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INTERNATIONAL CROPS RESEARCH
INSTITUTE FOR THE SEMI-ARID TROPICS

Comprehensive Project on Rice Fallow Management (2022-23)

Project Report

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Directorate of Agriculture and Food Production
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Government of Odisha

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Executive Summary

The Comprehensive Project on Rice Fallow Management is a transformative initiative launched by the Directorate of Agriculture and Food Production, Government of Odisha for the intensification of pulses in *rabi* (post-rainy) fallows. The project's primary goal is to enhance pulse production in the state, thereby addressing food security and nutritional challenges and improving farm income. During the first year of the project (2022-23), the International Crops Research Institute for the Semi-Arid Tropics **(ICRISAT),** partnered with the Department of Agriculture and a local NGO for the implementation of demonstrations of pulses in 5000 hectares (ha) in Koraput district.

The project adopted a scientific approach by using GIS and remote sensing technology for the selection of suitable areas and collected baseline data on soil health and information from demonstrators followed up by an endline survey a few months after the harvest. Through a careful cluster identification and selection process, suitable areas were identified for demonstrations in consultation with the department officials. Participating farmers were supplied with the seeds of improved varieties of pulses (chickpea and black gram), along with the recommendations and support for best agricultural bio-intensive practices. To ensure effective implementation, ICRISAT used a modern digital tool for monitoring and evaluation.

Findings reveal promising outcomes in the targeted areas. Remarkably, the initiative inspired 61.9% of participating farmers to cultivate a second crop for the first time in the last five years, underscoring its significant impact. The land left fallow during the previous *rabi* season decreased significantly, from 83.3% to 41.7% in the demonstration area. Pulse production at the household level showed a significant increase as compared to the previous years. Most of the farmers (75.2% of black gram and 63.1% of chickpea) sold a portion of their harvest, while 64.8% of black gram and 61.4% of chickpea growers saved seeds for the next season. Importantly, food security and nutritional status improved, with per capita daily pulse consumption escalating from 31.7 grams to 40.2 grams, aligning with the Indian Council of Medical Research guidelines which recommend 40 grams per person per day. The results indicate a significant enhancement in the minimum dietary diversity among women (MDD-W) aged 15-49 years rising from 29.7% to 43.9%. The project has evidenced a positive impact on the farm income of the demonstrators, reflecting a 34.0% income hike from *rabi* farming and an overall (entire cropping season) 10.1% increase from all farming activities, in comparison to previous years. The project presents a successful model for the intensification of pulses in rice fallows and holds significant implications for policymakers advocating for the scaling of this approach.

Highlights

01

The Comprehensive Project on Rice Fallow Management inspired 61.9% of participating farmers to cultivate a second crop for the first time in the last five years.

02

Land left fallow during the previous *rabi* season significantly decreased from 83.3% to 41.7% among participating farmers.

03

The average productivity for black gram reached 6.2 q/ha, achieving a maximum production of 8.2 q/ha (SD : 0.8). For chickpea the average productivity was 6.4 q/ha, reaching a maximum of 10.4 q/ha (SD : 1.5).

04

The yield comparison among different sowing dates was significantly visible irrespective of the crop and its duration, however, chickpea exhibited higher yield penalty and poor crop growth when it was sown late in rice fallows. The yield reduction in late-sown plots is attributed to the depletion of moisture in the fields.

05

About 75.2% of black gram growers and 63.1% of chickpea growers, sold a portion of their harvest.

06

64.8% of black gram farmers and 61.4% of chickpea growers retained seeds for the subsequent year's production.

07

The results indicate a significant enhancement in minimum dietary diversity among women (MDD-W) aged 15-49 years rising from 29.7% to 43.9%, with pulses playing a substantial role in achieving this improvement.

08

Cultivating *rabi* pulses substantially improved local food security and nutritional status, with per capita daily pulse consumption increasing from 31.7 grams to 40.2 grams, aligning with the ICMR guidelines which recommend 40 grams per person per day.

09

The project evidenced a positive effect on the farming income, reflecting a 34.0% income increase from *rabi* farming and an overall 10.1% increase from all farming activities.

1. Background

The rice-fallows cropping system poses a significant challenge in South Asian agriculture, covering a vast expanse of 14.6 million ha, with India accounting for 80% of this area. The undulating to hilly Eastern Plateau region, comprising the states of Odisha, Jharkhand, Chhattisgarh, Bihar, and West Bengal, is particularly affected by this phenomenon.

Rice fallows refer to the areas where paddy is cultivated during the *kharif* (rainy season) but remain uncropped during the subsequent *rabi* (winter) season due to various constraints. The reasons for leaving these lands fallow during the *rabi* season are multifaceted. Challenges include the lack of irrigation facilities, the cultivation of long-duration rice varieties, early withdrawal of monsoon rains leading to soil moisture stress at the time of winter crop planting, lack of moisture in November and December, and socio-economic issues such as the presence of stray cattle. These factors collectively hinder the cultivation of crops during the *rabi* season, resulting in unutilized agricultural potential and missed opportunities for improving food security and farm income.

To address these challenges and utilize the potential of rice fallows, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) partnered with the Department of Agriculture, Government of Odisha to implement the "Comprehensive Project on Rice Fallow Management" with the support of the Government of Odisha.

The primary rationale of the project is to scale the production of short-duration pulses in rice fallows to improve the livelihood of the farmers through enhancement of income, reduction of malnutrition, and improvement of soil health.

2. Objectives

The specific objectives are as follows:

A Upscaling the area of pulses in rice fallows by exploring residual soil moisture.

B Restoring soil health by increasing the soil biomass and organic carbon of soil.

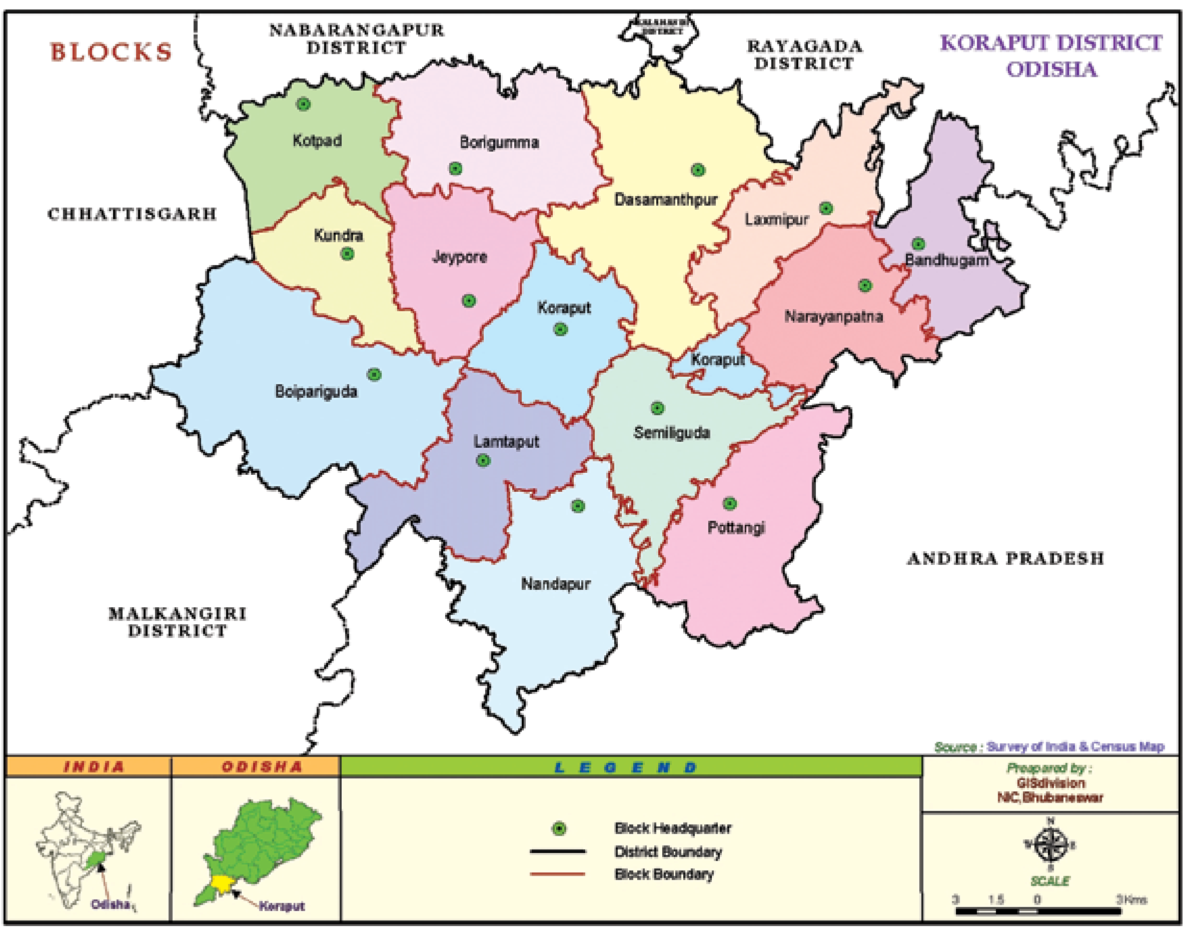
C Enhancing the livelihood of farmers through improved income and nutrition.

3. Environment & Socio-economic Status

3.1. Geography

The project primarily focused on the heartland of the tribal community in Koraput district of Odisha. The district is in the Eastern Ghats and is renowned for its rich biodiversity and unique tribal culture. Using GIS and remote sensing data demonstration sites were selected in eight blocks namely, Borigumma, Jeypore, Kotpad, Koraput, Nandapur, Lamtaput, Kundra, and Dasmantpur.

Figure 1: District Map Koraput, Odisha



3.2. Climate

The district is characterized by a tropical monsoon climate, deeply influencing its agricultural patterns and crop choices. The majority of the district's rainfall, averaging around 1600 mm annually, is precipitated during the monsoon months that extend from June through October. This substantial and predictable rainfall provides an essential resource for cultivation in the *kharif* season but falls short during the *rabi* season. The district enjoys a wide temperature range, from a mild low of 13°C during winter to a high of 35°C during peak summer. This broad thermal range creates a conducive environment that supports the growth of a wide range of crops and endorses the region's agro-biodiversity. The climate's features, characterized by a distinctive monsoon season and a favorable temperature range, play a crucial role in shaping the district's agricultural productivity and crop choices.

3.3. Socio-economic aspects

The district is home to several tribal communities, each with its unique culture and traditions. Most of the population is dependent on agriculture for their livelihood. The income levels are generally low, and there is a significant prevalence of poverty. The project's focus on enhancing farm income and nutrition through the intensification of pulse cultivation in rice fallows is thus highly relevant and crucial for the overall socio-economic development of the district.

4. Methodology

4.1. Selection of sites and partner

The project started the process of identifying suitable rice fallows across Koraput district for cluster demonstrations of short-duration pulses by using Geographic Information System (GIS) and remote sensing technologies that provided précised and accurate data about the geographical characteristics of the rice fallows. ICRISAT collaborated with Pragati, a local partner, having invaluable local knowledge and expertise that aided the physical identification of suitable rice fallows and the beneficiaries in consultation with the district agriculture officials. This technology-driven approach along with the local partner's expertise was instrumental in the identification of a suitable rice fallow area of 5000 ha across eight blocks of Koraput district namely Kundra, Kotpad, Borigumma, Jeypur, Koraput, Nandapur, Dasmantpur, and Lamtaput. This targeted approach aimed at capitalizing on the residual moisture in areas previously left uncultivated during the *rabi* season.

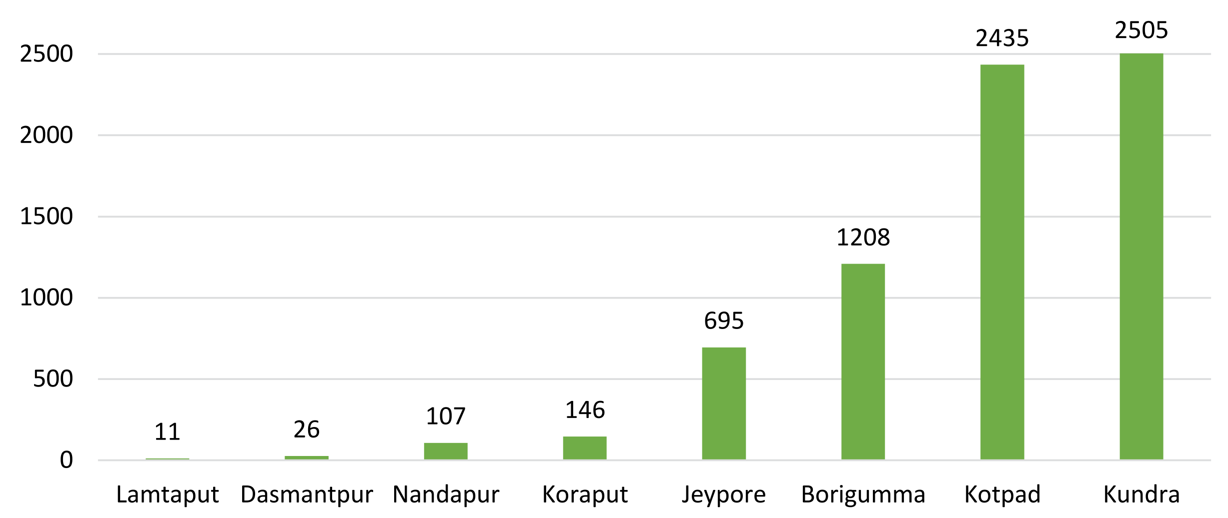
The project maintained a close association with district and block-level agricultural officers and local administration throughout the cropping season. Pragati ensured regular communication with ICRISAT, fostering seamless coordination, sharing of insights, and prompt resolution of challenges encountered during the cropping season.

In a move to enhance data management and project monitoring, ICRISAT developed an Android-based beneficiary registration tool and a comprehensive monitoring system using Open Data Kit (ODK). The system facilitated comprehensive data collection and maintenance encompassing soil sampling, GPS data along with geo-fencing data, detailed beneficiary records, input distribution data, baseline and endline evaluation, cost of cultivation, technical data of crop management, yield, and post-harvest information. This extensive data management system ensured the regular tracking of progress and informed decision-making, ultimately contributing to the success of the project. The final data about the beneficiaries and other details were finally uploaded on the Government of Odisha portal (ADAPT).

4.2. Selection of farmers

ICRISAT, post finalizing the blocks, proceeded with a systematic and inclusive process to identify and select the participating farmers. Given the nature of the project, which provided only partial support for inputs and other operations, it was paramount to ensure that the selected farmers were willing to participate. To ensure that farmers fully understand the aims and objectives of the initiative, participatory meetings were organized at the village level with the help of the local partner. Here, the objectives of the demonstrations,

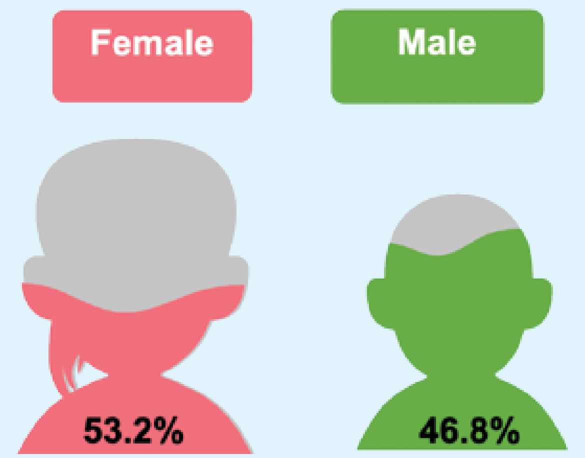
Figure 2: Block-wise distribution of registered beneficiaries.



the expectations from the farmers, and their roles and responsibilities were clearly explained. Moreover, detailed information regarding the production technology of short-duration pulse varieties was provided to both the farmers and the personnel from the local NGO partners, ensuring that no ambiguity or miscommunication could lead to incorrect selection of fields or farmers.

To efficiently organize these demonstrations and ensure they met the desired objectives, ICRISAT trained 27 volunteers from the partner organization to use mobile applications specifically designed for farmer registration. This effort was accompanied by an impressive 120 village-level meetings aimed at orienting farmers about the specificities of the chosen varieties, seed treatment, and other input applications.

To promote inclusivity, efforts were made to ensure an equal gender ratio during the farmer registration process, emphasizing the project's commitment to gender equity in agricultural initiatives. Additionally, to enhance effective on-ground coordination between ICRISAT, partner organization, and the farmers, block coordinators were appointed for each block. Additionally, ICRISAT deployed two Research Associates to monitor and support the partners, ensuring seamless interactions with the participating farmers and regular updates to government officials on the developments on the ground.



**Distribution of gender of the registered beneficiary (n = 7133)*

4.3. Soil sampling

Understanding the soil's health and characteristics is critical for effective agricultural practices, particularly for intensification. The soil

Table 1: Block-wise collection of soil samples.

Name of the block	Number of Soil Samples Collected
Kotpad	80
Kundra	60
Borigumma	55
Jeypore	45
Koraput	40
Nandapur	40
Dasmantpur	35
Lamataput	23
Total	**378**

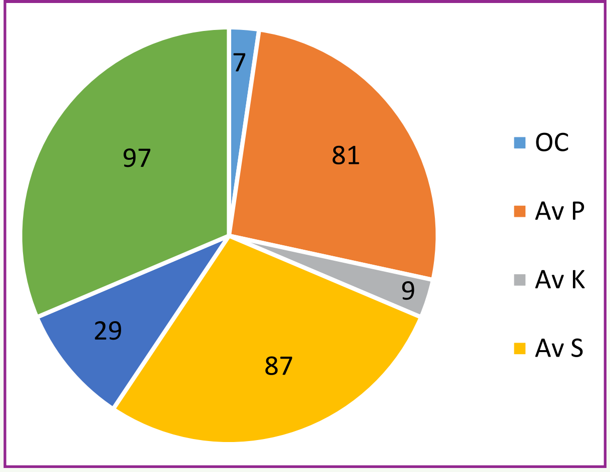
sampling exercise undertaken for this project not only ensured accurate assessment but also laid the foundation for informed decision-making for future agricultural interventions.

A total of 378 units of representative soil samples were scientifically collected, processed, and analyzed at the state-of-the-art laboratory in ICRISAT, Hyderabad. Samples were critically analyzed for all the essential nutrients along with pH, organic carbon, and electrical conductivity. Analysis results showed that 98% of soil samples were found to be acidic with a mean pH value of 5.4. The soluble salt content was found to be normal with a mean EC value of 0.1 dS/m. The organic carbon content of the soils was found good having a mean value of 0.8% which suggests conservation agriculture practices can help maintain organic carbon content.

Among primary nutrients, phosphorus was found to be deficient in 81% of the soil samples with a mean value of 11.5 kg/ha. Potassium content was found to be optimum with a mean value of 266.5 kg/ha. Application of 25% higher doses of phosphatic fertilizer can be beneficial for getting higher yields as per the research-based recommendation of the State Agricultural University, Odisha.

The secondary nutrient, Sulphur, was seen to be deficient in 87% of the soil samples analyzed, while the rest of the other secondary nutrients were found to be above the critical limits. The availability of sulfur content in the soil is around 7.2 ppm. Gypsum or pyrite can be applied to improve sulfur availability in the soil. Alternatively, $ZnSO_4$ foliar application on the crops during peak flowering season can help overcome the sulfur deficiency.

Figure 3: Percent nutrient deficiency in soil.



Boron and zinc deficiency was found to be significant in the soils of Koraput. About 97% of the soil samples were found to be deficient in Boron, whereas 29% of the soil samples were deficient in zinc. These two micronutrients help control flower dropping and improve the quality of produce. These micronutrient fertilizers were replenished by applying 25 kg of zinc sulfate (21%) and 5 kg of boron (20.5%) per ha.

5. Project Implementation

5.1. Input distribution

Taking into account the short window for sowing pulses after the harvest of rice, ICRISAT prioritized the timely procurement of seeds and other essential inputs for seed treatment, including Phosphate Solubilizing Bacteria (PSB), Trichoderma, and Rhizobium. Certified seeds were procured from reliable entities like the National Seed Corporation (NSC) and Telangana State Seed Development Corporation (TSSDC). Each lot of seeds underwent a rigorous inspection process led by the Chief District Agriculture Officer (CDAO). The seeds were also subjected to a germination test to ensure their viability and the highest possible quality before distribution.

Each selected farmer received quality seeds, seed treatment inputs including PSB, Trichoderma, and Rhizobium, need-based pesticides, pheromone traps, solar light traps, and sticky traps apart from micronutrients and pesticides for pests and diseases. This strategy of supplying certified seeds along with other supportive quality inputs not only facilitated their immediate use but also increased overall productivity. This comprehensive support allowed farmers to commence their crop cultivation promptly and effectively.

Table 2: Distribution of demonstration area and seeds by block

Blocks	Chickpea				Black gram			
	No of GPs	No of Beneficiary	Area (In ha)	Seed Distributed (In Qtls)	No of GPs	No of Beneficiary	Area (In ha)	Seed Distributed (In Qtls)
Borigumma	20	837	599.4	239.8	17	389	233.6	46.7
Dasmantpur	2	26	14.1	5.6	–	–	–	–
Jeypore	7	442	336.7	134.7	8	420	223.7	44.7
Koraput	3	146	70.4	28.1	–	–	–	–
Kotpad	15	1814	850.9	340.4	12	1180	763.0	152.6
Kundra	12	1633	824.8	329.9	15	1543	1044.4	208.9
Lamtaput	4	11	6.6	2.6	–	–	–	–
Nandapur	4	53	12.9	5.2	6	63	19.5	3.9
Total	**67**	**4962**	**2715.8**	**1086.3**	**58**	**3595**	**2284.2**	**456.8**

5.2. Capacity building

Capacity building is a pivotal aspect in ensuring the success of any agricultural initiative. By empowering stakeholders through skill enhancement and knowledge sharing, it's possible to establish a sustainable model for agriculture that is rooted in informed decisions and best practices. Here's a detailed explanation of the various training components of this project:

5.2.1. Training of volunteers for farmer's registration

A specialized training session was conducted specifically for 27 field technicians from the partnering organization. The focus of this training was on the use of an ODK based mobile application, a tool specifically designed to facilitate farmer registration and collect demographic data. The systematic delivery of this training played a vital role in simplifying and streamlining the farmer registration process and gathering essential data. This process was key to the project's successful execution, enabling effective management and consistent monitoring.

5.2.2. Training for baseline survey

A 3-day intensive training was conducted to equip 22 enumerators with the necessary skills for carrying out baseline surveys using mobile-based Computer-Assisted Personal Interviewing (CAPI) tools.

5.2.3. Soil sampling training

A focused training was conducted for 20 technicians. They were trained in soil sample collection techniques, enabling them to gather soil samples accurately and ensuring reliable soil health assessment data.

5.2.4. Farmer's orientation for varieties & seed treatment

To educate the farmers about varietal characteristics and seed treatment techniques and recommended agronomic practices to be followed for the crop demonstrations, 120 training sessions were conducted. These hands-on training sessions equipped farmers with practical knowledge of crop management and seed production, preparing them to maximize their yields.

5.2.5. Farmer's field days and awareness creation

Throughout the project, more than 50 Farmers' Field Days were systematically coordinated in strategic locations. The primary aim of these field days was to create awareness, expand knowledge, and share pertinent farming technologies among the local agricultural community. These informative events operated as engaging platforms, granting farmers from neighboring villages the chance to witness, learn, and gain direct insights from the project's on-field demonstrations. Through this hands-on approach, the farmers could intimately understand the nuances of pulse production techniques. This exposure significantly expanded the reach and amplified the impact of the project, transforming the local agricultural dynamics.

Additionally, training was provided to two Farmer Producer Organizations (FPOs) associated with our partner organization. These trainings focused on enhancing the FPOs' abilities to produce and use quality seeds locally. This crucial capacity-building initiative not only reinforced the project's commitment to sustainable agricultural practices but also empowered these FPOs to contribute more effectively to their local agricultural ecosystems.

5.2.6. Crop-cutting training

A total of 10 training sessions on conducting crop-cutting activities scientifically were attended by 25 Community Resource Persons (CRPs) of the partner organization and selected farmers from both chickpea and black gram clusters. These trainings ensured precise yield measurements, which are essential for assessing the project's impact.

5.2.7. Training for GPS data collection

A 2-day training session was organized to equip 20 enumerators with skills in collecting GPS

data using mobile phones. This training was key to accurately mapping the demonstration sites and helped in the overall monitoring and management of the project.

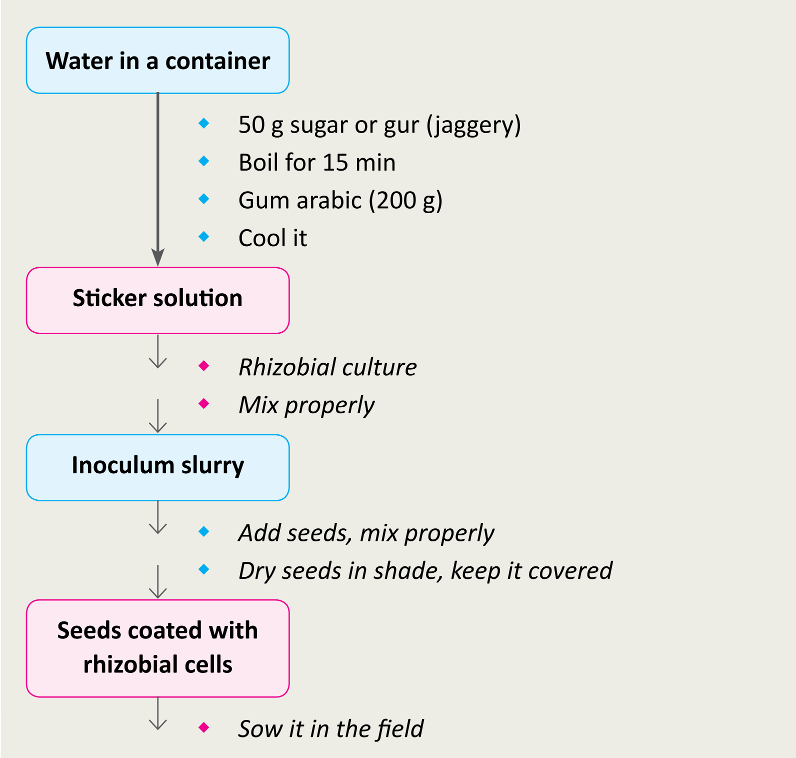
5.2.8. Training for endline survey

For the endline survey, a series of rigorous training sessions were conducted over three days. The primary objective of these training sessions was to thoroughly prepare a group of 20 enumerators to carry out the endline surveys using mobile-based Computer-Assisted Personal Interviewing (CAPI) tools. The training content was designed to emphasize the essentiality of meticulous and precise data collection, a core aspect of attaining accurate project impact assessment. The enumerators were not only equipped with the necessary technical skills but were also instilled with an understanding of the crucial role their work plays in evaluating the project's outcomes and overall success. The effective administration of the endline survey subsequently facilitated a comprehensive analysis of the project's impact, drawing from reliable data procured with the assistance of these well-trained enumerators.

5.3. Agronomic practices

5.3.1. Seed treatment

All chickpea and black gram seeds were treated with Rhizobium, PSB, and Trichoderma sp. before sowing. These biological treatments play a crucial role in enhancing the nutrient availability to the crops. Rhizobium is known to aid in nitrogen fixation, while PSB improves phosphate availability, and Trichoderma sp. helps to control various plant diseases. This seed treatment is aimed at improving seed germination and crop yields, whilst also enhancing soil fertility and plant health. The farmers were trained to use personal protective equipment during the process of seed treatment and for other chemical applications.



5.3.2. Sowing

Most of the sowing was done through broadcasting, however, we used the manual line-sowing method in the demonstrations located at the prime locations to compare the farmers' practice with maintaining the proper spacing of 10 × 30 cm. This method facilitates a better spread of the crop in the field, ensuring appropriate sunlight and nutrients reach each plant.

5.3.3. Micronutrient application

To further enhance crop growth and productivity, micronutrients such as BORAX (10.5% B) and Sulphur (90% S) were applied.



These micronutrients play a vital role in plant growth and development. Based on the soil testing analysis, the doses of the micronutrients as recommended by the soil scientists were adopted. This strategy of providing essential micronutrients at the right growth phases aims to enhance plant health and yield and concurrently works towards restoring soil health by supplementing it with necessary nutrients.

5.3.4. Integrated pest management (IPM)

To prevent crop losses caused by pests and diseases, we adopted an IPM approach that involved a holistic approach to keep the pest population under the threshold level and minimize losses. Pheromone and solar light traps were used to monitor and control the adult population of insect pests in both crops. The use of these traps allowed for early detection and timely intervention, preventing significant crop losses.

5.3.5. Foliar spray

Black gram clusters received a foliar spray of micronutrients, along with fungicides. The fungicide was used specifically to combat powdery mildew disease, which poses a significant threat to the health of the black gram crop, while the insecticide was utilized to manage whiteflies and thrips that spread diseases. The spray was applied evenly across all the clusters, ensuring that every plant received the required treatment. This comprehensive approach to crop management using foliar spray was intended not only to boost the health and yield of the black gram crop but also to demonstrate to the farmers the benefits of proactive and targeted crop management strategies.

6. Monitoring and Evaluation

6.1. Introduction to the modern digital tool for monitoring

To streamline the real-time data collection and tracking, ICRISAT developed a comprehensive monitoring framework utilizing the Open Data Kit (ODK) platform. This open-source tool allowed efficient and accurate data collection using mobile devices, even in remote or offline areas. The platform's flexibility and adaptability made it an excellent fit for the project's diverse and dynamic data collection needs. The ODK-based monitoring framework created by ICRISAT encompassed every aspect of the project, from farmer registration, baseline survey, soil sampling, seed distribution and monitoring, management of crop practices, and collection of GPS data to crop yield analysis. This ensured that every piece of data, no matter how minute, was accurately recorded and immediately accessible for analysis. By implementing this innovative monitoring framework, ICRISAT was able to take full advantage of the benefits of real-time data collection, leading to improved decision-making, greater efficiency, enhanced collaboration, and ultimately, a more successful project outcome.

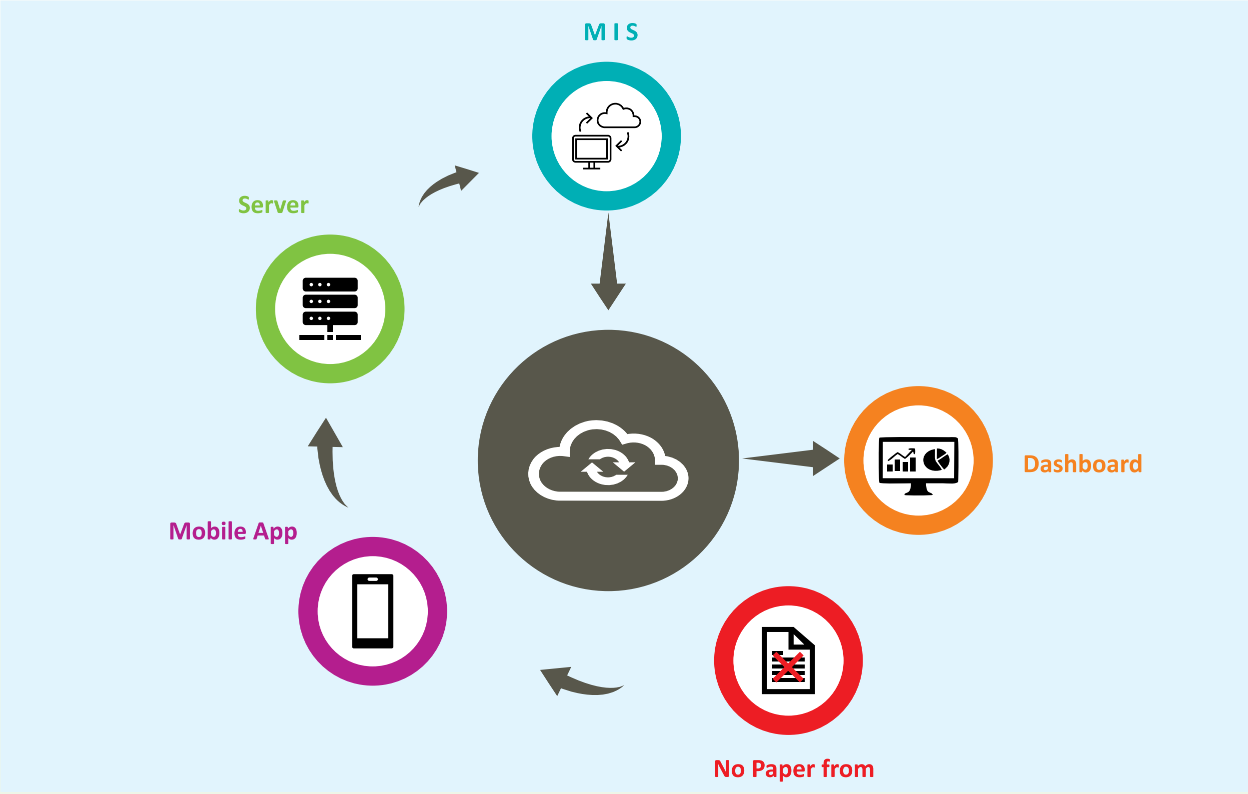


Figure 4: Geo-tagging of cluster demonstration, Jeypore block, Koraput.

6.1.1. GPS monitoring

In the current digital age, Precision Agriculture plays a crucial role in enhancing the effectiveness of frontline crop demonstrations. Acknowledging this, ICRISAT has developed a GPS monitoring platform, which is rooted in ODK technology, to accurately capture the geolocation of all cluster frontline demonstrations. This state-of-the-art platform is designed to utilize the capabilities of a Geographic Information System (GIS) to assemble, analyze, and visually represent the demonstration sites with geographically referenced information. The application facilitates the collection of two distinct types of GPS data:

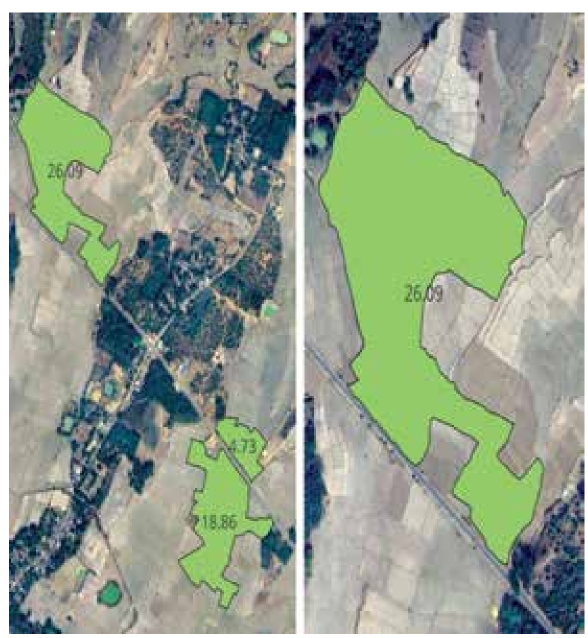
6.1.2. Geo-point

The Geo-point feature serves to accurately pinpoint the specific geographical location of each demonstration site. It allows the tracking and recording of the precise latitude and longitude coordinates, providing an exact spatial reference for each location. This geolocation data aids in the efficient monitoring and management of the demonstrations.

6.1.3. Geo-shape

The Geo-shape feature is leveraged to compute the actual area under demonstration using a

Figure 5: Geo-shape of cluster demonstration area measurement at village Chhatrala, Jeypore.



geo-polygon-based area calculation on a pilot basis. This method is especially beneficial for managing large-scale frontline demonstrations. It not only facilitates an accurate evaluation of the area under demonstration but also assists in creating vegetation indices using advanced GIS techniques.

6.2. Field visits and stakeholder engagement

From the project's inception, ICRISAT maintained close monitoring protocols and involved officials from the Department of Agriculture in the entire process, strengthening the collaboration between government officials and ground-level NGO partners. This collaboration extended across the seed distribution process, awareness programs, joint field visits with government officials, and frequent field observations by the partner organization.

The role of field visits was manifold, offering a platform for direct verification of data, on-site observation of implemented techniques, and immediate interaction with participating farmers. Government officials, project coordinators, and agricultural experts jointly undertook these visits. These field visits served as a channel for knowledge exchange and facilitated open communication with farmers. This approach provided first-hand insights into farmers' experiences, the challenges they faced, and the lessons learned from the project.

The integration of advanced technologies further enhanced monitoring efficiency during field visits and this comprehensive approach ensured the project's successful implementation and the achievement of its desired objectives.

7. Impact Evaluation and Results

To assess the impact of the project, rigorous baseline and endline surveys were conducted in 64 sampled villages across 8 blocks in the district. Considering the entire program area, to estimate the required sample with 99% level of confidence, 5% margin of error, and incorporating a design effect of 1.5%, the required sample size was determined to be 995 respondents. To accommodate the potential losses between the baseline and endline surveys, an extra 20% was included in the sample, leading to a final estimated sample size of 1194. However, 1185 farmers were interviewed both in the baseline and endline survey.

7.1. Data

The impact survey employed a panel sample, which involved interviewing the same households as those included in the baseline survey. The baseline survey was conducted in December 2022, while the endline survey took place in July and August 2023. Before commencing the interviews, verbal consent was obtained from the respondents, and they were provided with information about the study's background. Moreover, respondents were assured of the confidentiality of their records. Data collection was facilitated through the use of Android-based CAPI (Computer-Assisted Personal Interviewing) programming.

7.2. Data analysis

Data was analyzed using STATA version 18.0. Descriptive statistics were obtained to explore the detailed socio-economic characteristics of the farmers. Bi-variate cross-tabulation was done. A 95% confidence interval was calculated to provide a better understanding of the parameter wherever necessary.

7.3. Socio-demographic characteristics of the study population

7.3.1. Background characteristics

The study encompassed a sample of 1,185 respondents hailing from 8 distinct blocks within the Koraput district of Odisha. Table 3.1 presents an overview of the background characteristics of these respondents as recorded during the baseline survey. It is noteworthy that a significant portion of the beneficiaries were in the age group of 35 to 44 years. Moreover, the average age of the beneficiaries was calculated to be approximately 42.8 years.

Nearly 54% of the beneficiaries were male and 46% of the beneficiaries were female. Almost half of the beneficiaries were reported to be illiterate. Among the illiterate beneficiaries, 43.1% were female and 56.9% were male. Only 2.9% of the beneficiaries had received a higher secondary or higher level of education.

Table 3: Background characteristics of the beneficiaries in Koraput district.

Indicators	Frequency (n=1185)	Percentage
Age of the beneficiary (In Years)		
Below 25	53	04.4
25-34	218	18.4
35-44	407	34.4
45-54	305	25.7
55-64	171	14.4
65 and above	31	2.6
Gender of the beneficiary		
Female	550	46.4
Male	635	53.6
Education of the beneficiary		
Illiterate	570	48.1
Up to Primary	442	37.3
Up to Secondary	139	11.7
Higher Secondary and above	34	2.9
Social group of the beneficiary		
General	75	6.3
OBC	263	22.2
SC	115	9.7
ST	732	61.8
Type of house structure		
Hut	164	13.9
Kutcha house	490	41.4
Kutcha-Pucca house	376	31.8
Mixed house	74	6.3
Pucca independent house	78	6.6

Source: Survey Statistics

Out of those who received a higher secondary or higher level of education, only 18.2% were female and 81.8% were male.

Among the respondents, more than three-fifths of respondents were from Scheduled Tribe (ST) group. More than 97% of total beneficiaries had ration cards of which most of the ration cards were reported to be BPL (Below Poverty Level) type followed by Antyodaya and Above Poverty Line type of ration cards.

7.4. Operational land-holding statistics

Among the surveyed farmers, most of the farmers were found to have total operational land from 0.5 acres to 2 acres (0.4 hectares make one acre). This means the proportion of marginal farmers is significantly high. As per the agriculture census published by the Ministry of Agriculture and Farmers Welfare of the Government of India, farmers are of five categories where marginal farmers are categorized as those having a land holding of less than 2.5 acres. More than 66% of farmers were found to be in the marginal category as their operational land holding was less than 2 acres.

7.5. Trends of *rabi* cultivation

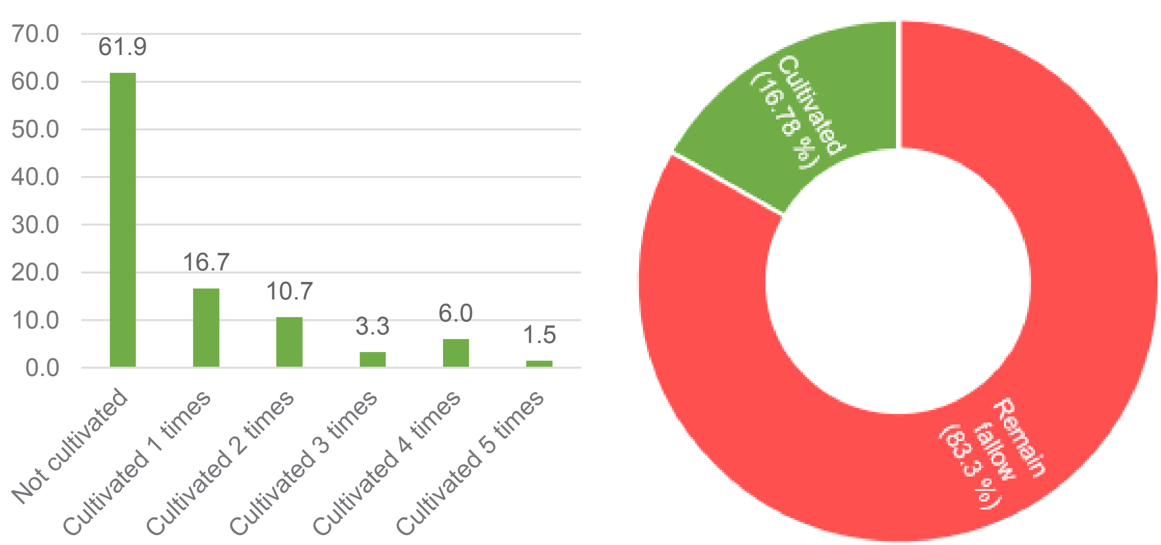
A crucial part of the impact analysis is to map the trends of *rabi* cultivation over the previous years. It is a fact that, before the intervention, a significant 83.3% of farmers left their fields fallow during the *rabi* season in the last year (2021-22). Further, over the past five years, 61.9% of farmers had not cultivated any crop during the *rabi* season. On the other hand, 16.1% had engaged in cultivation only once during these five years. Notably, 1.5% of farmers had consistently cultivated crops each *rabi* season over the last five years.

Table 4: Percentage distribution of total land size among the selected blocks in Koraput district

Name of the Block	Less than 0.5 acre	0.51 - 2 acre	More than 2 acres
Borigumma	5.81	66.77	27.42
Dasmantpur	13.04	56.52	30.43
Jeypore	1.32	57.89	40.79
Koraput	0.0	57.97	42.03
Kotpad	4.93	69.96	25.11
Kundra	2.44	60.57	36.99
Lamataput	12.5	75.00	12.50
Nandapur	5.13	51.28	43.59
Total	**3.88**	**62.70**	**33.42**

Source: Survey Statistics

Figure 6: Percentage of farmers who cultivated rabi crops over the past five years.



Rabi **cultivation over the last five years** ***Rabi*** **cultivation during 2021-22**

Source: Survey Statistics

7.6. Agricultural productivity

The primary focus of the project was directed toward the increase in crop production through the incorporation of short-duration pulse varieties in the rice fallow area.

The average productivity for black gram reached 6.2 q/ha, achieving a maximum production of 8.2 q/ha (Standard Deviation: 1.8). For chickpea, the average productivity was 6.4 q/ha with a maximum of 10.4 q/ha (Standard Deviation: 2.3).

Table 5: Yield performance of blackgram and Chickpea.

Sl. No.	Block	Gram Panchayat	Village	Farmer Name	Name of the variety	Area (in ha)	Yield/ha (in Qtls.)
Yield Performance of Blackgram							
1.	Borigumma	Anchala	Anchala	Bighna Halwa	PU-01	0.6	5.37
2.	Borigumma	Dumuriguda	Konagam	Baidyanath Gouda	PU-01	0.4	5.42
3.	Borigumma	Dumuriguda	Konagam	Laxman Nayak	PU-01	0.6	6.55
4.	Borigumma	Mankidianatala	Katharagada	Rama Paik	PU-01	0.4	5.82
5.	Borigumma	Modeiguda	Konagam	Maheswar Nayak	PU-01	0.4	5.65
6.	Borigumma	Modeiguda	Konagam	Pitambar Nayak	PU-01	0.4	7.01
7.	Borigumma	Sanamajhiguda	Nuagam	Jhadeswar Gouda	PU-01	0.8	6.36
8.	Jeypore	Bhaliaguda	Ranigada	Bhagaban Penthia	PU-01	0.8	6.03
9.	Jeypore	Biriphulgumma	Ranigada	Damburu Penthia	PU-01	1.2	7.44
10.	Jeypore	Boriput	Ranigada	Narayan Nayak	PU-01	0.2	5.39
11.	Jeypore	Chhatarla	Pujariput	Pratima Nayak	PU-01	0.4	7.01
12.	Jeypore	Dangarkarchi	Ranigada	Balaram Nayak	PU-01	0.8	7.00
13.	Jeypore	Dangarkarchi	Ranigada	Daitari Penthia	PU-01	0.4	6.50
14.	Jeypore	Dangarkarchi	Ranigada	Padma Nayak	PU-01	0.8	5.45
15.	Jeypore	Pujariput	Pujariput	Gadadhar Sadangi	PU-01	1.2	6.20
16.	Koraput	Mohadeiput	Machhara-2	Chaitanya Jani	PU-01	1.2	5.49
17.	Koraput	Mohadeiput	Machhara-2	Padalam Hantal	PU-01	0.8	6.28
18.	Koraput	Mohadeiput	Machhara-2	Pratap Golari	PU-01	0.4	7.02
19.	Koraput	Mohadeiput	Machhara-2	Krushna Chapadi	PU-01	0.8	7.01
20.	Koraput	Mohadeiput	Machhara-2	Kesaba Golari	PU-01	0.8	5.31
21.	Kotpad	Asna	Guali	Daimati Kakadia	PU-01	0.6	8.20
22.	Kotpad	Asna	Guali	Tulasa Kakadia	PU-01	0.8	7.11
23.	Kotpad	Bandhaguda	Chitra	Kausalya Gouda	PU-01	0.8	5.87
24.	Kotpad	Chitra	Bandhaguda	Sunamani Gouda	PU-01	0.5	5.71
25.	Kotpad	Chitra	Bandhaguda	Padma Gouda Pop	PU-01	0.7	5.81
26.	Kotpad	Chitra	Bandhaguda	Haribala Gouda	PU-01	0.8	5.77
27.	Kotpad	Chitra	Bandhaguda	Pruba Gadaba	PU-01	1.6	5.56
28.	Kotpad	Chitra	Bandhaguda	Panmati Gouda	PU-01	0.8	5.31
29.	Kotpad	Chitra	Bandhaguda	Bhagabati Bhatra	PU-01	0.8	5.30
30.	Kotpad	Chitra	Bandhaguda	Surjay Nayak	PU-01	0.4	6.73
31.	Kotpad	Chitra	Bandhaguda	Purni Gouda	PU-01	0.4	8.00
32.	Kotpad	Chitra	Bandhaguda	Nila Gouda	PU-01	0.4	5.51
33.	Kotpad	Chitra	Bandhaguda	Daimati Gadaba	PU-01	0.4	5.68
34.	Kundra	Darliguda	Masigaon	Mana Kateri	PU-01	0.8	5.30

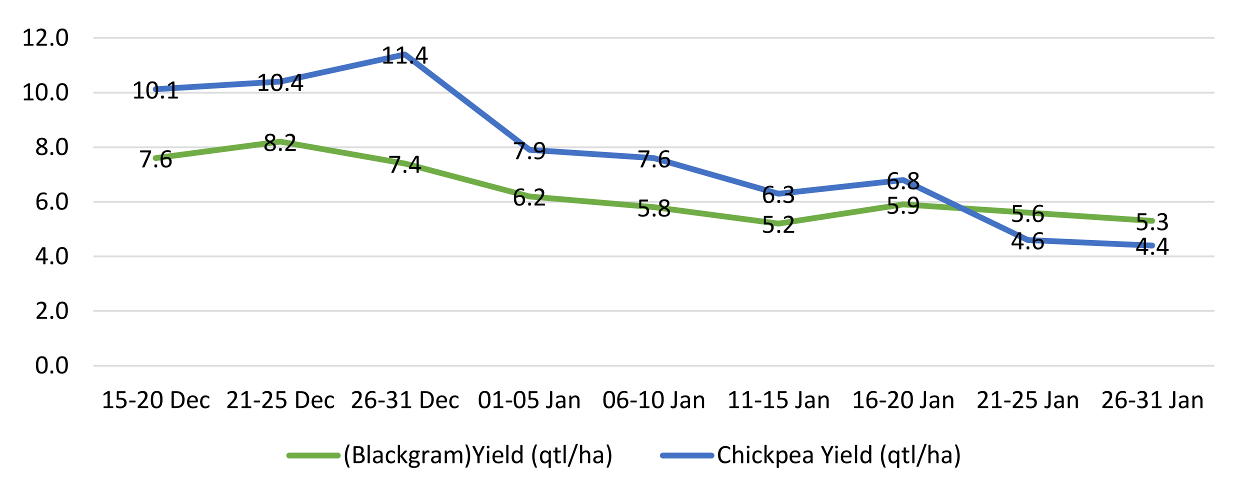
Sl. No.	Block	Gram Panchayat	Village	Farmer Name	Name of the variety	Area (in ha)	Yield/ha (in Qtls.)
35.	Kundra	Jhiligaon	Kundra	Suka Paraja	PU-01	0.8	7.04
36.	Kundra	Kusumguda	Lima	Laxmi Durua	PU-01	0.8	5.72
37.	Kundra	Kusumguda	Lima	Chandrama Patra	PU-01	0.8	6.71
38.	Kundra	Pujariput	Masigaon	Khagapati Bhumia	PU-01	0.8	6.81
39.	Kundra	Pujariput	Masigaon	Ghenu Majhi	PU-01	0.8	6.74
40.	Kundra	Pujariput	Masigaon	Chanchala Majhi	PU-01	0.8	5.96
41.	Kundra	Pujariput	Masigaon	Asai Bhumia	PU-01	0.8	6.09
42.	Kundra	Saralguda	Pakhnaguda	Madan Bhumia	PU-01	0.8	5.85
43.	Lamtaput	Godhihanjar	Banguripada	Sanamani Kirsani	PU-01	0.8	8.11
44.	Lamtaput	Godhihanjar	Banguripada	Subarna Sisa	PU-01	0.4	5.30
45.	Lamtaput	Thusuba	Tusuba	Angu Sisa	PU-01	0.4	5.39
46.	Nandapur	Atanada	Banour	Adu Sriram	PU-01	0.4	5.35
47.	Nandapur	Atanada	Banour	Mukunda Srigam	PU-01	0.4	7.02
48.	Nandapur	Atanada	Banour	Sunadhar Dalai	PU-01	0.4	6.25
49.	Nandapur	Atanada	Banour	Gopa Allang	PU-01	0.8	5.59
50.	Nandapur	Atanada	Banour	Madhu Alanga	PU-01	1.0	6.04
Yield Performance of Chickpea							
1.	Borigumma	Benagam	Benagam	Anjana Bindhani	NBeG-03	0.4	4.60
2.	Borigumma	Benagam	Benagam	Kunda Amanatya	NBeG-47	0.4	4.90
3.	Borigumma	Benagam	Benagam	Manika Pentia	NBeG-47	0.8	4.64
4.	Borigumma	Ranaspur	Chandalguda	Bimola Harijan	NBeG-47	1.0	4.40
5.	Borigumma	Ranaspur	Chandalguda	Kamalachan Harijan	NBeG-47	1.6	8.37
6.	Borigumma	Bandiguda	Badanayakguda	Ramanath Gadaba	NBeG-03	0.4	7.43
7.	Borigumma	Bandiguda	Bandiguda	Prahalad gadaba	NBeG-03	0.4	10.20
8.	Borigumma	Bandiguda	Pakhnaguda	Tulasa Ganda	NBeG-03	0.2	5.39
9.	Borigumma	Katharagada	Pakhnaguda	Madhu Gouda	NBeG-03	0.8	9.76
10.	Borigumma	Katharagada	Pakhnaguda	Narahari Bhatra	NBeG-03	0.4	4.71
11.	Jeypore	Kebidi	Batajagganathpur	Prakash Mali	NBeG-03	0.4	8.00
12.	Jeypore	Kebidi	Tentuliguda	Damai Bhumia	NBeG-03	0.4	5.69
13.	Jeypore	Pujariput	Pujariput	Dalimba Amanatya	NBeG-47	0.8	4.62
14.	Jeypore	Pujariput	Pujariput	Sasmita Hota	NBeG-47	0.8	5.51
15.	Jeypore	Pujariput	Chhatarla	Parsuram Nayak	NBeG-03	0.8	4.99
16.	Jeypore	Ranigada	Dangarkarchi	Balaram Nayak	NBeG-03	0.4	6.45
17.	Jeypore	Raniguda	Tingiriput	Lakhan Gouda	NBeG-47	0.8	4.87
18.	Jeypore	Raniguda	Tingiriput	Sada Gouda	NBeG-47	0.8	6.94
19.	Jeypore	Raniguda	Tingiriput	Samara Gouda	NBeG-47	0.7	6.65

Sl. No.	Block	Gram Panchayat	Village	Farmer Name	Name of the variety	Area (in ha)	Yield/ha (in Qtls.)
20.	Koraput	Kendar	Upardakra	Chandra Muduli	NBeG-49	0.4	5.30
21.	Koraput	Kendar	Upardakra	Chandra Muduli	NBeG-49	1.2	5.81
22.	Koraput	Kendar	Upardakra	Dhanapati Muduli	NBeG-49	1.1	6.06
23.	Koraput	Kendar	Upardakra	Laxmi Jani	NBeG-49	0.4	5.71
24.	Kotpad	Guali	Asna	Manikya Pujari	NBeG-03	0.4	5.89
25.	Kotpad	Guali	Guali	Baidi Nayak	NBeG-47	0.8	5.45
26.	Kotpad	Guali	Guali	Sanamati Nayak	NBeG-47	1.3	9.69
27.	Kotpad	Guali	Guali	Satyama Pujari	NBeG-47	1.2	7.11
28.	Kotpad	Sutipadar	Bandhaguda	Sumitra Gouda	NBeG-47	0.9	8.27
29.	Kundra	Assna	Ambaguda	Debasish Gouda	NBeG-47	0.4	6.88
30.	Kundra	Assna	Ambaguda	Maheswara Goudo	NBeG-47	0.4	5.86
31.	Kundra	Assna	Ambaguda	Rukamani Nag	NBeG-47	1.0	5.02
32.	Kundra	Assna	Ambaguda	Soiba Goudo	NBeG-47	2.0	10.40
33.	Kundra	Assna	Ambaguda	Suriyanarayan Pangi	NBeG-47	0.4	7.77
34.	Kundra	Kundra	Chendia Jhiligaon	Indu Paraja	NBeG-03	0.4	4.81
35.	Kundra	Kundra	Jhiligaon	Dhanirjay Jani	NBeG-03	0.8	6.91
36.	Kundra	Lima	Lima	Trinatha Samarath	NBeG-03	0.8	4.77
37.	Kundra	Lima	Pukiaguda	Laxman Paraja	NBeG-03	0.4	5.16
38.	Kundra	Massigam	Pujariput	Chanchala Majhi	NBeG-49	0.8	6.09
39.	Kundra	Massigam	Pujariput	Ghasi Majhi	NBeG-49	0.5	5.37
40.	Kundra	Massigam	Pujariput	Jugadara Badia	NBeG-49	0.7	7.02
41.	Kundra	Massigam	Pujariput	Padam Mali	NBeG-49	0.7	5.65
42.	Kundra	Pakhanaguda	Saralguda	Dhanapati Bhumia	NBeG-49	1.0	6.64
43.	Kundra	Pakhanaguda	Saralguda	Laba Bhumia	NBeG-49	1.0	6.13
44.	Kundra	Pakhanaguda	Saralguda	Sankhya Santa	NBeG-49	0.8	5.39
45.	Kundra	Pakhanaguda	Saralguda	Somanath Bhumia	NBeG-49	1.1	11.10
46.	Nandapur	Nandaka	Parjaburuda	Dhanai Bhoi	NBeG-47	0.4	4.44
47.	Nandapur	Nandaka	Parjaburuda	Hari Bhoi	NBeG-47	0.4	6.72
48.	Nandapur	Nandaka	Parjaburuda	Gopinath Guntha	NBeG-49	0.4	6.28
49.	Nandapur	Nandapur	Parjaburuda	Dambu Bhoi	NBeG-49	0.8	7.07
50.	Nandapur	Nandapur	Parjaburuda	Keshab Bhoi	NBeG-49	0.8	5.42
51.	Nandapur	Raising	Mulda	Damni Gadang	NBeG-49	0.8	6.16
53.	Nandapur	Raising	Mulda	Hira Jani	NBeG-49	0.8	5.32
53.	Nandapur	Raising	Mulda	Laxmi Khara	NBeG-49	0.4	5.34
54.	Nandapur	Raising	Mulda	Laxmi Pangi	NBeG-49	0.8	5.75
55.	Nandapur	Raising	Mulda	Madhu Pangi	NBeG-49	1.2	6.00

Table 6: Summary of crops cut data

Crop Name	Name of the Variety	No of CCE	Min. Yield (Qtl/ha)	Max. Yield (Qtl/ha)	Average Yield (Qtl/ha)
Chickpea	NBeG-03	15	4.60	10.20	6.32
	NBeG-47	20	4.40	10.40	6.43
	NBeG-49	20	5.30	11.10	6.18
Blackgram	PU-01	50	5.30	8.20	6.20

Figure 7: Yield performance of different crops by date of sowing in Koraput district.

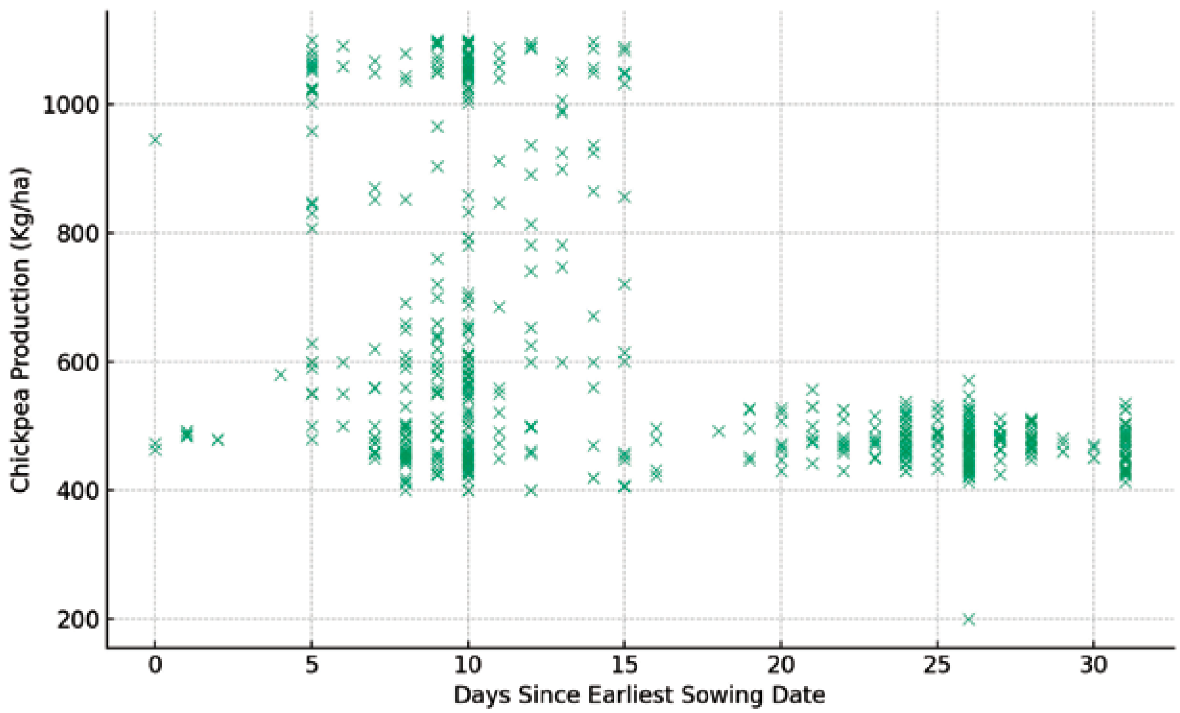


The sowing date considerably influences the productivity of both black gram and chickpea. Specifically, black gram yields were optimal when sown between 21-25 December, achieving 8.2 q/ha. However, yields declined when sowing was delayed to January, dipping to the lowest at 5.3 q/ha for sowing between 26-31 January. In the case of chickpea, the highest yields were recorded when sowing occurred between 26-31 December, at 11.4 q/ha, and similarly showed a reduction with later sowing dates, by 4.4 q/ha for sowing between 26-31 January. These patterns highlight the critical importance of sowing within the optimal window to achieve higher yields in these crops.

The survey data also revealed the same trend for both chickpea and black gram cultivation that late sowing is associated with lower productivity. This pattern was evident across multiple instances of cultivation, underscoring a significant correlation between the timing of sowing and crop yield. The data consistently showed that as the sowing date was delayed, the productivity for both chickpea and black gram tended to decrease, highlighting the importance of timely sowing for achieving optimal yields in these crops.

The graph presents a scatter plot that depicts the relationship between the sowing date of chickpea and the resulting production, measured in kilograms per hectare (kg/ha). Each point on the graph represents a unique instance of chickpea cultivation, with the X-axis indicating the number of days since the

Figure 8: Impact of sowing date on chickpea production



earliest sowing date and the Y-axis showing the corresponding production. The plot reveals that late sowing results in lower productivity, highlighting a significant relationship between the timing of sowing and the yield of chickpea.

Interestingly, 75.2% of the black gram farmers and 63.1% of chickpea demonstrators, sold part of their produce, thus contributing to their income. Moreover, seed preservation practices for future cultivation were adopted by 64.8% of the black gram farmers and 61.4% of the chickpea farmers, indicating the adoption of sustainable farming practices and their preparedness for the next cropping season.

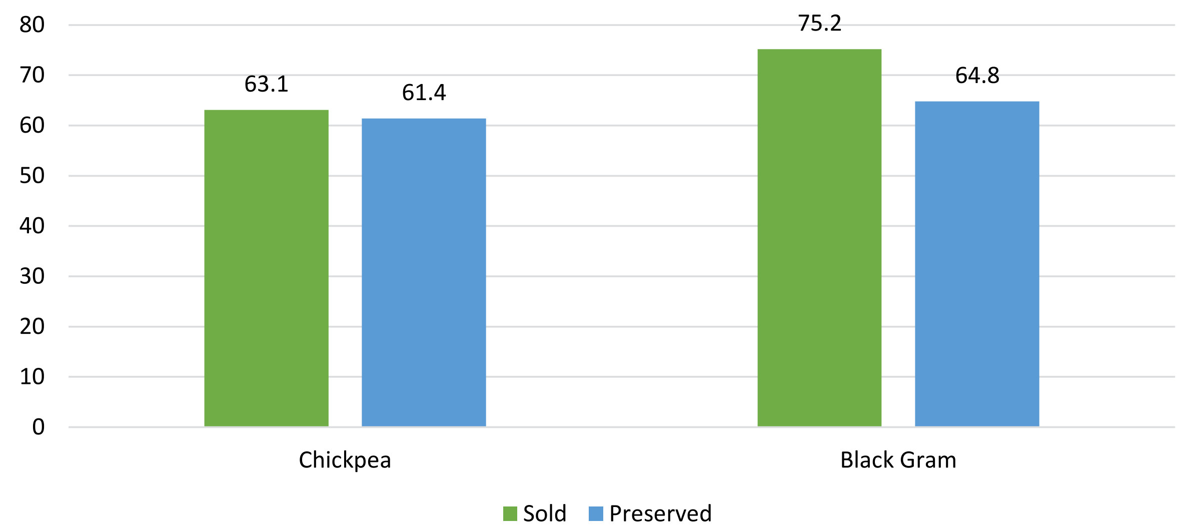
The majority of farmers predominantly sell their harvest to local traders for both crops, followed by consumers and the *mandi* (market). In addition, very few farmers opt to directly supply their seeds to processors. When it comes to pricing, farmers reported a range of selling prices for black gram, varying between ₹85-110/kg, while they received comparatively lower prices for chickpea, ranging from ₹50-90/kg.

These results underscore the substantial improvements in yield facilitated by the project interventions and underline the success of the project in achieving its primary objective of enhancing agricultural productivity for increased farm income.

7.7. Soil health and environmental impact

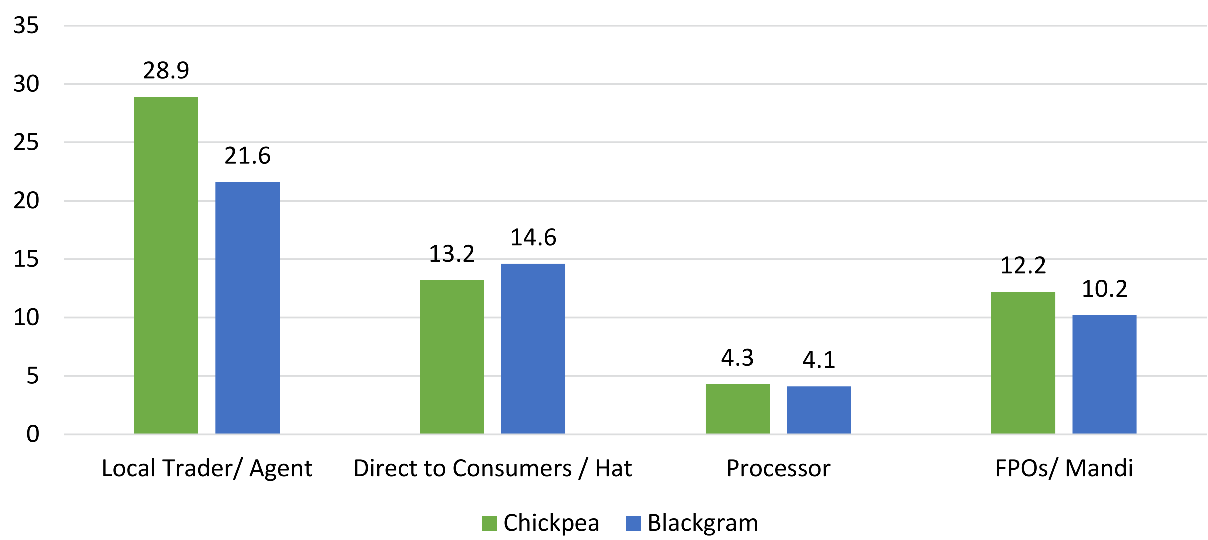
The cultivation of short-duration pulses, due to their leguminous nature, has a positive and profound impact on soil health. These crops contribute to soil fertility by naturally fixing atmospheric nitrogen. Soil samples to assess post-harvest soil health, are being collected before the *rabi* this year to compare the effect

Figure 9: Proportion of farmers who sold their harvest and those who preserved seeds for subsequent year's production.



Source: Survey Statistics

Figure 10: Source of selling.



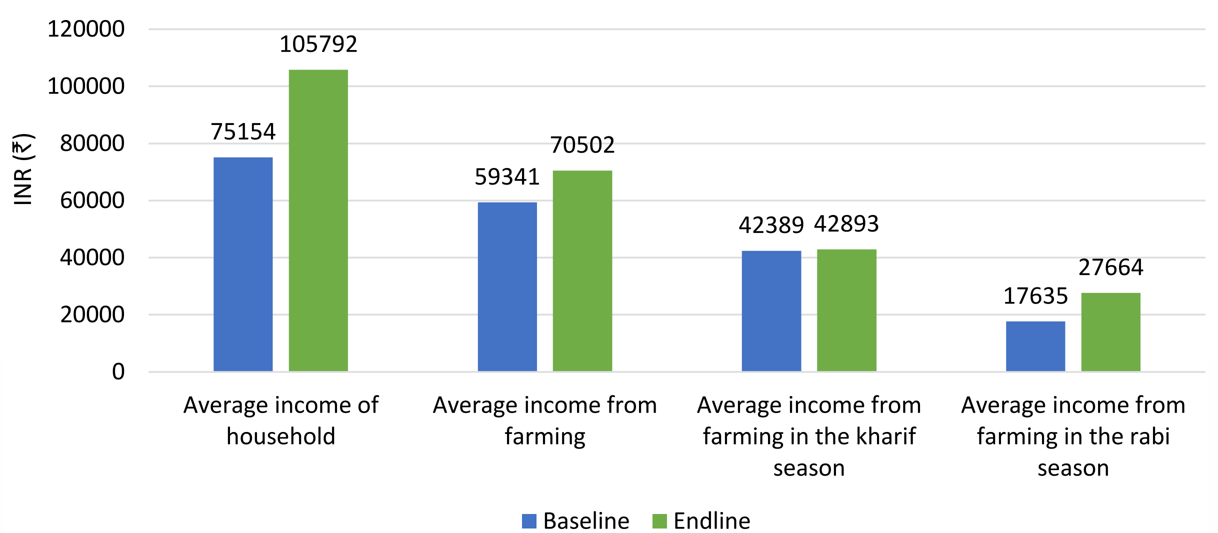
Source: Survey Statistics

of growing pulses in rice fallows by comparing it with the results from samples taken for baseline.

7.8. Economic impact

The project's intervention witnessed significant economic benefits for the farmers. Before the project's implementation, lands left fallow after rice cultivation presented missed economic opportunities. The financial well-being of the farmers saw a noticeable hike when we compared their earnings before and after the project's intervention.

Figure 11: Change of income of farm household between baseline and endline.



Source: Survey Statistics

The project made a significant contribution to enhancing the income of the participating farmers. These farmers saw a rise of 34.0% in their earnings from *rabi* season farming, and an overall boost of 10.1% in total income from farming as compared to the previous years.

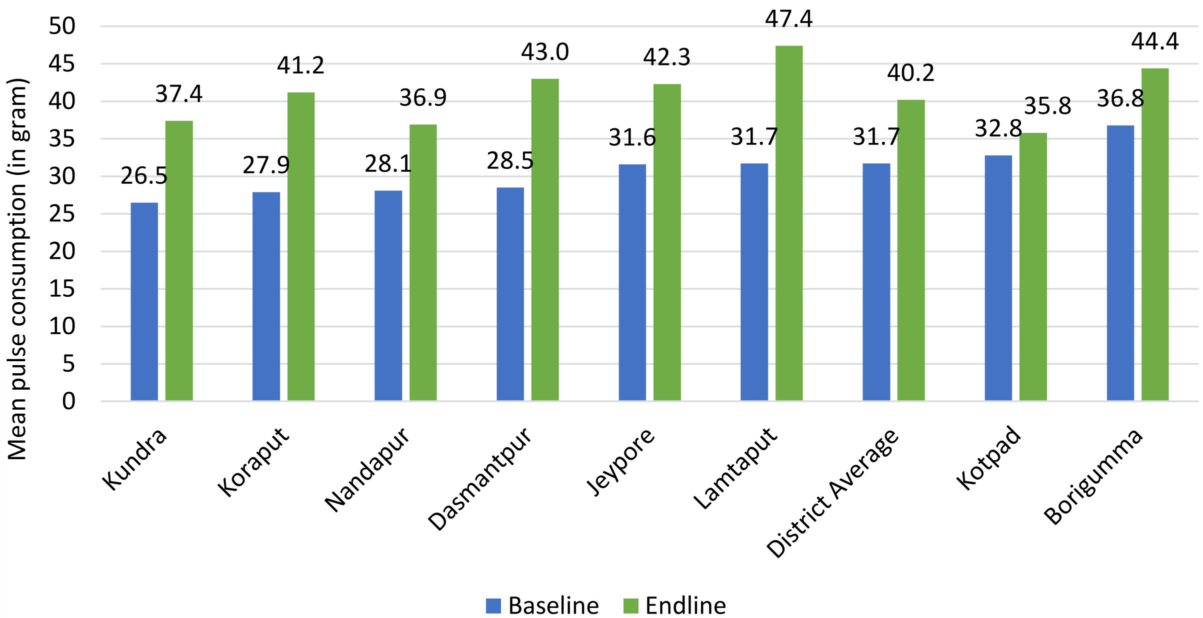
This data illustrates the project's comprehensive approach to promoting sustainable farming practices, demonstrating its success in not only increasing agricultural productivity but also contributing to the economic empowerment of the farming community. The graph depicts that the intervention has brought about a substantial enhancement in farmers' earnings. Notably, there has been a remarkable increase in the income derived from *rabi* farming, whereas the rise in income from *kharif* farming remains comparatively modest.

7.9. Diet and nutritional improvement

The project's impact extends beyond agricultural productivity to significant improvements in dietary and nutritional outcomes. According to the recommendations by the Indian Council of Medical Research (ICMR), the average per capita daily intake of pulses should be 40 grams. The baseline survey revealed that before the implementation of this project, the average intake of pulses was only 31.7 grams per person per day. However, through the cultivation and incorporation of pulses like chickpea and black gram added into local diets, the project significantly increased the daily pulse intake to an average of 40.2 grams.

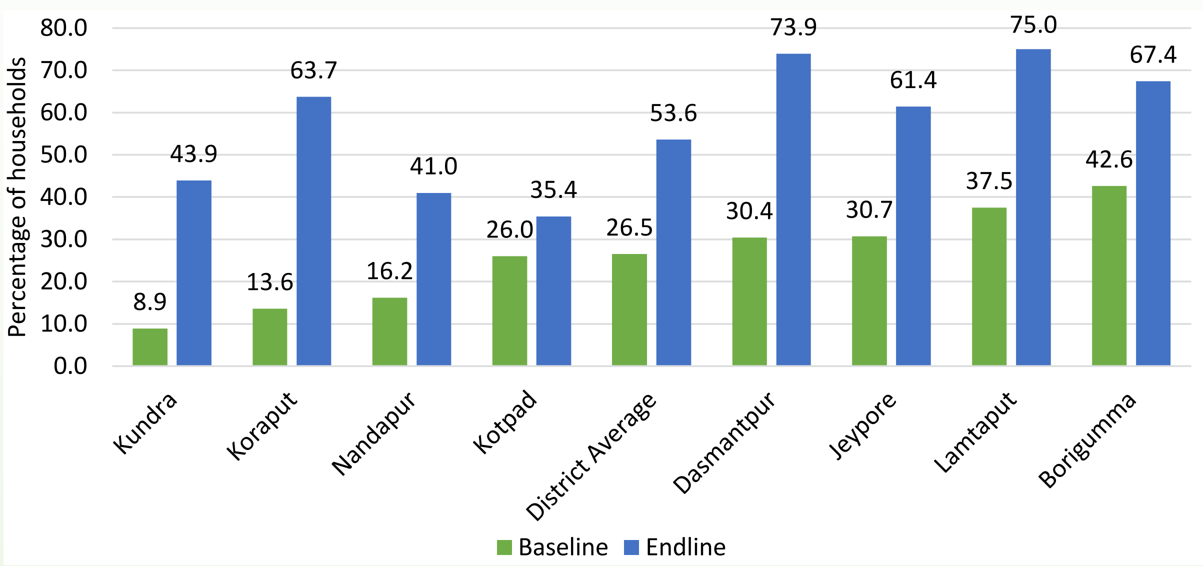
The daily pulse intake reached 41.2 grams in Koraput, 42.3 grams in Jeypore, 47.4 grams in Lamtaput, 43.0 grams in Dasmantput, and a noteworthy 44.4 grams in Borigumma. These figures highlight not only a significant improvement but also visibly align with the daily intake recommendations set by the ICMR. This significant rise in consumption is a testament to the project's success in fostering better nutrition practices and achieving its nutritional objectives.

Figure 12: Per capita mean consumption of pulses in grams.



Source: Survey Statistics

Figure 13: Percentage distribution of households having ICMR-prescribed level of pulse consumption.



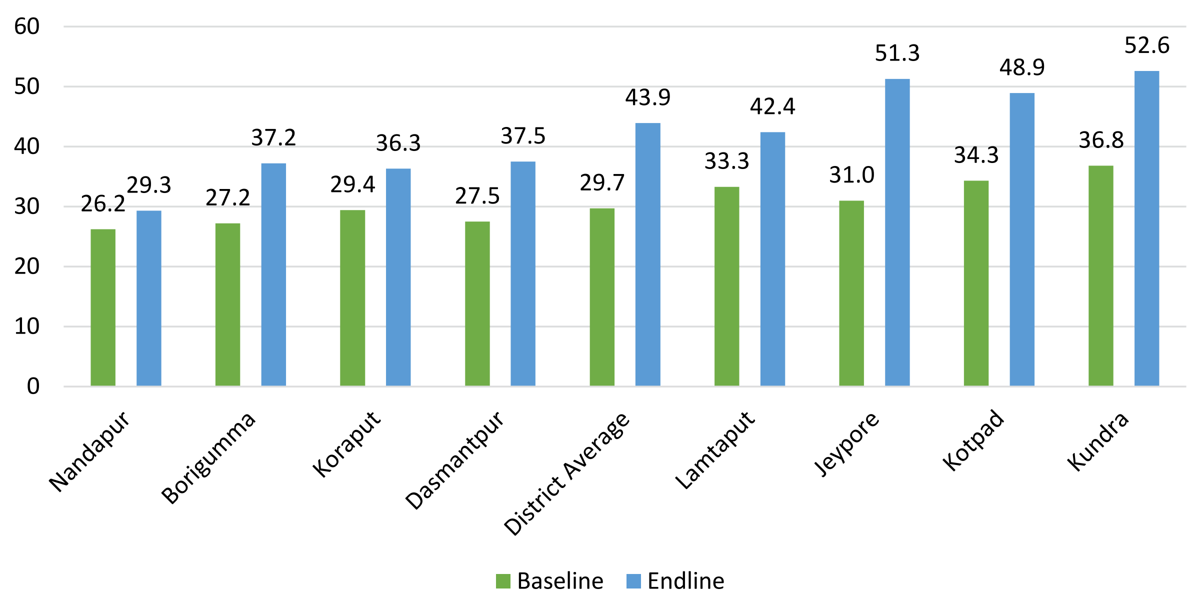
Source: Survey Statistics

Women of reproductive age (WRA) are often nutritionally vulnerable due to their physiological needs during pregnancy and lactation. The World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO, 2004) highlight that the nutrient requirements for pregnant and lactating women are generally higher than for adult men. Outside of pregnancy and lactation, other than for iron, requirements for WRA may be similar to or lower than those of adult men. Insufficient nutrient intake before and during pregnancy and lactation can affect both women and their infants. Given that a significant proportion (33.73%) of the total beneficiaries of the demonstration were women in their reproductive age, assessing their nutritional status becomes an essential objective of the impact analysis.

MDD-W is a dichotomous indicator of whether or not women 15–49 years of age have consumed at least five out of ten defined food groups the previous day or night. The proportion of women 15–49 years of age who reach this minimum in a population can be used as a proxy indicator for higher micronutrient adequacy, one important dimension of diet quality. Therefore, the Minimum Dietary Diversity for Women (MDD-W) indicator was created based on whether the participating women aged 15-49 consumed at least 5 specified food groups among the 10 food groups within the last 24 hours (WHO, 2007). The food groups include (1) grains, roots, and tubers, (2) pulses (3) nuts and seeds, (4) dairy products, (5) meat, poultry and fish, (6) eggs, (7) vitamin A-rich fruits and vegetables (8) dark leafy greens and vegetables, (9) other vegetables and (10) other fruits.

The results indicate a significant enhancement in dietary diversity among women in farm households, rising from 29.7% to 43.9%, with pulses playing a substantial role in achieving this improvement. Furthermore, it was observed that 87.5% of participating farmers were consuming pulses from their own production, compared to 18.6% in the baseline, significantly contributing to achieving dietary diversity within the households. The interventions resulted in a substantial 34.0%

Figure 14: Block-wise percentage distribution of women aged 15-49 years having Minimum Dietary Diversity.



Source: Survey Statistics

additional income during the rabi season, indirectly empowering farmers' purchasing power to meet dietary needs.

7.10. Institutional strengthening

The project took a significant step towards building a sustainable local seed system by empowering the abilities of the NGO partner, Farmer Producer Organizations (FPOs), and Self-Help Groups (SHGs) in the seed sector. Recognizing the pivotal role of seeds in rice fallow areas, our baseline survey revealed a lack of information among farmers in the project area regarding short-duration pulse varieties and limited access to quality seeds for cultivating pulses in rice fallows.

In pursuit of project sustainability, we took proactive measures by imparting hands-on training in high-quality seed production and storage techniques. To establish a community-based local seed system, ICRISAT, with support from the Department of Agriculture and Food Production, assisted Javik Sri Farmer Producer Company Ltd. with capacity building for the establishment business oriented seed enterprise and supported them with a seed processing unit to ensure that seeds produced by the company locally meet quality standards.

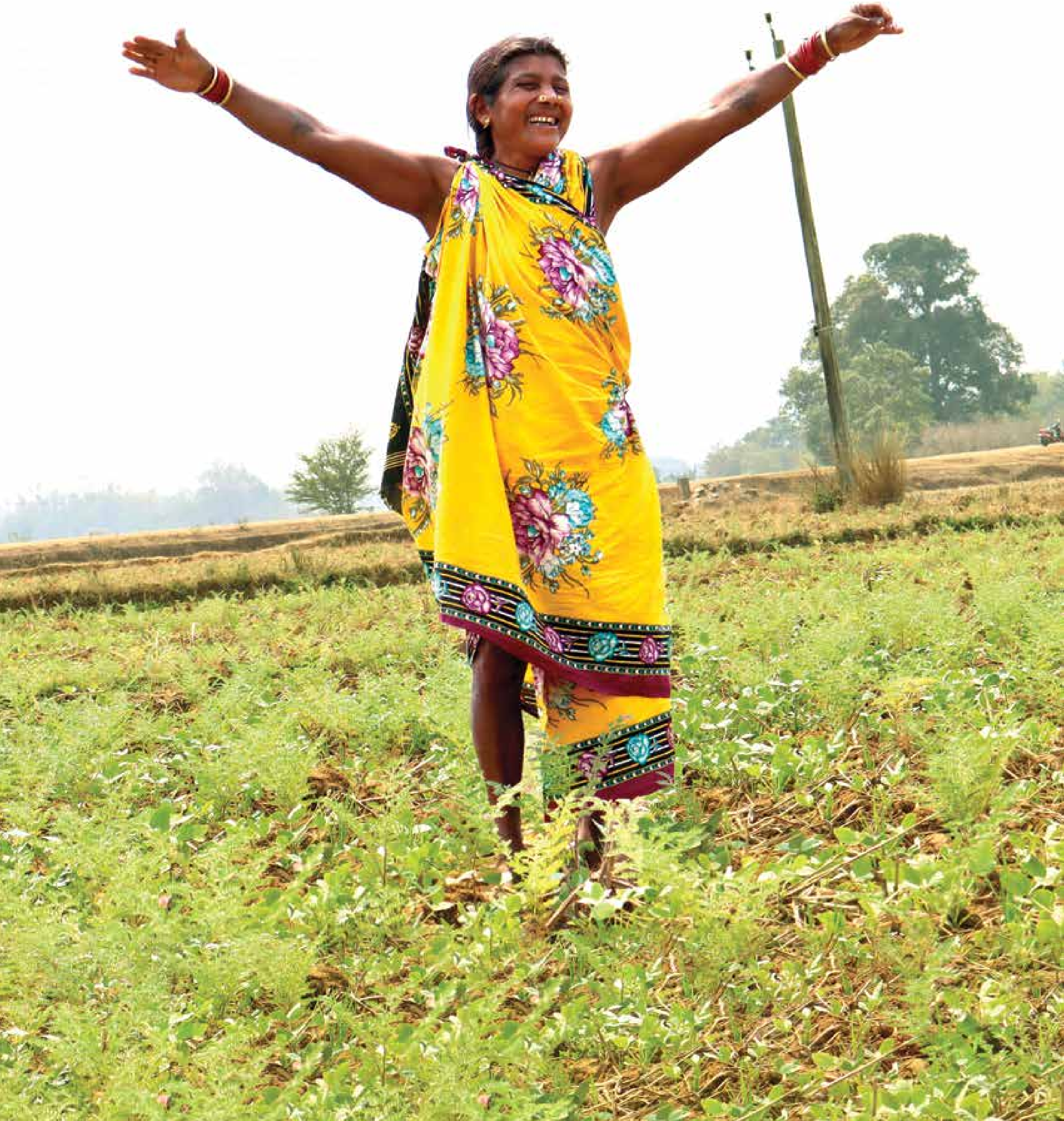
This intervention will not only improve the seed access for the farmers locally but also provide income benefits for the FPO managing this seed enterprise. The overall goal is to initiate and promote a local brand for legume seeds, with a focus on ensuring their consistent availability for the communities to make farming resilient and profitable.

8. Conclusion and Recommendations

The "Comprehensive Project on Rice Fallow Management" highlights its effectiveness in transforming underutilized rice fallows into productive agricultural land. This initiative has yielded notable enhancements in pulse production, local food security, nutritional intake, and overall farm income and livelihoods of the farmers.

To ensure the sustainability of this initiative, it is imperative to ensure the timely availability of quality seeds. The establishment of community-based seed enterprises is a key step in empowering farmers to learn about seed production locally and sustain their livelihoods through locally produced seeds. Furthermore, it is crucial to educate farmers about recent developments in short-duration seed varieties and appropriate timing for sowing and crop management to maximize benefits. Additionally, enhancing the capacity of Farmer’s Producer Organizations and Self-Help Groups will further contribute to the long-term benefits of the farming community.

Moving forward, scaling up this model is essential, involving the reinforcement of continuous farmers’ training, ensuring the timely availability of high-quality seeds, and strengthening the capacity of local community-led institutions.



ICRISAT
INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

About

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a pioneering, international non-profit scientific research for development organization, specializing in improving dryland farming and agri-food systems. The Institute was established as an international organization in 1972, by a Memorandum of Agreement between the Consultative Group on International Agricultural Research and the Government of India. ICRISAT works with global partners to develop innovative science- backed solutions to overcoming hunger, malnutrition, poverty, and environmental degradation on behalf of the 2.1 billion people who reside in the drylands of Asia, sub-Saharan Africa, and beyond.

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