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Assessing the Impact of Village Adoption Programmes on Agricultural Production and Farmers' Income

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ABSTRACT

The Village Adoption Programme plays a crucial role in showcasing the benefits of agro-technologies and promoting their adoption for rural development. From 2019 to 2022, ICAR–Krishi Vigyan Kendra (KVK), Ramgarh, adopted Indrabad village in district Ramgarh Jharkhand with the objective of introducing site-specific interventions to enhance productivity and income. Technologies such as drought-tolerant and disease-resistant crop varieties, integrated pest and nutrient management, and income-generating activities like mushroom cultivation were introduced. The programme resulted in notable yield gains: cereals, pulses, and oilseeds improved by 8.89–38.41%, vegetables by 8.57–28.55%, and oyster mushroom production recorded the highest increase at 44%. Economic analysis revealed significant rises in net returns and benefit-cost ratios, with pigeon pea (2.83), onion (3.33), and tomato (2.9) performing exceptionally well. Varietal replacement and scientific crop management proved effective under drought-prone conditions. These outcomes highlight the potential of participatory village adoption models in advancing climate-resilient, diversified, and sustainable agriculture for improved rural livelihoods.

Keywords: Village adoption, Yield enhancement, Profitability, Drought tolerance, Vegetable production, Climate-resilient agriculture

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INTRODUCTION

The economy of the country is largely dependent on the economy of its villages, and agriculture remains the main occupation in rural areas. Agricultural productivity, in turn, depends on the quality and availability of land and water resources, along with various inputs and environmental factors that influence the overall output (Singh et al., 2021). The Village Adoption Programme plays a vital role in demonstrating the benefits of agro-technologies as models for adoption, aimed at uplifting the rural economy (Sadvi et al., 2020).

In this regard, ICAR-Krishi Vigyan Kendra, Ramgarh, Jharkhand, adopted Indrabad village for a period of three years from 2019–2022, with the objective of introducing location-specific technologies, enhancing farm productivity, and improving the livelihoods of the farming community. Indrabad is a village situated in Mandu block of Ramgarh district in Jharkhand. It lies approximately at 23.643° North latitude and 85.377° East longitude, at an average elevation of about 450 meters (1476 feet) above sea level. The village is surrounded by fertile plains and gentle undulating terrain, offering a suitable environment for diverse agricultural activities.

The climate of Indrabad is typically tropical, characterized by hot summers with temperatures ranging from 28°C to 40°C, pleasant winters with temperatures between 10°C and 20°C, and a monsoon season extending from June to September, which brings moderate to heavy rainfall. The total cultivable area in the village is around 320 acres, with predominant soil types being sandy loam and red loam, suitable for a wide range of crops.

Major crops grown in Indrabad include paddy, maize, pigeon pea, mustard, vegetables (tomato, brinjal, okra), and fruits such as mango and papaya. Livestock rearing, especially cattle and goats, also contributes significantly to the rural economy.

Participatory Rural Appraisal (PRA) and group discussions with farmers identified several key challenges (Hema Sarat Chandra et al., 2017; Chandan et al., 2022):

- Low crop yields due to traditional farming practices and poor seed quality.
- Incidence of pest and diseases in paddy and vegetables.
- Limited awareness about improved crop varieties and scientific cultivation methods.
- Inadequate livestock management practices leading to low milk production.

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- Poor soil health due to imbalanced use of fertilizers.

Based on these findings, ICAR-KVK Ramgarh implemented multiple technical interventions, including the introduction of high-yielding and disease-resistant crop varieties, integrated pest management practices, soil health testing and balanced nutrient application, scientific dairy management training, and demonstrations of improved agricultural implements. These efforts aimed to serve as a model for adoption, ultimately contributing to the sustainable development and economic Upliftment of Indrabad village.

MATERIALS AND METHODS

The study was carried out in Indrabad village of Mandu block, Ramgarh district, Jharkhand, which was adopted under the Village Adoption Programme of ICAR–Krishi Vigyan Kendra (KVK), Ramgarh, during the period 2019 to 2022. The objective was to introduce and evaluate location-specific technological interventions aimed at enhancing agricultural productivity and farm income under drought-prone and resource-constrained conditions.

Both primary and secondary data were utilized. Secondary data were obtained from village records and KVK reports, whereas primary data were gathered from beneficiary farmers of the adopted village through a structured interview schedule. The data encompassed details of crop yields, input usage, and cost of cultivation, gross returns, and net income before and after intervention.

The technological interventions included:

- Varietal replacement with drought-tolerant and disease-resistant crops (e.g., Swarna Samridhi Dhan in paddy, Arkel in pea, Swarna Shyamali in brinjal).
- Integrated nutrient and pest management practices, such as balanced fertilizer use, bio-control agents, and foliar sprays.
- Income-generating activities, notably oyster mushroom cultivation, promoted as a low-cost, high-return enterprise.

The collected data were subjected to analysis using simple statistical tools such as frequency, percentage, mean, and benefit-cost ratio (BCR) to assess the impact of interventions on productivity and profitability.

This participatory approach enabled direct comparison of farmers' practices with improved technologies, providing empirical evidence of the programme's impact on yield enhancement, economic gains, and adoption potential.

RESULTS AND DISCUSSION

It is evident from Table 1 that the implementation of multiple technical interventions across different crops under drought-prone conditions led to significant improvements in both yield and farm profitability, primarily due to the adoption of improved varieties and recommended production technologies.

Yield Analysis

Across all crops, the introduction of drought-tolerant varieties and improved crop management practices resulted in yield enhancement ranging from 8.89% to 38.41%. Among rice cultivars, Swarna Samridhi Dhan exhibited the highest yield increase (15.54%), producing 53.96 q/ha compared to 46.70 q/ha under farmers' practice. Similarly, IR 64 drt-1 recorded a remarkable 25% increase over the local check, demonstrating the potential of stress-tolerant rice varieties for climate-resilient agriculture. In pulses and oilseeds, black gram (IPU 2-43), mustard (BBM-1 with integrated crop management), and pigeon pea (IPA 203 with Rhizobium seed treatment) recorded yield gains of 33.09%, 38.41%, and 38.13%, respectively. Oilseed crop sesame (RT-351) also performed well with a 29.47% improvement in productivity. The findings of this study align with the earlier results reported by Singh et al. (2020) and Mishra et al. (2021), who emphasized the role of improved cultivars in enhancing productivity under stress-prone ecosystems.

Economic Analysis

The economic analysis showed a substantial increase in net returns and benefit-cost ratio (B:C ratio) after interventions. In rice, Swarna Samridhi Dhan exhibited the highest net return of Rs. 59,178/ha with a B:C ratio of 2.55, compared to Rs. 46,110/ha (B:C ratio 2.44) under farmers' practice. Similarly, maize (Bio 9544) showed an improvement in B:C ratio from 1.30 to 1.80, highlighting the advantage of drought-tolerant cultivars. Among pulses, pigeon pea generated the highest net return of Rs. 65,300/ha with a B:C ratio of 2.83, followed by black gram (Rs. 36,120/ha; B:C ratio 2.18). Oilseeds also showed favorable economics, with sesame recording a B:C ratio of 2.71 against 2.47 in the control. Mustard demonstrated an appreciable improvement in profitability, with net returns increasing from Rs. 16,125/ha to Rs. 27,152/ha.

These findings suggest that the integration of improved varieties with suitable agronomic practices can substantially improve farm income in resource-constrained environments. Similar impacts of varietal replacement and improved production technologies on profitability were reported by Meena et al. (2019) and Roy et al. (2022).

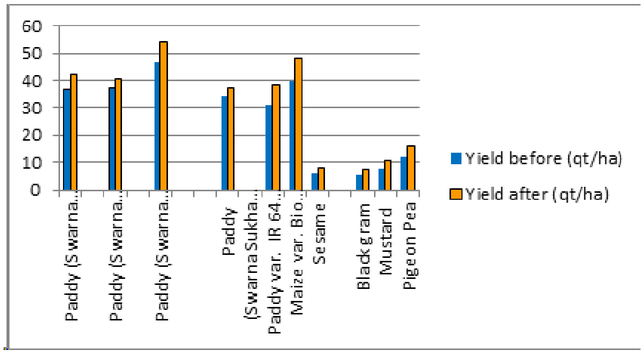
Implications for Climate-Resilient Agriculture

The observed results underline the importance of varietal interventions in addressing the challenges of climatic variability, especially drought. Adoption of stress-tolerant varieties in cereals, pulses, and oilseeds not only enhanced yield but also ensured stability in farm income. This supports the evidence that improved cultivars, when coupled with recommended agronomic practices, act as key drivers for sustainable intensification in fragile agro-ecosystems (ICAR, 2021; FAO, 2020).

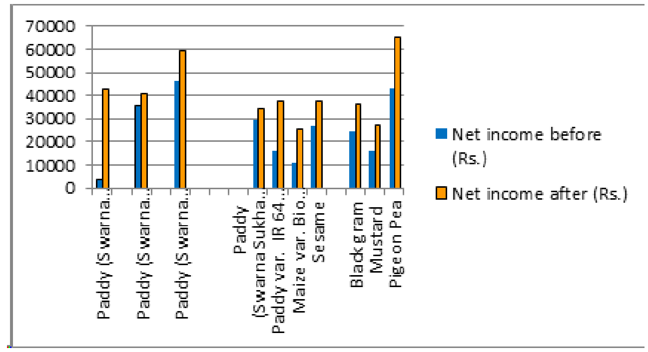
Overall, the study demonstrated that strategic interventions through drought-tolerant varieties, seed treatment, micronutrient management, and pest/disease control significantly increased both productivity and profitability of smallholder farmers in rainfed regions.

Table 1: Impact of Crop production interventions on yield and income

Crop	Thematic area	Use of technology	Yield (q/ha)		Increase yield in %	Economics of before intervention (Rs./ha)				Economics of after intervention (Rs./ha)			
			Before	After		Gross Cost	Gross Return	Net Return	BCR	Gross Cost	Gross Return	Net Return	BCR
Paddy (Swarna Shreya)	Crop Production	Drought tolerance variety	36.70	41.96	14.33	30750	66060	35310	2.14	32600	75528	42928	2.31
Paddy (Swarna Shakti Dhan)	Crop Production	Drought tolerance variety	37.11	40.41	8.89	31300	66798	35498	2.13	31800	72738	40938	2.28
Paddy (Swarna Samridhi Dhan)	Crop Production	Drought tolerance variety	46.70	53.96	15.54	34450	84060	46110	2.44	37950	97128	59178	2.55
Paddy (Swarna Sukha Dhan)	Crop Production	Drought tolerance variety	34.20	37.52	9.76	31800	61560	29760	1.93	33200	67536	34336	2.03
Paddy var. IR 64 drt-1	Crop production	Popularization of drought tolerant cultivars of rice	30.8	38.5	25.00	29800	46200	16400	1.55	31500	69300	37800	2.2
Maize var. Bio 9544	Crop production	Popularization of drought tolerant cultivars of maize	40	48	20	30000	41000	11000	1.3	32500	58000	25500	1.8
Sesame	Crop production	RT-351,HYV	6.14	7.95	29.47	18600	46050	27045	2.47	21985	59625	37640	2.71
Black gram	Crop production	IPU 2-43, resistant to YMV &Powdery Mildew	5.5	7.32	33.09	14200	38500	24300	1.71	16500	52620	36120	2.18
Mustard	Crop production	BBM1, resistant to white rust & Alternaria blight	7.55	10.45	38.41	25400	41525	16125	1.63	29800	56952	27152	1.91
Pigeon Pea	Crop production	IPA 203, HYV. resistant to sterility mosaic disease	11.80	16.30	38.13	27600	70800	43200	2.56	34500	97800	65300	2.83



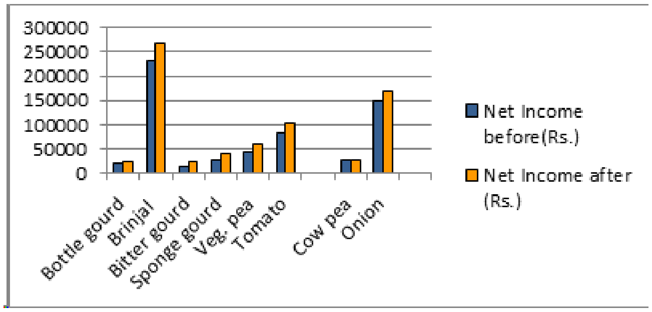
Yield Analysis



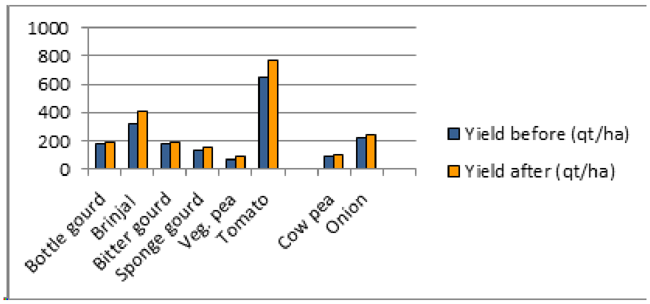
Economic Interventions

Table 2: Impact of vegetable production interventions on yield and income

Crop	Thematic area	Use of Technology	Yield (q/ha)		Increase yield in %	Economics of before intervention (Rs./ha)				Economics of after intervention (Rs./ha)			
			Before	After		Gross Cost	Gross Return	Net Return	BCR	Gross Cost	Gross Return	Net Return	BCR
Bottle gourd var. Swarna Sneha	Vegetable production	Popularization of Downey mildew and powdery mildew olerant variety	175	190	8.57	44500	63400	18900	1.4	46000	70600	24600	1.5
Brinjal var. Swarna Shyamali	Vegetable production	Wilt resistant varietal popularization	319.14	410.25	28.55	204612	435000	230388	1.1	187500	455625	268125	1.4
Bitter gourd var.- Swarna Yamini	Vegetable production	Popularization of high yielding variety	175	190	8.57	45500	87500	42000	1.92	46000	95000	49500	2.08
Sponge gourd var- Swarna Sawani	Vegetable production	Popularization of early flowering and fruiting satputiya	136	160	17.60	39000	68000	25900	161	41500	80000	38500	1.92
Veg. pea var.- Arkel	Vegetable production	Popularization of high yielding early variety	71.40	91.4	28.02	34750	75000	44000	1.2	32500	91400	58900	1.8
Tomato var. Swarna Sampada	Vegetable production	Popularization of bacterial wilt and early blight tolerant variety	655	772	11.70	49500	131000	81500	2.6	52000	154400	102400	2.9
Cow pea var. Swarna Mukut	Vegetable production	Popularization of bush type with good yield	87	100	15.00	38000	63500	25500	1.67	40000	68000	28000	1.70
Onion (Arka Niketan)	Crop Production	Long self-life	218	242	11.00	69800	218000	148200	3.12	70500	242000	169500	3.33
Oyaster mushroom	Income generation	Advance oyster mushroom production	0.90Kg /bag	1.30K g/bag	44.0	78/bag	180/ba g	102	2.3	85/bag	260.00/ bag	175/ba g	3.05



Economic Interventions



Yield Analysis

The impact of crop production interventions on vegetables and income-generating enterprises is presented in Table 2. The adoption of improved varieties and scientific production technologies demonstrated a significant increase in yield, profitability, and benefit-cost ratio (BCR) across different crops.

Yield Performance

All the demonstrated vegetable crops recorded higher yields than the farmers' practice, with yield enhancement ranging from 8.57% to 44.0%. Among vegetables, vegetable pea (Arkel) and brinjal (Swarna Shyamali) registered substantial yield gains of 28.02% and 28.55%, respectively, reflecting the importance of varietal replacement in disease-prone areas. Tomato (Swarna Sampada), tolerant to bacterial wilt and early blight, achieved an increase of 11.7% over the local check, producing 772 q/ha compared to 655 q/ha under traditional practices. Similarly, onion (Arka Niketan) recorded an 11% increase, which is crucial considering its importance as a cash crop with high market demand.

Interestingly, the highest relative gain was observed in oyster mushroom production, where yield increased from 0.90 kg/bag to 1.30 kg/bag, corresponding to a 44% improvement. This indicates that low-cost, high-return technologies in mushroom cultivation can significantly contribute to farm income diversification. These findings are in line with the reports of Meena et al. (2019) and Singh et al. (2021), which highlighted that varietal interventions in vegetables and mushrooms enhance productivity under biotic and abiotic stress conditions.

Economic Analysis

Economic evaluation revealed that the interventions resulted in substantial improvement in farm profitability. Among vegetable crops, brinjal generated the highest net return of 2, 68,125/ha after intervention, followed by tomato (1, 02,400/ha) and onion (1, 69,500/ha). The B:C ratio also improved significantly in most crops, particularly in tomato (2.9 vs. 2.6), onion (3.33 vs. 3.12), and vegetable pea (1.8 vs. 1.2). In cucurbits, bitter gourd (Swarna Yamini) and bottle gourd (Swarna Sneha) recorded net returns of 24,600/ha each, reflecting moderate but positive economic advantages. Sponge gourd (Swarna Sawani) and cowpea (Swarna Mukut), however, showed profitability with net returns of 38,500/ha and 28,000/ha, respectively, which could be attributed to local market fluctuations and higher cost of production relative to returns.

Oyster mushroom production emerged as a highly profitable enterprise with net returns of 175/bag and a B:C ratio of 3.05, compared to 102/bag (B:C ratio 2.3) in the traditional method. This demonstrates the potential of mushroom cultivation as a supplementary income-generating activity for small and marginal farmers. Similar economic benefits from mushroom cultivation have been reported by Sharma et al. (2020) and Verma and Singh (2022).

Implications for Sustainable Livelihoods

The study highlights that varietal replacement with disease-resistant and stress-tolerant cultivars, coupled with improved management practices, significantly enhanced both productivity and profitability in vegetable crops. The results also underline the importance of integrating high-value enterprises like mushroom cultivation into the farming system, which can serve as a reliable source of supplementary income, particularly under resource-limited and drought-prone conditions. These outcomes are consistent with earlier studies (ICAR, 2021; FAO, 2020), which emphasized the role of technological interventions in strengthening climate-resilient and market-oriented farming systems.

CONCLUSION

The Village Adoption Programme implemented by ICAR–KVK, Ramgarh, in Indrabad village demonstrated that strategic technological interventions can significantly enhance agricultural productivity, profitability, and resilience under drought-prone and resource-constrained conditions. The adoption of stress-tolerant and disease-resistant varieties, integrated nutrient and pest management, and diversification through enterprises like oyster mushroom cultivation led to notable yield gains ranging from 8.57% to 44% across cereals, pulses, oilseeds, vegetables, and income-generating activities. Economic analysis revealed substantial improvements in net returns and benefit-cost ratios, particularly in crops such as pigeon pea, onion, tomato, and brinjal, highlighting the effectiveness of varietal replacement and scientific crop management practices. The results confirm that participatory and location-specific approaches like village adoption programmes not only strengthen climate-resilient agriculture but also play a vital role in uplifting rural livelihoods and ensuring sustainable development in vulnerable farming communities.

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