Nutrient - Satellite Trials – 75 Trials
- Balanced Nutrient - Scale Up Trials - 92 Trials
- Fallow Management- Nucleus Trials- 15 Trials
- Fallow Management- Satellite Trials – 50 Trials
- Water use efficiency – 20 Trials
- Summer vegetable cultivation – 10 farmers (2.4 ha.)
- Seed treatment with Tricoderma

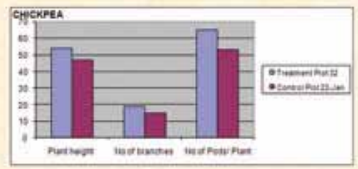
RABI 2011 - SAGAR

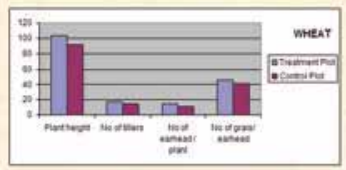
- Balanced Nutrient - Nucleus Trials – 15 Trials
- Balanced Nutrient - Satellite Trials – 76 Trials
- Balanced Nutrient - Scale Up Trials - 108 Trials
- Fallow Management- Nucleus Trials- 15 Trials
- Fallow Management- Satellite Trials – 46 Trials
- Water use efficiency – 25 Trials

CHICKPEA		Yield Kg/ ha
Farmers practice	Balanced Nutrient	50% Vermi compost+ 50% BN
1900	2090	2269

WHEAT		Yield Kg/ ha
Farmers practice	Balanced Nutrient	50% Vermi compost+ 50% BN
3978	4246	4445

Performance of Chickpea and Wheat





Farmers day-KARAIYA – Dis. SAGAR

- Date 07 January 2012, Participants 136
- Resource persons Dr Y R Khare (Prog Co, KVK Sagar) , Dr S N Tripathi (PA/ FED, KVK, Sagar), Mr Prasad Kamdi (ICRISAT), Mr RS Kushwah & Mr AS Rajput (Agriculture Dept.), Mr SN Singh (Veterinary dept), Akhilesh Singh Yadav, Vijay Saxena, Sabir Ali
- Issues discussed – Farmers experiences sharing while using IV, Micro nutrient, FYM and BBF. Discussion on ways to minimize the damage from frost, How to get better yield with moisture stress and shallow soil? Different ways to conserve the water ?
- Resource persons from KVK explain about various varieties developed by JNKV. Also they discuss about crop rotation to minimize damage.
- All the participants visit the satellite trial plots of Wheat and Chickpea.

Farmers day- SIYALWADA

- Date 30 JANUARY 2012, Participants 195
- Issues – Farmers organisation? Marketting of Agri produce ? Soil health? Challenges in Agriculture development, Integrated Pest management, Organic farming
- Resource persons- Hon M P Goswami, Member ZP Raisen, Dr Girish Chander (Scientific officer- ICRISAT), , Mr Prasad Kamdi & Satish Gahukar (ICRISAT), Mr Mahesh Thakur (Agriculture dept), Mr Akhilesh Singh Yadav
- Experience sharing by farmers while using IV, BN and fallow management trials, delebrations on best practices and learnings, Information sharing by resource persons on agri techniques, Question answer session, Field visit of demonstration plot.

Vegetable Cultivation

- Kitchen garden with 40 HH in Kharif season, average earning from kitchen garden about Rs 2400 over and above HH consumption.
- Commercial vegetable cultivation was done in 5 ha land with 10 farmers. Onion, Brinjal, Tomato done by farmers with Zinc and Agribor application. Better growth and average profit per farmer comes to Rs. 22000.
- 20 farmers are involved in the Rabi/ Summer vegetable cultivation in about 4 ha land. Onion Potato and other seasonal vegetable were grown in Rabi season.
- The onion yield with micronutrient application increased by 30% in the residual ptot.
-

Cattle health

Animal vaccination camps - HSBQ	10 villages	239 cattles	Vaccination done with help of veterinary department through special camps.
Animal vaccination camp-FMD	10 villages	351 cattles	Before camps all villagers were informed in advance to participate.
Artificial insemination	5 villages	42 cattles	The AI done with help of JK Trust & Veterinary dept.. Linkages developed through their participation in farmers day.

Linkages with departments

- Sprinkler Systems 04 farmers (50% cost bear by the farmer)
- Spray pump 10 farmers, Pheromone trap 10 sets
- 35 farmers of Sagar booked 35 Q Soybean seeds at KVK (JS 9560, JS 335)

Fodder development

- Fodder development by 10 farmers in 4 ha area. Sorghum chari and Barseem seeds was provided on need.

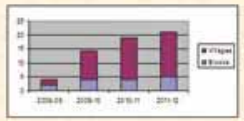
Gliricidia Plants

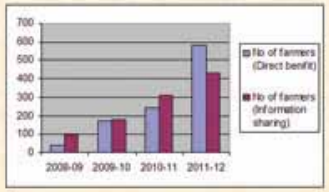
- 2900 saplings planted

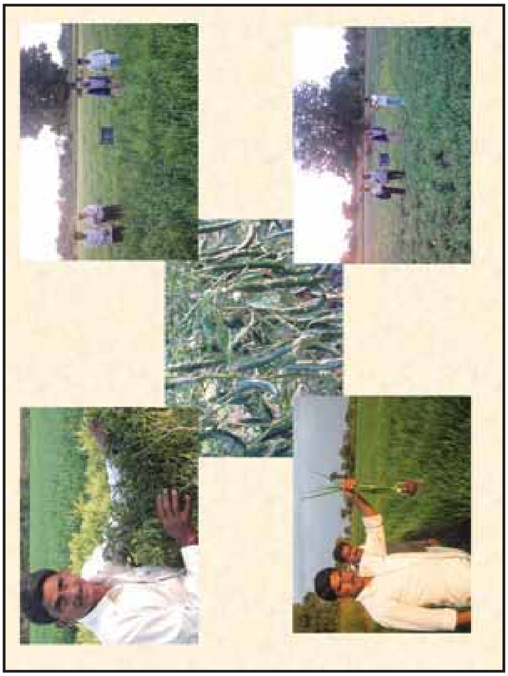
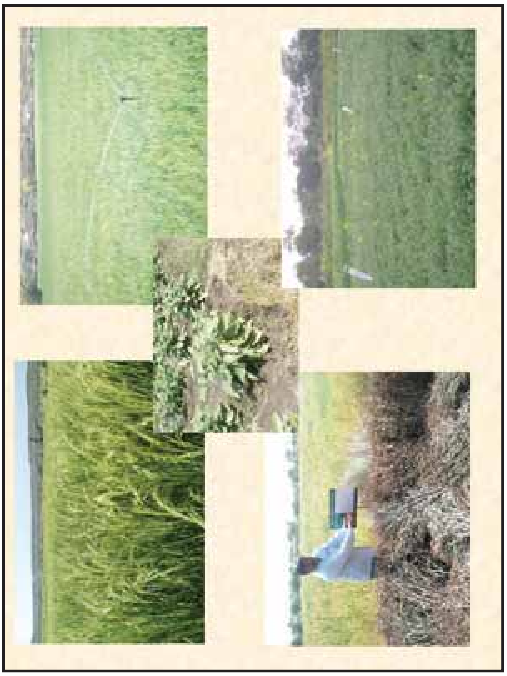
Women Empowerment

- 8 Self help group organised in the villages
- Total saving Rs. 0.85 lakh
- 100 women are associated with groups
- 3 SHGs involved in Mid day meal schemes
- 32 women from 3 SHG are doing backyard poultry, this year they got Rs 750.00 each for cage to protect chicks by Veterinary department
- 2 days Training to SHG women on their role in development and SHG management
- Involvement of women in Kitchen garden activity
- Training of women and Adolescent girls on Biodiversity

Coverage of TATA ICRISAT project in Sagar & Raisen district





Challanges

This year spate of unforeseen climatic turbulences posed grave challenges to project intervention, prominent are-

- **Performance of monsoon was very unfavorable – Some times insufficient some times more than expectations. Also its distribution across monsoon period was very skewed. This year due to water logging Soybean and Pigeonpea crops affected negatively.**
- **Since last two years elongated cold wave caused frost bite in chickpea crops, which negatively affected yield.**

Looking ahead…

- Information dissemination to larger community
- Vermi compost/ Gliricidia promotion
- Wateruse efficiency –for fallow management intensively in 5 villages
- Strengthening of community based institutions
- Training of farmer groups in non project villages for technology dissemination
- Institutional building
- Cattle Breed improvement
- Capacity building of Women Farmers

ICRISAT
Science with a human face

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

Implementing Agency

Centre For Advanced Research And Development (CARD) - Shajapur

Project at a Glance

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

Annual Budget of Project (2011-12)

First Installment	- 1,07,225/=
Second Installment	- 1,07,225/=
Total Annual Budget	- **2,14,450/=**

- Implementation Team Structure
- **Dr. Yaseen Khan** — **Associate fallow**
- **Mr Amol Gawande** — **Project Coordinator**
- **Mr Nirajan Gour** — **Research Assistant**

Objectives

1. Enhancing the levels of Agricultural Production and Productivity by implementation of various trials of Agricultural Practices among farmers.
2. Introduction of Efficient Irrigation Management for Enhancing water use efficiency in the region.
3. Popularisation of Organic Farming to Improve soil health and its Fertility in the Area.
4. Dissemination of New Agricultural Technologies with Practical Intervention in the Region.
5. Improve the Technological Awareness of farmers through their capacity Building and trainings.

4

PROJECT LOCATION

Details of Sample Villages

Block wise Distribution of Sample Villages

SN	Name of Blocks	No. of Sample Villages		
		2009-10	2010-11	2011-12
1	Agar	1	2	4
2	Susner	1	2	2
3	Barod	1	3	3
4	Nalkheda	0	2	3
	Total	**3**	**9**	**12**

Details of Blockwise Sample Villages Year 2009-12

PROJECT AREA

Selection Criteria for Beneficiary Farmers:

- Progressive Farmers which having irrigation facility.
- Farmers with willingness towards adaption / trials of improved Agricultural practices.
- Farmers with recognition among community members.

Details of Physical & Financial Coverage
Year 2011-12

SN	Particular	Quantum
1	No. of District.	1
2	No. of Blocks	4
3	No. of Villages	12
4	No Family Covered for Program	365
5	Area covered in Tails + Forage + Vegetables+ Improved Agriculture (Hactors)	110
6	Sanction Amount for Year 2011-12 (Rs)	2,14,450

Proposed Project Activities of Year 2011-2012

S.N.	Project Activities	Unit	Target	Achievement	Present Status	Reason of Variance
1	Productivity Enhancement Trials	No.	579	514	- 65	Due to low interest of farmers to conducted trails
2	Construction of Vermi composting Pits	No.	0	8	+ 8	Complete Last Year backlog
3	Forage Production	Ha	25	0	- 25	Due to small land holding and lack of irrigation facility.
4	Vegetable Production	Ha.	25	25	Completed	
6	Gliricidia Plants	No.	4000	1500	- 2500	Sapling losses in nursery stage
7	Animal health Camp	No	1	1	Completed	
8	Farmers Day	No	2	2	Completed	
9	Low cost Drip	No	3	5	+ 2	Completed
9	Sprinkler Set	No	1	1	Completed	
10	Training	No	2	2	Completed	

Details of Village Wise Trials Conducted in Kharif Season (2011)

S N.	District	Block	Sample Village	No of Nucleus Trials	No of Satellite Trials	No of Scale up Trials	No of total Trials
1	Shajapur	Agar	Mahudiya	3	12	23	38
2		(98)	Moyakheda	1	3	16	20
3			Raipuriya	1	3	19	23
			Salari	3	11	3	17
4		Barod	Barkheda	4	12	8	24
5		(52)	Ralayati	0	3	17	20
6			Barda	0	0	8	8
7		Susaner	Khanota	1	14	8	23
8		(40)	Chapriya	1	10	6	17
9		Nalkheda	Lasudiyagopal	1	3	8	12
10		(22)	Payli	0	1	9	10

Details of Crop wise Trials Target Achievement of Kharif Season (2011)

S. N.	Trail Type	Crops	Target	Achievement	Remark
1	Nucleus	Soybean	15	15	
2	Satellite	Soybean	60	60	
		Groundnut	3	3	
		Maize	3	3	
		Black Gram	3	3	
		Green Gram	3	3	
		Pigeon Pea	3	0	Due to damage of seed
3	Follow Nucleus	Soybean	15	0	Non Ava. raining fallow
4	Follow Satellite	Soybean	25	0	Non Ava. raining fallow
5	Water Use Efficiency	Soybean	25	25	
6	Residual Nucleus	Soybean	15	15	
7	Residual Satellite	Soybean	25	25	
8	Scale up Trials	Soybean	125	125	
	Total		**320**	**277**	**86.75%**

Details of Village wise Trials Conducted in Rabi Season (2011-12)

S N.	District	Block	Sample Village	No of Nucleus Trials	No of Satellite Trials	No of Scale up Trials	No of total Trials
1	Shajapur	Agar	Mahudiya	0	10	16	26
2		(57)	Moyakheda	0	2	3	5
3			Raipuriya	1	1	7	9
			Salari	3	8	6	17
4		Barod	Barkheda	4	7	10	21
5		(42)	Ralayati	0	5	11	16
6			Barda	0	0	5	5
7		Susaner	Khanota	2	8	0	10
8		(34)	Chapriya	1	10	13	24
9		Nalkheda	Lasudiya gopal	4	0	7	11
10		(20)	Baigaon	0	2	4	6
11			Payli	0	0	3	3

Details of Crop wise Trials Target Achievement of Rabi Season (2011-12)

S. N.	Trail Type	Crops	No. of Trials Target	Target Achieved	Status
1	Nucleus	Chickpea	7	3	Less Cropped Area
	"	Wheat	8	12	Increasing Area
2	Satellite	Chickpea	50	13	Less Cropped Area
	"	Wheat	25	40	
3	Follow Nucleus	Chickpea	15	3	
4	Follow Satellite	Chickpea	25	13	
5	Water Utilisation Efficiency	Chickpea	15	13	
	" " "	Wheat	10	20	
6	Scale up Trials	Chickpea	75	13	
	" "	Wheat	50	72	
7	Residual Nucleus (Since Kharif(2010)	Chickpea	5	5	
	" " "	Wheat	5	5	
8	Residual Nucleus (Since Rabi 2010-11)	Wheat	10	10	
9	Residual Nucleus (Since Kharif 2011)	Wheat	10	10	
10	Residual WUE (Since Kharif 2011)	Chickpea	10	5	
	Total		**320**	**237**	**74.06%**

Productivity Enhancement Trials in Soybean

- No of Participate Families - 84
- Average Area Trial Area - 0.20 Ha.
- Total Trial Area - 16.80 Ha
- Practices:
  - Seed treatment with fungicide.
  - Introduction of early verity JS- 9560
  - Application of Vermicompost / FYM
  - Application of Zn Sulphate and Boron
  - Timely weeding.
  - Control plots without Zinc & Boron

Analysis of Soybean (JS-9560) Yield and Productivity with Zn and Boron Application

S N	Name of Farmer	Area (Ha)	Zn sulphate (Kg)	Bo (Kg)	Yield (Kg)	Productivity (Kg / Ha)
1	Ratan Singh Sisodiya	0.20	5	1.5	494	2470
2	Sardar Singh	0.20	5	1	475	2375
3	Nain Singh Thakur	0.20	5	1	460	2300
4	Shanti Lal Jain	0.20	5	2	495	2475
	Average	0.20	5	1.34	481	2405

Productivity Enhancement Trials in Wheat HI-1500

Trial I – Farmer Input

- No of Participate Farmer - 51
- Average Area Trial Area - 0.20 Ha.
- Total Trial Area - 10.20 Ha
- Level of Productivity - 2700 kg / hact
- Practices:
  - Application of FYM 1500 kg / hact
  - Use of DAP 250 kg / hact
  - Application of Urea 100 kg / hact
  - Zinc Sulphate 25kg /hact
  - Agribore 2.5 kg/ hact

Productivity Enhancement Trials in Wheat HI-1500

Trial II – Farmer Input + Micronutrients

- No of Participate Farmer - 50
- Average Area Trial Area - 0.20 Ha.
- Total Trial Area - 10.00 Ha
- Level of Productivity - 3500 kg / hact
- Practices
  - Application of FYM - 1500 kg / hact
  - Use of DAP - 150 kg / hact
  - Application of Zinc Sulphate - 25 kg / hact
  - Broadcasting and Spraying of Agribore - 2.5 kg / hact

Productivity Enhancement Trials in Chickpea

Participation:

- No of Farmers Participated - 41
- Average Area of Trial - 0.20 Ha.
- Total Area of Trial - 8.20 Ha.

Nature of Interventions:

- Use of improved varieties JG-130.
- Application of Zinc and Boron
- Attention towards Timely Sowing.
- Seed treatment with Rhizobium & Sodium Molibdate.
- Proper Control of Insect & Pest

Details Productivity Analysis of Chickpea JG- 130

Sl. No	Treatments	No of farmers	Area sown (Ha)	Yield kg/ ha	% of Increase
1	Farmers input	42	8.40	1450	-
2	Farmers input + Micronutrients	41	8.20	1800	19.44%

Efficient Irrigation Water Management
Drip Irrigation.

- Drip system is Installed in 5 Farmers fields.
- Average Irrigated Area 1 Ha.
- Farmers Contributed 25% of total cost.
- One Farmer use Drip irrigation for Papaya Plants.
- Two Farmer use Drip irrigation for Orange Orchard.

Efficient Irrigation Water Management
Drip Irrigation

Photographs

Efficient Irrigation Water Management
Sprinkler System

- Sprinkler System Demonstrated in one Famers Field.
- Three Sprinklers and six pipes of 36 meters length.
- Irrigated Area 2 hact.
- Farmers contributed 25% of total cost.
- Introduction of Sprinkler Irrigation in Wheat crop.

Mr Nathu Lal of Salari village

Vermicompost

- Total 8 Pits are constructed by 7 farmers.
- Trainings conducted for transferring production technology.
- 10 Pits are in production phase.
- Vermicompost harvested from 6 Pits.
- Average yield is 400 Kg to 500 Kg per Pit.
- Vermicompost Stored for Vegetables and fruits crops.

Levels of Technology Dissemination during Year 2011-12

- Total 365 farmers from 12 villages are included during this Year.
- Different Technical trainings arranged for farmers of all the 12 sample villages.
- Agricultural Productivity Enhancement Trails are adopted by large numbers of Farmers.
- Micronutrients are popular among the farmers.
- Farmers are participating in all trials particularly micronutrient trials.
- Seed Demand of Soybean JS – 9560 is highly increased due to short duration variety.

Impacts of Technology

- Increasing in the production as well as productivity in following crops with comparisons of farmers practices.
  - Soyabean 15.25 % increased
  - Wheat 22.85 % increased
  - Gram 19.44 % increased
- Improvement in water use efficiency.
- Quality of production improved.
- Use of Organic manure increased.
- Reduction in Animal Dieses observe.
- Awareness of technology among the farmers with special reference micronutrient.
- Improvement in soil fertility and soil health.

Agricultural Development Activities Under other projects in the area

A. Agriculture Technology Management Agency (ATMA)

- Arranging Farmers Field Schools.
- Demonstration on IPM and INM
- Allied Demonstration on Vegetable Production.
- Exposure visits of Achiever Farmers within district and out side district.
- Training of farmers on Soyabean production, Organic Farming in KVK Shajapur.
- Capacity Building of Common Interest Group(CIG's)
- Arranging Farmers Scientist Interaction under the Kisan Gosty Program.

Agricultural Development Activities Under other projects in the area

B. Suzlon Project

- Introduction of Soil and Water Conservation Activities in Villages
- Pasture Land Development
- Plantation of Jatropha, Neem, Khamer, Caciasima, Karanj, Sisam, Akaua etc.
- Construction of Vermi composting Pits
- Organising Farmers Training Programs .
- Conducting Training on Agriculture Water Management.
- Development of Linkage with line Departments

Agricultural Development Activities Under other projects in the area

C. DST Project

- Introduction of Agro Based Occupations among SC Farmers.
- Introduction of Agarbatti Rolling technology among SC Women
- Livestock Based Occupations for poor Farmers.
- Construction of Vermi compost Pits.
- Implementation of Kitchen Garden.
- Introduction of Micro Irrigation System.
- Distribution of Horticulture Plants.
- Exposure Visits of Farmers

Farmers Perceptions

- Productivity as well as quality of crops improved by introduction of micro nutrients.
- Pest resistance power enhanced by the use of micro nutrients.
- Crops productivity increases about 20 percent due to introduction of micro nutrients.
- Size and quality of Anion improve by use of Vermicompost.
- Vermicompost increase water retention capacity of soil.
- Drip irrigation increase length of water availability for rabi crops.
- Drip irrigation reduce the crop water requirement in a particular crops.
- Yield and quality of vegetable improve due to Zn & Boron application.
- Glyricidia is good for soil fertility but farmers did not pay require attention towards it.
- Trainings, farmers camps and exposure visits are helpful in improving the levels of farmers awareness.
- Animal camps gave opportunity to farmers to learn animal health care practices.

Learning from Project

- Farmers are willing to Adopt new Agriculture Technology for improvement of Agricultural Production.
- In the Absence of Agricultural Technology Awareness Farmers are not getting proper benefit of Agriculture.
- Introduction of Subsidy some time harmful for Adoption Rate of new Agriculture Technologies.
- Availability of Quality Seeds on higher Price rate which reduce the seed replacement rate.
- Crises of Irrigation Water become lacuna for Agricultural Development in the Region.
- Excess use of Fertilizer and Pesticides are harmful for Agricultural Production and Soil health.
- Decreasing of Farmers Dependency on Agriculture due to reduction in Land Holding Size and high cost of Production.

Glimpses of Project Activities

Glimpses of Project Activities

Glimpses of Farmers Day

Thank You

SDTT PROJECT

Improving Rural Livelihoods and Minimizing Land Degradation Through The Community watershed Approach for Sustainable Development For Dry land areas

DEEP DEVELOPMENT RESEARCH FOUNDATION INSTITUTE AND TEAM

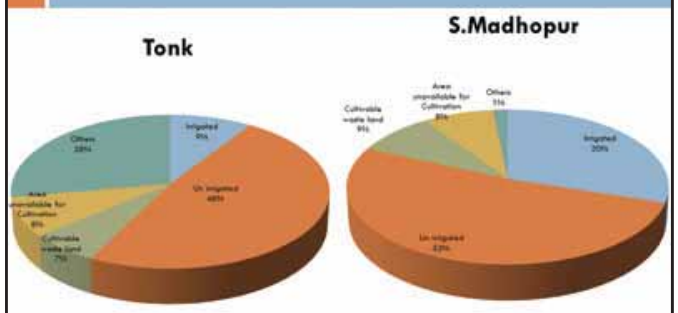
OBJECTIVES

- **Community watershed approach at nucleus benchmark watersheds for enhancing productivity and reducing land degradation in two districts and to use these sites as centers of learning for scaling-out the benefits across the two districts.**
- **To scale-out the benefits of productivity enhancement and community watershed management with technical backstopping in the target agro-eco-region of 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 through establishment of a National Support Group for community watershed development.**

Bio physical characteristics of the watershed village

District	No. of Village	HH	Land use pattern (ha)					
			Irrigated	Un irrigated	Cultivable waste land	Area unavailable for Cultivation	Others	Total
(Tonk)	3	404	206	1086	145	186	623	2246
S.Madhopur	3	1517	1519	2634	444	400	83	5080
Total	6	1921	1725	3720	589	585	706	2371

Land Use Pattern of Tonk & S. Madhopur watershed village



Project Activities

- Identify the best bet technology for enhance the crop productivity
- Constraint identification
- Farmers' participatory evaluation & Selection of varieties
- Micronutrient amendment balanced nutrient mgmt trials
- Promotion of water saving technology
- Vermi composting
- Village level seed banks
- Capacity building
- Convergence of on going Government activities
- Breed improvement of small ruminant
- Soil water monitoring for develop the irrigation scheduling

No. of beneficiaries since 2008

Years	Tonk		S. Madhpour		
	Kharif	Rabi	Kharif	Rabi	Total
2008	25	25	25	25	100
2009	81	35	40	34	191
2010	81	35	40	34	191
2011	136	362	105	357	960

Effect of INM & BNM on Kharif crop yield in Both district

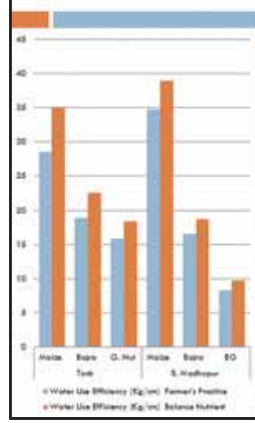
District	Crops	FP yield (qt/ha)	BN yield (qt/ha)	VC+ 50% BN yield (qt/ha)	% increase over FP BN & INM
Tonk	G. Nut	13.44	15.28	16.64	13.7 (23.81)
	Bajra	17.17	20.55	22.81	19.68 (32.84)
	Maize	24.09	27.58	30.58	14.49 (24.94)
	BG	6.95	7.89	9.91	13.53(42.58)
S. Madhopur	Bajra	13.40	14.67	16.06	9.48 (19.85)
	Maize	23.28	27.03	29.97	16.10 (28.74)
	BG	5.87	6.82	7.53	16.18 (28.27)


Farmer's practice


VC+ 50% BNM

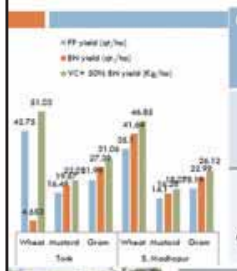

100 % Balance Nutrient

Effect of micro nutrient on Crop WUE in Kharif



District	Crops	Grain yield (qt/ha)		Water Use Efficiency (Kg/cm)	
		Farmer's Practice	Balance Nutrient	Farmer's Practice	Balance Nutrient
Tonk	Maize	21.87	26.75	28.6	35.01
	Bajra	14.427	17.26	18.9	22.6
	G. Nut	12.09	14.07	15.8	18.4
S. Madhopur	Maize	26.59	29.78	34.8	39.0
	Bajra	12.62	14.24	16.5	18.7
	BG	6.33	7.36	8.3	9.7

Effect of INM & BNM on Rabi crop yield in Both district



District	Crops	FP yield (qt/ha)	BN yield (qt/ha)	VC+ 50% BN yield (qt/ha)	% increase yield over FP, (BN & INM)
Tonk	Wheat	42.75	46.53	51.03	8.84 (19.4)
	Mustard	16.49	19.67	22.01	19.2 (33.4)
	Gram	21.99	27.39	31.07	24.6 (41.3)
S. Madhopur	Wheat	35.10	41.64	46.85	18.6 (33.5)
	Mustard	14.09	16.28	18.07	15.5 (28.2)
	Gram	18.19	22.99	26.12	26.4 (43.6)


Chick pea demo in Dharola (Tonk)


Mustard demo in S. Madhopur


Wheat demo in Dharola (Tonk)


Mustard demo in Dharola (Tonk)

Efficient irrigation management for enhance the water use efficiency in watershed area (Increase in irrigated area)

Farmers name	Initial irrigated area (bigha)	Present irrigated area (bigha)	Area increased by technology	Remarks
Nejanlal (Dharola)	5 bigha	7 bigha	2	Taking the good benefit in Summer season in fodder crops
Durga shankar ji	36 bigha	51 bigha	15	Farmer's using the Sprinkler, Drip and Rain gun in his crops
Ramdayal ji	8 bigha	13 bigha	5	
Laddulal ji (S.Madhopur)	6 bigha	8 bigha	2	
Badrilal ji (S.Madhopur)	10 bigha	14 bigha	4	Farmers using Summer season in fodder crops

Crop diversification

District	Village	Season	Before project	After project
Tonk & Sawai Madhopur	Dharola & Bairva ki Dhani Juwar	Kharif	Maize, Pearl Millet, Sesame, Groundnut, Black/Green Gram, Sorghum	Using the HYV of GN, Bajra, and increased the area of Maize crop
		Rabi	Mustard, Wheat Gram, Barley	Mustard, Wheat Gram, Barley, Cumin, Garlic, Onion
		Zaid	Lucerne crop for fodder	Sorghum, Vegetables (Onion, Okra, Chilly & Cucumbers, Bitter gourd and Pea

MICRO LEVEL ACTIVITIES WITH LAND LESS OR SMALL FARMERS

Vermi composting

Bread improvement of small ruminant animals thru revolving funds

Farmers Name	Goats in a hard	Male born	Female born	Total
Ramdayal ji		2	1	3
Ramlal		2	2	4
Mahavir		0	0	0
Mahadev		0	0	0
Total		4	3	7

Awareness & impact of green fodder

- Farmers has awarded about the green fodder in the area
- Providing the green fodder with dry fodder to his milking Animals and his Bullocks.
- Increased the milk quantity of animal approximately 2-3 lit. per day
- Farmers proving the greed fodder for Improving the health of his bullocks

Fodder demo in Dharola (Tonk)

Fodder production demo in Juwar (S. Madhopur)

Impact of micro nutrient on Vegetable and fruit plants

Farmer harvested the Chilly crops

Residual effect of Micro nutrient on Papaya

Pea harvest in Dharola

Residual effect of Micro nutrient on Aonla

- Hajarilal ji have been sold the green pea Rs 1700 in cash and got the 100 kg wheat grain by vegetables from 500 squire meter area
- Durga shankar also has sold the green pea Rs 1900 in market by cash and also got the 150 kg wheat grain by pea in kinds from 800 squire meter area
- First time fruit has been come on Aonla tree by using the micro nutrient after sixth years
- This season Eleven farmer has grown the commercial Onion cultivation with project support in the area.

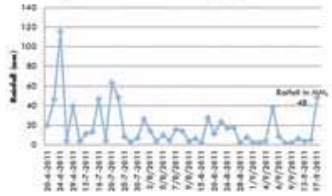
Meteorological information station and Rainfall in watershed village

Automatic weather station installed in Dharola village

Rain gauge in Dharola

Dharola Rain Gauge

Years	Rainy days	Rainfall collected
2011	43	763.16 mm



Challenges in the area

- Erratic rainfall is the major challenge in the area.
- Attack of Blue bull and wild animal
- Availability and uncertainty of good quality seed and micro nutrients
- Market linkage
- Undulated and sloppy land in the area
- Less aware about the proper use of ground water in irrigation
- Less education status
- Less aware about Government scheme

Target Achieved

S.No	Target	Unit/ Target	Achievement
1.	Productivity enhancement trial for two seasons (incentive on seed and fertilizer inputs @ 35% cost will be provided)	430 Trials 128 ha. X two season total 860 trials	70 ha area and 241 families have been covered under kharif season. 180 ha area and 619 families have been covered under Rabi season.
2.	Efficient irrigation management for enhancing water use efficiency	Revolving fund X 2 districts Operational expenses X 2 districts	One sprinkler distributed & 13 ha. Area covered under the Sprinkler irrigation.
3.	Diversification with high-value vegetables with micronutrient and land form/irrigation treatments	15 ha X 2 districts	15 ha. area & 54 families have been covered in two district

Cont.

4	Increasing forage production to cover seed + fertilizer cost subsidy for the farmers)	15 ha X 2 districts	15 ha. Area & 54 families covered in two district.
5.	Revolving fund for income generating activity	10 Nos	-
6.	Water Use Efficiency	53 Trials X 2 Total 106	100 Trials completed in two district.
7.	Human resource development activity for skill enhancement	25 Farmers per course X 2 Course X 2 District	2 Training course comleted
8.	Documentation, photography and videography		Completed
9.	Dissemination (Farmers' Day)	2 districts (2 in each district	One Farmers Day celebrated in Rabi District Tonk

Thank you

PROJECT LOCATIONS

Project –Headlines

- 1022 Farmers have joined in participatory Research, 1293 trial plots covered under participatory research trails.
- 5354 Families are associated under programme with covering 27 village of fives block of fives district of Rajasthan state .
- 850 A.I. have been done through Baif door step service in the project villages.
- Adoption of Gypsum is increased at locally.
- 1052 families have got information on various technologies through disseminations.
- Micro nutrients are using in horti. Crops also.

Project Component

- Participatory Research & Development
- Dissemination of Technologies
- Capacity Building
- Community development

S. N.	Activity	Unit	Trg.	Achi.	Variance	Reason of Variance
1	Trials	No.	1790	1293	28%	*
2	Water use efficiency trials	No.	50	61		
3	Forage Production	Ha	75	30	40%	Lack of willingness
4	Vegetable Production	Ha.	75	22	71%	*
5	Live stock Dev. Centre	No.	500	850	+70%	
6	IGA (small ruminants)	No	10	02	80%	
7	Dissemination through Farmers day	No	10	07		
8	Training	No	10	07		

District wise Progress

Activity	Alwar	Bundi	Bhilwara	Banswara	Jhalawar
Nucleus T.	-	07/15	-	15/15	15/15
Satellite	-	60/75	-	75/75	75/75
Scale up	227/250	151/250	68/250	185/250	130/250
W.U.E. T.	-	50/50	11/25	-	-
SHG	-	02	-	-	-
A.I.	na/350	na/200	na/100	0/100	na/300

Activity Frame- PRD

Concerning objective	Physical status
To scale-out the benefits of productivity enhancement	Total participatory trials -1293 Total covered area -158 ha. Nucleus & satellite trials -532 Scale up &other trials -761
Output 1022 families got benefits of productivity enhancement due to application of micronutrients. 158 ha. area treated by basal application of micronutrients.	**Out come** Due to treatment of micro nutrients 1022 farmers will get incremental production up to next two years. As per yield observation 2 to 7 qt. production is increased in the first year and 1.5 to 3.0 in residual years.

Detail of treatments:

T-1	Basal dose of nutrients with 100% recommended quantity based on soil testing+ Foliar spray of Neem oil
T-2	Basal dose of 50% FYM or vermi compost + 50% quantity of balance nutrients
T-3	Farmer practices

Lay out:

R1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
T2	T1	T3	T2	T1	T3	T2	T1	T3	T2	T1	T3	T2	T1	T3
T1	T3	T2	T1	T3	T2	T1	T3	T2	T1	T3	T2	T1	T3	T2
T3	T2	T1	T3	T2	T1	T3	T2	T1	T3	T2	T1	T3	T2	T1

Observations

- Date of Sowing
- No. of nodules
- Plant height at 60 days(cm)
- No. of Pods
- Biomass yield
- Grain yield

Detail of Dose

FYM	250 KG PER HECT.
V.C.	125
DAP	65 kg
UREA	nil
ZN	50
GYP.	200
AGRIBOR	2.5

Major Findings

INDICATOR	T-1	T-2	T-3
Pods per plant	54	69	50
Grain yield per ha. (KG)	1900	2230	1720

Conclusion

- Treatment- 2 is observed as a best with observation of 17% higher yield as compare to T-1 and 29.65% as compare to control plot.

Residual effect

Name	Crop	year	Addi. yield	Addi. Inputs per plot Value in Rs.	Value of production per plot
Jliya	Maize	2010	2.6-1.9=0.7	394	700
	Gram	2010	1.1-0.75=0.65	-	1300
	Maize	2011	2.20-1.90=0.30	-	300
	Wheat	2011	6-5=1.0	-	1300
Per plot Inputs/Production				394	3600

Visuals

Increasing Consumption

Source	Zinc	Gypsum	Agri.B.
Gupta traders J.	10 qt.	8qt.	
Jain T. JHA.	5qt.	-	
Hariyali	5qt.		
Societies, department	7 qt.	700 qt.	-
Lucky bundi	60qt	500qt.	
Societies, department,Banswara	4 qt.	400 qt.	
Societies,Alwar	5 qt	500 qt.	
Total	104 qt.	2100 qt.	

Activity frame HRD & Dissemation

Concerning objective	Physical status
Capacity building of lead farmers, development workers and SHG for other village level organization.	**No. of training – 7** **No. of farmers – 7**
Output Total 1052 participants got information on advance technologies like improved agriculture , live stock & watershed management practices and schemes. Participants knew about required fertilizer dose for existing crop during group exercise. Farmers realized impact of treatment after comparison between treatment during group exercise on farmers day .	**Out come** Farmers are demanding short duration varieties. Consumption of Gypsum is Increasing as known by experience sharing during farmers day. Farmers are being aware about various government schemes, banded pesticides and other issues.

Activity frame – Community Development

Concerning objective	Physical status
Improving Rural lively hood through community approach	**No. of SHG - 2** **AI -850**
Output Total Rs. 50000 is deposited against taken loan by SHG in hindoli block of Bundi district . Groups have also taken assistance of Rs. 50000 revolving funds of project . One group has been got bank linkage . Total 425 animals have conceived against the 850 AI.	**Out come** Some SHG member have taken Loan to complete education for their collegian sons . All group members are getting agri inputs timely duo to collective management through revolving fund . At least 340 progenies will get against the successful inseminations.

Good practices

- Inter cropping
- New varieties- Js 9305, DBW
- Application of boron in vegetables.
- Comprehensive cropping scheme

Gaps/ Constraints

- Limited availability of micro nutrients
- Subsidies other government schemes
- Limited manpower at the time of data collection
- Lack of research attitude

iznsˆk

THANKS

Model Watershed Project Review and Planning Meeting

Sustainable intensification of Rain-Fed Agriculture Thru Natural Resource Management

23-25 May 2012

CF Bentley Conference Centre (212 Bldg)
ICRISAT, Patancheru,India

Sustainable intensification of Rain-Fed Agriculture Thru Natural Resource Management
AGASANAHALLA MODEL WATERSHED PROJECT

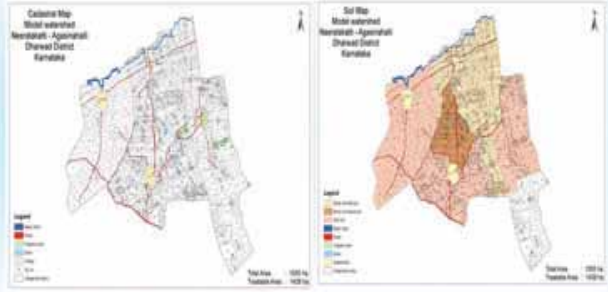
Mr: Mahantesh Agasimundin
Managing Director ,Bijapur Integrated Rural Development Society ® (BIRDS)
HUNGUND-587 118 Dist: Bagalkot

PROFILE OF THE MODEL WATERSHED

Particulars	Remarks
Project Name	Agisanahalla Model Watershed Project
Donor	ICRISAT Hyderabad (Govt of India)
Implementing Agency	Bijapur Integrated Rural Development Society®(BIRDS)
Project Area	Agasanahalla Tq/Dist:DHARWAD
Duration	FIVE YEARS
Project Area (In ha)	1555
Project Covered Villages	04
Soil Depth	6 to 9 inches
Type of Soil	Black, Red , Brown.
Major Crops	Maize,Chickpea, Soybean & Groundnut

Agasanahalla Model Watershed

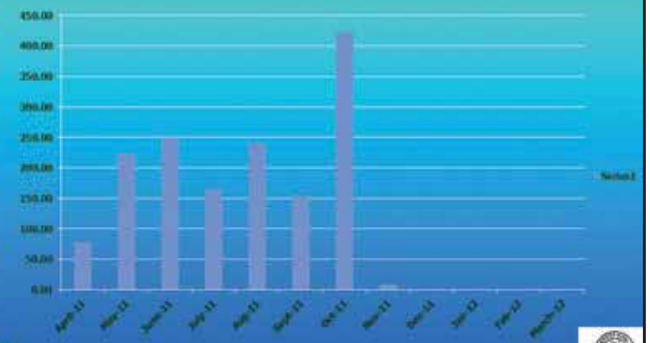
Cadastral & Soil Map



Progress report-2011-2012

Activity	Phy	Fin	Contribution collected from Farmer
Vermi compost	03 No	9000-00	0-00
Borewell Recharge pits	17 No	170000-00	30000-00
Form ponds	12 No	354098-00	70820-00
Agro Forestry	0.5 He	4997-00	3440-00
Horticulture	15 He	113610-00	37307-00
Revolving Fund to initiate SHG activities	18 No	180000-00	0-00
Ph D Student Plots (Research)	10.20 He	170580-00	0-00
Total (Rs.)		**992285-00**	**141567-00**

Daily rainfall 2011



Improved seeds and micro nutrients were provided by ICRISAT (2011-2012)

Inputs		Quantity provided (kg)
Improved seeds		
Maize	Kaveri,	600
	Prabhat	405
	Bioseed	365
	Hytech	100
Sorghum (M-35)		84
Soybean, JS-335		1860
Pigeon pea	ICPL-87119 (Asha), ICPL-85063	100
Chickpea	JG-11, ICGV-37	*400*
Glirisidia Seeds Distributed		*1*
Micro and secondary nutrients		
Agribor		50
Zinc sulphate (Through RSK)		500
Gypsum (Through RSK)		2500

Percent increased yield in crop over farmer's practice

Crop	Yield in farmer's practice (Q ha-1)	Yield in improved practice (micronutrient)	Per cent increase
Maize	43.5	48.8	10.9
chickpea	11.5	13.2	12.8
soybean	19.8	24.5	19.0
groundnut	13.5	16.4	17.8

Micronutrient applied: Agribor, Gypsum, ZnSO4

Farmers participated in demonstration trial: Kharif 103; Rabi 70

Details of Self Help Group

- 20 SHG's formed (19 Women & 1 Men)
- Total Members :292 (Female:275+Male:17)
- Total savings :Rs:4,74,630-00
- Revolving fund Distributed:RS:1,80,000/-
- Bank linkages: 11 S.H.G's (Banks & NABARD)
- Total loan from:1) Bank Rs :10,30,000/-
  2) Nabard Rs:4,80,000/-
  Total Rs:**15,10,000**/-

Training and Capacity Building

- 180 Members from 20 SHG Trained Income generating & Entrepreneur Development(EDP).
- 325 Farmers from 30 User group's(UG) trained on Model Watershed about Micronutrient.
- Exposure tour programme organized for IFS Programme to Near BAIF Surashettikoppa
- 340 Farmers Visited Krishi Mela Dharwad

Achievement/ IMPACT

- Due to application of NPK fertilizer alone yield level will not increased; as per the recommendation of ICRISAT and model watershed about Micronutrient application yield was increased to an extent of 10-15%.
- Construction of farm pond and recharge pit there will be better conservation of water during off season by adopting this there will be increase in yield up to 3-5 % compare to farmer's practice.
- Mango Plantation Developed in 65 He land. Under MNRGEA.
- Bhoochetana Programme and other govt. programs implanted in Model watershed area.
- Ground Water level increased 1.5 to 2.5 Mtr due to water harvesting structures

Other Government Activities taken up in model watershed

In Model watershed area under MGNAREGA we are planting horticulture crop in an area of 65 hectares and forest species in an area of 49 hectares and also taken up IFS activities in collaboration with UAS, Dharwad and Karnataka state government in model watershed area.

High Yield with less expenditure

- Agasinhalla is small village in dharwad District and also Dharwad Taluk. Here is small farmer named channbasappa Ambanna having 1hectore of land in this area he is growing maize every year even applying high dose of NPK fertilizer hardly getting 45 quintals yield ha^{-1} after getting seed and advice as per the recommendation by ICRISAT and model watershed for fertilizer (NPK) as well as micronutrient application he is getting yield of about 53 (>15%) quintals from the same field compare to last year

Achievement of Men belonging to poor family

Jai Hanuman Men Model Watershed SHG (17 member) of Neeralkatti has been started last 3 years Back with a saving of weekly 10Rs each and they started income generating activities like bamboo basket and broomsticks with assistance ICRISAT revolving fund of Rs. 10000 and 1.2 lakh from Indian overseas bank (Garag) before initiation of this activity they were earning Rs:1000-1500 per member per month know they were earning more than Rs:3000 member/month from this activities (leisure time activity)

We are finding our livelihood from this activity and getting benefit out of SHG.

Watershed activities

- Australian scientists visited to our model watershed area and discuss with SHG member

ACTIVITY PHOTOS

Action plan -2012-2013

Activity	Target	Fin
Vermi compost	05	15000-00
Borewell Recharged pits	10	100000-00
Form pond	5	125000-00
Agro Forestry	5 Ha	50000-00
Horticulture	5 Ha	50000-00
Chaff cutter through revolving fund for	10	15000-00
Animal Health camp	4	20000-00
Vegetable (micronutrient application)	10 Farmers	50000-00
Total (Rs.)		**425000-00**

Learnings

- Villages farmers are adopting improved practices seen in our model watershed
- IWMP watershed farmers visited and discussed with farmers of MWS
- Farmers participation in watershed activities increased (outlet of farm pond by farmers money)
- Gram panchayat is actively is involved in watershed activities
- MGNREGA convergence for horticulture and afforestation activities
- Bhoochetana program taken up in big way in watershed
- Farmers get guidance from university scientists and students research.


Thank you

ICRISAT

International Crop Research Institute for Semi-Arid Tropics, Hyderabad

In Collaboration with

JalaSRI

Watershed Surveillance and Research Institute, Jalgaon

Padmalaya Model Watershed Development Programme Pathri-Samner, Jalgaon District, Maharashtra

Dr.Gauri Rane

ICRISAT & JalaSRI Team

Funded by: Ministry of Agriculture- GOI

Partners:

- ICRISAT- International Crops Research Institute for Semi Arid Tropics, Hyderabad
- JalaSRI, Watershed Surveillance and Research Institute, Jalgaon
- Jalgaon District Agriculture Department

Duration: 2008-2013

JalaSRI

Watershed Surveillance and Research Institute, Jalgaon, India

A multidisciplinary Research Institute

Sponsored By

Khandesh College Education, Society's

MOOLJI JAITHA COLLEGE, JALGAON

[NAAC Accredited "A" Grade, UGC Honoured "College with Potential for Excellence" and ISO 9001:2008 Certified]

A District level Research Initiative for Digital Governance and Hotspot Geoinformatics

Team

ICRISAT	JalaSRI
• Suhas P. Wani	• Gauri Rane
• P. Pathak	• Chetan Mahajan
• Sudi Rao	• Hemant Koli
• ICRISAT Team	• JalaSRI Team

&

Padmalaya Model Watershed Committee

Objective

The main objectives of this project is to improve the food security and livelihood opportunities for rural people in rainfed area of Pathri-Samner through integrated watershed approach

Padmalaya Model Watershed

Watershed area: 982 ha

Population: (Total - 6477)

Pathri : Female : 1266 Male: 1302 **Total : 2568**
(SC : 200, ST : 144, Other : 2224)

Samner : Female : 1911 Male: 1998 **Total : 3909**
(SC : 110, ST : 325, NT: 25, Other: 3449)

Total Farmers:

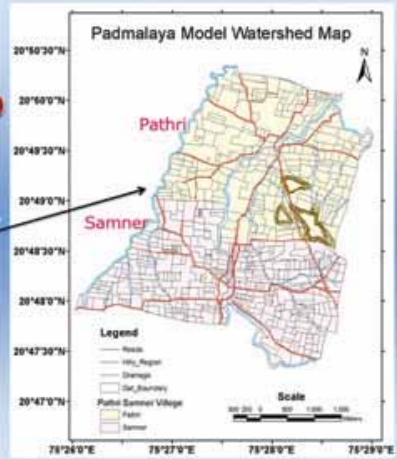
1.Pathri : 623

2.Samner : 641

Soil depth : 15-150cm

Soils : Black loam

Location Map



Work Done

2009 - 2010


ICRISAT
Inauguration and Address by ZP President
Automatic Weather Station
Base-line Survey with ICRISAT Scientist
Hydrological Monitoring Station


ICRISAT
Soil Sample Collection: Stratified Sampling
Use of Tropicultor for Better Crop Establishment
Seed and Fertilizer Distribution for Participatory PE Trials
Exposure Visit of Watershed Committee to ICRISAT


ICRISAT
Women Self Help Group Formation
Training for Biogas by ARTI - Appropriate Rural Technology Institute, Pune
Monitoring Groundwater in Selected Wells
Discussion With Govt. Officials


Work Done
2010 - 2011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Topographical Survey using Total Station
Farm pond
KT weir Repairing, Pathri
BEFORE
AFTER
BEFORE
AFTER
Storage Tank, Samner


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Tropicultor use for Broad Bed and Furrow (BBF) Practices
Gliricidia Nursery Development
Plantation
Students Involvement through NSS


Work Done
2011 - 2012


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Soil and Water Conservation
New Check Dams


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Soil and Water Conservation
Diversion Canal


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Soil and Water Conservation
Percolation Tank
Canal with Water
Canal
Diversion Canal
Farm pond
N


ICRISAT
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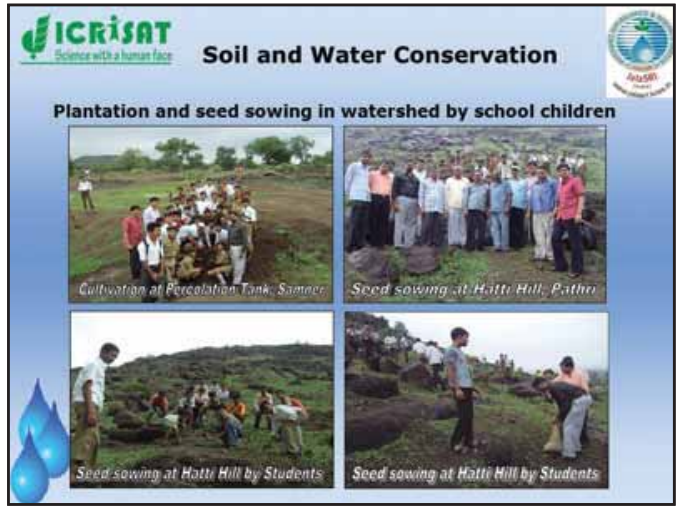
Soil and Water Conservation
Sunken Pits
Repairing of Check Dam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Soil and Water Conservation
Plantation and seed sowing in watershed by school children
Cultivation at Percolation Tank, Samaor
Seed sowing at Hatti Hill, Pathri
Seed sowing at Hatti Hill by Students
Seed sowing at Hatti Hill by Students

Soil and Water Conservation

Construction work done in Watershed

Name of Work	Nos.
Check Dam	02
K.T. Weir repairing	01
Renovation of Check dam	02
Diversion canal	01
Farm pond	06
Sunken Pit	08

Convergence

Diversion of Water from Bahula Dam Reservoir

Approval of New Big K.T. Weir in Watershed

Visit of Dr. William Dar

Environmental Awareness

Films & Poster Presentation on "Environment Day"

Data Collection

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Installation New Automatic Weather Station

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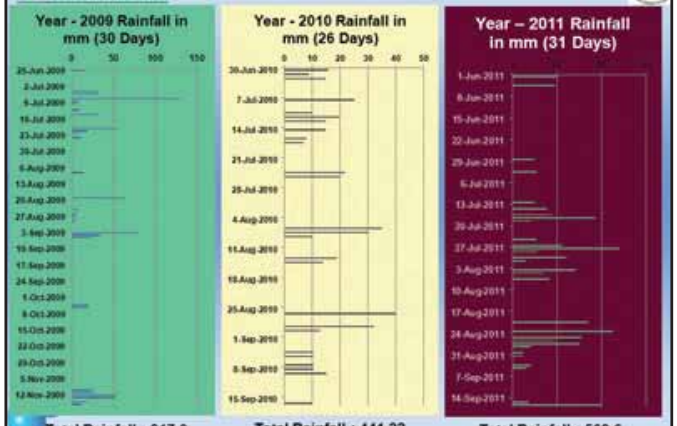
Rainfall Data



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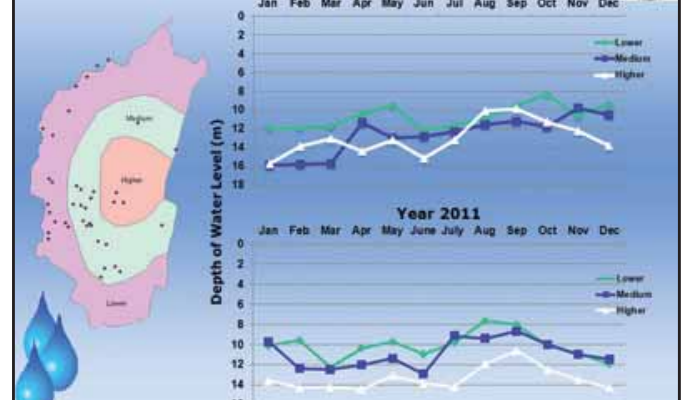
Ground Water Monitoring



Yield Analysis

Crops	Grain / pod yield (t/ha)		
	Farmers Practice	Improved variety	Percentage
Maize	4.40	5.88	37
Sorghum	2.02	3.37	40
Soybean	1.89	2.25	19
Pearl millet	1.4	1.8	29

Values in parentheses are the % increase over Farmers practice

Research

Mr. Rajendra Sishodia (Ph.D. Student, South Dakota State University, University of Florida)

Dr. Sanjay Shukla, (Guide, Associate Professor, Water Resources, Agricultural and Biological Engineering, SW Florida)

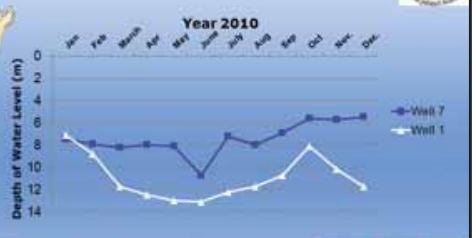
- **7 Wells and 2 Tube wells are monitoring daily**

Trial plot of Spices seeds

Distinguished Visitors

Success Stories

KT weir Repairing, Pathri



- Many wells recharged although there is less amount of rainfall in both the villages
- Additional 20,000 Banana plants were grown

Success Stories of Pathri

Pradip Patil, Pathri
- Increased water level and Production
- Papaya crop was taken in place of sorghum

Kalyansing Patil, Pathri
- Increased production (40 %)
- Papaya crop was taken instead of Maize and Soyabean

Karamsing Damu Patil, Pathri
- Additional 20000 Banana plants were grown
- In Rabi season Chickpea was grown

Nilesh Patil, Pathri
- Increased production (20 %) and ground Water level

Bhimrao Patil, Pathri
- Increased wellwater level Now pumping is about 150 min. instead of 15 min.
- Papaya was grown instead of cotton

Govinda Chintaman Patil, Pathri
- Increased water level due to KT weir repairing

Dharmsing Damu Patil, Pathri
- Increased water level due to KT weir repairing

Rajendra Sandu Patil, Pathri
- Increased water level due to KT weir repairing

Success Stories of Samner

Devidas Bhiku Patil, Samner
- Increased water level and Production

Devidas Valmik Patil, Samner
- Increased water level and production due to Storage tank

Pratap Patil, Samner
- Increased water level and Production due to check dam

Ravindra Babulal Salunke, Samner
- Increased water level and production due to Storage tank and farm ponds

Ganvent Lalan Patil, Samner
- Increased water level and Production due to Check dam

Samadhan Kautik Patil, Samner
- Increased water level and Production due to storage tank

Dagadu Ramkrushna Chavhan, Samner
- Increased water level and production due to Storage tank

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Tropicultor use for Broad Bed and Furrow (BBF) Practices

Seed and Fertilizer Distribution for Participatory PE Trials

Pradip Patil, Pathri

- Increased Production due to ICRISAT's BBF technique and improved seed and micronutrient

Kalyansing Patil, Pathri

- Increased Soyabean crop production (19 %) due to BBF technique

Devidas Bhila Patil, Sonner

- Increased Production because of ICRISAT's improved seeds and micronutrients
- Increased production of Pigeon pea due to BBF technique

Ankushsing Patil, Sonner

- Increased Production because of ICRISAT's improved seeds and micronutrients

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Capacity Building

1. **Training –** The Environmental awareness for students

2. **Short Duration Research Projects**
   Students of M. J. College, Jalgaon did project on Watershed

3. **Students Involvement through NSS : Dec. 2011**
   - Repairing the damaged bund of the K T Weir, Pathri
   - Spreading awareness regarding Sanitation and health issues

4. **Vermicompost** (6 units)

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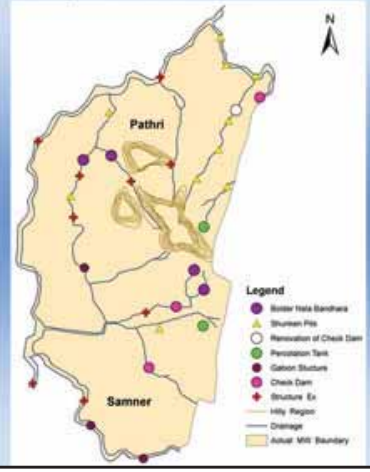
Work in Progress

Work To Be Done

Proposed Work Plan



Proposed Work Plan

Soil and Water Conservation:

- Plantation-1000
- Gully plugging- 50
- Sunken pits-30
- Gabion Structure- 04
- Field bunds-As required

Water harvesting structures:

- Farm Ponds-02
- Masonry check dam- 02
- Bolder Nala Bandhara- 04
- Percolation tank-01
- Renovation of Check Dam- 02

Productivity Enhancement:

- Micronutrients, Farm machineries, integrated pest management, improve land and water management practices

Capacity Building

- Trainings, Exposure visits, Participatory labour contribution(Shramdan)

Acknowledgements

- Dr. Suhas Wani and ICRISAT Team
- District Collectorate Jalgaon
- President, K. C. E. Society, Jalgaon
- Principal, M. J. College, Jalgaon
- Students of M. J. College, Jalgaon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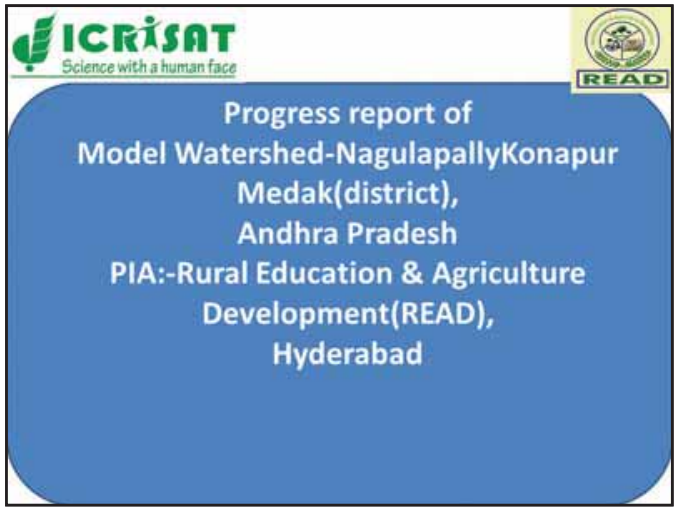
READ
Review and planning meeting of Model watershed
23-25 May 2012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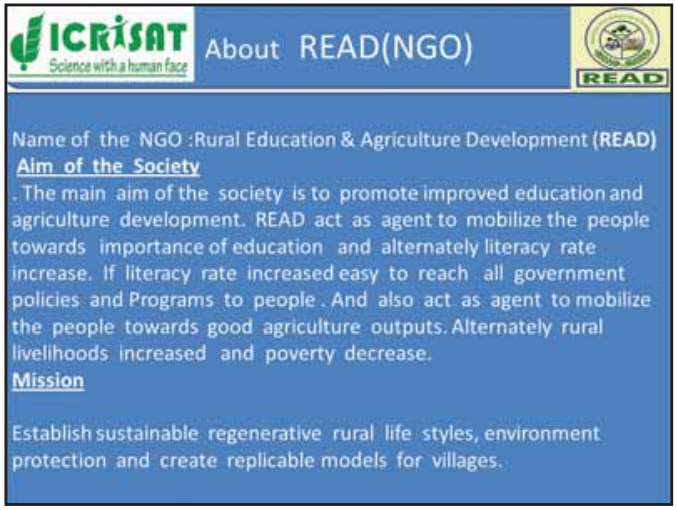
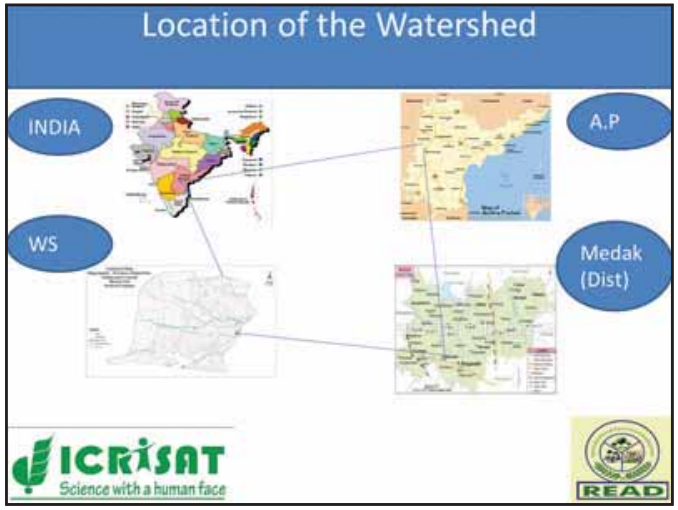
READ
Progress report of
Model Watershed-NagulapallyKonapur
Medak(district),
Andhra Pradesh
PIA:-Rural Education & Agriculture
Development(READ),
Hyderabad


ICRISAT
Science with a human face
About READ(NGO)
READ
Name of the NGO :Rural Education & Agriculture Development (READ)
Aim of the Society
. The main aim of the society is to promote improved education and agriculture development. READ act as agent to mobilize the people towards importance of education and alternately literacy rate increase. If literacy rate increased easy to reach all government policies and Programs to people . And also act as agent to mobilize the people towards good agriculture outputs. Alternately rural livelihoods increased and poverty decrease.
Mission
Establish sustainable regenerative rural life styles, environment protection and create replicable models for villages.


Location of the Watershed
INDIA
A.P
WS
Medak
(Dist)
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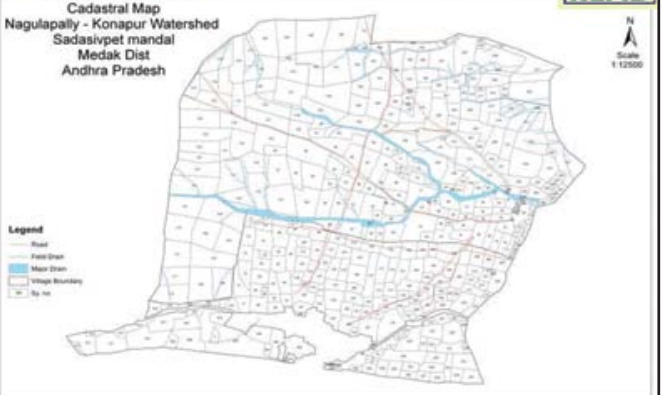
Watershed Map



Watershed Welcome board Constructed at National Highway Road towards awareness of ICRISAT Model WS Implementing Site

BRIEF DESCRIPTION OF THE WATERSH

Nagulapally-Konapur

- Nagulapally revenue village is located 10 Km away to Mandal head quarters of Sadashivapet(Mdl).
- The Sadasivapet is in South part of the Medak Dist which is purely rural area with agriculture environment.
- Name of the Gram Panchayat: Nagulapally and Konapur
- Villages/habitations: Nagulapally and Konapur Name of the mandal:- Sadasivapet

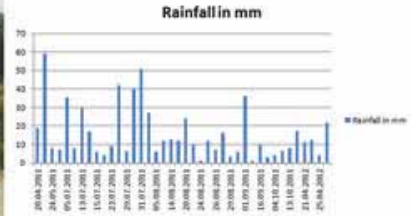
Continue.....

- Name of the district:- Medak
- Name of the State :- Andra Pradesh
- Latitude N: 17° 52' 28.0" - 17° 56' 11.0"
  Longitude E: 77° 38' 13.1" - 77° 54' 40.0"
- Distance from ICRISAT campus :- 40 km
- Major drainage system and tributaries of which the Watershed is a part:-

Sethamma vagu,Baswanna vagu, Chelmaya vagu & Laxminarayanavagu.

- Total W/S area :- 1185ha
- No of House holds in the W/S area :- 692 no`s

Rainfall Record:-2011-12



Total Rainfall received during the year 628.20mm

Average Rainfall of WS 855mm

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Physical & Financial Progress

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READ

Sl No.	Component/ Activities	Unit	Total Target as per DPR		Achievement		Convergence with line department		
			Physical	Financial	Physical	Financial	Departmental	Phy	Fin
2.	Watershed works Phase								
	A. Area treatment								
	Farm Bunding	Cum	7600	486400	1088	69630	NREGS	2800	17920
	Trench cum Bund	Cum	1200	76800		0			
	Stone outlets in Bunding	No	132	254800	15	25331			
	Farm Pond	No	2	70000	3	42443			
	B. Drainage Line Treatments								
	Mini Percolation tank	No	5	300000	8	437933			
	Rockfilldams	No	28	224000	31	125905			
	Loose boulders	No	64	259000	48	101103			
	Gaboinstructure With Masonry	No	2	120000					
	Check Dam-1	No	5	990000	2	330207			
	Check Dam-2	No	2	500000	1	249905			
	Check Dam Repair	No	8	260000	2	47987			
	Sunken pond with Revetment	No	2	70000	2	33435			
	Check wall	No			1	48958			
	Dug out Earthen Gully Plug	No			3	18609			

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Physical & Financial Progress

READ

Sl No.	Component/ Activities	Unit	Total Target as per DPR		Achievement		Convergence with line department		
			Physical	Financial	Physical	Financial	Department	Phy	Fin
3	Afforestation/Horticulture								
	Bund Plantation	No	25000	310000	22200	214044			
	Seed Dibbling on bund	Kg	50	10000		1200			
	Avenueplantation	No	200	50000	150	22485			
	Grass seed on Bunding	Kg	200	6000					
	Rocky yard plants	No	1000	20000	800	16000			
	Vegetable cultivation	Acre	20	80000			AP Horticulture department	10acre	27000
4	Livelihood support system								
	Details of Activities								
	(i)Tin Shop	No	1	3000	1	3000			
	(ii)Goat rearing	No	25	125000	25	125000			
	(iii)Milk animal	No	1	50000	1	50000			
	(iv)Sheep rearing	No	2	20000	2	20000			
5	Production system & Micro Enterprise								
	Desilting of Checkdams & Silt application on fields	Ha	20	240000					
	Animal loans	No	1	20000					
	Water trough for cattle	No	1	20000	1	7887			
	Improved irrigation system	1 Acre	10	100000			AP Micro irrigation department	1acre	48000
	(i)Vermicompost	No	10	60000	10	60000			
	Total			4737000		3913043			

Water storage Capacity

READ

Sl No.	Component/ Activities	Storage in Cum
	Farm Bunding	1088
	Farm Pond	450
	Mini Percolation tank	24000
	Rockfilldams	1550
	Loose boulders	1440
	Check Dam-1	12200
	Check Dam Repair	6300
	Sunken pond with Revetment	300
	Check wall	1200
	Dug out Earthen Gully Plug	1500
	Total	50028

Physical interventions of the watershed

Soil conservation Works:-

Formation of farm bunding in the Nagulapally village 2394m of length with the expenditure of Rs 76593/--. 12 no`s of beneficiaries with extent of 52 acres of land soil erosion to be arrested, Soil fertility improved and 645 employment man days has been generated. And also 5600m bunding were done cost Rs 179200/-convergence with NREGS Programme

Soil conservation Works:-

48no`s Loose boulder structures constructed in the watershed area with the cost of Rs 101103/-. 29 no`s of beneficiaries with extent of 32 acres of land soil erosion to be arrested and 470 employment man days has been generated. And also Put U/S of Bund With Vegetative barriers i.e Vaillee

Soil conservation Works

31no`s Rock fill dams constructed in the watershed area with the cost of Rs 125905/-. 31 no`s of beneficiaries with extent of 31acres of land soil erosion to be arrested and 504 employment man days has been generated. And also Put U/S of Bund With Vegetative barriers i.e Vaillee

Soil conservation Works

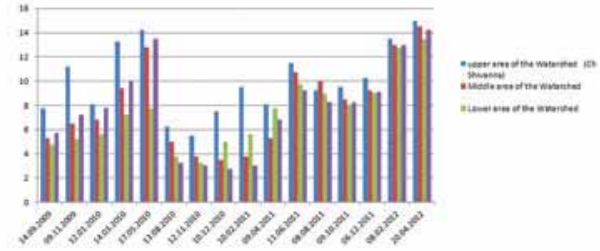
15no`s Stone outlets in Bunding constructed in the watershed area with the cost of Rs 25786/-. 12 no`s of beneficiaries with extent of 22 acres of land soil erosion to be arrested and 98 employment man days has been generated.

Water Harvesting Structures

3 no`s Check dams constructed in the watershed area with the cost of Rs 5,80,112/-. Check dam constructed across Baswanna vagu at Chakali Srinivas land. 6 bore wells Ground water levels before check dam construction 7 to 10m below GL, after the check dam 3 to 5m below GL. And 1 open well dry before CD, after the CD, that open well 3m below GL. 16 acre of additional area brought under irrigation crops i.e vegetable cultivation in wet year 2010-11, But this year 2011-12 low rainfall, depth of ground water goes down to 12-13m,Even farmers grown 12acres vegetable cultivation.

Check dam

Ground water levels of watershed area



Water Harvesting Structures

Repairing 1 old Check dam Sethamma voduka Yellakonda Narsimulu land, which is constructed 20years back Soil conservation department

Before check dam repair

After check dam repair

Water Harvesting Structures

Repairing 1 old Check dam which is constructed 20years back Soil conservation department

After check dam repair

Water Haresting Structures

Construction of 6 Mini Percolation tank at Nagulapally village and

2 Mini Percolation tank at Konapur village with the cost Rs 4,37,933/-.

Water Haresting Structures

Construction of 6 Mini Percolation tar at Nagulapally village and

2 Mini Percolation tank at Konapur village with the cost Rs 4,37,933/-.

Water Harvesting Structures
Formation of 3 Dug out Earthen Gully Plugs

Water Harvesting Structures
Earth work excavation of 3 Sunken pond

Sunken pond execution time

Sunken pond after Rain

Water Harvesting Structures
Earth work excavation of 3 Sunken pond

Sunken pond execution time

Sunken pond after Rain

Affersation:-
Teak plants 2000 no`s were planted in two villages to increase greenery

Glirisidia seed dibbling on bunds to strengthen the bunds by reducing soil erosion and to increase the availability of nitrogen rich green leaf manure to the farmers

Fruit tree seedlings of guava 200, Acid lime 200, Mango 200, Drumstick 200, Curry leaf 200 were distributed and planted in two villages by farmers in their back yard and kitchen garden.

We are regularly monitoring the water levels of total 49 Bore wells and 5 open wells continuing regularly. Near newly constructed check dam ground water levels are increased 3- 4 m in wet year & 1-2m dry year details are shown in chart

Chart Showing Water levels of the bore wells before and after near check dam

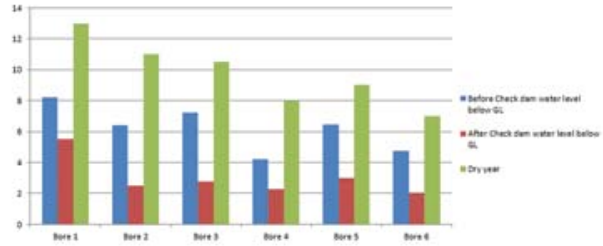
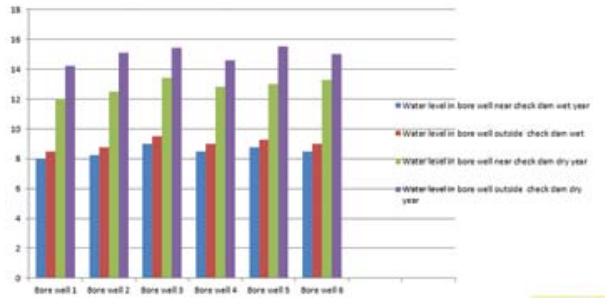


Chart Showing Ground water levels near check dam , outside check dam



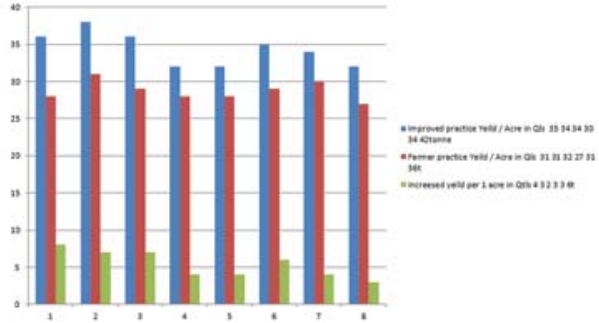
- Agriculture productivity Enhancement Activities

Crop Yield 2011-12

SL NO	Name of the Beneficiary	Name of the crop	Aplication of micronuetrients	Improved practice+INM Yeild / Acre in Qls	Farmer practice Yeild / Acre in Qls	Increased yeild per 1 acre in Qtls
1	MD Sardhar miya	Paddy	Aplied	35	31	4
2	China jogu Anthaiah	Paddy	Aplied	34	31	3
3	Modumpally Ashok	Paddy	Aplied	34	32	2
4	MOdumpally Veeranna	Paddy	Aplied	30	27	3
5	Patlola Basappa	Paddy	Aplied	34	31	3
6	Md Magbool miya	Sugarcane	Aplied	42tonne	36t	6t
7	Badem Raju	Vegetable	Aplied	36	28	8
8	Chakali Srinivas	Vegetable	Aplied	38	31	7
9	Dakuri Anjanna	Vegetaltble	Aplied	36	29	7
10	ChinnaJoguAnthaiah	Vegetaltble	Aplied	32	28	4
11	Karkani Balaiah	Vegetaltble	Aplied	32	28	4
12	Md Sardhar miya	Vegetaltble	Aplied	35	29	6
13	Chakali Baswaraj	Vegetaltble	Aplied	34	30	4
14	Badem Molaiah	Vegetaltble	Aplied	32	27	3

SL NO	Name of the Beneficiary	Name of the crop	Aplication of Varmi compost	Yeild / 1acre		Increesed yeild it acar anuval
1	Badem Raju	Vegetable	Aplied	34	36	2
2	Chakali Eashwaramma	Vegetable	Aplied	32	35	3
3	Dakuri Veeranna	Vegetable	Aplied	30	32	2
4	Chakali Narshimulu	Vegetable	Aplied	27	28	1
5	Basnagari Sudharshn	Vegetable	Aplied	36	28	2
6	Patlolla Basappa	Vegetable	Aplied	29	31	2

Crop Yield 2011-12




Application of micronutrients in Paddy
Md Sardar field with & Without micronutrients
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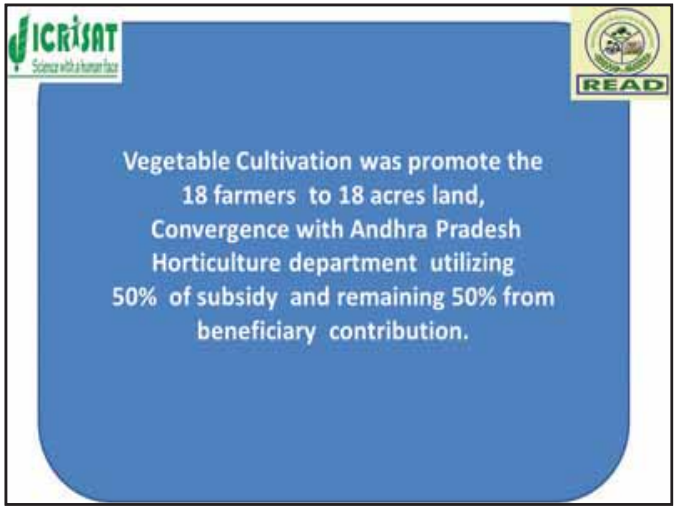
Improved sorghum cultivation with micronutrients
READ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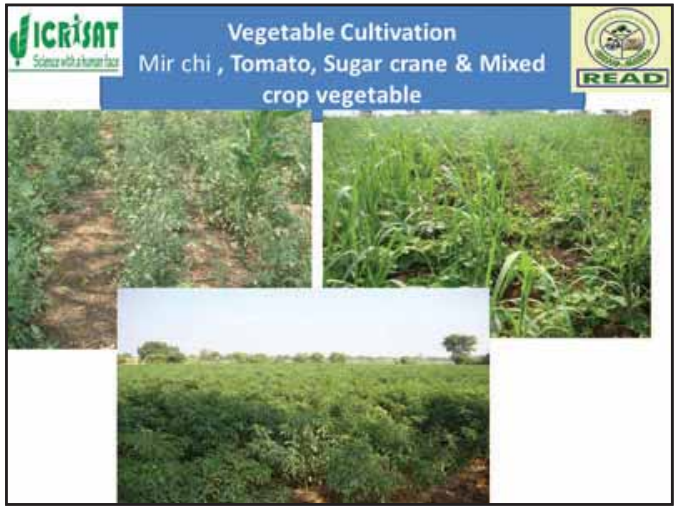
READ
Vegetable Cultivation was promote the 18 farmers to 18 acres land, Convergence with Andhra Pradesh Horticulture department utilizing 50% of subsidy and remaining 50% from beneficiary contribution.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Vegetable Cultivation
Mir chi , Tomato, Sugar crane & Mixed crop vegetable
READ

8 Acres of Sprinkler irrigation convergence of AP micro irrigation

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Livelihood Activities

Construction of 10 vermicompost units as a micro enterprise to improve livelihoods of 10 women SHG members. They are produce 32qls & Sale @ Rs5/Kg

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25 SHG members taken Goat rearing activities after the one year they are get Rs 3000 to Rs 5000 income/person

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20000 no`s seedlings (Nursery) were Raising one SHG members. (Glirisidia,Teak,Pongamia plants), they get Rs20000/- income

SHG`s 5 Dairy development as a micro enterprise, they get 3-4 liters/day,Rs 50-80 per day/person

Revolving fund given to landless labor Pretty shop & Tea shop, they get Rs 100/day

Revolving fund given to landless labor Sheep rearing, They get Rs6000 in this year/person

Infrastructure development in the watershed

Installation of Automatic Weather Station

Installation of Automatic Ru & Sediment sampler recorder

Rain gauge

Total station survey

ICRISAT Officials Visit WS for Check dam site selection

ICRISAT Officials With Check dam & RFD

Institutional arrangements ; -

- Formation of Watershed development committee ;- 1 no
- No of area groups :- 22 no`s
- No of labor groups ;- 6no`s
- Sub w/s committee : - 2no
- Name the W/S Committee : - Model watershed committee, Nagulapally-Konapur

Continue....

- Registration no :- 75/2009,Date.04.07.2009, As per AP registration act 2001 (Act no 35 F 2001)
- Details of WS committee members;-
- No of watershed committee members:- 16no`s
- Male -- 10 no`s and Female –6no`s

Caste wise:-SC -7, BC – 6, Others – 3

Capacity building :

Trainings :-

- **Watershed concept to farmers 2nos**
- **Watershed concept to labour group members 1no**
- **Watershed concept to watershed committee members 2nos**
- **Watershed concept to SHG members 2nos**
- **Book keeping to WS committee members 3nos**
- **Roles and responsibilities of committee members 2nos**
- **Construction of water harvesting structures to area group members 2nos**

Continue.....

- **Construction of water harvesting structures to labour group members 2nos**
- **Nursery raising to SHG members 1no**
- **Application of micronutriments and importance of micronutriments 3nos**
- **Préparation and maintenance of vermicompost 1no**
- **watershed committee members, Farmers and SHG members Exposure visit to ICRISAT Patencheru 2nos**
- **No of Gramasabha`s :- 10no`s**
- **No of Watershed committee meetings:- 28no`s**

watershed committee members, Farmers and SHG members Exposure visit to ICRISAT Patencheru & Kothapally Watershed

Exposure visit to ICRISAT

Training to watershed committee members & SHG members

watershed committee meeting monthly

Watershed **Social Audit Board** display at centre of the village For Awareness of Ws Funds Release, Activity wise Expenditure & Balance details to creation of transparency in funds

We were organize the Clean and Green programme to awareness to rural people clean and to increase the greenery in the village .
Cleaning of partheenium

We are encourage the sanitation in the village & construct Toilets with convergence of Govt dept

Formation of Farmer clubs With assistant of NABARD

Action Plan for 2012-13
PIA :- READ

Slno	Activity Proposed	No of Units	Unit	Rate/unit	Amount in Rs
1	Farm Bunding	1200	Cum	64	76800
2	Trench cum Bund	500	Cum	64	32000
3	Farm pond with Revetment	2	No	35000	70000
4	Rockfilldams	12	No	8000	96000
5	Loose boulders	25	No	4000	100000
6	Gaboinstructure With Masonry	2	No	60000	120000
7	Check Dam-1	2	No	200000	400000
8	Check Dam-2	2	No	250000	500000
9	Check Dam Repair	4	No	80000	320000
10	Bund Plantation	5000	No	15	75000
11	Seed Dibbling on bund	50	Kg	200	10000
12	Avenueplantation	100	No	250	25000
13	Cross seed on Bunding	200	Kg	30	6000
14	Vegetable cultivation	20	1 Acre	4000	80000
15	Improved irrigation system	20	1 Acre	10000	200000
				Total	2110800
	Improved seed	20acre			
	Application of microneutrients	40acre			


Thank you
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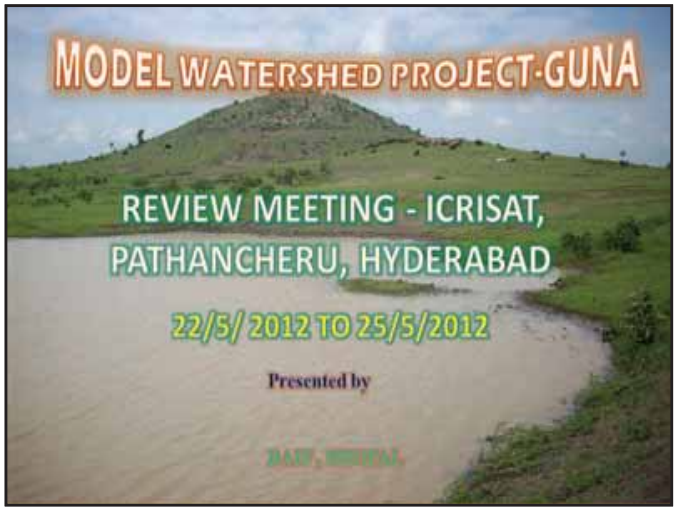
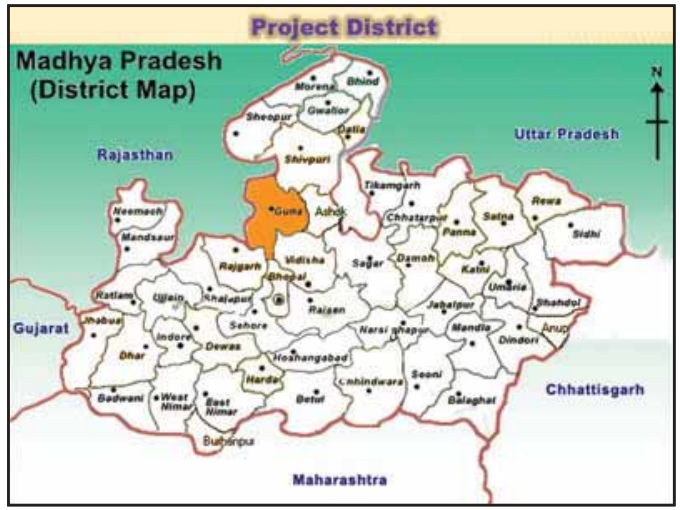
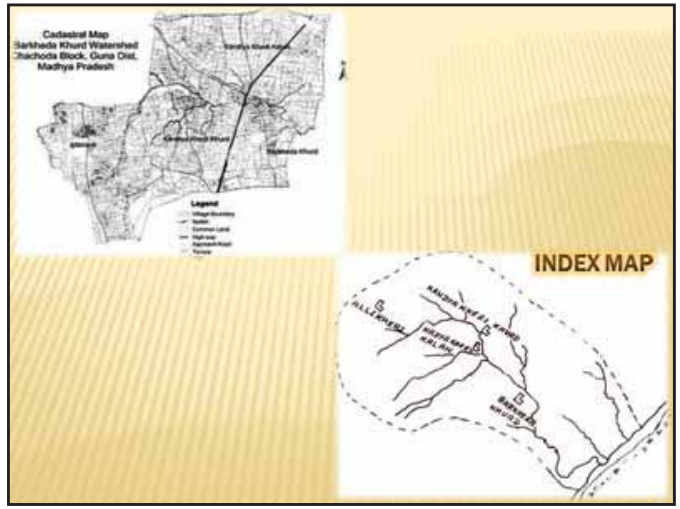




BASIC INFORMATION

No. of Village	04
Total Households	415
Avg. land holding (ha./family)	3.5
Total sanctioned area (ha.)	1367.00
Starting Date	Nov. 2008
Cultivated land (ha.) Irrigated land (ha) Un irrigated (ha)	1226.00 321.00 905.00
Soil depth	2 to 10 ft.
Average Rainfall	856 mm
Sources of Irrigation	Dug well , River , Tube well , Water Tank
Soil Type	Black , Sandi loam , Sandi
Main Crop's	Soybean , Maize , Coriander , Wheat & Chickpea



OBJECTIVES

- Regeneration of Natural Resources
- To reduce soil erosion
- To increase in ground water table
- Empowerment of women
- Change cropping pattern and increase double cropping area
- Capacity Building through Inclusive Development of village through watershed
- To improve the socio economic condition of rural farmers

MAJOR COMPONENTS OF THE PROJECT

- ❑ Soil & Moisture Conservatuion Works
- ❑ Water Harvesting Structures
- ❑ Afforestation Works
- ❑ Pasture Development
- ❑ Horticulture Development
- ❑ Other Activities

WORK PLAN 2011-12

Sl. No.	Activities	Unit	Physical Unit
1	Water Harvesting Structures – a) Earthen Dam b) Percolation Tank c) Pacca Check Dam d) Dug out Pond e) Farm Pond	No.	 2 2 6 4 10
2	Soil & Moisture Conservation Works – a) Contour Trench b) Gully Plugs c) Farm Bunding (Soil) d) Farm Bunding (Stone)	 NO NO RMT RMT	 2000 30 5000 1000
3	Pastureland Development	Ha.	20
4	Horticulture Development	Ha.	5

PHYSICAL PROGRESS- 2011-12

MONTHLY GROUND WATER LEVEL OBSERVATION 2011-12

Gound water table measuring

Record Keeping of Depth

RAIN FALL DATA – 2011-12

Records in mm

SHG PROGRESS

a)	Number SHGs –	02
b)	Starting –	May'2010; 11
c)	Number of Members –	20
d)	Saving Frequency –	Monthly
e)	Monthly Saving Per member –	Rs 25.00
f)	Total Savings Amt. –	Rs 9000.00

THANKS

MODEL WATERSHED FOR SUSTAINING AGRICULTURAL PRODUCTIVITY AND IMPROVED LIVELIHOODS- DOMAGOR PAHUJ WATERSHED, JHANSI

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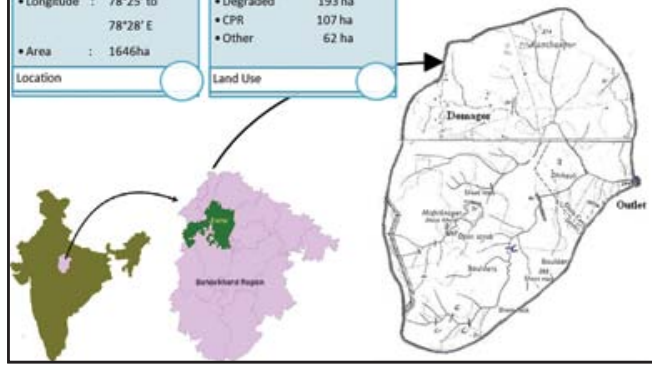
NRCAF

Development Alternatives

Domagor-Pahuj at a Glance..

Location		Land Use	
• Latitude	25°28' to 25°31' N	• Cultivated Area	960 ha
• Longitude	78°25' to 78°28' E	• Forest Area	154 ha
• Area	1646ha	• Drainage	170 ha
		• Degraded	193 ha
		• CPR	107 ha
		• Other	62 ha



OBJECTIVES

- Improved rural livelihoods on sustainable basis
- Establish model site of learning for semi-arid areas
- Build capacity of stakeholders

RESOURCES

Population: 3500

Households: 778

Livestock population: 3051

Average Land Holding: 1-1.25 Ha

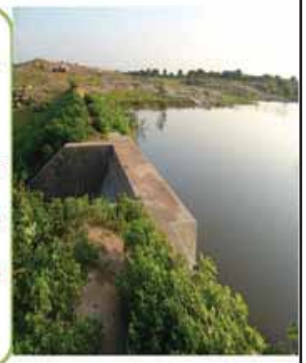
Vegetation:
Kardhai Palash, Neem, Mahua, Wild Zizyphus, Chiraul and Bamboo. Grasses: Cinchrus and Aristida

Main Crops
Kharif Groundnut, Urd, Mung & Maize
Rabi Wheat, Mustard & Chickpea

Soil
90% Red Laterite & 10% Black Soil. Low in N,P, OC and medium in K
deficient in zinc, sulphur and boron

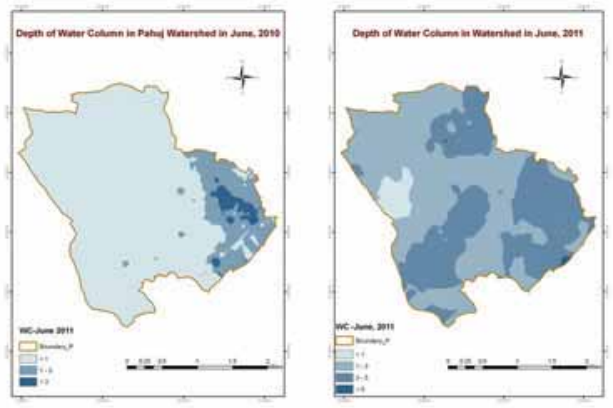
DEVELOPMENT OF WATER RESOURCES AND ITS MONITORING

- Water table of wells- monthly basis
- Rainwater harvesting structures-11 (9 in 2010-11 and 2 in 2011-12)



Contd…

- Surface water storage- 15000 m^3
- Water table rose by 2 to 3 m in about 2/3 area



Daily rainfall in the watershed during 2011

PERFORMANCE OF CROP DEMONSTRATIONS AT DOMAGOR

Groundnut with micro-nutrient

Crop	Pod yield (kg/ha)
Groundnut + FP (50 % of RDF) + Agribor + Zink Sulphate	1842
Groundnut + FP	1577
FP: 60 kg DAP Groundnut variety: local RDF for Gnut: (20:60:40)	

Barley in participatory trials

Variety	Number of PTs	Area	Mean seed yield (kg/ha)
Narendra -2	80	140 acre	3686
Local Barley	-	-	2947

Natural Resource Conservation through Changing Cropping pattern

- Demonstrated field trial of Barley 140 acre, 80 farmers, 3 villages & 48 Quintal seeds.
- Benefits experienced by farmers as compared to wheat –
  - 50 per cent less input cost.
  - 25 per cent less labour cost.
  - 50 – 75 per cent less water requirement
  - 25 per cent increase in production.
  - 25 per cent more selling price than wheat.
  - No damage by wild animals

Vegetable Cultivation

Crop	Variety	Number of PTs
Garlic	G-50	10
Pea	AP-3	03
Onion	Nasik Red-N53	18
Potato	Kufri Badshah	03
Coriander	Avatar (F1)	04
Oat	JHO-114	03
Berseem	Vardan	03
Total	-	44

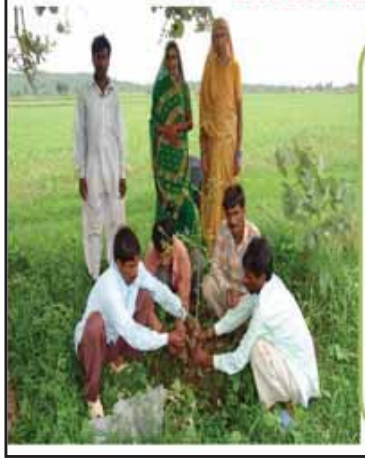
Pea Cultivation-a case study

S. No.	Particulars	Economics
A	Cost of cultivation	Rs./ha
1	Field preparation and sowing	4500
2	Seed	3125
3	Fertilizer	2250
4	Irrigation	8000
5	Weeding	2250
6	Green pod picking and marketing	6750
7	Harvesting, threshing and cleaning	3750
8	Misc.	1500
9	Total cost	32125
B	Returns	Rs./ha
1	Gross return (Green pods + Seed + Straw)	87250
2	Net return	55125
3	B:C ratio	1.72:1

DEVELOPMENT OF AGROFORESTRY INTERVENTIONS

- 10 thousand plants of different species
- Survival of different species varied from 35 to 69 per cent by the end of February

Ber Budding



- 344 desi ber were budded (survival-55 per cent)
- 20 village youth trained for scaling the activities
- On an average 10-15 kg ber/plant was harvested by the farmer

Strengthening Institution

- Formation of WSHG -26 no.
- Micro enterprise development -10 WSHG.
- Total Saving with WSHG Rs. 179000.
- Loaning to WSHG from W. C. Committee Rs. 162000
- Repayment from WSHG to WC Rs. 42150

Sl No	Total Group	Utilization of Revolving Fund Through SHGs for creating Enterprise				
		Goatry	Vegetable	Nursery	Stitching	Vegetable Trolly
1.	4	1				
2.	11	4	2		1	1
3.	11			1		
Total	26	5	2	1	1	1

Contd..

- **Village level Committee (VLC) of WSHG in each village is in process**
- **WSHG formed in the area will be graduated for federation for sustainability.**
- **Environment club at each village involving school children (Library, awareness about water & sanitation, etc.)**

Exposure Visits

CONVERGENCE

- Agroforestry in 22 acre through NRCAF, Jhansi
- Demonstration trials of garlic (G-50) at 23 farmers' fields through Horticulture Mission, Jhansi
- Demonstration trials of wheat (Lok-1 and WH-147) at 24 farmers' fields through Dept. of Ag.
- Micro irrigation- 12 units

PLAN FOR THE YEAR 2012-13

SMC AND EFFICIENT USE OF WATER

Field bunding-100 ha

Field drainage structure-75

Micro irrigation-10 unit

INCOME GENERATING ACTIVITIES

- **Goat rearing**
- **Vegetable cultivation**
- **Vermi-compost**

Contd..

PARTICIPATORY TRIALS

- Groundnut trial - 30 acre with 60 farmers in 3 villages
- Vegetable trial -15 acre with 30 farmers
- Papaya plantation -20 acre
- Agroforestry - 15 acre
- Green shade net erection and coco peat technology for vegetable cultivation-05

CONCLUSIONS

- Water table rose by 2 to 3 m through construction of rainwater harvesting structures which resulted into crop diversification and higher cropping intensity
- Application of B and Zn increased the groundnut yield by 16.8 per cent over control.
- Vulnerable section of the community are earning their livelihoods through micro-enterprises by support of revolving fund

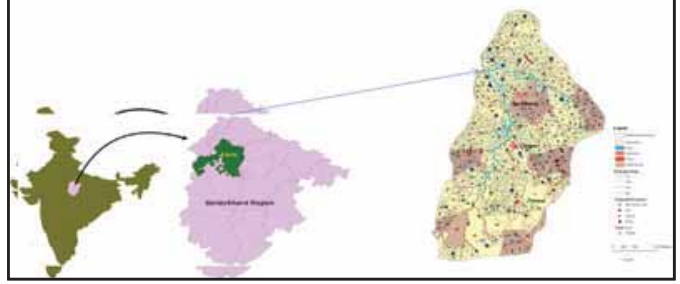
Enhancing groundwater recharge and water use efficiency in SAT region through watershed interventions- Parasai-Sindh Watershed, Jhansi

ICRISAT
Science with a human face

NRCAF

PARASAI-SINDH WATERSHED

Geographical area : 1383 ha
Inception of the Project : August 2011



Demography

Number of households: 410

Population: 1918 (1068 male and 850 female)

Literacy: Poor (41.5% adult male, 12.4% adult female , >60 % children)

Occupation Structure

Big farmers (80% income from agriculture and 20% from milk)

Small and marginal farmers (agriculture- 33%; milk prod.-33% and daily wages, 33%).

Caste Structure

Schedule Caste (14.76%), Other Backward Community (76.2%) and General (9.04%)

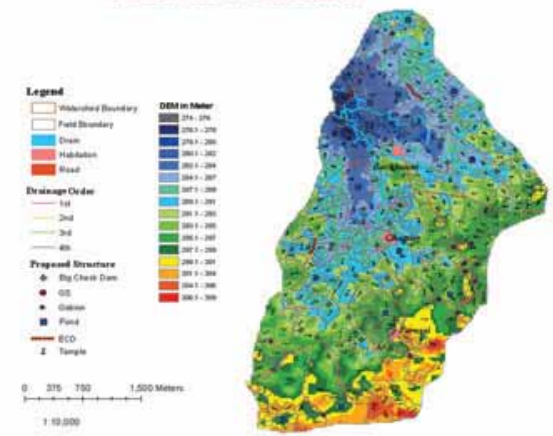
MAJOR PROBLEMS

- Low water holding capacity
- Shallow depth of soil
- Crisis of drinking water
- Degraded land with multi directional slopes prone to severe soil erosion
- Poor productivity of crops and livestock
- Frequent Droughts
- Uncontrolled grazing
- Poor literacy
- Poor socio-economic status of the people

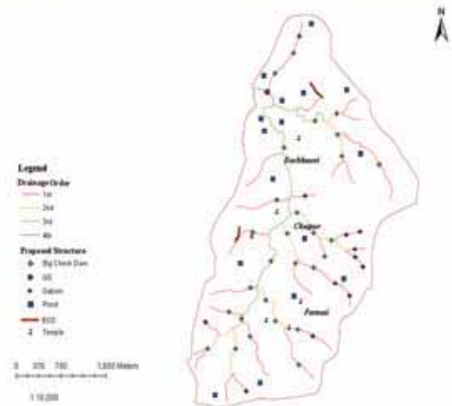
OBJECTIVES

- To enhance water availability in target villages through rainwater harvesting and recharging of the wells
- To enhance water use efficiency and agricultural productivity through improved management of land and water resources
- To establish a site for learning

DEM of Watershed

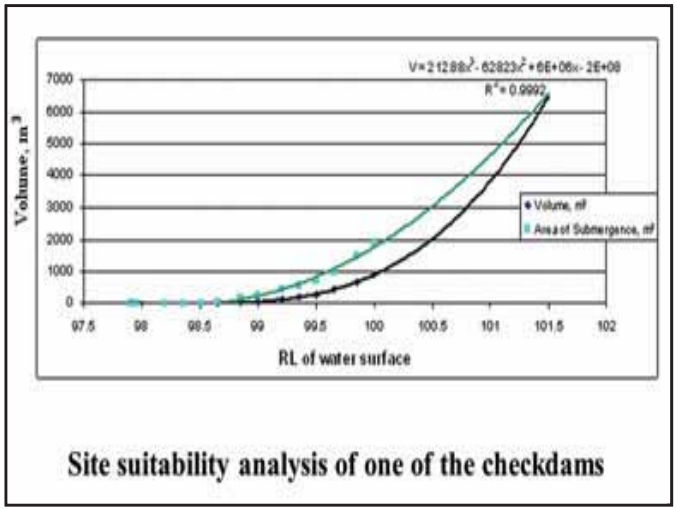


Identifying water harvesting structures location



DEVELOPMENT OF WATER RESOURCES

- Water table of wells- monthly basis
- Rainwater harvesting structures- 02
- Water storage craeted-5000 cum.



Site suitability analysis of one of the checkdams

PERFORMANCE OF CROP DEMONSTRATIONS AT PARASAI

Groundnut with micro-nutrient

Crop	Pod yield (kg/ha)
Groundnut + FP (50 % of RDF) + Agribor + Zink Sulphate	1825
Groundnut + FP	1510
FP: 60 kg DAP Groundnut variety: local RDF for Gnut: (20:60:40)	

Performance of participatory trials during Rabi 2011-12

Crop	Variety	Number of PTs	Mean seed yield (kg/ha)	% yield increase
Gram	Vaibhav	5	1870	33.4
Local	Desi	-	1402	-
Lentil	DPL-62	6	1130	17.7
Local	Desi	-	960	-
Mustard	Pusa Bold	3	1470	24.6

Participatory trial of chickpea

DEVELOPMENT OF AGROFORESTRY

Name of Plants	Number
Citrus	535
Guava	150
Bamboo	134
Teak	110
Karonda	76
Aonla	161
Mango	15
Shisham	35
Jackfruit	10
Total	1226

Ber Budding

➢Thirty six desi ber were budded with improved varieties

➢Survival was about 53 per cent by February 2012.

Strengthening Institution

- Formation of watershed committee -02
- Formation of environmental clubs

Meeting with community at Parasai village

Mobilization of Peoples' Participation

- In-depth discussion with community before taking of activities
- Indent from the committee
- Written assurance from WC-responsible for quality, quantity and any disputes
- Procurement of materials by WC on the basis of limited hand quotation for > Rs. 15000

Contd…

- Capacity building-Measurement and MB maintenance
- Every payment was made after proper endorsement by WC through cheques
- Transparency about budget of the project

Impacts

- **Quality, transparency and feeling of belongingness-resulted into high community participation**
- **Less cost of the structures**
- **Due to involvement of community-Less efforts for any activities**

Reasons Behind Huge Peoples Participation

- Reputation of the institutions- 12
- Clarity about the project-6
- Frequent meetings-9
- Formation of environment clubs-5
- Exposure to Garhkundar-Dabar Watershed-9
- Construction of 1st checkdam-41
- Belongingness-18

CONVERGENCE

- Babool and Senegal based AF System-5 Acre from NRCAF, Jhansi
- Desilting of drains through MGNREGS

PLAN FOR THE YEAR 2012-13

SMC, WRD AND EFFICIENT USE OF WATER	INCOME GENERATING ACTIVITIES
• Construction of SWCS-20, Field bunding-150 ha, • Gauging Station-01 • Field drainage structure-100 • Well recharging unit-05 • Micro irrigation-05 unit	• Seed Bank (Groundnut and Chickpea) • Vermi-compost •Lac cultivation

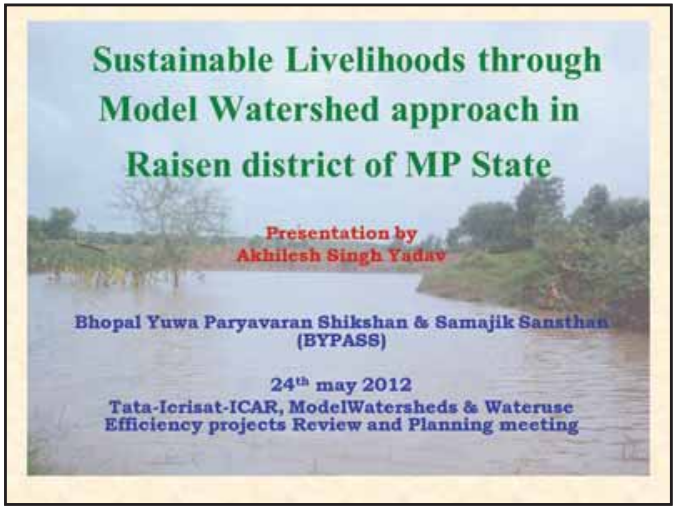
Contd…

PARTICIPATORY TRIALS

- Agri-horticulture- 9 acre
- Teak based AF on field bund-30 acre
- Groundnut trial - 15 acre with 15 farmers in 3 village
- Forage crops- silage-15 farmers
- Green shade net erection and coco peat technology for vegetable cultivation -1 no

CONCLUSIONS

- Quality and transparency in construction of checkdams and sense of belongingness mobilize peoples' participation
- Surface water storage of about 5000 cum. was created through two checkdams @ Rs 72 per cum
- Application of B and Zn increased the groundnut yield by 21 per cent over control
-



GARBHAN NADI MODEL WATERSHED

Chorpipariya
Siyalwada
Gaganwada
Rampura
Dungariya
Padariya Kalan

Social Profile

HH in project area	Population	ST HH	SC HH
511	2821	248	48
		48.5%	**9.5 %**

Area profile

Area of Watershed taken (ha.)	Villages covered	Agriculture Land (ha.)	Forest Land (ha.)	Waste Land (ha.)
1736	06	1237	422	51
		71.2%	24.3%	2.9%

Average Annual Rainfall - 950 mm
Rain fall in year 2010 -510 mm
Rain fall in year 2011 - 1032 mm

Plan for 2011-12

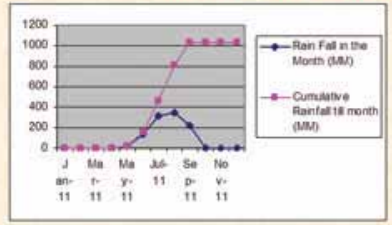
- Data collection -Ground water, Rainfall, Soil loss etc
- Community organisation and capacity building
- Watershed development activities by watershed Committee
- Soil conservation structures – Gully plugs, LBS
- Water harvesting structures- Dug out Ponds,Earthen Nala Bunds, Stop dams
- Productivity enhancement trials on Nutrient management, Fallow management, Water use efficiency
- Vermi Composting and Gliricidia – Green manure promotion
- Crop diversification
- SHG development/ Women Empowerment

Data Collection Process

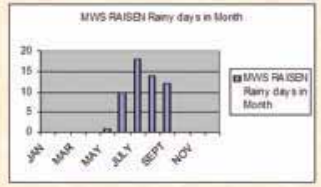
- Rain gauge
- Run off recorder / sediment sampler
- Automatic Weather station (watch dog)
- Ground water measurement equipment



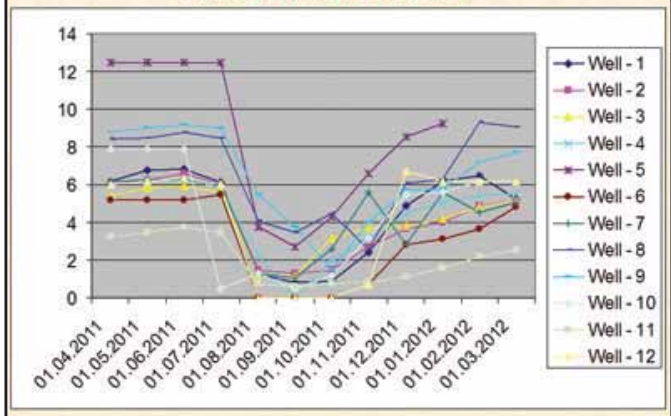
Rain fall data of Watershed area



Rain fall in 2011 – 1032 mm
Rainy days - 55



WATER LEVEL IN BENCH MARK WELLS
Water level from top Of the well



Capacity building of farmers

- Kharif crop preperations – 184 farmers
- Rabi crop preperations – 165 farmers

Issues

- Soil & water conservation,Utility of Broad bed & Furrow technique, Fallow management, Crop divercification , Agriculture development - INM/ Improved variety,Importance of FYM (Advantages of Biogas & Compost fertilizers), Linkages with NREGS & Agriculture department, Risk management

3 days Training of Model Watershed Management Committee

ISSUES

Introduction of Model watershed development project – Why? What? How?
Community participation – What? Why?
Responsibility of each Stake holder in development.
Insitu- Exsitu Moisture conservation
Technical aspects of Soil Water Conservation

Soil water conservation activities

- **Loose Bolder Structures work was started in drains started from ridge area. 65 LBS were done with participation of farmers. These structures protect Soil loss in about 18 hectare Agriculture land. 12 farmers in uplands benefited from this activity.**
- **Cement Bag Structures were constructed in 3 villages during October 2011. Through these structures huge amount of water was stored in the nalas, which was used by the farmers for irrigating the crop, also recharged water was used by the farmers through wells.**

Water Storage structures

5 Ponds/ Earthen structures were constructed in 3 villages for water storage and recharging purpose. Total capacity of these structures is 32400 cubic meter. The sites are very much suitabl for ponds which lies between agriculture land. These effort will directly help to improve moisture profile in surrounding farms hence it will directly support the Agriculture productivity. In rainy season the plantation is planned around these ponds

Farmer Khushilal
Tola Nayakheda, Village- Siyalwada

- Activity Dug out Pond with bunds (20m x40m x2.4m), As it was dug on Nala, Water got stored back up to 115 meter.
- Two Borewells and One Open well got recharged
- Farmers got Pigeonpea on nala bund, Pigeon pea and Wheat on waste land comes under cultivation, Irrigate Paddy and Wheat, Onion and Garlic cultivation on Pond bed after harvesting water in Rabi.
- Out of investment of Rs. 0.96 Lakh he got Rs. 0.48 Lakh return in One year,

Vermi compost Units

- One day refresher training session of farmers was organised in each village on " composting techniques". All 12 vermi compost units were produced 24 tons compost which was used by farmers in different crops, Trials and vegetable cultivation. Farmers also compared the results of vermi compost application in agriculture production.
- In village Rampura Farmer Narmada Prasad used vermi compost in vegetable cultivation. He asked that the shine, weight and colour was improved . He got 1 to 3 Rs more per kilogram of vegetables. He use VC in Ginger, Onion, Tomato, Bottle gourd, Ridge gourd, Beans etc.

Improved variety

CROP	VARIETY
PIGEON PEA	ICPL 871119
GROUND NUT	ICGV 91114
BLACK GRAM	T-9
MAIZE	KAVERI 235
	DHM 117

Tropicultor

- Tropicultor was provided to farmers of Gaganwada village
- Practical demonstration was also conducted in village with farmers

Productivity Enhancement

Kharif 2011- RAISEN MWS

- Balanced Nutrient - Nucleus Trials
- Balanced Nutrient - Satellite Trials
- Balanced Nutrient - Scale Up Trials
- Fallow Management- Nucleus Trials
- Fallow Management- Satellite Trials
- Wateruse efficiency
- Special Trials on Agribor SBZ application

Rabi 2011

- Balanced Nutrient - Nucleus Trials
- Balanced Nutrient - Satellite Trials
- Balanced Nutrient - Scale Up Trials
- Fallow Management- Nucleus Trials
- Fallow Management- Satellite Trials
- Water use efficiency – 20 Trials
- Special Trials on Agribor SBZ

Kharif 2011

PADDY – Pusa basmati	Treatment Plot (With Agribor SBZ)	Control Plot (Farmer practice)
Yield (Q/Ha)	57.8	50.2

RAISEN - MWS	Plot yield in Kg (Plot size 2000 sq.m.)	
Crop	Treatment Plot – IV+ BN	Control Plot – IV+ FP
Piegen pea	206	188
Black gram	277.5	265.2
Groung nut	286	225
Maize	243.8	223.3

CHICKPEA	Balanced Nutrient	50%BN + 50% Vermi compost	Farmers practice
Yield (Q/Ha)	17.4	19.4	15.6
WHEAT			
Yield (Q/Ha)	40.4	42.1	34.7

•**Gliricidia** – Green manure

1170 Plant saplings developed in Nursery by women SHG and planted by 11 farmers around their farm land

Farmers observations

•8 to22% more yield in Treatment plot as compare to FP.
•The plant strength, growth and greenery was better in BN + Vermicompost plot in all crops, at harvesting time it also dry 5 to 6 days later than control plot
•Soil texture improve due to BBF+ BN application

•CHALLENGES-

•Water logging due to Continuous rains in July-August 2011 effects the Soybean.
•As there is good forest cover around project area, damage caused to crops through wild animal is a big challenge.
•Wilt disease in Chickpea crops
•Inertness/ Socio Polytical fractions

Women Empowerment

- 8 Women SHGs were organised in the project villages having 108 women in these. Last year saving of these groups was 52450.00 Rs. All these groups are from tribal community.

• In each of 3 villages 2 days Capacity building sessions were organised.
• Main focus of capacity building was on Income enhancement strategy.
•Loan to 18 Women was provided through SHGs for Income generation activities.
•Women were participated in State level Mela to sale SOY Flour, Mixed flour (Birra) of Wheat Soy and Chana, Desi food grains etc which are useful to abolish the malnutrition.

Linkages with Agriculture dept

Promotion of efficient irrigation system - Sprinkler system to 2 farmers

Kitchen Garden

Kharif season – 30 HH Bottle gourd, Ridge gourd, Cluster bean, french beans etc. Avg production from Kitchen garden come to 4200 Rs.

Summer season – 10 HH Spinach, Bottle gourd, Ridge gourd, Bitter gourd, Cucumber, Lady finger etc.

Commercial vegetable cultivation

Six Farmers from project did Onion, Tomato & Brinjal cultivation in 3 ha area.

Use of FYM, Zinc and Agribor to enhance productivity. The average profit increased by Rs 28000.

Animal health camps

Service	No of animals	When
HSBQ / FMDvaccination	633	June July, Nov-Dec 2011
Cattle health Checkup	112	July-Dec 2011

•Special drive in June – July, Nov- Dec 2011 were organised in project villages with the help of Veterinary department in 6 villages of Raisen. Before camps the meeting with community were organised to motivate them for participation.

•2 Proposals got sanctioned for Goat rearing under Veterinary dept. scheme

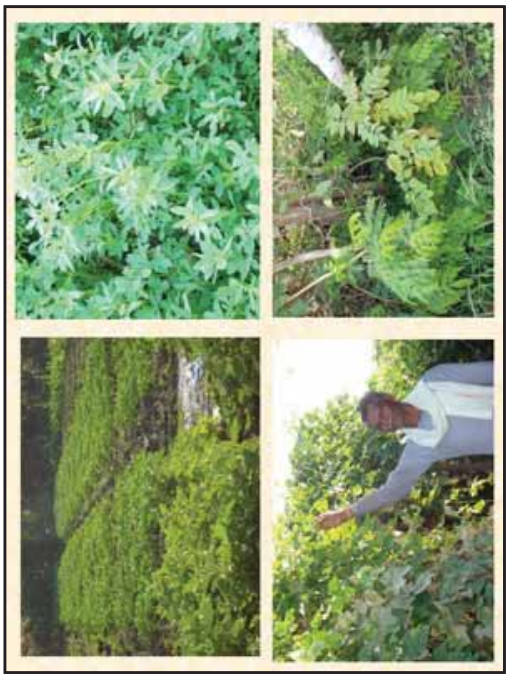
•In order to initiate the good quality green fodder for cattles, barseem seeds were provided to 6 cattle owners who have started Milk selling in local market. At present the barseem grass has been used by all 6 HH as green fodder.

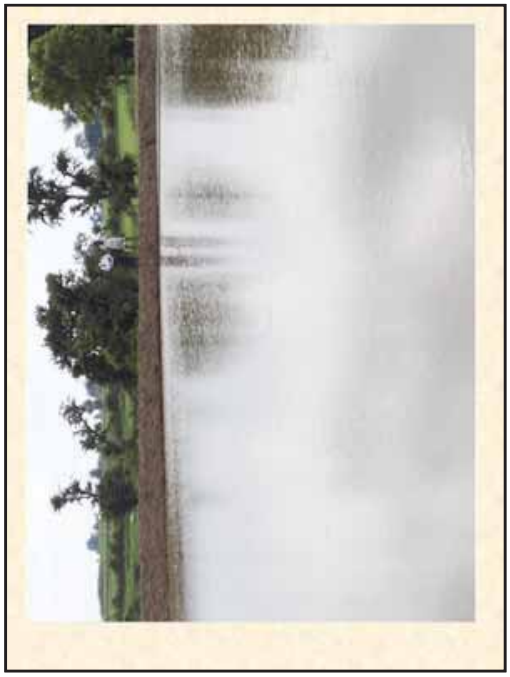
Farmers day- SIYALWADA

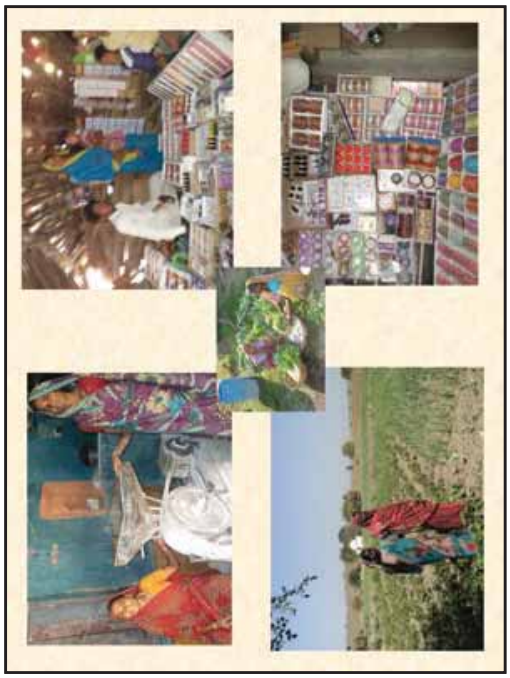
- **Date 30 JANUARY 2012, Participants 195**
- Issues – Farmers organisation? Marketting of Agri produce ? Soil health? Challenges in Agriculture development, Integrated Pest management, Organic farming
- Resource persons- Hon M P Goswami, Member ZP Raisen, Mr Girish Chander (Scientific officer- ICRISAT), , Mr Prasad Kamdi & Satish Gahukar (ICRISAT), Mr Mahesh Thakur (Agriculture dept), Mr Akhilesh Singh Yadav
- Issues – Experience sharing by farmers while using IV, BN and fallow management trials, delebrations on best practices and learnings, Information sharing by resource persons on agri techniques, Question answer session, Field visit of demonstration plot.

MID TERM EVALUATION

- **Mid term evaluation study of project was done by AP Academy of Rural Development in Dec2011.**
- **Team members Prof. R Ratnawswamy and Mr K Prasad Rao visited for Six days in the watershed villages.**
- **The gone through all kin d of activities and interviewed beneficiaries from all Six villages.**
- **They were appreciated tha development processes adopted by ICRISAT with partners in remote villages with community in need.**







Looking ahead…

- More water harvesting structures to be constructed
- Promotion of BBF / Conservation furrow to manage fallow land
- Productivity enhancement techniques
- Crop divercification
- Green/ Organic manure promotion
- Income enhancement for land less/ marginal farmers
- Promotion of thorny species in farms near forest area
- Linkages with MNREGS and Agriculture dept.
- Strengthening of CBOs/ Capacity building

WELL COME!!

ICRISAT MODEL WATERSHED PROJECT

MOTA VADALA, DIST: JAMNAGAR

GUJARAT

PIA: BAIF-GRISERV

REVIEW AND PLANNING MEETING

Date:-23rd to 25th May 2012

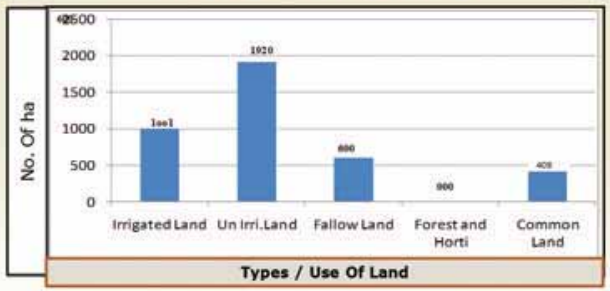
ABOUT WATERSHED VILLAGE

- DIST. FROM Dist. H.Q. : 62 km
- DIST. FROM TALUKA H.Q : 15 km
- Geographical Location of the Dist : 21° 47' and 22° 57' north Latitude
  68° 57' and 70° 37' west Longitude
- POPULATION : 4935
- No. OF HOUSE HOLD : 1050
- TOTAL LAND : 3930 ha
- AREA OF WATERSHED : 1000 ha
- AV. RAIN FALL : 600-800 mm
- MAX.- MIN TEMP : 45° c Max – 4 ° c Min
- AGROCLIMATIC ZONE : 05 (NORTH SAURASHTRA)
- SOIL TYPE : Medium Black Calcareous soils

Water Resource In Village

Open Well Irrigation	Tube Well Irrigation	Drinking Water Tube Wells	Old Water Harvesting Structures
635	32	03	32

Land Use Pattern (3930 ha)



Progress Report 2011-12

Sr.	Activity	Unit	Target	Achievement	Variance
1	Check Dam	No.	3	2	1
2	Well Recharge	No.	20	0	20
3	Nala Plug	No.	8	3	5
4	Field Outlet	No.	50	20	30
5	Farm Bunding	RMT	2500	1250	1250
6	Afforastation	ha	2	1	1
7	Roof Water Harvesting	No.	1	0	1
8	Gliricidia Plantation	No	20,000	3000	17000
9	Loose Bolder	No	10	0	10
10	Farm Ponds	No	5	0	5
11	Kitchen Garden	No	200	200	0
12	Renovation Of Old Structures	No.	4	1	3

Progress Report 2011-12

Sr.	Activity	Target	Achievement	Variance
13	Horticulture Plant	2000	0	2000
14	Crop Demo. Plot (0.20ha)	10	40	---
15	Fodder Demo. Plot (0.20 ha)	50	20	30
16	Micro Nutrient Demo. (0.20 ha)	5	15	---
17	Gypsum Application (ha)	5	1	4
18	Cattle Breeding Centre	1	1	--
19	Animal Health Camp, Vaccination, De Worming, Minerals	2	4	---
20	Training Programmes	15	0	15
21	Exposure Visits for Farmer	3	0	3
22	Awareness Programme	12	12	0
23	Compost Pit Demo	5	0	5

Progress Report Of Other Activities 2011-12

Sr.	Activity	Unit	Target	Achievement	Remarks
A	Data Collection				
1	Rain Fall Reading	Month	4	4	
2	Well Water Observation	No.	16	16	
3	Automatic Weather Station	No.	1	1	
4	Runoff and Soil Loss	No.	1	1	
B	Demonstration Plots				
1	Crop (Cotton & Groundnut)	No.	50	40	
2	Fodder	No.	25	20	
C	Field Trials				
1	Water Calculation Impact Trials	No.	4	4	
2	Groundnut Different Four Variety (NICRA) Trials	No.	2	2	

Important Physico – Chemical Properties Of Initial Soil Testing April: 2010-11

No.	Indicator	Availability	Remark
1	Soil pH (1:2 soil: water)	8.1	Neutral to Alkaline
2	Electrical Conductivity (dS/m)	0.64	Safe
3	Organic Carbon (%)	0.53	Medium
4	Ols . Phosphorous (ppm)	7.9	Low
5	Exch. Potassium (ppm)	172	High
6	Available Sulfur (ppm)	30.7	High
7	Available Zinc (ppm)	0.45	Low

Effect of Zn and B on Growth and Yield of Cotton grown on Medium Black Calcareous soils of Saurashtra Region

- **Objectives:**
  1. To evaluate the effect of Zn and B on yield of cotton.
  2. To work out monetary benefit of application of micronutrients in cotton
- **Experimental Details:**

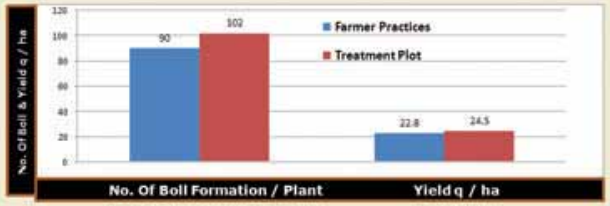
  A. Treatments :2

  1. Farmer Practices - D.A.P. 350 Kg & Urea 325 Kg per ha
  2. Farmer Practices + Zinc Sulphate 50 kg + Agribor 1.25 kg per ha

  B. Environment (Multi Location Trial): 14

  C. Plot Size: 0.20 ha

  D. Season: *Kharif*



Report	Increase in yield (q) due to treatment over control	Additional Income from Increased Yield	Additional Cost Of Micronutrient Fertilizer	Net Income over farmer's practice	Remark
Treatment finding for 1 ha	1.70	7225 Rs	2340 Rs	4885 Rs	Price: 4250 Rs / q Or 850 Rs / 20 Kg

Research Findings

- 13 % Increase in boll formation due to micronutrients application
- 7.40 % increase in seed cotton yield

Conclusion

Use of Zn and B containing fertilizers in medium black calcareous soils of saurashtra region in cotton found beneficial

NICRA Project: Groundnut Experiment (Year: 2011-12)

Comparison of different groundnut varieties in the form of Pod yield, Kernel yield and Haulm yield

Objectives:

Comparison of groundnut variety in the form of Pod, Kernel and Haulm Yield.....

General Information For Trail:

No. Of Farmer: 1 **No. Of Variety: 4**

Types: ***Spanish (Two Variety)***

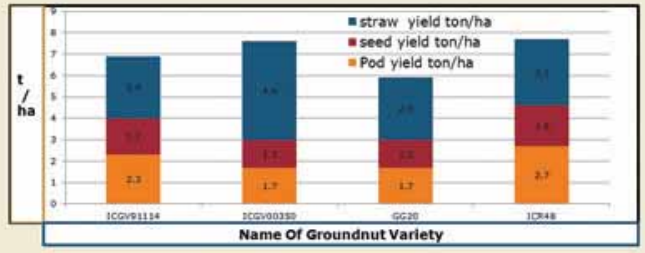
1. ICGV91114 2. ICGV00350

Virginia (Two Variety)

1. GG20 2. ICR48

Season: *Kharif* **Plot Size:** 15 x 9.5 m

Variety	Pod yield Ton / ha	Kernel yield Ton /ha	Haulm yield Ton / ha
ICGV91114	2.3	1.7	2.9
ICGV00350	1.7	1.3	4.6
GG20	**1.7**	**1.3**	**2.9**
ICR48	2.7	1.9	3.1



Result

ICR48 Variety produced highest both kernel and pod yields.

ICGV00350 Variety gave highest haulm yield over other varieties.

Conclusion

Among these four groundnut varieties, ICR48 found superiors with respect to production of economical yields of groundnut.

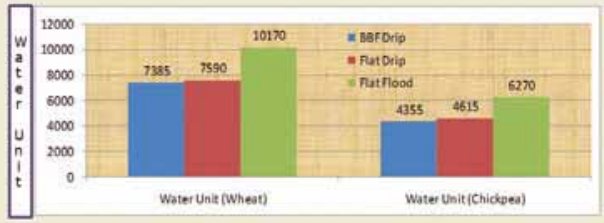
Water Impact Calculation (WIC) Trial

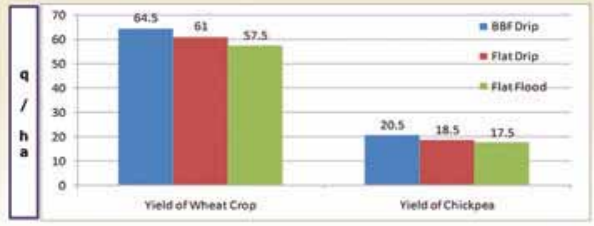
GENERAL INFORMATION

- No. of farmers -4
- Area – 4 acres
- Crop & Variety :
  - (1) Wheat: GHW-496
  - (2) Chickpea: G-2

Key observations:

- Measurement of irrigation water & production.
- Soil moisture monitoring at different soil depth 15,30,45cm
- Method of irrigation
  - (1) BBF drip
  - (2) Flat drip
  - (3) Flat flood





Result in water measurement:

- 27 % water is saved in BBF Drip method compare with Flat food
- 25 % water is saved in Flat drip irrigation method compare with Flat Flood irrigation method

Result in yield measurement:

- 12.25 % increase in crop production in BBF Drip irrigation method compare with Flat Flood
- 7.0 % Increase in crop production in Flat Drip Irrigation method compare with Flat Flood.

Ground Level Well Water Observation (m)

Objective:

Role & Effect of water harvesting structure in recharge of ground water level

General information about work done in village

- No .Of Nala Plug: 4
- No. Of Check Dam: 3
- No. Of Filed Outlet: 10
- Filed bund: 750 RMT

No.	Month	Year	
		2010-11	2011-12
1	April	17.55	12.80
2	May	17.31	13.26
3	June	16.16	14.86
4	July	10.93	10.72
5	August	1.78	1.67
6	September	1.44	1.58
7	October	3.57	3.10
8	November	4.92	4.50
9	December	5.25	5.10
10	January	7.85	8.10
11	February	10.22	10.25
12	March	11.78	11.50

Innovative agricultural intervention by farmer through by our direction

Name of farmer:-N. S. Busa
Name of crop:-Water melon (Taiwan Tela)
Area of crop:-1.35 Acer
Irrigation System:-Drip with Mulching
Total production: 245 q
Income Rs:- 2,45,000 Rs (10 Rs / Kg)
Expenditure Rs.:-74,000 Rs
Net profit Rs.:-1,71,000 Rs

Other Field Activities – Cattle Development Program

Sr	Activities	Achievement	Remark
1	A.I.	177	
2	P.D (Pregnancy Diagnosis)	52	
3	Calving	3	
4	Animal Health Camp	4	(83 Cattle)
5	De worming	1200 Dose	
6	Vaccination	302 Dose	FMD
7	Mineral Powder	80 Kg	

Rain fall data for the year: 2010-2011 (mm)

Sr.	Month	Particulars	Year 2010-11	Year 2011-12
1	June	days	7	4
		Rain	85.75	64.1
2	July	days	23	14
		Rain	281.5	447
3	August	Days	20	16
		Rain	287	275.75
4	September	days	8	16
		Rain	83	207.5
5	October	Days	3	-
		Rain	44	-
6	November	days	6	-
		Rain	73.5	-
7	Total	days	67	50
		Total Rain	1054.75	994.35

Year	Maxi. Temperature	Mini. Temperature
2011-12	45° C	4°C


Different Watershed Structure
Field Outlet
Nala Plug Work
Check Dam


Pasture Land Development
Work In Progress
Position Before Work Star
Name Of Grass: Europlus (1.5 ha) &
Staylohamata (1.5 ha)
Area: 3 ha
Sowing: Monsoon
Final Result Of Field


Thank You

Model Watershed,Nuagoan,Khunta, Mayurbhanja,Odissa

By: ICRISAT, Shristi, KVK and Watershed Committee

Title of the Project

Model Watersheds for Sustaining Agricultural Productivity and Improved Livelihoods

Mayurbhanja District, Orissa

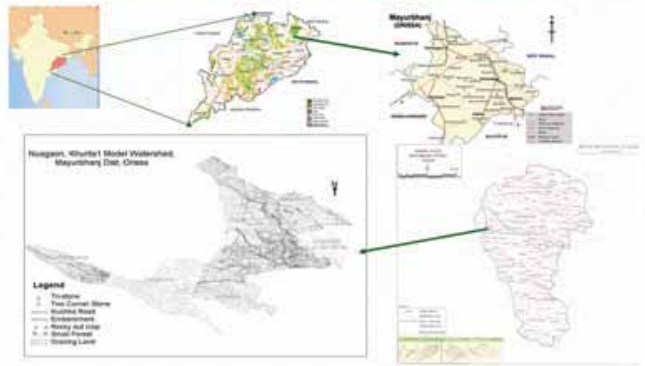
Specific Objectives

A: *To improve* rural livelihood activities through participatory WDP with consortium approach through application of cost- effective integrated genetic and NRM practices appropriate to socio economic conditions of farmers and natural resources of the ecosystem

B: To establish one Model Site of Learning at Mayurbhanj district, Orissa for high rainfall dry land areas (>1100 mm rainfall per annum) for demonstrating the potential of rainfed areas by adopting IWRM approach

C: To build capacity of different stakeholders in the areas of integrated watershed management for enhancing impact of watershed programs.

Location of model watershed...



Watershed Features

Villages	Dabak, Nuagaon, Baniabasa, Dengam, Srirampur, Rangamatia, Chapaldihi, Mahuldihi
Gram Panchayat	Bholagadia, Dengam and Badapathara
District/Block	Mayurbhanja/Khunta
Total HHs	1035(according to PRA)
Total population	4657(according to PRA)
Annual rainfall	1250mm
Nos of open well for irrigation	1
Cropping pattern	Mostly mono crop(Khariff paddy), little paddy in rabi where water is available
Soil type	Red

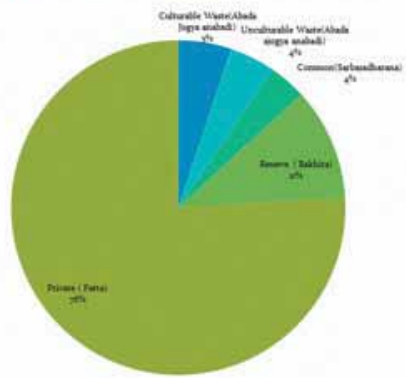
Watershed Key Livelihoods(before intervention)

Biomass based	Farm :Paddy, Bubai, Vegetable Forest :Siali, Fuel wood, Honey, Palua Off farm :Livestock (Goatery, poultry)
Skill/caste based	Bubai rope making, Potter, Bamboo artisan
Trade	Vegetable vending, petty business
Other	Wage labour, Migration

Collaborating Organization...

- ICRISAT (International Crop Research Institute for Semi-Arid Tropics), Hyderabad
- KVK (Krishi Vigyan Kendra), OUAT, Syamakhunta, Mayurbhanja
- SHRISTI (Society for Harmonious Renaissance Innovative of Simple Technological Initiatives), Bhubaneswar
- Model Watershed Committee, Nuagaon

Land type in MWS



Process that followed for implementation

- Village meeting, sharing the objective
- Discuss on project support and contribution
- Discuss the problems which may arise
- Collects the feedbacks
- Prepare a list for each village
- Visit the area, Discuss with the individual farmer
- If needed provided exposure
- Than finalize the quantity of activity

Progress for the year 2011_12

Community institution

Progress

- Working with 39 nos of WSHG having membership 410
- Regular monthly meetings and Savings
- Mobilize savings Rs 1,92,400/- (last year 1,02,400/-) through WSHG
- 4 new WSHG are formed during this year
- 5 WSHG are linked(Amount Rs 15. lac) through SGSY for Sabai and poultry
- 2 WSHG are involved in Mid –Day meal
- Mobilize savings Rs 66,980/- through farmers club(137 member)
- Farmers club are conducting training programme on crop production

Capacity building

SL	Capacity building	No of times	Total participants
1	Leadership Trng	2	60
3	Mushroom Trng	1	20
4	Plantation	1	32
5	SRI	1	23
6	Upland cropping	2	45
7	Pickles Making	1	32
8	Participation in Exhibition	1	12
9	Farmers Field day	1	518

Income Generation Activity(IGA)

Progress:

- 70 quintals vermin compost are cultivated from 32 Pit(10*3*3 feet)
- 32 kitchen garden for nutritional suppliment along with additional income of Rs 1500- 2000/-.
- 1 WSHG raised nursery. Raised(Glricidia, Papaya, Lemon, drumstick, Jackfruit) by taking loan Rs 10,000/- with monthly interest is 0.5%. Group earn Rs 34340/- within 6 months.
- 2000 Banaraja birds are given to 110 women member. The survival rate is 80%. Within a period of 8-12 months , each bird sells on Rs 200-250/-

Continued IGA...

- 450 beds of paddy straw mushroom are raised by 2 WSHG. Average production is 850gm per bed. They sold it Rs 100/- per Kg.
- 3 farmers club engaged in fish cultivation in leased pond. On an investment of Rs 10,000/- every one gets 2-3quintal of fish. The average selling price is Rs 100/- per kg.
- Members of WSHG are involved in making pickles of mango and jackfruit. 1 qtl of pickles are prepared by members.
- 2 WSHG are involved in Honey business with ORMAS

Soil water management interventions

Progress:

- 5 nos of Dug well in 5 villages
- 22 ha. Dahi lands are in cashew and mango plantation
- 5 ha. Dahi and homestead land are in mango plantation
- 4500 nos of Glricidia planted in field bond and homestead

Productivity enhancement

Results:

- Yield increased in each crop against last year.
- SRI and Line sowing adopted by farmers gradually
- One crop of paddy to a second crop is in progress
- Up land cropping pattern is changing from paddy to non paddy
- Area, Farmers and Crop under Rabi seasons is constantly increasing
- Farmers gradually aware on application of micronutrient
- 1 maize farmers selected by OUAT from the entire district.
- 1 farmer nominated for ASPEE foundation award for maize cultivation

Details of crop production

Khariff Crop	Area(acre)	Farmers(nos)	Variety	Yld(qtl/Ha) 2010_11
Maize	61	58	Jk_suravi gold	28
Ground nut	5	8	ICGS	16
Pigeon pea	6	18	ICPL ,ICPH	10
New variety paddy	75	58	Manaswani	34
SRI	15	2	Swarna	71
Rabi Crop	Area(acre)	Farmers(nos)	Variety	Yield(qtl/Ha)
SRI	20	14	pratikshya	65
Wheat	5	3	Oriseed	25-28
Horse gram	25	15	Oriseed	5.5
Potato	3	6	Oriseed	100-125
Ground nut	22	16	ICGS	Not harvest
Watermelon	10	6	Variety from KVK	-
Vegetable	20	15	Oriseed	-

Area(Ha) comparison

Crop	Area(0910)	Area(1011)	Area (1112)
N. p. variety	2.4	12	75
SRI	0	10.8	35
Maize	2	4.8	32
G.Nut	2.4	12	17
Pigeon pea	3.6	1.6	6
Chick Pea	4	14	0
Horse Gram	0	8.8	16
Wheat	0	2	5
Potato	0	2	3
Vegetable	2	16	20
Total	**17.6**	**90**	**209**

Farmer participation(comparison)

Crop	09-10	10-11	11-12
N. paddy	26	15	58
SRI	0	22	16
Maize	25	46	58
G.Nut	18	23	29
Pigen pea	21	6	18
H. Gram	0	15	15
Wheat	0	3	3
Potato	0	7	6
Vegetable	21	98	126
Total	**126**	**266**	**328**

Yield comparision

Crop	Y(qtl/Ha) 09_10	Y(qtl/Ha) 10_11	Y(qtl/Ha) 11_12
New variety paddy	27	30	34
SRI	0	70	71
Maize	20	25	28
Groundnut	12.5	15	16
Pigeon pea	7.5	9	10
horse gram	0	5	5.5
Wheat	0	28	28
Potato	0	125	128

Micronutrient consumption

SL	Nutrient	Unit consumption	2009-10	2010-11	2011-12
1	Paper mill sludge	Bag	100	400	400
2	Zypsum	Bag	100	400	500
3	Zinc	Kg	45	250	1800
4	Boron	Kg	10	120	150
5	Bio-fertlizer	Pkt	20	200	240

Problem faced in productive enhancement

- Limited farm mechanization
- Small size plot, difficult in use of implements
- Land ownership(20% lands are owned by non watershed villagers)
- 30% lands are under Sabai cultivation
- Change of mind set among tribal community to adopt new technology and crop
- Lack of scientific knowledge on agriculture

Convergence

- Plantation of Mango and Cashew in 22 ha through NHM
- Sanctioned 6 farm pond from block through grampanchayat
- Facilitation for construction of 1 drop structure through ITDA
- SRI in 6 Ha. through Dept. of Agriculture
- Mobilized 27lac for check dam from Minor Irrigation
- Mobilized 15,thousands from ATMA for Pond based agriculture.

Fund Flow

Challenges ahead...

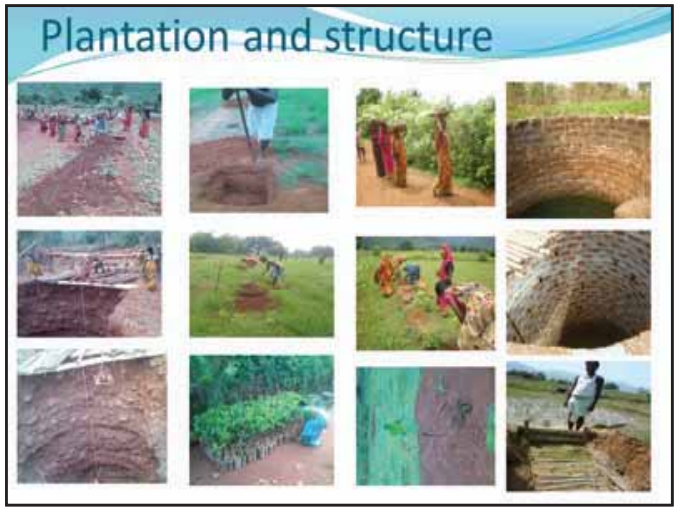
- Timely fund availability
- On time implementation of planned activities
- Plantation in Sabai land
- Creation of Irrigation Facilities
- Maximum coverage of upland under non paddy
- Farm mechanization
- Effective use of soil moisture for Rabi cropping

SNAPSHOT OF ACTIVITIES

Capacity Building

IGA


Productive Enhancement


Plantation and structure


Thank You
Shishirsarangi

MODEL WATERSHED DEVELOPMENT PROJECT FOR SUSTAINABLE AGRICULTURE AND POVERTY REDUCTION

Presentation By

JSVS PEDO

Jan Shiksha Evam Vikas Sangathan (PEDO)

Dungarpur- Rajasthan

Name of the Watershed: Model watershed Saram

Location: Gram Panchayat Veerpur, Bichhiwara Panchayat Samiti, District Dungarpur (Rajasthan)

Bio-physical characteristics of SARAM Watershed

Revenue Village	6 villages: Saram, Virpur, Gesuon-ka-waga, Baka-Khada, Sara and Himmatpur
Name of the Watershed	***Model watershed Saram***
Panchayat	Virpur
Tehsil	Dungarpur
Panchayat Samiti	Bicchiwara
District	Dungarpur
State	Rajasthan
Location	Southern part of Rajasthan (Agro Climate zone IV B Udaipur)
Total Area of revenue village	1353 ha
Total irrigated area	128 ha
Un irrigated area	765 ha
Cultural waste	149 ha
Area un available for cultivation	310 ha
Agro Climate	Rain fed climate

Activity Plan for 2011-12

Activity-1	**Crop production Enhancement**
	Best Bet Technology Options
A	Kharif (Maize)
	Rabi (wheat)
	Crop and cropping Systems
	Seed replacement
	Kharif-Maize
	Rabi-Wheat
	Improving Planting methods
B	Maize with Black Gram
	Maize with Pigeon Pea
	Varietal Trails
	Kharif- Maize
	Rabi- Chick-pea / Mustard
	Crop Diversification:
	Fennel, Castor, Cotton, Ground-nut, Turmeric
Activity-2	**Fodder Production**
	Sorghum & Barseem
	Livestock Improvement
Activity-3	Animal Health Camps- Linking with Government Programs
	Artificial Insemination Camps

Activity Plan for 2011-12

	Income Generation activities through SHGs, WSCs and WUGs
Activity-4	Seasonal vegetable / spice cultivation
	Value Addition unit
	Nursery Raising (Gliricidia)
	Vermin composting
	Soil and water conservation Works
Activity-5	Farm pond / earthen pond
	Masonry Check Dams (ANICUT)
	Renovation of Wells & Drip irrigation
	Human resource management
Activity-6	Training (Strengthening of Village level Institutions for Watershed)
	Monthly review and planning meetings

Crop Production Enhancement

- **Best bet technology options**
  - **Kharif**
    - Maize: Two Demo plots of BIO 9220 -Maize with Integrated Micro-Nutrients in 0.32 Ha
  - **Rabi**
    - Wheat: Eleven Demo Plots of RAJ 4037 -Wheat with Integrated Micro-Nutrients in 1.76 Ha.

Crop Production Enhancement

- Crops and Cropping systems
  - Seed replacement
    - Kharif- Maize
      - High yield seed of Variety JK 3672, JK 4212 & JK 175 were sown in a total area of about 129 Ha (Under the Golden range program of TAD, Govt. of Rajasthan) – 5KG of seed was provided to each farmer
    - Rabi- Wheat
      - High yield seed of variety RAJ 4037 was sown by 355 farmers in about 176 Ha of land.
  - Improving Planting Methods- Inter Cropping
    - Maize with black-gram: this Inter-crop cultivation was done with 45 farmers in about 5 Ha of Land
    - Maize with Pigeon Pea: this Inter-crop cultivation was done in 15 Ha of land by 117 Farmers
    - Maize with Cotton: was done with 23 farmers in 3 Ha. Of land

Crop Production Enhancement

- Crop Diversification
  - Turmeric: 18 farmers had sown the turmeric crop in their lands producing about 3,686.5 KG of raw turmeric. It provided an income of Rs. 1,17,968 to the farmers.

Crop	Farmers cultivating the crop	Area in Ha
Fennel	70	14
Castor	63	13
Cotton	394	67.2
Groundnut	10	1.5

Fodder production

- **Sorghum:** 76 farmers had sown Sorghum in about 8 Ha of land for fodder production

Horticulture based activities

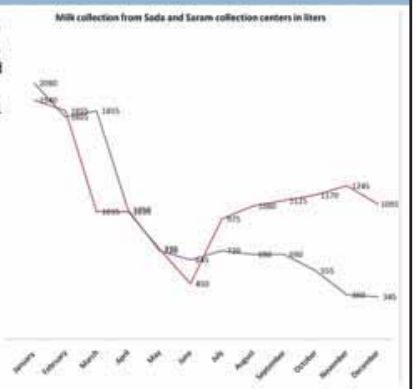
- **Mango plantation:** 2 orchards were developed in the watershed region

Livestock Improvement

- **Animal Health Camps:** A total of 19 cows, 27 Oxen, 17 Buffaloes and 75 goats were treated in the Two Animal Health camps organized in the watershed region between July 2011 and March 2012.
- **Artificial Insemination:** with the help of Department of Animal Husbandry, A total of 11 cows and 20 buffaloes were artificially inseminated in the watershed region.

Income generation Activities through Self Help Groups, Water Shed Committees and Water User's Groups

- **Milk collection center:** The Two centers Located in Saram & Sada Villages have collected about 25,255 liters of milk during Jan 2011 and Dec 2011 from its members of the two milk collection centers. It generated and additional income of about Rs. 8,80,000 (and a bonus of about Rs.1,60,000) for 48 families.



Income generation Activities through Self Help Groups, Water Shed Committees and Water User's Groups

- **Seasonal vegetable:** Lady finger, beans, tomatoes and Brinjal were sown by the local farmers.
- **Spice cultivation:** Turmeric, Ginger, garlic and Chilies.
- **Value addition unit:** Turmeric processing Unit.

Income Generation Activities

- **Nursery raising- GLIRICIDIA:** Nursery was raised by the farmer's group and 4065 plants were distributed for Live hedge and for production of organic manure.
- **Vermin compost pits:** 18 pits have been constructed in partnership with farmers of the watershed area. This exercise is to reduce the use of Chemical fertilizers . A Total of 20,300 KG of manure has been produced and used by these farmers. This has reduced the dependency on chemical fertilizers and manures, and has also enhanced the quality of food crops.

Soil & Water conservation works

- **Farm Pond / earthen pond:** 2 farm ponds and 2 earthen ponds
- Masonry Check Dam (**Anicut**): 3 completed and 2 under construction
- **Drip Irrigation:** 2 drip irrigation systems were installed as Demo by ICRISAT. 83 government subsidized Drip irrigation projects have been executed, by Dept. of Agriculture, majorly utilized for Cotton seed production.

Human Resource Development

- **Trainings**
  - Strengthening of Community based Organization
    - Training of water User's group
      - Turmeric processing and production training: One day workshop at Watda Field office was organized and was attended by 22 farmers (16 males and 6 females)
      - Nursery Raising Training
      - Anicut construction methodology & training.
- **Monthly review & Planning of Watershed activities**

Performance of the Self Help Groups

- Based on the principles of SELF HELP, these were women's groups for saving and credit linkages, with formal financial institutions.
- A portion of the livelihood revolving fund of Rs.200,000 is used by the SHG members for investments in agro-based livelihood activities.
- **Total savings till March 2012 of the 19 SHGs in the watershed area was Rs. 22,62,658.** With a Saving loan Outstanding as on 31st March 2012 was Rs. 18,58,210 and Bank Loan Outstanding was Rs.19,93,402 (Total Loan Rs.37,51,612)
- The Loan imparted to the members have been majorly invested into Agricultural inputs and Milch cattle, and also on education and Health.

Project Impact

- Alternative sources for Livelihood generation with Enhanced (Quality & Quantity) agriculture production
- Use of improved technologies in agriculture and Capacity Building and skill enhancement of farmers
- Watershed level Institutional development & formation of village level network for developmental activities
- Easy accessibility of Marketing and other services
- Convergence of programs
- Promotion of high value crops
- Development of seed bank
- Rain water harvesting & Ground water recharging
- Increase of women's participation in agriculture related activities

Collaborations

- ITC
- National Agricultural Innovation Project
- MNREGA (16 sites of water conservations covered)
- Krishi Vigyan Kendra: Sirohi, Banswara, Dungarpur
- Agriculture Department
- Horticulture Department
- Animal Husbandry Department
- Maharana Pratap Agriculture University, Udaipur

Thank You

Objectives

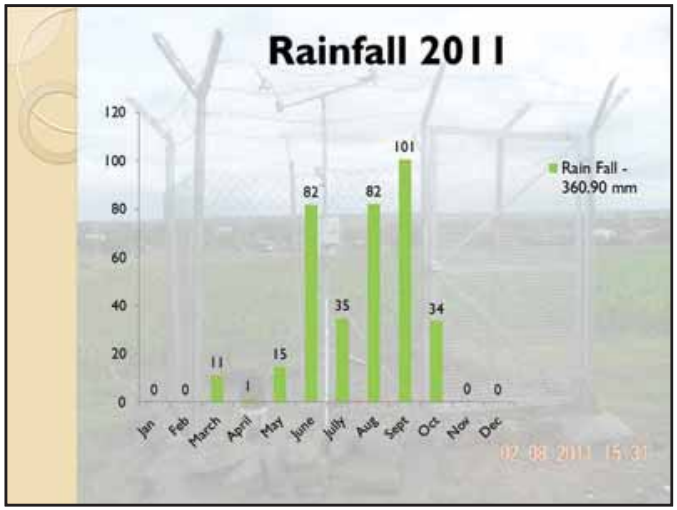
- To improve rural livelihoods through participatory watershed development program with consortium approach through application of cost- effective integrated genetic and natural resource management practices appropriate to socio economic conditions of farmers and natural resources of the ecosystem
- To establish a Model Site of Learning in Ahmed Nagar district , Maharashtra for demonstrating the potential of rainfed areas by adopting integrated water resource management approach

Location

Dolasane-Bambalewadi Project is connected by National Highway No. 50 and is situated 22 km towards south of Sangamner town of Ahmednagar district (Maharashtra State).

Demographic Details

- The total geographical area of the project is 1563 Ha
- Forest land area is 463.59 Ha.
- Total number of households is 325 and total population is 1727
- 41% of the total population belongs to scheduled caste and Scheduled tribes
- Exact location of the village / watershed is Lat: 19° 25' S, Long- 74° 10' E



Soil and water conservation Measures

- Continuous Counter Trenches – 10 Ha.
- Counter Filed Bund -120 Ha.
- Gully Plug - 25
- Loose bolder Structures - 46
- Gabion Structures - 01
- Farm Pond - 13
- Earthen Nalla Bund – 01
- Check Dam - 02

Soil and Water Conservation Measures

Continuous counter Trenches

Field Bund

Out-Let

Gully Plugs

Soil and Water Conservation Measures

Losse Bolders

Gabion Structure

Earthen Nalla Bund

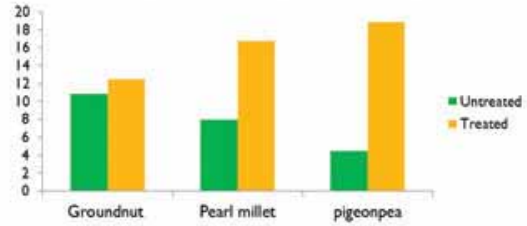
Farm Pond

Agriculture

- Focus on modified and advanced agricultural practices related to
- in situ and ex situ moisture conservation,
- Appropriate basal doses and improved seed.
- 7 farmers installed the vermi bed.
- 42 farmers were covered in the program during Khariff season 2011.
- One wheat demo plot completed in Rabi 2011. grain yield is increase by 163 % compare to Control Plot.

Agriculture

		Yield Kg/Ha.	
Name of Crop	No of trial plot	Untreated	Treated
Ground Nut	22	1083.33	1245.8
Pearl Millet	12	793.75	1180
Pigeonpea	8	447.2	750



In situ water harvesting systems

Farmers Practice / Improved Practice

Farmers Practice/Improved Practice

Farmers Practice/ Improved Practice

Horticultural Plot - Pomegranate

Agro-Advisory

Impact

- Women Participation leads to increase the SHG group.
- Farmers were aware and come forward for agricultural Plan.
- The Display of weather data leads to more participation of villagers.
- in situ and ex situ water harvesting systems adapted for strengthening the resilience to drought in tropical agriculture.
- Decrease in Migration by 20 % due to Watershed work.

Awareness Programs

- Gramsabha - 04
- Farmer Meetings - 04
- Women Meeting - 03
- Mahila Melawa - 01
- Kalapathak - 01
- Exposure visit - 01
- Field day - 01
- Health Camp - 01
- SHG Formation - 11
- Watershed Committee Training -01
- SHG Training - 02

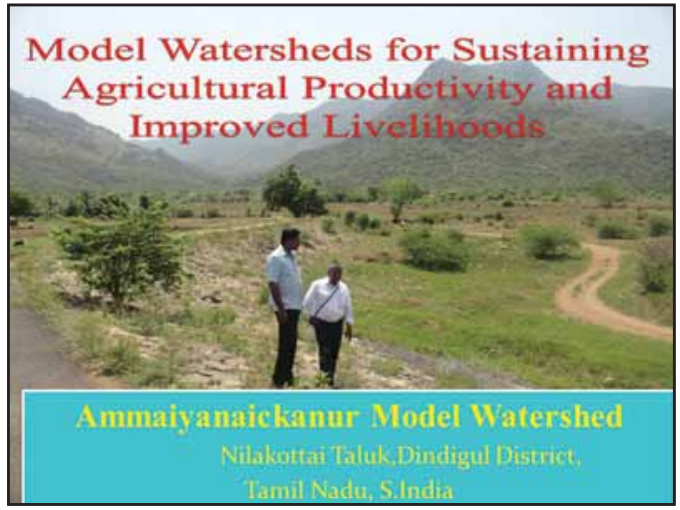
Events

- Installation of Auto Weather Station.
- Installation of Soil Erosion measurement unit
- Mr. Sudi monitoring Visit to project in August 2011.
- Mid term evaluation in Dec 2011.
- People of Project were participated in Regional Biodiversity Festival.

Learning's

- Improved practice has significantly increased the yield compare to farmers practice
- If agri inputs are made available to farmers at the right time, we can reap rich benefits from the program.
- Agro- Advisory leads to increase the participation of farmer in project.

Runoff and soil loss monitoring unit



Consortium partners

- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- Department of Land Resources, Ministry of Rural Development ,Government of India
- Government of Tamil Nadu, District Administration, Dindigul District, Tamilnadu
- Centre for Improved Health and Environment Protection (CIRHEP)

Ammaiyanaickanur Model Watershed

- State : Tamil Nadu
- District : Dindigul
- Block : Nilakottai
- Panchayats : Ammaiyanaickanur
  : Malaiyagoundanpatti
  : Kullalagundu
  : Pallapatti
- Villages : Rajathanikottai
  : Sadaiyandipuram
  : Nakkampatti
  : Pottikulam
  : Kannimanagar
  : Gopalapuram

Watershed Location

22 kms from Dindigul District Head quarter.

12 kms from Nilakottai Taluk Head quarter.

The watershed locates between

Latitude -10° 7′ 58.8″ north to 10° 12′ 43.2″ north

Longitude-77° 54′ 7.2″ east to 77° 58′ 1.2″ east

Watershed Details

Land Area Details

Micro watershed Code numbers	Total area in ha.	Treatable area in ha.
4A2A4b4c1d2a	417.0	324.01
4A2A4b4c1d1	272.0	363.78
4A2A4b4b3c	290.0	332.52
4A2A4b4b3b	250.0	214.24
4A2A4b4b3a	500.0	201.42
4A2A4b4a4	767.0	137.93
Total	2496.0	1574.0

Watershed Committee Members Details

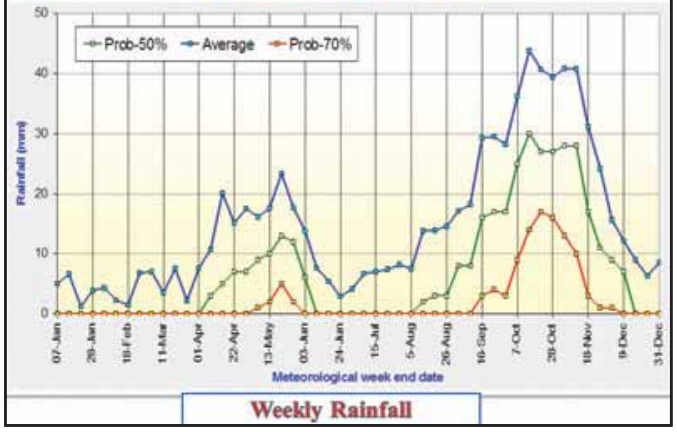
Category of members	Male	Female	Total
Area groups	6	6	12
Panchayat	2	-	2
SHG	-	3	3
SC/ST	2	1	3
Landless	-	3	3
PIA	1	-	1
Total	11	13	24

Watershed Committee Members

Area Group

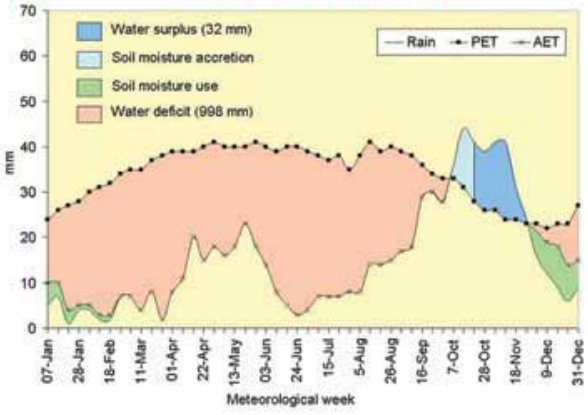
Automatic & Manual Weather Station

Rainfall Details



Weekly Rainfall

Water Balance



Open well & Bore wells Details

Soil Nutrients Analyses

- No. of Soil Samples : 80 no's
- Selection of Soil Samples : Upper land – Big, Medium, Small Farmers
  : Middle land – Big, Medium, Small Farmers
  : Lower land – Big, Medium, Small Farmers

Work plan

Activity	2010 - 2011 Target (1)	Achievement (2)	Balance (3)	2011 - 2012 Target (4)	Achievement (5)	Balance (6)	Target (1+4)	Achieve Ment (2+5)	Total balance (3+6)
Management component									
Base line data collection	6 Villages	6 Villages					6	6	
Committee registration	1 no	1 no					1	1	
Soil and Water conservation and water harvesting structures									
Diversion drain	1150 m	1150 m		1500 m		1500 m	2650 m	1150 m	1500 m
Gliricidia hedge plant	1150m	1150 m					1150 m	1150 m	
Field bunding	2500 m	1689 m	811 m	1500 m		1500 m	4000 m	1689 m	2311 m

Work plan

Activity	2010 – 2011			2011 – 2012			Target	Achieve	Total
	Target (1)	Achievement (2)	Balance (3)	Target (4)	Achievement (5)	Balance (6)	(1+4)	Ment (2+5)	balance (3+6)
Soil and Water conservation and water harvesting structure									
Loose boulder nalla plug	20 no's	20 no's		5 no's		5 no's	25 no's	20 no's	5 no's
Earthen check dam	10 nos	10 no's		5 no's	5 no's		15 no's	15 no's	
Loose stone Nalla plug	40 no's	40 no's		15 no's		15 no's	55 no's	40 no's	15 no's
Management component									
Check dams	1 no's	2 no's		8 no's	5 no's	5 no's	9 no's	5 no's	4 no's
Groundwater recharging bore open with	20 no's	5 no's		10 no's		10 no's	30 no's	5 no's	25 no's

Work plan

Activity	2010 – 2011			2011 – 2012			Target	Achieve	Total
	Target (1)	Achievement (2)	Balance (3)	Target (4)	Achievement (5)	Balance (6)	(1+4)	Ment (2+5)	balance (3+6)
Productivity Enhancement and micro enterprises activities									
Farmers Participatory Trials	30 ha	20 ha	30 ha	30 ha	2 ha	48 ha	100 ha	22 ha	78 ha
Vermi composting	20 no's	17 no's	3 no's				20 no's	17 no's	3 no's
Revolving fund for SHG	10 groups	3 groups	7 groups				10 groups	3 groups	7 groups
Capacity building									
WC members, SHG members and farmers on new technologies	1 no		1 no				1 no		1 no

Work plan

Activity	2010 – 2011			2011 – 2012			Target	Achieve	Total
	Target (1)	Achievement (2)	Balance (3)	Target (4)	Achievement (5)	Balance (6)	(1+4)	Ment (2+5)	balance (3+6)
Alternate land use system									
Horticulture	30 ha	30 ha					30 ha	30 ha	
Agro forestry	20 ha	20 ha					20 ha	20 ha	
Weather station installation	2 no's	2 no's					2 no's	2 no's	
Kitchen garden	100 no's	50 no's	50 no's	100 no's	10 no's	90 no's	200 no's	60 no's	140 no's

Earthen Check Dam

- Achievement : 15 no's
- No. of Wells Benefited : 27 wells
- No. of Bore wells Benefited : 19 Bore wells
- No. of hectare irrigated area increased : 16 ha
- No. of Farmers benefited : 68 Farmers

Earthen Check Dam




Masonry Check Dam

- Achievement : 5 no's
- No. of Wells benefited : 15 no's
- No. of Bore wells : 12 no's
- No. Hectare irrigated area increased : 11 Ha
- No. of Farmers Benefited : 48 farmers



Masonry check dam


Loose Stone Nalla Plug

- Achievement : 40 no's

Impact of Structure

- Reduce soil Erosion
- Ground Water Increase
- Reduce water velocity


Loose Boulder Nalla Plug

- Achievement : 20 no's

Impact of Structure

- Reduce Water Velocity
- Reduce Soil Erosion
- Ground Water increase


Field Bund

- Achievement : 1689 m
- No. of Farmers benefited : 17 farmers
- No. of hectare cultivated : 42 hectare


Diversion Drain

- Achievement : 1150 m

Impact of Structure

- Reduce Water velocity
- Reduce Soil erosion



Well Recharge Thru Open Wells

- Achievement : 5 no's
- No. of wells benefited : 5 no's
- No. of hectare Irrigated : 12 ha.


Tanks

- Target : 1 no
- Achievement : 1 no
- No. of Wells near by tank : 7 no's
- No. of bore wells near by tank : 9 no's
- No. of hectare benefiting from this Tank : 11 ha


Dugout Ponds

- Target : 1 no
- Achievement : 1 no
- No. of Wells benefited : 6 wells
- No. of hectare cultivated : 7 ha.


Productivity Enhancement Crop Trials Details

- No. of Villages covered : 3 Villages
- No. of hectare covered : 22 ha
- No. of families involved : 20 families

Crop trials

Crop	Variety	Seed (Kg)	Area (ha)	Macro Nutrient	Micro Nutrients
Pearl millets	CO(CU)-9	9.0	12	DAP, FYM, Urea	Boron, Zinc Sulphate
	ICMV-221	48	64	DAP, FYM, Urea	Boron, Zinc Sulphate
	ICTP-8203	21	28	DAP, FYM, Urea	Boron, Zinc Sulphate
Sorghum	M-35-1	55	44	DAP, FYM, Urea	Boron, Zinc Sulphate
	CSV-15	15	12	DAP, FYM, Urea	Boron, Zinc Sulphate
Cowpea	CO(CP)-7		02	DAP, FYM, Urea	Boron, Zinc Sulphate
Pigeonpea	ICPL-85063	-	02	DAP, FYM, Urea	Boron, Zinc Sulphate
Groundnut	ICGV-91114	-	0.8	DAP, 17-17-17 complex	Boron, Zinc Sulphate, Gypsum
Maize	Nk-6240		0.8	DAP, 17-17-17 complex	Boron, Zinc Sulphate

crop trials - comparisons

Local Practice

Crops	Variety	Micro nutrients	Macro nutrients	Yield kg/ ha.
Pearl millet	Local Variety	-	FYM – 2 loads Urea - 50	650
Sorghum	Local Variety	-	Urea – 50	600
Cow pea	Local Variety	-	FYM – 2 loads Urea - 50	350
Pigeon pea	Local Variety	-	Urea - 50	250
Ground nut	Local Variety	-	Complex - 100	2600
Maize	Local Variety	-	Complex -	1250

Improved Practice

Crops	Variety	Micro nutrients	Macro nutrients	Yield kg/ ha.
Pearl millet	ICMV – 221	Zinc sulphate – 50 Borax – 5	DAP – 200 Urea - 75	850
Sorghum	M 35-1	Zinc sulphate – 50 Borax – 5	DAP – 200 Urea - 75	950
Cow pea	CO(CP) - 7	Zinc sulphate – 50 Borax – 5	DAP – 200 Urea - 75	550
Pigeon pea	ICPL - 87041	Zinc sulphate – 50 Borax – 5	DAP – 200 Urea - 75	450
Ground nut	ICGV - 91114	Zinc sulphate – 50 Borax – 5 Gypsum - 200	DAP – Complex -	3500
Maize	NK – 6240	Zinc sulphate – 50 Borax – 5	DAP – Complex -	1600

Crop Trails- Photos

Crop Trials - Photos

Vermi composting

- Achievement : 17 no's
- No. of farmers benefited : 17 Farmers

Impact

- Soil organic matter increase
- Product –Quality, quantity increase

SELF HELP GROUP

- No. of SHG's : 3 Groups
- Total Members : 36 Members
- Revolving fund : Rs. 72,000/.
- Total savings : Rs. 10,800/.

Gliricidia Nursery Maintain by Vinayaga Women's SHG's

- No. of Seedlings raised : 4000 no's
- Rate per Seedling : Rs. 3/-
- No. of Seedlings Sales : 4000 no's
- Total amount : 4000 x 3 = Rs.12000/-
- Total Expenses : Rs. 8000/-
- Net Income for SHG's : Rs . 4000/-

INCOME GENERATING ACTIVITY IN SHG's

Milch animals
Goatary
Country Chicken
Vermi composting




Horticulture Plantation

- Achievement : 30 ha.
- No. of Saplings planted : 4900 Plants
- No. of Farmers benefited : 70 farmers



Agro forestry

- Achievement : 20 ha.
- No. of Seedling planted : 4900 no's
- No. of Farmers Benefited : 45 Farmers




Gliricidia Plants

- Achievement : 1150 m plantation
- No. of Seedlings planted : 8050 plants


Kitchen Garden

- Achievement : 60 no's
- No. of Families benefited : 60 Families

THANK YOU

TVS-ICRISAT-Melkarai Model Watershed Project-*Venkatrangapuram*

Annual Report for-2011-12

ICRISAT Science with a human face

TVS

Profile of Melkarai Watershed Area:

Name of Panchayat:	Venkatrengapuram, Keezhakaduvetti & Singikulam
Name of the Blocks:	**Kalakkad and Cheranmahadevi**
District	: **Tirunelveli**
State	: **Tamilnadu**

- Total no.of Hamlets - 10
- Total Family - 1496
- Total Population - 7137
- Total Extent of Area - 2064.17 hec
- Total no of Farmers - 739
- Net Treatable Area - 1242.28 hec
- Wet Land - 271.19 hec
- Water Table Level - 10 to 30 meter
- Income level of family - 5000 to 6000 (78%)

Goal of Melkarai Watershed

The overall goal of this initiative is to improve the livelihoods of rural poor in fragile dryland areas on a sustainable basis by enhancing the impact of integrated watershed management .

Objectives of Melkarai Watershed

1.To establish Model Site of Learning for medium rainfall dryland areas (600-850mm rainfall per annum) for demonstrating the potential of rainfed areas by adopting integrated water resource management approach; and
2.To prepare training modules in the areas of integrated watershed management for developing capacity of different stakeholders.

Scope for Soil & Water Resource Management

- 65% of lands have been fallow land since last 3 decades.
- The water scarcity is largely due to improper management of water resources and not so much due to low water quantity. Rainfall use efficiency in the rainfed areas is low (35 to 55%)
- The rainfall in the tropics is seasonal with erratic distribution and generally comes as torrential downpours, resulting in large runoff and severe soil erosion.
- Agriculture & Allied activities are the main source of income.
- Migration is resulting in this area.

Integrated Strategies of Melkarai Watershed

1. Community Organization & Participation
2. Capacity Building
3. Income Generation Programs
4. Productivity Enhancement
5. Soil and Water Conservation
6. Convergence of Govt.Schemes.
7. Community Development Programs

1.Community Organization & Participation

- Habitation wise project dissemination programs have been organized.
- Community Participation(Contribution through Material or Labor) is being ensured in all respects of project implementation.
- Transparency in project implementation is being ensured through Watershed Committee and User Group members.


Results:

a. 1035.5 hec of Land Covered through Soil and Water Conservation.
b. Community contributes physically and financially by 30 to 50% on watershed projects.

2.Capacity Buildings

Activities	Units	As on March'12
Training WSC-Members	12 Prog	32 members
Exposure Visits	2 Prog	164 Farmers
Women enrolled in SHG	8-Groups	133 women
Training for Women-SHG	5-Prog	387 women


Results:

a.SHG-Women have the savings of Rs.1.35 lakhs and received loan of Rs 6.75 lakhs.The repayment was 97%.
b. 387 women are trained in records and accounts maintenance.

3.Income Generation Program

- 327 SHG women trained in Nursery,Cattle feed,Backyard Poultry,Goat Rearing and Dairy.





Results:

a.327 SHG member were provided with IGP and earn additional income of Rs.1500 to 2500/month

4. Productivity Enhancement

Activities	Units	Total
Dry Land Farming	132.53 Ha	324.2 Ha
Vegetable Cultivation	9.5 Ha	
Fodder Cultivation	52.67 Ha	
Horticulture Plantation	6285 Plants(81.5Ha)	
Gliricidia Plantation	6500 Plants	
Agro-forestry	27500 Plants(48Ha)	
Kitchen Garden	794 HH	**794 Families**
Veterinary Camp	3 nos	**1245 Livestock**
Vermicompost Units	47 nos	**23.5 Tonnes P/M**

Results:

a. 231(58%) farmers got the income of Rs.4500 to 6000 through Dry land farming after 3 decades.
b. Vegetable cultivated 19- farmers got the income of Rs.7000 to 10000.
c. 129.5 Ha of fallow land brought under green cover.
d. 1673 livestock treated, immunized and artificial immunization done.
e. There is no epidemic disease found for livestock since last 3-years.
f. 788-Goats weight have been improved 2 to 3 kgs and The milk yield increase in 358(68%) cows by 7 to 8 litres.

4.1. dry land farming

4.2. vegetable cultivation

4.3. fodder cultivation

4.4. horticulture plantation

4.5. gliricidia plantation

4.6.agro-forestry


4.7.kitchen gardening


4.8.veterinary camp


4.9.vermicompost units


5.Soil & Water Conservation

Activities	Units	Total
Continuous Contour Trench	Hec	83.7
Field Bund	Hec	738.5
Gully Plug	Nos	52
Farm & Percolation Tank	Nos	19
Catch Water Pits	Nos	44

Results:

a. 937.7 hec of fallow land soil loss and water runoff arrested after 3 decades.

b. 7.8km of drain formed and 47 gully plug laid to avoid soil loss and control run off water.

c. The water level increased for 2.5 to 5 mts in 107 wells and 89 bore wells out of 197 and 127.

5.1.continuous contour trench

5.2.field bund

5.3.gully plug

5.4.farm & percolation tank

6. Convergence of Govt. Schemes

Name of the Depart.	Schemes	Units	Total
Horticulture Department	Mango, Anola,Sapota	Nos	4500 plants
	Drip & Sprinkler Irrigation	Hec	12.6
Agriculture Department	Seeds-Vegetable,cereals	Kgs	82kgs
Veterinary Department	Veterinary Camp	Nos	3
	Fodder-Neppiar Co-4	Acre	27
Forest Extension Depart	TCPL & Bund planting	Nos	27500
DRDA &Village Panchayat	MGNREGP-Field bund	Hec	8.7
Agri.Engg.Department	Subsidy Rent Dozzer & Tractor	Hec	729.8

6. Community Development Program

Name of the Activity	Units	Total
Paddy Drum seeder demonstration	Nos	2
Anemia Screening Camp	Nos	7
Nutrition Demonstration & Health Awareness Program	Nos	9
Balwadi Renovation Works	Nos	5

Impacts:

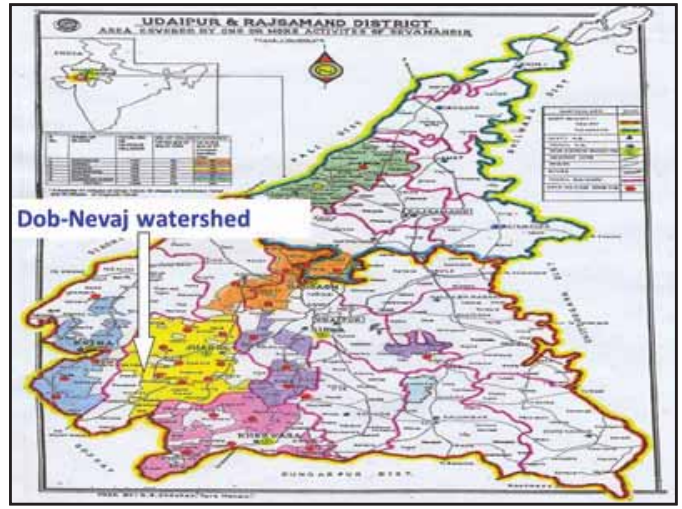
- 937.7 Ha fallow land covered under Soil and Water conservation.Dry Land farming,fodder,horticulture and agroforestry made in 609.5 Ha.
- The water table increased from 40 feet to 10 feet.
- Migration on want to income reduced from 45% to 25%.
- Family income level increased as Rs.8000 to 10000 per month(47%).

Well Water Table Level

Fallow Land Converted as Paddy field

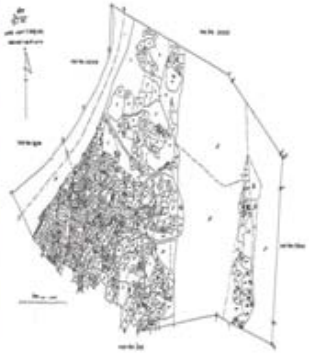

Thank you

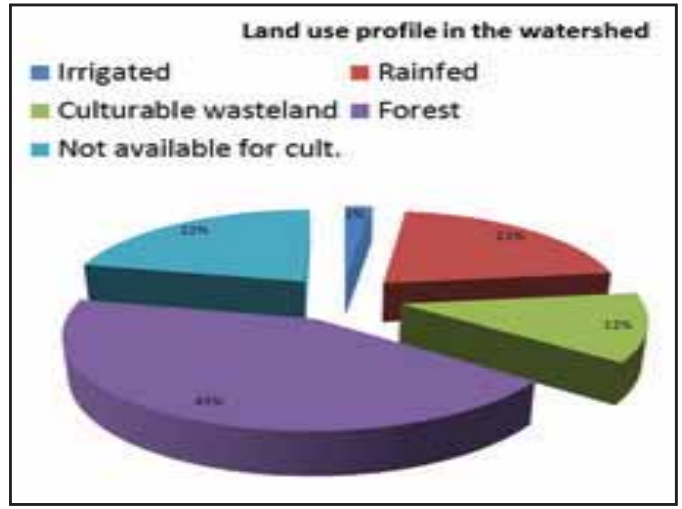
Progress of
Dob-Nevaj Atwal model watershed Seva Mandir, Udaipur



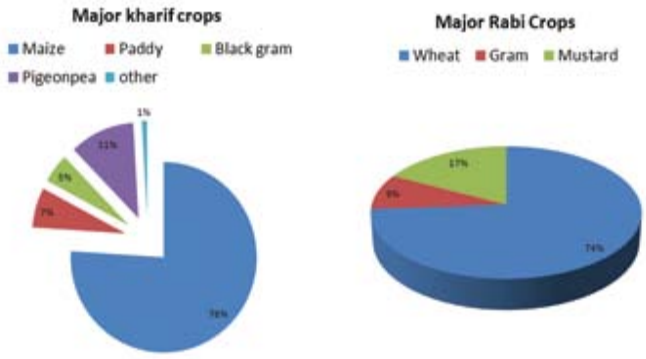
Watershed Details

Macro watershed Name	Gamari I
Macro watershed No	12
Micro watershed No	1,3 and 4
Total geographical area (ha)	1330
Cultivable land (ha)	625
Forest land (ha)	555
Non-arable land (ha)	120
Village Pasture (ha)	30
Villages	Dob, Nevaj and Atwal

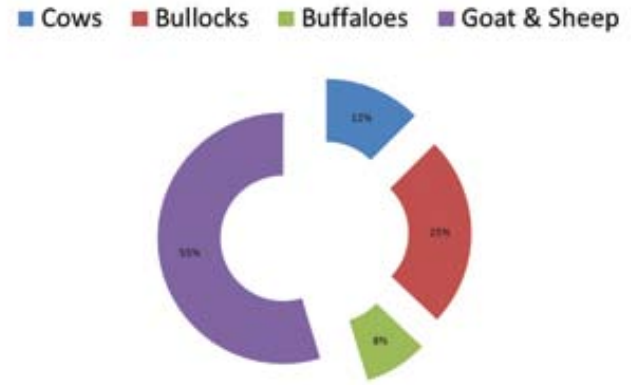




MAJOR CROPS



LIVESTOCK



Consortium partners

- Dob-Nevaj Watershed Committee
- Gram Panchayat-
- Seva Mandir, Udaipur
- ICRISAT
- Maharana Pratap University of Agriculture and Technology, Udaipur
- Departments of Agriculture and Animal husbandry
- Forest Department, Government of Rajasthan, Udaipur
- Department of Watershed Development, Udaipur
- Krishi Vigyan Kendra, Vidya Bhavan, Udaipur

Strategy for watershed Development

- Incorporating own learning and rich experience and expertise of ICRISAT and all other partners.
- Integrated household planning for NRM and production activities
- Productivity enhancement plan and activities to go hand in hand with S&W conservation
- Stress on empowerment of VIs-WDC,SHGs
- Convergence with mainstream development initiatives like NREGS and NRLM
- Collaborating with Government, MPUAT and PRIs

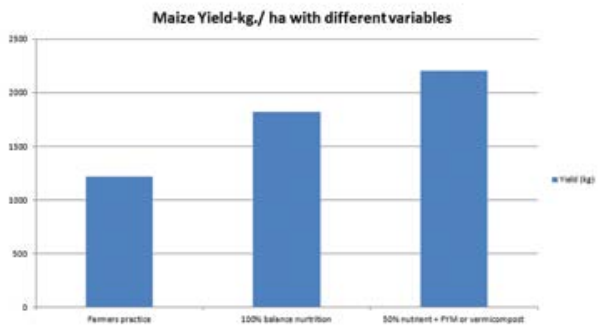
Planned activities accomplished

- Institutional framework
- Baseline and preliminary survey
- Knowledge based entry point activity
- Weather and hydrological monitoring
- Treatment of forestland under JFM
- Production enhancement activity

Soil health Status -Percent farmers' fields deficient in various nutrients at Dob-Navaj model watershed,

Village name	% deficient					
	OC	Av P	Av K	Av S	Av Zn	Av B
Atwal	55	40	0	60	35	90
Dob	60	20	0	65	20	100
Nevaj	78	33	0	72	72	89
Total watershed	63	31	0	66	41	92

Productivity trial



Rabi Trials

- Six trials under nucleus system
- 27 trials of scale up (imp var.+ micro nutr)
- Special research trials (micro nutr. From Morarji Borax)

Trends of of trials on MNs

- Farmers able to understand the science and logic behind micro nutrient trials
- Farmers convinced with the yield figures of use of micro nutrients
- Challenge lies in up scaling the success

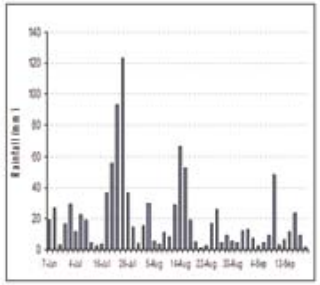
Weather and Hydrological monitoring

Weather station

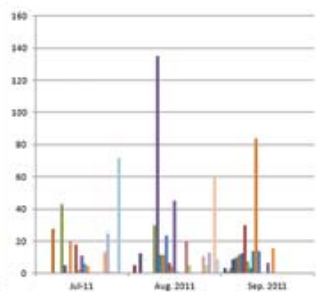
Runoff recorder

Observed rain fall pattern

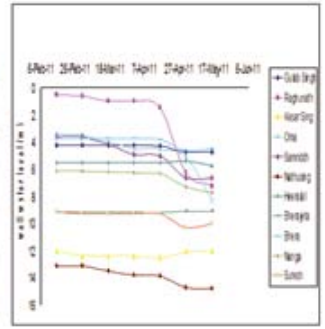
2010



2011



Hydro geological monitoring



VERMICOMPOSTING

- 9 Farmers following the activity
- Farmers applied harvested manure in vegetable and field crops

Joint Forest Management

- Treated 81 hectare forestland upstream with the permission of Forest Department under JFM
- Completed all soil & water conservation and production activities
- It will have positive impact downstream

Nursery Raising

Capacity building

- Trainings on various themes (technical and institutional) for WDCs and groups
- Trainings for women SHGs for taking up IG activities with the women

Activities in the next phase

- Treatment of individual farm and non cultivable land
- Intensification of productivity enhancement activities
- Grading of SHGs and kick off of the IG activities.

THANKS

About ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, and 644 million of these are the poorest of the poor. ICRISAT and its partners help empower these poor people to overcome poverty, hunger, malnutrition and a degraded environment through better and more resilient agriculture.

ICRISAT is headquartered in Hyderabad, Andhra Pradesh, India, with two regional hubs and four country offices in sub-Saharan Africa. It belongs to the Consortium of Centers supported by the Consultative Group on International Agricultural Research (CGIAR).

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ISBN 978-92-9066-551-9 CPE 170 323-2012