

REPORT ON KHARIF PADDY STABILIZATION IN JHARKHAND

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INTRODUCTION:

Rice is the most important cereal food crop of India. It occupies about 23.3% of gross cropped area of the country. It plays vital role in the national food grain supply. Rice contributes 43% of total food grain production and 46% of the total cereal production of the country. Rice is the staple food of more than 60% of the world's population especially for most of the people of South-East Asia. Among the rice growing countries in the world, India has the largest area under rice crop and ranks second in production next to China.

The state Jharkhand is dominated by monocropping of rice. Out of 10.13 million working population, 76.86% are engaged in agriculture. Vast working force and natural resources are able to produce food grain to meet only 50% requirement. Water is the major constraint in agricultural land along with soil erosion. Comparison of the agricultural production of the state vis-à-vis requirements with that of the country show the need for up scaling the production related activities in agricultural sector. 39% of the total geographical area has waste lands and only 8% of the total area is irrigated. The productivity of principal crops is very poor because of the typical undulating topography with light soil and rainfall dependent risk prone agriculture. Total cultivable area of Jharkhand is 38 lakh hectare out of which net sown area is 18.04 lakh hectares. The area under rice cultivation is 1.4 million hectare. Productivity of paddy is far less than state and national yields. The paddy yields in this region have consistently hovered around 3.98 quintals / acre, much below the state average of 6.07 quintals / acre (source). This is despite the fact that the region is well endowed in terms of natural resources and receives a good amount of rainfall (www.rainwaterharvesting.org/Common.ppt). Impact of low productivity could be seen in form of food insecurity, distress migration and low incomes in hand. Main reasons for low productivity, as found by CINI, were inefficient cultivation practices followed by the tribals, coupled with the erratic monsoon rains.

Rainfed rice farmers in Jharkhand are trapped in a cycle of food insecurity in which high risks from drought or erratic pattern of rainfall, understanding among the tribal people and absence of proper extension networks which can be termed as support system stresses prevent adoption of improved technologies for rice production, diversification of rice systems and investment in non-farm activities. Reducing food insecurity, productivity of paddy to be greatly increased and stabilized in rain fed rice systems.

The experience of Asian economic development in last 50 years indicates that the achievement of large and stable increases in rice production by farmers leads to greater income and food security, freeing them to engage in other income-generating activities.

Looking at food security as an entrenched issue in tribal population of Jharkhand CINI has put effort to stabilize the kharif paddy cultivation among the tribal farmers of Jharkhand through partner organizations. Though this state is one of the rice producing states in India, inability of proper cultivation of mono crop rice is leading to insecurity of food among the tribal communities. Inherently tribal communities are not rendering to settled agricultural practices. They have to undergo different phases of growth to attain a settled way of life. During these different phases, there is need of different support to boost up their settlement process. Settling down of agricultural or crop production practices leads the community to overall settlement by taking up other economic activities.

Self sufficiency in food grain production enhances the economic activities which are integral part of settled ways of life. In this situation it is very much rational to help the tribal farmers undergoing phases of growth to boost up production of food grain. CINI's effort towards stabilizing kharif paddy among the tribal farmers in this state is very much appreciable. CINI in coordination with partners, PRADAN, TSRDS, KGVK, NBJK and NEEDS is trying to improve the livelihood of the tribal inhabitants of this area for ensuring the food security among themselves. The key intervention selected is to stabilize the kharif paddy cultivation to improve the food grain production.

Generally the land capability in terms of agriculture is envisaged by the topography of the area. The entire landmass of Jharkhand is composed of undulating topography which is governing the agriculture to a typical pattern. The land is divided into three types depending on the elevation. The low land is called as 'Bera' in local language, middle land, called as "Don2" and upland is called as "Tarn".

The water availability in the different time of the year determines the type of cultivation to be performed in these three types of land. The bera land is mostly dominated by rice cultivation which was earlier direct seeded and certainly with local varieties. The concept of transplantation of seedling of rice was out of the vogue of the tribal farmers in the region. The yield and productivity of the crop was solely depending on the amount of precipitation of the season.

In the "Dond 2" type land farmers go for rice, wheat, potato and winter vegetables. Cultivation of all these crop in this case is also completely rainfed. Since the water retention of this category of land is much lower, the productivity of rice is also very low as compared to the bera type.

Tarn type of land is suitable for vegetables, some of the pulses like arahar, black gram etc, and short duration rice like Gora dhan. The productivity of these crops is very low because of the pattern of rainfall as well as the lesser water holding capacity of the soil of this upland.

The farmers have been following traditional methods of cultivation with subsistence level of production. Agencies put effort to intervene in the following key points of cultivation practices:

1. **Use of HYV seeds:** In traditional practice farmers used to grow paddy with old seeds which is one of the major cause of lower productivity. Partner organizations introduced HYV of rice for following transplantation method of cultivation.
2. **Nursery Bed Preparation:** The rice cultivation was entirely direct seeded, farmers followed broad casting methods. Partner Organizations motivated and trained the farmers to prepare scientific nursery bed for raising seedlings.
3. **Timely Transplantation & Line Transplantation:** Previously very few farmers paid attention to timely transplantation as a result of which yield was reduced to a large extent.
4. **Ensuring Basal Fertilizer Dose and Top Dressing:** Previously most of the farmers especially tribes applied only manure to grow paddy. Organizations made efforts to motivate them to apply requisite doses of manure and fertilizer timely. What are these requisite dosages
5. **Pesticide Application as and when required:** Previously farmers were not oriented to deal with pest attack. During the kharif paddy intervention farmers are trained to recognize the disease and pests and their respective remedies.

The outcome of this intervention is the increase in productivity of rice. Kharif Paddy Stabilization program has led to enhancement of paddy productivity by double (from 1.8 ton/ha to 4 ton/ha). Farmers are motivated towards the adoption of new methods of cultivation. In some villages even 75% of the household who is having substantial amount of bera land are adopting improved methods of cultivation of transplanted kharif rice. So, the acreage under improved kharif paddy has taking upward trend in the intervention villages. But the methods adopted by the farmers

are not uniform across the region. The farmers in different districts and under the guidance of different organizations follow different methods and sometime farmers used to adjust according to their convenience.

This study will envisage the future strategies to be adopted for boosting up stabilization process by looking at present status of practices followed by different farmers. Different partners are recommending different practices to the farmers in different areas. Reviewing all the efforts by the partners in terms of practices prescribed and advantages and disadvantages of these practices and their popularity among the farmers and cost involved in them, a set of common practices will be selected which can be used across the state for rising production of rice. Finally it will give rise a scientific, easily acceptable package of practices of kharif paddy cultivation which will put forward optimum yield across the region.

Photo 1: Dry undulating rice field during the month of May in Saraikala district



Objective:

Primary objective of this study is to develop a POP of Kharif paddy cultivation which is affordable to all type of farmers and can give rise to optimum yield in the given situations of the state.

To obtain the above objective, we have to fulfill the following secondary objectives systematically.

Secondary objectives of the study are as follows:

Objective1. To analyze the impact of POP followed by different partners and comparison among themselves.

Objective2. To assess factors responsible for the adoption of different components of POP to be analyzed and to understand the perception of different farmers of different location of study area towards the different practices of POP.

Objective3. To assess the components of different support systems available in the study area to facilitate the easy adoption of POP by the farmers.

Objective4. To find out, different strategies to be followed for gearing up the kharif paddy stabilization process.

Best practices at lower cost for optimum production/yield can be easily adopted by all categories of farmers under prevailing situations.

Methodology :

The methodology of this study includes the collection of primary as well as secondary data followed by field observation and analysis.

Primary Data: The primary data has been collected from the farm families regarding cultivation practices followed in kharif Paddy cultivation in this season of 2008-2009 with the help of structured questionnaire. The field animators of different partner agencies facilitated data collection under coordination of partners and the researcher. Besides this, researcher has collected information by conducting personal interviews and focus group discussion among the farmers. This provides information to understand the perception of farmers towards the adoption of package of practices of rice.

Secondary data: Information regarding POP followed by government department and the recommendation from agricultural scientists are being collected from department of agriculture of different districts of Jharkhand and Birsa Agricultural University Ranchi.

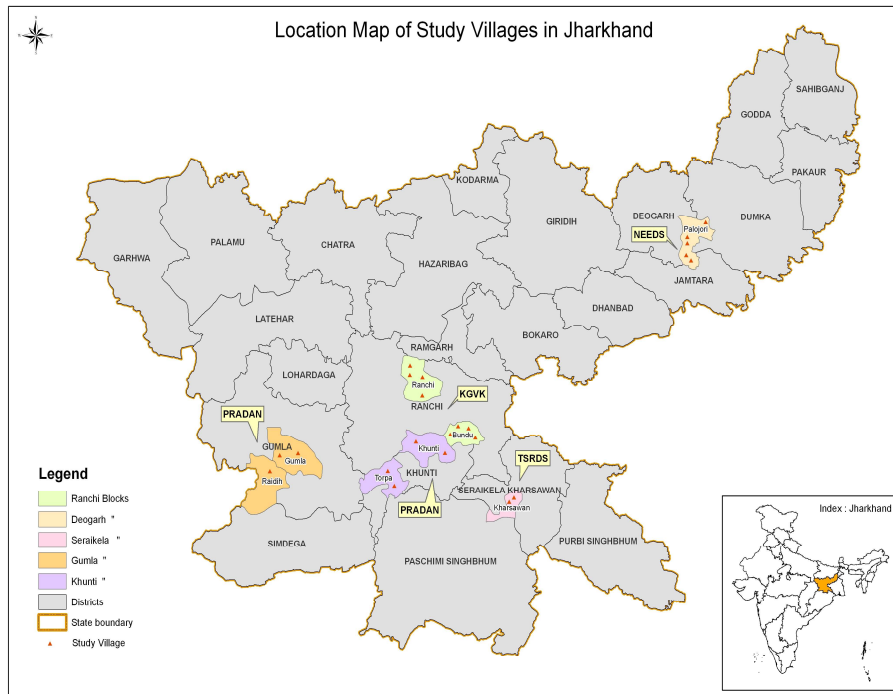
Study Area:

The study is conducted in different locations of the state, where different partners of CInI are working. The area under PRADANs jurisdiction is villages of Raidi and Gumla block in Gumla district and Torpa and Khunti blocks in Khunti district. The area under NEEDS is villages of Palojori block of Deoghar district. Likewise villages of blocks of Saraikala in Saraikala district and Ranchi and Bundu blocks in Ranchi district are selected for conducting study with coordination of TSRDS and KGVK respectively.

***Sampling:* Sample size is 500 respondents (farm house holds).**

Sampling is purely random selection of farm families in the villages of intervention area of different partners. Control villages are also selected in nearby villages where there is no intervention.

There are 3 villages from each partner's jurisdiction area and 1 control village nearby. In each village 20 households are interviewed and 5 households in control villages. So, total number of village surveyed is 20 including control villages and total figure of sample size comes up to 500.



Approach: In this study approach is being made to understand two aspects of this intervention. First is the documentation of the field operation of different components of POP in the study area. And the second is to analyze the factors responsible for adoption of POP in study area. For understanding the first aspect farmers are approached with structured questionnaires having three parts comprising of activities of kharif paddy cultivation of this season. These are filled up by field staff time to time as when the practices were done in the field by the farmers in different locations.

In the second aspect, researcher has tried to ascertain the factors that govern the acceptance of the farmers toward new practices. For this the perception of farmers towards following of POP of kharif paddy is analyzed with the help of farmers comments and responses which are captured by researcher with close contacts of farmers in different locations of study area.

Analysis:

The analysis is based on the primary data collected in the questionnaire and the format filled with filtered data and the observation of the researcher.

All the practices related to kharif paddy cultivation is analyzed in terms of popularity, convenience in performing and the cost involved in adaptation. The widely followed practice with lower cost, which gives rise optimum yield, is accepted as the component of POP depending on the prevailing situation.

The whole adoption process is being divided into different stages of growth and development where each stage is defined with particular characteristics which are widely discussed in following chapter. Different farmers are under going different stages of adoption process. Looking at the degree of precision in following POP, the farmers are categorized as adopters, partial adopters and non adopters.

On the basis of information collected about the perception of farmers towards POP by interviewing the farmers and observation of the researcher, the factors governing the adoption of the POP are being listed out. With the help of indicators both behavioral and operational, different levels of adoption by different farmers have been figured out. Putting different group of farmers in each study area and trying to find out the stage in which the region is undergoing.

On the basis of adoption level of farmers and the stages of them in stabilization process, future strategies along with the action points are developed for better promotion of POP kharif paddy in Jharkhand under CInI.

Components of POP promoted by partner organizations in the study area:

Use of HYV seeds: The improved varieties of paddy like Swarna, Lolat, Ranjit are made available for the farmers at subsidized rate. Organizations distribute government seeds as well as purchased seeds from market. Last three years they have been supplying certified HYV seeds and in 2008 TSRDS is providing foundation seeds purchased from Birsa agricultural university. The cost of per kg seed is Rs17 in market. They provide the seeds to farmers at Rs6 per kg. Swarna and Lolat grow very well in medium low and upland and Ranjit is best for lower land.

Methods of nursery bed preparation and Time of transplanting

Seed bed should be prepared during early days of Monsoon rain and last date of sowing recommended by the organization is 30th June. Farmers used to delay in preparing nursery bed till mid of monsoon. This results delay in transplantation and consequently crop takes longer duration and land become unavailable for second crop. This intervention tried to motivate the farmers to go for timely transplantation and line transplantation. The transplantation should be completed before 15th of August.

Organizations demonstrate the farmers about chemical treatment of the nursery bed for protecting the seedlings from disease and pest. A typical nursery bed is a raised seedbed keeping 1.0 to 1.5 m width and of convenient length keeping 30 cm distance between the two beds for irrigation/drainage with application of FYM one ton per 1000 m² and nitrogen (5 - 10 kg N), phosphorus (5 kg P₂O₅) and potash (5 kg K₂) fertilizer for every 1000 m². Soil should be treated with Phorate 10 G @ 12.5 kg per ha before sowing.

Line transplantation of seedlings maintaining proper row to row and plant to plant distances (15cm plant to plant 10 cm row to row) is also recommended by the partner organizations.

Use of fertilizer:

Use of fertilizers like urea, DAP, MOP and lime has been promoted by the organizations. Fertilizers are made available among the farmers by partner organizations at subsidized rate. Farmers have to pay Rs6 for per kg DAP and Rs.3 for per kg Urea. In some areas the organization supplies fertilizers to the farmers in credit and the repayment is to be done after harvest in the form of cash or grain.

Results:

The Impact of kharif paddy stabilization program:

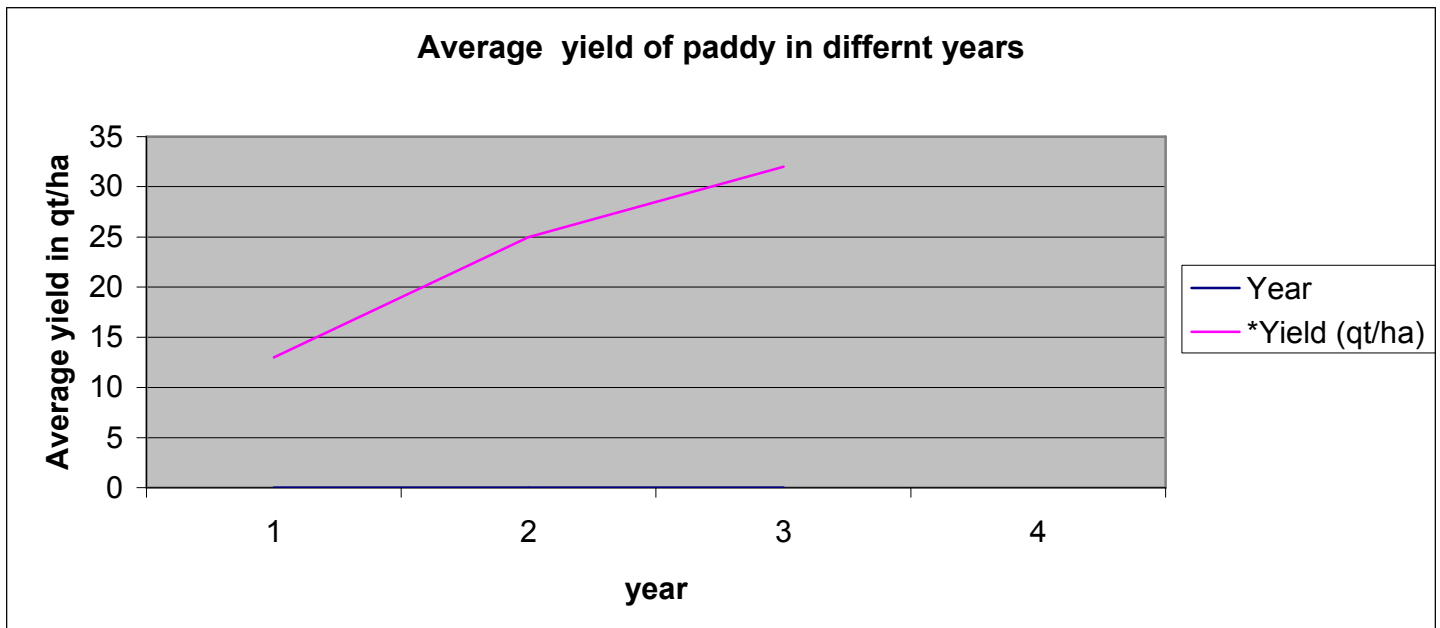
Impact of kharif paddy stabilization of CInI can be weighed up in three fronts. The first front is the yield obtained by beneficiaries in the intervene areas. Second front implies the extent of the adoption of POP and the third front is the degree of precision of adopted practices.

Yield Impact

It takes at least two to three years for the farmers to enjoy the yield benefits of cultivating a particular crop by adopting POP in a particular area considering prevailing conditions. It has been seen that average yield and productivity of intervention area of kharif paddy stabilization program is increased but the increase of yield is marginal in individual level of farmers during last two years but the yield augmentation is satisfactory in this year i.e. in the year 2008-2009.

Year	*Yield (qt/ha)
2006-2007	13
2007-2008	25
2008-2009	32

Average productivity of the farmers of study area.



The average production of the respective districts of Jharkhand is also in upward trend. Increase in yield of paddy boost the food security of the farm families, this is obvious in the intervene area of this kharif paddy stabilization program. The food sufficiency of the respective farmers has extended by 2to5 months during last three years which was earlier only 5 months in average of the farmers surveyed. So, presently the food sufficiency on an average in the household under this study area is 7to 10 months in a year.

Adoption Impact

For successful promotion of POP, it is very important to understand what section of the farmers are following the prescribed practices of the POP and what are the advantages and disadvantages that farmers are facing while adopting. All the practices involved are interrelated and needs specific heed in terms of operation as well as application of input. The improper management of previous practice results no scope of correction in succeeding

stage. Complete benefit of POP can be obtained only when most of the prescribed practices are followed but which is not practically feasible for the farmers in the poorer section of the community as the economic viability can not be achieved within short period of time among this type of farmers. In our study area the intervention in the POP is both in operation as well as input management required for the cultivation of kharif paddy. The input management includes the recommendation of proper dose of seed, fertilizer and other inputs whereas operation implies the recommendation of management practices for cultivation of paddy.

90% of farmers having low and medium land in the study area have transformed from cultivating local varieties of paddy to HYV seeds which gives rise to augmentation of yield of paddy in this area.

99% of farmers under consideration of this study are using chemical fertilizers earlier which were not in the vogue of the farmers of this area.

Operationally the transplantation of seedlings in the main field is common in some part of the study area nowadays was direct seeded local variety cultivation during earlier periods. This results in higher yield and also developed a habit of better cultivation practice.

Precision Impact:

Though these efforts are reasonable, still results are mixed. No doubt that the average yield of the area under study is increasing, but all the farmers are not enjoying the varietal benefit fully, only a section of farmers are obtaining the recommended yield of cultivating HYV and hybrid varieties. The 30% of total household surveyed are enjoying recommended yield of the variety *Swarna*, which is the most popular variety among the farmers of this area. The recommended yield of *Swarna* is 40q per hectare but average yield of this variety in the study area is 25 to 30q per hectare. This is because of the degree of precision in following the recommended cultivation practices. Complete benefit of varieties of improved seeds can be obtained only when POP is followed properly. Regarding nutrient management, 100% farmers of study area are using FYM and chemical fertilizers but very few farmers are using in recommended dose. Only 10% of farmers in the study area are using fertilizer in three split doses with proper dose and during right time.

Substantial number of the farmers came across during focus group interview are unaware of recommended dose and some of them responded that, they are using fertilizers according to their affordability not according to the POP. Likewise the method of transplanting is not uniform across the farmers of the area. Though transplantation of paddy is common in the area still the method of transplantation by maintaining row to row and plant to plant is not properly followed which results in difficulties in weed management, in this type of condition use of mechanical devices like paddy weeder is not possible and nutrient availability for the plants are not uniform. Consequently yield loss occurs because of weed infestation.

The degree of precision of practicing each cultural practice of paddy cultivation by farmers is very much important factor to achieve proper yield and production. In other words farmers who follow the recommended practices of each cultivation activity harvest better yield.

The study area comprises of assort farmers. The degree of precision of cultivation practices is not uniform. The majority of farmers are adopting practices with minimum degree of precision. 90% of farmers came across during the survey use chemical fertilizer but only few of them apply fertilizer in proper dose in three parts. Regarding disease and pest management no farmer in the study area could mention the name of any pesticide.

Area wise status of Adoption of POP:

Settled cultivation practices add value to the settlement of a community which nurture their needs and wants, provide support in hiking in the steps for prosperity and development. Settlement of cultivation of a particular crop passes through different phases of growth and development. In every stage the driving force for adoption, pattern of adoption and expectation for outcome are assorted. In this study we are trying to analyze the different phases of stabilization of kharif paddy in different areas of Jharkhand with the help of some indicators. Which are helping CInI in formulating future strategies to promote improved POP in kharif paddy, this in turn will lead to better production of rice in the state.

The whole stabilization of kharif paddy can be divided in to four stages of growth and development.

The initial stage can be termed as *nascent* stage. In which the food security itself drives the axel of adoption. In this stage there is no structured or organized methods, it is generally followed by tribal people in their traditional unsettled cultivation. Farmers undergoing this phase cultivate with traditional ways and no proper methods followed in cultivation. In Jharkhand the existence of such farmers are also in some pockets in all the study areas.

The subsequent phase can be termed as *pre settlement* stage where repetition of same crop in same area for more than one year and in this stage farmer looks for innovation in their cultivation practices such as better land preparation, removal of weeds, preservation of seeds for subsequent year etc.

The third stage is the beginning of stabilization process which can be termed as *settlement* stage. In this phase farmers adopt innovation in existing practices and look for improved ones.

In the final stage crop gets stabilized properly which can be termed as *pro settlement* stage. In this stage farmers adopt improved techniques; they become alert for efficiency, production quality and enjoy the surplus benefit in terms of profit.

The duration of each stage of growth varies according to crop, prevailing climatic situation and some factors which are discussed below. Normally the duration in the nascent stage is longer sometimes more than a decade. The kharif paddy stabilization process in Jharkhand by CInI is undergoing different stages of development in different study area under different partners.

We are trying to identify which area is under which stages of growth and development and each stage is justified by some indicators. These indicators include both the operational indicators and behavioral indicators.

The behavioral indicators are of qualitative type and those are entirely depending on type of farmers, their community and tradition and accessibility to the source of livelihood etc.

Operational indicators are the agricultural operations involved in the paddy cultivation. The popularity of these intercultural operations in the area can indicate the type of cropping practices the farmers follow in the area to obtain proper harvest. These indicators are

Name of area	Name of partner	Operational Indicators							** Average range of Food security of farmers (month)
		Practice of direct seeded paddy	%of farmer using *machinery	%of farmers using fertilizer	%of farmers using HYV	%of farmers using pesticide	% of farmers using insecticide	% of farmers using irrigation	
Gumla	PRADAN	found	nil	100	95	50	60	nil	5-12
Khunti	PRADAN	found	nil	100	90	60	70	nil	6-12
Ranchi	KGVK	found	nil	100	75	60	70	nil	5-12
Deoghar	NEEDS	Not found	nil	100	75	60	70	nil	4-12
Saraikala	TSRDS	found	nil	99	70	40	50	nil	3-12

- Farm machineries like weeder , planter, harvester etc.

** Food security is in terms of months consumption of rice from own production in the current situation, even after the increase in production

From the above table it is can be presumed that the farmers of different study area are undergoing different phase of the stabilization process. But this information is not sufficient to explain the actual scene in the field since all the information is on the percentile basis .The phases under which the different study area is undergoing can be well explained by the type of farmers in each study area.

On the basis of the degree of precision in following up of intercultural process of kharif paddy cultivation, farmers can be grouped Adopters, Partial Adopters and Non Adopters.

Adopters are the farmers who follow the practices as recommended in the POP. Their degree of involvement in each practice is high.

Partial adopters are the farmers who follow some of the practices as recommended in the POP and the degree of involvement in the followed practices is poor.

Non Adopters are least follower of recommended practices. They hardly involve in any practices while cultivating paddy, for the sake of cultivation they are cultivating.

On the basis of information collected and observation of the researcher, there is some estimation of composition of farmers in different study area is drawn in the following table

Name of area	% of Adopters	% of Partial Adopters	% of Non Adopters
Gumla	Nil	75	25
Khunti	Nil	60	40
Ranchi	Nil	70	30
Deoghar	Nil	80	20
Saraikala	Nil	60	40

The above analysis brings us to conclusion that farmer of different study area under different partners are undergoing different stages of stabilization process as mentioned above. It is now easily affirm that hardly farmers of any area achieved pro settlement stage. Gumla, Khunti and Deoghr is undergoing transition mode from settlement to pro settlement stage. Farmers of rest of the areas are either in pre settlement or in settlement stage. The requirements of the farmers undergoing different stages of adoption are important point while promoting POP. The proper fulfillment of these requirements helps in upgrading of farmers towards succeeding stage.

System of rice intensification as a component of kharif Paddy stabilization process:

In some parts of the intervention area, partners PRADAN, NEEDS and KGVK are promoting SRI among the farmers for their up gradation from settlement stage to pro settlement stage in the development cycle.

This effort is very much significant and the adoption rate is uniform and yield obtained by the farmers is also very satisfactory. The rate of adoption of POP and the level of precision of different practices are also appreciable. Partners are popularizing the POP of this system of production of paddy very appreciably which results in substantial yield augmentation of paddy as compared to the conventional methods. Yield augmentation is triple as compared to normal kharif paddy cultivation. The maximum yield recorded from SRI in the study area is 12.9MT per ha whereas minimum yield recorded is 6.5MT per hectare.

Few practices like water management and labor intensive practices like weeding and transplantation need special attention and high skill labor. In study area these practices yet to be refined in terms of skill required, management and mechanization.

The partner organizations specially PRADAN and NEEDS are supporting farmers practicing SRI with all sort of necessary training in developing skill of practices like nursery raising ,transplantation, weeding etc.

Huge biomass is required in terms of organic manure in SRI practice of paddy cultivation. Partner organizations are also facilitating the farmers in producing vermin compost which can be utilized in SRI practicing fields for better production of paddy.

Though the POP for SRI is rigorous still it can be termed as dynamic practice where there are provisions in change in coping up the geographical and seasonal variances. In Jharkhand the SRI is very much location specific because of the topography and provision for water management. Farmers have started practicing SRI in the fields where there is provision for water control. But now a days in some areas especially in Gumla and Khunti districts the SRI practicing

farmers cultivating rice in this methods in rainfed condition in undulating topography by managing flow of water with the help of contouring the field. Partner organizations are trying to develop some water harvesting structures in many locations in the state which are facilitating water management in SRI fields.

The comparison of POP of both conventional kharif paddy cultivation and the POP of SRI reveals that SRI requires much more precision in following up of the cultivation practices than the conventional method. Some practices like transplantation of 10days old seedling at a rate of single seedling in one hill, alternate wetting and drying of field etc. requires proper skill. Farmers need to undergo training for practicing these methods. The risk involvement in SRI cultivation in kharif paddy is higher than the conventional methods. Heavy downpour just after transplanting cause mortal of the seedlings and many a times water control may not be possible in the topography posses in Jharkhand.

Looking at these types of issues related to SRI practices it can be deduced that SRI is convenient for the farmers who are partial adopters and undergoing settlement stage of growth who has sufficient proficiency in following up cultivation practices with precision and have the ability to withstand the risk involved.

The challenge of making these practices affordable to farmers will be achieved within very short period of time because of the motivation of the farmers and their involvement in maneuvering the practices according to their field conditions. SRI can be considered as a future aid or tool for the up gradation of farmers to a succeeding stage after attaining the settlement stage. This will enhance the economic activities by providing surplus food production of rice in the state.

Factors affecting Kharif Paddy stabilization:

The process of stabilization of kharif paddy in Jharkhand is affected by some external and internal factors. These factors govern the farmers in adopting practices recommended in POP.

- The main factor is typical undulating pattern of land.
- Scarcity of water , uncertainty in rainfall and lack of irrigation infrastructure
- Availability of support system
- Mental setup of farmers
- Labour availability during transplanting and harvesting
- Lack of finance

The state Jharkhand is characterized by undulating topography availing the land pattern comprises of three strata

Upland locally known as *Tarn*, mid land locally known as *Dond2* and low land this is locally known as Bera.

The water retention capacity of these layers is different. This classification of land type is varied according to the terrain of the particular area.

Scarcity of water is always hindering the paddy production in the state though the annual rainfall of Jharkhand is sufficient. Uncertainty of rainfall during the critical stages of growth of paddy occurs particularly in three stages.

First uncertainty is during the preparation of nursery bed that is during mid of June to end of June.

Second uncertainty is seen during transplanting paddy from nursery bed to main field in the month of end July to mid August.

Third uncertainty arises from September (Hatia Nakhstra) rain. During this period crop undergoes panicle initiation stage where the water requirement is high. Failure to rain in this stage causes lower yield of paddy.

The irrigation infrastructure was very poor in the study area. There are very few open wells and lift irrigation facilities seen some pockets of Deoghar and Saraikala area.

Support system mentioning here refers to the group of stakeholders in the cultivation of paddy in a particular area. In study area the support system includes the government agency, department of agriculture and irrigation, rural development, other development agencies, private agency like dealers and retailers of seeds and pesticides, fertilizer, FCI warehouse etc. In study area the support system is not functioning in proper way they are expected to perform.

They are not efficient in supply of input like seed and fertilizer. Government supply seeds and fertilizers which are not sufficient in quantity.

Information dissemination in terms of extension services by government department is very poor in the study area. 95% of farmers interviewed during study denied the guidance of agricultural extension workers in cultivation process.

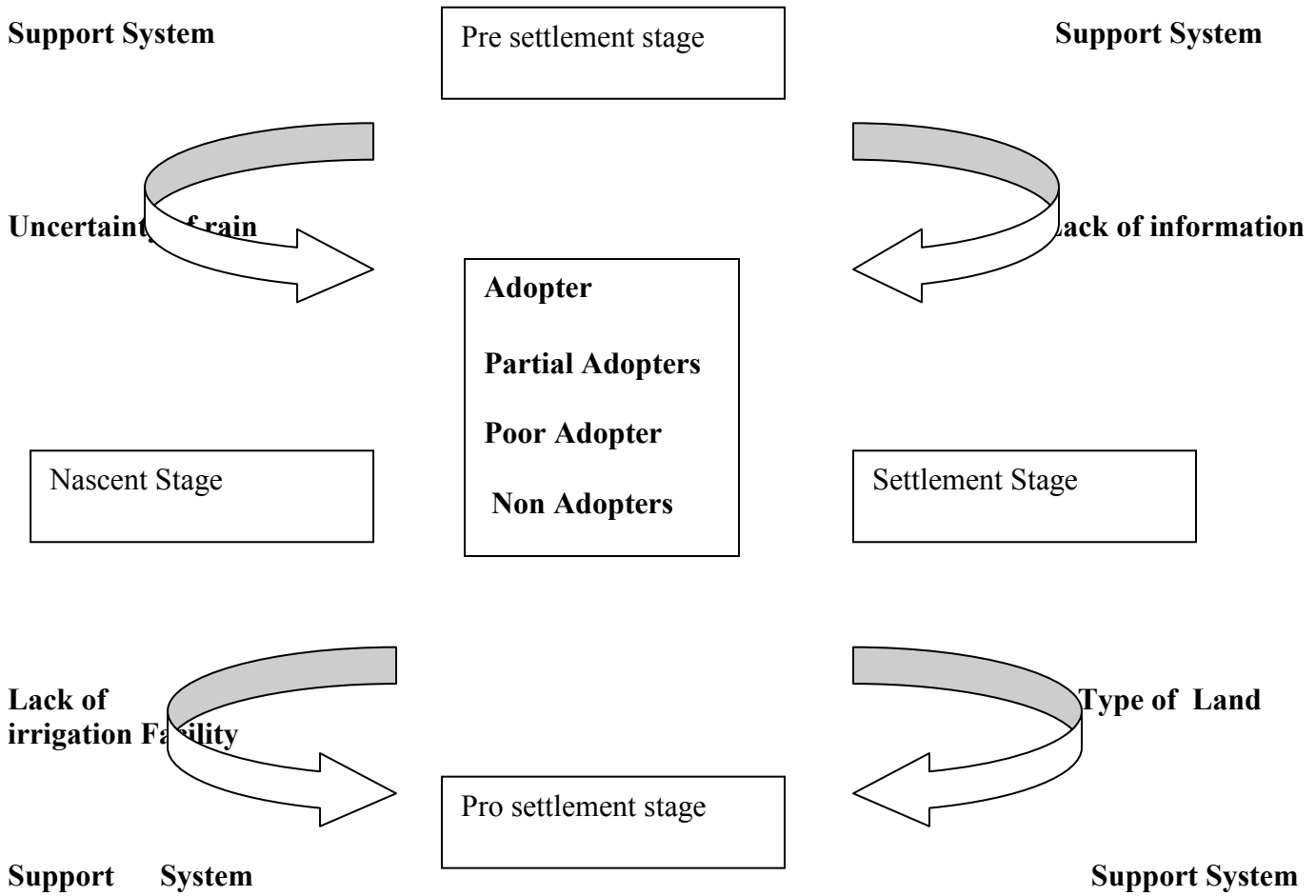
There are private seed and pesticide dealers are available in the proximity of the farmers in local market, but they more commercial than the genuine. They sell products like chemicals available with them irrespective of type of disease and pest occurred in the field.

Farmers recognize very few development organization working consistently in the field of agriculture specially rice intensification who can provide them better guidance in the field of cultivation. Tribal population in the interior villages is lack of any sort of exposure of outside world and so there is some sort of blockage lurking in their mindset. Because of such mindset they want to enclose their activity within their traditional methods and culture. Improved type of practices is not in the vogue of these tribal farmers and that is why they get hold of longer time to adopt the practices recommended in the POP.

Improved practices need consistent effort for efficient functioning of cultivation methods. This requires skill and availability of labor. In the study area availability of labor is always a problem especially during transplantation and harvesting.

The lack of credit facilities to purchase the required input is an important factor that affecting the adoption of POP of kharif paddy in the state of Jharkhand. The existing credit system is with private money lenders with higher rate of interest and sometimes in exchange with the crop after harvesting. But failure of crop due to uncertainty in rain and other natural disaster makes farmers in trouble while repaying back of loan. PRADAN has some SHG mechanism for micro financing but in the study area no farmers responded as a loan holder from micro finance institution or bank to invest in agricultural activities.

Correlation between the factors and the different adopters undergoing different stages of adoption:



Recommended Strategies for future course of Action:

1. Upgrading of farmers from existing phase to subsequent phases :

It is being understood the partial adopters dominate all the study areas and no farmers is an adopter and no area is undergoing pro settlement stage. Depending on the resource availability and constraints or factors each area to be upgraded from pre settlement stage to settlement and from settlement to pro settlement stage.

Action points:

- Awareness generation among the farmers about improved practices and their benefits with the help of campaign and other promotional activities like distribution of package and practices of rice among the farmers written in local language.
 - Strengthening of linkage between the farmers and the support system. This will facilitate the farmers in easy access of input as well as the information.
 - Indoctrination of improved methods like SRI, technologies like water harvesting and better inputs like hybrid seeds and green manure machineries like weeder, planter, harvesters etc.
2. Customized support to different group of farmers undergoing different phases of growth. For up gradation of farmers in the stabilization process, the requisites of the farmers undergoing different phases of stabilization process are varied according to the area, resource availability, type of farmers etc. Providing customized support will be more justified in this varied situation for better adoption of the improved practices.

Action points:

- Capacity building of the farmers according to their needs. The farmers in the pre settlement stage may require skill of row transplanting whereas requisite of farmers of settlement stage may be SRI methods.
 - Input supply also should be need based considering the prevailing situation. It is being observed in the study area that only high yielding varieties of seeds and limited amount of fertilizer and lime is supplied to the farmers every year. It will be more effective if farmers are provided with the package of input depending upon their size of land in subsidized rate or with some other terms and conditions.
3. Visibility of program activity
- The program activities in the study area should have some visibility in terms of quantitative and qualitative form. This sort of visibility of program can be achieved by integrated approach. The stabilization of kharif paddy should be clubbed with other program like water management or livestock rearing etc. That type of program may be of self or run by other agencies or government scheme.
 - Proper follow up of input supply along with POP activities will be an important action for helping in better adoption of the POP which is not prominent in the study area.
4. Attempt for sustainability: To make the kharif paddy as a stabilized crop in terms of cultivation and settlement of community for long time, there is always need of sustainable attempts by the agencies or partners. So that after the withdrawal of program activities farmers are self motivated as well as proficient to carry out their production process.

Action points:

- Strengthening of support system in the area. A strong support system helps in making the farmers equipped and informed which makes their agricultural activities sustainable.
- Support system will be of no use if there is no linkage with the farmers. Effort should be made to make the farmers accustomed with the prevailing support system to attain a sustainable agricultural system.
- For greater penetration of program activities and sustainability of them, there is need of withdrawal from one area and launching in new area. The abrupt withdrawal will be damaging for the flow of the

agricultural activities among the farmers. It is wise to withdraw in phase wise from a particular area of intervention when the cultivation practice of farmers of that area becomes stabilize.



Photo 2 : Puddle field ready for transplantation

Package of Practices of Kharif Paddy for Jharkhand

This POP is based on the methodology, where selecting the low cost practices followed by majority of farmers in the study areas which give optimum yield and the review of POPs recommended by different partners and the POP published by department of Agriculture of Government of Jharkhand.

Common name: Rice

Scientific Name: Oryza sativa

Name of recommended Varieties

Name of variety	Type of land	Type of seed	Duration (days)	Recommended Seed Rate (kg per hectare)
Swarna /MTU7029	Low land	HYV	150	40-45
Lalat	Midland	HYV	120	45-50
IR 36	Midland	HYV	120	45-50
Ranjit	Low land	HYV	150	45-50
Beramalti	upland	Local	90	55-60
Birsa dhan101	upland	HYV	90-95	45-50
Lohana	Upland	local	90	55-60

Nursery management

Seed Treatment:

- Salt water (1.08 g m per liter) treatment of seed (5 kg in 20 liter of water) to select bold seeds.

Soil Treatment:

- Phorate 10 G @ 12.5 kg per ha should be mixed with soil before sowing.

Method of seed bed preparation:

- Prepare a raised seedbed keeping 1.0 to 1.5 m width and of convenient length keeping 30 cm distance between the two beds for irrigation/drainage
- Application of FYM one ton per 1000 m²
- Apply nitrogen (5 - 10 kg N), 5 kg Phosphorous and potash 5 kg fertilizer for every 1000 m²
- Apply double dose of phosphorus under low temperature conditions.
- One time weeding in nursery within 3 - 4 days after sowing nursery to control weeds effectively
- 4 leaf stage of seedlings should be uprooted and transplanted

Nursery Area: 1/20th parts for one hectare

Time of sowing: 7th June to 30th June depending on variety.

Number of days Seedlings in nursery bed: 15-20 days



Photo 3 : Uprooted seedlings ready for transplantation

Main field preparation:

Direct sowing: 2 to 5 ploughings and repeated weeding before sowing of germinated seeds. Puddling should be done just before sowing.

Transplanted:

2 to 3 ploughings one month before the transplantation followed by 2 to 3 ploughs, weeding and bounding of the four sides of the plot and ultimately puddling should be done 7 days before transplanting for incorporating the weeds in to the soil.



Photo 4: Fertilizer top dressing before transplanting

Spacing: 15cm plant to plant

10 cm row to row

Date of transplanting: 15 July to 15 August

Number of seedlings per hill: 4 to 5 number of seedlings per hill

Nutrient Management:

Direct sowing paddy:

For upland in case of local varieties:

Name	Dose kg per ha
Farm Yard Manure	1000
Urea(Nitrogen)	80
DAP(Phosphorous)	40
MOP(Potassium)	40
Lime	300-400

Method of Application: The FYM and lime and one fourth urea , full MOP and DAP should be applied as basal application. Rest of the fertilizers should be applied in three split doses.

First split dose should be applied during 15 to 20 days after transplanting during weeding.

Second dose of urea should be applied during tillering stage.

Last dose of urea should be applied during panicle initiation stage.

Transplanted Paddy:

Name	Dose kg per ha
Farm Yard Manure	5000
Urea(Nitrogen)	135
DAP(Phosphorous)	87
MOP(Potassium)	33
Lime	300-400

Method of Application of Fertilizer: The FYM and lime should be applied during the final land preparation.

One third of Urea and full dose of DAP and MOP should be applied in the time of final land preparation.

First top dressing should be done during tillering stage 3 to 4 weeks after transplanting.

Second topdressing of urea should be done during panicle initiation stage, 6 to 8 weeks after transplanting.

This time varies according the type of variety of seed and duration of the seed.

Irrigation and Water Management:

There should be sufficient water in the puddle field while transplanting. 5-7cm standing water should be available till the booting or milking stage of the crop.

In the medium or upland situation crop should be irrigated 4 to 5 times within 15-20 days interval

Weed Management:

Weeding is very important in both the upland and low land cultivation. Upland cultivation is more prone to weed infestation than the low land situation. Because of water logging situation of low land condition weed growth is restricted.

For upland and medium land 5 to 6 weedings within 15 days interval is recommended. Manual and mechanized weeding with the help of cony weeder in low land situation is useful for better harvest of paddy.

Major Disease and their control Measures

Name of disease	Local Name in Jharkhand	Symptom	Chemical control	Physical Control
Blast	<i>Jhulsa</i>	Brownish red colour eye shaped spots on the leaf and sheath. Blackening of affected nodes and ultimately the falls off.	Application of Bavistin50WP@0.1% Can control blast in rice	Destroying of affected plants and burning them.
Sheath Blight	<i>Patrwaran Angmari</i>	This disease occurs during tillering stage, makes the sheath white in color, and leaves become dry.	Application of Validamycin @0.25% May control this disease	Draining out the Logged water from the field and application of additional amount of potash @30Kg per hectare. The last topdressing of nitrogen should be delayed.
False Smut	<i>Abhasi kanda</i>	Affected plants bear grains without filling. The panicle appears to be large green velvet look.	Bavistin@0.5gm/litre Of water should be sprayed in 5 days interval just before grain filling stage.	
Bacterial Leaf blight	<i>Patra Angamari</i>	Yellowing of edges of Of leaves of affected plants and slowly lower portion also becomes yellow and leaves become completely dry.	Application of Streptocyclin 6gm per 60 liters of water should be done when the attack is severe	Selection of healthy seeds. Application of nitrogen should be in proper dose.

Major pests and their control Measures:

To make the crop free from the pest , a prophylactic measure can be done by Carbofuran 3g or Phorat10g per hectare can be applied 3weeks after transplanting.

Name of Insect	Local Names in Jharkhand	Physical control	Chemical Control
Gandhi Bug	<i>Gandhi kit</i>	Lighting of flame in the corner of the plot in evening time	Application of Endosulfan 4% dust will kill Gandhi bug
Stem borer	<i>Char chedak</i>	Heavy ploughing of field after the previous harvest to avoid the life cycle of this insect	Application of Carbofuran 3G @ 25 kg ha - 1 or Phorate 10 G @ 10 kg ha - 1
Gallmidge	<i>Sarha</i>		Phorate 10 G @ 10 kg ha - 1 or fipronil 0.3 G @ 25 kg ha - 1.
Rice Hispa	Not known	Draining out the field.	Apply Endosulfan 35 E.C. @ 1.25 lit./ha or Phosphymidon 85 E.C.@ 300 ml/ha.
Leaf Folder	<i>Patralapetak</i>	Tipping of the upper part of leaves with the help of bamboo strips.	Same as above
Rice case worm	<i>Bakaya</i>	Passing a long rope immersed in kerosene over the standing crop. This will make the larvae Fall down in standing water. Later on water is drained out from the field	Apply Malathion5% Dust 25kg per hectare in the affected field

Harvesting: Harvesting of paddy should be started as soon as the 80% grains are filled and starting golden coloring of the grains. Delay in harvesting cause the falling of tillers and ultimately yield of paddy suffers.



Photo 5: Threshing after bumper harvest in Deoghar district during the end of December 2009

Post Harvest: After harvesting threshing of paddy is done manually and with the help of manual threshers which is followed by winnowing and drying of grains before storage.

Recommended Yield: 40-50 qt/ha

Seed Preservation: The seeds for future propagation should be harvested by selecting matured seeds from the plants that are free from disease infection, insect infestation and exposure to alternate wetting and sun scalding. The collected seeds sorted by winnowing and sieving to remove chaffs, weed seeds, soil and other inert particles. After cleaning, seeds should be dried under bright sun shine for a day to avoid moisture in the grains. Dried seeds should be put in a clean dry earthen pot and the earthen pot should be painted with coal tar or some paints in its both internal and external side. At the base of the pot and above the seeds, dry Neem leaves should be spread and cover the mouth of the pot by making it air tight.

References:

1. Book; *Mainstreaming The Margins* by Sanjiv J . Phansalkar & Shilp Verma
2. Kharif Paddy Intervention in Purulia District of West Bengal- A Study by Arnab Chakraborty.
3. Rice Varieties in East India : Publication of USDA.
4. Handbook of Agriculture: ICAR Publication

Table 1. Name of the villages of different districts of Jharkhand

Name of district	Name of Partners	Name of block	Name of villages
Ranchi	KGVK	Bundu Ranchi	Madhukolma Salgadih Borkalma Chotokalma Tau Gutihatu Gosaidih Heth Kanchi
Deoghar	NEEDS	Palojori	Bajinathpur Amagachi Sagrajor Rampur Dumariya
Saraikala	TSRDS	Kharsawan	Mosodih Baksahi
Gumla	PRADAN	Raidih, Gumla	Chhati Kurag Kundu
Khunti	PRADAN	Torpa, Khunti	Kinsu Sundari Bortoli Sundari Pakartoli Sundari Pasartoli

