

INCENTIVISING AGRICULTURE

RKVY INITIATIVES



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सत्यमेव जयते

Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation

First Edition

April 2012

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Published by

Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation

Design & Print

Macro Graphics Pvt. Ltd.
www.macrographics.com

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D.O. No. 1099/JAM

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Government of India

12th April, 2012

PREFACE



I am extremely heartened that the Department of Agriculture and Cooperation is publishing some of the successful interventions taken up by the States across the spectrum of agriculture and allied sectors under Rashtriya Krishi Vikas Yojana (RKVY). Agriculture is the mainstay of the Indian economy and constitutes the backbone of the rural livelihood security system. Rashtriya Krishi Vikas Yojana (RKVY) was launched in 2007-08 to reorient the current agriculture development strategies to meet the needs of the farmers through fresh efforts by the Central and State Governments to rejuvenate agriculture. RKVY format was designed to provide complete flexibility to the States to select, plan, approve and execute projects as per their priorities. RKVY has no doubt emerged as the principal instrument in financing development of agriculture and allied sectors in the country in the XI plan.

RKVY targets the agriculture and allied sectors with schemes and programmes, which typically benefit individual farmers and farming community. The programme presents an excellent opportunity to the States to reorient their strategies to provide the much needed impetus to the growth of agriculture and allied sectors. With sustained efforts of the Central Government as well as the State Governments, RKVY has been able to achieve its objectives. Implementation of RKVY has also led to larger resource allocation to agriculture and allied sectors. States have welcomed the autonomy and the flexibility of the RKVY format and have made very good use of the scheme, to accelerate growth in these sectors.

This publication of selected success stories of RKVY will indeed provide a valuable insight into the RKVY experiences across States and sectors. I commend the efforts of the officials of the Department of the Agriculture and Cooperation of Government of India and the State Governments in coming out with this compilation.

(SHARAD PAWAR)



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Government of India
Ministry of Agriculture
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FOREWORD



Rashtriya Krishi Vikas Yojana (RKVY) was designed to tackle the deceleration of growth rate in agriculture, at a time when post liberalisation, the rest of the economy was on a high growth rate trajectory. With the majority of the population dependent on agriculture for their livelihood, slow growth of agriculture sector despite the immense potential available for higher agricultural productivity, was a matter of grave concern.

To address the situation, the National Development Council decided in 2007 to launch RKVY as a special Central Assistance Scheme to incentivise the states to draw up plans for their agriculture sector more comprehensively taking into consideration, their respective agro-climatic conditions, natural resource base and technology issues and also integrating livestock, poultry and fisheries sub-sectors into the overall agrarian scenario. RKVY has two strategic objectives - first, to encourage States to allocate more funds for agriculture and allied sectors and second to focus States' attention to generate additional growth in agriculture and allied sectors by better planning and undertaking need-based growth-oriented projects to achieve higher growth in the sector.

There can be no two opinions about the fact that RKVY is a quantum leap in the evolution of agricultural planning in terms of the autonomy it has given to the states to choose the interventions, designed as they are, for optimum suitability to local conditions. RKVY is unique in its approach since there are no prescriptions about the projects, schemes and other programmes to be undertaken by the States. It provides complete flexibility to the States to choose what is best suited to their conditions keeping in view the States' priorities for generating growth.

In the 5 years since inception, RKVY has definitely come a long way; States have taken up more than 5700 projects across different sectors like, crop husbandry, soil health, seed, horticulture, marketing and post harvest management, animal husbandry, fisheries, dairy development, watershed development, land reclamation, etc, both for enhancing production and productivity and for setting up critical and much required infrastructure in these sectors. All these scientifically thought out projects have succeeded in providing a definite momentum for agricultural growth.

In fact another indicator of RKVY achieving its objectives is the increased flow of funds into agriculture and allied sectors by the States, which is evident from the fact that allocation to agriculture and allied sectors as a percentage of total State Plan expenditure has increased from 4.88 % (₹ 8770.16 crores) in 2006-07 to 6.04 % (₹ 22158.46 crores) in 2010-11(RE).

To detail each and every intervention under RKVY would need a shelf of books. In this volume we have portrayed a few of our success stories, to depict the range and variety of RKVY-assisted interventions that have been taken up by the States to incentivise agriculture and the resilience and the enterprise of the Indian farmer, who despite all odds always emerges the winner, master of his own destiny with hopes and plans for the future.

I congratulate the RKVY Division in DAC and the State Governments who have come out with this collection of RKVY success stories.

New Delhi
10th April, 2012

(P.K. Basu)

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Introduction

This is Not Breaking News!

Events make Breaking News ...processes do not, because it is difficult to capture them, especially if they take place in a spatial domain which is not close to the National Highway or metalled roads. Thus the price of onions makes headlines, but interventions to create value chains in this commodity by setting up farmers groups and scientific farm level storage does not! The denial of a Chinese visa to an Arunachal officer evokes editorial comment, but 'off- season- vegetables' in Lower Subansiri district by the Ziro Women Farmers club does not find a mention anywhere! Panelists on Food Inflation talk about the higher share of dairy products, but are blissfully unaware of innovations like hostels for milch cattle to address issues of scale, scope, habitat and ecology. Disruption in the supply of milk to urban centres makes it to page one, but fodder development or bovine health does not feature on the radar screen of the mainstream media.

The volume in your hand is an attempt to address issues and processes which would normally not make it to newspaper columns. Yet their impact on transforming the lives of people is perhaps much higher than what the papers generally report. When agriculture was not doing well, there was no dearth of reports. Now that interventions on account of the Rashtriya Krishi Vikas Yojana popularly known by the acronym RKVY, have arrested the decline, and created a virtuous cycle, it is important to acknowledge the innovative interventions and the positive outcomes.

A word about the RKVY..... Launched in August 2007 after deliberations in the National Development Council (NDC), the main agenda was to encourage capitalisation of Indian agriculture and ensure an aggregate growth rate of at least 4% from agriculture and allied sectors. It was felt that agricultural development strategy should be reoriented to meet the needs of farmers and state and central governments need to evolve solutions to rejuvenate agriculture. The NDC resolution stated that the RKVY would incentivise states to draw up plans for their agriculture sector more comprehensively, taking into consideration the States' agro-climatic conditions, natural resources and technology. In addition, efforts would be directed towards integrating livestock, poultry and fisheries more fully into the overall agrarian scenario.

States were advised to prepare comprehensive agriculture development plans for the districts as well as the state as a whole, after extensive consultation with all stakeholders to reflect the 'felt needs', the 'market potential', the agro-climatic conditions and the institutional support available in the State. The States are free to take up projects and interventions across the agriculture and allied sectors that emerge as the need of the hour to promote growth in their agrarian sector, at the end of this bottom-up approach of planning.

Chief Secretaries of states were entrusted the responsibility of chairing the State Level Sanctioning Committees which has departmental secretaries, vice chancellors and technical experts as members.

Proposals under RKVY have ranged from farm mechanisation to bee-keeping, from micro irrigation to support for Good Agricultural Practices (GAP), hostels for cows and infrastructure for cymbidiums, study tour of farmers and electronic auction platforms.

In recent times, RKVY has also addressed special needs –like Bringing Green Revolution to Eastern India, the National Vegetable Initiative

for Urban Clusters, Sixty Thousand Pulses Villages in Rain-fed Areas, National Mission on Nutri Cereals, Fodder Development, Oil Palm, Protein Supplements and Saffron.

Whether or not the programme has been a success can be judged from the selection of 'success stories' that follow. Large tracts in Arunachal have moved from *Jhuming* to terrace cultivation and many villages have taken up off-season vegetables (OSVs), which has transformed their lives. RKVY has also supported the construction of sixty wayside markets in Arunachal Pradesh along the highway. This has also led to the integration of Arunachal's economy with that of Assam, which is where most of these vegetables are marketed. The success story from Assam is on increasing cropping initiatives by providing assured irrigation. Water users associations have been formed under RKVY to cover water-shed command areas. This has ensured multiple cropping, thereby increasing incomes and livelihoods. In fact, it strengthens the postulate that wherever there is water, poverty will dissipate by itself.

Andhra Pradesh decided to focus on infrastructure for seed farm mechanisation and vegetable cultivation to improve the incomes of farmers. All these interventions are based on the felt needs of the farmers, especially in the context of climate change and scarcity of farm labour. While Bihar's success in doubling its rice production under the Bringing Green Revolution in Eastern India (BGREI) initiative is well known and documented, another highlight of the state is its tryst with organic farming. The success of the first organic village Pothia in Samstipur was an inspiration for State Agriculture Department to utilise RKVY funds for supporting one such bio-village in each of the 38 districts of Bihar.

Chhattisgarh is a new state with a pre-dominance of marginal farmers, many of whom are living in tribal hamlets. Goats are an important source of basic and supplementary income to the farmers and RKVY took up a major campaign to

vaccinate 90% of the total goat population against the *Peste-des-petits Ruminants* (PPR) or goat plague among the livestock of Chhattisgarh. This has led to significant reduction in mortality among the goats. The point to note is that these innovative steps could not have been undertaken, but for the flexible approach encouraged under the RKVY.

Amongst the four success stories from Gujarat, the most innovative is the establishment of an animal hostel for the milch cattle. Established at a cost of nearly rupees six crores, it has a capacity to house one thousand cattle in thirty six sheds. The hostel has elevated water storage, an underground sump, a bio-gas plant, fodder cultivation plots, vermi-compost units and a unique system of bio-metric based animal identification. The hostel is managed by the Akodara Milk Cooperative Society.

In spite of being one of the smallest States (1.3% of total area) of India, Haryana has a prominent place in the dairy map of the country. Haryana possesses 2.5% of the bovine population of the country but produces more than 5% of the nation's total milk. RKVY has supported the Murrah Breeders Association to take care of the superior buffaloes and male progeny for 'in- situ' preservation of the Murrah Germplasm Bank. It is expected that the scheme will contribute significantly to the genetic improvement of buffaloes in the country. Both Haryana and Punjab have leveraged RKVY funds for laying Under Ground Pipe Lines (UGPLs) from canals for farmers in the tail- end of the irrigation command area and those suffering from poor quality water, especially in areas affected by salinity and sodicity.

Himachal Pradesh has taken up an innovative programme of Mobile Sheep Dips. These light weight structures are made of high grade steel and can be easily towed behind a jeep. The objective is to ensure that sheep can be dipped at least thrice a year to rid them of parasites like ticks, lice and mite. This intervention will prevent losses both in terms of wool and meat among the sheep

flock of the State, a large part of which is migratory. The point to note here is that such an intervention could have never been imagined in the precincts of Krishi Bhawan or Yojana Bhawan.

Jharkhand has taken up rain water harvesting and check-dams along with sunken wells and lift irrigation system in a big way. RKVY has supported the participatory community management through *Pani Panchayats* and these interventions have doubled the cropping intensity in the command areas.

Jammu & Kashmir is well known for its saffron, apples, walnuts and cherries. However, the Gandarbal area of J&K has made a name for the cultivation of *Sahibi* and *Hussaini* varieties, which mature in August when grapes are not available in the other parts of the country. The RKVY has changed the crop cultivation scenario by providing canopy management structures to replace the traditional wooden structures, thereby improving the quality of produce, plant health and enabling women to harvest the fruit without additional support - therefore among other things, it is also a gender friendly intervention.

In keeping with its reputation as the country's leading IT state, Karnataka has taken up electronic auction in APMC markets under RKVY, ensuring greater transparency in transactions, and better returns to farmers.

Kerala has found a solution to the problem faced by the out-migration of 1.2 million workers to the Gulf, which left large tracts of agricultural lands fallow. RKVY helped the formation of a Food Security Army (FSA) to address this issue. FSA recruited over two thousand people, provided them training in all aspects of farm equipment and agronomic practices and organised them into agro- machinery operation service centres. The FSA provides its services for different agricultural operations on the farmer's fields. This has enhanced incomes of FSA members as also that of the farm owners.

Madhya Pradesh used RKVY to upgrade its Kisan Call Centres while Maharashtra established scientific onion storage on the farmer's field to ensure that distress sale of onion is avoided during the peak production season. Both Maharashtra and Madhya Pradesh have also utilised RKVY funds for water harvesting and micro irrigation.

In Orissa, RKVY funds were leveraged to improve livelihood of tribals through production and value addition to indigenous tuber crops, pineapples and organic spices by linking it to the Orissa Tribal Empowerment Livelihood Project (OTELP). This intervention has revived the traditional crops like Elephant Foot Yam and Cassava, which are preferred in the preparation of temple food over potato, cauliflower and tomato, which are considered to be of foreign origin.

Sikkim has taken up pig farming in a big way under RKVY as the State is not self-sufficient in its requirement of pork and bacon. To address issues of reproductive health of cattle, especially cows and buffaloes, Tamil Nadu introduced the Oestrus Synchronisation Technology (OST) to induce heat, thereby improving the conception rate. It also ensures that animals can be given Artificial Insemination (AI) at a pre-determined time to ensure higher conception rate.

Tripura is known for quality pineapples, mostly the Queen & Kew varieties. Under RKVY, the State has taken up staggered planting of pineapple to prevent seasonal glut and ensure availability of pineapple for at least eight months in a year while raising productivity levels from 15 to 20 MT per hectare.

Uttar Pradesh is known as the sugar belt of the country and its landscape is replete with both sugar mills and *Gur* manufacturing units. However, farmers often complain about lower realisation from the sugarcane crop. To address this issue as also to enhance production of pulses, RKVY undertook inter-cropping of pulses with spring-sown sugarcane in 265 blocks of 30 selected districts.

Last but not the least, West Bengal's initiative of producing sexed sperm at their frozen semen lab of Haringhata farm is truly an example of using state-of-art scientific technology to bolster the rural economy. This state-of-art assisted reproductive technology for pre-determination of bovine sex is expected to enhance creation of assets for enhancement of the rural economy by producing desired female dairy calves in rural areas, which will ultimately augment milk production, create employment generation in rural areas, and improve livelihood of the rural population of West Bengal.

Through the pages of this book we take you on a fascinating journey, from the far-flung hills of Arunachal Pradesh to Gujarat in the west, from Kashmir to Kerala. We detail how the lives of beleaguered marginal farmers and impoverished rural women are vastly improved. How through the education, guidance and financial assistance offered by interventions under the RKVY, a vast and diverse rural community has beaten back inclement climate, poor soil conditions and a host of unfavourable odds to emerge intrepid winners all the way!!!!





Managing Topographical Constraints

Background & Objectives

Arunachal Pradesh is a mountainous region with undulating hilly terrain all over. Cultivable flat land is very limited. 40% of the farm land in Arunachal out of the total gross cropped area of 282000 ha is still under *Jhum* cultivation. Land levelling terracing with bunds can wean people away from the practice of shifting cultivation which, because of shortened cycles, is detrimental to the environment. Expanding agriculture by land terracing, practiced with minimal landscape planning and mostly through human labour is therefore being taken up in the State under RKVY.

Arunachal Pradesh also is climatically suitable to produce off-season vegetables. Off-season vegetables are cultivated before or after their normal season of production or by adjusting planting time, by selecting and improving varieties and/or creating controlled environment. Taking advantage of the varied climatic zones from mild tropical to temperate and alpine in Arunachal, which makes temperate high hill areas of Arunachal Pradesh suitable for off-season vegetables, programme of promoting off-season vegetable (OSV) production, was taken up under RKVY. OSV farming can be an important source of income for farmers of these areas. There is immense inter and intra state marketing potential for surplus off-season produce of these areas. The produce can feed markets in the foot hill areas of the state besides the plains of neighbouring states like Assam.

*Terraced Fields*

Intervention

Subsidy linked area expansion programme through land terracing program was taken up in the year 2009 under RKVY with a total outlay of ₹ 2.55 crore. It was continued in the year 2010-11 with an outlay of ₹ 2.75 crore. Food deficit border areas of the state with 10-20% slopes were given priority under the program. For a unit of 1 ha area under land terracing, a subsidy of ₹ 50,000 was provided. In the year 2009, when the program was launched, it was envisioned that the program will reach approximately 500 beneficiaries and will result in expansion of net sown area by 0.15%.

For achieving maximum impact of the program, convergence of land terracing program was made with various state and central

sector projects being undertaken by allied departments such as rural works department and department of horticulture. For example, beneficiaries of land terracing program were encouraged to set up horticultural gardens instead of paddy cultivation, under technology mission.

In convergence with Technology Mission on Horticulture, Department of Agriculture implemented a project to boost production of off-season vegetables during the year 2009-10 (implemented from August' 2010) with the support of RKVY. The project supported 90 beneficiaries in six select districts. The beneficiaries were provided with seeds, organic manure, bio-fertilizers and bio-pesticides. Department of Horticulture, Government of Arunachal Pradesh also initiated a project under RKVY in the same year to provide low cost polyhouses for vegetable cultivation. A total of 60 beneficiaries



Preparing Terraces

were provided with low cost polyhouses with a total outlay of ₹ 27 lakhs.

Outcome

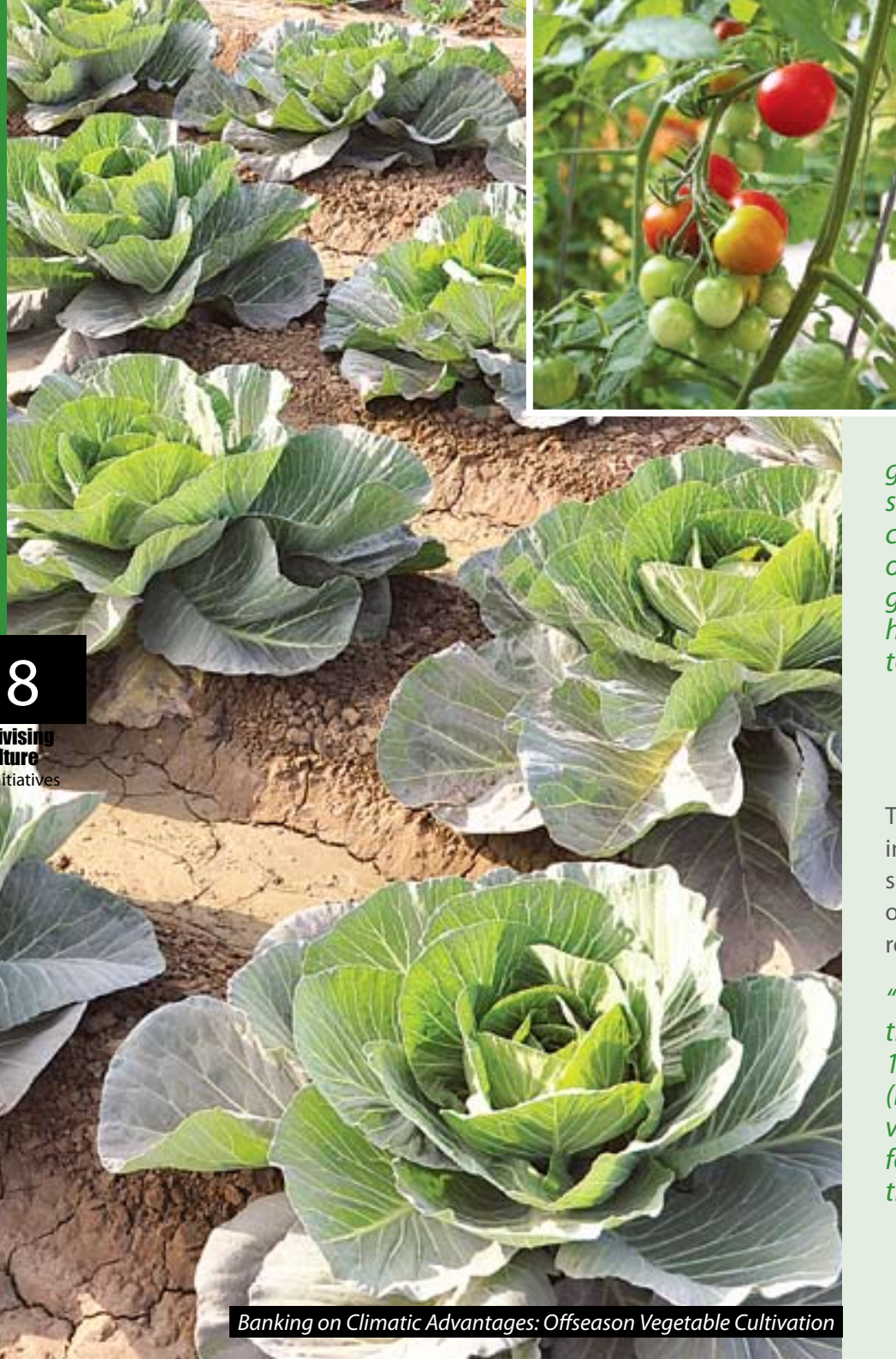
A quick evaluation of the impact of area expansion by land terracing indicates that the program is helping marginal farmers. The State Agricultural Plan envisages an investment requirement of ₹ 90 crore for land terracing during the 11th Plan. Convergence of efforts by state departments like department of rural works will be of paramount importance in the years to come.

There is substantial demand for assistance under this programme as reflected in large number of applications recommended by

village and Anchal Panchayats. The growth impact of the project is likely to be long lasting and multifold. The newly terraced lands are being brought under irrigation by many farmers which can potentially lead to increase in cropping intensity in future.

Similarly, off season vegetable programme has also made its impact. As per the estimate of the department of Agriculture, the RKVY intervention in the state has led to an increase in Area under vegetables from 22135 hectare to 22225 hectare (approx. 0.41%). Estimated increase in production is from 94.148 MT to 94.523 MT (approx. 0.41%).





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**Incentivising
Agriculture**
RKVY Initiatives

Banking on Climatic Advantages: Offseason Vegetable Cultivation

"I am grateful to the Department of Agriculture for subsidy under RKVY. The cost of labour in my area is very high and it's difficult for small farmers like us to manage funds for undertaking manual land terracing work."

— A beneficiary of area expansion
by land terracing program,
Lower Subansiri Dist.

"Our group's off-season vegetable production has gone up substantially after we started using polyhouses supported under RKVY to cultivate tomato, cabbage, chillies, etc. Cultivation under polyhouses improves quality of produce and permits early harvesting. This year we got better price of tomato @ ₹ 20 per kilo because of early harvesting. The productivity of tomato has also increased to 20 ton/ha."

— Smt. Kago Kampu
Siuro Women Farmers Club, Ziro, Lower Subansiri District

The interventions under RKVY have brought in the much needed incentive to vegetable farmers in Arunachal Pradesh and the same are likely to augment production. Off-season vegetables of Arunachal like tomato have already attained a brand and it is regularly entering markets in Assam.

"We are regularly purchasing off-season (produce beyond the month of April up to November) tomatoes from around 10 villages located in Rupa area of West Kameng District (Near Bomdila) of Arunachal Pradesh for distribution to various markets in upper Assam. The business is profitable for us. The production is substantial and seems growing in the last few years."

— Mr. Prafulla Saikia
Golaghat, Assam



Increasing Cropping Intensity through Irrigation

Background & Objectives

Assam has bountiful rainfall, yet very large fallow lands in post monsoon period. The state, with 32.24 lakh ha of cultivable area and net area sown of only 27.53 lakh ha in 2006-07, had cropping intensity of 135.7%. Assam's monsoon-based rice production system sprawls in the Brahmaputra and the Barak valleys. The state receives high rainfall of over 2000 mm on an average per annum. Erratic spreads of monsoons, in many years, also do not match the water requirement of crops. If water shortage occurs early in crop development, maturity gets delayed and impacts yields negatively. Similarly, moisture shortage in the late growing season affects quality of produce to a great extent. The twin challenges of large fallow lands and lower productivity on account of erratic rainfall, if addressed, can convert Assam into rice bowl of India taking green revolution to the East.

The intensity of rainfall in the state is very high from April to October and it is scanty between December and February. Assured irrigation during post monsoon period is, therefore, highly essential in the context of Assam for farmers to engage in double cropping. Alluvial tracts of the Brahmaputra plains are rich in groundwater with multiple aquifer systems. Assam is also endowed with vast surface water resources. In spite of all these natural advantages, although providing assured irrigation to farmers has been the priority

Members of a Water User Association in Kamrup District maintaining a small scale Flow Irrigation Project covering a Command Area of 130 ha benefiting 174 families



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Incentivising
Agriculture
RKVY Initiatives

of the state government for years, only a fraction of the full potential had been realised by the time RKVY was ushered in the State.

Public investment for ensuring assured irrigation by minor irrigation projects in Assam received first major boost during 2001-2005 through the World Bank aided Assam Rural Infrastructure and Agriculture Services Project (ARISP). The project provided subsidised Shallow Tube Wells with pump sets to individual or small groups of farmers for utilizing the available ground water.

Subsequent to ARISP, irrigation investments in Assam were also channelized through a number of projects such as Shamridha Krishak Yojana (Aided by NABARD), Technology Mission on Horticulture, National Food Security Mission (NFSM), Assam Agricultural Competitiveness Project (AACP – World Bank Aided), Assam Bikash Yojana (ABY), and State Priority Sector Scheme (SPS). The Assam Agricultural Competitiveness Project (AACP) launched in the year 2005 also provided Low Lift Pump sets (LLP) to tap the surface water resources. Irrigation potential in the state increased from 214500 ha in 2000-01 to 367592 ha in 2007-08 due to the above interventions.

Intervention

Department of agriculture, government of Assam decided to scale up minor irrigation related interventions under RKVY to boost ongoing efforts during 2008-2009. These interventions were prioritized as RKVY flagship scheme with a total outlay of ₹ 7.90 Cr, ₹ 17.22 crore and ₹ 130.26 crore during the years 2008-09, 2009-10 and 2010-2011 respectively.



A Shallow Tube Well with Diesel Pump Set supported under RKVY irrigating Paddy in Nagoan District of Assam

Minor irrigation interventions under RKVY included private Shallow Tube Wells (STW) with diesel/electrical pump sets to pump ground water, installing Low Lift Pumps (LLP) for lifting flowing surface water, Deep Tube Wells (DTW) both on individual and community basis and constructing minor check dams on permanently flowing streams for providing irrigation facilities. All these interventions provide irrigation facilities during *rabi* and *boro* seasons and thereby bring additional area under cultivation raising cropping intensity. These interventions also enable farmers to address intra-seasonal stress during periods of erratic monsoons.

In the case of STW and LLP subsidy assistance was earmarked at a maximum of 60 percent subject to an amount of ₹ 20400 for STW and ₹ 15000 for LLP, whereas 90 percent assistance was provided for flow irrigation. On an average, a minor flow irrigation project received subsidy assistance at ₹ 5400 per hectare. For DTW, assistance was provided with normative cost of ₹ 5 lakh and subsidy assistance of ₹ 3.5 lakh per DTW.

Outcome

Substantial progress has been made in the creation of irrigation related assets by RKVY during the last three years.

During the period from 2008 to 2011, a total of 39189 STWs with pump sets and 7207 LLPs were installed. Government had planned to install 59815 STWs and 20694 LLPs during this period. Therefore, there is still a lot of catching up to do. State has realised flow irrigation potential of 5000 ha with these interventions and assured irrigation capacity created through STWs and LLPs under RKVY so far is 91000 ha and 40700 ha respectively. Upon completion of RKVY projects taken up during the 11th plan, the state would have added an additional irrigation potential of 141700 ha in all.

As per latest available statistics (December' 2011), the department of Agriculture created assured irrigation facility (under utilization) for 4.70 lakh hectare which is 16.8 % of Net cropped area. Together with intervention of state irrigation department the current area under assured irrigation in the State is 7.73 lakh ha which is 27.5% of Net cropped area against national average of 39%. In comparison to situation in 2006-07 mentioned above, the current Net sown area in the State is 28.10 lakh ha and average cropping intensity is 142% against national average of 139%.

Continuing the policy thrust, the Department of Agriculture, intends to bring in an additional 200000 ha area under assured irrigation through installation of 75,000 STWs and 50000 LLPs by the end of 2015. The planning includes measures to monitor and ensure sustainable use/safe yield of ground water.

Assured irrigation together with coordinated intervention in the field of mechanisation, marketing and farm extension helped the state in



A Deep Tube Well at Hebeda Village. The beneficiary Farm Management Society subsequently received assistance under NFSM for Rice Demonstration

achieving accelerated growth with a significant shift in cropping patterns and enhanced production. Today the cropping intensity in majority of STW areas is crossing 200 percent. The state achieved record rice production of 50.86 LMT during 2010-11 against local requirement of 41 LMT. The impact of STW/LLP distribution on equity and poverty is quite positive as all attempts are being made to select beneficiaries for small and marginal farmers in close association with *panchayat* level institutions. The growing intensification of agriculture resulting in greater number of working days has also directly benefitted landless agricultural laborers.

Building on the need for convergence for greater impact, the department is trying to dovetail RKVY irrigation related intervention with other concurrent central sector projects like National Food Security Mission (NFSM). For example, *Pathar Parichalana Samity* (Farm Management Society) in Hebeda Village, Makum, Tinsukia District received assistance both for deep tube well and scientific rice demonstration under RKVY and NFSM respectively.

The intervention of STW/LLP distribution is more likely to be sustainable as beneficiaries are fully responsible for their operation and maintenance. It has been observed that though electrical pump sets are more economical than diesel sets, farmers could not fully utilise the benefits of electrical pump sets. This is due to the fact that power lines with required load bearing capacities hardly reach interiors of farm fields; there is shortage of voltage and power supply. This drawback is being tackled by the department.

Shallow tube-wells have done to Indian irrigation what personal computers have done to computing globally; they have democratized irrigation, taking it out of command areas to every nook and corner of the country. In other words it brought about greater spatial equality in irrigation, unlike canal projects which have created concentrated pockets of agrarian prosperity in canal commands. In flood prone eastern India, tube-well irrigation has helped mitigate the rapacity of floods and water-logging by reducing 'rejected recharge'.

– Excerpt of essay by Tushaar Shah, IWMI

A STW helps irrigate 2 ha of land for a small farmer providing him opportunity to take one/two additional crops from the same piece of land. Small and marginal farmers have on an average been able to earn a minimum of ₹ 50000 extra per year per hectare with this intervention. Similar gains have been reaped by farmers benefitting from other minor irrigation interventions.

“Government subsidy under RKVY on STW and pump sets is a gift for my family. We tried to purchase one earlier also but high cost of installation of tube wells and pump sets prevented us from doing so.”



Mr. Nurul Haque, RKVY Beneficiary, Village Adhiar Para, Hajo, Kamrup (R) District



Christian Basti Flow Irrigation Project (Local Name: Kritupal Bheta), Christian Basti, Sonitpur



Happy Faces of a Minority Farm Family at the Backdrop of their Newly Constructed Pucca Home



Members of Solaguri Krishak Gut, Solaguri, Dhing, Nagoan (Right: Mr. Pradip Kr Das "Dhaan Samrat")

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"Our Samity covers 132 minority farm families. It was a long cherished dream to have a permanent structure in order to continuously tap a known perennial source of water in our area for irrigation. For decades we used earthen structures that were damaged frequently. Under RKVY a flow irrigation structure was erected at the cost of ₹ 2.7 lakh. Our Samity could also manage some support under MGNREGS for land development work. The structure, which is of high quality is now ensuring irrigation for around 1500 bighas of land in the area".

– Sri Lawrence Bhengra

Christian Basti Pathar Parichalana Samity (PPS) Sonitpur, Assam

"Ours is a 70 member progressive group of farmers with total land holding of around 280 ha. We received assistance under RKVY in the form of installation of Shallow Tube Wells (STWs) with 27 Electrical and 5 Diesel pump sets. With assured irrigation our production and productivity have gone up many fold. One member of our group Mr. Pradip Kumar Das was recently awarded with 'Dhaan Samrat' (Paddy Monarch) award by a private company for producing 2040 kg of paddy per 0.4 ha".





Cattle Housing for Higher Production

Background & Objectives

Providing comfortable living sheds to cattle can be profitable as well as environment friendly. RKVY interventions in several states- notably in Gujarat, Haryana and Punjab- have led to hygienic living quarters for cattle providing them 'creature comforts', and thereby increasing yields to make the owners of the cattle laughing all the way to the bank. Farmers of village Akodara [Dist. Sabarkantha] in north Gujarat demonstrated their path breaking initiative by establishing an animal hostel for their milch cattle.

Akodara is a typical village of Gujarat with a population of 1085 (total families 215; cattle owner families 205; cattle population 1166 and milch cattle 400). Average daily milk collection was 574 litres from Buffaloes and 583 litres from Cows. In Akodara too, like any other village of the state, milch cattle are taken care of predominantly by women within their own premises. This results in problem of cleanliness and hygiene both for humans and animals and practically bonds women to the upkeep of their animals in the house.

In order to alleviate drudgery of women involved in animal care and address the problem of limitation of space available for cattle in-house and lack of hygiene and also to make better use of animal wastes like urine and dung and improve sanitation of village, and for production of gobar gas and vermi-compost for organic farming etc., the Government of Gujarat decided to set up an animal hostel in Akodara during 2008-09.

Punjab, with larger size of operations, adopted a different approach, but with the same objective. Punjab went for a scientifically designed and maintained cattle shed at the farmer's place itself.

Intervention

Animal hostel in Akodara was set up at a total cost of ₹ 584.62 lakhs with the capacity of 900 animals. It was funded primarily from RKVY to the extent of ₹ 434.62 lakhs with contribution by Department of Animal Husbandry from their budget of ₹ 1 lakh, by DRDA of ₹ 50 lakhs, GEDA of ₹ 49 lakhs and people's own contribution of ₹ 50 lakhs.

Animal Hostel has capacity of accommodating 900-1000 cattle in 36 Cattle sheds. The facility also has an elevated water storage tank of 1,00,000 litres, an underground sump of 80,000 litres and three bio-gas plants of 255 cubic metres' capacity. To provide fodder to animals, fodder cultivation plots measuring 50 ha have been included in the project for fodder production of 3000 tonnes/year. The facility will also produce 1000 tonnes/year vermi-compost. A system of bio-metric based animal identification was introduced to streamline the operations.

The animal hostel is being managed by Akodara Milk Cooperative Society. Animal owners arrange green and dry fodder and also contribute ₹ 500 per animal per month to the hostel. The concentrates are, however, arranged by the society. Similarly, regular check-up of animals' health and artificial insemination is arranged by the Society. Recurring expenses of hostel are met through the income of gobar gas, vermi-compost, and Gaucher development. Income from milk is distributed to the owners of milch cattle on actual basis.

Scientifically designed cattle sheds in Punjab at individual farmer's place were promoted with a financial incentive of



A hostel for Cattle in Akodara, Gujarat



Scientifically Designed Cattle Shed in Punjab

₹ 1.50 lakh per shed constructed as per approved design with assistance from RKVY. Only those beneficiaries with less than 10 acres of land and maintaining a minimum of 10 milch animals were eligible under the Programme. The scheme is very popular and very useful. It came into operation in the year 2008-09. 1143 sheds have been constructed in the state by middle of 2011-12 with the incentive provided under



Animal Shed in Akodara Hostel

RKVY. Subsidy to the tune of ₹ 1700 lakh has been provided to 1143 beneficiaries @ 25% of the cost of the shed subject to a maximum limit of ₹ 1.50 lakh.

Outcome

Establishment of this animal hostel in Akodara has been a resounding success on all parameters. In the first year itself, 90 farmers started keeping 600 of their milch cattle in the hostel. As better supervision and environment was available to cattle in the hostel, quality and quantity of milk production improved. In just one year, milk production increased by 15-20%. This has also improved the surroundings and hygiene of the Akodara village and households of dairy farmers. Additionally, production of gobar gas and conversion of gobar into compost has reduced deforestation.

It is also expected that the quality of agricultural land will also improve due to non use of chemical fertilizers which is the main

cause of soil degradation. To top it all, human health and animal health have improved and also employment generation in the village received a boost. Overall cleanliness in the village has also greatly improved. Being a pro-women and pro-poor project, it will help in achieving improvement of Human Development indices.

In the true sense, the Animal Hostel in Akodara is a unique concept of integration and participation of People-Public-Participation. A wonderful collaborative model with participation of cattle owners of village, Akodara for keeping their milch cattle in the hostel, Government of Gujarat for playing a lead role in bringing up the hostel, Sabarkantha district Milk Co-operative Union, Village Milk Co-operative Society, Akodara Gram Panchayat and Government of India, Rashtriya Krishi Vikas Yojana for grant-in-aid.

“Due to lack of space, I could not maintain more number of milch cattle. Now, I have purchased more animals, and kept them in the hostel and consequently I am earning more from them.”

– Sh. Ganpatibhai Prajapati, Animal Owner

Cattle Housing scheme has changed the dairy scene in Punjab as well. Dairy farmers, due to the incentive available under the scheme, have started investing in animal housing which was hitherto ignored. They have now understood the importance of this component. The modern cattle shed saves the milch animals from extreme hot weather. There is a discernible difference in the temperature inside and outside the shed, and the productivity of milch animals has increased.

Harjit Singh proclaims he is fortunate that he undertook to build a modern cattle shed with the financial incentive under Rashtriya Krishi Vikas Yojana. He got the information about the new design of the shed and the incentive available through the block level camps organised by the department.



Gobar Gas & Vermi-Compost Unit

Ever since his milch animals have been shifted to the modern cattle shed, the functioning and profitability of his farm changed for the better. He confirms that the new shed provides adequate natural lighting, cross ventilation and protection from heat stress. He adds that the temperature in the shed during summer remains about 5-6 degree centigrades lower than the temperature outside the shed. The design of the shed provides modern manger and a facility for water shortage. He feels that his new shed has helped him in getting the optimum output from his animals. According to him, productivity of milch animals has increased by 2-3 litres per day. The production loss due to health problems of milch animals has diminished sharply. He started his HANS Dairy farm at Ghumandgarh, Dist. Fatehgarh Sahib in 2007 with 20 cows. He now is running a commercial dairy farm with 50 high yielding cows producing 3500 litres of milk daily. During Feb. 2011 in the PDFA International Dairy Show one of his cows won the first prize in



Fodder Cultivation

milk competition by yielding 54 litres milk in a day. His success has been a source of inspiration for others.

Prize Winning Cow along with proud owner, Sh. Harjit Singh





Winning with Wayside Markets

Background & Objectives

Roads in very sparsely populated and hilly and inaccessible terrain in States like Arunachal Pradesh can bring producers of vegetables and fruits and consumers of urban areas together to the advantage of both. Farmers, virtually practicing subsistence agricultural production, can realise better price for their produce thereby incentivising them to produce more if good wayside marketing facilities are available. Similarly, urban consumers, who normally pay high prices for vegetables can benefit by buying directly from farmers by paying reasonable price at such facilities. Achieving surplus production at local levels with the involvement of a large number of subsistence farmers is a challenge. One of the critical components to meet this challenge is to provide an assured market to the farmers. Increasing awareness about opportunities and capacity building of farmers coupled with public investment in the state has generated entrepreneurial zeal among some of hardworking farmers who are now resorting to commercial production of vegetables. However, limited surplus production mostly from scattered production areas with poor connectivity makes it difficult for majority of rural farmers or aggregators to bring the produce to major urban markets. The situation is far worse for farmers in the case of perishable fruits and vegetables.

Selling of fruits and vegetables at the wayside of major connecting roads is a common phenomenon in hilly areas, more particularly during winter harvesting season. The involvement of women is a notable feature in such selling. Farmers from far flung areas use

their own means to bring their meager surplus near the wayside of roads in anticipation of selling them directly to travelling consumers. Such farmers hardly get any infrastructure support unlike in conventional markets where there are sheds and other facilities. With the sole aim of assuring remunerative prices to the farmers, Arunachal Pradesh has made amendment in the Agricultural Marketing (Regulation) Act-1989 in the year 2006 permitting direct marketing by growers and contract farming, has also been allowed.

Intervention

In the year 2009, Department of Agriculture, Government of Arunachal Pradesh with the objective to augment production of vegetables and fruits, decided to make a demand side intervention under RKVY aimed to help numerous

small farmers who sell their limited produce mostly at wayside of roads. The intervention targeted farmers of villages/areas with limited road connectivity. It was envisioned that support to growth of wayside markets will encourage aggregation by farmers themselves. The markets will connect the small farmers to tourists/travelers if not traders thus leading to better price realisation. The sheds will protect mostly women and old farmers from adversity of climate during the trading period.

The project, initiated in the year 2009-10 with an outlay of ₹ 1.8 Cr, supported construction of designed sheds at 60 select wayside markets spreading over 16 districts of the state. During 2010-11, 66 more such markets sheds were taken up for. The state government further decided to earmark these wayside market sheds exclusively for women and old farmers. The endeavor is to encourage direct selling to consumers thus ensuring maximum price benefit to the farmers.

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A Woman Farmer in a Remote Area Carrying Produce to Wayside Market



A Wayside Market Selling Fruit

Typically a wayside shed constructed under the programme provides a plinth area of 432 sq ft. It also has provision for properly keeping and displaying their produce. A shed costs ₹ 300000 which is supported under RKVY as 100% grant.

The demands for support under the project came from local Panchayats who in turn volunteered to donate community land for this purpose. The project provided for investment on infrastructure like tin roofed sheds with concrete, elevated floor or wooden racks, etc. The infrastructure constructed in each wayside market is largely semi permanent in nature and will require expenditure on maintenance. The department of agriculture is exploring ways to ensure recovery of maintenance cost which includes nominal rent collection through agriculture produce market committees.

The project was an instant success in terms of infrastructure creation and engagement of people and their institutions. Farmers have been using the new sheds, to their advantage.

Outcome

The markets in many places are increasingly becoming points of aggregation and farmers now have the dual option of both selling either to consumers or to traders.

People consider wayside markets as a source of quality local produce. This message has also been aptly disseminated to visiting tourists to the state. The department is all set to engage more stakeholders to ensure that the wayside markets received the promotion it deserves.



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Women Farmers Actively Involved in Managing a Wayside Market Shed

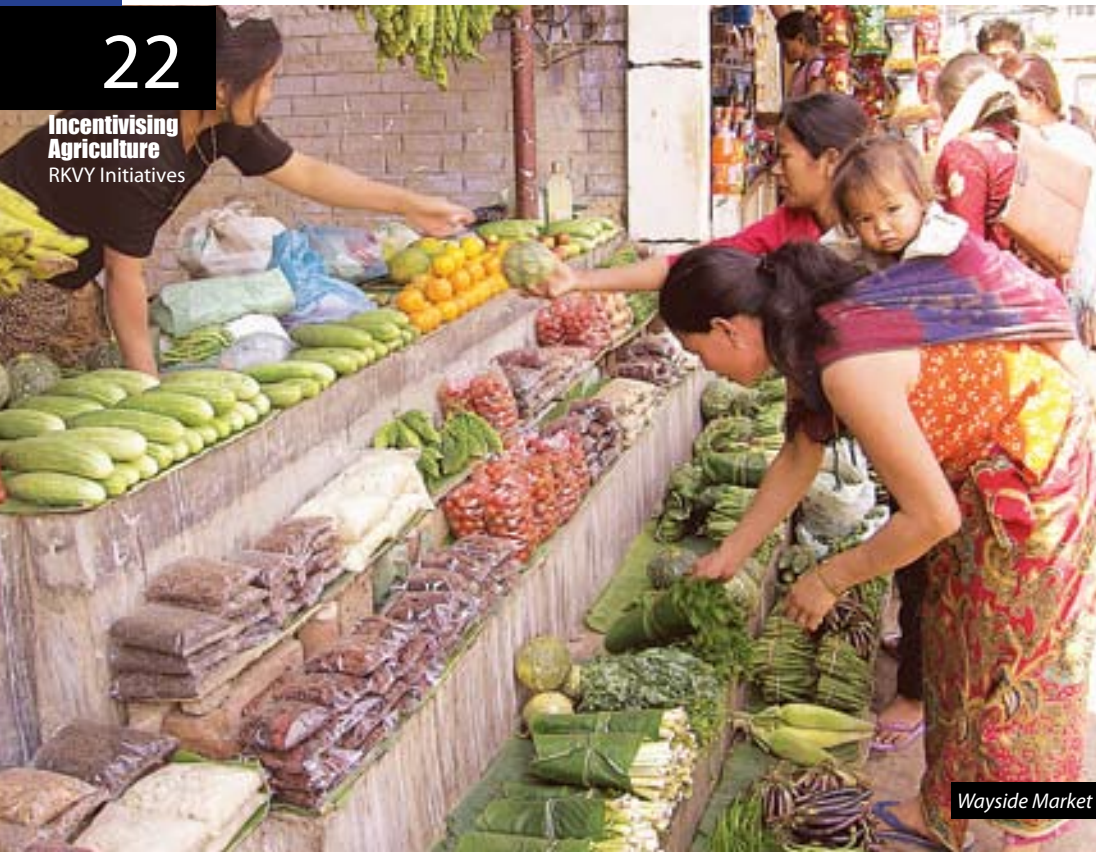
"My home is around 3 km from here. Travel on foot is the only option. I try my best to aggregate and bring my meager produce to this wayside market almost every day. This is the only place where I can meet my friends from distant places and discuss many things".

– Ms. Achu, a woman farmer using wayside market facility



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Wayside Market

"The wayside market-shed is a gift to women farmers of my village who are now encouraged to produce/aggregate more for selling. Travelers prefer to purchase from our shed. Farmers struggle to get space under the shed during busy trading seasons. Many are selling outside the shed area alongside the road. There is ample scope to improve design and provide other amenities. At the panchayat we are determined to maintain the shed necessarily involving users."

– Ms. Tana Yakhi, Panchayat Member and Chairperson Upper Sher Village, CD Block: Kimin, Papumpare District



Managing Water Stress with Farm Ponds

Background & Objectives

Maharashtra occupies an important position in the agriculture economy of the country with 34% of country's area under cotton, 17% of total area under sugarcane and 15% of the area under oilseeds. The State is also a major producer of horticulture crops like onion, grapes, pomegranates etc. Maharashtra, however, faces tremendous water scarcity in large parts of the State with 80% of its 175 lakh hectare area under cultivation being rain-fed.

Nearly 52% of the cultivated area in the State is drought prone. This presents enormous challenge for the State to harness and provide water to its' farmers for raising crops on sustainable basis.

Maharashtra has been planning and undertaking programmes for water and soil conservation including rain water harvesting on a large scale to convert their constraint into opportunity. A massive watershed development plan was therefore conceived for the State and over 30000 micro watersheds have been developed with State funding by constructing check dams, contour bunding etc.

In addition, it was also obvious that private investments will need to be boosted in water conservation at the micro level by encouraging construction of farm ponds by farmers in their farms to conserve rain water and surface run off from higher elevations. Promoting construction of farm ponds was, therefore, identified as one of the earliest interventions for taking up under the Rashtriya Krishi Vikas Yojana in the state with the objective to increase ground water recharge in water stressed areas to provide protective irrigation to the standing crops during the dry period and to improve the ground water table.

A farm pond is usually of 3 ft depth with width and length varying depending upon the farmer's land and catchment water potential in his field or what he can transport from the source. Most farm ponds are without any permanent ground or side linings. A typical farm pond in Maharashtra has dimensions of 30' x 30' x 3' or 25' x 25' x 3' with an inlet for water to collect from surface run off from higher reaches/or to receive pumped water and an outlet for overflow of water. Water is usually collected during monsoon in these farm ponds. But, wherever water can be pumped from the water sources, the same is done in winter season or even early summer. Stored water is utilised for protective irrigation for *kharif/rabi* crops and, wherever possible for providing water to fruit plantations during summer.

Most of the farm ponds also recharge ground water as water percolates down in unlined ponds and help in raising water tables in nearby wells. Many farmers have laid polythene cover for the stored water in the ponds to help conserve water for irrigation during *rabi* season/summer period. This is more evident in loose soil areas where water percolation is very fast and hence the storage gets depleted soon.



Farm Pond for Protective Irrigation

Intervention

Maharashtra took up promotion of farm ponds in a massive way in the first year of RKVY itself. A project of ₹ 92.74 crores was approved for farm ponds as the first project of RKVY in 2007-08. The same commitment continued next year when another project of ₹ 123.79 crores was approved for farm ponds. Finally, Maharashtra approved a multi-year farm ponds project in 2009-10 with allocation of ₹ 224.00 crores. Implementation of the Scheme was initiated in two major cotton growing regions of Vidarbha and Marathwada in 2007-08 in the districts of Yeotmal, Amravati, Akola, Buldhana, Washim, Wardha, Chandrapur, Nagpur, Latur, Osmanabad, Nanded, Hingoli, Parbhani, Aurangabad, Jalna and Beed. It was extended to Khandesh region in 2008-09 covering the districts of Jalgaon, Dhule, Nandurbar, Nasik and Ahmednagar. Finally, the scheme was extended to non cotton growing

Drought Prone Area Programme (DPAP) blocks in the districts of Sangli, Satara, Pune, Nasik, Ahmednagar and Solapur. The scheme has been finally implemented in as many as 250 Talukas of 25 districts of the State.

Under this scheme, subsidy is extended to farmers who take up construction of farm ponds of specific designs provided by the Department. The average subsidy amount ranges from ₹ 52000 to ₹ 82500 depending on the size of the ponds constructed while the actual cost to the farmers ranges from ₹ 1.5 lakh to ₹ 2.5 lakh.

A total of 73500 farm ponds were proposed to be funded under RKVY projects approved in three years (2007-10). 69279 farm ponds have been actually constructed by December 2011 at a total cost of ₹ 40987.24 lakhs. Highest number of 17007 farm ponds with outlay of ₹ 9546.19 lakhs has been constructed in Amravati district, followed closely by Latur district where 16500 farm ponds have been constructed under RKVY with expenditure of ₹ 9205.94 lakhs. Other districts with substantial number of farm ponds are Aurangabad, Nasik and Nagpur.

The State has also converged the farm pond programme under RKVY both in terms of scale expansion as well as vertical integration. The State Government is taking up construction of 100000 farm ponds under Mahatma Gandhi National Rural Employment

Guarantee Act (MGNREGA) and also under other initiatives like 60000 Pulses Villages Programme and Horticulture Mission. State Government has provided pump sets to 12871 RKVY farm ponds farmers under National Food Security Mission. The State has taken up demonstration of cotton, oilseeds and pulse crops in the fields of 22790 farmers and also assisted in installation of sprinkler sets in the fields of 4174 of these farmers.

Outcome

The implementation of the programme has helped in providing protective irrigation for about 81,145 hectare area during *kharif*. For crops like cotton, these farm ponds have been extremely important. With the construction of farm ponds, the ground water table has also increased by approximately 0.5 to 1 metre in the catchment area. In some cluster villages, where large number of farm ponds have been constructed (25-30 farm ponds in a village), ground water table is up by as high as 2.5 metres. With these farm ponds, wells in the catchment areas also get recharged, and drinking water for cattle has become available.

Sillod is a block in Ajanta Hill ranges of Aurangabad. It receives moderate rainfall of around 700 mm annually. The land mass in the block comprises of hard rock which allows lesser penetration of rain water and storage. Not only the *rabi* sowing was less than 7% of *kharif* area in this block, even *kharif* crops were highly irregular due to lack of supplementary irrigation facilities. The situation has got dramatically altered now after introduction and implementation of "Farm Pond scheme" under RKVY. The yield of cotton crop, with availability of 'assured and protective irrigation' has increased by 50% from less than 400 kg/ha to over 600 kg per ha. The *rabi* area in the village has also shot up from 67 ha to over 350 ha during the first year itself after construction of 42 farm ponds.

In the Kaygaon village of the district, *rabi* cropping area has increased from 250 ha to over 350 ha after construction of 19 farm ponds and in Nillod village, the area under *rabi* crop has increased from 160 ha to over 380 ha after construction of 34 farm ponds.





Similar happy reports have come from thousands of farmers. Mrs. Wasundhara Ashok Rout, who was sanctioned a farm pond of the size 30'x30'x3 with assistance of ₹ 82240, actually constructed a farm pond of 35'x35'x3 size. She raised gram crop in 2009-10, when water was available in the farm pond. Her yield of gram went up from 9 qtl/ha in the year before to 16 qtl. She obviously is quite happy and so are over 70000 farmers of Maharashtra.

Use of plastics in farm ponds has enabled several farmers to keep water for their fruit plantations, especially pomegranate, during summer months which are critical for the survival and productivity of pomegranate crop.

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Rashtriya Krishi Vikas Yojna
Farmpond



Yield of gram crop per ha before completion of Farmpond	Yield of gram crop per ha after completion of Farmpond	Increase in yield per ha.
year 2008-2009 9 Qtl.	year 2009-2010 16 Qtl.	7 Qtl.

Name : Smt. Wasundhara Ashok Rout
AI post : Ghusar TO, Dist: Akola
Sanctioned Size : 30X30X3 Mtr.
Actual Size : 35X35X3 Mtr.
Sanctioned Subsidy : 82,240 Rs.

UP & GP
Rashtriya Krishi Vikas Yojna





Integrated Pest Management for Higher Fruit Production

Background & Objectives

Three districts of South Gujarat: Surat, Navsari and Valsad are leaders in horticulture. These are also part of an agri-export zone for fruits and vegetables. But, the life of these fruit-farmers was made miserable by tiny fruit fly. Fruit fly is a major pest of mango, sapota and cucurbits. Intensity of damage recorded was as high as over 30 percent in mango and sapota, and between 20-40 percent in cucurbitaceous vegetables. Fruit flies cause heavy damage in terms of quality and quantity to the farmers every year. Insecticidal sprays, though they control infestation a little bit, are not only uneconomical but they leave residual effect much above tolerance limit, affecting adversely the prospects of export of such fruits and vegetables.

Fruit flies are a modern-day pestilence which ravage production. These flies, moreover, are good fliers and therefore their spread is extensive. Hence, area wide adoption of management strategy is required. Male Annihilation Technique (MAT), an Integrated Pest Management Technique (IPM), which uses sexual lures to capture males of fruit flies and kill them, is the only way to control growth and spread of fruit flies. This however, requires a Community approach for implementation.

Navsari Agriculture University designed, developed and commercialized an eco-friendly, economical and easily adoptable fruit fly trap popularly known as "Nauroji-Stonehouse Fruit Fly Trap". The trap uses Methyl Eugenol and Cuelures as par pheromones well-known for fruit



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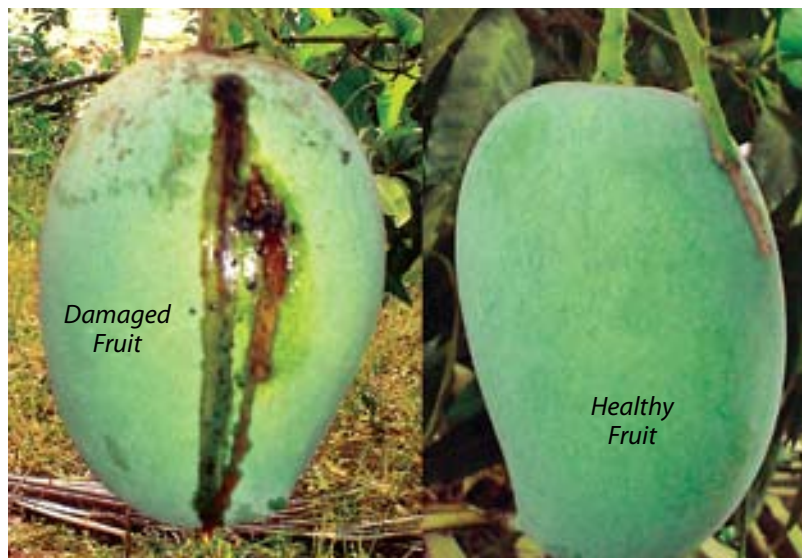
flies. In this trap, plywood blocks are soaked in the solution of lures + solvent + insecticide. Such traps remain effective for 5 to 6 months, which cover the entire fruiting period in mangos, sapota as well as cucurbitaceous vegetables and no recharge is necessary. It is eco-friendly, economical and easily adoptable.

It was decided to adopt this technology and spread it in the Surat-Navsari-Valsad belt for controlling and managing the fruit fly problem. It was also recognised that wide area adoption would help in developing this zone as a Pest Free Area (PFA). The project was taken up under RKVY.

Intervention

Nauroji-Stonehouse Fruits Fly Traps are prepared in food quality Testing Laboratory, NAU Navsari. Six talukas viz., Gandevi, Chikhali, Valsad, Pardi, Dharampiur and Kaprada of Navsari and Valsad districts were selected for the purpose. A block of orchards in each village in each Taluka was selected for first year implementation. Other blocks were selected during the following years.

In the selected blocks, farmers of all categories were covered. Traps were distributed to the farmers taking into account their area of plantation of mango, sapota and cucurbitaceous vegetables. Farmers' meetings were organised at village level to educate them regarding biology of fruit fly, nature of damage, technology for its management, installation of traps etc. They were educated by delivering lectures using LCD projector, display of flex banner, booklet and actual demonstration of the traps. To generate awareness of technology, 93 farmer's group training meets were scheduled. During group meetings scientific information of fruit flies emphasizing the life cycle of the pest, host range, damage symptoms, severity of damage and control methods to combat the pest in eco-friendly manner were covered. Gram Panchayats, Village level co-operative societies



and milk collecting centres collaborated in organising meetings, preparing lists of farmers, disbursement of traps etc.

With all this training and awareness, Farmers themselves installed the traps in their fields. Fruit fly population was also recorded at fortnightly intervals during the fruiting period in randomly selected orchards. The percent damage of fruits was worked out from orchards where traps were installed as well as uninstalled orchards. The level of damage in treated and untreated orchards was compared to know the actual impact of technology.

In all, 209 villages in 6 talukas of two districts were selected as target area during 2009 and 2010. The project was implemented in about 6814 ha area comprising of 6367 ha of fruit orchards and 447 ha of melon orchards of 15339 farmers of all categories. 1,10,640 traps were distributed to the farmers in the targeted villages for mango, sapota and cucurbitaceous vegetables.

Farmers were also educated on maintaining sanitation in the orchard. The fallen/damaged fruits in the orchards were collected

Preparation of Fruit Fly Trap



Supervision



Plywood blocks in trays



Preparation of chemical mixture



Blocks soaking in chemical (24 Hrs)



Blocks ready to install in traps



Sealing of blocks



Nailing & Threading



Heap of soaked blocks



Labels of trap



Ready fruit fly trap



Trapped fruit flies

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by the farmers and buried in the pits with application of methyl parathion dust to minimize further multiplication of fruit flies. About 6000 booklets were disbursed to the farmers while 500 flex banners were displayed in the target villages. Data on fruit fly catches and infestation were recorded regularly in the target area.

The project involved an investment of ₹ 7.86 crores funded through RKVY.

Outcome

By installing the fruit fly traps in a wide area it was possible to successfully bring down the infestation level to 3 to 4 percent, which meant 85 percent control of the pest. Using this technology, the fruit fly damage in mango orchards minimised to 3.06 (0 to 4) percent and the damage in untreated orchards was 30.34 (30 to 35%) percent. Thus, more than 85.0 percent damage due to fruit fly was reduced which resulted in increase of 27.27 percent yield.

Moreover, being an eco friendly approach, it was possible to certify the produce as organic. Thus, the quality of a large quantity of fruits and vegetables improved making them suitable for export. Low expenditure incurred on the control of fruit fly could motivate the growers and possibly enhance the sustainability of the technology demonstrated. The area wide adoption of fruit fly traps could effectively kill the male flies and thereby check further multiplication without disturbing the ecosystem. If such technology is adopted for a considerable time it would definitely be helpful in recognizing the area as PFA (Pest Free Area) and ultimately it will help boosting the export trade.

About 15339 farmers of all categories as well as free riders of six talukas in two districts could save about ₹ 35 crores every year by controlling fruit flies in mango, sapota and cucurbitaceous vegetables. The quality of the products, increase in production and goodwill generated in terms of healthy production ultimately benefited the farmers adopting this technology. Area wide control strategy is not known in our country. Therefore, farmers could also ascertain the actual benefits of adopting such technology which will further motivate them in future.

The effectiveness of low cost IPM technology in controlling infestation of fruit fly disseminated through the RKVY project has brought tremendous behavioral changes in the attitude of fruits and vegetable farmers. Now farmers have adopted this technology which has resulted in export oriented organic production of fruits and vegetables.

In terms of cost-benefit analysis, an estimated benefit of ₹ 81,840/ha is achieved by spending merely ₹ 350/ha. Thus, implementation of fruit fly technology in over 6000 ha of mango could have benefited the farmers to the tune of about ₹ 49 crore, while in case of cucurbitaceous vegetables, the fruit fly damage was minimised up to 2.5 to 4.6 percent by using the technology while the damage was 19 to 32 (30.50) percent in untreated fields. Thus, more than 85.0 percent damage due to fruit fly was reduced resulting in yield increase of 27 percent. Ultimately an estimated benefit of ₹ 26,250/ha in bitter gourd and ₹ 39,350/ha in bottle gourd was attained by spending only ₹ 550/ha. Thus, implementation of fruit fly technology in over 447 ha of cucurbitaceous vegetables crops benefited the farmers to the tune of ₹ 1 crore.



Fruit Flies trapped in Fruit Fly Trap



Ferrying Sweet Water for Higher Productivity

Background & Objectives

Rice-Wheat and Cotton-Wheat are two principal cropping sequences of Haryana covering an area of around 17 lakh ha. These crops are irrigated by canal or underground water. Mode of irrigation is still essentially flood irrigation. Flood irrigation results in loss of appreciable quantities of water by way of evaporation and seepage from irrigation channels. However, while the farmers with fields next to canals or having underground water source in their field do not care much about efficient use of water. The farmers in the tail end of irrigation command area or the farmers not having underground water resources in their fields as a consequence suffer, as irrigation water normally does not reach the fields at the tail end. Their fields remain parched. More and more farmers in the districts of Karnal, Kaithal, Kurukshetra, Panipat, Sonapat and Yamunanagar are joining the ranks of the water starved farmers as underground water resources in the state has been consistently declining at the rate of up to 31 cm annually.

There is yet another problem in Haryana. Though 84% of cultivated area is under irrigation in the State, about 62% of area gets poor quality water, especially in the districts of Bhiwani, Mahendragarh, Rewari, Jhajjar, Gurgaon and Mewat. There is a serious problem of salinity and sodicity in these areas. This water cannot be used for agriculture purposes unless salinity and sodicity in the water are brought to tolerable levels by mixing it with fresh water. By laying UGPL system, fresh water can be brought and collected in tanks for mixing with saline water for subsequent use for irrigation with little negative impact on productivity.

Water has to be brought from some distance to deal with the problems of farmers at the tail end, farmers without underground water sources in their fields or farmers with saline/sodic water. Traditionally, many of these farmers have tried to cope with these issues by bringing

water from a distance source by digging and building open channels. However, this has had another set of problems. There is water loss in transit. Such water channels tend to get damaged very often and consequently they require constant maintenance. Such channels also consume valuable land which could be better utilised for cultivation.

Underground Pipe Line (UGPL) system, which uses irrigation pipes placed underground to fetch the water from the source to the field, provides the most appropriate solution to tackle the above mentioned problems. Depending on the mean sea level of the source and the fields, UGPL system can bring water by gravity or by lifting and by carrying irrigation water from a source well to the field with pressure.

The problems faced by farmers in neighbouring Bathinda District of Punjab are also very similar. Most of the area of the district is sandy and has sand dunes. Underground water is generally brackish and of poor quality. The main source of Irrigation is canal water. In this district, the area of most of the villages falls at the tail end of canal and this water is not sufficient for irrigation. Most of the area thus remains rain-fed. For these farmers also, the salvation lies in bringing water through underground pipelines. In Punjab, by introducing UGPL system, canal water is lifted from outlets through lift pumps and provided to the fields by laying Underground Pipeline System.

UGPL system minimises water losses during conveyance from water bodies to farmers' field. Further, maintenance of irrigation channels is a bigger problem particularly during the paddy growing season when weed intensity is at peak. By creating underground conveyance system, thus, additional land is also effectively brought under cultivation by saving on the lands lost in making irrigation channels.

UGPLs, by bringing fresh water to the farmers' field allows conjunctive use of saline water by mixing it with fresh water for providing life saving irrigation.

Intervention

Haryana initiated UGPL programme in the first year of RKVY in 2007-08 on a small scale with allocation of an amount of ₹ 115 lakhs only to facilitate bringing water to an area of 2193 ha. The programme was subsequently expanded to reach to 4457.24 lakhs in 2010-11 for bringing water to as much as 36748 hectare. In all, the Government has approved a total outlay of ₹ 8034.00 lakh in first four years with the objective of facilitating irrigation of



Laying of Underground Pipe Line in Haryana

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72560 ha of land. An amount of ₹ 8034.24 lakh has actually been utilised on providing assistance to the 19,658 farmers covering an area of 72,560 ha under this system up to March, 2011.

The financial assistance in Haryana for UGPL system is provided @ 50% of total cost of HDPE/PVC pipe line limited to the maximum of ₹ 60,000 per beneficiary for all categories of farmers under RKVY.

The farmers generally use HDPE/PVC pipe for laying out UGPL system of 125/140/160/180 mm diameter based on the discharge of the tube-well or availability of water at the source. In order to ensure that farmers get quality material at competitive rates while at the same time have flexibility of choice of suppliers, the state

Agriculture Department registers/empanels the UGPL supplying firms every year with their quoted rates but without fixing any price. The rates quoted by the empanelled firms are negotiated by the farmers when they decide to take pipes from any supplier. Adoption of this practice has provided wider and more transparent choice to the farmers for procurement of material as well as release of subsidy.

The system in Punjab is more generous considering the fact that most of the water which is used by farmers in Bathinda district is canal water which virtually comes free for farmers. Government of Punjab, therefore, provides 90% of the total cost of the project under RKVY for laying UGPL system in the state. Further, taking

note of the poor economic condition of farmers in the region, the labour work is allowed to be done by the farmers themselves on community basis in lieu of their 10% share.

In Punjab, the sweet water was drawn from the Sirjeana Minor coming out of Bhakra Canal passing about 8-10 km away from the villages. The sweet water of Bhakra has reached the fields only due to the laying of Underground Pipeline system.

Under the UGPL project of Punjab, an amount of ₹ 122.43 lakhs has been provided under RKVY covering an area of 489 ha for laying 8000 metres of pipeline for 589 beneficiaries.

Outcome

The UGPL programme of Haryana is very popular with the farming community and there is huge demand for this system. Farmers are highly convinced about its benefits. Average production & productivity have increased by more than 30% in the area where such system is installed. Farmers are now taking 2-3 crops instead of only one crop earlier. In the water deficit areas & areas having unsuitable/brackish ground water, although the crop production & productivity are very low, at least one crop is now taken with life saving irrigation provided from UGPLs.

A third party evaluation conducted By NABARD revealed:

- There is significant increase in crop productivity due to use of UGPL system in the fields. The increase is 18% for paddy, 52% for wheat and 161% for Sorghum.
- There is saving of water as well. The average saving of water in irrigating one acre of paddy field is 36.1% whereas the same is 43.3% for the wheat crop.
- The UGPL system has helped in reduction of labour cost and drudgery for the farmers.
- A few other benefits reported were, land saving by about 3%, elimination of water logging near channel to the extent of 1.5%, elimination of additional wells in the area, safety in operations etc.



UGPL Project in Punjab

Punjab has also reported very encouraging results after implementation of UGPL system.

- Increase in yield: Per acre yield for Wheat has increased from 10 qtl to 20 qtl and that for Cotton from 4 qtl to 10 qtl.
- Improved Land Value: Due to assured irrigation & higher yields, the land value has increased from ₹ 60,000 per acre to ₹ 13.00 lakhs per acre.
- Saving of cultivable land: Due to the laying of underground pipeline, the land falling under kacha channels & bunds has also come under cultivation thereby helping in higher agricultural production.
- Diversification in Crops: farmers are diversifying to other crops like Paddy, Vegetables etc. after getting assured irrigation.
- Supplementary Income from other Occupations: Assured irrigation has helped farmers in growing green fodder for cattle.



Black Gold

Elite Murrah Germplasm

Background & Objectives

In spite of being one of the smallest States (1.3 % of total area) of India, Haryana has a prominent place in the dairy map of the country. Animal husbandry activities in the state play a pivotal role in the rural economy through a variety of contributions in the form of income generation, draught power, socio-economic upliftment, employment avenues and better nutrition to human population through livestock products like milk, eggs & meat.

Haryana possesses 2.5% of the bovine population of the country but produces more than 5.0% of the nation's total milk production. Similarly, per capita milk availability of the state is quite high at 680 gm against the national average of 236 gm. Haryana is the home of world famous 'Murrah' buffaloes popularly called the 'Black gold of India' and the all purpose 'Haryana' cow. The state has long been the prime source of Murrah germplasm for other states as well as abroad for up gradation of their low producing buffaloes. The demand for superior germplasm of Murrah is ever increasing in the rest of India and other countries. In Haryana, the livestock sector is contributing an impressive 36.1 percent of Agriculture GDP (at current prices).

Murrah buffaloes are heavy milk producers with high fat content in addition to being efficient feed converters even when fed poor quality roughage. Buffaloes contribute more than 90% of total milk produced in the state. In addition, they are a source of quality

Competition amongst Elite Murrah Buffaloes for Milk Production in Haryana



lean meat and valuable draught power. Murrah has also a central position in the rural economy as it contributes the lion's share of the income of the rural households.

Fast genetic improvement of Murrah is not only the top priority for Haryana but is also a national concern. The state had taken up an ambitious programme to identify the top quality Murrah germplasm through field performance recording, which serves as an in situ germplasm bank for further preservation and propagation. This programme of national importance has been substantially strengthened through RKVY.

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Intervention

Basic approach for identifying superior Murrah germplasm includes screening of the Murrah buffalo population possessing true breed characteristics. Minimum cut off yield for such a superior Murrah for one lactation period is 2600 litres of milk. Once such buffaloes are identified, their production performances in lactation are tracked. Male progeny of these recorded buffaloes are procured and are reared under scientific management at rearing stations or in situ as future bulls.

Initial yield is arrived by recording milk production for four consecutive timings with first recording being ignored as "emptying milk". This first recording is followed by monthly recordings by employing contractual milk recorders for accurate assessment of the lactation yield. Individual yield records are

pooled and compiled at the sub division, district and state level using suitably evolved computer programmes. Upon identification, these elite animals are insured at the spot with at least 50% of the premium being borne by the Government. The list of these elite buffaloes and their progeny, being regarded as prized national wealth, are displayed on the departmental website for easy access of all those who need it.

To motivate the owner (through an affidavit) not to sell his/her recorded buffalo and its male progeny at least for one year, Cash incentives are provided under the RKVY scheme. With lactation yield being the hallmark of superiority of the germ-plasm, cash incentives take into account lactation yields.

Cash incentive is given to the owners of different categories of the recorded buffaloes at the following rates:

Lactation Yield (kg)	Cash Incentive (₹)
2600-3200 (13 to 16 kg peak yield/day)	5000.00
3201-3800 (>16 to 19 kg peak yield/day)	10000.00
3801-< 5000 (>19 to < 25 kg peak yield/day)	15000.00
5000 kg and above (25 kg & more peak yield/day)	25000.00

As a consideration for cash incentive, the owner remains under obligation to look after the male calf properly and the department gets first right of its purchase. This arrangement creates an 'in situ' Murrah Germplasm Bank, available at all times. In case, the farmer does not abide by the contract or disposes of the identified buffalo or its male calf, he has to return the cash incentive received by him. In addition, the owners of the recorded buffaloes are required to breed their animals through artificial insemination only.

The progeny born to the buffaloes yielding 15 kg & more as peak yield per day are also provided enriched concentrate ration at 2 kg per day for a period of one year. The approximate cost of extra feeding for each such calf for a year is ₹ 8760/- 50% is provided under RKVY funds and the remaining 50% is the share of the owners.

RKVY assistance is also used for incentivising establishment of Murrah Breeders Societies in ideal Murrah Villages. A modest beginning has been made with ultimate aim to establish "Murrah Breeders Association" on the lines of similar associations world over to look after different breeds, e.g., Holstein Friesian, Jersey etc. Ideal Murrah village is identified as one which has 50 or more performance-recorded Murrah buffaloes out of which 1/3rd should yield 15 kg & more milk per day. A grant of ₹ 5.00 lakh as assistance is given to the Society established in such Ideal Murrah Village subject to the fulfillment certain criteria. More than 24 ideal Murrah Villages has

been established till now as self-sustaining agencies which are responsible to look after genetic improvement, conservation, propagation and trade aspects etc.



An Elite Murrah Buffalo

Outcome

In three years, i.e., from 2008-09 to 2010-11 since the scheme is in operation under RKVY, an amount of ₹ 1580 lakhs has been used under programmatic activities. 22950 animals have been recorded as top milk yield animals and more than 24 villages have been identified and declared as ideal Murrah villages. More than 6000 male calves have been procured from the field out of the total 22990 animals recorded in the scheme and more than 4000 young bulls have been

supplied to gram Panchayats under RKVY for taking up breed improvement activities.

The scheme has contributed significantly to the genetic improvement of the buffaloes in the country. Depletion of quality germplasm has been arrested if not stopped altogether. 'In situ' Murrah Germplasm Bank has been established and exported to other states to meet their demand for good quality genetic material required to upgrade their stock as per national breeding policy.

A data bank of quality germplasm has been established which will help in future planning to assist in harvesting the benefits of recent biotechnological advances in animal breeding and reproduction. Females born to recorded Murrah buffaloes are identified as future bull mothers and reared by farmers in situ. There is a significant improvement in genetic quality vis-à-vis productivity of buffaloes and this has brought socio-economic upliftment of their owners throughout the country. In last three years there has been 10% increase in milk production in the state, i.e., from 57.45 lakh tonnes to 62.67 lakh tonnes from the year 2007-08 to 2010-11 respectively.

Certified quality young bulls for Semen Production Centres as well as for natural breeding are available.

Karambir Singh, resident of village Sunariyan, District Kurukshetra got interested in the scheme when he visited the State Livestock Show last year. He purchased a high yielding Murrah buffalo, which was later recorded as the second highest milk yielder in the State and was awarded an incentive of ₹ 25,000 by Hon'ble Chief Minister, Haryana at a State-level function at Sonipat in March, 2011. By virtue of recording under this scheme, his buffalo has been priced at about ₹ 2.5 lakhs in the market in addition to very high price of the progeny of the buffalo, i.e., the male calf which shall be used as a bull in the future at one of the Semen Banks of the Animal Husbandry & Dairying Department, Haryana for propagation of this high quality germplasm in the State as well as in the country.

There are several Karmabir Singhs in Haryana. 10 proud murrah owners were given incentives of ₹ 25000 for recording yields of over 25 litres per day in 2009-10. Another set of 8 such farmers achieved this feat in 2010-11. These proud farmers are:

S. N.	Name	Village	District	Yield Per Day	Amount of Incentive (₹)
1	Dharam Pal s/o Rati Ram Gehdu	Neemka	Faridabad	29.94	25000
2	Sandeep s/o Rajinder	Neemka	Faridabad	27.13	25000
3	Narender s/o Randhir Singh	Didwari	Panipat	25.63	25000
4	Vijender s/o Ram Pal	Chulkana	Panipat	25.613	25000
5	Hawa Singh s/o Nathu Ram	Samani	Kurukshetra	25.6	25000
6	Dharam Pal s/o Fateh Singh	Sutana	Panipat	25.17	25000
7	Jagdish s/o Surat Singh	Bhurtana	Bhiwani	25.16	25000
8	HarBlash s/o Kali Ram	Bhurangpur	Ambala	25.1	25000





Pest Management through Pest Surveillance

Background & Objectives

Pests can suck your crops if you are not vigilant and cause losses running into millions. However, if you are vigilant, you can best the pests, save your crops and harvest excellent yields.

Agriculture in Maharashtra is predominantly rain-fed (83%). Cotton and soybean are the two major *kharif* crops covering as much as 62 lakh ha. Soybean farmers of Maharashtra have been devastated many times in the past by outbreak of caterpillar pests (*Spodoptera litura*, *Helicoverpa armigera* and other leaf eating pests). There was a severe caterpillar pest attack on soybean crop in Marathwada and Vidarbha regions of the State during 2008-09. Crops over an area of 14.64 lakh ha were infested by these lethal pests with level of infestation exceeding 50% in as large an area as 10.44 lakh ha. Estimated losses due to this pest attack were as high as ₹ 1400 Crores. Such a huge loss resulted in a national outcry. A team of experts, tasked to study this disaster, found out that lack of information about pest appearance and consequential absence of early warning system coupled with paucity of manpower to tackle pest management were responsible for the losses and recommended institutionalization of a pest surveillance system to take care of the same.

Learning from the disaster of 2008-09, Crop Pest Surveillance and Advisory Project (CROPSAP) was designed for all cotton-soybean growing districts of the State. CROPSAP project included:

- ▶ Developing and adopting a scientific approach to pest surveillance, monitoring the pests continuously and putting in place an early warning system of pest outbreaks.
- ▶ Building an on-line Pest Monitoring System for major pests of soybean and cotton (Tur and Gram crops were also identified for monitoring later).
- ▶ Building an institutional arrangement of visits by trained pest scouts for locating emergence of pests at very early stage, working with the farmers of the area.
- ▶ Creating awareness among the farmers about Integrated Crop Management (ICM) practices more specially IPM in soybean and cotton crops.
- ▶ Guiding the farmers for management of major pests through appropriate advisories.

Intervention

CROPSAP, conceived by the Department of Agriculture, Government of Maharashtra, is under implementation in the State since 2009-10 and the project is being implemented through funding from RKVY. The project funds gathering of data about emergence of pests by undertaking scientific surveillance of crop pests and diseases and issuing real time advisories to farmers for taking appropriate pest management strategies.

A Steering Committee headed by the Commissioner of Agriculture is responsible for coordination and monitoring of the project implementation. Work relating to field surveillance is being undertaken through a team of Pest Scouts and Pest Monitors and on line management of data for watching pest situation and issuing appropriate advisories through a team of Data Entry Operators.



Checking for Pest Incidence

Pest scouts collect data on pest/disease incidence from a mix of fixed and random plots in selected representative villages every week. Each Pest Scout collects data from 8 villages (covering approximately 12000 ha) by recording data from 4 plots (2 fixed plots and 2 random plots) on Mondays, Tuesdays, Thursdays and Fridays. The observations recorded on data sheets are passed on to Pest Monitors who get this data transmitted to the computer system with the help of the Data Entry Operators.

Pest Monitors also conduct surprise checks and random compilation of data collected by the scouts under their control (10 scouts per Monitor). Data recorded on Mondays and Tuesdays are transmitted to the system on Wednesdays and that collected on Thursdays and Fridays are fed on Saturdays. The data is analysed on real time basis and necessary advisories are transmitted on Thursdays and Mondays. While the pest data could be viewed/updated by user Department, the advisories, issued based on the data analysed,



Pest Scout at Work

is available for all to see on the webpage. Software developed for this purpose has advance features of reporting systems- current, temporal and temporal cum spatial pest scenarios and location of hotspots through GIS maps generated for any point of time.

Taluka level advisories are transmitted by the system through SMS text messages from Sub-Divisional Agriculture Officer to the mobile numbers of the registered farmers of concerned Taluka. Copies of the advisories are also prominently exhibited in village Panchayat offices in the form of Jumbo Xerox on notice board and used by the field staff of the Agriculture Department for dissemination.

The process involves regular (weekly) monitoring of standing crops for selected major pests/diseases and direct feeding of the data generated for expert analysis at National Centre of Integrated Pest Management (NCIPM). The results of this analysis are also passed on to farmers and other stakeholders in the form of advisories on real time basis using mobile/internet connectivity for taking appropriate remedial measures.

Scope of the scheme was subsequently expanded to four crops which are more prone to pest attacks, viz., cotton, soybean, pigeon pea and Chick pea in 2010-11 and 29 of the 33 districts of the State were covered (30000 villages). During 2010-11, the scheme covered a total cropped area of 92.67 lakh ha, 25.95 lakh ha of soybean, 39.51 lakh ha of cotton, 13.70 lakh ha of pigeon pea and 13.32 lakh ha of chickpea.

The entire cost of CROPSAP is incurred under RKVY and an amount of ₹ 43.05 Crores has been incurred for taking up this scheme in the State until December 2011. Central Research Institute for Dry-land Agriculture (CRIDA), Hyderabad correlates weather parameters with pest infestations reported for understanding and analysing the effect of weather parameters with pest population dynamics on GIS maps. Long term data collected through the project will help in developing pest forecasting models of major crop pests in Maharashtra.



Ring Pit Cultivation for Bumper Sugarcane Harvest

Background & Objectives

India is world's second largest producer of sugarcane with sugarcane being cultivated in 4.86 million ha in 2010-11 producing 324.91 million tonnes of sugarcane with an average productivity 66.9 MT/ha. Haryana had relatively small area of about 0.09 to 0.14 million ha under sugarcane cultivation in 2007-09 (about 2-2.5% of national area), with yields slightly lower than national average.

Among the various agriculture crops, sugarcane is one of the most remunerative crops. Sugarcane is also an important cash crop of Haryana and is cultivated in its northern part especially in districts of Ambala, Kurukshetra, Yamuna Nagar, Karnal, Panipat and Sonapat. Sugarcane productivity in Haryana was also, like in other parts of the country, stagnating whereas the cost of cultivation of sugarcane has been increasing. This led the State Government to look for new techniques to raise the productivity of the crop substantially.

The State's search led to a very suitable technique known as '**Ring Pit Method**'. The method, in farm trials, proved not only cost-effective but also demonstrated that the yields can be increased to two or three times compared to the conventional '**Row-to-Row**' planting technique. This technology, thus, has the potential of raising the present average productivity of about 70 MT/ha



Sugarcane Crop by Ring Pit Method of Cultivation

by three fold. Government of Haryana zeroed on this system of sugarcane cultivation as the best among the presently available techniques of cultivation for promoting the same for adoption in the State.

Under the conventional system, the Setts (Stem cuttings or sections of sugarcane stalks usually having three buds used for planting sugarcane) are grown in rows of 90 cm spacing and are arranged in a series without adequate spacing. This makes germinated Setts very thin in appearance ultimately affecting the number of canes in each Sett and its development. In the 'ring pit' method, sugarcane Setts are planted and raised in round 'pits' at the spacing of 180 cm between rows and 150 cm between individual pits in a row.

The pits are dug using specially designed tractor drawn power tillers. The pits are then filled with top soil, 5 kg of farm yard manure

(FYM), 100 gms gypsum and 125 gms super phosphate and are watered well before planting. Pit depth is kept at 1.25 ft. to 1.5 ft. Under this 'ring pit' system, around 2700 pits are thus made per acre. After planting Setts in this method, care is taken to see that only thirty mother shoots are allowed to develop which then leads to development of robust and healthy millable canes of 1.25-1.75 kg each. This technology can give a yield of 800-1100 qtl/acre (or around three times of conventional method) if the recommended package of practices is fully adopted.

The ring pit method of sugarcane cultivation is more water and nutrients efficient as well. This method, not only reduces water use, but also enhances nutrient use efficiency. Further, no ploughing and lodging is required, which save labour and machining cost.

Intervention

Haryana has taken up several programmes for sugarcane development in the state, which includes production of sugarcane seed and promotion of sugarcane cultivation. However, this innovative programme of promoting 'ring pit' method of cultivation was taken as a 'demonstration programme' to demonstrate to the farmers the method and also the productivity gains possible by its adoption. The state Government provided assistance of ₹ 6,000 per acre under RKVY for hiring of pit digging machine and paying labour charges etc.

The demonstration project was initiated during the year 2008-09 and continued in 2009-10. The assistance was reduced to ₹ 4000 per acre during 2010-11, which continues to be the norm in 2011-12. A total assistance of ₹ 48.72 lakhs has been utilised on this project during last 4 years covering an area of 812 ha demonstrating the technology in the fields of 359 farmers.

Technology demonstration of the ring pit method of planting sugarcane has led to many farmers adopting the same.



Ring Pits for Sowing

Outcome

By adopting the Ring Pit Method of sugarcane cultivation, the sugarcane yield has increased from an average of about 700 qtl/ha to about 2000 qtl/ha in farmers' fields, registering an increase of 167 to 195 %. The average net income of farmers has increased by ₹ 48000 to ₹ 119637 per acre or ₹ 120000 to ₹ 300000 per hectare. Subsidy of ₹ 15000 per hectare (later reduced to ₹ 10000 per hectare) by the Government has resulted in substantial increase in income of the farmers.

Shri Amarjit Singh, resident farmer of Jharauli Kalan, a village in the district of Kurukshetra, harvested 850 qtl in an acre of land when sugarcane was cultivated through ring pit method. His income increased by ₹ 65000/acre.

Sh. Hem Raj of village Muwana part of Jind had another satisfying experience to recount. After adopting this method in an area of 12 acres, his sugarcane yield increased from the state average of 288 qtl/acre to 830 qtl/acre registering an increase of 188%. He earned a net income of ₹ 119637/acre.



Early Development of Sugarcane in Ring Pits



Happy and Proud Farmer in his Sugarcane Field

Like Kurukshetra and Jind, Shri Rakesh of village Rajlu Garhi part of Sonipat district also harvested record crop by adopting this technology. Area cultivated by him was 2.5 acres. His

sugarcane yield increased to 770 qtl/acre registering an increase of 167.36%. The farmer increased his net income by ₹ 48,000/acre.



Stable Prices with Onion Storage

Background & Objectives

Storage of onion, especially in the long gap between the *rabi* crop and next *kharif* crop, can save tears both for farmers and consumers by evening out the supply and demand position. Onion is an essential ingredient of Indian food. Seasonality of onion production introduces volatility in its prices and often leads to major consumer resentment, when it goes up and proves disastrous for farmers when the price crashes due to over-production. Onion, with appropriate scientific storage, can be stored for up to six months.

Maharashtra accounts for 25-30% onion produced in the country and 80-85% in the total onion export from India. Estimated production of Onion in the State is over 41.47 lakh MT during 2010-11. Ahmednagar, Nasik and the neighbouring districts are the major onion producing districts of the State. Maharashtra districts harvest three crops of onion- about 10-15% during Kharif, 30-40% as late *kharif* and as much as 50-60% during *rabi*/summer season. Planting of *kharif* onion starts in June and it arrives in market during Sept-November. The late *kharif* onion planted in August arrives in the market during December- January. Onions of both these crops are not very suitable for storage. It is the main *rabi* crop which arrives in March-June which, besides being the largest crop (about 25 lakh tonnes), is also most suitable for storage. Since the bulk of *rabi* Onion is harvested during April-May, just before the onset of the monsoon, the prices of onion decline during this period while the same shoots up during the rainy season. Non-availability of storage facilities at farm level forces farmers to sell their produce immediately after the harvest to save further deterioration during rains. As a result they get the most depressed prices and the

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Scientific Onion Storage

middlemen in the trade get the advantage of volatility of prices of this essential commodity.

The prices of onion were as low as ₹ 500-600 per quintal during May, 2011 while they were over ₹ 1200 per quintal during July, 2011. The situation was much worse a couple of years back when there were insignificant storage structures at village level. If only the farmers had enough storage facilities to store and release the onion to the market evenly, the prices would have been less volatile and benefits would have accrued to both farmers and consumers.

Conventional storage of onion at the farm level had many pit falls. These temporary structures could not protect the produce from seepage of humidity and lacked aeration leading to high levels of sprouting and rotting of bulbs, thus resulting in high losses, neutralizing the advantages of higher price realisation during off season.

It was, therefore, realised that it would be essential to provide proper storage facility for this important food item to reduce the post-harvest losses. Government of Maharashtra took the initiative to encourage farmers to construct their own storage structures by providing subsidy for Scientific Onion Storage.



Bumper Crop of Onion

Comparison of Conventional and Scientific Storage

Conventional	Scientific
Highly susceptible to rain water seepage	Well protected from rain
No proper aeration	Aeration provided with open space under the structure and between storage bins
Storage not properly compartmentalized leading to difficulty in partial lifting of Onion	With protected compartmentalization partial lifting of Onion possible
Requires annual replacement of the structure due to temporary nature of construction	Permanent structure with no need of replacement
No space for sorting, grading and loading of Onion for transport	Provision for space in between the storage structures for sorting, grading and loading

Intervention

Government of Maharashtra launched a scheme to provide subsidy to the farmers at 25% of the cost of construction for Scientific Onion Storage under RKVY. Maharashtra State Agricultural Marketing Board (MSAMB) was entrusted with the responsibility of implementing the scheme in the state. To cover all categories of farmers, especially small and marginal farmers, storage capacities ranging from 5 MT to 50 MT were planned and promoted under the scheme. The norms for storage structures were laid down by MSAMB.

Normative cost of a 5 MT onion storage is ₹ 30000 and it goes up to ₹ 300000 for 50 MT storage capacity. As the subsidy support from the Government is limited to 25%, farmers do invest amounts ranging

from ₹ 22,500 to ₹ 225000 for constructing one storage facility in their farms/homes.

The scheme was launched during the year 2008 with a publicity campaign involving local press, leaflets, and radio and T.V. footages and with the active involvement of the APMCs in the State. There was an overwhelming response from the farmers in the State. By the end of year 2011 over 4.25 lakh MT capacity of onion storage has been created involving a subsidy of ₹ 49.57 crores from RKVY funds benefitting 17874 farmers of 11 districts.

Onion storage structures have come up in large numbers with the capacity of 2.30 lakh MT in Nasik and 1.11 Lakh MT in Ahmednagar districts. Such storage facilities have been created in as many as 25 districts of Maharashtra. Storage capacity of 4.45 lakh MT created so far can provide about 25% storage facility for *rabi* harvest.

Very tiny and marginal farmers have constructed onion storage godowns by forming Self Help Groups (SHGs), as witnessed in Beed district.

Some of the Agriculture Produce Marketing Committees (APMCs) have also started constructing onion storage in their premises.

Outcome

The onion storage scheme has benefitted both consumers at large and farmers in particular. Farmers have benefitted with storage losses reducing from 25 – 30% as in traditional storage to 5% in case of scientific storage. Consumers have benefitted from less volatility in the prices of Onion due to even arrival in the market. Onion Storage has also facilitated promotion of onion exports from India.

A commendable contribution of the scheme is illustrated from the experience of Hiware Bazaar village in Ahmednagar. More



Scientific Onion Storage at an APMC

than 40 farmers have erected onion storage structures having capacity of 25 MT each. Together, these farmers stored over 1100 MT *rabi* onion and released their stock in the market during August, 2010 fetching a price of ₹ 800 per quintal as against ₹ 400-500 prevalent after the harvest in May, 2010. These farmers contributed ₹ 500 each from their earnings to provide benches for the village school. With onion cultivation turning profitable for the farmers of Hiware Bazaar, reverse migration has started. Farmers now find their agriculture lands providing better living to them compared to doing manual labour in Mumbai.

This pioneering initiative in Maharashtra has truly proved a game changer for the Onion farmers.



Taking Soil Testing to Farmers

Background & Objectives

Plants require 16 nutrients/elements for normal growth and for completion of their life cycle. Those used in the largest amounts- carbon, hydrogen and oxygen- are **non-mineral elements** supplied by air and water. Remaining 13 elements are taken up by plants only in **mineral** form from the soil. Plants need relatively large amounts of nitrogen, phosphorus and potassium, known as **primary** nutrients. Three **secondary** nutrients - calcium, magnesium, and sulphur- are required in smaller amounts than the primary nutrients. The rest like boron, iron, zinc etc., known as **micro-nutrients**, are also important for growth, quality and productivity of crops. The big challenge for the farmer is to know the status of availability of these nutrients/elements in his field so as to enable him to apply the right kind of nutrients by means of fertilizers or manures or in other forms like bio-fertilizers etc.

The cost of essential fertilizers constitutes a large part of the input cost for the farmers. Applying less fertilizer than needed by the soil will adversely affect production both in terms of quantity, and quality but applying more will, besides costing him additional expenditure, also lead to damage to the crops. It is, therefore, imperative to have the soil fertility evaluated before applying any fertilizer to the crop to economise on production costs. For evaluating/testing soils, we need soil testing laboratories.

Most of the soil testing infrastructure in the country has been sought to be created in public sector. This has become a constraint in the expansion of soil testing infrastructure. Building this entirely in public sector requires substantial land, capital for construction and equipments,

and most of all personnel to carry out tests. Government of Gujarat worked out a solution for managing these constraints and to expand soil testing infrastructure substantially in the State.

Farmers of Gujarat are very enterprising. They want their soil to be tested. They also bring their produce to agriculture produce markets. Agriculture produce markets have land and funds to construct buildings- in many cases they already have spare buildings. The Government, therefore, thought of roping in Agriculture Produce Market Committees (APMCs) in this endeavour. Government of Gujarat also thought of bringing the private sector to carry out soil tests to take care of the constraint of hiring staff in government. RKVY funds were utilised to procure equipments and other testing machines. The confluence of APMCs, RKVY funds and private sector gave birth to the unique model of soil testing infrastructure in Gujarat. The state decided to build soil testing laboratories in the APMCs - the place where farmers are frequent visitors for buying and selling of their produce - with land and building contributed by the APMCs. Building of Soil Testing Laboratories (STLs) in APMCs was also expected to motivate farmers to appreciate the need for evaluation of their soil fertility. The STLs so built were to be operated by the private sector agencies and RKVY funds were earmarked for providing equipments and chemicals.



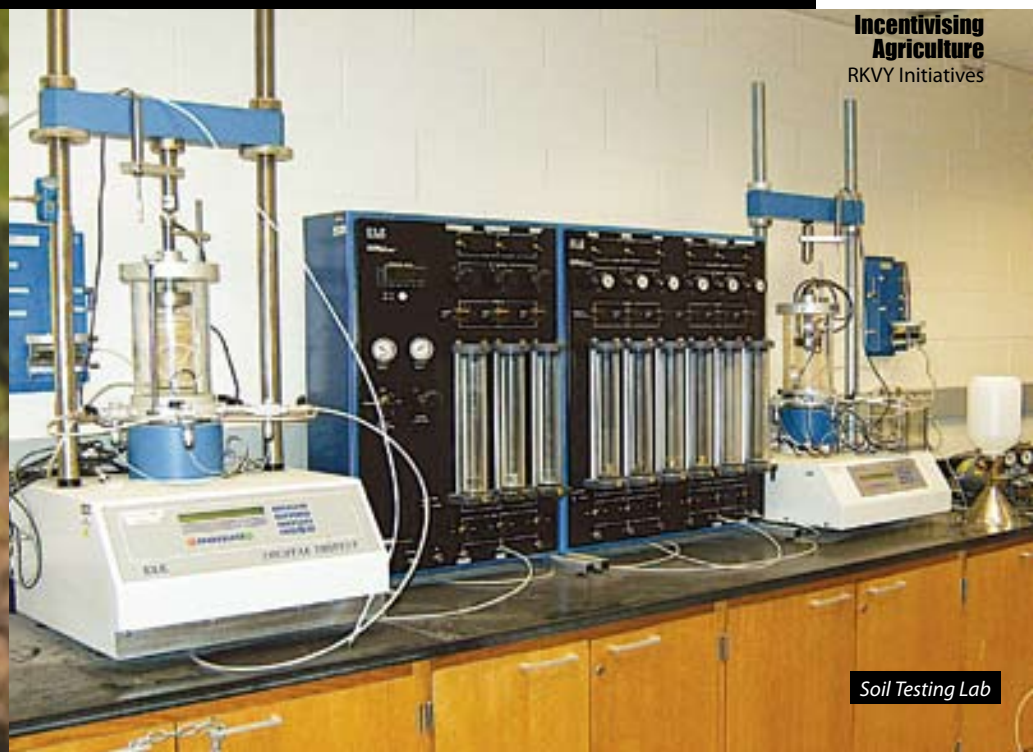
The state also decided to give preference for setting up STLs first to those APMCs' which had built up rooms and all other required infrastructure. Only renovation cost was allowed under the project. Soil samples were to be arranged by the district agriculture officers and operators at such laboratories were engaged on contract basis.

Intervention

The state took up setting up 63 soil testing laboratories at major APMCs with a contribution of ₹ 660 lakhs from RKVY approved during 2008-2009. 60 soil testing laboratories have been set up in the APMCs at the cost of ₹ 595.90 lakhs and they have become fully operational. In fact, as infrastructure was readily available with APMCs, more than 40 STLs became functional within 1 month of launching the project.

APMCs do not charge anything for the land and infrastructure provided by them as it is a service rendered to the farmers. The private sector operator is being paid service charges for testing at the rates decided by the Government of Gujarat. Glass wares, instruments and chemicals required for testing first 10,000 samples soil samples have been provided by Director of Agriculture. Kits and the cost of chemicals for testing beyond 10,000 samples is being borne by the APMCs. Expenses on staff, chemicals, electricity and stationary etc. are also borne by APMCs. The entire staff for testing is kept on contract on variable rates by APMCs under Public Private Partnership (PPP) mode which is working effectively.

A joint account of APMC and Gujarat State Agriculture Marketing Board (GSAMB) was opened to exercise proper control on funds. APMCs have also signed an MOU setting out their obligations.



Soil testing samples are collected from farmers' field by KHEDUT (farmer) MITRA/Volunteers who submit the same to the nearest STL. Farmers can also bring samples directly when they come to Mandis for sale of crops or purchase of inputs and hand over the same to the STLs. STLs test the samples in the lab for evaluation of nitrogen, phosphorus, potassium, EC and pH balance. The results are reported to the concerned farmers in the form of a soil health card with the advice to apply specific doses of nutrients.

Outcome

There is spectacular increase in the soil samples tested after creation of the STL infrastructure under RKVY. The Scheme, taken up in the year 2008-09 started showing excellent results. The soil samples tested in the entire state until 2008-09 used to range between 140000- 210000 annually. Soil samples tested increased to 310000 in the year 2009-10 when the work of setting up STLs was going on. In the year 2010-11, by the time the entire additional STL infrastructure was in place, the number of samples tested rose to over 18 lakhs- 1814095 to be precise. The soil samples tested increased by a phenomenal 500% in one year. It is easy to imagine benefits accruing to over 18 lakh farmers in the form of precise application of nutrients in the soil as a result of these testing reports.

Correct application of nutrients as a result of recommendations contained in soil testing cards as a result of availability of soil testing laboratories, in large numbers in their vicinity and also at the convenient place which they frequented, has brought about revolutionary change in the attitude of farmers. Earlier, farmers had to be persuaded for soil testing but now they insist on it because they are fully convinced that the soil test results helped them in minimising expenditure on fertilizers and in maximising productivity.

It is well known that continuous use of high doses of chemical fertilizers leads to degradation of soil fertility. Soil tests have helped farmers to adopt corrective measures on the basis of test results.

In Gujarat, though the soil testing laboratories were established and operated by the Department of Agriculture, public sector and state agriculture universities earlier, major impact of soil testing started showing only after launching of RKVY project in the state from 2008-09.

The STLs have not only made testing easier and faster but also ensured that there is no major liability on APMCs/Government .



Bulk Milk Coolers

Boon for Dairy Farmers

Background & Objectives

Milk is a highly perishable commodity. Further, the fact that cattle and buffalo rearing in India is a small holder activity with most farmers and dairy units being very small, sometimes limited to one animal, makes the matter worse. Although India is the highest producer of milk in the world with total milk production of 112.54 million MT per annum which is about 26% of world milk production, average milk production per animal is very low compared to world averages. There were approximately 10.1 million exotic/cross bred cows and 28.8 million non-descript/indigenous cows in milk in India in 2010 with total estimated milk production of 47.83 million MT with average milk yield of less than 3.4 kg per day. Similarly, 35.48 million buffaloes yield only about 59.2 million MT milk at a daily average of 4.5 litres per day. Rest of the milk production is largely accounted for by the goat milk.

The temperature of milk at the time of milking is about 37°C. It is to be quickly chilled to 4°C to check the growth of micro-organisms and to maintain its quality as per international standards. With most farmers owning less than 2/3 animals, it is well nigh impossible for these small dairy owners to have the resources to invest in storing the milk at required 4°C before supplying to consumers or milk collection centres.

Rajasthan is ranked 3rd in the country after Uttar Pradesh and Andhra Pradesh with annual total milk production of 9.55 million MT in 2010 with the state's share of 8.48% in national milk production. The total number of cows and buffaloes in the state are 12.12 and 1.11 million respectively.



A Bulk Milk Cooler of 5000 Litre Capacity Installed at a Dairy Cooperative Society in Rajasthan

The average milk production for a cow is 3.68 lpd and for a buffalo it is 5.66 lpd, slightly higher than national average. However, dairy is a real small holder activity in Rajasthan and dairy farms with more than 50 animals is almost non-existent. The Rajasthan Cooperative Dairy Federation (RCDF) is the largest organised milk supplier in the state with its network of 16 district level milk processing plants with membership of 6.65 lakh milk farmers. RCDF collects about 16.27 lakh kg of milk per day.

Small dairy owners bring the milk to the Dairy Cooperative Societies (DCS). The milk is retained in DCS until the milk tanker reaches DCS collection centre. In many cases, the milk is transported in raw form to district level milk processing plants in simple plastic/aluminium milk cans. The time between milking and delivering the same to the RCDF tanker/milk processing plant constitutes quite a few hours and is long enough to affect the quality of milk and, in many cases, milk gets spoilt. There were regular incidences of milk spoilage either at DCSs or during transportation. RCDF record shows that 1.5 to 2% milk used to get spoilt. The loss of the precious produce

was affecting the profitability of all stake holders including milk producers, DCSs and the RCDF.

In this situation, the most sensible investment was to install Bulk Milk Coolers (BMCs) at village level DCSs, which is the first stage of milk collection. A BMC is a two shelled container consisting of an inner and outer stainless steel shells with injected Poly Urethane Foam (PUF) insulation in between the two shells. Each BMC is equipped with an in-built light weight, low rpm (25-32) agitator and a refrigeration system and an additional milk reception unit, a pumping device and a generator set. The refrigeration system consists of a hermetically sealed compressor, controls and safety features that make the BMC extremely reliable and energy efficient. The milk from suppliers is poured into the reception unit and stored in a BMC where it is cooled to 4°C within 2-3 hours after its collection. The milk in BMC is maintained at this temperature till it is pumped into specifically designed milk transportation tankers through which it reaches to district milk processing plants.

Installation of BMCs in DCSs had started before RKVY but received a significant boost after RKVY funds became available in 2007-08.

The situation in Punjab is somewhat different. Punjab was a close competitor to Rajasthan with total annual production of 9.39 million MT of milk production in 2010. But, Punjab has much better stock of milch animals and average animal ownership per farmer is also higher. Punjab has 714 thousand exotic/cross bred cows compared to only 132 thousand such cows in Rajasthan. Non-descript and indigenous cows are almost negligible in Punjab with their number being only 133000 whereas bulk of Rajasthan's cattle are of this type and their number is 1727000. Both the states have large number of buffalo population with Punjab farmers owning 2.1 million and Rajasthan farmers having 2.8 million of them. Punjab farmers have invested in private dairies with individual farmers or group of farmers making investment in BMCs.



Intervention

Rajasthan took up a project with an outlay of ₹ 20 crores under RKVY in the very first year to invest in BMCs. This was followed up with another project with an outlay of ₹ 31.76 crores in year 2010-11. The RCDF installed a total of 760 BMCs with a total chilling capacity of 12.63 lakhs litres of milk at 760 village DCS's with this investment. The scheme covered 18 districts of the state - Ajmer, Alwar, Bhilwara, Bhartpur, Bikaner, Chittorgarh, Churu, Jaipur, Jalore, Jodhpur, Kota, Nagaur, Pali, Sikar, Shri Ganganagar, Sawai-Madhopur, Tonk & Udaipur. These BMCs are now very useful to the farmers at the DCS as they are able to keep the collected milk chilled till the tanker arrives from the Milk Union.

Punjab's model is more individual farmer oriented. Government provides a financial incentive of 50% for installing Farm Milk Coolers (Farm BMCs) having capacity of 500 litres, 1000 litres and 2000 litres with a suitable DG set. So far, 23 Farm Milk Coolers have been subsidised and ₹ 90 lakhs have been disbursed as financial incentive to dairy units under RKVY.

Outcome

An impact assessment study conducted at District Milk Cooperatives of Ajmer, Alwar, Jaipur, Jalore, Pali and Sikar during pre and post BMC phase indicated that the installation of BMC's has significantly improved the quality of milk and income of beneficiaries at all levels. The major outcomes of the BMC intervention are:

- Transportation cost of milk from DCS to processing plants has been reduced by 20% as milk is transported only once a day. The distance of milk route has been increased and the requirement of number of vehicles has reduced.
- Expenditure on purchase, maintenance and washing of milk cans has been fully avoided.
- Milk collection time has increased at DCS.
- Average milk procurement has increased by 30% at most of the DCS's where BMC's are installed.
- Incidences of sour curd are now rare from 1-2% earlier.
- Average sale price of milk at DCS has increased by 15%.
- Overall profitability of DCS has increased by 2%.



Sh. Kanwaljit Singh, Dairy Farmer of Garanga Village Along With His Farm Milk Cooler

Installation of BMCs has substantially boosted the process of dairy development in the state of Rajasthan. It is definitely not through increase in milk production but mainly through improvement in quality and Minimising the operational cost on procurement, transportation and processing of milk. The average daily milk procurement which was 13.59 lakh kg per day during 2007-08 (pre-BMC phase) has increased by 21.5% to 16.51 lakh kg per day during 2010-11. The milk farmers of the state are thrilled to reap the benefits of chilled milk.

In Punjab also, Dairy farmers, who have invested in farm milk coolers at their dairy farms, have reaped rich dividends after installation of Bulk Milk Coolers. This facility has helped farmers to maintain the quality of milk and increase its shelf life.

Sardar Kanwaljit Singh of Village Garanga, Distt. Mohali has been running a dairy farm. He was maintaining about 150 cows and producing 800 litres of milk daily. Initially he was having no facility of cooling the milk at farm level, and so he had no capacity to keep milk with him for even a short duration because the bacteria in the milk multiplied very quickly. He had to sell his produce immediately

which sometimes led to panic sale and he suffered losses. The investment on the creation of this facility was quite high and hence he could not make arrangements to install a farm milk cooler and had to remain at the mercy of milk purchasers.

He availed assistance under RKVY to install Farm Milk Cooler. He arranged a bank loan and with the assistance from Dairy Development Department, he purchased a farm milk cooler of 2000 litres capacity along with a DG Set. A very happy Sh. Kanwaljit Singh claims that with the help of Farm Milk Cooler, he is able to maintain the quality of milk. He says he can now keep milk with him for sometime, which has provided him the advantage of selling it at the optimum rate. Because of Farm Milk Cooler, he asserts, he is able to sell milk at an increased rate of ₹ 1.00 per liter. The buyer happily pays this premium because the quality of milk in farm milk cooler remains up to the mark and the processor has to incur a much smaller cost on its transportation and processing. According to Sh. Kanwaljit Singh yearly benefits due to saving on transportation and higher cost of milk is nearly ₹ 3.00 lakh. This is an extra income, which accrues to him due to the investment in Farm Milk Cooler.



Bringing Home the Bacon

Promoting Pig Farming

Background & Objectives

More than 70% of the population of Sikkim eats pork. Traditionally almost every household rears a few pigs to cater to their requirements. However, supply of pork is far short of demand. Production of pork is presently at 171 MT in Sikkim against an estimated demand of 1246 MT. Similar is the situation in almost all North Eastern Hill States of Nagaland, Manipur, Tripura, Arunachal Pradesh and Mizoram. Demand-supply gap almost makes it certain that financial viability and success of piggery based ventures is quite assured.

Pig farming is traditionally undertaken by the rural poor belonging to the lowest socio-economic strata. They have limited means to undertake scientific pig farming with improved foundation stock, proper housing, feeding and management. Therefore, suitable schemes to popularize scientific pig breeding and rearing of meat producing animals with adequate financial provisions are necessary to modernize the pig industry and to improve the productivity of small sized rural pig farms. The biggest constraint in promoting pig rearing is the availability of good breeding stocks to produce piglets for rearing by the farmers.

Department of Animal Husbandry, Livestock, Fisheries and Veterinary Services, Sikkim had 5 piggery demonstration farms at different districts, namely:



Piggery Sheds

- BOP Piggery Farm, Chungthang (North Sikkim)
- Tingvong Demonstration Piggery Farm (North Sikkim)
- Gyaba Piggery Demonstration Farm, Gyalshing (West Sikkim)
- Mangalbaria Demonstration Piggery Farm (West Sikkim)
- Karfectar Piggery Demonstration Farm (South Sikkim)

These farms were, however, inadequate to provide necessary number of piglets. Moreover, there was no pig breeding farm in East Sikkim and the farmers had to depend on other farms. To ease this constraint, it was decided to set up two more '50 sow farms' under RKVY, one at Assamlingzey in East Sikkim and the other at Mellidara in South Sikkim in 2009-10.

Piglets from these farms can be provided to rural farmers of Sikkim, especially the educated unemployed youth of villages, to enable them to take up piggery enterprises. This would not only meet the growing demand of pork & pork products of the state but also provide farmers a supplementary source of income.

Other north eastern states- Manipur, Arunachal Pradesh, Nagaland, Tripura and Mizoram have also decided to take up not only setting up of new pig farms, but also strengthening of existing farms, distributing pig units to farmers for raising pigs and also production of fodder for pigs.


Intervention

Two mother parent nucleus farms set up at Assamlingzey in East Sikkim and at Mellidara in South Sikkim, with parent stock capacity of 50 sows each with 4 satellite breeding farms at the village level. The nucleus farm supplies piglets to satellite farms, which in turn provide piglets & fatteners to the weaker sections of the communities. These farmers rear the piglets in the villages to meet the increasing the demand for piglets & pork.

The mother farm units produce good quality boars and sows, develop Parent Stock for production of young boars for public, check in-breeding of the existing stock and produce porkers and fatteners to meet the growing demand of ham, bacon, sausages and other popular pork products.

Farms are managed on scientific basis to demonstrate knowledge intensive technologies to encourage shift from input-intensive technologies to improved technologies which maximise the efficiency of scarce natural resources, undertake collaborative applied research activities for production of alternative feeds, search for unconventional feed ingredients, herbal drugs and supplements etc. Farms are also used to train and demonstrate model piggery farming practices to unemployed youth/farmers for developing them as entrepreneurs. in pig breeding.



A photograph showing three piglets in a simple, possibly outdoor or semi-outdoor, enclosure. One piglet is in the foreground, looking towards the camera. Two other piglets are in the background, one partially obscured by the other. A large, bright red plastic bowl sits on the ground between the piglets. The walls are made of a light-colored, textured material, possibly mud or plaster. The floor is dirt.

The farms will also be used as a demonstration units for imparting practical training to people on piggery management and production.

Both the farms have become functional. An investment of ₹ 90.67 lakhs was made in constructing sheds for housing 50 sows and breeding pigs in each of the two mother farms. 240 piglets were born until 31st of December 2011 in these two farms. 50 piglets were transferred to the satellite centres and 20 units (10 piglets- 9 female and 1 male) were given to 20 farmers for raising pig production.

Outcome



hipra Hang Subba was provided 9:1 piglets to start the satellite farm in September, 2010. The production of piglets in this farm is about 100 to 110 per year. His income per year is approximately ₹ 2 -2.5 lakhs.

Two other beneficiaries, Nimkit Lepcha and Phurba Dorjee Tamang have also reported similar increase in their incomes.

Pig meat is a preferred source of protein in the North East. RKVY projects in various states have strengthened the existing farms and set up new pig breeding farms to assist in promoting development of genetically superior livestock with high productivity which has helped in improving the socio-economic status of weaker section of farmers and unemployed youth by providing them with a supplementary source of income, protein rich food as well as organic manure that would add to their crop production.



Land Reclamation

Ramganga Experience

Background & Objectives

Priver Ramganga originates from Pauri Garhwal and enters Uttar Pradesh at Moradabad, flowing through Rampur, Bareilly, Badaun, Shahjahanpur and Farrukhabad before joining the Ganga in Hardoi. The river keeps on changing course frequently, causing heavy erosion and mass sand deposition on fertile lands along its banks. Very often flash floods occur in the catchments of its older paths, and water stagnates for 10-15 days at a stretch, causing heavy damage to standing crops.

With the passage of time, such affected areas got covered with dense shrubs like Moonj, Narkul, Sarpat, Sarkanda etc. As a consequence, about 56800 ha of land of 355 villages became barren with little or no cultivation. Locally the affected area is called *Katri* area. Over time, the affected area has gradually converted into wasteland and the occurrence of perennial weeds has stopped agricultural activities. Most often such areas harbour anti-social elements.

In 2006, the Police Department, Government of UP suggested to the Department of Agriculture that the *Katri* areas be taken up for land reclamation and turned into cultivated land so that the hide-outs of anti-social elements could be weeded out.

This was the genesis of the project for development of *Katri* lands in the districts of Bareilly, Shahjahanpur, Badaun, Rampur, Hardoi, Farrukhabad, and Moradabad.



Land Reclamation in Progress



Distribution of Seed for Demonstration Plots

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Incentivising
Agriculture

RKVY Initiatives

Intervention

The project had the following objectives:

- To bring the affected area under crop cultivation.
- To generate employment opportunities in the project area with flood control measures.
- To improve the socio-economic condition of the farmers in the area.
- To ensure capacity building of beneficiaries through training and crop demonstrations.
- To restore law and order in the affected areas.

The project was proposed to be taken up in phases and the project areas were to be selected on the basis of severity of problem in the area. Areas where scheduled caste/scheduled tribe farmers, small/marginal farmers and women farmers

are in majority were to be given priority while selecting the project area.

A pilot project was implemented during 2008-09 & 2009-10 in Shahjahanpur & Bareilly in which 806 ha of land was reclaimed at a project cost of ₹ 2 crores.

The process of land reclamation was initiated with the mechanical removal of perennial shrubs and leveling of affected land. The intervention also involved construction of contour bunds, peripheral bunds and check dams, spur or retaining walls, construction of embankment and link roads, provision of irrigation facilities and finally, demonstrations of crop, horticulture, forestry and agro-forestry. Crop production activities have been started in both *kharif* & *rabi* seasons.

During the first year of 2009-10, about 10705 ha of such problem areas were reclaimed with a provision of ₹ 23.00 crores and the



reclaimed lands were brought under cultivation in coming *rabi* season (2010-11).

All the farmers and labourers in the project area are beneficiaries of this scheme. Local administration in the district is responsible for getting the area surveyed and for allotment to farmers as per entries in the revenue records.

The total area reclaimed under this RKVY intervention in seven districts is 23215 ha out of an identified problem area of 64832 ha (up to 2010-11) involving a total investment of ₹ 50 crores.

Outcome

Out of total treated area of 23215 ha in the *Katri* areas, about 17087 ha area has been brought under agriculture. Cropping intensity has increased from 35% to 180%. Crop rotation in the treated area includes maize and mustard, urad and wheat, maize and lentil, sugarcane and single crops. There has been significant increase in the income levels of farmers as well as three times enhancement in the value of land. Additional

employment generation has been achieved with reduced anti-social activities.

Productivity enhancement in the project area has been impressive. Maize output after treatment was 18.20 qtl/ha, wheat 33.40 qtl/ha, lentil 10.35 qtl/ha, mustard 10.45 qtl/ha, and sugarcane a whopping 675 qtl/ha against the pre-treatment yields of 4.6 qtl/ha, 8.5 qtl/ha, 5.8 qtl/ha, 6.5 qtl/ha and 124 qtl/ha respectively. In percentage terms, the increase is 295 for maize, 292 for wheat, 78 for lentil, 60 for mustard and a whopping 444 for sugarcane as compared to the pre treatment levels of production.

Allotment of land in *Katri* area as per revenue records is being completed. Since the area is prone to flood, there is a need to promote community participation for protecting the embankments, regular monitoring of progress and dovetailing of support through other schemes for sustainability of cultivation in the area, after withdrawal of Government support.

Ecological enhancement and natural resource management as done in the *Katri* area of Ramganga River would play a significant role in the state's plan to double food production in the next two years.



Bumper Harvest of Lentil and Wheat in Reclaimed Katri



Maximising with Mechanisation

Background & Objectives

To meet food and nutritional demands of a growing population, Indian agriculture needs to grow at about 4% during the 12th Five Year Plan, that too, in the challenging context of competing demands for land and water resources, scarcity of farm labour and a looming threat of climate change.

An accelerated growth in Farm Mechanisation during the current decade will be a key enabler for coping with this challenge and helping to sustain desired agricultural growth.

In India, farm mechanisation has gained ground in the last five years for carrying out various farm activities efficiently and effectively; it has gained additional momentum due to the ever increasing scarcity of agricultural labour in the recent years. However, farm mechanisation in India, notwithstanding its strong and positive correlation with agricultural productivity, has only been able to achieve a meager growth rate of less than 5% in the last two decades.

The primary reason for the low level of mechanisation is the difficulty of mechanising the small and marginal farms (<2 ha of farm size) who remain at the core of Indian agriculture. Mechanising these small and non-contiguous lands is against 'economies of scale' especially in operations like land preparation and harvesting that require capital intensive equipment. With continued shrinkage in average farm size and lower credit worthiness of small farmers, individual ownership of agricultural machinery becomes progressively more uneconomical and out

of reach of majority of Indian farming communities. This phenomenon of gradual 'exclusion' of majority of small and marginal farmers in India from the benefit of farm mechanisation has been reaffirmed by NSSO sample survey (2005) that revealed that the degree of farm mechanisation has developed a stronger bias towards larger land holdings (>5-6 ha farm size).

Intervention



In Andhra Pradesh, focus on farm mechanisation has, in the past, been by way of providing subsidy to farmers for procuring farm implements suitable to their needs. However, this benefit has, as elsewhere, not reached many of the small and marginal farmers. Therefore, though there has been considerable progress of mechanisation in agriculture in the State, its spread has been very uneven.

Moreover, there were also concerns regarding further progress in this sector. What was really amiss was overall farm mechanisation that required employment of contemporary highly mechanised farm machinery such as paddy transplanters, combine harvesters, multi-crop threshers, etc., was still to make any major impact in the process of agri-mechanisation, primarily due to the high capital cost involved.

In order to accelerate the pace of agricultural mechanisation in Andhra Pradesh, the Government undertook implementation of the Intensified Farm Mechanisation Project under RKVY from 2008-09 to 2010-11.

Supply of farm implements to individual farmers on 50% subsidy was limited to ₹ 30,000 during 2008-09 and ₹ 45,000 during 2009-10 & 2010-11. ₹ 96.46 crores have been invested in this intervention during the span of 3 years.

From 2009-10, the Project was extended to provide high cost machinery to Farmers' Groups on 50% subsidy, limited to ₹ 10.00 lakhs. Subsidy of ₹ 50.66 crores was provided to various farmers' groups for purchase of 541 modern high value implements like transplanters, harvesters, threshers, power weeders, etc. in the 2009-10 and 2010-11.



Outcome

Though increase in production of food grains has been made possible as a result of several factors like adoption of quality seeds, better use of fertilizers, plant protection techniques and improved irrigation facilities, it is observed that farm power availability contributes significantly in increasing productivity and promotes better handling of inputs and outputs, which results in saving in inputs and reduction in harvest losses.

Supply of farm machinery has resulted in efficient management of inputs facilitating increased cropping intensity, plantation and harvest at proper stage, rapid and timely harvest that has provided extra days for land preparation and early planting of the next crop, reduction of cutting and containing losses to less than 2 percent, reduction in threshing time and obtaining required quality outputs compared to traditional threshing methods, and reduction in drudgery and operation time.

With increase in efficiency and timeliness of farm operations, mechanised farming resulted in saving of inputs, viz., seed and fertilizer by 20% thereby reducing the cost of production as compared to the traditional cultivation practices. Productivity increased by 10 to 30% and quality of produce also improved resulting in higher net returns to farmers.

This is what beneficiaries report

Rythu Club, Korrapadu Village, Rajupalem Mandal, Kadapa District

“We have been facing lot of problems in completing rice transplantation in time because of labour shortage. To overcome this problem, we procured a Rice Transplanter costing ₹ 10.20 lakhs on 50% subsidy under RKVY this year. Spacing was perfectly maintained and as a result there was good aeration, more number of tillers and fewer problems of weeds. We have a total savings of around ₹ 1800 per acre and an increase of about 25% in yield; the quality of the grain is also better”.



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Incentivising
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**Parimi Venkata Narsimha Rao, Pasivedala Village,
Kovvur Mandal, West Godavari District**

“I procured an 8 row paddy drum seeder on subsidy for ₹ 3,201 (full cost ₹ 6,402). The labour required was much less compared to the traditional method and water consumption also got reduced. There was profuse tillering with uniform grains. I achieved 12% increase in productivity and ₹ 90,000 additional income per hectare.”

**R. Subba Reddy, B. Cheruvu Village, Atmakur Mandal,
Nellore District**

“I procured a Rotary Tiller (Rotavator) on subsidy used for preparatory cultivation. I took up paddy cultivation in 5 acres. There was good and optimum soil tilth condition. As a result, plant population was optimum. There was a saving of ₹ 1500/acre as there was no need to take up ploughing, puddling and levelling operations separately. Weeds, stubbles and green manure were effectively mixed in the soil thereby improving the organic content of the soil. I observed

a 10% increase in yield, @ 2 qtls/acre. On the whole, I got a total benefit of ₹ 3300/acre after using this implement.”

**M. Thirupal Reddy, Thuvvapalli Village, Kodur
Mandal, Kadapa District**

“I procured a Multi Crop Thresher. I cultivated Sunflower in 10 acres and used this Multi Crop Thresher for threshing the produce. There was substantial saving in time and labour cost and about 15% reduction in grain loss and good improvement in quality of grain. I could get a net benefit of ₹ 1000/acre with the use of this machine.”

The project on Intensified Farm Mechanisation Project in Andhra Pradesh has come at a crucial time and has helped to widen the reach of farm mechanisation to traditionally excluded small and marginal farmers. Due to implementation of this programmatic intervention, farm power availability in the State has increased from 1.6 kw/ha during 2008 -2009 to 2.40 kw/ha in 2011-12.





Speed Breaker on Salt March

Background & Objectives

Gujarat is a coastal state, and as many as 14 out of 26 districts are affected by saline sea water. The natural boundaries of western and southern districts are very vulnerable to the flow of sea waters into arable land, particularly during high tide. As a result of this salinity of soil and ground water increases in the cultivable land making it unfit for growing crops.

Typically, salinity ingress in coastal areas is characterised by the mixing of sweet rain-fed underground water with horizontal saline water aquifers. In other words, it is the penetration of saline sea water into underground water sources like wells, which makes the underground water saline. The primary reason for this phenomenon is the excessive extraction of groundwater, encouraged primarily by agricultural growth that causes intrusion of sea water into the water table.

The increase in salinity has led to reduction in arable area, agricultural yields and paucity of drinking water and is threatening the livelihood of people, putting the region at risk of economic marginalisation and forced migration.

Checking salinity ingress has been one of the focused interventions taken up by Government of Gujarat. The agencies involved in this activity include Gujarat Government Departments of Agriculture, Horticulture, Forests and Irrigation, Gujarat Agriculture University, University of Junagadh, Anand, Navsari, Central Soil Salinity Research Institute, Bharuch, Central Salt Marine Chemical Research Institute, Bhavanagar, Narmada & Water Resource Dept.



Bunding

The project was initiated in 2007-08 and is being implemented by the Gujarat Land Development Corporation under RKVY from 2007-08 onwards with an overall outlay of ₹ 136.01 crores and a physical target treating 70795 ha.

Intervention

Experiences in salinity mitigation show that combating salinity requires a multi-dimensional approach that includes building ingress prevention structures, increasing rain water recharge potential of the area by constructing recharge structures,

water harvesting and run-off diversion systems, rehabilitation of the highly saline waste land by re-vegetation through afforestation and non-conventional crops, capacity building of farming communities on efficient water management practices and adoption of low water-intensive crop farming, among other interventions.

All these measures would fulfill the ultimate objective of improving the socio-economic status of the people by checking migration and increasing their income.

The RKVY project entails three pronged corrective measures which are as follows:

- Erection of reclamation bund along the arable land to prevent saline sea water entering into arable land.
- Promotion of recharging of ground water through various measures such as loose boulder structure, farm ponds, *nala* plugging for conservation of rainwater, earthen water harvesting systems, masonry check dams, percolation tanks, recharging of village tanks, wells and *sim talavs* etc.
- Adoption of soil conservation measures such as field bunding with drainage, land leveling, soil texture amendments, green manuring, deep ploughing, afforestation, silvi pastures & over seeding of grass etc.

The action plan was prepared in consultation with villagers, Central Soil Salinity Research Institute and scientists of state universities.

In each district affected by salinity, micro plans were prepared to check salinity ingress, and to deal with recharge of water and soil salinity management at the village level. Village Sarpanchs and Panchayats played a key role in all such activities. Once all the plans were executed, further maintenance of ponds, recharge structures, check dams etc was the responsibility of village Panchayats.

The entire expenditure of ₹ 135.43 crore involved in the project in the state was met from RKVY. The period of implementation was 2007-08 to 2011-12.

The approved project was implemented at the coastal sites through the field staff of GLDC in accordance with the micro-plans and action

plans of the sites selected. User groups were also formulated to check and supervise the activities and also to make the policy for distribution of stored rain water in ponds, tanks etc. and to maintain the water bodies created under the project. User groups also ensured transparency in all activities.

Execution of various activities like reclamation bunds, farm ponds, land leveling, percolation tanks, *sim talavs* and desilting of village ponds was carried out by both manual labourers and by machinery.

Outcome

Due to construction of long reclamation bunds along the sea, the entry of saline water into agricultural land has stopped. The quality of saline sub-soil water has improved and its pH and EC (Electrical Conductivity) has become normal due to percolation and recharge of sweet water from farm ponds, percolation tanks, and other storage structures.

Large areas of fallow land have become cultivable in *kharif* season due to soil and water conservation measures likes field bunding, land leveling and land shaping. *Kharif* crop failure due to long dry spells in the monsoon season has been controlled, soil fertility and productivity have improved, and the effects of flood and drought hazard mitigated.

Additional area of 8580 ha has come under cultivation in the *rabi* season, due to creation of supplementary irrigation facilities through water



Masonry Check Dam

harvesting structures, percolation tanks, farm ponds etc. In addition, drinking water facilities for the human population and cattle have also been created. Cropping intensity has increased by approximately 1.5 times. Yield under various crops has also shown increase after treatment, e.g. cotton production has increased from 8 qtl/ha to 12 qtl/ha, paddy from 38.20 qtl/ha to 58 qtl/ha, wheat from 8 qtl/ha to 10 qtl/ha, castor from 15 to 20 qtl/ha and fennel from 8 to 12 qtl/ha.

Land reclamation, soil fertility conservation, ground water quality improvement and rain water conservation for enhancement of crop production are the parameters for success of the project. In Gujarat, 69771 ha of land has been reclaimed making it cultivable through the project till November 2011. Total number of farmers who have benefitted from this intervention is 20479.

In south Gujarat, the problem of salinity ingress is more severe than in other parts of state. The project work was verified in two districts, viz, Navsari and Valsad where the project was allotted in 2009-10. The areas covered in the two districts were 3478.00 ha and 5311.52 ha, respectively, making a total of 8789.52 ha. In these

2 districts 23.22 kms of reclamation bunds were constructed leading to 782 ha of fallow land becoming cultivable in the *kharif* season and 163 ha in the *rabi* season.

The number of beneficiaries of villages Malvan, Untadi, Chharvada and Khatalvada in Valsad and Dandi & Sultanpur in Navsari districts are 5642 and 405 (total 6047) and their land reclaimed is 4580.71 ha and 529.95 ha (total 5110.16 ha) respectively.

As a result of implementation of the project, quality of soil in the project areas also improved as revealed from the data pertaining to specific farmers as depicted in the table.

Before implementation of the project in the salt affected areas, crop cultivation was either not possible or else it was limited to the *kharif* season only. Project implementation made it possible to take crops both in *kharif* and *rabi*. Cropping patterns have also changed thereby lifting the economic status of the farming community and preventing migration in search of greener pastures. They are the contented beneficiaries of this RKVY intervention.

Survey: Area and Period			Before Project		After Project
Sampling Month	Name of Farmer	Village	pH	EC	pH & EC
Jan-10	Mulijibhai Mangal Kapil	Khatalvada	8.33	19.30	Normal
Jan-10	Dhanji Gopibhai	Khatalvada	8.16	18.73	Normal
Jan-10	Yogesh Mahdev Desai	Sultanpur	8.21	14.21	Normal
July-09	Rabiben Dayabhai	Dandi	7.86	13.03	Normal
July-09	Jeevanbhai, Somahbai	Dandi	7.74	11.82	Normal
July-09	Ramji Bhama	Dandi	7.76	–	Normal





Pulses Energising Sugar

Background & Objectives



In India, Pulses are grown on the marginal and sub marginal lands of the farmers and about 85% of the pulses production is done in rainfed areas.

Apart from being a rich source of protein, pulses also increase fertility of the soil due to their leguminous nature. India is the major producer and consumer of pulses. Despite their importance, the per capita availability of pulses has reduced to almost half from about 70 gm/day in 1950-51 to 30 gm/day at present. This is against the recommendation of 43gm/day given by Indian Council of Medical Research in India.

The area under pulses is decreasing due to several production constraints such as lack of adequate quantity of quality seeds, varieties being prone to disease and pest, lack of technical know-how, slow dissemination of technology, lack of mechanisation, marketing problems etc. Increasing pulse production is a national concern today so as to meet the recommended per capita protein requirement. For increasing the area and production of pulses, inter-cropping with sugarcane is considered one of the potential possibilities because of crop compatibility and crop duration.

Uttar Pradesh has made an attempt to enhance area and production of pulses by inter-cropping with sugarcane in western U.P. with funding from RKVY. This attempt has led to increase in soil fertility and in turn has increased the production of sugarcane.

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Intervention



In Uttar Pradesh, the area under pulses is 2.22 million ha and production is 1.99 million metric tonnes with an average production of 8.99 qtl/ha. Total area of sugarcane in the state is 22.49 lakh ha. A scheme for **“Increasing Area & Production of Pulses through Inter Cropping with Spring Sown Sugarcane”** has been implemented under RKVY in major sugarcane growing areas of Uttar Pradesh since February, 2011. Total expenditure under the project for the years 2010-11 and 2011-12 is ₹ 421.75 lakhs.

An area of 85272 ha in 265 blocks of 30 selected districts of the State was targeted through this intervention. The activities that were carried out under this scheme were distribution of inputs like pulse seed (*urd*), bio-fertilizers, trichoderma, *Beauveria bassiana*, insecticides, raised bed planters, organisation of training & field days, distribution of literature etc.



Sugarcane inter-cropped with Pulses

Major areas having sugarcane based cropping system were identified, followed by selection of farmers willing to take up inter cropping of pulses with sugarcane. Such willing farmers were trained on package of practices of sugarcane-pulses inter-cropping, the cost benefit advantage of inter cropping with sugarcane explained to them.

Sowing of one row of pulses between two rows of sugarcane by the farmers was carried out under the watchful eye of the block supervisor.

Field days were organised at village level to show the response of the inter cropping to neighbouring farmers.

Finally, a record of the observation and feedback from the farmers was maintained.



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Nearly 43723 ha sugarcane area has been covered in 265 blocks of 30 districts against the target of 85272 ha under the pulses inter-cropping. *Urd* (black gram) Seed of 4603.83 qtl was distributed and 60000 farmers were benefited.

Outcome



This project has promoted efficient use of cultivated land in sugarcane areas, optimised use of available resources, i.e., water, labour and other inputs, and reduced overall cost of cultivation.

Moreover, it has not only provided additional yield of pulses averaging 6.56 qtl/ha to beneficiary farmers but also benefitted sugarcane crop symbiotically. Soil health has improved due to fixation of atmospheric nitrogen by root nodules of *urd/moong* which ultimately benefits the sugarcane crop, resulting in increased yields by 10%.

Truly a win-win situation for farmers!!



Success with Check Dams

*When water fails, functions of nature cease,
Thus when rain fails, no men can walk in "duty's ordered way*

–Kural (20)

Background & Objectives

Agriculture and related activities are the primary source of livelihood for the people in Jharkhand, with nearly 67% of the total work force dependent on agriculture.

Out of 38 lakh ha of cultivable land, presently only 18.04 lakh ha are net sown area. However, despite the fairly sufficient average rainfall of around 1400 mm, only 11.3% of the total net sown area is under irrigation in Jharkhand.

The State has a fairly high potential for agriculture in general and for cultivation of certain high value agricultural crops including fruits, flowers and vegetables in particular due to the favourable climatic conditions. Despite these advantages, agricultural development and adoption of modern technologies are yet to reach their potential in the State. Consequently, production and productivity are below the national average in the case of most of the crops.



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Irrigation plays a significant role in increasing yield from the land. Non-availability of timely and adequate water for irrigation is a serious constraint in achieving higher productivity and stability of farming; assured irrigation is the need of the hour. Though the total rainfall in Jharkhand State is satisfactory, its distribution over time and space is highly uneven. Therefore, rain water harvesting and water use efficiency are critical for increasing production and productivity.

Intervention

The water holding capacity of the State soil is very low due to porous nature of the soil and undulating topography. The annual average rainfall in the state is approx 1200-1400 mm, which occurs mainly during the monsoon months i.e. during June-Sept. Out of the total rain, 60% is wasted due to

surface run-off and leaching and only 40% rainwater remains available for crop use. Given the geographical and soil conditions, the most effective method of rainwater harvesting in Jharkhand is to collect runoff in streams (*nalas*) through construction of small check dams that will enhance water conservation as well as control soil erosion.

Approximately 80% of the farmers in the region are small and marginal (<2 ha) and the high cost of investment in soil & irrigation development is beyond the reach of most rural families. Therefore, Participatory Integrated and Improved Community Irrigation Projects have been promoted with subsidy up to 90% of the project cost with the following structures:

- ▶ Birsa Pucca Check Dam (BPCD).
- ▶ Loose Boulder Check Dam (LBCD) and Guard Wall.

- ▶ Lift Irrigation System (Including Sunken Well, Pump House, 8hp Diesel Pump set and underground PVC pipe system (with 4kg/cm²).

Participatory Community Irrigation Management (PCIM) through Water Users Associations (*Pani Panchayats*) has been encouraged to maximize the benefit from the available water. Capacity building of *Pani Panchayats* has been taken up to bring about awareness of rights, roles and responsibilities of these groups for effective utilization and monitoring of water allotted to them.

For better water utilisation in the targeted areas, irrigation water is supplied through underground conduits to minimize

transmission loss and Rotational Water Supply System has been adopted for effective use of water.

Assured irrigation of at least 90-100% in *kharif* season, 80-90% in *rabi* season and 20-30% in summer season has been made available for cultivable land in each cluster of 20-25 ha. This has been achieved by a suitable combination of flow irrigation, as well as micro irrigation system.

Micro Irrigation (drip and sprinkler irrigation) helps farmers in saving water, increasing yield, supporting new technological packages and increasing employment. Micro irrigation is being promoted in a big way in the State by providing subsidies upto 90% of cost for setting up drip and sprinkler irrigation system and this will go long way in efficient use of water.





Outcome



In Jharkhand 943 Birsa Pucca Check Dams (BPCD) have been constructed across the perennial streams in 2009 and 2010-11 at a total cost of ₹ 89.164 crores and the cost has been met largely from RKVY. An irrigation potential of 18700 ha has been created for *kharif* and *rabi* crops. There used to be severe water stress during *kharif* earlier. Now farmers are in a position to raise crops without interruption in areas where check dams have been constructed. In *rabi* the production has enhanced by 80-90% in these areas. The cropping intensity in these areas has been enhanced by more than 200%.

Earlier, farmers used to take Paddy & Maize only during *kharif* season because they were dependent on rain only. In *rabi* season agriculture was almost negligible and only *rabi* vegetables were grown with very low production. After construction of the check

dams, not only was paddy cultivation ensured with increased production but *rabi* and summer cultivation also came into regular practice.

For example, Shri Umesh Pd. Mahto, S/o Sri Tiku Mahto, a farmer of Village Nagwan, Block Sadar, District Hazaribagh, who has a farm of about 1 acre notched up a cropping intensity of 300% in 2009-10 by cultivating hybrid rice, maize and vegetables in *kharif*, wheat and vegetables in *rabi* and vegetables in summer after availing the benefits of assured irrigation through construction of the BPCD in his area.

The total targeted investment from RKVY for this intervention from 2009-10 to 2012-13 is ₹ 165.164 crores. It is expected that due to this intervention the state will be able to bring more than 37000 ha area under assured irrigation by the end of 2012. In other words, there will be an increase of 1.65% of irrigated area in the State.



– Shri Minu Mahto, beneficiary of BPCD
in Village Lochan, Keredari, Distt. Hazaribagh



Food Security Army

Background & Objectives

The Wadakkanchery regiment of Food Security Army (FSA) is at your service, Sir”, the Regiment Commandant of Wadakkanchery Food Security Army and his men with their artillery of agro machinery is reporting at the door step of the farmer to receive instructions for execution of works on his farm. Wadakkanchery is a village which is largely agricultural. The FSA has the technical knowledge of farming operations and is trained to carry those out with modern agro machinery. They are attired in ‘FSA’ uniform and are ready to render services round the clock. Their services can be sought through mobile phones. They are the service providers for farming activities - the ‘guardian’ of food security of the country.

In Kerala, over the last four decades, there has been a steady decline in the number of people available for or willing to work in the fields with nearly 12 lakh workers having left the agrarian sector. The primary reasons for this phenomenon are migration of the younger generation away from the State and from the agriculture sector due to the strenuous nature of the work. Migrant workers from other States were available, but their wages were exorbitant as it vied with employment opportunities in other, more lucrative sectors. Farmers were increasingly opting out of cultivation as it was just not economically viable.



"Sir, Food Security Army is at your Service"

How then, was the State to sustain seasonal agrarian activities? How to get people engaged in the noble profession of farming? How could social security, social respect, and self esteem be brought back

to this profession? How to prevent fertile paddy fields from turning into fallow land? How would the food security of the State and the country be ensured if the current trend was to continue?

Intervention

Three years ago the Government of Kerala thought of an innovative idea to address this issue. The call of the hour was to create an able service provider for the farmer. The State visualised establishing a corps of highly disciplined and dedicated personnel, similar to the army, to work on farms to produce food and ensure food security for the country. This would be the “Food Security Army” (FSA)! They would be trained for punctuality, discipline, dedication and commitment, similar to military training. They would have first-hand experience in operating all agro machinery in actual field conditions. They would have a distinctive dress code and follow good work ethics.

The platform to translate this vision into reality was provided by the Rashtriya Krishi Vikas Yojana. The project had three phases. The first phase comprised of putting in place a veritable artillery of new generation agro-machinery that is user friendly, health and life caring and drudgery removing and establishing a quality training hall that is inspiring and motivating. The project was implemented during 2008-10. Machinery worth ₹ 100 lakhs was procured and used for training. Around 2200 people were trained for the FSA, among them 1370 men and 830 women from 80 villages. An accreditation ceremony, akin to the passing out parade was organised on the occasion of the successful completion of the training process.

The second phase involved large scale demonstrations of operations of the FSA, to convince the farmer of the competence and usefulness of the FSA. In the process the FSA would gather valuable field experience, earn confidence and esteem and create goodwill among the public. This phase was drawn up and implemented during 2009-11.

The third phase was the actual creation of FSA service centres at village level. The FSA gets first hand experiential learning of hardware aspects, e.g., repair, service and operation of agro machinery and masters the art of crop production using machinery. They are organised to work in groups termed “Agro Machinery Operation Service Centres”. 23 such service centres have already been registered to operate at village level, and many more are in the process. The Agro Machinery Operation Service Centres provide agro machinery operation services on contract basis to farmers on demand. The service charges

Training in Progress





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are fixed and notified. The services are guaranteed and timely as per contract. The operational services include, land preparation, planting, inter cultivation operations, harvesting and post harvest handling and several such operations using agro machinery for paddy and other crops.

The total outlay of ₹ 250.60 lakhs for the 3 phases was met from RKVY allocation of the State.

Outcome

Latha Raveendran, Commandant of 'Parappur Regiment' says "Before joining FSA, my daily income was ₹ 80 per day, that too seasonal. Now it is more than ₹ 700 per day, I don't have holidays". She commands a 43-member regiment which collects more than ₹ 50 lakhs annually

in service charges. "I have never seen currency worth lakhs before", she says.

Suresh, Commandant of Wadakkanchery Regiment tells, "The entire 4250 acres of paddy in Wadakkanchery is now completely mechanised. Green Army is rendering the service. All the 110 *padasekharams* (groups of paddy farmers) have contracted with us. The business is over ₹ 100 lakhs".

Indira Lawrance from Kodakara Regiment says "Last season the entire work in 10 acres of barren land was contracted for paddy cultivation from Panchayath and the service charge received was ₹ 14,000 per acre". Indira also provides services of coconut climbing and is a Master Trainer for the FSA.

Latha, Suresh and Indira are role models of FSA. Several Lathas, Indiras & Sureshs have been created by RKVY.



President of State *Kole* land farmers Sri Kochu Muhammed openly admits. "When the idea of Food Security Army was mooted, I thought it will be a flop. But, now I understand that it is an inevitable part of society for food security". Many echo his sentiments.

Creation of the FSA was a unique venture for bringing back prosperity in the agrarian sector and creating an invaluable human resource dedicated to this sector. It provided an

opportunity for the youth to serve the country. The scope of the FSA is spreading from village to village in Kerala and also to other states. Farmers feel secure having the FSA to provide essential services round the clock. Land hitherto left fallow is slowly coming back under cultivation. RKVY has enabled quality and assured agricultural services at the door steps of the rural population.

The slogan being raised yet again is "Jai Jawan Jai Kisan"!!





Empowering Women in Agriculture

*When women thrive, all of society benefits,
and succeeding generations are given a better start in life.*

– Kofi Annan

Background & Objectives

Women play a pivotal role in all economic and crop production activities in the hills. In Himachal Pradesh, women farmers are the veritable back-bone of subsistence agriculture. Yet due to gender insensitivity they do not receive the desired recognition. Women farmers' needs and rights have been largely ignored and in many cases their condition is little better than that of farm labour. Therefore, the State felt the need to mainstream women farmers in developmental activities and utilise their potential with adequate recompense.



कृषि में महिलाओं का योगदान
नभको करना होगा सम्मान।

महिलाओं को शिक्षित बनाना है,
कृषि में नई क्रान्ति लानी है।

मुख्य उत्पादन

कृषि विभाग

TOURISM TRAVEL OFFICE
Reservation
Tour-Air-Rail

महिला उत्पादों का विकल्प केंद्र

कृषि विभाग

कृषि विभाग

कृषि विभाग

कृषि विभाग



Members of Women SHG

Intervention

About 80% of the field work in agriculture, from sowing to harvesting, post harvest management and dairy management is done by women farmers. The tasks are laborious and since the woman is unaware of the latest technical know-how, her output and productivity are low. There is need to cut the drudgery of women farmers and make their efforts worthwhile and economical.

To uplift the socio economic status of this group, a project on women empowerment, with an outlay of ₹ 372.90 lakhs covering a period of three years was initiated in 2009-10 under RKVY. The prime focus of the project was to mobilise women farmers to form Self Help Groups (SHGs) through awareness programmes, provide them technical assistance through capacity building, and motivate

them to generate on-farm as well as off-farm income through various activities.

A total of 1030 women SHGs comprising of 20 farmers in each group have been formed across all the blocks in Himachal Pradesh. From each SHG, a group leader, who is called the link worker, is selected and provided training on managerial skills so as to actively run and mobilise the group activities. The SHGs identify their issues and objectives and the Government provides them requisite technical support through institutional trainings, demonstrations, exposure visits etc.

Institutional trainings of 2-3 days duration is provided on latest technology and improved practices to get more yields in agriculture, horticulture and animal husbandry. Vermi-composting has been a major practice that SHGs have been willing to adopt. This improves soil fertility and minimises the laborious and often



Mahila Goshti

unpleasant task of carrying farm yard manure by head load, vermi-compost being comparatively lightweight. The SHGs are also made aware of the departmental schemes and programmes in these sectors so that they are able to avail maximum benefits therefrom.

Demonstrations are laid out in the fields of SHG members to apprise them about productivity enhancing practices such as use of quality seeds and improved varieties, seed treatment, nutrient management, vegetable cultivation, vermi-composting, plant protection measures, etc.

Specialised trainings in food processing and fruit preservation are organised to help SHGs supplement their incomes. Exposure visits are organised for these groups to state level universities, progressive farmers and other farms. Seed capital of ₹ 10,000 is provided to each group and efforts are made to link them with banks.

Mahila goshtis are organised annually to exhibit their products, share experiences and interact with experts. This enhances their knowledge, competitiveness and marketing ability.

Outcome



Adoption of improved practices has increased production by these farmers to the extent of 25 -30%.

Interaction with scientists and subject experts during exposure has sensitised them to the benefits of diversified agricultural practices, especially in tiding over lean periods in normal agricultural activities. As a result 190 groups have started vegetable cultivation, 70 groups are involved in mushroom cultivation, 50 in dairy farming and 90 in organic farming, which has increased their income by 4-5 times.

Specialised trainings in food processing and fruit preservation have given a new advantage to their post harvest management practices and SHGs have started making quality pickles, jams, Sheera etc not only for their own consumption but also for sale in nearby markets, thereby adding to their earnings. Members have also taken up other activities like making soft toy, weaving shawls and woollen garments.

Groups were given a small seed capital of ₹ 10,000/- to support these income generating activities and 450 groups have already been linked with banks for credit to promote their agri-entrepreneurial efforts. Several members have also switched over to commercial agriculture. Some of these women are now active members of Panchayats, ATMA etc., bringing many more of their sisters into the development fold.

Economic empowerment through formation of SHGs has ensured better life and status for these women, and infused them with new found confidence and decision making ability.





Food for the Gods

Background & Objectives

Potato is the favourite tuber crop in almost everybody's list. It is the king when it comes to street food across the country. Potato is so much part of our lives now that it is difficult to imagine that it came to us only about 180 years ago. Originally from Bolivia and Peru, legend has it that it was brought to India to please the palate of Warren Hastings in 1780. By 1830, potato was growing in Dehradun, and the rest, indeed is history.

The tribals in Kandhamal, Kalahandi and Koraput districts of Orissa have a long tradition in foraging for food, collecting different forest roots and tubers, of course other than potato, to meet their food demand at times of scarcity. Ecological degradation, erratic rainfall and of drought are the principal causes of food insecurity in these areas, resulting in increasing migration among tribals and periodic starvation deaths. Agriculture is the major source of livelihood of tribals in these districts as they get more than half of their income from settled agriculture and shifting (podu) cultivation.

Some tuber crops can however withstand long periods of drought and low fertility levels. The most important tuber crops are "Elephant Foot Yam" (*Amorphophallus paeoniifolius*), "Cassava" (*Manihot esculenta*), "Yam" (*Dioscorea alata*) and "Sweet Potato" (*Ipomea batatas*). These crops have attracted increasing attention worldwide because of their remarkable ability to produce tremendous amount of food at



Farmer at his Yam Plot

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a modest cost. Equipped with the ability to adapt to various agro-ecological situations, these tuber crops are found suitable for mixed farming with millet, maize, bean, niger and pulses. Cassava can be a very useful crop in ensuring food security and promotion of agro-based industries. Yam and elephant foot yam offer excellent scope for staple food.

Based on this special affinity of the tribals, Orissa Tribal Empowerment Livelihood Project (OTELP) is being implemented from the year 2006-2007 for cultivation of the above mentioned varieties of tubers in Tumudibandha block of Kandhamal District to make tribals habituated for its cultivation rather than depending on forest produce.

The project was developed with the aim of livelihood improvement of tribals through production and value addition of indigenous

tuber crops, pineapple and organic spices by OTELP under the aegis of Rashtriya Krishi Vikas Yojana (RKVY). The tribal areas of Koraput, Kalahandi, Kandhamal and Gajapati districts of Orissa were covered under OTELP.

The overall objectives of the programme have been to achieve food and nutritional security, increasing household income through scientific methods of cultivation and value addition, up-scaling of tuber crops area, contour cultivation techniques of pineapple, area expansion under organic spices, and inter-cropping of turmeric and yam.

Intervention



Various stages of the intervention in a staggered time-line include selection of the beneficiary, procurement of seeds, layout of demonstrations, training, harvest and marketing, exposure and monitoring, data collection and analysis, and finally documentation.



Trial Harvesting of Yam in the Plot of Sri Keshab Bihari Dalai



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Root and tuber crops are important food crops of tribal community which ensure lean season food security. The old varieties grown over many years have low yield potential, poor in quality and marketability. Research findings suggest that these crops can be grown as commercial crops in tribal areas. Considering the importance and suitability of these crops, a production-cum seed multiplication programme was taken up under RKVY during 2011-12 in the tribal areas covered by Orissa Tribal Empowerment & Livelihoods Programme (OTELP).

Amorphophallus paeoniifolius, commonly known as elephant foot yam and *Dioscoria alata* or greater yam were cultivated by selected tribal farmers. Two improved varieties of elephant foot yam (Gajendra) and yam (Odisha Elite) were supplied as planting materials. These crops have yield potential of 30-50 t/ha. Quality planting materials along with required agro-techniques were provided by OTELP to the selected farmers for higher production and seed multiplication.

Outcome

Through the sustained efforts of extension personnel of the agriculture department and effective social mobilisation by the NGO partner "Pradan", there has been

significant shift in terms of adopting scientific method of cultivation of tuber crops by tribals of KBK (Kalahandi, Bolangir, Koraput) Region. The kind of behavioural changes and agri-entrepreneurship the project inculcated in the tribals of these regions is indicated as under:

Sri Keshab Bihari Dalai of Telimunda village in Tumudibandha Block of Kandhamal district had planted 25 kg of yam in his field. As per trial harvesting made in the presence of OTELP officers and local farmers, the yield on his field was calculated at 45 t/acre (111 t/ha). His total cost of production was ₹ 2400, including cost of planting material, Farm Yard Manure (FYM) and labour. The estimated yield from 165 pits was 495 kg, which can be sold @ ₹ 10/kg, with an estimated profit of ₹ 2550.

In village Gunjigaon of K. Nuagaon Block in Kandhamal district 45 farmers were supplied with 50 kg yam each. Sri Baidyanath Mallik of the village had planted 250 pits of yam with application only of FYM in the pits before planting and zero chemical fertilizer usage. During trial harvest in January 2012, 8.15 kg was harvested from 5 pits. Estimated production from 250 pits is around 407 kg which can be sold at ₹ 4070 @ ₹ 10/kg with a net profit of ₹ 1530. The net profit will be higher if the farmer is able to sell his produce in urban centres where prices are @ ₹ 15-20/kg. Assuming 15000 pits per acre, the estimated yield per acre is around 24 t-60t/ha.

Status Before Intervention	Improvement
Growing few plants in backyard here and there	Compact patch by following scientific method including staking
Growing yam and cassava	Introduction of elephant foot yam apart from cassava and yam
Not aware of improved varieties	Introduction of improved varieties
Inadequate application of organic manures and mulches	Application of recommended dose of organic manures and mulches
No value addition	Value addition made
No collective marketing	Collective marketing supported
Yield 10-15 t/ha	Yield 25-30 t/ha



Smt. Gitanjali Digal of Gunjigaon of Gunjigaon Showing Yam

Two other women farmers of the same village, namely Smt. Gitanjali Digal and Reeta Digal have harvested 3.75 qtl and 3.5 qtl, respectively out of 250 pits where 50 kg of yam was planted. In their case the yield per acre is estimated to be 22.5 tonnes and 21 tonnes, respectively and the seed multiplication ratio is 1:7. Farmers are willing to preserve at least 50% of their produce as planting material for the next season, which can be utilised by them and other villagers also.

Orissa has a tradition of its many temples serving wholesome, multi-course meals as “Prasadam” to its deities and its distribution to the devotees at a modest cost. This also is a good source of revenue for the temple exchequer. Yam, cassava and other indigenous tuber crops are preferred as raw materials for preparation of temple food over potato, cauliflower and tomato, which are considered to be of “foreign” origin. The purchase of these vegetables by temples all over the state is easily to the tune of hundreds of tonnes every day.



Harvested Yam of Smt. Reeta Digal of Gunjigaon (Kandhamal)



*Sri. Sarat Kumar Beruk of Dangarpadar Village (Tumudibandh)
Displaying Harvested Elephant Foot Yam*

The produce of the tribals thus has a ready domestic market. The religious commitment of the innocent tribals would provide a further fillip to cultivation of non-potato tuber crops in large area, if marketing tie-up with temple administrations for procurement of these indigenous organic

varieties of vegetables is ensured. The district administration is understood to be working in this direction. Undoubtedly, the presence of a domestic market would ensure long-term viability of this project and provide sustainable livelihood to the tribals of the State.





Succeeding with Minor Irrigation

Water, like religion and ideology, has the power to move millions of people. Since the very birth of human civilization, people have moved to settle close to it. People move when there is too little of it. People move when there is too much of it. People journey down it. People write, sing and dance about it. People fight over it. And all people, everywhere and every day, need it.

– Mikhail Gorbachev

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Background & Objectives



Water is essential for crop production, indeed for survival itself. Madhya Pradesh, one of the largest states in the country, suffers from inadequate availability of irrigation water, mainly because of its undulating topography, high surface runoff, and lack of surface storage facilities. Out of its total geographical area of 307.74 lakh ha, the net sown area is only 150.74 lakh ha. The net irrigated area in the state by all sources is 64.18 lakh ha, which accounts for only 42.57% of total cultivated land. The average annual rainfall in the state is 857.70 mm and an estimated 60% of rain water is wasted as run off.

Of the total irrigated area in the State, canals contribute 10.51%, well and tube wells 42.56%, other sources 9.73% and tanks a mere 1.38%.

Thus despite all efforts to increase irrigated area by way of constructing big irrigation dams, so far only 10.51 lakh ha area has been brought under irrigation through dams and canals. Moreover, dams can only irrigate land in specific areas downstream of the dam by way of canal irrigation. Therefore, remote areas where no rivers flow are deprived of irrigation facilities.



Percolation Tank

To remedy the situation, the State started Minor Irrigation Schemes (Tube wells) and Micro Minor Irrigation Schemes (Micro Minor Irrigation Tanks (MIT) & Percolation Tanks (PT) and during 10th Five Year Plan, 128 MIT and 763 percolation tanks were constructed which brought additional 101341.28 ha under irrigation. However, the size of the State Sector Scheme in 10th Five Year Plan was ₹ 6025.28 lakhs, which was too small to benefit the large number of farmers.

Intervention

Small and medium irrigation works have an important role to play in developing irrigation in the country. They have many advantages. They provide a large amount of dispersed employment. They involve smaller outlay and can be executed in a comparatively shorter period.

Historically, development of irrigation in Madhya Pradesh started with construction of water storage tanks long back in the 1st

century A.D. by Chandel Kings in Khajuraho (Chhatapur district). Similarly tanks have also been constructed by Kalchuri dynasty in Bilaspur district during 1120-35 A.D. A tank may be defined as a reservoir of any specific size. In the uneven and comparatively rocky plateau of Peninsular India, tank irrigation is popular. In this procedure, a small dam that is constructed across a stream impounds water that is led through slender channels to cultivated lands.

Percolation tanks, which are based on principles similar to those of *nala* bunds, are among the most common runoff harvesting structures in India. A percolation tank is an artificially created surface water body submerging a highly permeable land area so that the surface runoff is made to percolate and recharge the ground water storage. These are generally constructed across streams and bigger gullies in order to impound a part of the runoff water. This water, in due course, finds its way into subsoil and recharges the ground water and leads to better recuperation of wells in the downstream areas. They differ from *nalah* bunds in having larger reservoir areas. They are not provided with sluices or outlets for discharging water from the tank for irrigation or other purposes. They may, however, be provided with arrangements for spilling away surplus water so as to avoid over-topping of the tank bund.

Since Rahrriya Krishi Vikas Yojana (RKVY) started in the year 2007-08, percolation tanks and micro minor irrigation tanks have been taken up as one of the flagship projects of the State. So far the number of micro irrigation tanks and percolation tanks constructed under RKVY from 2007-08 to 2011-12, including those that are ongoing, is 621 and 1017, respectively. The corresponding number of beneficiaries is 13986 and 8136. The overall area brought under irrigation is 26995 ha with a total outlay of ₹ 22074.98 lakhs during the 11th Five Year Plan.

Outcome



Case studies of Micro Minor Irrigation Tanks- Mana-Pipaliya & Bhoodha.

Village Mana Pipaliya comes in Bagli Block of Dewas district. This block lies in the near critical zone of underground water availability. The ground water utilization in this block is 45 to 75%.

The MIT was constructed in this village in the year 2009-10 in survey number 142. Its submergence area is spread over 2.60 hectare and storage capacity is 63047 cu metres of water. Sixteen farmers of Mana Pipaliya village are using the water through lifting devices. Overall 15 ha of area has now been converted into irrigated land.

The cropping system has since changed radically. Before construction of the MIT, the main crops were rainfed wheat and gram, with productivity of 10 qtl & 5 qtl/ha, respectively. Due to the irrigation made possible after construction of MIT, the productivity of wheat and gram has increased to 35 and 8 qtl/ha, respectively, in the cropping season of 2010-11.

Village Bhoodha comes in Rithi Block of Katni district which was also approaching towards semi-critical zone of underground water availability. The ground water utilization in this block is also 45 to 75%. The MIT was constructed in this village in the year 2009-10 in survey number 287/1. The length of structure is 275 metre and the height is 7.5 metre. The submerged area of MIT is spread over 4.1 hectare which accumulates 175400 cu metre of water. Thirty two farmers are using water by their own lifting devices and overall 40 ha has been converted into irrigated land.

Earlier the main crops were rain-fed rice and wheat, with productivity of 1.2 qtl and 10 qtl/ha, respectively. After



Micro Irrigation Tank

construction of the MIT, during the cropping season of 2010-11, the productivity of rice and wheat has increased to 2.1 and 18 qtl/ha respectively because of irrigation.

As per the survey conducted in Dewas & Katni, benefited farmers in both areas have given feedback that due to construction of this structure the water level of Dug Wells and Tube wells in the downstream area has also increased and remained for comparatively longer time, a phenomenon which has occurred mainly because of recharging. Farmers are enjoying higher incomes due to increased production.

Research has already proved that irrigation has a vital role in enhancing crop productivity & thereby production. It is anticipated that 15-20 % increase occurs by virtue of providing irrigation. The overall status of production & productivity of major crops in Madhya Pradesh has recorded significant increase

since implementation of this RKVY intervention began in 2007-08.

By 2011, paddy, despite recording a marginal decrease in area cultivated by 2010-11 registered an increase in production of 33% overall with a productivity increase of 36.81% per ha.

As for wheat, the area under cultivation showed an increase of 11.48%. The total increase in production was 34.29% and in productivity the increase was an impressive 20.47%.

As regards pulses the area cultivated recorded an increase of 17.89%. Production grew by 27% and productivity by 7.73%.

Area under oilseeds grew by 7.11%, production by 30.36% and productivity by 18.14%.

Anupam Mishra, one of the most respected chroniclers of the tank system in northern and central India says that historically, tanks have been an integral part of life across the country. Most

of the tanks were built by local rulers or community and all were maintained by the community. The tradition of tank building in different parts of Indian society created and sustained the tanks in difficult terrain for many centuries. Tanks were part of social culture, customs, rituals, norms and in various places they also had religious significance. The tanks had respect in society.

This reflects the wisdom of our forefathers who had made water harvesting and water management an integral part of community life and these practices were performed by the common man and his community as their duty and social responsibility and part of good local self-governance. This “water-wisdom” ensured adequate availability of water for communities and fostered development and prosperity. The need of the hour is to revive the age-old practices of community based water management for the benefit and progress of our people, especially the India that lives in villages. This intervention in Madhya Pradesh is an important step in that direction!





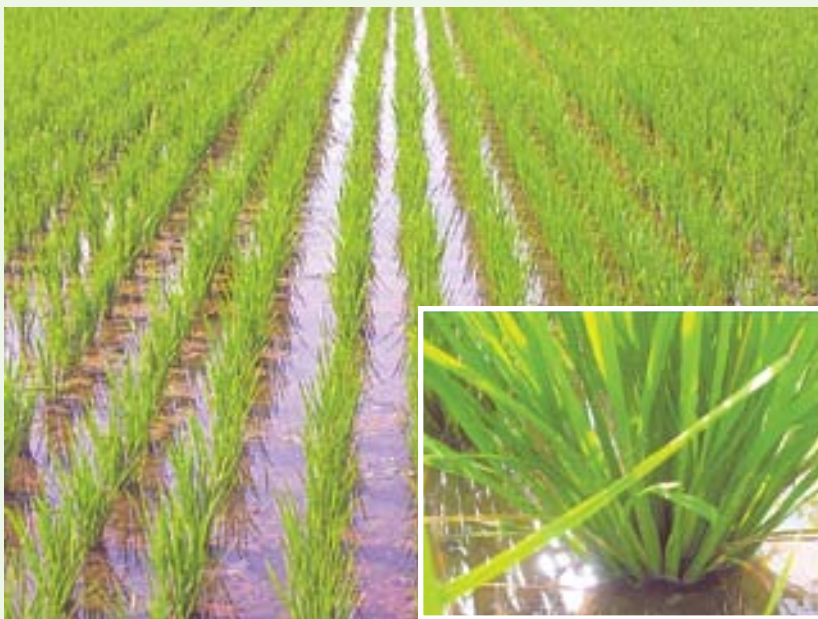
SRI

Enhancing Paddy Production

Background & Objectives

Rice production needs to be increased dramatically in the next decades to meet the demands of a growing population. This increase must be accomplished with less land per capita, smaller and less reliable Water supplies, less degradation of the environment, and less drain on the resources of small farmers. The System of Rice Intensification (SRI) is perhaps the best current example of options available to farmers to promote community-led agricultural growth, while managing soil and water resources more sustainably and even enhancing their future productive capacity. SRI represents an unprecedented opportunity for developing economies to enable farm households to be more productive, secure, and self-reliant, while buffering and even reversing the trends that contribute to climate change. This is a win-win-win situation for rural households, countries and the planet.

Tripura is one of the States in the country, which has successfully adopted and popularised the System of Rice Intensification (or SRI) technique, also known as the Madagascar method. The system is based on principles, which are different to conventional rice cultivation method. They include developing nutrient-rich and un-flooded nurseries, ensuring wider spacing between rice seedlings, preferring composts or manure to synthetic fertilizers, and managing water carefully to avoid plant roots from saturation.



SRI Cultivation

Intervention

Department of Agriculture, Tripura started the SRI on an experimental basis with just 44 farmers. Large-scale adoption of the method started in the 2006-07 with conjunctive use of State Plan funds and funds under the Centrally Sponsored Scheme of Macro Management of Agriculture.

However, SRI intervention got a major fillip with the advent of RKVY. Over the three years from 2009-10 to 2011-12, ₹ 30.48 crores has been provided for SRI in Tripura, making it one of the flagship interventions under RKVY. Major components of this intervention are:

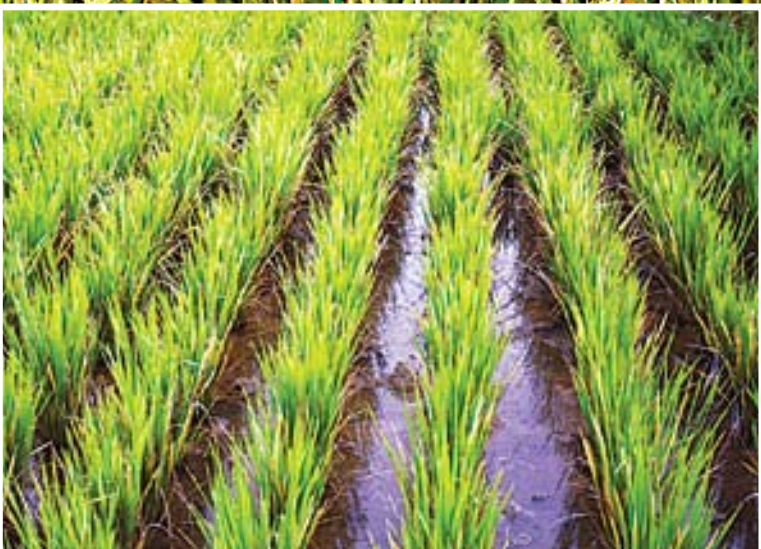
- ▶ **Capacity building of farmers** by organising extensive trainings on SRI techniques for farmers from village level upto district level.

- ▶ **Selection of interested farmers** with the help of panchayat bodies.
- ▶ **Technical interventions under SRI and their benefits include**
 - Growing seedlings on raised beds and transplanting them to main field in 8-12 days instead of one month;
 - Requirement of 5 kg seed instead of 50 kg/hectare due to single seedling planting;
 - Transplanting one seedling at 25x25 cm spacing with the help of markers especially prepared for SRI method of cultivation; less time required for transplanting due to fewer seedlings;
 - 35-40% less water utilisation for irrigation since the field is not continuously flooded;
 - Reduced cost per hectare, as there is less seed requirement, less synthetic fertilizers, no herbicides or pesticides, and less labour is required after practice of 2-3 seasons;
 - More tillers/plant as there is no competition from other seedlings that leads to more panicles and grains.

Outcome

Tripura has adopted SRI with the objective to increase productivity of rice with reduced requirement of water, seed, synthetic fertilizers, pesticides, herbicides and often labour inputs.

RKVY enabled coverage of 2.17 lakh ha gross cropped area under SRI in the 3 years from 2009-10 to 2011-12, benefiting over 6.52 lakh farmers during the 3 crop years (farmers may avail assistance for more than 2-3 seasons/year). Water usage has reduced by an average of 35-40% and average additional productivity of rice due to adoption of SRI is reported to be 825 kg/ha, which increased average total productivity to 2752 kg/ha in Tripura.



Experiences of SRI rice cultivators in Tripura

Improved Household Food Security

After adopting SRI method in half an acre out of the 1.6 acres of my land, I found that I not only needed less amount of seed, fertilizer and water, but one male and one female labourer were enough to complete the transplantation. I got more paddy when compared to the earlier years, and one and a half times more green fodder. This means, from this year onwards I can ensure that my family eats more food while saving on some of the costs of cultivation.

– Smt Jaya Sinha, Woman SRI Farmer and President of Farmers Club, Raghna, Dharmanagar, North Tripura



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“For example, one conventional plant produces 8-10 panicles [fertile tillers], one SRI plant produces 18 -24 panicles. Each conventional panicle contains 100-120 full grains while each SRI panicle has 180-200 full grains. Surely, SRI is a winner. It rightly responds to the pressures of high input costs and low margins in this tough business where many farmers have suffered. They heavily applied chemical fertilizers, thus, soil becomes infertile. The over-use and abuse of herbicide spray makes the rice plants become unhealthy and more susceptible to diseases and less productive.

– Shri Abu Sarkar, Baikhora, Tripura (1st SRI Farmer of the State)



Bhoochetana

Adopting Dryland Farming Technology

"We need a second green revolution that is more broad-based, more inclusive and more sustainable... this must explicitly embrace dryland farming."

– Hon. Prime Minister Manmohan Singh, 11 July 2011

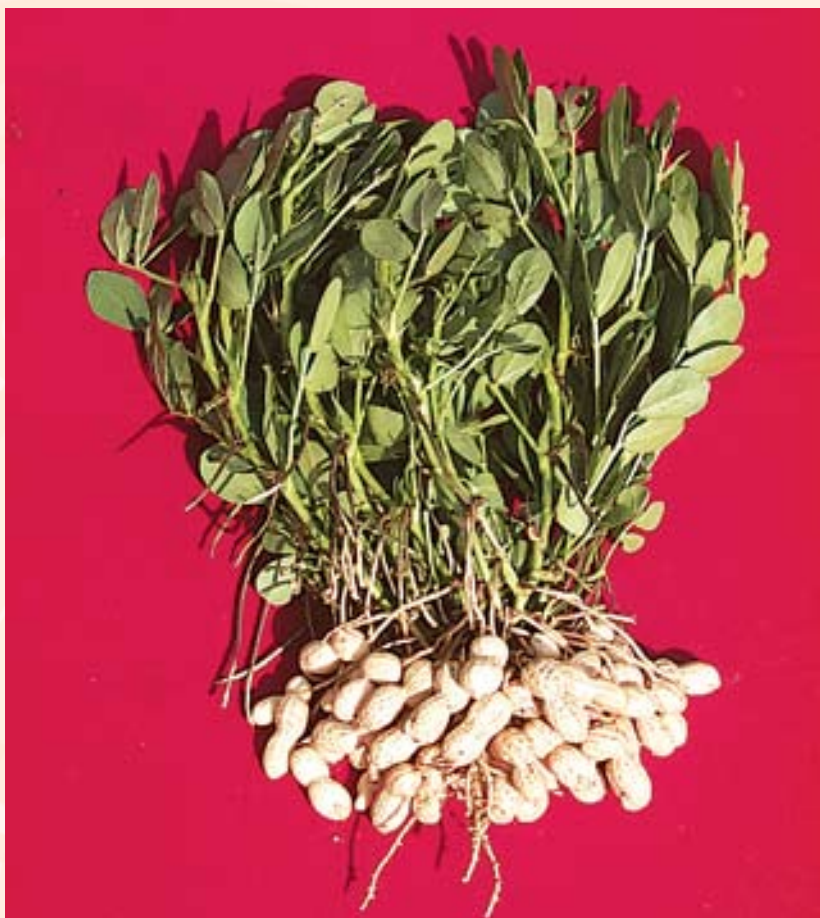
Background & Objectives

In India, 60% of total cultivated area is rain-fed, which means that crop production in these areas is dependent on rainfall, having no facility for protective or life-saving irrigation. Rain-fed areas meet 40% of India's food demands and support 60% of total livestock population; coarse cereals, rice, oilseeds, pulses and cotton are predominant crops. Agricultural productivity in rain-fed areas has remained low and unstable due to vulnerability of the area to vagaries of the weather, degraded soils and continuing poverty of farmers, who are mostly small and marginal.

Even if India were to achieve its full irrigation potential, approximately half of the cultivable area of 142 million ha will still remain largely dependent on rainfall. It is also estimated that by 2025, of an expected population of 1.5 billion, 500 million will live in rain-fed areas. In India, therefore, ensuring sustainability of rain-fed agriculture is critical, more so in the scenario of climate change and the vulnerability of populations living in these areas. Watershed development & water management, improved farming practices and income diversification are essential to address the issues of these ecologically fragile and economically weak areas. There is an urgent need to identify the opportunities for stimulating agricultural growth and reducing poverty and environmental degradation in rain-fed areas to ensure food and livelihood security of the country in the coming decades.

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Ground Nut

Karnataka has the second largest area under rain-fed agriculture after Rajasthan in the country. Nearly 55% of total food grain production and 74% of oilseeds production come from rain-fed agriculture in Karnataka. Therefore rain-fed agriculture plays an important role in total food grain production in the state. It is evident from the higher yields observed in crop demonstrations as compared to current crop yields that rain-fed agriculture has substantial untapped potential, and crop yields can be increased in the dry land areas by adoption of various dry-land production technologies.

Government of Karnataka initiated a novel project under Rashtriya Krishi Vikas Yojana (RKVY) called '*Bhoochetana*' to improve the livelihoods of dry-land farmers in the State by increasing the agricultural productivity of rain-fed agriculture. The prime focus of *Bhoochetana* is revival of soil fertility status and the project was initiated in May 2009 covering the period up to 2013-14.

The basic purpose of the project is to increase average productivity of major rain-fed crops by 20% in all 30 districts in a phased manner over 4 years by undertaking stratified soil sampling, analysis of soil samples & preparation of GIS-based soil fertility maps in all the districts and capacity building of dry land farmers. The major crops covered are maize, groundnut, *ragi*, soybean, red gram, black gram, green gram, bengal gram, sunflower, jowar, rain-fed paddy, cotton & *bajra*.

Implementation of the project is by a Consortium comprising of Karnataka State Department of Agriculture, Watershed Development Department, University of Agricultural Sciences, Bengaluru/Dharwad/Raichur, and ICRISAT.

Intervention



The primary strategy of *Bhoochetana* is soil testing based nutrient management with a major thrust on micronutrients. Inputs are made available at 50% subsidy at village/cluster village level through timely positioning and farmers are sensitised by wide publicity through wall writings, posters, village meetings & mass media.

Strategies adopted included:

- Identification & adoption of best management practices for selected crops.
- Soil test based nutrient management with major thrust on micronutrients.

- ▶ Registration of all farmers.
- ▶ Timely positioning and distribution of inputs (seeds, seed treatment chemicals, Gypsum, micronutrients & bio-fertilizers) at subsidised rates at village/cluster village.
- ▶ Farmer facilitators and lead farmers' service for extension activities at village level.
- ▶ Active Role by District Nodal Officers.
- ▶ State, District, Taluk & Village Level Trainings.
- ▶ Wide Publicity & Awareness creation through wall writings, posters, village meetings & mass media.

Department of Agriculture is the nodal department for implementing the project. Technical support/consultancy services and training are being provided by ICRISAT, Hyderabad.

State Agricultural Universities (SAUs) assist in identifying suitable high-yielding cultivars of the identified crops as well as appropriate management practices including pest control measures at district levels and provide knowledge and guidance to farmers at state, district and taluka level. Watershed Department is responsible for identifying and converging various watershed development activities in the target districts. SAUs also assist ICRISAT in organising training programmes for the Farmer Facilitators. Crop cutting experiments are conducted and yields of controlled and untreated plots are recorded jointly by Department of Agriculture, ICRISAT, WDD and SAU.

Technological information access to farmers at their door steps through farmer facilitators and agricultural extension personnel coupled with availability of critical inputs at cluster villages (2-3 villages per each cluster) and method demonstrations, result demonstrations throughout villages has motivated large member of farmers to adopt appropriate dry-land production technologies.

The mission has become immensely popular as farmers have widely accepted the improved practices with successful yield results.



Finger Millet (Ragi)

Outcome

In the first phase, project was implemented in six districts of Kolar, Chikkaballapur, Tumkur, Chitradurga, Haveri and Dharwad in 2009-10 covering an area of 2.25 lakh ha in four crops, viz, groundnut, *ragi*, maize & soybean. It benefitted 2 lakh farmers from 1440 villages, who registered significant productivity increase across crops. Productivity of groundnut enhanced in the range of 32 to 41%, maize up to 44% and Soybean up to 39% in different districts with improved management options including balanced nutrition compared to fields under farmers' management.

During the year 2010-11, project was implemented in 16 districts (including 6 first phase districts) of Chitradurga, Chikkaballapur, Dharwad, Haveri, Kolar, Tumkur, Bidar, Bijapur, Chamarajnagar, Gadag, Gulbarga, Yadgir, Bengaluru (Rural), Hassan, Davanagere and Raichur, with an area coverage of 12.00 lakh ha.



Soybean



Maize

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In this phase 8.70 lakh farmers from 5030 villages were brought under the *Bhoochetana* umbrella and about 23-57% increase in yields was observed in treated plots compared to non-treated plots.

During the year 2011-12, the project is being implemented in 30 districts covering an area of 31.1 lakh ha benefiting 25.54 lakh farmers from 14,000 villages; about 23- 50% increase in yields has been recorded.

Improvement in delivery time of services and convergence of all the existing schemes has been one of the visible and positive impacts of *Bhoochetana*. Scientific approach, technical support through effective extension and timely supply of package of inputs

have enabled dry-land farmers to enhance crop productivity significantly.

Farmers have appreciated the benefits (higher yield) of balanced application of nutrients and adoption of improved cultivation practices. The farmers' acceptance was widely noticed during the second phase of project implementation. Improvement in measurable indicators has been observed in terms of increase in productivity and corresponding cost benefit ratios.

Bhoochetana has also underlined the importance of effectively organising and utilising communities for increasing productivity of dry-land agriculture.



Protection Against Goat Plague

Background & Objectives

Agriculture in Chhattisgarh is dominated by small land holders and landless. The distribution pattern of animals in the state indicates that 42.8% of small ruminants are reared by landless, sub-marginal and marginal farmers. Public investment and interventions made in small ruminant sector are expected to increase productivity and profitability of these poor farming communities, bringing them out of the poverty cycle.

Goats are an important provider of subsidiary income to the farming community and provide monetary cushion when crops fail due to low rainfall and other natural calamities.

Peste-des-Petits Ruminants (PPR), popularly known as 'Goat Plague' is an acute and highly contagious, viral disease which affects goats and sheep. Any outbreak of this disease may rapidly escalate to epidemic proportions spreading to several villages, leading to panic and distress selling of animals. Health of small ruminants and the livelihood of farmers are therefore closely interlinked.

Mass Vaccination Campaign



The State Government initiated a campaign against PPR under RKVY in 2010-11 and 2011-12 with an overall outlay of ₹ 4.82 crores, with a physical target of vaccinating 90% of total goat population.

Intervention

To prevent PPR among the livestock of Chhattisgarh, the State Government undertook a project aimed to conduct mass vaccination of sheep and goat population in a campaign mode (similar to pulse polio campaign). In order to increase the efficacy of vaccination, prior mass de-worming of the animals

was also undertaken on a mass scale. Wide spread awareness generation and information regarding the campaign was initiated prior to field activities. During the scheduled campaign in a district, entire departmental staff and associated manpower were involved in de-worming and vaccination of sheep and goats. For increased efficiency, division of labour into vaccine and logistic transporters, vaccinators, block/district/state monitors was planned. Budgetary provisions were made for all the sub-activities in the campaign.

The cost of the vaccine was shared by RKVY and ASCAD (Assistance to States for Control of Animal Diseases, a Centrally Sponsored Scheme of Department of Animal Husbandry, Dairying and Fisheries) and totalled ₹ 52.50 lakhs. All other costs were borne by RKVY solely which included cost of de-worming, honorarium for non-government vaccinators, transportation and syringes etc.

All districts of Chhattisgarh were covered in the project targeting about 90% of goat population.

Field level planning and technical sensitisation of the deworming and vaccination teams was the entry point activity of the project. Before the actual beginning of the campaign, district wise action plans, schedules and training and monitoring mechanisms were intricately planned on the lines of Pulse Polio Campaign. For each campaign vaccination teams were identified which consisted of 2-3 members assigned to cover 6 to 12 villages (depending on the topography, animal distribution, available transport etc.) in 7-8 days time frame of the campaign.



Goat Camp

In 2010-11, a total of 1752 vaccination teams covered 18,738 villages conducting a total of 25.95 lakh vaccinations in June 2010. This was preceded by 24.14 lakh de-worming in the month of May.

Serum samples from about 0.1% goats randomly has been collected prior to vaccination in all districts and another 0.1% samples collected randomly after 21 days of vaccination constituting the sero-monitoring strategy of the project.

The project had in built mechanisms to check the performance of field level vaccination efficacy. This was done by checking whether the vaccination done at field level was carried out properly by testing the blood serum. In this technique, serum was collected

randomly in a sample population before the start of vaccination and 15-21 days after vaccination. A total of 1280 pre-vaccination and 5664 post-vaccination samples were analysed by a technique called c-ELISA at Indian Veterinary Research Institute Mukteshwar, Uttarakhand. Results show that the post-vaccination protection level averaging the figures of different districts increased from 40% to 88%.

The intervention was given highest priority by the State leadership and the Government and extensive media coverage and publicity was provided to generate awareness.



Outcome

Data obtained from Integrated Sample Survey indicates that growth rate of goat meat production in the State was more than in any period in the state's history. In 2007-08 (baseline year for RKVY) total goat meat production was 4.95 thousand MT which increased to 6.10 thousand MT in 2010-11, recording an annual growth rate of 7.74%.

The incidence of PPR disease has been brought down to a bare minimum. From an average of 5-6 major epidemics of the disease

before 2007-08, it has reduced to 1 in 2010-11 in the state. Reduction in mortality due to PPR disease is estimated to be between 50-90%.

The implementation of this project saw escalation in the of number of vaccinations for PPR disease from 5-6 lakhs per year before project period to 26 lakhs during the project period, which is approximately a five fold increase.

This intervention is expected to largely control PPR disease and pave the way for its complete eradication. It is also expected that the PPR Control project would be extended to neighbouring states as well.



Vineyard Vigour in the Valley



Background & Objectives

Traditionally grape cultivation in Jammu & Kashmir was confined to certain villages where there was no concept of canopy management. Farmers used to make the grape vines climb over non bearing trees, fence walls and habitation structures. Proper training, pruning, shaping and canopy management was an unknown practice with them. During the rainy season frequent attacks of fungal diseases especially powdery mildew, downy mildew, anthracnose etc. was very common in such grape vines. Such an unscientific management also resulted in under maturity of most of the produce, due to lack of proper sunlight. This ultimately resulted in poor quality fruit and poor returns to the growers.

Bird damage was also a common problem, especially on such fruit bunches which were exposed at vulnerable sites of the vines. Spraying of fungicides, thinning out of densely vegetative shoots as summer pruning, harvesting of fruits and managing such vines was a difficult task. This was largely because of unmanageable vine lengths and a proliferation of uncontrolled offshoots.

With the continuous efforts of the department of Horticulture the growers were educated about canopy management techniques. Some farmers adopted a technique of initially raising of grape vines over wooden structures as a beginning of canopy management.

Ganderbal area of J&K State, especially Lar block is known for cultivation of *Sahibi* and *Hussaini* grape cultivars. The fruit matures in the month of August, when grapes are not available in other parts of the country. Traditionally the grape vines were being raised on wooden structures. These generally used to get damaged during heavy snowfall in winter and as such, the growers had to re-install



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Erected Bower System

these structures every year. The collapse of such wooden structures either due to heavy snowfall or load of fruit crop and vegetative growth would generally damage the fruit plants and reduced the productivity potential of the vineyards. Moreover, these structures were not ideal to facilitate proper training and pruning of vines, which hamper quality production of grapes. Heavy infestation of diseases especially during the rainy season was a very common phenomenon in these vineyards.

Intervention



To change the scenario and give a boost to grape production, an intervention was made through Rashtriya Krishi Vikas Yojana (RKVY) to introduce canopy management in Lar

Block especially in Repora and adjoining villages of Ganderbal District. Assistance of 50% was provided to the grape growers for installing permanent canopy management systems (bower system) in replacement of traditional wooden structures.

The structures so erected under canopy management programme is permanent infrastructure which is likely to give support to the grape vines under formal training system for the entire life span of grapevines and even give support to extended rejuvenated vines as well.

Till date, 414 beneficiaries have been covered under RKVY for installation of bower systems in a cluster manner in Repora and adjoining villages. An amount of about ₹ 1 crore has already been paid as assistance to the farmers for an infrastructure worth about ₹ 2 crores.



M.S. Shah, Grape Farmer (Lar Ganderbal)

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The intervention has greatly helped in boosting quality production of grapes. Proper canopy management has drastically reduced the disease incidence in grapes thereby resulting in significant improvement in quality.

Canopy management under RKVY is making a visible impact especially in the improvement of quality of produce, plant health, saving of labour on fruit harvest and other allied activities required for grape cultivation. Quality impact of the intervention on grapes has proved very successful in convincing the farmers to use the scientific technique of canopy management.

One of the major impacts of this intervention has been that farmers' wives have been able to harvest the fruit without any other assistance or without any additional infrastructural support, as the canopy management is a great enabler. This was not possible prior to the installation of such fabricated bower systems.

Outcome

The quality improvement has ultimately resulted in higher returns to the growers. As against about ₹ 10000 per MT prior to installation of canopy management infrastructure, the growers have started getting about ₹ 25000 per MT thereby recording an increase of 150% on the sale realisation of the crop. Besides improvement in the quality, reduction in the recurring cost for replacing wooden structures and frequent damage caused to the fruit crop is an added advantage.

The future years are expected to bring a significant increase in production and productivity as well, because proper pruning and management of the grape vines has been facilitated by installation of bower system. This is bound to improve the production of the grapes as well.



Fish Fry

"Sell a man a fish, he eats for a day, teach a man how to fish, you feed him for a lifetime"

–Chinese Proverb

Background & Objectives

Higher incomes mean better affordability for finer gastronomic delights such as fish, meat, and other ready-to-eat food products. High perishability of fish coupled with poor post-harvest handling results in post harvest losses of upto 15%, in both marine and inland fisheries. Therefore, strengthening of post-harvest infrastructure in the form of better fish landing and handling facilities, cold chains, storage facilities, ice plants, transportation, etc., as well as an effective marketing system in identified areas is a key requirement for the development of this sector. In Karnataka, hygienic fish kiosks for retail use has proved to be an important intervention under RKVY for making fish and fish products affordable for consumers and lucrative for fish producers.

The production of safe and quality fish and fishery products requires effective hygienic practices throughout the food chain from fish harvesting to consumption. According to FAO standards, food hygiene relates to "all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain". These hygienic measures aim at preventing or reducing fish contamination and microbial growth and encompass aspects related to hygienic design of facilities on-board, during transportation, processing and distribution, cleaning, sanitation and pest control, and personnel hygiene.

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Mangalore Landing Center



Tumkur Retail Outlet

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Major problems identified were poor and unorganised marketing infrastructure and dominant role of middlemen in the fish trade leading to meagre margins to the producers. Another bottleneck was the lack of integrated approach in planning for fisheries development. Concerted efforts in addressing the major issues of resource use, production and productivity, value chain, support service systems, internalising input availability, viz., fish seed, feed and technology service, suitable marketing strategies, policy and programs that lead to long-term sustainability of the sector are thus warranted.

The Department of Fisheries, Government of Karnataka is striving hard to dovetail the various aspects of harvesting, post harvest handling, processing and recipe development to literally bring hygienic and delicious fish cuisine on a platter to the people of Karnataka.

Intervention

The project was initiated in February 2009 with an outlay of ₹ 25 crores. The components for strengthening of Fish Marketing in Karnataka included:

- Establishment of one Modern Fish Processing Plant at Mangalore and two Fish Pre-Processing Units, one each at Mangalore and Malpe.
- Setting up of six Ice Plants of 10 MT, 15 MT, and 20 MT capacity at strategic fishing and storage locations, with total production capacity of 90 MT/day.
- Setting up of 48 Modern Fish Kiosks, 20 Hygiene Fish Markets and 12 Modern Air Conditioned Retail Outlets at Bengaluru and other important cities and towns in Karnataka.

- Provision of 7 Cold Chain facilities, with overall capacity of 14 MT.
- Establishment of one Frozen Storage at Bengaluru with a capacity of 25 MT.
- 5 Ornamental Fish Production Units.

At the RKVY funded Karnataka Fisheries Development Corporation (KFDC) managed outlets, all personnel that come into contact with fish and fish products directly or indirectly, are trained to maintain an appropriate degree of personal cleanliness and wear suitable protective clothing, head

covering and footwear, where required. The kiosks have been able to establish effective maintenance and sanitation systems including pest control and waste management.

Outcome

The RKVY funded hygienic fish kiosks have played a vital role in educating urban consumers about the far reaching health benefits of fish consumption, while simultaneously offering easy and highly affordable means of accessing tasty fish recipes in strategically located areas.



Mathsyadarshinis at various places like Cubbon Park and Indiranagar in Bengaluru, Tumkur and Kolar sell fresh and frozen fish, as well as aquarium and ornamental fish and have become extremely popular. Additionally, the Modern Fish Restaurants cater to the urban fish eating populace, at reasonable rates, rendering them affordable even to the common man. The high demand by the locals has compelled KFDC to open evening counters at Cubbon Park.

Due to the initiatives of KFDC, sale of fish and fish products at these outlets has increased to 2.5 MT/day. The statistics also show a steady and significant growth in awareness about the benefits of fish consumption. Promotion of fish consumption with renewed vigour

will fulfil popular demand while creating new opportunities for intensive marketing of fresh, frozen and ready to eat fish products. The RKVY intervention, through establishment of modern fish kiosks cum cafeteria in selected urban areas, has facilitated competitive and alternative fish marketing channels that ensure continued supply of quality fish and fish products on a sustained basis.

The RKVY assistance to strengthen fish marketing has helped the Karnataka State Government in creating the necessary infrastructure to cater to the fish-relishing populace, where fine fish cuisine is paired with convenience and affordability.





Sexed Sperm for Improving Rural Economy

Background & Objectives

West Bengal, although having a large cattle population (199.5 lakh as per the 18th Livestock Census 2007-08), is traditionally a low milk producing state due to a negligible buffalo population and the absence of any recognised breed of cattle. 80% of cattle population in West Bengal is of indigenous non-descript type, which is a very poor milk yielder – averaging 400 litres in 300-lactation days.


In the year 2002, when Paschim Banga Go-Sampad Bikash Sanstha came up, a total of 35.15 lakh MT of milk was produced, with a per capita availability of 119 gm. By the year 2009-10, the scenario changed considerably with the production of milk rising to 43 lakh MT, with a per capita availability of 131.40 gm. The primary reason for the change is increase in Artificial Insemination (AI) coverage in rural areas by “Prani Bandhus” – trained, self-employed AI Workers, along with other government employees. However, as the actual requirement of milk is about 57 lakh MT, there is need to increase per cattle milk production.

Increasing the overall milk production in the State required targeted quantitative, qualitative and genetic improvement of cattle population along with strengthening of infrastructure for collection and processing of milk from the rural producers and marketing to the urban consumers by co-operatives, private sectors as well as government.

To increase overall numbers and improve the breeds of cattle, Paschim Banga Go-Sampad Bikash Sanstha undertook production of sexed sperm by introducing ‘BD Influx High Speed Cell Sorter’ in the Frozen Semen Laboratory, at the Haringhata Farm. This project was taken up

under RKVY with a total outlay of ₹ 2.90 crores, during 2007-08 and 2008-09 and completed in November, 2009.

Intervention

 In order to bring about rapid increase in numbers of better-breed milk producing bovines, a system was introduced whereby insemination can be planned to produce a specific sex of cattle. The process involves pre-determination of sex by sorting 'X' and 'Y' chromosome-bearing live sperm cells using the DNA content of sperm as the discriminatory parameter. A flow-cytometer/cell sorter is used to detect the difference in the total DNA content between 'X' and 'Y' chromosome bearing sperm, separate them and create frozen semen straws accordingly.

This intervention would help achieve the following objectives:

- Insemination can be planned to produce animals of predetermined sex.
- Destruction of undesired bull calves would be avoided.
- Superior quality male calves, as per parameters laid out by Government of India, can be planned for Frozen Semen Bull Stations to enable production of elite cows in Bull Mother Farms using semen of superior elite bulls.
- Dairy herd can maintain elite quality cows along with production of female replacement heifers by using 'X' semen of Superior Dairy Bulls.
- Intensity of selection can be high so that genetic gain per generation is enhanced.
- Large number of sexed embryos can be produced using Multiple Ovulation & Embryo Transfer and In-Vitro Fertilization, resulting in production of large number of female calves, which would ultimately boost milk production.
- Large number of female calves can be maintained by progressive farmers in rural areas, with little limitations.
- "Breeding Policy" of the State can be implemented by upgrading non-descriptive cows zone-wise using 'X' Frozen Semen Straws of Sahiwal and Gir Breeds.

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High Speed Cell Sorter Machine



The Scientists of the Sanstha have dedicated substantial efforts to modify the BD Influx high speed cell sorter to separate the 'X' and 'Y' - chromosome bearing sperm from billions of bovine sperm cells and cryo-preservation of sexed sperm cells. After tremendous efforts the procedure of sorting sperm was standardised (staining procedure, sorting procedure and cryo - preservation of sexed sperm) in the month of March, 2010. Two lasers operating at 488 nm (blue laser) and 355 nm (UV laser) are used for coarse calibration and fine calibration of cell sorter before actual sorting. Subsequently the UV laser is used to excite the Hoechst 33342 stain of sperm cells. The stained 'X' sperm shows more fluorescence than 'Y' sperm because of the higher DNA content in it. The emitted fluorescence is captured by different Photo Multiplier Tube (PMT) and the analog signal is converted to a digital signal. The difference in fluorescence of 'X'-chromosome bearing sperm and 'Y' - chromosome bearing sperm can be accurately analysed by observing the two peaks in the appropriate software.

Purity of sorted 'X' and 'Y' chromosome bearing sperm is determined by Polymerase Chain Reaction (PCR) by amplifying both bovine 'X' chromosome specific (PLP) and 'Y' chromosome specific (SRY) gene. Two pairs of primer and probes have also been developed for quantification of sorted 'X' and 'Y' chromosome bearing sperm thereby improving the sorting efficiency and sorting rate.

Outcome

 he first pre-determined sexed male calf in the country, named Shreyas was born on 01.01.11 by using sorted 'Y' chromosome bearing sperm. Till date, five female calves and three male calves have been born by using sorted 'X' and 'Y' chromosome bearing sperms at Bull Mother Farm, Paschim Banga Go-Sampad Bikash Sanstha, located at Haringhata Farm.

Till now, 598 'X' sorted and 622 'Y' sorted Frozen Semen Straws have been produced and eighty one (81) animals have been inseminated using thirty

six (36) 'Y'- bearing and forty-five (45) 'X'- bearing Frozen Semen Straws. Out of these, eleven animals inseminated by 'Y'-bearing sperm and fifteen animals inseminated by 'X'-bearing sperm were found pregnant.

Currently the production capacity of this fluorescence activated cell sorter is 10 to 12 million sperm of each sex per hour. After standardisation and cryo-preservation of sexed sperm, the current levels of production are @ 40-50 nos. of Frozen Semen Straws in a

day, with a target of production of at least 100 Frozen Semen Straws in a day.

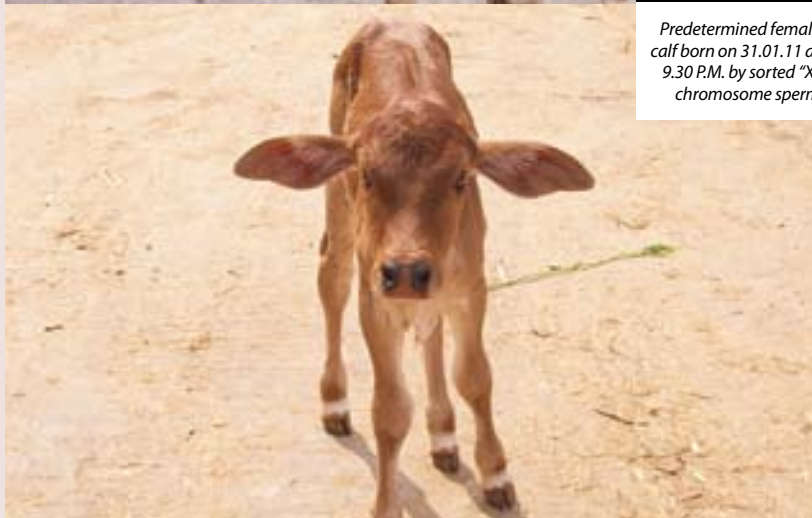
This state-of-the-art assisted reproductive technology for pre-determination of bovine sex is expected to enhance creation of assets for enhancement of the rural economy by producing desired female dairy calves in rural areas, which will ultimately augment milk production, create employment generation in rural areas, and improve livelihood of the rural population of West Bengal.



"Shreyas", the 1st predetermined male calf born on 01.01.11 at 2.36 A.M. by sorted "Y" chromosome sperm



Predetermined female calf born on 28.01.11 at 3.50 P.M. by sorted "X" chromosome sperm



Predetermined female calf born on 31.01.11 at 9.30 P.M. by sorted "X" chromosome sperm



Predetermined female calf born on 05.02.11 at 4.17 A.M. by sorted "X" chromosome sperm



Vegetable Cultivation with Trellises

Background & Objectives



India's diverse soil and climate, comprising several agro-ecological regions, make it conducive to grow a wide variety of horticulture crops comprising of fruits, vegetables, root and tuber crops, flowers, ornamental plants, medicinal and aromatic plants, spices, condiments, plantation crops and mushrooms, which form a significant part of aggregate agricultural produce.

Cultivation of horticultural crops provides an important source of livelihood and generates substantial employment on account of being labour-intensive for the rural population of India. Fruits and vegetables are also rich source of vitamins, minerals, proteins, carbohydrates, etc., which are essential to ensure nutritional security of the people. Thus, cultivation of horticultural crops plays a vital role in the prosperity of a nation and promotes the health and happiness of its people.

India is next only to China in vegetable production with an annual production of 87.53 million tonnes from 5.86 million ha, which is 14.4% of the world production. Adoption of high yielding cultivars and FI hybrids and suitable production technologies has largely contributed to higher production and productivity. With changes in incomes and consumption patterns, demand for vegetables has also increased, with per capita consumption of vegetables increasing from 95 grams to 175 grams per day over the last decade. More than 40 kinds of vegetables belonging to different groups, namely cucurbits (cucumber, gourd, melon, pumpkin), Cole crops (cabbage, cauliflower, broccoli,



Trellis/Pandal for Gourd Cultivation

turnip), solanaceous (eggplant, pepper, tomato, chillies), root and leafy vegetables are grown in different agro-climatic situations of the country.

Andhra Pradesh being endowed with diversified agro-climatic conditions has a vibrant horticulture sector which has been identified as one of the growth engines for increasing overall agriculture growth. Andhra Pradesh produces 4% of the country's vegetable production with the area under vegetable production increasing steadily since last two decades. Small and marginal farmers account for 83 percent of land holdings and 46% of operated area in Andhra Pradesh as per agriculture statistics of the Department of Agriculture in the state. Irrigation covers 35% of net sown area while the remaining 65% of net sown area is rain fed. The agricultural production system in the state of Andhra Pradesh is multi-cropped with diversified systems of both agricultural and horticultural crops, separately and together. The state has an area of 203 thousand ha under vegetables cultivation with a production of around 3.4 million tonnes in 2009-10.

Andhra Pradesh took up a major programme under Rashtriya Krishi Vikas Yojana (RKVY) to boost production of the major horticulture crops across the State. The intervention comprised of construction of permanent *pandals* and trellises for protected cultivation of horticulture crops through a cluster approach, duly considering local agro-climatic conditions/needs/crops/priorities, and providing market linkages for ensuring remunerative prices to the farmers. Boosting the horticulture sector would not only ensure additional income to farmers but also meet the demands of changing nutritional requirements of the people.

Intervention



The major vegetables grown in the state are tomato, onion, tapioca, brinjal and okra. The main vegetables grown across different production clusters are shown in the table below:

Main Production Clusters - Vegetables in AP	
Vegetable	Main Production Clusters
Tomato	Kurnool, Chittoor, Rangareddy, Prakasam
Onion	Kurnool, Medak, Cuddapah, Mahabubnagar, Rangareddy
Tapioca	East Godavari
Bhendi	Kurnool, Krishna, Warangal, Vizag, Nalgonda
Brinjal	Vizag, East Godavari, Nizamabad, Rangareddy, Anantapur, Krishna
Beans	Vizag, Medak, Nizamabad, Rangareddy


Cultivation of these vegetables was adopted in a cluster approach in 232 potential *mandals* of various districts. Thereafter, producers' hubs and collection centres to support the farmers in the entire value chain was systematically developed to ensure reasonable price for their produce.

The Department of Horticulture introduced the system of cultivation of vegetables on *pandals*, both permanent and semi-permanent to increase productivity of twining vegetables and trellis system for indeterminate type of tomato hybrids in 2008-09 under RKVY Programme.

In general, such vegetables need proper support for their growth and development. *Pandals*/trellises are special structures used for twining vegetables. The weak climbers utilise this support, which protects the produce from soiling and increases exposure to sunlight and aeration, thereby increasing the number of flower buds, ultimately resulting in more fruit of superior size and quality.

In the 3 years from 2008-09 to 2010-11, permanent *pandals* were erected for gourd clusters covering 4696 acres at 50% assistance not exceeding ₹ 6000 per acre, at a total cost of ₹ 17.46 crores benefitting more than 5200 farmers. For tomatoes, trellises were set up in 2844 acres with 50% subsidy, not exceeding ₹ 7500 per acre, covering almost 3200 farmers at a cost of ₹ 2.20 crores.

Outcome

 In an average, farmers have realised yield of 30 MT/acre of tomatoes by growing under trellis method, with added advantage of superior quality of the crop. Through semi permanent *pandals* the yield of gourds recorded per acre is 11.25 metric tonnes; on an average, additional yield of 2.5 MT/acre has been obtained in comparison to normal method. The fruit colour and quality also improved, making it less susceptible to pests.

This intervention has helped in increasing vegetable production of the State, which has increased from 53.11 Metric Tonnes in 2007-08 to 61.60 Metric Tonnes in 2010-11.

Case Study

Name of the Farmer	Akkabatla Veera Ganeswararao
Village & Mandal	Penakanimetta Savaram, Kovvur
District	West Godavari District
Crop	Tomato
Area	1 acre
Subsidy Pattern	50% subsidy, not exceeding ₹ 7500/acre.

The farmer earlier used to grow tomato hybrid varieties through traditional methods and over a period, realised lesser profits, and waited for an opportunity to access the latest technologies to multiply the net profits. At this juncture the Horticulture Department took him to Raipur for an exposure visit on trellis method of cultivation of vegetables during 2008-09. This motivated him to adopt trellis method to grow tomato crop over an area of 1 acre in his land.

The farmer was provided with a subsidy of ₹ 7500 per acre to meet the expenditure for erection of trellis and he was encouraged to



install drip irrigation to further increase yields. Subsequently, by using fertigation he has not only increased efficiency of fertilizer usage and minimised the cost on fertilizers, but also benefitted on account of saving time and labour.

The farmer today is satisfied with the harvest of 15 MT/acre by cultivating tomato with trellis method, as against his earlier yield of 7-8 MT/acre under the traditional method.

His gross income is ₹ 1.40 lakhs, with the expenditure of ₹ 70,000/- incurred towards cultivation and installation of Drip Irrigation System. The net income is ₹ 70,000/acre. The farmer has expressed his confidence to increase the net returns in the ensuing seasons, when he would no longer have burden of paying for the installation of drip irrigation system.

The farmer today is a role model to other farmers for taking up modern technology and cultivation methods.

Case study

Name of the Farmer	Chukka Sambashiva Rao
Village	Gundavaram
Mandal	Chebrolu, Guntur District
Crop	Bottle gourd
Area	1 acre
Subsidy	₹ 30,000

Under RKVY scheme by erecting of semi-permanent *pandals*, the farmer cultivated bottle gourd in an area of 1 acre in 2009-10.

The total cost incurred by the farmer was ₹ 65835 towards various components like bamboo poles, G.I. pipes, twine, etc., required for erection of semi-permanent *pandals*. The growth of bottle gourd vines was luxuriant and promoted vigorous flowering. The yield recorded per acre is 11.25 MT/acre, with an average increase in yield of 2.25 MT/acre in comparison to normal method in the previous years. The farmer can maintain the semi- permanent *pandals* for a minimum period of three years, cultivating 3 crops per year on the same structures. Even though the erection charges are more in initial stages, substantial net profit will accrue in the next two crops.





Staggered Planting of Pineapple for Better Harvest

Background & Objectives

Tripura is known for quality pineapples, mostly the “Queen” & “Kew” varieties. The organoleptic and other properties of both the varieties are very unique and ideal, for table and processing purposes respectively. However, there has also been the problem of lower productivity and seasonal glut in traditional system of cultivation, often depressing the market and interest of the grower.

In order to overcome these shortcomings, a project was undertaken for block plantation of pineapple through staggered planting and induction of chemical in about 500 ha area, involving 570 growers of the state with assistance from Rashtriya Krishi Vikas Yojana (RKVY) scheme with total investment of ₹ 4.30 crores for a period of 3 years (2008-09 to 2010-11).

The main objectives of the programme were:

- Making pineapple available in the market for at least eight months in a year.
- Increasing existing productivity levels from 15.00 MT to 20.00 MT or more.
- Assuring better price-realisation to growers.

Intervention

In order to calibrate reaching the specified vegetative stage for application of chemical and initiation of flowering in successive months, the planting of ground sucker (average 300 gm in case of Queen and 400 gm in case of Kew) was done in successive months starting from February to November, instead of the traditional practice of planting in the months of September and October. Staggered planting has almost assured reaching of a vegetative stage of 35-40 leaves in about 8-9 months, which is the ideal time for application of chemical; this is done successively in the blocks planted one after another.

The chemical solution has been earlier standardised in the Horticulture Research Centre, Nagicherra, Tripura, and is prepared with Ethrel, 25 ppm (6.25 ml/100 lts. of water) in conjunction with 2% Urea and 0.04 % Sodium Carbonate. A dose of 50 ml/plant is applied for each pineapple plant that has reached the desired stage of 35-40 leaves, successively, to ensure flowering, subsequent fruiting and full maturity in about 5-6 months. This chemical induction has assured about 90% fruiting in plants, as against 50% in untreated traditional practice.

Outcome

After following the process in the targeted area, average 21.46 MT/ha of productivity of pineapple was achieved in all the districts. Normal annual yield without staggering is between 18.50-19.50 MT/ha.

This has resulted in additional production of 1095.20 MT in the first year (2008-09), 2013 MT in 2009-10 and 2931 MT in 2010-11. The average price realisation of fruit has also increased due to avoidance of glut in peak production season (May-July) and also on account of continued availability of the fruit even in the off-season



(September-March) factors that have ensured a better market for pineapple. The average price during June –July without staggering was on an average ₹ 2/kg; escalated price in off-season is now ₹ 6/kg. Moreover, the income from fruits continued in second and third season as well from the ratoon crop that brought the cost-benefit ratio to 1:33. With an average annual return of ₹ 1.176 lakh per ha, Pineapple growers are happy and willing to expand cultivated areas, wherever possible.



Strengthening Seed Industry

"As resources such as water and nutrients are drawn in, the seed organizes the process that generates growth. In a sense, the seed is a gateway through which the future possibility of the living tree emerges."

– Peter Senge

Background & Objectives

Seed is the basic and most critical input for sustainable agriculture. The response of all other inputs depends on quality of seeds to a large extent. It is estimated that the direct contribution of quality seed alone to the total production is about 15–20% depending upon the crop and it can be further raised up to 45% with efficient management of other inputs.

Therefore, making available timely and quality seeds to farmers at a reasonable price is one of the primary requirements for ensuring that production and productivity keep pace with the growing demands of food in the country.

Andhra Pradesh State Seeds Development Corporation Limited (APSSDC) was established on 26th March 1976 with a mandate to produce quality seeds and supply them at reasonable prices to the farmers. APSSDC is producing quality certified seed to meet the indents of the districts, duly ensuring that seed chain is maintained for ensuring proper productivity to the farmers. The Corporation is producing major seeds of paddy, groundnut, bengal gram and other pulses. To meet the increasing need of quality seed production, the Corporation

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expanded its activities from existing 5 units to 22 unit offices located throughout Andhra Pradesh. The enhanced capacity for processing seeds will augment seed availability by an additional 3 lakh qtl approx.

The Corporation had a processing facility for 4.68 lakh qtls per annum and storage facility of 3.99 lakh sq. ft. The processing capacity and the storage capacity needed to be enhanced to cater to the required need. The gap between the existing production programme and existing processing and storage facility was huge.

Intervention

The Corporation has implemented the project for augmentation of Processing and Storage facilities and up-gradation of Seed Testing Laboratories with an expenditure of ₹ 40.42 crores between 2008-09 and 2009-10.

The Corporation has created seed storage and processing facilities at different locations, namely Karimnagar, Nizamabad, Srikalahasti, Warangal, Armoor, Wanaparthy, Srikakulam, Vizianagaram, Cuddapah and Anantapur. The total additional godown area created thus stands at 1.86 lakh sq ft.

Apart from the above infrastructure created under the aegis of the RKVY, processing units have also been put up at other towns namely

Srikakulam, Vizianagaram, Srikalahasti, Karimnagar, Warangal, Nizamabad, Armoor, Wanaparthy, Tanuku, Kurnool, Maruteru, and Ongole. The total processing capacity created under RKVY is 1.80 lakh qtl.

In addition, three Seed Testing Laboratories at Vijayawada, Kurnool & Jeedimetla have been upgraded and strengthened for quality control of seed multiplication and production.

Outcome

After successful implementation of this intervention under RKVY, additional storage and processing infrastructure facilities, as depicted in the table, were created enabling the Corporation to meet targeted seed production.

Since, APSSDC supplies quality certified seed to the farmers throughout the State of Andhra Pradesh, assuring availability of certified seed during the agricultural seasons without resorting to open market procurements, elimination of uncertainty about seed availability and quality assurances is the major benefit to the farming community.

Additional area created under cultivation is around 10.05 lakh acres and additional seed produced is 4.02 lakh qtls. Productivity increased by 15.07 lakh qtls benefiting 6.70 lakh farmers in the State. Creation of scientific storage godowns has ensured that quality of

Sl. No.	Infrastructure	Existing Capacity	Additional Capacity	Total Increased Capacity due to Implementation of Scheme
1	Processing (in lakh qtls)	4.68	1.80	6.38
2	Storage godowns (in lakh sq ft)	3.99	1.86	5.85
3	Quality Control Laboratories (No. of samples tested)	40000	60000	100000



New Godown Constructed at A.P.S.S.D.C. Ltd., Srikalahasthi



Machinery at A.P.S.S.D.C. Ltd., Warangal

seeds is maintained during storage period till seed is sold through sale points.

8000 seed growers of the Corporation have benefited by receiving early payments for the seed produced by them since seed processing is now completed within 45 days, as against 80 to 100 days prior to creation of infrastructure.

The Seeds Corporation is also saving ₹ 1 crore annually on storage charges on rental godowns and custom processing charges.

There is a crying need for State Seeds Corporations to transform themselves in tune with the industry in terms of infrastructure, technologies, approach and the management culture to be able to survive in the competitive market and to enhance their contribution in the national endeavour of increasing food production to attain food & nutritional security. That is exactly what Andhra Pradesh State Seeds Development Corporation Limited (APSSDC) has managed to do successfully under RKVY and it has set an example for other State Seeds Corporations, in this endeavour.





Electronic Tender System in APMCs

Background & Objectives

Better price realisation for agricultural commodities is a strong incentive for the farmers to produce more. Many steps are being taken up by the Government of Karnataka towards this purpose. One such activity is to assure competitive price for the farmers' produce in the markets through Agricultural Produce Market Committees (APMCs).

The APMCs have been established in Karnataka under the Karnataka Agricultural Produce Marketing (Regulation & Development) Act, 1966. The main objective of APMCs is to bring in better agricultural and marketing practices in ensuring remunerative prices to farmers for their produce and their accurate weighing. Attention is also given to timely payment of sale proceeds to farmers in addition to providing basic infrastructure facilities for trade of agricultural commodities.

Under sale through manual tender system, sometimes the arrivals of commodities in the markets are so huge that it takes up to evening or night to complete the process of trade. There are also possibilities of error while entering the rates in tender slips. Moreover, farmers have to wait for a long period especially during heavy arrival period, due to delay in completion of trade transactions. To overcome these problems, Electronic Tender System of sale was introduced.

The Electronic Tender System of sale is a unique and innovative project involving adoption of modern technology at the primary wholesale market level aimed at ensuring fair marketing practices and competitive price for the farmers' produce.

Intervention



After the success of a pilot project at Mysore, Electronic Tender System has been taken up at 42 APMCs in the state

during the years 2008-09 and 2009-10. During the first phase, the project was implemented in 18 APMCs at a cost of ₹ 7.77crores during the year 2008-09, which included RKVY assistance of ₹ 4.00 crores and the balance ₹ 3.77 crores from concerned APMCs. The APMCs where the project was implemented in the first phase are Tumkur, Shimoga, Sagar, Chitradurga, Gulbarga, Sedam, Yadgir, Kanakagiri in Gangavathi, Bellary, Kottur, Bijapur, Haveri, Byadagi, Ranebennur, Hubli, Bagalkot, Sirsi and Kumta. During the year 2009-10, 24 more APMCs were taken up at a total cost of ₹ 8.83 crores of which the RKVY component was ₹ 7.00 crores and the balance from concerned APMCs of Challakere, Bhimasamudra in Chitradurga, Hosadurga, Bhadravathi, Channagiri, Tiptur, Mandya, Arasikere, Sulya, Bailhongal, Saundatti, Ramadurga, Lakshmeshwar, Siddapur, Yallapur, Dharwar, Annigere, Gadag, Jevargi in Gulbarga, Surpur, Koppal, Bidar, Shahapur and Sindhnoor.

The project was implemented with the help of KEONICS – a State Government organisation, which developed the necessary software required for the system to operate. Under the electronic tender system, farmers bring their produce for sale at the market yards through different means like trucks, carts, tractors etc. At the market gate details of the commodities including the name of the farmer, his address, name of the commodity, approximate quantity, name of the commission agent or trader's shop where the commodity will be displayed for sale are recorded in the installed computers.



Issue of Gate Pass to farmers



Display of Tender rates through website

■ Trader inspects the commodities displayed at the yard and quotes his best price through the computer system ■



■ A responsible officer of APMC opens the system through a secret code and the highest prices quoted appear on the monitor instantaneously. ■

Each commodity is given an identity and the gate pass is given to the farmer. Thereafter the farmer takes the commodity to the commission agent or trader's shop. The licensed traders who are interested in buying the commodity are given a unique code number. The interested trader inspects the commodities displayed at the yard and quotes his best price through the computer system he is having at his shop or through computers in kiosks that are established in different places in the yard.

In this way the rates quoted by different traders for different commodities are collected at the central server located in the APMC office, which is connected to the input systems located in different places in the market yard either through cable or satellite. At the prescribed time a responsible officer of the APMC will open the system through a secret code given to him and the highest prices quoted for different lots of commodities appear on the monitor instantaneously. The print-out of this information is taken and circulated among all the farmers and traders and is also displayed on the notice board.

The information is also available in the website of the Department of Agricultural Marketing (<http://krishimaratahavahini.kar.nic.in>), for dissemination to all concerned. After acknowledging the rates, the farmer decides whether to sell his commodity or not; in case he agrees, an agreement is made between the farmer and the commission agent after which the commodity is weighed and account settlement slip prepared. The farmer gets his sale proceed immediately and can go back home early. The trader who purchases the commodity takes delivery of the commodity. The APMC realises the market fee either from the trader or the commission agent, which is always paid by the purchaser of the commodity.

When the project was taken up at Mysore under the technical assistance of the National Informatics Centre, Bengaluru as a pilot project, several problems, both administrative and technical cropped up. These were subsequently rectified and the system was finetuned. The farmers, commission agents and traders have realised the advantages of electronic tender system of sale and are welcoming its continuance and extension.

Outcome

The electronic tender system has brought transparency and confidence among the stakeholders in the system of sale. It has helped farmers to get competitive price for their produce. A study of 9 markets and 21 commodities has revealed that there has been an increase of 20 percent in the arrivals of commodities and the farmers are able to get an increase in prices for their commodities ranging from 4% to 50%. Further,

there is a saving of time in completion of the process from 1 to 3 hours. The project has brought in accuracy in the system and removed the errors and mistakes in the prices quoted.

It has helped collection and maintenance of correct information of prices and arrivals of commodities and timely dissemination of such information. The Department has also realised increased income by the way of market fee without evasions. The system brought marketing reforms in the state, and behavioural changes among the farmers and market stakeholders by adopting modern technology.



Traders Offering their Tender Rates through Computer Kiosk Established in the Market Yard

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Safe Rearing of Sheep

Background & Objectives

Ecto-parasite infestation is a serious problem amongst the sheep and goat flocks of Himachal Pradesh. This is due to non availability of water bodies where these flocks can be dipped in order to get rid of various parasites like ticks, lice and mites on regular intervals. It is highly recommended that the sheep and goat must be dipped at least thrice a year to keep the animals free from infestations. However, due to lack of awareness coupled with non availability of dipping infrastructure in Himachal Pradesh there are huge losses both in terms of wool and meat amongst the sheep flocks of the state.

Presently only constructed fixed dips are available on the migratory routes in the districts of Chamba, Kangra, Kullu, Mandi, Shimla and Kinnaur. A few fixed sheep dips are also available in the districts of Solan, Sirmour, Bilaspur and Una.

The problems being faced in the fixed constructed dips are their high cost of maintenance, non availability of land at suitable places, abundant and varied migratory routes, lack of security at sheep dips, and the non availability of free flowing water. All these problems are compounded by the fact that regular maintenance and cleanliness are not possible.



Mobile Sheep Dip Tank

The answer to the above problems lies in introduction of mobile dip tanks on migratory routes. Mobile sheep dips are constructed of light weight, high grade steel and designed for sheep and goats. The system is designed for a convenient self contained towing configuration which can be towed easily behind a jeep. The unit can also be manoeuvred by hand to be set up at difficult locations. It can be set up by a single person at a convenient location by detaching it from the trailer. The location is selected after considering ease of sheep flow, land and access to water etc.

Intervention



The chief objectives behind introducing mobile sheep dips are to improve the health of sheep, reduce mortality rate, enhance meat production and for getting better returns to breeders. To achieve these objectives and to cover approximately



■ Large numbers of migratory flocks are being covered by this process. ■

1,50,000 sheep in the Districts of Hamirpur, Bilaspur, Kullu, Mandi, Solan, Sirmour, Una and Lahaul & Spiti, the state has approved purchase of three mobile sheep dip tanks through RKVY funds at a cost of ₹ 142.00 lakhs. These mobile dip tanks are arranged on the migratory routes of sheeps and goats and the flocks are dipped/drenched in ecto-parasiticide for cleaning.

Earlier the sheep were being dipped in fixed sheep dips/tanks which have been constructed long time ago on the migratory routes of sheep. The Department was facing difficulty in construction of new fixed dip tanks due to problems in land transfer as most of the land on migratory routes is forest land. Therefore, the benefit of dipping was not being extended to cover more sheep population. After purchase of mobile sheep dip tanks, this problem has been solved to a great extent.

The place of installing mobile dip tanks is identified on the migratory routes through which maximum number of sheep flocks pass during migration on locations where adequate water supply and disposal is available. The Sheep Dip Tank is carried to this place during the migration period for mass dipping and drenching of the sheep flocks.

Outcome

The benefits of the above efforts are manifold. Large numbers of migratory flocks are being covered by this process. Total swim length of mobile sheep dip is 8.5 metres which is more than the length in conventional sheep dips and this results in better contact with deworming medicine. Fixed sheep dip tanks were catering to needs of only those flocks that were passing through that particular migratory route. Now with introduction of mobile sheep dip tanks, different migratory routes can be accessed leading to more coverage of flocks. So far 1.25 lakh numbers of sheep and goat have taken dips in these

tanks. This has resulted in improved health of sheep and lower mortality. The production of meat and wool has also increased from 1427 tonnes to 1441 tonnes (estimated) and 1114 tonnes to

1137 tonnes (estimated), respectively, during the period 2009-10 to 2011-12. As a result, the income of sheep owners has also increased.



Sheep Dipping

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Precision Farming in Sugarcane

Background & Objectives


Sugarcane is an important commercial crop in India. India ranks second in the world, after Brazil, in terms of area (4.1 million ha) and sugarcane production (355 million tonnes in the year 2007), though in terms of productivity it stands at tenth position (61.95 tonnes). Sugarcane in India is grown in two distinct agro-climatic regions – the tropical (largely comprising Maharashtra, Karnataka, Gujarat and Tamil Nadu) and the sub-tropical (Uttar Pradesh, Punjab, Haryana and Bihar). The yields are substantially higher in the tropical belt as compared to the sub-tropical regions.

There are 35 million farmers growing sugarcane and another 50 million depend on employment generated by the 571 sugar factories and other related industries using sugar. Among the states, while Uttar Pradesh dominates in area (2.25 m.ha) and production (134 MT) of sugarcane, in terms of productivity, Tamil Nadu leads with 105 t/ha.

In Tamil Nadu, sugarcane is the most important commercial crop, covering about 3.35 lakh ha, of which 63.4% is planted and 37.6% is *ratoon*. Villupuram, Erode, Cuddalore, Thiruvannamalai, Vellore, Perambalur, Thanjavur, Dharmapuri, Namakkal and Salem districts together accounted for almost 75% of the total sugarcane area of the state.

Precision farming in sugarcane was being practised by farmers in Dharmapuri and Krishnagiri districts of Tamil Nadu between 2004 and 2007, and had resulted in considerable economic prosperity in the area. With the advent of Rashtriya Krishi Vikas Yojana and the flexibility it provided the State in terms of project selection and implementation, the State put in place an ambitious plan to upscale practice of precision farming in sugarcane through cluster approach, wherever controlled irrigation is possible across the State.

Intervention

uring the initial years of RKVY funding (2007-08 and 2008-09), Precision farming included sugarcane, cotton, maize, banana, and a whole lot of horticultural crops. Considering the importance of sugarcane and other agricultural crops, separate projects were posed before the SLSC titled "Precision farming for agricultural crops". With an annual coverage of 4000 ha, this project was implemented during the years 2009-10, 2010-11 & 2011-12. A total outlay of ₹ 137.89 crores has been provided under precision farming for the years 2007-08 to 2011-12.

The major theme in expanding precision farming is "*Save Water & Electricity*". With less than 60% of the net cultivable area under irrigation, any saving in water through precision farming over conventional farming would lead to expansion of the area under irrigation. At present, farmers are not charged for their electrical energy consumption for lifting water and therefore, any saving in water would also result in minimising the energy consumption.

The success of Precision farming in Krishnagiri & Dharmapuri districts during the period 2004-07, formed the basis for up scaling precision farming in other districts. "Cluster approach" was followed for implementing the project. A 20 ha cluster involving 20 farmers

was the norm followed; wherever contiguous farm holdings were not available, a virtual cluster was formed. The farmers of each cluster formed a group, registered themselves under Society Registration, maintained records, elected their leaders and approached the Department of Agriculture for assistance under RKVY.

It was proposed to dovetail the programme with Micro Irrigation Programme of Government of India with 50% subsidy. However, the micro irrigation systems adopted under precision farming are more intensive than that prescribed under Government of India's programme, and often cost of such systems exceeds ₹ 80,000 per hectare. Therefore, subsidy assistance was provided under RKVY for farmers for which they could register online. The groups of farmers of each cluster were given technological training on precision farming at Tamil Nadu Agricultural University or its Research Stations located close to the cluster. In addition, exposure visits were arranged to locations which had registered early success in precision farming.

The project is spread across 28 districts of the State and concentrated in sugarcane growing tracts and areas where ground water is the major source of irrigation. The key success of the project results from the precision application of water, nutrients and plant protection chemicals that result in uninterrupted growth and development of sugarcane. Timely application in right quantities enabled longer internodes in sugarcane thereby pushing the height of the crop and thereby its yield.

Water soluble fertilizer is a critical input that plays a major role in increasing the crop productivity and it has to be essentially applied with the recommended dose as prescribed by Tamil Nadu Agricultural University. The same, while being expensive, when applied in right quantities and right time enhances fertilizer use efficiency, saves labour and increases inter-nodal length and thereby productivity in sugarcane.

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Year-wise Spread of Project Across Districts (2007-08 to 2010-11)

Districts	Area Covered (in ha)				No. of Sugarcane Farmers Benefitted		
	2007-08	2008-09	2009-10	2010-11	2007-08 & 2008-09	2009-10	2010-11
Coimbatore	500	-	-	100	374	-	-
Cuddalore	90	350	40	380	440	40	380
Dharmapuri	470	-	100	300	359	100	300
Dindigul	500	-	-	-	40	-	-
Erode	180	300	-	200	440	-	200
Kancheepuram	100	90	-	-	40	-	-
Karur	410	190	260	200	460	227	200
Krishnagiri	500	-	-	-	88	-	-
Madurai	90	90	-	-	160	-	-
Nagapattinam	40	90	60	120	130	60	120
Namakkal	500	-	500	500	350	235	349
Perambalur	500	-	880	500	500	880	500
Pudukottai	90	90	120	200	180	120	200
Ramnad	140	-	-	-	140	-	-
Salem	450	40	660	500	290	490	500
Sivagangai	100	350	700	320	420	700	320
Thanjavur	100	100	-	-	200	-	-
Theni	100	360	-	-	322	-	-
Thoothukudi	100	100	-	60	133	-	-
Tirunelveli	100	400	-	100	480	-	100
Tiruppur	20	100	-	100	120	-	-
Tiruvallur	90	90	-	-	160	-	-
Tiruvannamalai	100	400	60	100	500	60	100
Tiruvarur	90	90	40	40	180	40	40
Trichy	90	350	-	-	362	-	28
Vellore	90	350	-	40	440	-	-
Villupuram	450	-	580	240	440	580	240
Virudhunagar	90	350	-	-	284	-	-
Total	6,080	4,280	4,000	4,000	8,032	3,532	3,577

Note: Besides Sugarcane, the other crops covered under this project by the Department of Agriculture are Maize, Cotton, Groundnut and Sunflower.

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Outcome



The average yield of about 90-100 tonnes/ha in conventional farming, has increased to 160-170 tonnes/ha on a conservative estimate. There are several instances of higher yields in each district where precision farming was practiced.

Precision farming, which remained a success in select districts of Tamil Nadu, had been extended across the State through RKVY assistance. The introduction of drip irrigation (in many cases sub-surface drip) has brought it wider spacing of crops (five feet broad beds between furrows where the drip line passes). This wider spacing is made good with a rain fed inter-crop (mostly pulses) that nourishes the soil; inter-crop also curtails weed growth during initial stages of sugarcane development. Application of fertilizers and plant protection chemicals through drip lines minimises input cost and the farmers can now manage these operations themselves, which were otherwise dependent on hired labour.

The difference that precision farming made to the farmers' incomes comes from savings on account of cost of inputs and labour on one hand and the increase in productivity (yield) and the milling quality of the canes (in terms of sugar recovery) on the other. However, this difference is possible only with the initial investment assistance that had been provided under RKVY.

Tamil Nadu Agricultural University's Precision Farming Cell & e-extension centre had conducted bench mark and impact

study across districts and came out with the following observations:

- Irrespective of the districts, the farmers have accepted and adopted the technology primarily due to the water economy, which in turns helps to expand the area under irrigation, fewer weeds which reduced the cost of cultivation, greater possibility for timely operations and enhanced input use efficiency.
- The productivity increase ranged from 20-150%. On an average, 40-60% yield increase was reported in all the districts.
- Farmers were unanimous in voicing that the era of 'Stressful' or 'Distress' agriculture was over as dependency on increasingly scarce labour was minimised, irrigation has become one man affair and the expenses on plant protection chemicals have come down to half, making agriculture profitable.
- Majority of farmers shared their experience on precision farming with fellow farmers on fertigation, marketing problems, soluble fertilizers and plant protection.
- Availing institutional credit to supplement subsidy assistance extended under NADP was the major constraint expressed by the farmers. After sales service from the drip system firms continues to be a problem for farmers.
- High costs of water soluble fertilizers are a concern for a majority of farmers. Most farmers discontinue the use of water soluble fertilizers, as the same is not available at subsidised cost beyond the project.

Sl. No.	Crop	Yield (MT/ha)		Increase in Yield with the Introduction of Precision Farming (MT/ha)	% Increase in Yield with the Introduction of Precision Farming (₹)
		Before PF	With PF		
1	Sugarcane	105	183	78	90

Success Story of Ameerdeen, Dindigul District

My name is Sultan Ameerdeen, I belong to Velvarkottai village, Vadamadurai block of Dindigul district. I have been a Sugarcane farmer for a long time and decided to take up RKVY assisted Precision Farming based on the awareness created by the Agriculture Department staff. Based on their advice, I chose CO-86032 variety and planted 30,000 two-budded sets at a row spacing of two and half feet on 5th December, 2008.

Under RKVY precision farming scheme, I had installed drip irrigation system. I was also provided with 55 kg of NPK 19:19:19 water soluble fertilizer, 37.5 kg of MOP, 65 kg of Potassium Nitrate and 25 kg of S Potash. I followed fertigation practices as told by the Agriculture Department staff. I had a good crop stand. On 18th October, 2009 I harvested 126.75 tonnes that fetched me ₹ 1,90,125. The total cost I had incurred until harvest was ₹ 53,500 (i.e., a profit of ₹ 1,36,625) as against my previous profit of ₹ 91,500 when I followed the conventional method of cultivation. I am happy that I received inputs worth ₹ 40,000 through RKVY scheme and doubly happy that I made a profit of ₹ 45,125 over my previous income. I am now confident from my experience that by practicing precision farming we can obtain higher incomes and profit from any crop.



Fertigation Assembly



A Farmer Shares his Success



Sugarcane Sets Planted in Furrows



A Weed-free, Uniform Crop Stand



Drip System in Sugarcane



A Bountiful Crop



Quality Seed

Key to Success

Background & Objectives

Subeejam Shukshetre Jaayate Sampradayte means good seed in a good field produces abundantly. To be able to produce more and prosper, farmers must use pure and healthy seeds as per the certification norms which have a standard germination percentage. Good quality seeds are those which have genetic and physical purity, health standards, and moisture content in accordance with seed certification standards. Quality seed increases production of crops by about 20%. Farmers make arrangements for many inputs but quality seed is the most essential input among all the inputs. If the seed is of bad or inferior quality, then labour and other expenses are in vain.

Chhattisgarh was carved out of Madhya Pradesh and granted statehood on 1st November, 2000. It has total geographical area of 13.79 million ha. Constituting 4 percent of total geographical area of India. Rice is the principal crop of Chhattisgarh. However productivity of various crops in the state is much below the national average. Among other factors, inadequate production and usage of quality seed is a major constraint in increasing productivity in the State.

For achieving self-sufficiency in Quality Seeds, the State prepared a Seed Rolling Plan for the first time in 2005 by involving all stakeholders, i.e., State Seed Corporation, State Agriculture University, Agriculture Department and Seed Certification Agency. Timely procurement of breeder seeds from SAUs & Research Stations, identification & training of seed growers and production as per seed rolling plan were the

thrust areas of the Plan. The main objective of the programme was to increase the Seed Replacement Rate (SRR). Seed Replacement Rate is the percentage of area sown out of total area of crop planted in the season by using certified/quality seeds other than farm saved seed.

Intervention

This involved the following activities:

- ▶ Procurement of Breeder seeds from Government of India.
- ▶ Multiplication of Breeder seeds to the foundation seeds through farms of State Agriculture University, State Agriculture Department and State Seeds Development Corporation.
- ▶ Distribution of foundation seed to the growers to multiply as certified seeds.
- ▶ Receipt of raw seeds from growers.
- ▶ Processing of raw seeds in seed processing plant.
- ▶ Certification of processed seeds for sale to farmers through State Seed Certification Agency.

Total outlay on these activities was ₹ 85.49 crores from 2007-08 to 2011-12, of which ₹ 75.02 crore was met from RKVY and the balance from "Assistance for the Creation of Seed Infrastructure Facilities under the Central Sector Scheme".

Seed growers training programmes were organised as an incentive measure to encourage quality seed production and distribution which earlier was the main drawback in quality seed production by seed growers. Seed exchange programme was introduced to promote use of quality seed among SC, ST, small and marginal farmers on exchange basis.

However, one of the main constraints to achieving desired SRR has been lack of infrastructural facilities to achieve the desired goal. Construction of new seed processing centres, strengthening of old processing centres, construction of seed godowns, subsidy on seed production & distribution have been undertaken in a big way under RKVY.

- ▶ New seed processing centres in the unrepresented districts at Korla and Korba were established. Four new seed processing centres have been started at Chaple (Raigarh district), Dharampura (Bilaspur district), Gariyaband (Raipur district) and Saraipali (Mahasamund district) to facilitate the seed growers in their pursuits.
- ▶ The capacity of seed godowns was enhanced to 45000 MT from existing 17000 MT.
- ▶ Availability of additional 21 seed grading machines increased the seed grading capacity by 58 TPH, thereby enhancing seed availability twice over. A total of 70575 MT of packed certified seeds was made available during 2011-12 as against earlier 17930 MT in 2007-08

(₹ in lakh)

Project	2007-08		2008-09		2009-10		2010-11		2011-12	
	Phy.	Fin.	Phy.	Fin.	Phy.	Fin.	Phy.	Fin.	Phy.	Fin.
Godowns (Nos.)	01 No.	35.00	17 No.	680.00	02 No.	80.00	07 No.	262.50	03 No.	132.00
Grading Machines (Nos.)	04 No.	80.00	08 No.	240.00	02 No.	64.00	04 No.	100.00	03 No.	84.00
Production Subsidy to Seed Growers (Lakh MT)	-	-	0.299 lakh MT	599.00	0.372 lakh MT	743.36	0.407 lakh MT	814.34	0.503 lakh MT	1005.43
Distribution Subsidy to farmers (Lakh MT)	-	-	-	-	-	-	0.178 lakh MT	534.19	0.246 lakh MT	774.98



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Outcome



As rice is the main crop of the state, covering nearly 76% of the net cultivated area, a case study was undertaken to assess the impact of initiatives under RKVY particularly with regard to Seed Replacement Rate (SRR) in Paddy. The results show an overall increase in area, production and use of quality seeds in Paddy.

Particulars	2001-02	2006-07	% Increase Over 2001 -02	2010-11	% Increase Over 2001 -02
Area under seed production programme (hectares)	2462	11702	375	49029	1891
Production of quality seed within state (MT)	2780.3	12419.9	346	52425	1785
Distribution of quality seed (MT)	6612.5	12804.3	93	58416.4	783

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Due to these interventions, state has achieved high SRR ensuring higher productivity in a sustainable way as depicted below:

Particular	Base Year 2001-02 Qty.	2006-07		2010-11	
		Qty.	% Increase Over Base Year	Qty.	% Increase Over Base Year
Production of Quality Seed of Rice (lakh MT)	0.028	0.124	347	0.531	1813
SRR of Rice (Percent)	2.00	8.50	325	28.41	1320
Productivity of Rice (kg/ha)	1331	1447	8.7	1751	31.5
Production of Rice (lakh MT)	50.04	54.42	8.7	61.59	23

Notable initiatives like area expansion under SRI, improvement in Seed Replacement Rate, use of hybrid seed and micro nutrients have resulted in highest production of rice of 61.59 lakh MT in *kharif* season 2010-11 which is 50% more than the production of

kharif 2009-10. State Government of Chhattisgarh was presented the "Krishi Karman" Award by the Department of Agriculture & Cooperation, Government of India for achieving its highest ever rice production in 2010-11.



Kisan Call Centre

Aid to Farmers

Background & Objectives

Agriculture extension services along with facilitation to farmers are the mandate of Agriculture Department everywhere in the country. Continuing fragmentation of land holdings and the increasing number of small holdings are creating challenges for the extension function from the viewpoint of input supply, transfer of technology, ensuring general awareness, etc. One-on-one contact via extension services is now becoming practically difficult, and a shift towards the group approach is becoming inevitable.

For speedy transmission of technology and latest technical updates to farmers, for resolving their diverse problems, an innovative means, namely, the Kisan Call Centre, was established in Madhya Pradesh under Rashtriya Kisan Vikas Yojana (RKVY) during 2008-09.

After fulfilling all necessary formalities, the Government of Madhya Pradesh, Department of Farmer Welfare & Agriculture Development, in coordination with SIAET, chose Indian Society of Agriculture Business Professionals (ISAP), as a partner. The responsibility of ensuring smooth functioning of the KCC was entrusted to ISAP. KCC in the state started to function in Bhopal in September, 2008 with the following objectives:

- ▶ To facilitate farmers of the state to get information/ solutions to their problems through use of the Toll Free Number 1800-233-4433.
- ▶ To provide technical inputs to farmers.
- ▶ To serve as a feedback mechanism for the policy makers.
- ▶ To forge strong Research-Extension-Farmer Linkages.

Intervention

The Kisan Call Centre established in the state functions from 7 am to 7 pm every day. It comprises a 15-seater computerised answering system working in two shifts, i.e., 7 am to 1 pm and 1 pm to 7 pm. The major topics handled by KCC experts are as follows:

- ▶ Disease and pest control for different crops grown in the region.

- ▶ Good agricultural practices, livestock management, fishery, etc.
- ▶ Best practices in agriculture in the state as well as of other states.
- ▶ Crop related information in agriculture, horticulture, animal husbandry aromatic plants, spices, plantation crops, cash crops, etc.
- ▶ Vermi-compost, organic farming, including organic plant protection, etc.
- ▶ Information on HYV seeds and nutrient management for different crops.
- ▶ Market related information for different crops in the state.
- ▶ Farmer support programmes which are being implemented by the government of Madhya Pradesh; and
- ▶ Agriculture related information that impacts farmers, farming practices, etc.

The Kisan Call Centre works on two levels. At the first level, replies/ solutions are provided to farmers' queries instantaneously by experts. At the next level, the queries are analysed so that area-specific analysis can be done based on which timely information could be disseminated to farmers through TV, radio etc., to caution or overcome possible damage to agricultural crops or livestock. It is important to mention here that KCC served as an early warning system as witnessed during the crisis of drought during 2009 *kharif* and untimely floods in October 2009. It was transformed into a control room to provide solutions to the emergent and contingent needs of the farmers on area specific basis across the state.

Queries related to agriculture and allied sectors are being addressed through the Kisan Call Centre, instantly, in the local language, by experts in Agriculture/Horticulture Departments, State Agricultural Universities, ICAR institutions etc. Subject



Matter Specialists (SMSs) interact with the farmers via telephone and computer to understand their agriculture-related problems and answer the queries through the Call Centre. The infrastructure is provided at three locations namely - a Professionally Managed Call Centrer (Level-I), a Response Centre in each organisation, where SMSs are made available (Level-II) and the Nodal Cell (Level-III). Queries related to agriculture and allied sectors are being addressed through these call centres to deliver extension services to the farming community.

KCC provides answers to farmers on queries related to agriculture, horticulture, plant pathology, soil sciences, and animal husbandry and so on. The information dissemination to the farmers is mainly categorised into three types, namely, information on Pre-cultivation, Cultivation and Post Cultivation. Information under the category of Pre-cultivation that is provided to the farmers through the KCC includes information related to field preparation, time and place of availability of HYV seeds, availability of fertilizers, training and orientation for the farmers for usage of best seeds, balanced use of pesticides and fertilizers, required amount of water for the specific crop, etc.

Under the category of cultivation phase, KCC provides information related to pest and disease control, irrigation, government schemes, loans, etc. In the post cultivation phase, it provides information on the market, storage facilities, transportation, value addition, etc.

KCC experts use back-end data support systems, which are in-built in the MIS system. Kisan Call Centre Software is an MIS tool covering the complete milieu of advisory services provided through the Call Centre providing back-end data support to the knowledge worker, while processing queries from farmers from 7 a.m. to 7 p.m., all seven days of the week. The software captures caller details and the

query. The information is processed into an MIS output which helps area-wise, crop-wise and problem wise analyses within the time-space framework and provides preventive and advance action solutions from both qualitative and quantitative aspects. It also helps to identify pest attacks in any particular geographical area and the information collected is provided to the State Agriculture Department for taking appropriate timely action through broadcasting on Kisan Call Centre itself. It addresses not only agricultural practices, but also livestock, policy issues, government interventions, etc.

The Kisan Call Centre is a fusion of two separate technologies, namely, Information and Communication Technology (ICT) and Agricultural Technology. Both have their specialised domains and work cultures. The Kisan Call Centre staff are organised into three levels, namely Level-I (the basic Call Centre interface, with high quality bandwidth and local language proficient Agriculture Graduate), Level-II (Subject Matter Specialists on concerned important crops and enterprises, connected through good bandwidth telecom and computer connectivity) and Level-III (the Management Group to ensure ultimate answering and resolution of all the farmers' queries which are not resolved at Level-II, connected on off-line mode).

The total cost of the KCC project is ₹ 2.25 crores per year funded by the Department of Agriculture and the Department of Farmer Welfare and Agriculture Development, Government of Madhya Pradesh, and covers the software, hardware and other operational costs of the initiative.

The KCC provides timely information to the rural farmers who are benefited through this project. The farmers get accurate answers to their queries, thus facilitating them to better manage their crops.

Outcome

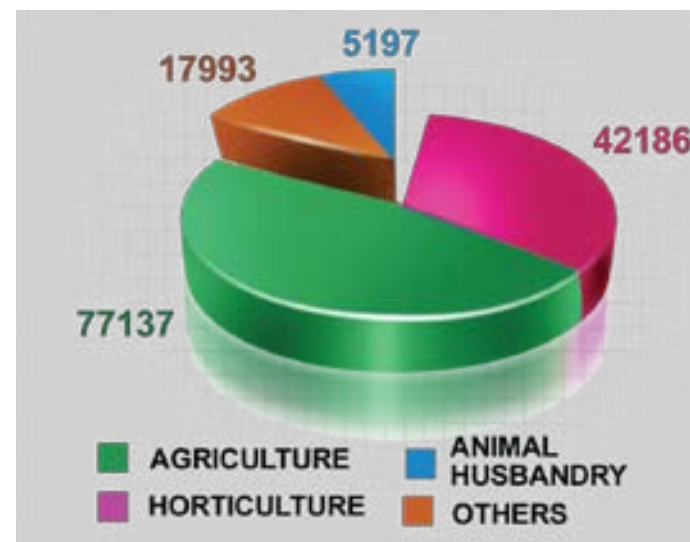
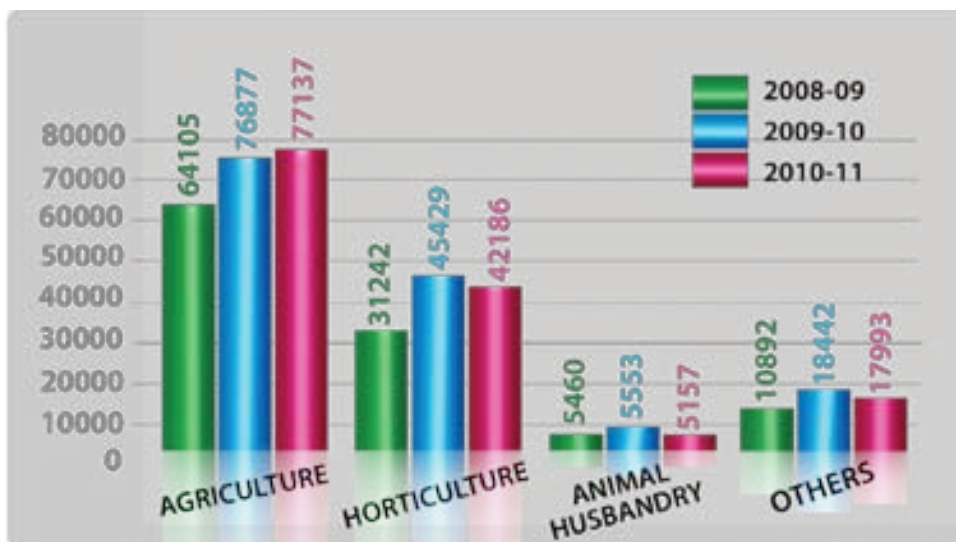
The KCC has resolved 4,73,694 queries from farmers of 50 districts of Madhya Pradesh as of December 2011. For successful functioning of the KCC, monitoring and review of the various activities of the KCC is being carried out on a regular basis by the Nodal Institution.

A comprehensive and exhaustive case study of KCC has been done by National Institute of Rural Development (NIRD). The major findings of the impact analysis is as given in the figure below.

After detailed interview with 30 beneficiary farmers, it was also found that 88.66% farmers were not participating in any social activities before introduction of the KCC initiative, but post-KCC, at least 13.33% of the farmers have increased their interaction with fellow farmers. Successful farmers who benefited through KCC, have become members of one or two organisations.

As many as 30 beneficiaries accepted that they adopted new technologies/farm practices which helped to increase their farm income substantially.

Details of Calls received by Kisan Call Centre during 2010-11





Organic Farming for Prosperity

Background & Objectives

Demand for organically grown crops is on the rise, both in domestic niche markets and in export markets. Bihar is strong in production of certain high quality crops, vegetables, fruits and spices which are suitable for organic production system. Department of Agriculture, Bihar has taken initiatives to promote organic farming on a large scale.

Government of Bihar has taken up several programmes to encourage organic farming, with the objectives of promoting sustainable production, improving soil organic carbon for sustenance of soil quality, and promoting export of quality organic produce. In the first phase, based on the experience of the first organic village Pothia, Samastipur, one village in each of the 38 districts was selected as organic or bio-village.

Bio-village is a unit to improve physical, chemical and biological status of soil through locally available organic inputs and production of crops through scientific methods by farmers at village level. The concept helps to lower cost of production, increase fertility and check degradation of soil. Area under vegetable cultivation and number of milch animals are the two important criteria for selection of a bio-village.



Dhaincha Field

Intervention

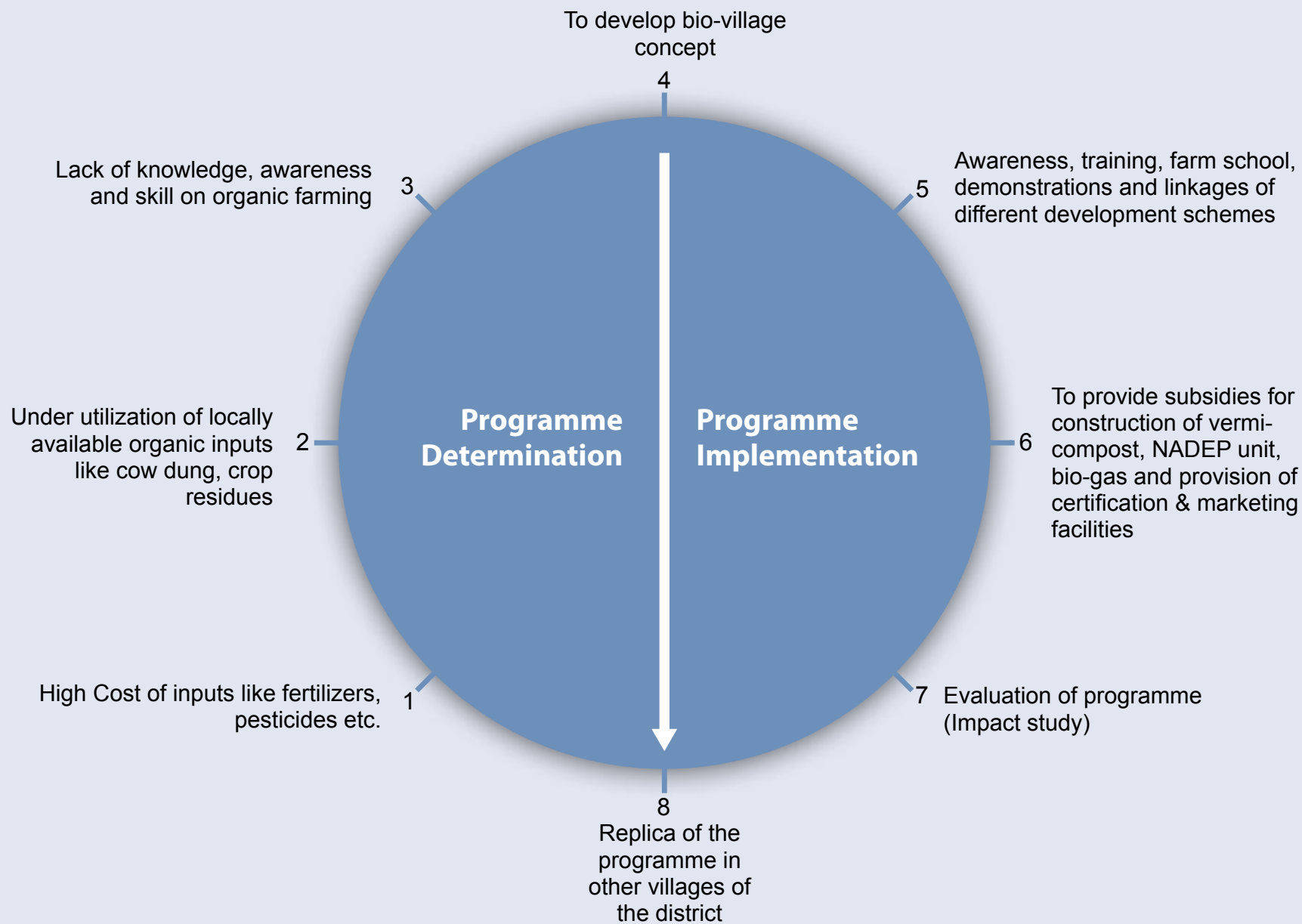
To encourage organic farming on a large scale with the view to declare the state as an Organic State, Department of Agriculture has prepared a five year road map for promotion of organic farming in the State. An amount of ₹ 80.93 crores has been provided under RKVY from 2008-09 onwards for promotion of organic farming.

Priority was given to the declared organic village in each district for providing vermi-compost units to all eligible farmers who applied for assistance. Subsequently, Bio-gas plant units were also included in RKVY in 2011-12. Farmers are encouraged to establish 2cft/3cft bio-gas unit to promote vermi-compost units assuming that the by-product of bio-gas plant will be used in vermi-compost units.

Commercial vermi-compost units with production capacity of 3000 MT/year were approved to be set up at a maximum subsidy of ₹ 25 lakh (50% of cost). 20 such units are being set up across the State at a total cost of ₹ 5 crores.

In addition, vermi-compost is distributed at subsidised rate and bio-fertilizers like Blue Green Algae/Rhizobium/PSB/Azactobacter/Mycorrhiza are also distributed free of cost to farmers for seed treatment of pulses, maize and paddy seed production under Chief Minister Rapid Seed Extension Programme and Seed Village Scheme. There is 100% support for production of bio-fertilizers in public sector and subsidy is also provided for production of bio-fertilizers in the private sector. ₹ 6.46 crores has been provided from RKVY for distribution of bio-fertilizers.

A massive programme for encouraging the use of green manure particularly *Sesbania (Dhaincha)* has been initiated from *khari*



Steps in organic production in Bio-village

2011. *Sesbania* seed was distributed to all interested farmers who have irrigation facility at 100% subsidy for a minimum of ½ acre and maximum of 5 acres; selected farmers of seed village, bio-village, and those using hybrid paddy as well as SRI technique are given priority. Extensive training programmes and mass media publicity were organised along with seed distribution and extensive follow up done to ensure success of the programme. About 1 lakh quintals of Dhaincha seed was distributed to more than 5 lakh beneficiary farmers at a total cost of ₹ 38 crores, which was met from RKVY funds.

An area of 3.70 lakh ha was covered during *kharif* 2011 against the target of 4 lakh ha. In the selected villages, farmers are sensitised about the importance of organic farming and the different schemes for promotion of organic farming as well as the methods and materials used for promotion of organic farming.

The programme determinants and phases of programme implementation in the production system of bio-village are shown on previous page:

Support for Organic Farming under RKVY

S I. No	Components	2011—12	
		Physical (Nos.)	Financial (₹ in lakhs)
1.	Vermi-compost units	42315	1269.45
2.	HDPE units	32974	1692.60
3.	Commercial Production units of vermi-compost	20	500.00
4.	Quantity of vermi-compost distributed (Quintals)	160000	960.00
5.	Quantity of Bio-fertilizer distributed (Quintals)	48400	605.00
6.	Dhaincha Seed distributed (Quintals)	100000	3800.00

Outcome

The success of bio-village concept in terms of farmers' group formation, trainings and area under different crops is as below:

Particulars	Achievement
Number of organic villages	38
Number of Farmers' Groups formed	270
Total number of member farmers	4217
Number of vermi-compost units constructed	2110
Number of applications for vermi-compost received	2433
Number of trainings organised	270
Area under different organic crops (in acres)	7396

Case Study

A study was conducted in village Sohdi in the district of Nalanda to find out the success of organic farming and the perception of farmers towards cultivation through organic methods and profitability of organically produced vegetables. There are about 265 farmers, associated with Farmers Interest Group (FIG) registered under ATMA, Nalanda who are involved in growing organic vegetables round the year using standard organic methods. Village Sohdi has successfully crossed the C-1 level of certification and C-2 level of certification is in its last phase. There are about 320 HDPE vermi-compost units established in the village and the average production of compost is about 2500 MT per annum. The farmers are selling the compost as well as earthworms not only in the state but outside the state also. The experience of farmers shows that the quality of different vegetables including the keeping quality is longer when grown organically. The organic onion (C-1) is exported to Bangladesh

while the organic vegetables (C-1) grown in the village are sold in the metropolitan cities of Bihar, Jharkhand and West Bengal. The cost of production in organic farming is less as expenditure on irrigation and chemical fertilizers is reduced and there is no expenditure on pesticides. The farmers of the village Sohdih are mostly small and marginal but they have become a role model for the farmers of the State in growing organic vegetables. The details of acreage, productivity and comparative profits with respect to non-organic growers are depicted in the table below:

Farmers of many villages of different districts like Nalanda, Muzaffarpur, Samastipur, Nawada, Purnia, Vaishali and many more in Bihar are now producing vermi-compost through their units and using it in their fields, in addition to selling it to other farmers.

53 farmers applied for setting up commercial vermi-compost production units. 23 units have been sanctioned and 7 units have already commenced production. The production of vermi-compost from all sanctioned 23 commercial units, once established would be about 70000 MT. Apart from this, about 65000 units were established by farmers. This will also generate at least 70000-80000 MT vermi-compost/year. In this way Bihar is expected to produce about 1.5 lakh MT vermi-compost/year. Bihar

has adopted an integrated model of Agriculture with Livestock to increase the incomes of farmers and to promote soil health and organic farming.



Vermi in Soil

Average Productivity and Comparative Profitability of Organic Produce

Sl. No.	Type of Organic Vegetable	No. of Farmers Associated	Area (ha)	Average Productivity	Comparative Profit (₹/ha)
1	Potato	265	200	480 qtls/ha	32000
2	Cauliflower	265	105	64000/ha	160000
3	Onion	265	120	576 qtls/ha	180000
4	Bitter Gourd	265	40	640 qtls/ha	192000
5	Pumpkin	265	40	950 qtls/ha	189000



Vermi-compost bed in Nalanda District



Organic Farming

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By using green manure, the requirement of chemical fertilizers has reduced and the farmers on an average applied only 80 kg nitrogen, 30 kg phosphorus and 10 kg potassium as against the general practice of 110 kg nitrogen, 40 kg phosphorus and 20 kg potassium. Consumption of chemical fertilizers decreased from 180 kg/ha in *kharif* 2010 to 138 kg/ha in *kharif* 2011. This has reduced the cost of production per hectare. The average yield of paddy increased and the highest ever yield of


224 qtls/ha was recorded by a farmer of Nalanda District surpassing the previous Chinese record of 190 qtl/ha. There has been an added advantage of 25,690MT of nitrogen fixation in the soil @70 kg/ha in an area of 3.7 lakh ha where Dhaincha was cultivated. Consequently, net return per hectare has increased. The above mentioned interventions have also resulted in improved soil health which is the key to sustainable agriculture.





Enhancing Fertility in Cows

Background & Objectives

attle in rural areas of Tamil Nadu generally suffer from two major reproductive conditions - *Anoestrus* condition or failure of coming to heat (20–30 %) and Repeat Breeding or repeated failure to conceive (around 10%). These conditions result in abnormally long average inter-calving intervals of more than two years, as against an ideal interval of one year. In a recent survey conducted in Tamil Nadu, it was found that only 35 percent of cows and buffaloes were pregnant as against a desirable level of 70 percent; around one third of cows and buffaloes were infertile because of anoestrus or repeat breeding. This means that out of 50 lakh breedable cows and buffaloes available in Tamil Nadu, around 15 lakh are infertile.

Poor heat detection, untimely insemination, poor nutrition and lack of awareness on efficient husbandry practices are the major contributing factors for the widespread infertility problem in cows and buffaloes.

Oestrus Synchronisation Technique was adopted in cows and buffaloes in rural Tamil Nadu to improve fertility, reduce inter-calving interval, improve milk production and enhance economic return to the farmer with assistance from NADP/RKVY of ₹ 2 crores in 2008-09 and ₹ 3.8 crores in 2011-12.

Oestrus Synchronisation Technology involves the use of certain drugs to bring a group of cows and buffaloes into oestrus at a fixed time and breed them. This technology has the following advantages:

- Induces heat in anoestrus animals thereby tackling a major cause of reproductive inefficiency.
- Improves conception rate due to timely insemination.
- Brings the animal into heat at pre-determined time so that there is no need for dependence on the farmer to detect heat.

Intervention



In this intervention, a device known as CIDR (Controlled Internal Drug Release) is impregnated with progesterone hormone and used as the main agent along with another drug called Prostaglandin $F_{2\alpha}$ for synchronisation of oestrus. In addition, the cows and buffaloes are primed with mineral supplements before starting the synchronisation protocol. A total of 15,149 cows and buffaloes were oestrus synchronised and bred by AI in 20 districts of Tamil Nadu at a cost of ₹ 2 crores. The districts covered were Villupuram, Erode, Salem, Kanchipuram, Thiruvallur, Namakkal, Dharmapuri, Pudukottai, Thanjavur, Nagapattinam, Tirunelveli, Krishnagiri, Vellore, Thiruvannamalai, Sivagangai, Cuddalore, Tiruchirapalli, Karur, Thiruvarur and Dindigul.

The Tamil Nadu Veterinary & Animal Sciences University (TANUVAS) piloted the project through its network of 16 Training and Research Centres in the districts. All procurements were done centrally by TANUVAS and distributed to the line departments. 750 veterinarians of the Department of Animal Husbandry, Co-operative Milk Unions and Veterinary University were involved at field level.

Major steps involved in Oestrus Synchronisation and Artificial Insemination (AI) were as follows:

- Potential villages were selected by the veterinarian.
- Camps were organised, wherein cows and buffaloes were examined individually and the animals are selected.
- Selected animals were given a dose of de-worming drug and two kg of mineral mixture to be fed at the rate of 30 g daily.
- The selected animals were re-examined after 15-30 days and the synchronisation protocol was adopted.
- After three months the pregnancy was verified in all the identified animals.

Buoyed by the success of the first phase of the project that was taken up in 20 districts only, an additional project of ₹ 3.79 crores has been taken up during 2011-12 to extend oestrus synchronisation technique in 50,000 cows and buffaloes spread over all districts of Tamil Nadu, including all anoestrus animals at the district livestock farms.

Outcome



The results of this project manifest in three ways, viz.:

- Improved fertility and reduction of inter-calving period that can be measured by the success rate of AI.
- Improvement of milk production, and
- Salvaging infertile cows, which otherwise find their way to slaughter houses.

This project achieved a conception rate of 60.25 % in mostly infertile cows and buffaloes. It improved conception rate by 20-25 % and reduced calving interval by 5-6 months. This means the farmers were saved from maintaining unproductive animals for a long time and they earned more income because of more days of milk production.

For various reasons, milk production has remained static in Tamil Nadu at 5.5–5.7 million tonnes for the last 4 years. The

Synchronisation Protocol Employed in Selected Cows



1. Initial Camp, animal selection



3. DAY 8: Prostaglandin Injection



5. DAYS 11&12: Artificial Insemination

15-30
Days
interval



2. DAY 0: CIDR insertion



4. DAY 9: CIDR withdrawal



6. Pregnancy Diagnosis

After
3 months

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reduction in inter-calving interval would result in 30–40% increase in milk production from an individual animal. If the synchronisation technology is adopted in fairly large number of cows, e.g., in 2 lakh cows, it would improve the total milk production by 700 lakh litres in a year. This would help to meet the increase in demand for milk and also help to control price inflation.

The most important outcome is that 9,124 cows and buffaloes had become pregnant out of 15,149 synchronized. Induction of heat was almost 100% in anoestrus (not coming to heat) cows and buffaloes. A conception rate of 60.23% achieved in mostly infertile cows and buffaloes is a significant feat.

The implementation of this Project resulted in improvement in milk production by 46.0 lakh litres (8,550 cows calving x 90 milking days x 6 lit/day) on annual basis. This improvement in milk production comes without increasing the number of animals and exerting pressure on feed resources. In addition, this project could salvage at least 20-30% of cows and buffaloes from going to slaughter as unproductive animals.

Mrs. Mallika Sekar of Kachur Village in Thiruvallur District of Tamil Nadu says “My buffalo is 8 years old and did not come to heat. When a camp was conducted here (under RKVY), I brought this animal. First they examined it and gave mineral mixture and de-worming drug and asked to bring the animal after one month. When I brought the animal to the next camp, they introduced a tube like thing (CIDR) into the vagina and when I asked what it was they replied that it is a device that will make the buffalo come to heat. Subsequently, after the removal of CIDR, the animal came to heat following which it was inseminated artificially twice. It is now confirmed that the buffalo is pregnant.”

She also adds “Earlier we were planning to sell the buffalo but now since she is pregnant we will not sell. Brokers were offering ₹ 5,000–10,000 for taking our buffalo for slaughter. Since we were rearing this buffalo for 8 years, we were reluctant to sell. But out of frustration only we were about to sell the animal. Now after calving the buffalo would fetch ₹ 20,000–25,000. During the first calving it is expected to yield not less than 5 litres a day and in the next, it will give about 8 litres a day”.

Economic Returns of Project (Project Cost Excluding non-recurring: ₹ 1.58 cr.)

Sl. No.	Economic Impact and Return to Farmers	₹ in Crores
1	The increase in value of the animal as it becomes pregnant. (15,000 x 60% preg. x ₹ 8,000 value addition)	7.20
2	Savings through reduction in calving interval (8,550 x 120 x ₹ 20/day –maintenance cost)	2.05
3	Incremental days of milk production as calving interval is reduced & number of calving increased (8,550 x 90 days x 6 lit/day x ₹ 15/lit)	7.39
4	Economic gain through sale of female calves (2,990 x ₹ 10,000)	2.99
	Total Economic Benefit	19.63





Telemetric Weather Stations for Better Agriculture

Background & Objectives

The larger part of agriculture in India is rain-fed; more so in Karnataka with average rain-fall of only 73 cm per year in Northern Karnataka compared to the national average of 125 cm. Deficient rainfall, coupled with high temporal and spatial variability, leaves farmers in worse condition. Average rainfalls can further be quite deceptive if it is measured over longer distances. This was the situation in Karnataka. The state had practically only one rainfall measuring device in one Taluk and that too used very old technology making the rainfall data suspect. Inadequately measured rainfall and absence of any localised prediction created problems for farmers not only in sowing and nurturing crops, but also created problems in insurance claim settlement, if their crops failed on account of either drought or flood, which has been an annual feature every year since 2001. Insurance settlement is more accurate if it is based on rainfall data of small geographical units, but can be quite disastrous if averaged out for very large geographical units like a Taluka. In this scenario, it is imperative to have an effective and accurate rainfall monitoring system.

The genesis of this project started in 2001. A study of the performance of rain-gauges, installed by Irrigation Department at the field level, revealed several practical problems. These included quick dust accumulation, weed growth, blockage, complete lack of maintenance, misuse of the instrument, non transmittance of data due to frequent power cuts in the rural areas and poor connectivity in remote areas. These problems were diligently and systematically addressed which led to evolution of a sturdy, solar dependent, weight based rather than volume based instrument needing minimal maintenance and care. This gave birth to the present day Telemetric Rain Gauges (TRGs), which have proved their sturdiness and efficiency in the fields.

Karnataka recognised the need for installing TRGs and initiated a pilot study in the year 2005 by installing TRGs at 27 district headquarters. This project was initiated through the funds available in the erstwhile Drought Monitoring Cell which was strengthened and renamed as Karnataka State Natural Disasters Monitoring Centre (KSNDMC), a Registered Society and an autonomous body affiliated to Department of Science and Technology.

TRGs are indigenously developed instruments and offer low cost and customised telemetric data transfer solutions. TRGs are GPRS enabled, solar powered, tipping bucket telemetric rain gauges. TRGs measures near real time received rainfall data at 15 minutes interval and record the same in digital format. TRGs can store 6 months rainfall data measured and have provision for onsite retrieval. They transmit data at an interval of 15 minutes through GPRS facility to a central server leading to rainfall data availability on hourly/sub-hourly basis. It was, therefore, decided to install TRGs in all the 747 Hoblis (Hobli is mid way between Tehsil and village Panchayat).

Bringing about a paradigm shift in agriculture and other related sectors from development to management requires not only accurate, reliable and timely rainfall data but also information on other weather parameters like temperature, moisture, wind velocity etc. The state, therefore, decided to move forward and install Telemetric Weather Stations (TWS), to begin with, at Taluka level.

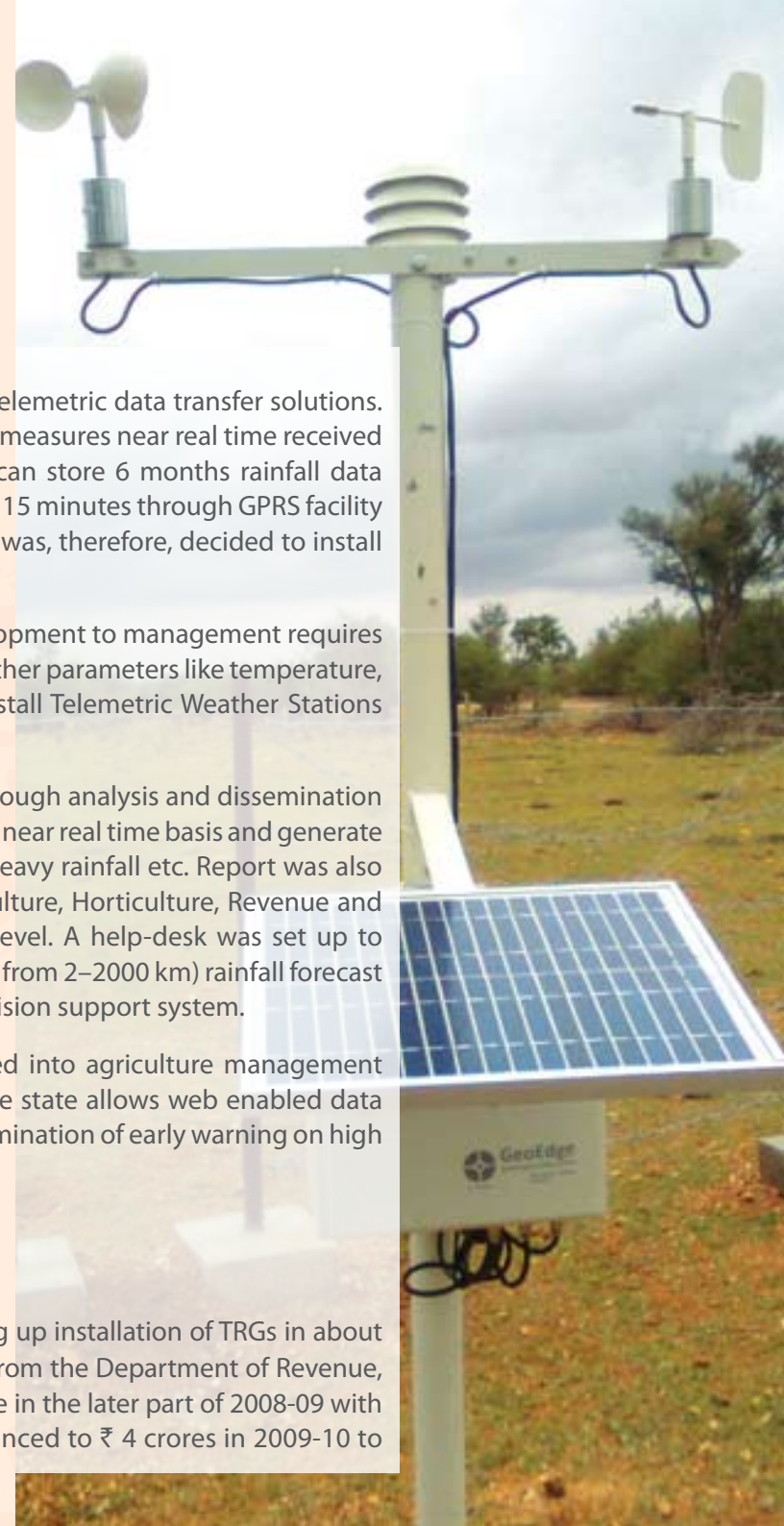
Collection of data through TRGs/TWSs was planned to be complemented with thorough analysis and dissemination thereof. The state level monitoring station developed the capacity to analyse data on near real time basis and generate alert recognition also on near real time on high intensity rain, heavy rainfall, very heavy rainfall etc. Report was also generated and disseminated on near real time basis to the Departments of Agriculture, Horticulture, Revenue and Water Resources and for Police officers functioning at State/District/Taluk/Hobli level. A help-desk was set up to provide information to the farming community. Further, a Meso-scale (areas ranging from 2–2000 km) rainfall forecast model was developed for providing information twice a day for supporting the decision support system.

This project has sought to transform the way meteorology could be incorporated into agriculture management systems. TRGs/TWSs and the entire weather management system developed in the state allows web enabled data base management to process the data on near real time, alert recognition and dissemination of early warning on high intensity rain, high rain and very heavy rain on auto mode.

Intervention



Actual project was initiated four years ago with the state government taking up installation of TRGs in about 600 Hobli headquarters in 2008-09 with funding support of ₹ 2.61 crores from the Department of Revenue, Government of Karnataka. RKVY funding was introduced in the programme in the later part of 2008-09 with infusion of funds to the tune of ₹ 50 lakh initially. RKVY support was further enhanced to ₹ 4 crores in 2009-10 to




expand the scope of the project to install TRGs in all the 747 Hoblis located in 30 districts of Karnataka and also to take these to Gram Panchayats with 100 gram Panchayats being taken up in the first page. The State then expanded their vision to take TRGs to all the 4688 Gram Panchayats and install TWSs in all the 137 Talukas, with further support of ₹ 2.93 crores from RKVY in 2010-11.

TRGs have actually been installed by last quarter of December 2011 in all 747 Hoblis and also in 770 Panchayats at a total investment exceeding ₹ 6.90 crores. In addition, installation of 137 TWS has been completed at Taluk level with sensor calibration & commissioning being under progress at the cost of ₹ 97.6 lakhs.

Collaborating with the Department of Revenue at the Gram Panchayat level, the RKVY funded KSNDMC has evolved a 3 level maintenance protocol for ensuring efficient working of the installed Rain gauges at the field level. This includes co-opting a local caretaker, an employee of Department of Revenue or Agriculture, with additional incentive to take care of the day-to-day maintenance, mandatory monthly monitoring visits to a minimum of 10% of the installation sites by the KSNDMC officers and Annual Maintenance Kits containing specific syringes, brushes, cleaning cloth, and even a bottle of water for the caretaker. Orientation programs at the Taluk level and television programs have created a huge awareness among the farmers and have ensured their participation in this project.

KSNDMC is now generating Hobli level and also Panchayat level rainfall data and providing the same to farmers, state governments and insurance companies. Many a times, it is quite telling to see difference in Gram Panchayat rainfall data as averaged by a Taluk level rain-gauge and the one based on Panchayat level TRGs.

Outcome

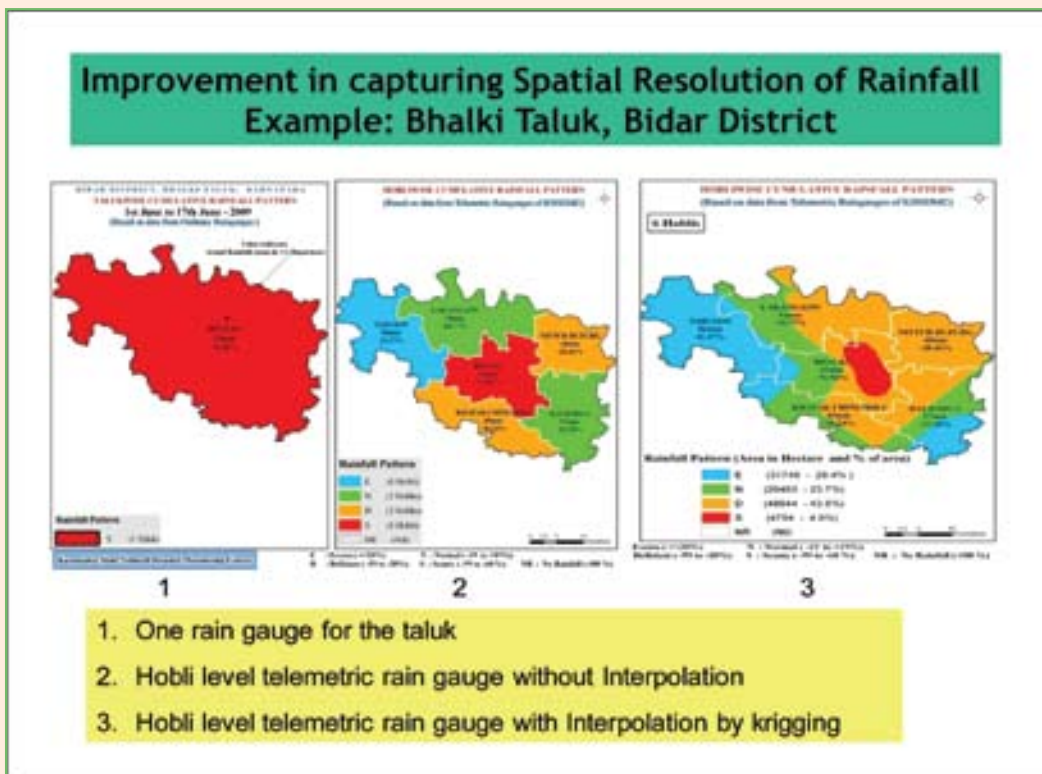
he project has brought under its umbrella all farmer communities located in 747 Hoblis located in 30 districts of Karnataka. The benefits that have accrued from the project include:

- ▶ Near real-time rainfall data;
- ▶ Significant reduction in time gap between data generation and information generation;
- ▶ Rainfall data on hourly/sub hourly basis;
- ▶ Alerts on high intensity/heavy/very heavy rainfall events;
- ▶ Accurate and reliable data in building up trust under weather based crop insurance program;
- ▶ Data dissemination in weather forecast model;
- ▶ Rainfall forecast and advisories at Hobli level;
- ▶ Speedy dynamic and informed decisions taken at the State Level Weather Watch Committee, State Level Coordination Committee on Crop Insurance and Executive Committee/General Body of KSNDMC.

The project focuses on providing advisories (warnings about bad weather conditions) to farmers and inputs to the Weather Based Crop Insurance program in Karnataka. The monitoring system dovetailed with meso scale (areas ranging from 2–2000 acres) rainfall forecasting system on pilot basis provides valuable advisories to the farming community. These mid course corrections aid adoption of better agriculture practices are leading to significant financial savings and returns. The financial gain for the farmer can be assessed as an aggregate of the following three factors:

- ▶ Improving the efficacy of the operations and enhancing productivity by advancing or postponing critical field level operations;
- ▶ Minimising wastage of valuable seeds, labour, and time due to informed choices about the time and acreage of sowing, based on impending rainfall data; and
- ▶ Securing the produce against rain damage by hastening harvesting operations.

While precise quantification of the benefit is difficult to assess in a project such as this, implied quantification reveals benefit accruals



exceeding a 10 fold improvement. The advisories to farmers in crop management and farming activity have far reaching benefits which are difficult to be analysed comprehensively. The alerts provided in case of heavy rains especially in the flood prone areas have helped in taking timely precautionary measures in mitigating the impact of heavy rains/floods.

The help desk at the KSNDMC centre receives an average of about 450 farmers' calls from all over the state requesting forecasts, advisories and operational suggestions.

This unique RKVY funded Karnataka project serves as a major reference within all the government agencies in Karnataka dealing with related data information collection and dissemination, use of

imagery in the field of rainfall and other disaster management.

This intervention has successfully bridged the gap between the worlds of technical experts and the grassroots farmer with easy to use rain gauges. Collaborating with CSIR- CMMACS for developing mathematical forecasting models using Supercomputers, to provide early warning and alert capsules to the farmer has helped development of this project to provide one-of-a-kind service to the agricultural community anywhere in India.

Given the frequency of drought occurrence in Karnataka, the need for macro and micro level readjustments and analysis to reach the extension workers and farmers in time for suitable action is critical. Research organisations and Universities have always valued the importance of information databases and have methodically archived research and development findings. However, the urgency to make relevant local rainfall information available to the communities and farmers for

whom well-informed decision making would mean better and more efficient management of the scarce resources like water and seed stocks, has been underlined only in the recent years. At the end of the day, dry land agriculture is still the most sustainable of all our agriculture systems. Scarce natural resources led our farmers to make farming part of a life style, in spite of all odds; the least technological advances can do is to support them with accurate and real time weather information and advisories to enable necessary mid course corrective measures for effective agricultural planning.

*When it rains on your parade, look up rather than down.
Without the rain, there would be no rainbow.*

– Jerry Chin



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