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ACKNOWLEDGEMENT

The increasing vulnerability of people in terms of food and livelihood security, especially in ecologically degraded areas, has been a major concern for development organizations. It has also been widely recognized that solutions based on local resources and situations are sustainable and cost effective.

Bundelkhand region has been one of the areas having lowest development indices. The area is also prone to ecological stresses thereby contributing to the vulnerability of the people.

Considering local agro-climatic situations and availability of un-utilized rice fallows, improved varieties of Chickpea has been introduced in the area on a pilot basis. Scientists, NGOs and communities have joined hands in experimenting and exploring means of reducing vulnerability of people through improved chickpea varieties. The present study is an effort to compile major processes and outcomes of the initiative.

The study team enjoyed the work and wishes to thank Catholic Relief Services (CRS) for having provided us the learning opportunity. We are also thankful to Sarvodaya Sewa Ashram, the Counterpart, and the operating partners of CRS.

We express our sincere gratitude to the farmers – men and women– of Bundelkhand for sparing their precious time and providing information to the study team.

We are also thankful, in particular, to Shri. Abhimanyu Singh, Mr. Surendra Kumar Yadav and Mr. Srivastava, who devoted their valuable time and had been a leading force in the successful completion of the study process.

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INTRODUCTION

The *'Rainfed Rabi Cropping with Chickpea in Rice Fallows'* project (for the sake of convenience, the term hereinafter shall be referred to as 'Chickpea Project') for promoting Chickpea crop in semi-arid zones of Madhya Pradesh and Uttar Pradesh (Bundelkhand region) is a part of an international programme supported by Department for International Development (DFID) of the British Government. The objective of the project is to promote diversification in cropping patterns in rainfed rabi cropping in rice fallows areas of South Asia. The project is being implemented in India, Nepal, USA and the UK and has extensively involved a number of international institutions, government departments, research institutes and grass root level implementing organizations at different levels. While in Bundelkhand, the Ministry of Agriculture, ICRISAT and Catholic Relief Services (CRS) have been involved, in Nepal, NGLRP, CIMMYT and AVRDC became the main partners of the project. In USA, the Cornell University and UK based Centre for Arid Zone Studies as well as DFID-Plant Science Research Programme (PSRP) are linked with the project.

Geographical locations of the project in India and Nepal

Country	States/Districts
India	Orissa, West Bengal, Chattisgarh, Jharkhand and Madhya Pradesh, Uttar Pradesh
Nepal	Jhapa, Morang, Saptari, Siraha and Kapilbastu districts

In India, CRS took this opportunity to conceptualize a project with the objectives of addressing livelihood issues in semi arid zone of Bundelkhand region where some of its network partner organizations have already been working with poor and marginalized farming communities through watershed and other activities. The harshness and obscurities of Bundelkhand region has made the life of people difficult. The low rainfall and acute water scarcity has resulted the region suffer more climatic variability, food insecurity and poor developmental infrastructure. It was poverty, lack of livelihood opportunities, minimal income diversification, and male out migration and geographical & topographical obscurities of the region that prompted CRS to develop

strategies for the development of the area on a priority. Following a number of planning meetings, visits in the fields and consultations with local communities and organizations, the project modalities were evolved which aimed to reduce the poverty of the region through crop intensification and diversification.

For the purposes of field level implementation, CRS involved Sarvodaya Sewa Ashram, one of its partner organizations from Bundelkhand region as the main coordinating and support organization. Two more grass root level organizations Vikas Chetna and Rameshwari Manav Kalyan Samiti were involved through the coordinating NGO as the field level operating partners.

PROCESS DOCUMENTATION - STUDY METHODOLOGY

The present report is focused on the activities conducted in partnership mainly between CRS/ ICRISAT, Sarvodaya Sewa Ashram and two other operating CRS partners, namely, Vikas Chetna and Rameshwari Manav Kalyan Samiti. During the process of this study, the field visits in the project areas of the above mentioned operating partners were conducted, necessary interactive sessions were organized and documents and records were consulted for preparing this report.

The process documentation of chickpea program was carried out for the two districts, namely, Satna in Madhya Pradesh and Chitrakoot in Uttar Pradesh. In order to have an overview of the project, a meeting with the main coordinating organization Sarvodaya Sewa Ashram (SSA) was organized at their office. The project staff made a brief presentation, which was followed by detailed discussions. Methodologies and logistics for the study were also discussed in the meeting and the field visits were planned accordingly.

A total number of 4 villages, namely, Kilhaura, Mudkhoha and Patna Kala of Majhgawan block and Sundarnagar of block Mau were selected for purposes of field study. These represent two development blocks in the two districts – Chitrakoot and Satna of two states UP and MP. Besides conducting personal interviews, gathering views and information from farmers meetings; data and information collection from secondary sources were also undertaken. This included review of documents and records maintained at project offices and at the village level. Relevant information has also been retrieved from websites and online databases.

A brief account of the field visits, meetings with farmers, SHGs and other community members are given in the following table:

Date	Activity
7-8th April 2005	• Study of project documents and other relevant information provided by CRS
9th April 2005	• Arrival in Chitrakoot- discussion held with project persons of Sarvodaya Sewa Ashram (SSA) at Chitrakoot, brief presentation of the project activities and project areas.

10th April 2005	• Field visit to village Kilhaura, block Majhgawan, district Satna. Meeting with Chickpea farmers, personal interviews with farmers, visit to Seed Banks and meeting with SHGs and other community members.
	• Field visit to village Mudkhoha, block Majhgawan, district Satna, meeting with Chickpea farmers, visits to Seed Banks, NPV Labs, meeting with SHGs and Panchayat members.
	• Visit to KVK Majhgawan, discussion held with KVK scientists regarding trainings, convergence and mutual cooperation.
11th April 2005	• Field visit to village Patna Kala, block Majhgawan, district Satna, meeting with Chickpea farmers, personal interviews with farmers.
12th April 2005	• Field visit to village Sundarnagar, block Mau, district Chitrakoot, meeting with Chickpea farmers, personal interviews with farmers.
13th April 2005	• Meeting and discussions with the persons involved in the project.
14-18th April 2005	• Compilation of data and observations.

Scope of Study

The study is mainly to process document the chickpea project so that the learning is disseminated amongst NGOs and farmers. Hence, the study should not be considered as a scientific analysis based on technical inputs. It is mainly for understanding the process and outcomes of the project for wider learning.

GEO-CLIMATIC SITUATIONS OF BUNDELKHAND

With a significantly large area as dry land, Bundelkhand region stretches over twelve districts of northern Madhya Pradesh (MP) and five districts of southern Uttar Pradesh (UP), thus occupying almost 70,000 square kilometers of the central plains in India. Bounded to the north by the Yamuna River and to the south by the hills of the Vindhya Plateau, the region presents a unique set of geologic and geographic characteristics, which have had profound effects on human development in the region as well as on the country as a whole.

Geology and Topography

With extremely low water table, the entire Bundelkhand falls under the semi arid region. Granites, sandstone and limestone are the predominant geological material found across in the region. Alluvial deposits of clay, silt and sand of subaerial and fluviatile origin are the most recent geologic deposits in the Bundelkhand and are more predominant near the Yamuna River and its tributaries. The resulting terrain is gently undulating; grading slowly into a level plain in the northern side of the region. Spectacular ravine lands in the north and deep gorges in the south result from the active erosion of the unconsolidated alluvial material deposited by the main streams in the region, namely the Betwa, Dhasan and the Ken. These ravines and gorges are uncultivable and pose an increasing threat to nearby farmland as they continue to expand.

Climate

Located between the generally hot and humid climate of the eastern coast (Bay of Bengal) and the dry continental climate of the west (Rajasthan), the Bundelkhand generally experiences a semi-arid climate, though this is highly variable depending on the region and the time of year. Indeed, the area is notorious for experiencing droughts in summer and disastrous floods during the monsoon. Like other parts of India, the Bundelkhand also sees two main seasons: monsoon and dry. The monsoon brings over 90% of the annual rainfall between the months of June to September, with the highest precipitation occurring in July and August. On average, the region receives anywhere from 75 cm to 125 cm of rain each year. The dry plains in the north usually receive less while the southeast benefits from more water.

Drainage

The Bundelkhand is drained by the Yamuna River system, itself one of the principal tributaries of the Ganges. Due to this, drainage occurs principally from north to south, with some local variation depending on topography. The main tributaries of the Yamuna are the *Betwa, Ken, Baghain, Pahuj* and *Dhasan* Rivers, most of which are important sources of irrigation water. However, even more important than these for checkdams are the numerous small streams and *nallahs* that feed the larger rivers. The monsoon brings heavy flooding and the highest flows in all the rivers and tributaries. During the dry season, *nallahs* often become dry and the flow in the major rivers dwindles. As a consequence, irrigation becomes difficult and greater stress is placed on groundwater resources.

Vegetation and Soils

The natural vegetation in the Bundelkhand reflects the semi-arid climate. The region was previously forested, but intensive deforestation and logging over the past several decades has left the countryside denuded of

its forestland. Grasses, predominant in the rocky plains and hills, and shrub and bush species are also common where more water is available for their growth. These grasses and shrub species are important as fodder for cattle and have economic value.

Red and Black soils are the two main soils found in the Bundelkhand. Red soils are more predominant in the northwestern region and are usually gravely and shallow with poor moisture retention. The black soils, which are found mostly in the south, are more water retentive and are therefore preferred for wheat, gram and sugarcane cultivation. Besides, riverine soils, though covering a small area of the region, are also found; these soils are generally not used for agriculture and are therefore not considered as an important soil type in the region.

Problems and Concerns

Environmental Concerns

Bundelkhand is seen as a region suffering from acute ecological degradation. Logging and mining activities over the past several centuries have destroyed the landscape and caused the erosion of the fragile soils. Additional population and livestock pressures, which are already high, have only served to aggravate the problem. Expanding ravine lands, especially in the northern area, are already threatening local farmland and can have serious consequences on the socio-economic situation.

Access to abundant water resources has always been one of the major environmental concerns in the region. Irregular rainfall has led to the increasing dependence on groundwater resources resulting lowering of the groundwater table in places where withdrawals have exceeded recharge. The decline in groundwater levels, erosion from marginal lands and agricultural fields has undermined the development of this area. The growing use of pesticides and chemical fertilizers, which until now has remained quite low, is also affecting water quality.

Isolated due to the natural geography and harshness of the climate, the people of the Bundelkhand have remained both politically and economically separated from the rest of India. As such the area has one of the lowest levels of economic and human development in the country. Indeed, the remoteness of the region has prevented the development of basic infrastructure such as roads, electricity, water and sanitation services, and telephone lines. The lack of these services has only perpetuated the poverty cycle in the region.

Population

According to current estimates, the human population of the Bundelkhand region is approximately 21 million. The present population is four times greater than in 1961, which indicates that the population growth rate has remained high since the green revolution improved cropping practices and ensured greater food security. Population distribution has remained fairly even despite the increase in total population size in the latter half of the past century.

Bundelkhand is an agriculture-intensive region and therefore the majority of the population is rural and dispersed over the area. Nonetheless, increasing population pressures will force a greater number to settle marginal lands, which have previously remained abandoned. In addition, more and more rural inhabitants are leaving their villages and migrating to the larger urban centers such as Jhansi in southern UP. Recent rural migration data indicates a rate as high as 39% per year, which is over three and a half times the national average of 11%.

Human Development Index

Human development indicators such as per capita income and literacy levels show that the Bundelkhand is among the least developed regions in the country. Per capita income hovers around Rs. 8,114 versus the national average of Rs. 13,193 in 1997-98. Crippling poverty has therefore prevented many from improving their situation. Although the entire population suffers from poor development, women and the Scheduled Castes and Tribes (SC/ST) have been more vulnerable as compared to the high caste communities.

In general, few facilities are available to the population. Health care is virtually non-existent and many die from preventable diseases every year.

Water-related illnesses such as chronic diarrhoea and malaria are particularly prevalent and affect a large percentage of the population. Infant and maternal mortality is high and the use of family planning measures still has not been widely adopted in the remote areas.

Education opportunities are few and most of the children only complete the primary level. Those willing to pursue higher education have to cover a considerable distance for availing this privilege/facility. Adult literacy therefore remains low: just 51% of rural men and 20% of rural women in the region are able to read and write. The majority, work as farmers or agricultural laborers and supplement their income occasionally as day laborers in small cottage industries during the non-planting season. Male rural out-migration is quite common but nonetheless disruptive to the family social unit**.**

Problems vis-a-vis Potentials

Some of the distinguishing features, which makes it distinct from other parts of the country and due to which Bundelkhand region has been chosen for the 'Rainfed Rabi Cropping with Chickpea in Rice Fallows' project have been given in the following bullets:

- Large dry land area (semi arid zone)- low water table, terminal drought.

- Large area as rice fallows- in Madhya Pradesh alone, the estimated rice fallows areas during the year 1999-2000 was 4.4 million ha which is 78% of kharif rice area in MP.

- Agriculture based livelihood, limited scope for income diversification.

- Low human development index, majority of people Schedule Casts and Schedule Tribes, traditionally involved in local chickpea farming for food security.

- Abject poverty, insecure livelihood – while per capita income in Bundelkhand region had been merely around Rs. 8,114; the national average was Rs. 13,193 in 1997-98.

- Potential for diversification and second cropping through legumes- the yield of pulse crop increased from 510 kg/ha in 1970-72 to 705 kg/ha in during 1996-98

To sum up, the region has been categorized, as one of the least developed areas in terms of social and economic development indicator, while on the other hand, it has been found to be having tremendous scope and potential for promoting agriculture activities through crop diversification and intensification.

AGRICULTURE BASED LIVELIHOOD OF BUNDELKHAND REGION

Agriculture plays an important role in the Bundelkhand economy. However, even this sector has not been capitalized/utilized to its full potential due to several factors. Poor soil and uncertain rainfall have made agriculture difficult in many areas. Crop productivity is among the lowest in the country, and even the value of agricultural production per hectare in the region is 1.4 times less than for Central India. Frequent droughts and floods have destroyed crops and undermined social security as well. Very few farmers have the privilege to irrigate their lands. This cycle has been further perpetuated by poverty that has prevented many farmers from switching to more efficient farming methods. As such, most of the agriculture is subsistence and contributes little to the overall economy in the region.

Nonetheless, the principle crops in the Bundelkhand are cereals such as wheat, rice, and barley. Cereals occupy the majority of the cropped area and are sown primarily during the *rabi* (winter/dry) season. In addition, pulses, grams and oil seeds are also important crops. Fruits, vegetables, and fibers are only secondary in importance and are localized to specific geographic areas. Mixed cropping is still practiced by some farmers as a precautionary measure against crop failure but very few farmers have adopted this practice. This practice is mainly found in the areas that have access to irrigation facilities.

However, in spite of agriculture being the major livelihood option, the people of this area have not been able to use this opportunity due to several topographical and other social factors. The old landmass composed of horizontal rock beds; rugged landscape featuring undulating terrain proves to be a difficult topography for agriculture. The region was densely forested until the late 18^{th} century. After the turn of the century, rising demands for wood and agricultural expansion led to increased level of deforestation. The prevailing soil types consists of a mix of black and red, the latter being relatively recently formed, gravely and shallow in depth, and thus is unable to retain moisture well.

Water Scarcity in the Region

The rainfall distribution pattern is irregular, with approximately 90% of all rainfall in the region caused by the monsoon, falling from June to October. Average rainfall per year is 800-900 mm in the months of July and August, while November to April are the driest months of the year. The nature of rainfall- short spells of heavy rain during two to three months of the monsoon- has strongly influenced agricultural practices in the region, especially water management for irrigation. Brief but intense spells of rain result in high levels of runoff and soil erosion, less percolation of water into the soil, and occasionally flash floods. In response to this climatic pattern, people have developed a tradition of using water-harvesting structures to store rainwater for the non-monsoon months, mostly in thousands of small reservoirs; and to regenerate groundwater resources. Irrespective of their primary purpose, all the traditional water storage methods indirectly improve soil moisture and induce percolation of water to aquifers. On the other hand, the scant winter rainfall is useful for the cultivation of 'rabi' crops, but it is usually inadequate without access to supplementary irrigation sources.

Throughout most of the year the residents of Bundelkhand experience acute scarcity of water for agricultural and domestic use. Water sources are varied and often seasonal, ranging from ponds, tanks, lakes and streams to open wells, bore wells and irrigation canals radiating out from large-scale dams. Mostly, agriculture is single-crop rain fed with supplementary water from private open irrigation wells. Thus, large numbers of farmers are highly dependent on the monsoon rains for recharge of these wells.

Rice Fallows

There are nearly 40 million ha under rice production in India, by far the largest rice-growing area in South Asia. Much of this area remains fallow during the rabi season after the harvest of kharif rice. The figure for the total rice-fallows for India is estimated at 11.7 million ha, and the state-wise distribution of these rice-fallows is presented in the table below. Among states of India, Bihar, West Bengal, Orissa, Madhya Pradesh, Maharashtra, and Assam contribute a major portion of rice-fallows in India. In Madhya Pradesh, nearly 80% of the kharif rice area remains fallow during the rabi season and this amounts to nearly 4.4 million ha, accounting for nearly a third of total rice-fallows in India. Most of these rice fallows are in the Bundelkhand region of Uttar Pradesh and Madhya Pradesh due to lesser rainfall and acute water scarcity as explained earlier.

SEARCH FOR A VIABLE ALTERNATIVE

The vast area under rice fallows was often considered as a wasteland until the next cropping season approached. The agricultural field remained uncultivated in this interim period between rabi and kharif and that used to be a big loss for the farmers. Moreover, the quality of the soil also deteriorated as the land used to remain barren for a long period of time. Besides, the food insecurity during these periods was a major problem for the farmers.

To overcome the above-mentioned problems, there was a search for an alternative short-term crop, which could utilize the rice fallow areas, stand in the low water availability conditions and also ensure food and nutritional security of the poor farmers.

Several researches revealed that rice-fallows offer some of the most productive lands for legume production and if suitably integrated into rice-production systems, this can revolutionize pulses production, resulting in increased per-capita availability of pulses in India. Thus introducing legumes into rice-wheat production systems and rice-fallow production systems may contribute to sustainability of these cereal-based cropping systems. (Kumar Rao *et al*. 1998)[*].

Preliminary trials showed that rice-fallows could support high yields of legumes during the rabi season. Introduction of short-duration legumes in rice-fallows, wherever feasible (during the rabi season) has a potential of enhancing legume production without disrupting regular cereal production.

For example, legume cultivation involving chickpea and lentil in rice-fallows of Madhya Pradesh have indicated that grain yields up to 2.5 t ha^{-1} can be achieved (Johansen *et al*.).[**] This showed the enormous potential niche these rice-fallows can offer for the production of legumes. Also, utilization of rice-fallows for legumes production can have enormous employment generation potential in the country, amounting to 503 million person-days, and thus having a dramatic effect on the economy and also contributing substantially to poverty alleviation.

[*] 'Promotion of Rainfed Rabi Cropping in Rice Fallows of Eastern India & Nepal –An Overview', ppt. by JVDK Kumar Rao, ICRISAT & D Harris

[**] Quoted in an unpublished document by ICRISAT by Johansen

CHICKPEA: A VIABLE OPTION

ICRISAT (**International Crops Research Institute for the Semi-Arid Tropics),** a premier research agency based in Patancheru working on the issues of semi arid farming across the globe had, through several years of research, developed two short duration (ICCV2 and KAK 2) and one long duration (ICCC 37) **CHICK PEA varieties** that were suited to grow in moisture stress situations. The above agencies got together to come up with simple technologies to propagate crop cover in Rabi fallows using pea. The biggest challenge was to link the benefits of scientific research with the resource poor farmers and create pathways to ensure that the farmers accept-simple basket of technologies to cultivate chickpea in their Rabi fallows and in turn build on their income.

The short term variety of chickpea was introduced in the project area with the idea that the introduction of chickpea would provide a crop cover for the rice fallows. Moreover, in the situation where farmers were familiar to sowing traditional chickpeas, introduction of a new and improved variety was thought to be a good strategy of improving their livelihood conditions.

Chickpea is grown in tropical, sub-tropical and temperate regions. It is one of the major grain legumes widely grown in India, and is suitable for rice-fallows of Uttar Pradesh and Madhya Pradesh. Chickpea is valued for its nutritive seeds with high protein content, 25.3-28.9 %, after de-hulling. Chickpea seeds are eaten fresh as green vegetables, parched, fried, roasted, and boiled; as snack food, sweet and condiments; seeds are ground and the flour can be used as soup, dhal, and to make bread; prepared with pepper, salt and lemon it is served as a side dish. Dhal is the split chickpea without its seed coat, dried and cooked into a thick soup or ground into flour for snacks and sweetmeats. Sprouted seeds are eaten as a vegetable or added to salads. Young plants and green pods are eaten like any other green leafy vegetable.

Scientific Classification

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Fabales

Family: Leguminosae or Fabaceae

Genus: *Cicer*

Species: *arietinum*

Binomial Name: *Cicer arietinum*

Ecology

Chickpea is a self-pollinated crop. Cross-pollination is rare; only 0-1 % is reported. It is grown usually as a rain fed cool-weather crop or as a dry climate crop in semi-arid regions. The optimum conditions include 18-26ºC day and 21-29ºC night temperatures and annual rainfall of 600-1000 mm. It is generally grown on heavy black or red soils having pH 5.5-8.6. Frost, hailstones, and excessive rains damage the crop. Relative humidity of 21-41% is optimum for seed setting. Although known as "day-neutral," chickpea is a quantitative long-day plant, but flowers in every photoperiod.

Varieties of Chickpea

Two types of chickpea are grown: *desi*, which is thought to have originated first and produces small, coloured (mostly brown) seeds and *kabuli* which produces a larger, cream-coloured seed. Countries with high chickpea yields are producers of *kabuli*. However, it is often more prone to climatic and disease stresses. India has remained the largest producer of chickpea

over the last thirty years despite a decline in its production due to competition from wheat and oil-seed crops, which are grown in the winter months. In contrast, production has significantly increased in Australia, Mexico and Turkey who have become major exporters of chickpea.

- **Chickpea *kabuli* variety ICCV 2**

Chickpea *kabuli* Variety ICCV 2 is the first extra-short-duration *kabuli* line with *Fusarium* wilt resistance, suitable for peninsular Indian environments, where *kabulis* could not be grown earlier. At ICRISAT Asia Center under rainfed conditions, it matures in 85-92 days and it has been possible to grow two crops in the same field between October and March.

- **Chickpea *desi* variety ICCC 37**

ICCC 37 has given consistently high yield over the locally adapted cultivars at research stations and in farmers' fields in Andhra Pradesh. Due to its good yield and stability of performance, it was released in September 1989 for general cultivation by the government of Andhra Pradesh.

Chemistry of Chickpea

Chickpeas are very rich in its nutritive value. Chickpea seed has 38-59% carbohydrate, 3% fiber, 4.8-5.5% oil, 3% ash, 0.2% calcium, and 0.3% phosphorus. Digestibility of protein varies from 76-78% and its carbohydrate from 57-60%.

Traditional Medicinal Uses

Apart from the rich nutritional value, chickpeas also have some useful medicinal uses. Among the food legumes, chickpea is the most hypocholesteremic agent. Medicinal applications include use for aphrodisiac, bronchitis, catarrh, cutamenia, cholera, constipation, diarrhea, dyspepsia, flatulence, snakebite, sunstroke, and warts. Acids are supposed to lower the blood cholesterol levels. Seeds are considered ant bilious.

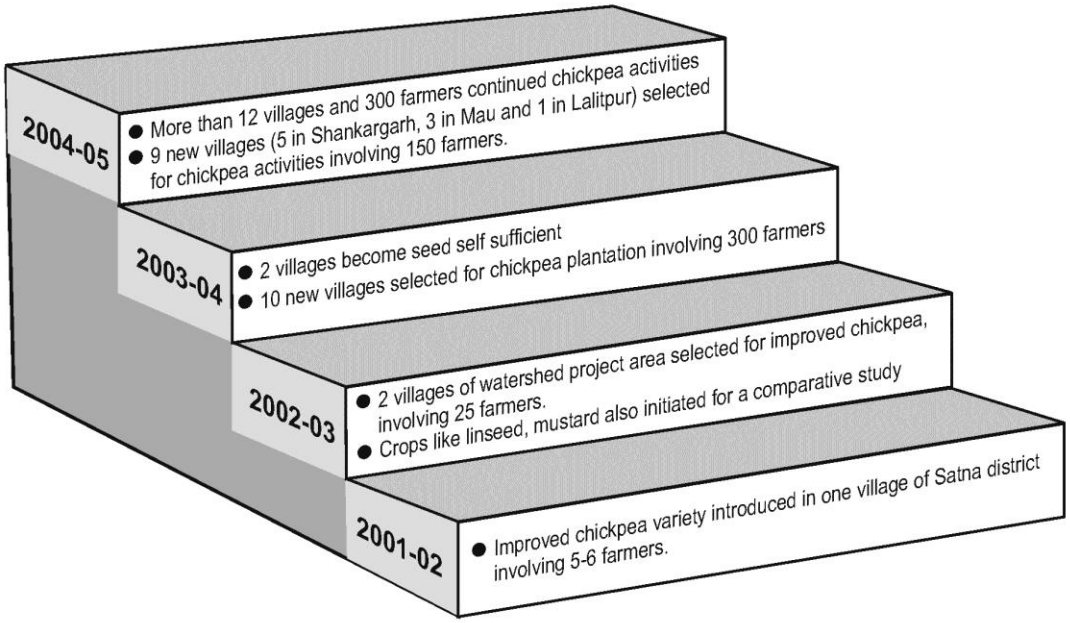
THE PROJECT OVERVIEW

Objective Of The Project

The major objective and the focus of the project was

"To improve livelihoods and reduce poverty of small and marginal farmers of Bundelkhand region through introduction of improved varieties of Chickpea as a viable alternative".

Project Timeline

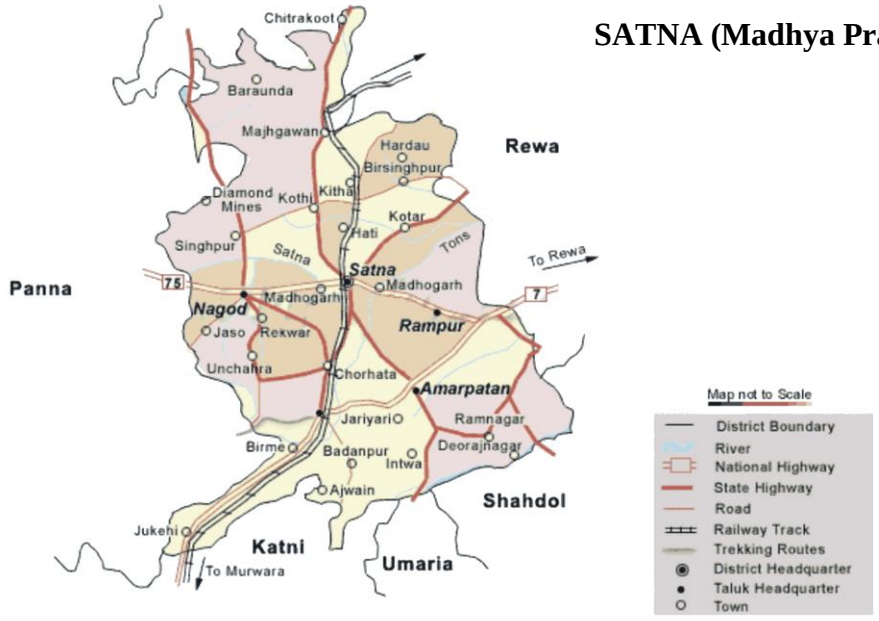


Geographic Focus Of The Project Areas

- **Satna**

  The District of Satna lies on the Vindhyan plateau and is situated between latitudes 23" 58' and 25"12' north and longitude 80"21' and 81"23' east in mid northern part of Madhya Pradesh state of India. In the north of the area is Banda district of Uttar Pradesh whereas in the west, lies the Jabalpur district of M.P.

SATNA (Madhya Pradesh)

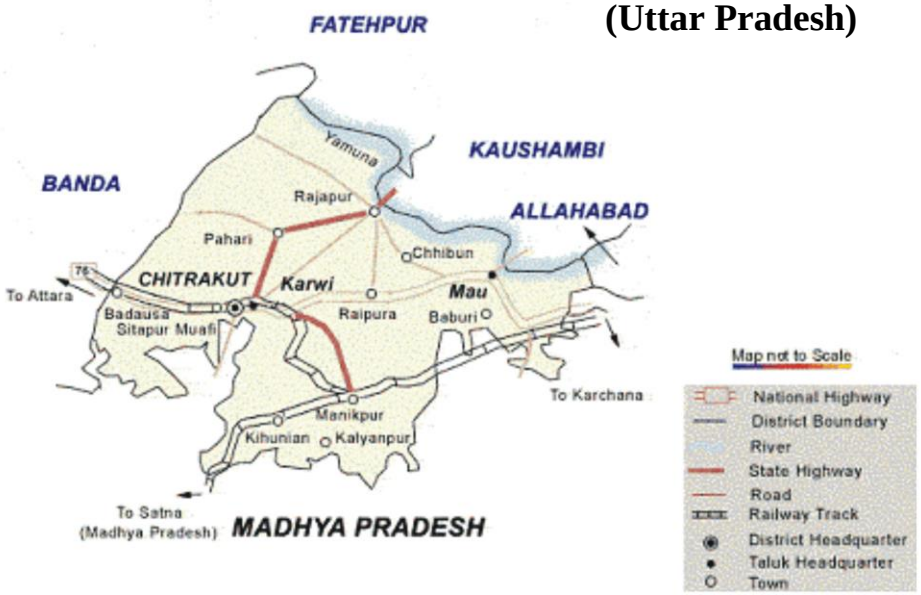


Like any other part of the State, Satna district receives its rainfall from the precipitation of the Arabian Sea monsoon. June to September are the months when most of the rainfall is received. The downpour, as well as the number of rainy days is maximum in the months of July and August.

- **Chitrakoot**

Chitrakoot, 'the hill of many wonders', nestles peacefully in the northern spurs of the Vindhyas, a place of tranquil forest glades and quiet rivers, and streams where calm and repose are all pervading. Chitrakoot is situated in the district Banda, on the banks of river Paisuni (Mandakini), lying in the latitude 25 10' N and longitude 80'53' E.

CHITRAKOOT
(Uttar Pradesh)



While the project geographically covers two states, 4 districts and 4 development blocks and details 20 villages, only 14 villages of 3 blocks were selected for conducting the study. The total number of the farmers involved is also given in the following table:

Project Coverage Areas and Farmers Involved: At A Glance

Region	Operating Partners	State	District	Block	Village	No. of Farmers
BUNDELKHNAD	**Vikas Chetna**	Madhya Pradesh	Satna	Majhgawan	Mudkhoha	30
					Kilhaura	32
					Baraha	30
					Bhathiya	30
					Rampur Garri	30
					Kishunpur	30
					Number of farmers	**182**
	Rameshwari Manav Kalyan Samiti	Madhya Pradesh	Satna	Majhgawan	Devlaha	30
					Umariha	30
					Rahuniya	30
					Patna	40
					Patni	35
					Kanpur	30
					Number of farmers	**195**
	Sarvodaya Sewa Ashram	Uttar Pradesh	Chitrakoot	Mau	Sundar Nagar	22
					Bashiniya	13
					Number of farmers	**35**
	Society for Watershed and Rural Development (SWARD)	Uttar Pradesh	Allahabad	Shankargarh	Sonpura	23
					Mawaiya Pahalwan	8
					Devri Beni	6
					Kariyakhurd	8
					Tikrohin Kala	5
					Number of farmers	**50**
	HBM Hospital	Uttar Pradesh	Lalitpur	Lalitpur	Harshpur	22
					Total Farmers	**484**

Project Process

Keeping in view the problems and the geo-climatic situation of the Bundelkhnad region, the Chickpea Program, supported by CRS and ICRISAT, was initiated in the village of Patna Kala by Sarvodaya Sewa Ashram (SSA). Training and demonstration were carried out in the planned manner. The main thrust of the project initiated in joint collaboration of CRS, ICRISAT and SSA was to enhance agriculture in non-irrigated areas.

Baseline Survey

For the purpose of collecting relevant information about all the revenue villages, the project functionaries contacted Patwari, Sarpanch and Secretary of the village Panchayat and collected the baseline data and information regarding land, number of families, population, community caste composition and other demographic details.

Selection of Villages and Farmers:

Workers from the organisation personally contacted the village Sarpanch and conducted collective meetings and group discussions with the farmers and made them aware of the details of the project and the program. The village meetings were organized for sharing of proposed chickpea programme and identification of farmer volunteers to take up the pilot implementation.

The criteria for the selection of villages and farmers for the project intervention were as below:

- Villages covered under the Watershed Management Project
- Farmers having agriculture as the basic source of livelihood
- Farmers whose fields usually remained uncultivated and unused after paddy cultivation.
- 30 farmers were to be selected from each village, out of which 80% had to be from Scheduled Caste and Scheduled Tribe and the rest 20% from general category. Emphasis was laid on the involvement of more farmers of SC and ST category in order to improve their livelihood conditions.
- The size of the land holding of farmers had to be within 5 hectares.
- The trial was to be done on 0.2 hectares of land of each farmer

In the year 2001, the organization, Rameshwari Manav Kalyan Samiti (RMKS), conducted the survey in the Patna Kala village of Majhgawan block. This village is situated at a distance of 12 km from Majhgawan on the Paharikhera - Panna Road and is 60 km away from the District headquarter. The entire area remains non-irrigated after the rainy season.

In the year 2002-03, Chickpea sowing program was initiated in the revenue village Kilhaura of block Majhagawan under Rainfed rabi farming program. In view of the success of this program, people's representatives

and farmers of nearby villages contacted workers of the organization and raised their demands to conduct similar program in their respective areas.

Considering their interests, the organisation selected 10 more villages for Rainfed Rabi farming program for the year 2003-04. The selected villages were Devlaha, Umariha, Rahuniya, Patni, Kanpur, Mudkhoha, Baraha, Bhathiya, Rampur Garri and Kishunpur. In each of these 10 villages, 30 farmers were selected and a total of 60 hectares of land was identified to be sown with chickpea.

Availability of Seeds and its Distribution

The Chickpea seeds were provided by ICRISAT, an agency supporting rain fed rabi farming in India and conducting related researches. The ICRISAT standard of variety and quantity of seeds use were as below:

Seeds	Quantity (per hectare)
Local	60 kg
KAK-2	100 kg
ICCV-2	80 kg

Once the seeds were received by the Operating Organisations, they were transported to selected villages and the information regarding seed distribution was disseminated to the farmers. A seed distribution plan was made according to which, 10 kg of local variety, 8kg of ICCV-2 and 10 kg of KAK-2 were distributed to each of the selected farmer.

Seed Treatment

The seeds were treated with agents such as Rhizobium and Molybdenum that were provided to the farmers by ICRISAT. The farmers were given trainings regarding the proper use of these agents in seed treatment. The following set of treatments were given to seeds before sowing:

- Priming
- Priming + Rhizobium
- Priming + MO (Molybdenum)
- Priming + Rhizobium + MO
- Priming + Rhizobium + MO + Soil

Farmers also adopted prevailing seed treatment practices, which are:

- Trichoderma seed treatment
- Rhizobium Seed treatment (1 kg. of seed + 4-5 gms. Rhizobium culture)
- Cow urine + jaggery + water
- Kapton seed treatment (4gm/kg)
- Molybdenum seed treatment (5 gm/kg)

Field Preparation and Sowing

Chickpeas are propagated through seeds. After the harvest of the paddy crop, 0.2 hectares of land was selected in the field of selected farmers. This particular piece of land was thoroughly ploughed 2-3 times using bullocks and it was ensured that the soil was adequately softened. The soil clods were broken and field was leveled. Chickpea seeds were sown by bullock plough in the month of early November. Two types of sowing were done – **Line Sowing and Bulk Sowing**. Seed was broadcasted or drilled in rows 25-60 cm apart, spaced at 10 cm between seeds, at a depth of 2-12 cm with soil well pressed down.

Harvesting

After 6-7 days of sowing of seeds, germination in the field of each farmer was observed. Some farmers also faced the problems of attack of the crop by wild boars and pigs. Chickpeas matured in about 90 days and the leaves turned brown/yellow during maturity. For dry seeds, the plants were harvested at maturity or before by cutting them close to the ground or uprooting. The plants were stacked in the field for few days to dry and later the crop was threshed by trampling or beating with wooden flails. The chaff was separated from the grain by winnowing.

Storage

Chickpeas are usually stored in bags or direct on ground in bulk. Proper cleaning, drying, and aeration are necessary to control seed beetles. A thin

coating with vegetable oil also helped reducing storage damage. Sometimes baskets, made from twisted rice straw, were also used as storage containers. It was observed that seeds stored in bags were lesser affected by pests.

Data Collection

Crop growth and productivity data was collected from farmer's field in an area of 4 X 1 sqm. The data on number of plants, growth patterns, diseases, etc. were regularly collected on the basis of formats provided by ICRISAT. The data analysis was done by ICRISAT but not shared with the farmers or NGOs.

Monitoring of the Process

Besides the regular participatory monitoring and data collection done by the farmers and involved project functionaries, a team consisting of CRS and SSA representatives also regularly visited the project areas and monitored the progress. The team provided necessary information and technical inputs as and when required.

OBSERVATIONS

The chickpea programme was launched with the idea that it was a viable option that could stand in the rice fallow areas and farmers could harvest an extra crop in the year that would make them economically strengthened. Moreover, chickpea was also a short duration crop, i.e. 90 days crop and the farmers could harvest it before the arrival of the next cropping season. Also, taking into account its nutritive and commercial value, it was thought to be a sustainable source of livelihood for the resource poor farmers.

Some of the major observations of the chickpea project are being mentioned in the following heads:

Economic Viability

In areas like Bundelkhand where majority of population is dependent on agriculture based economy and the agriculture production is one of the lowest in the country (per hectare production 1.4 times low compared to other central Indian areas) there is an urgent need to enhance the production as well as value of production. Considering the geo-climatic and agriculture production situation of the region there are a few options available, viz.

- Time management of the cropping cycle- utilizing the fallows for effective production
- Crop intensification – enhancing per unit production
- Lowering the costs of input – nutrient management
- Value addition – introducing varieties which can fetch better value

It was observed during the study that improved chickpea varieties have the scope of addressing all of such measures - though in some cases partially.

Chickpea has proved as a highly effective crop, which can be grown in the rice fallows. It needs lesser water, can survive extreme weather conditions and matures within a short time span. Considering the vast areas of rice fallows, which are not cultivated or under cultivated, in Bundelkhand, the land remains un or under-utilized for a significant time period in the cropping cycle adopted in the area. Chickpea has the

potential of this time management measure by which the fallows can be adequately utilized for economic purposes.

Chickpea has a potential of higher productivity compared to other contemporary crops like wheat. It was observed during the study that farmers preferred chickpea in comparison to wheat because of better net profits.

Table: Input-Output comparison between chick pea and other crops

Area = 1 acre

S.No	Agricultural Activities	Chick pea variety ICCV2	Other Crop (Wheat)
1	Preparation of land ploughing)	Rs. 600/-	Rs. 800/-
2	Sowing	40 kg seeds, Rs. 1000/-	45 kg seeds, Rs. 500/-
3	Weeding/Hoeing	Nil	Nil
4	Irrigation	1 time, 6 hours, Rs. 540/-	2 tuns, 12 hours, Rs. 1080/-
5	Manure/Fertilizers	20 kg, Rs. 110/-	50 kg, Rs. 275/-
6	Plant Protection	Nil	Nil
7	Harvesting	4 labours, Rs. 160/-	5 labours, Rs. 200/-
8	Threshing	Rs. 80/-	Rs. 500/-
9	Production	5-6 quintals, Rs. 5,500-6,500/-	8 quintals, Rs. 4,800 Rs. 5,000/-
10	Storage	Rs. 40-50/-	Rs. 50-60/-
		Total input = Rs. 2540/- Total Production= Rs. 6,500/- Net Profit = Rs. 3,960/-	Total input = Rs. 3,415/- Total Prodn.= Rs. 5,000/- Net Profit = Rs. 1,585/-

(As told by the farmers – Ram Prasad and Babu Yadav of village Kilhaura)

The above table shows a comparison of input and output costs of chickpea and wheat - the other major crop grown in the area during rabi season. It is clear that because of lesser inputs and higher market value, chickpea has a potential of higher economic preference.

Chickpea, being a legume crop, improves the soil fertility and nutritive conditions of soil. It has, therefore, potential of soil nutrition enhancement, thereby reducing the fertilizer demands from outside the farm system. On the one hand, this reduces the application of chemical fertilizers and at the same time significantly reduces the input costs for other crops grown in the same field.

It is well evident that the improved varieties of chickpea, introduced in the project, have a higher market value. Where as local varieties are sold

at a price of Rs.9-10 per kg, the introduced varieties fetch up to Rs.13-14 per kg. (Both are farm gate prices). Further, the improved varieties can even pay better if market linkages are ensured in an effective and ongoing manner.

Chickpea, therefore, has a potential of improving agricultural economy of Bundelkhand region as well as the farmers of the area.

Varietal Improvement

The introduced variety of chickpea has a higher nutritive, production and market value. In the present study, efforts were made to compare the input-output ratio of local variety with the improved variety ICCV2.

Table : Input-Output comparison between local variety and ICCV2

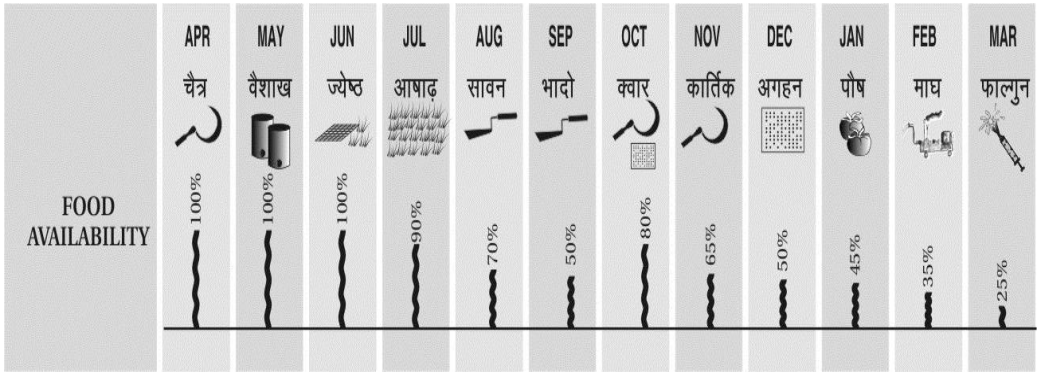
S.No	Activities	Local Variety	ICCV2
1	Preparation of land ploughing)	Rs. 200/-	Rs. 200/-
2	Seed Sowing	Rs. 300/-	Rs. 500/-
3	Irrigation	Nil	Nil
4	Protection	Rs. 90-100/-	Rs. 250-300/-
5	Plant Protection, diseases insects/pests a. Uktha b. Elli c. Termite	 40% loss 20-30% loss 20-30% loss	 70% loss 40-50% loss 50% loss
6	Harvesting	Rs. 120/-	Rs. 120/-
7	Threshing	Rs. 90/-	Rs. 90/-
8	Production	2 quintal @ Rs. 1200 = 2400/-	2.5 to 3.0 quintal Rs. 4,500/-
9.	Market	Nil	Nil
		Total inputs = Rs. 810/- Total prodn = Rs. 2,400/- Net Profit = Rs. 1,590/-	Total input= Rs. 1,210/- Total Prodn= Rs. 4,500/- Net Profit = Rs. 3,290/-

(Exercise conducted in village Kilhaura, block Majhgawan)

It was observed that the input costs of improved variety are higher compared to local variety. However, due to better market prices of improved variety, it fetches higher returns and hence the input-output ratio of improved variety is higher. It was also explained by the farmers, however, that the improved variety is more prone to pest infestation and diseases.

Food Security & Nutrition

Participatory exercises were conducted with the most deprived groups of studied villages for analyzing the livelihood aspects vis-à-vis chickpea crop. The scenario of availability of food during the whole year emerged as follows:



It was observed that the months of January, February and March are the most difficult months so far as the food availability to poor households are concerned. This is because there is a lean season during which agricultural fields are left fallow, due to various reasons explained earlier, and there is no production in agricultural fields. In most of the villages it was explained that the food availability during these difficult months reduces to one meal per day. Chickpea is harvested during February-March and the consumption or sale of produce provides food to communities. In the above situation, chickpea appears to be a viable possibility, which can fill-up the existing gap of food availability during the year.

Further, Bundelkhand region is one of the areas in which people suffer heavy under-nutrition (particularly protein) in almost all the age groups. Various supplementary nutrition programmes have been launched from time to time by various agencies to overcome this problem. In this context chickpea – a protein rich food, can substantially contribute to such under-

nutrition situations. It has been proved that chickpea has a high nutritive value.

Table: The Nutritional value of Chick Peas

Qty	Energy (calories)	Carbohydrates (gms)	Protein (gms)	Cholesterol (mg)	Wt. (gms)	Fat (gms)	Saturated Fat (gms)
1 cup	270	45	15	0	163	4	0.4

It is therefore concluded that chickpea has a potential to improve availability of food during the difficult months as well as nutritional status, particularly in poorest groups.

Case Study of a Successful Farmer

Background Information

Name : Mool Chand Sahu
Village : Kilhaura
Landholding : 5 acres, un-rrigated
Livestock : 2 Buffaloes, Cow, 2 Oxen, 5 Goats

There are 10 members in his family and he holds 5 acres of agricultural land and cultivates on it. But in spite of the large landholding, he was unable to cultivate crops that could suffice for his food consumption for the whole year round.

Mool Chand came in contact with Sarvodaya Sewa Ashram in the year 2002. When the chickpea programme was introudced. Mool Chand approached the organization and came to learn the benefits of coming chickpea.

For the first time, he bought, 11 kgs. of seeds of ICCV2 and treated it with Rhizobium culture. Then after, line sowing was done in 1 bigha of land. The local variety of chickpea was also sown in another portion of land. After 4-5 days of sowing, Mool Chand noticed that flowering had begun in ICCV2 whereas the same takes place after 15 days in local variety. He was surprised. Gradually, the crop went on maturing, suffering all the natural calamities. After threshing of chickpea crop, Mool Chand came to know that there was a record production of 2 quintal 73 kg of chickpea. The input cost output cost involved in the whole process was as below:

Input Cost

1. Seeds (11 kg)	:	*Bought on return basis in the ratio of 1:1.25*
2. Irrigation	:	*Not required, as there was rainfall.*
3. Protection from wild animals	:	*Did on his own with the help of family members.*
4. Diseases/Pest Management	:	*Used cow dung manure*
5. Harvesting	:	*On self and by family members*
6. Threshing	:	*By family members*

Total Input Cost :*The quantity that was to be returned in the ratio of 1:1.25 (i.e. 16 kg of chick pea)*

Output Cost

Total Production	:	*2 Q 73 kg.*
		(-) 16 kg (Returned in the ratio of 1:1.25)
		2 Q 57 kg.

Total Production sold @ Rs. 1400/ Quintal

Earnings	:	*Rs. 3,822/-*
Transportation	:	*Rs. 60/-*
Net Profit	**:**	***Rs. 3,762/-***

This profit and subsequent profits in the next years boosted Mool Chand confidence and faith in taking up chick pea as a major crop every year. There is a significant change in the livelihood of his family members. Mool Chand also bought a tractor on his own out of there earnings.

Mool Chand feels that by sowing ICCV2 he gets the following advantages :

- *ICCV2 production is more than the local variety.*
- *The monetary benefits are higher for ICCV2 than local variety.*
- *It tastes better.*
- *Nutritive value is higher them local variety.*
- *Time required is less for ICCV2 cultivation.*
- *Production use of rice fallow areas.*

Mool Chand has become a model for other farmers of the village. Farmers approach him for technical guidance on sowing the ICCV2 variety. His own son got interested in agriculture after seeing the amazing results of ICCV2 and started helping in its cultivation. Recently, based on his interest and capabilities, he was hired by the organization Vikas Chetna where he works as a Village Level Worker (VLW) and earns a decent salary of Rs. 2100/- per month.

This is a very good example of how chick pea indeed changed the lives of farmers. And this is not just one example, rather, there are many other farmers who have improved their livelihoods & benefitted from the chick pea programme.

Capacity Building

As the farmers were unaware of the technical aspects of improved chickpea variety, they were given proper exposure and trainings for their capacity building so that they could adopt better ways and methods of its cultivation and thus increase production. Different trainings given to farmers were based on techniques of sowing, seed treatment with Rhizobium and Molybdenum, preparation of NPV (Nucleus Polyhydrosis Virus), Integrated Pest Management, Management Information System (MIS) etc.

Mainstreaming Of Gender In The Programme

Women have been playing an important role in the field of agriculture since the ancient times. To bring women into the mainstream information and development process, the organization launched women Self Help Groups (SHGs) in the Watershed Program. This was basically done to strengthen the women-folk and involve them in different programs so that they can also empower themselves. Later these SHGs were linked with the Chickpea program also. Women are involved in almost all the steps of project implementation. They have gained knowledge and strength in the process. They are able to manage the Seed banks efficiently.

Institution Building

Efforts were also made in the project to develop various institutions at community level and work through existing institutions. The experimentations and other project activities were conducted by involving such institutions. Such institutions can be explained as follows:

Self-Help Groups (SHG)

SHGs were developed in the operational villages under the watershed programme. These SHGs were linked with service agencies like banks and cooperative societies for credits, skills and other issues. The SHGs were also observed to be closely involved with seed banks and other chickpea related activities.

Members of Radha Devi SHG, Village Mudkhoha

Seed Banks

For procurement, proper storage and timely distribution of chickpea seeds, seed banks were developed in the villages. Proper trainings were provided to those who are directly involved with various activities of such seed banks.

The Seed Bank approach was initiated in the year 2002-03 after it was realized that the farmers involved in the chickpea program were facing problems of storing the seeds. The other reasons of seed bank requirement were as below:

- To ensure timely availability of seeds to resource poor farmers.
- To ensure the availability of low cost seeds
- To make the seeds available to more and more farmers (enhanced coverage)
- To arrange other crop seeds like wheat, paddy etc. from the income generated
- To save the farmers from the exploitation of private moneylenders

An 11-member village level committee of farmers was formed for the proper management of the seed banks. It was also considered that these seed banks can be used as common platforms to bring farmers together for knowledge sharing and interactive learnings. The committee selected appropriate places where seeds could be stored. A token money is also collected from the farmers for the maintenance of seed banks. The seed banks have ensured proper and timely distribution of seeds.

NPV Laboratory

The project has established 2 village level NPV laboratories in the village Kilhaura and Patna Kala. These laboratories are used for the production of NPV, a virus against the pest *Helicoverpa armigera*. The farmers collect about 100 Ellis from infected crops and drop them in separate glass tubes containing 100 gms chick pea and NPV. After 24 hours, the Ellis are taken out and crushed in a mixer grinder. This powder in mixed in 80-100 liters of water and sprayed over the crops. When the Ellis attacks the chickpea pods, they absorb this virus. As a result, the water capacity inside the body of the Elli increases leading to the death of the Ellis and hence, protection of the crops.

Farmer Interest Groups

Those farmers who were identified for chickpea experimentation and implementation were dealt collectively. The capacity building, technical interventions, data collection, monitoring and other such project activities were undertaken in groups of farmers.

Working through such groups or institutions helped the implementing agencies in making the work more effective and efficient. Also, the activities in groups helped in cross learning and developing a positive environment in the area towards the objectives of the project.

Convergence Between Farmers And Institutions

The important stakeholders in the project were-

- Farmers
- NGOs
- ICRISAT
- KVK and other Resource Institutions
- CRS

The different stakeholders had different roles in the project but all worked towards the common objectives of providing livelihood and food availability to marginalized communities.

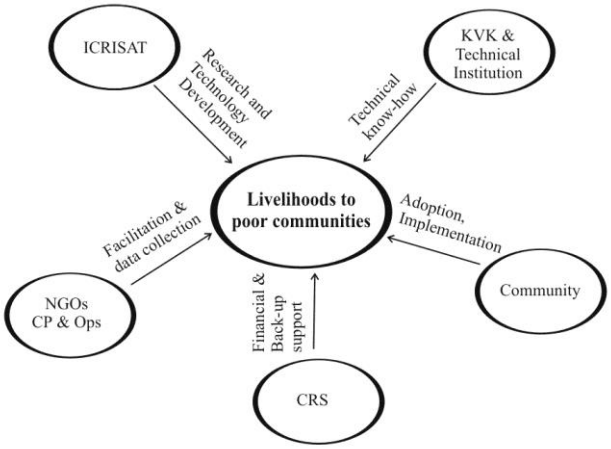


Fig: Convergence for common objectives

Though community was the target beneficiary in the process, the identified farmers also provided relevant data and feedback. The involved NGOs had most important role of facilitation and effective implementation of the activities. ICRISAT has been involved as the technical institution providing technical and other input support. In turn they were provided relevant data and feedback for the technology development and required validation. CRS has been instrumental in initiating the project and linking all the relevant institutions.

The convergence of stakeholders with clearly defined roles was observed to be a key factor responsible in successful implementation of the project.

Inter-Complimentarity with Watershed Project

It was observed that the villages those were selected for the implementation of Chickpea program were those that were involved in the watershed project. The watershed program was launched because the region suffered with problems such as, scarcity of water and low water table, soil degradation, lower agricultural productivity, the natural calamities that happen from time to time, etc. In response to these problems, the watershed project had come up in the area, which also contributed to the initiation of the Chickpea program. The interventions adopted in Watershed programme are quite helpful in Chickpea project. The rapport building with the farmers, soil conservation, availability of irrigation water and other such activities of watershed programme helped and complimented the efforts undertaken in Chickpea project. The chickpea program also responded to the problems mentioned above. In this way, it can be safely said that the two programs contributed to each other in complimentarity.

Problems and Constraints

The major problems faced by the farmers in the region with regard to chickpea cultivation can be divided in two different levels:

1. On farm problems
2. Off farm problems

On-Farm Problems

The On-Farm problems of the farmers mainly include the biotic and abiotic stresses that the chickpea crop undergoes. These are as described below:

Biotic Stresses

Nearly sixty insect pests are known to attack chickpea including pod borers, leaf miners, aphids and bruchids. However, *Helicoverpa armigera* pod borers are the most devastating insect pests of chickpea in this region, which feeds on leaves and developing seeds. Biological control of *H.armigera* is possible using sprays made from the naturally occurring Nuclear Polyhydrosis Virus (NPV). Fusarium wilt (*F. oxysporum ciceri*) is another major disease of chickpea, which affects crops grown in this tropical zone. The wilt pathogen is both seed- and soil-borne and can survive in the soil, in the absence of chickpea, for more than six years. Termites are another devastating insects that cause heavy damage to the crops. Farmers also use traditional methods in controlling and managing pests. The methods generally used to manage and control such pests are as follows:

Insects and Pests of Chick Pea Crop and their Management

POD BORER		WILT DISEASE		TERMITE	
Traditional Practice	**Chemical Treatment**	**Traditional Practice**	**Chemical Treatment**	**Traditional Practice**	**Chemical Treatment**
Mix 3 kgs ash + 5 litres of Kerosene oil and spray on the crops	• Spraying of Indosulfan + Mono crotophos • Spraying of NPV. This is a	• 1 Litre cow urine + 4 litres of water mix and spray • Ploughing	No knowledge of chemical pesticides to farmers.	• Spread of weeds in crops and their irrigating the field. • Deep	Use of Gamaxene and Malathion .

	biological control method.	in summer season and undertaking crop rotation practices.		ploughing in summer season.	

The above table shows the various types of insects and pests of chickpea crop that affect the crop adversely. This information was collected through PRA exercises conducted during the course of the study.

From the information collected during the discussions with the farmers, it was concluded that the farmers are still struggling with the problems of these pests and diseases. Also, farmers do not have effective knowledge of controlling wilt diseases. These problems cause loss of crops and productivity.

The other major problems farmers have encountered is non-availability of seeds in required quantity. Presently the Seeds provided by ICRISAT is distributed among the farmers at the rate of only 10kg/farmer. Lesser seeds mean lesser area for chickpea crop and limited significance to livelihoods of the family. Hence, it is not treated as an important crop, which should be well protected and secured. The diamond work in the nearby Panna district also demands labor from the project villages at the time when chickpea crop is maturing. As the limited sowing of chickpea crop do not significantly support livelihoods of people, the villagers give priority to out migration for diamond work. This reduces male population in the village and hence lesser people to protect chickpea crops from the

attack of wild animals. The situation could be checked by putting "more inputs (mainly Chickpea seeds) which, in turn would encourage all family members to be involved in chickpea production and stay back in their village, and protect the crops in the fields", farmers suggest.

The key safety measure to protect crops from the losses is to ensure night vigils when wild boars coming from the nearby forests attack the Chickpea crops in the fields close to the forests areas. "If we would be growing Chickpea as a main crop in a larger area than what we are doing presently, we would be building *Ghonpa* or *Chatta* (makeshift temporary shelter) in the fields to protect the crop," suggests Ram Kripal.

Abiotic Stresses

The major abiotic stresses in chickpea are extreme temperatures of cold and heat as well as drought conditions. Of these, drought is the major limiting factor for increased productivity, particularly as chickpea is usually grown as a post-rainy season crop. Drought stress can be managed with irrigation, but this is not available to chickpea growers of Bundelkhand region. Very low temperatures also destroy the crops drastically, sometimes, affecting the whole crop.

Off- Farm Problems

The major off-farm or socio-economic problems and constraints faced by the farmers of the region who cultivate chickpea in rice-fallows are discussed below:

Lack of awareness and knowledge among farmers

Most of the farmers in Madhya Pradesh, where large areas of rice-fallows are located, are not aware of the potential economic benefits of using fallows for chickpea cultivation. Farmers also have a low level of knowledge on pulse production technology and R&D aspects. The implemented chickpea project is also quite limited in its outreach and hence promoting rice fallow cultivation at a large scale.

Lack of seed availability

Non-availability of adequate quantities of quality seed of improved varieties, in time, is one of the major constraints in chickpea production. Therefore, farmers use their own seed of local varieties, which are often

of low quality due to generation loss in continuous uses and quality loss due to defective storage systems. Non-availability of adequate quantity of quality seeds adversely affects the production and hence the interest of farmers in the crop. Use of low quality seed results in poor plant stand, susceptibility to seedling diseases, and ultimately poor yields. Hence there is less motivation for cultivation of chickpea or other such leguminous crops that can stand in fallow lands after rice.

Marketing

Markets for selling off chickpeas are thin, fragmented and less organized in comparison with rice and wheat. There is a lack of proper and channelised marketing for chickpea in the area. The markets are situated at far off places that are difficult to access for small growers. Also, farmers are not able to get better prices for the improved chickpea in spite of better prices of the produce in the market. This is also related to limited production of improved variety, which hinders developing an effective access to organized market for the improved variety.

LINKAGE WITH OTHER DEPARTMENTS

Though the project has been implemented by few organizations, it has made good efforts in converging with a number of government and non-governmental agencies even beyond the geographical boundaries of project villages.

Soil Departments of Banda and Jhansi

The Soil Departments of both Banda and Jhansi provided a discount to the farmers involved in chickpea project in soil testing by charging only Rs 10/- against the normal prevalent charges. Besides, the soil department also proposed training on soil testing for the farmers and staff of the implementing organizations

Krishi Vigyan Kendra (KVK), Majhgawan, Satna

KVK Majhgawan is managed by *Deen Dayal Shodh Sansthan*. The major activities of KVK are to provide guidance, help solve problems of farmers, frontline demonstration, on farm testing etc. informed CM Tripathi, a scientist working with the KVK. He further explained that they have good linkages with the organizations implementing Chickpea project in that area for mutual earnings. Some of the field staffs of the implementing organization were also trained in the KVK on various aspects of crop protection. RMKS and KVK have developed good working relationship and are in a process of joint learning from chickpea project.

Convergence with Watershed Project

As explained earlier, the implementing areas of the Chickpea project have primarily been the sites of watershed programmes. This has helped RMKS substantially in building rapport with local communities, Government departments and Panchayatraj institutions.

Department of Agriculture, Chitrakoot

The district level department of agriculture has also helped the implementing organization in various ways. The department of agriculture has helped them in providing technical guidance, literatures and other necessary information.

District Administration and Development Blocks

The district administration and development block of Majhgawan has also been supportive and helpful to implementing organizations and involved farmers.

Convergence with NGOs

Linkages and networking with organizations such as HBM Hospital and Society for Watershed and Rural Development (SWARD), Allahabad and other NGOs working in the area helped in outcomes of the chickpea project and related learning.

As it has been already discussed above that the Chickpea project has not only helped the target beneficiaries of the project but has also been a success in bringing benefits to other projects and programmes run by the partner organizations directly or indirectly:

- Project area of both the implementing organizations expanded. Villages that have not been covered under other projects are now covered by the Chickpea project

- Chickpea project has extensively involved several activities that are technical in nature. Trainings and exposure opportunities help develop technical know-how among the field staff and the farmers as well – e.g. preparation and application of NPV treatment, plant protection, maintaining seed bank are the activities that have enhanced the skills and technical knowledge

- As a result of expansion, the project areas got expanded and the number of target beneficiaries also increased

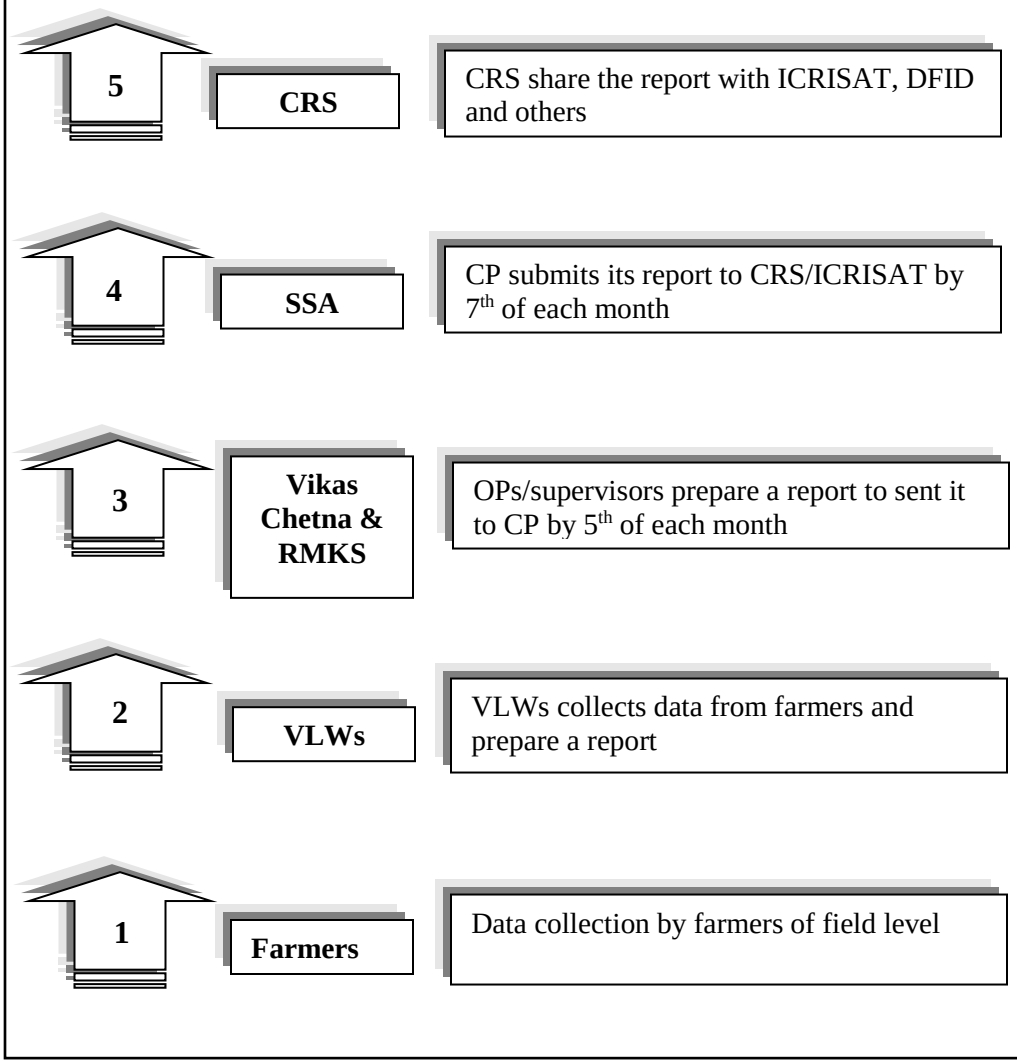
- Better opportunities for capacity building exposures and trainings- e.g. field staff of operating partner organizations went on an exposure trip to Raipur, Chattisgarh to see experiment of mixed cropping of Paddy and Chickpea

- Implementing partners (OPs) trained directly by CRS and ICRISAT

PROJECT MIS

The uniqueness of this project is that while the project has been implemented as a CRS supported major livelihood support programme through improved Chickpea varieties, the partnership of ICRISAT has been more research oriented that has extensively involved data collection and an effective monitoring system at various levels. An effective monitoring system ensured timely collection, compilation and analysis of information and data collected from farmer's field. The various stages, persons involved in this process and their roles and responsibilities are given below:

Fig : Management Information System



Farmers

The farmers were trained to record trends and information related to the crop and give it to concerned village level workers (VLWs) for further processing. The farmers have been trained by the operating organization and provided constant guidance for it. The farmers usually share the information with VLWs and other farmers of the area. This has helped in confidence building of farmers and encouraging them in field experimentation and innovation.

Village Level Workers (VLWs)

VLWs report on weekly basis to operating organizations and use their diary/notebook for recording data. There is no prescribed format for doing so but standard practice is followed. The weekly report is sent to the OP office every weekend. The report is personally delivered at the office or handed over to the Supervisor while visiting villages.

Supervisor / Operating Partners (OP)

It is OP's responsibility to prepare monthly report from VLW report and submit in the first week of each month. Supervisor being the person responsible for project implementation prepares such reports. OP uses a prescribed proforma for compilation of data collected from the fields. A copy of the proforma is attached herewith as annexure.

Counterpart Organization (SSA)

Counterpart submits its report in the first week of each month to CRS with a copy to ICRISAT. SSA prepares village wise report using Excel sheet on the basis of 30 data received from all 30 implementing farmers, his own report and sends to CRS. In April, the organization prepares a final farmer wise report and sends to CRS, ICRISAT and OP as well. The remarks given by OP are reproduced in the report in the form of observations. A copy of the proforma is attached herewith as annexure.

Catholic Relief Services (CRS)

The role of CRS, at this stage is to forward a copy of the report to their head office at Delhi and ICRISAT, Hyderabad.

ICRISAT

ICRISAT sends its final report to DFID. The final report is presented in a review cum planning meeting in June with DFID, ICRISAT, OPs, CPs and other representatives from Bangladesh, India and Nepal. The review meeting is also utilized for planning for next year. CP, OPs and CRS meets at least 10 days in advance of the review meeting for internal planning.

Despite the lack of some basic facilities the overall MIS systems of the project is working properly. This can be evident from the following facts:

- There has never been adverse comments by CRS about MIS
- There is enough clarity in the reports coming from the fields that confusion hardly arises
- Multi channeled reporting mechanism ensure any last minute corrections and clarification.
- Formal trainings both directly related to chickpea project and otherwise on MIS systems helped maintaining information in systematic manners.

THE PROCESS OF MONITORING AND EVALUATION (M&E)

The monitoring & evaluation in this project are multi-channeled processes that have involved farmers, OPs, CP and CRS/ICRISAT at different levels. The following table provides a picture of the processes of M&E.

MONITORING	
ICRISAT	▪ 3 visits per year ▪ Second visit Jan-Feb (Soil sample, pests) ▪ Third visit March (Grain sample: production on 1x1 meter) ▪ Scientist Raju Paul used to come to the project area for monitoring, now Dr MS Kumar
CRS	▪ Project monitoring at CRS level is done on quarterly basis ▪ There have been 3-4 visits in 2003 ▪ But only 1 visit in 2004
SSA (CP)	▪ Quarterly visits to OPs ▪ Visits generally combined with CRS/ICRISAT
OPs	▪ 3-4 visits per month ▪ VLW visits fields regularly on an average 2 visits /village week basis
EVALUATION	
	▪ Evaluation is done annually internally by CRS and ICRISAT. ▪ CRS and ICRISAT evaluates project jointly ▪ Last evaluation in Nov 2005 ▪ No external evaluation so far

SCOPE OF UP SCALING

The implementation of pilot project of improved chick pea in selected areas of Bundelkhand has established that:

- Chickpea is a viable option for utilizing vast rice fallows and hence improving the livelihoods and food security of the communities.

- Improved chick pea varieties demand very small amount of water and has the capability of surviving through extreme weather conditions (frost and low temperature) and drought and hence suits to local geo-climatic conditions of Bundelkhand.

- Chickpea improves soil fertility and hence reduces the fertilizer demands, thereby lowering the input costs in agriculture.

- If preventive measures for pest infestations are taken, the improved varieties provide better yields (compared to local varieties) and fetches better price also.

- The farmers are given only 10 kg seeds. This is mainly because the quantity of Chickpea seed available in Seed Bank is limited. One of the ways the availability of the seeds is increased in Seed Bank, rules may be framed whereby the farmers should be required to repay the 'Seed Loan' 25% to 50% more than the quantity they borrow. Presently, the arrangement is to repay the seeds equal to the quantity it was borrowed.

- Chickpea is an early crop hence more vulnerable to the wild animals. Since it is harvested much earlier than the other crops, wild animals especially wild boars are attracted to Chickpea and destroy it. The increase in cropping area would encourage farmers to take extra precautions to protect it from the wild animals.

- Technical trainings on all relevant aspects of improved Chickpea .

There are large areas in India as well as entire south Asia, which have similar agro-climatic conditions. The project intervention having established the suitability of adopted varieties in Bundelkhand, utilizing the rice fallows, it can be assumed that the varieties have a scale potential.

In India about 45 million ha of land is under rice growing area. Out of this, 40 million ha of land is left fallow during Rabi season. Thus, 81% of the total fallow land in South Asia is in India. These are primarily rainfed areas on which the Govt of India is considering promoting various programmes such as ground water recharge and lift irrigation schemes. According to an estimate out of 40 million ha of rice fallows, 27-28 million ha of land has potential for the 2nd cropping. This land can be used for promoting pulses. Development of dry land areas in the country has been a prime focus area.

Although chickpea has been identified as an option in Bundelkhand region, some other crops like oilseeds, lentil, pigeon pea and lenthyrus have also been identified for diversification depending upon the adaptability by the farmers and suitability to the area.

A scientific study using satellite imagery and similar to that of rainfed Rabi areas in Sotuh Asia, conducted by ICRISAT and DFID through National Remote Sensing Authority in early 2000, revealed that a substantially vast land of rabi areas in India were under fallows. The estimated rice fallows in Madhya Pradesh during the year 1999-2000 was 4.4 million ha which was 78% of Kharif rice area in MP. The reason apparently, was the lack of sufficient moisture required for the crop post rains.

The following table shows the extent of the rice fallows during 1999/2000 Kharif season from the analysis of satellite image of India.

Estimates of rice area during Kharif 1999 and rice-fallow area during Rabi 1999/2000 based on satellite image analysis for major rice-growing states in India.

State	Kharif-rice area ('000 ha)	Rabi-fallow ('000 ha)	Rice-fallow area as % of kharif rice area	% of total rabi-fallow area
Andhra Pradesh	2657	305	11.5	2.6
Assam	2234	539	24.1	4.6
Bihar	5974	2196	36.8	18.9
Gujarat	469	83	17.7	0.7
Haryana	1109	0	0.0	0.0
Karnataka	984	182	18.5	1.6
Kerala	241	0	0.0	0.0

Madhya Pradesh	**5596**	**4382**	**78.3**	**37.6**
Maharashtra	1762	629	35.7	5.4
Orissa	3879	1219	31.4	10.5
Punjab	2498	0	0.0	0.0
Rajasthan	214	25	11.7	0.2
Tamil Nadu	1695	20	1.2	0.2
Uttar Pradesh	6255	353	5.6	3.0
West Bengal	4617	1719	37.2	14.8
Total	40,184	11,652	29.0	100

Not only in India, entire south Asia have large rice fallows and following table gives a picture of the region :

Table 1Estimates of rice areas during 1999 Kharif season, and rice fallows during rabi season of 1999/2000 based on satellite image analysis in South Asia[1].

Country	Kharif-rice area (million ha)	Rabi fallows (million ha)	Rabi-fallow as % of rice area	% Total rice-fallows in South Asia
Nepal	1.45	0.39	26.9	2.7
Bangladesh	6.36	2.11	33.2	14.8
Pakistan	2.45	0.14	5.7	1.0
India	**40.18**	**11.65**	**29.0**	**81.5**
Total	50.44	14.29	28.3	

Such areas, which are largely uncultivated, can be effectively utilized for the benefit of marginalized communities. The improved varieties of chickpea have an established potential of such up scaling.

[1]'Promotion of Rainfed Rabi Cropping in Rice Fallows of Eastern India & Nepal –An Overview', ppt. by JVDK Kumar Rao, ICRISATand D Harris, DFID

ANNEXURES

ANNEXURES

ANNEXURE-II

RICE FALLOWS IN SOUTH ASIA: EXTENT AND SCOPE

As it has been mentioned that the concept of promoting Chickpea crop in semi-arid zones of Madhya Pradesh and Uttar Pradesh (Bundelkhand) is part of an international project supported by DFID. The main objective of the project is to promote diversification in cropping patterns in rainfed rabi cropping rice fallows areas of South Asia. The project is being implemented in India, Nepal, USA and the UK and is based upon the fact that the entire South Asia, with India having the largest chunk, as a major rice-producing belt in the world, has tremendous opportunities in promoting crop diversification through low water intensive crops in vast areas of rice fallows. Prominent among the countries in South Asia where rice fallows have been identified as scope for crop intensification and diversification under this project are Bangladesh, Nepal, Pakistan and India. With more than 50 million ha rice producing fields, these countries forms a major rice producing region which have an estimated 14.29 million ha Rabi rice fallows.

Although it's difficult to provide any precise estimate of areas of rice fallows, the DFID/PSRP funded project which is being implemented through ICRISAT, has documented spatial distribution and quantification of rice fallows in South Asia-potential for legumes. Based upon the satellite image analysis of rice fallows during Rabi and Kharif seasons of 1999, the following table gives a picture of rice fallows in South Asia:

Table: Estimates of rice areas during 1999 Kharif season, and rice fallows during rabi season of 1999/2000 based on satellite image analysis in South Asia[2].

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India	**40.18**	**11.65**	**29.0**	**81.5**
Total	50.44	14.29	28.3	

The satellite imagery of the extent of rice fallows is given in the accompanying map, which clearly reflects the areas identified under rice fallows in South Asia.

[2]'Promotion of Rainfed Rabi Cropping in Rice Fallows of Eastern India & Nepal –An Overview', ppt. by JVDK Kumar Rao, ICRISATand D Harris, DFID

RICE FALLOWS IN INDIA

In India about 45 million ha of land is under rice growing area. Out of this, 40 million ha of land is left fallow during Rabi season. Thus, 81% of the total fallow land in South Asia is in India. These are primarily rainfed areas on which the Govt of India is considering promoting various programmes such as ground water recharge and lift irrigation schemes. According to an estimate out of 40 million ha of rice fallows, 27-28 million ha of land has potential for the 2nd cropping. This land can be used for promoting pulses. Development of dry land areas in the country has been a prime focus area. Targeting the need of development of the semi arid zone, the Government of India has approved 'On-farm Water Management' project in eastern India and according to one report, GoI has invested about 700 crores of rupees for water management systems in the country

Although chickpea has been identified as an option in Bundelkhand region, some other crops like oilseeds, lentil, pigeon pea, lenthyrus have also been identified for diversification depending upon the adaptability by the farmers and suitability to the area.

Madhya Pradesh which falls under the Bundelkhand region, has been carefully selected, well thought of and a justified choice for the purposes of implementation of the project. A scientific study using satellite imagery and similar to that of rainfed Rabi areas in Sotuh Asia, conducted by ICRISAT and DFID through National Remote Sensing Authority in early 2000, revealed that a substantially vast land of rabi areas in India were under fallows. The estimated rice fallows in Madhya Pradesh during the year 1999-2000 was 4.4 million ha which was 78% of Kharif rice area in MP. The reason apparently, was the lack of sufficient moisture required for the crop post rains.

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Total	40,184	11,652	29.0	100

ANNEXURE-III

Economic Feasibility of Growing Chickpea in rice fallows

Experiments conducted in research stations to grow chickpea in fallow lands after rice showed that it is agronomically feasible and economically viable. This is reflected from the following table of data analysis collected nation-wide, retrieved from ICRISAT website http://www.icrisat.org/text/research/nrmp/dfid/text/India/RFE.html. The data assists in understanding of the likely benefits and investment requirements by individual farmers. As per the researches, it has been found that chickpea provides the highest net return of Rs. 17,850 ha^{-1} with a BCR of 3.20 among the various legumes assessed.

Cost and returns (per hectare) from cultivation of chickpea in rice-fallows of India

Description	Unit	Unit Price	Quantity	Amount (Rs.)
INPUTS				
Labour	DAY			2520.00
Land Preparation	Day	60.00	3	180.00
Sowing	Day	60.00	3	180.00
Weeding and cultural operations	Day	50.00	20	1000.00
Harvesting	Day	50.00	20	1000.00
Threshing	Day	80.00	2	160.00
Bullock Labour	Pair Day			450.00
Land Preparation	Pair-day	150.00	3	450.00
Machine Cost				
Threshing	Hour	200.00	2.50	500.00
Seed	Kg	40.00	75	3000.00
Fertilizer				
Diammonium Phosphate	Kg	9.80	100	980.00
Pesticides	Number	1.00	650	650.00
TOTAL COST				8100.00
OUTPUTS				
Grain Yield	Kg	25.00	1000	25000.00
Fodder Yield (By product)	Kg	2.00	400	800.00
Green Vegetable Consumption				150.00
RETURNS				
Gross Return				**25950.00**
Net Return				**17850.00**
Benefit Cost Ratio				**3.20**

Chickpea: Potential for Employment Generation

In a labor surplus economy like India, scope for employment generation is always an opportunity for the farm households and the national economy. It is estimated that cultivation of chickpea would create an employment opportunity of 48 person-days per hectare. On an average, cultivation of legumes in one hectare of fallow land would generate more than 43 person-days working opportunity and more than Rs. 2,500 remuneration as labor wage. If all the rice-fallow areas (11.65 million ha) can be brought under legume cultivation then additional employment creation in the Indian agriculture will be 502.7 million person-days.

Potential employment generation through introduction of legumes in rice-fallows of India

Crop	**Labour Requirement**
Chickpea	**48.00**
Mung bean	38.00
Pea	54.00
Khesari	38.00
Black gram	38.00
Cowpea	38.00
Lentil	48.00
Mean (Legumes)	43.14
Total rice fallow area (ha)	11652000
Potential employment creation (person-days)	502700571

ANNEXURE-IV

GLOSSARY

AVRDC – Asian Vegetable Research and Development Center

CIMMYT – Inernational Maize and Wheat Improvement Center

CIPM – Center for Integrated Pest Management

CP - Counterpart

CRS – Catholic Relief Services

DFID – Department For International Development

FIG – Farmer Interest Group

ICRISAT - International Crops Research Institute for the Semi-Arid Tropics

KVK – Krishi Vigyan Kendra

MIS – Monitoring Information System

MO – Molybdenum

NGLRP – National Grain Legumes Research Programme

NPV – Nuclear Polyhydrosis Virus

OP – Operating Partner

PSRP – Plant Sciences Research Program

RRC – Rainfed Rabi Cropping

Two NGOS – Vikas Chetna and Rameshwari Manav Kalyan Samiti

SHG – Self Help Group

SSA – Sarvodaya Sewa Ashram

VLW – Village Level Worker

Sarpanch – Elected Head of Village Panchayat