



Modification and Popularization of Improved Cultivation Practices of *Ekangi* (*Kaempheria galanga* L.) as Replacement Crop for Rice in *Kharif* Season for Red and Lateritic Belt of Birbhum District of West Bengal

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10.18805/ag.R-2858

ABSTRACT

Background: The significant presence of 13 (thirteen) numbers of the Community Development (CD) Blocks viz. Murarai-I, Murarai-II, Rampurhat-I, Rampurhat-II, Mayureswar-I, Muhammad Bazar, Suri-I, Suri-II, Dubrajpur, Khayrasole, Illambazar, Bolpur-Sriniketan and Labpur of Birbhum District, where a considerable Red Lateritic soil situation with mainly *Kharif* Rice - fallow farming system along with predominantly mono-cropped *Kharif* Rice farming situation prevails, raises the ecological and economic concern of overwhelming dominance and continuance of cultivation of Rice in *Kharif* season. In this background, Rathindra Krishi Vigyan Kendra introduced *Ekangi* as a crop of drought resistance capacity and totally rainfed, covering the fields within 3 months, preventing Soil erosion due to heavy rain or heavy wind, lowering soil water evaporation loss and maintaining the Soil Water table properly, is a potential crop with huge positive crop economics, can be utilized to replace *Kharif* Rice in mono-cropped farming situation of red lateritic zones.

Methods: Mainly comparative statistical analyses of the data from the study across all the front-line demonstration programmes on viz. *Ekangi* and newly released improved high yielding varieties of *Kharif* Rice viz. Ranidhan (IET-19418), Chandra (MTU-1153) and CR Dhan 800 (IET-20672) in terms of economics viz. net return (Rs./ha) and B: C ratio were analysed.

Result: The present study clearly revealed the fact that the improved cultivation practices for the production of *Ekangi* as modified by the scientists of Rathindra Krishi Vigyan Kendra had huge economic potential over and above the newly released improved high yielding varieties of *Kharif* Rice, especially in the mono-cropped *Kharif* Rice farming situation prevailing in red lateritic zones of Birbhum District, West Bengal. The front-line demonstration (FLD) programmes in the last three (3) years, i.e. 2023-24, 2024-25 and 2025-26, clearly showed that *Ekangi* has a massive economic edge over three (3) newly released Improved high yielding varieties of *Kharif* Rice viz. Ranidhan (IET-19418), Chandra (MTU-1153) and CR Dhan 800 (IET-20672) in terms of economics viz. net return (Rs./ha) and B:C ratio. *Ekangi* enjoyed overwhelmingly higher net return (Rs./ha), ranging from Rs. 6,35,590.00/ha against *Kharif* Rice Var. Chandra (MTU-1153) in 2023-24 to Rs. 5,91,700.00/ha against *kharif* rice Var. Ranidhan (IET-19418) in 2025-26 and higher B:C ratio over newly released Improved high yielding varieties of *Kharif* Rice, ranging from a highest of 4.30 against *Kharif* Rice Var. Chandra (MTU-1153) in 2023-24 to 3.10 against *Kharif* Rice Var. Ranidhan (IET-19418) in 2025-26.

Key words: B: C ratio, *Ekangi*, Front Line Demonstration (FLD) programme, Net Return (Rs./ha), Newly released improved high yielding varieties of *Kharif* Rice, Red lateritic zone.

INTRODUCTION

Sand / Aromatic Ginger also known as *Ekangi* in Vernacular Languages, especially in Bengali; *Chandramula* in Hindi; *Kencur* in Indonesian; *Cekor* in Malay or *Inchmoh* (local Khasi name) in Meghalaya [Techaprasan *et al.*, 2010; Selvam, 2012; Biswas, 2020 and Regional-cum-Facilitation Centre, Eastern Region (RCFC-ER), National Medicinal Plants Board (NMPB), Ministry of AYUSH, Govt. of India and Jadavpur University, Kolkata (2023)] is botanically known as *Kaempheria galanga* L., a perennial, stemless, monocotyledonous plant in the Zingiberaceae plant family with plant characteristics of aromatic herb formed by thin, moderately branching roots growing from a tuberous stem. The plant is native to India and originated in East Asia (with special reference to Burma, now renamed as Myanmar). Worldwide, this plant is mainly cultivated in South-East Asia, South Asia and China. In India, *Ekangi* is being produced by the farmers and farm women of Karnataka, Kerala, now renamed as Keralam, Tamil Nadu and West

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How to cite this article: Ray, P., Mandal, S., Mondal, S. and Ankure, P. (2026). Modification and Popularization of Improved Cultivation Practices of *Ekangi* (*Kaempheria galanga* L.) as Replacement Crop for Rice in *Kharif* Season for Red and Lateritic Belt of Birbhum District of West Bengal. *Agricultural Reviews*. 47(4): 664-670. doi: 10.18805/ag.R-2858.

Submitted: 12-05-2026 **Accepted:** 01-07-2026 **Online:** 25-08-2026

Bengal. The rhizome of *Ekangi* is fleshy, odorous and has a dull reddish-brown external skin with a delicate interior which is almost whitish to light yellowish with a tuberous tip, while the leaves are deep green to darkish green, radiating horizontally along with the ground layer (Selvam, 2012).

The compounds Ethyl-Cinnamate and Ethyl-P-Methoxycinnamate are the major bioactive constituents of Rhizome extracts of *Ekangi* that have been reported in Dichloromethane (Othman *et al.*, 2006), Hexane (Yu *et al.*, 2000) and Methanol (Huang *et al.*, 2008) extracts. Nonglang *et al.* (2022) confirmed the presence and identification of various phytocompounds, with Ethyl P-Methoxycinnamate identified as the major active compound from the Gas Chromatography-Mass Spectroscopy (GCMS) analysis of Rhizome extracts of *Ekangi*.

In evidence-based clinical medicine, *K. galanga* L. has been reported to possess different pharmacological properties like anti-inflammatory (Sulaiman *et al.*, 2008), anti-apoptotic and anti-carcinogenic activities (Liu *et al.*, 2010), sedative effects (Ali *et al.*, 2015) and wound healing activities (Shanbhag *et al.*, 2006) due to presence of above noted major bioactive constituents of its Rhizome. War and Kayang (2022) also pointed out from their Study that extracted oil from the rhizomes of *Ekangi* has had the potential to control fungal phyto-pathogens and their associated growths.

The above-noted findings clearly point out the fact that the derivatives, extracts and essential oils, mainly from the Rhizomes of *Ekangi*, have wide-ranging application in pharmaceutical, perfumery, food and feed flavouring and folk medicine Sectors.

Ekangi as a cultivable crop is also remunerative because of the high market price value of its dry Rhizomes. In 2016-17, the market price of *Ekangi* rhizomes was Rs.300.00 per Kilo Gram (Kg.), which was Rs.120.00 per kg. in 2012-13 (Preetha *et al.*, 2016). Apart from domestic market demand, this crop of *Ekangi* also has a fair export potential (Vincent *et al.*, 1991). The price of essential oil extracted from *Ekangi* rhizomes varied from US\$600.00 to US\$ 700.00 per Kg. in the international market in the early part of the 2000s (Chithra *et al.*, 2005). According to market aggregator, Amazon (2026), the retail sale price of Rhizomes of *Ekangi* is Rs. 3,956.00/kg to Rs. 4,000.00/kg with up to 44 per cent discount, resulting into a discounted retail price of Rs. 2,217.72/kg to Rs. 2,217.84/kg. The wholesale market price of *Ekangi* Rhizomes varies from Rs. 200.00/kg to Rs. 450.00/kg (Exportersindia, 2026). As a result, the crop of *Ekangi* is being transformed into the status of commercial crop from restricted cultivation in localised tracts of West Bengal, due to a steady increase in market demand and a sustained rise in market price in recent years.

MATERIALS AND METHODS

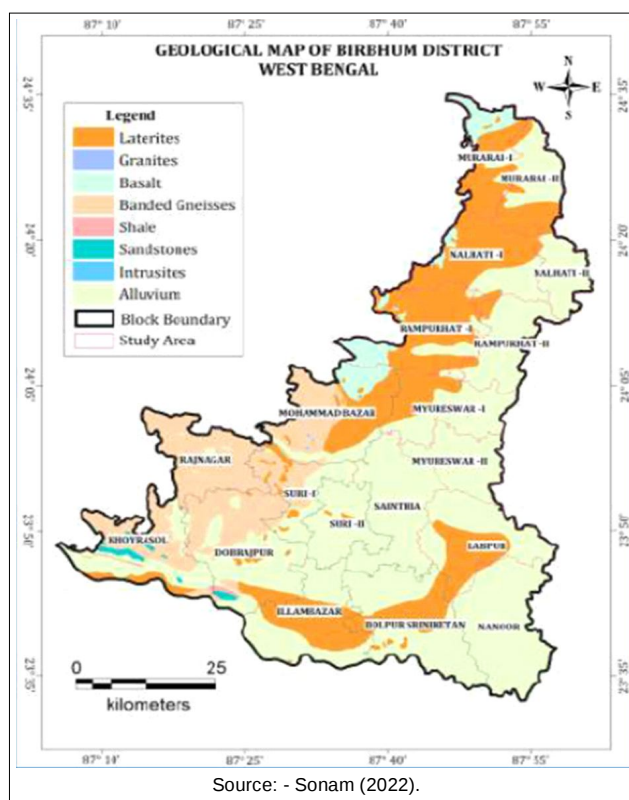
Keeping the above noted factors in mind, the scientists of Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana

(Institute of Agriculture), Visva-Bharati started its Research and Extension Works on *Ekangi* in 2013-14 with the following objectives:

1. Standardization of modified cultivation practices of *Ekangi* (*Kaempheria galanga* L.) in *kharif* season for red and lateritic belt of Birbhum district in West Bengal.
2. Popularization of *Ekangi* as a potential crop for crop diversification efforts (replacing *Kharif* Rice in mono-cropped farming situation with water stress problem in red and lateritic belt).
3. Ensuring higher economic benefits for the farmers through increased net return and also increased B:C ratio.

Study area

Representative 38 (thirty eight) numbers of villages from 13 (Thirteen) numbers of the Community Development (CD) Blocks viz. Murarai-I, Murarai-II, Rampurhat-I, Rampurhat-II, Mayureswar-I, Muhammad Bazar, Suri-I, Suri-II, Dubrajpur, Khayrasole, Illambazar, Bolpur-Srniketan and Labpur of Birbhum District, where considerable red lateritic soil situation (Map 1) (Sonam, 2022) with mainly *Kharif* rice - fallow farming system along with predominantly mono-cropped *Kharif* Rice farming situation prevails were selected for Font Line Demonstration (FLD) Programmes on *Ekangi* and the said FLD programmes have been being conducted by the Rathindra Krishi Vigyan Kendra since 2015-16 till date.



Map 1: Geological map of Birbhum district.

RESULTS AND DISCUSSION

Scientists of Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, critically studied the established protocol of cultivation-production practices of *Ekangi*, as elaborated/noted/established by Kerala Agricultural University (2007). Scientists of Rathindra Krishi Vigyan Kendra initiated On Station Trial (OST) for standardization of modified cultivation practices of *Ekangi* (*Kaempheria galanga* L.) in *kharif* season for red and lateritic belt of Chotanagpur plateau with special emphasis on Birbhum district in West Bengal in 2013-14 in its Medicinal Plants Garden. The trial concluded in 2014-15 with following Modified Package of Practices for cultivation of *Ekangi* (*Kaempheria galanga* L.) in *kharif* season for red and lateritic belt of Chotanagpur Plateau with special emphasis on Birbhum district in West Bengal.

Basic technology

The basic technological package of practices for cultivation of *Ekangi* was derived from Kerala Agricultural University (2007).

Brief about the modified technology

- Totally rainfed.
- **Time of planting:** May-June with nor-wester.
- **Seed rate:** 7.5 q/ha (Rhizome of 4 cm length with 2 buds)
- **Land preparation:** Only 2 cross ploughings with levelling.
- **Choice of land:** Medium to upland with proper drainage facility in mono cropped area.
- **Planting:** Spacing - 20 cms. × 20 cms.; Depth - 4 cms.
- **Seed treatment:** Rhizomes to be dipped in solution of *Trichoderma viridi* (4 gm/kg seeds).
- **Manures and fertiliser:** Well rotten farm yard manure (FYM) 10 ton/ha as basal.
- **Top dressing at one month after planting:** Urea 75 kg/ha, SSP- 600 kg/ha, MOP- 100 kg/ha.
- **Top dressing after three months of planting:** Urea - 75 kg/ha.
- **Intercultural operations:** - Weeding at 2nd. and 4th. Weeks after planting, then straw mulching.
- **Herbicide use:** Spraying of Glyphosate @ 5 ml. /lt. of Water at 15 days after planting.
- **Harvesting:** 6-8 months after planting.
- **Yield:** 300-350 q/ha.

Uniqueness of the technology in comparison to existing ones:

A. Saving of water, labour, time and energy:

- (a) Totally rainfed, 80% water saving than *Kharif* rice.
- (b) Total 200 labours per hectare saved.
- (c) Time requirement is more but it is irrelevant as it is cultivated in mono-cropped area.

B. Conservation of soil

Soil conservation is more because after 3 months the crop covers the land with its broad leaves and protects the crops from erosion and nutrient loss.

C. Climate resilience capacity

It can withstand severe drought.

D. Biotic factor resilience

Cattle do not graze it.

E. Cost effectiveness including B: C ratio

The partner farmers of Rathindra Krishi Vigyan Kendra, involved in the Kendra's front-line demonstration (FLD) programmes on cultivation of *Ekangi*, also cultivated *kharif* rice variety Swarna (MTU-7029) side-by-side and earned a net return of Rs. 22,500.00 per ha in their rain fed mono cropped farming situation with a B:C ratio of 1.82 in the Year of 2015-16 (Rathindra Krishi Vigyan Kendra, 2016). Now after cultivating *Ekangi* the above-mentioned Partner Farmers and Farm Women achieved a B:C ratio of 6.03 with net return of Rs. 7,47,500.00 per ha in the year of 2015-16 (Rathindra Krishi Vigyan Kendra, 2016).

F. Natural resource conservation

Ekangi as a field crop is totally rain fed. So, there is no loss of water. Total rainwater is used for production. Crops cover the fields within 3 months, so no soil erosion occurs due to heavy rain or heavy wind. Evaporation loss is lowered down from the area under cultivation of *Ekangi*, so the sub-surface soil water table is maintained properly.

Popularization of *Ekangi* as a potential crop for crop diversification efforts (replacing *Kharif* Rice in mono-cropped farming situation with water stress problem in red and lateritic belt)

After the standardization of modified cultivation practices of *Ekangi* (*Kaempheria galanga* L.) in *Kharif* season for red and lateritic belt of Chotanagpur plateau with special emphasis on Birbhum district is successfully operationalized, the Scientists of Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati initiated Front Line Demonstration (FLD) programmes on *Ekangi* with emphasis on imparting skill development trainings to the partner practicing farmers and farm women in 2015-16, which is continuing till date, involving a cumulative total of 266 numbers of partner farmers and farm women and 3.62 hectares of land under demonstration (Table 1).

Large tracts of Birbhum district is under mono-cropped farming system, especially in the areas with red lateritic soil profiles, with only *Kharif* Rice as the only cultivable crop in an annual crop calendar. This fact is corroborated by the information of the Department of Agriculture, Govt. of West Bengal (2026), which elucidates that *Kharif* Rice is the main predominant crop in the *Kharif* season and 94.00 per cent of the cultivated land of Birbhum district in *Kharif* Season is under Rice. This type of farming situation, overwhelmingly dependent on one crop *i.e.* *Kharif* Rice, can be further looked into from the fact that the *Kharif* Rice covered 3,03,395 hectares of land out of total net cropped Area of 3,20,610 hectares in the Year of 2020-21 in Birbhum district, which amounts to 94.63 percentage share of *Kharif*

Rice in net cropped area of the district (Dept. of Agriculture, Govt. of West Bengal-2021).

According to Mondal *et al.* (2018), 80.00 per cent of the area under rice in Birbhum district is under old high yielding Rice varieties like IR-36, varietal release in the year of 1976; Swarna (MTU-7029), variety released in the year of 1982; Khitish (IET-4094), varietal release in the year of 1982; Lalat (IET-9947), Varietal release in 1989 and Shatabdi (IET-4786), varietal release in 2000.

To achieve increased varietal replacement rate/seed replacement ratio in Birbhum district, the scientists of Rathindra Krishi Vigyan Kendra initiated Front Line Demonstration (FLD) programme on newly released improved high yielding varieties of *Kharif* Rice from the year 2020-21. In the last three years, i.e. 2023-24, 2024-25 and 2025-26, the Scientists of the Rathindra Krishi Vigyan Kendra organised FLD programmes on the newly released

improved high-yielding varieties of *Kharif* Rice, suitable red lateritic situation of Birbhum district viz. Ranidhan (IET-19418), variety released in the year 2009; Chandra (MTU-1153), variety released in the year 2015 and CR Dhan 800 (IET-20672), variety released in 2016; involving a cumulative total of 562 numbers of partner farmers and farm women and 160.60 hectares of land under demonstration (Table 2). The FLD performances of the above-noted three (3) *kharif* rice varieties are elucidated in Table 2.

To have a scientific economic comparison between the FLD Programmes organised by the scientists of Rathindra Krishi Vigyan Kendra on *Ekangi* and the three newly released Improved High Yielding Varieties of *Kharif* Rice viz. Ranidhan (IET-19418), Chandra (MTU-1153) and CR Dhan 800 (IET- 20672), the present authors have comparatively analysed the front-line demonstration data using tabular comparative tools as noted through Table 3.

Table 1: Front Line Demonstration Programmes on *Ekangi* organized by Rathindra Krishi Vigyan Kendra.

Year	Nos. of partner farmers	Area under Ekangi demonstration (ha)	Yield (Q / ha)	Net return (Rs. / ha)	B:C ratio
2015-16	03	0.26	112.00	7,47,500.00	6.03
2016-17	-	-	-	-	-
2017-18	15	0.26	135.00	9,15,000.00	6.55
2018-19	20	0.26	137.00	9,16,000.00	6.08
2019-20	32	0.39	*	*	*
2020-21	32	0.33	134.00	9,16,000.00	6.70
2021-22	30	1.00	133.00	9,04,000.00	6.65
2022-23	28	0.33	135.60	9,04,000.00	6.26
2023-24	56	0.26	134.70	6,78,200.00	6.22
2024-25	28	0.26	135.30	6,81,800.00	6.24
2025-26	22	0.27	133.50	6,81,800.00	5.48
Total	266	3.62			

*Collection, verification, analysis and interpretation of field data could not be completed due to COVID-19 restrictions.

Sources: Rathindra Krishi Vigyan Kendra (2016), Rathindra Krishi Vigyan Kendra (2017), Rathindra Krishi Vigyan Kendra (2018), Rathindra Krishi Vigyan Kendra (2019), Rathindra Krishi Vigyan Kendra (2020), Rathindra Krishi Vigyan Kendra (2021), Rathindra Krishi Vigyan Kendra (2022), Rathindra Krishi Vigyan Kendra (2023), Rathindra Krishi Vigyan Kendra (2024), Rathindra Krishi Vigyan Kendra (2025) and Rathindra Krishi Vigyan Kendra (2026).

Table 2: Front Line Demonstration Programmes on newly released improved high yielding varieties of *Kharif* Rice organized by Rathindra Krishi Vigyan Kendra.

Year	Variety	Nos. of partner farmers	Area under demonstration (ha)	Yield (Q/ha)	Net return (Rs./ha)	B:C ratio
2023-24	Ranidhan (IET-19418)	49	6.0	67.00	68,300.00	2.16
	Chandra (MTU-1153)	61	09.00	46.90	42,610.00	1.92
	CR Dhan 800 (IET-20672)	42	41.00	62.10	60,490.00	2.05
2024-25	Ranidhan (IET-19418)	58	25.60	67.20	86,940.00	2.40
	Chandra (MTU-1153)	33	7.20	47.20	54,840.00	2.00
	CR Dhan 800 (IET-20672)	58	11.80	66.70	85,840.00	2.40
2025-26	Ranidhan (IET-19418)	61	15.00	67.50	90,100.00	2.38
	Chandra (MTU-1153)	05	3.00	47.70	54,840.00	2.20
	CR Dhan 800 (IET-20672)	195	42.00	67.10	89,230.00	2.37
Total		562	160.60			

Sources: Rathindra Krishi Vigyan Kendra (2024), Rathindra Krishi Vigyan Kendra (2025) and Rathindra Krishi Vigyan Kendra (2026).

Table 3: Economic comparison between front line demonstration programmes on *Ekangi* and newly released improved high yielding varieties of *Kharif* Rice organized by Rathindra Krishi Vigyan Kendra.

Year	Crop	Net return (Rs./ha)	B:C ratio
2023-24	<i>Ekangi</i>	6,78,200.00	6.22
	Ranidhan (IET-19418)	68,300.00	2.16
	Chandra (MTU-1153)	42,610.00	1.92
	CR Dhan 800 (IET-20672)	60,490.00	2.05
2024-25	<i>Ekangi</i>	6,81,800.00	6.24
	Ranidhan (IET-19418)	86,940.00	2.40
	Chandra (MTU-1153)	54,840.00	2.00
	CR Dhan 800 (IET-20672)	85,840.00	2.40
2025-26	<i>Ekangi</i>	6,81,800.00	5.48
	Ranidhan (IET-19418)	90,100.00	2.38
	Chandra (MTU-1153)	54,840.00	2.20
	CR Dhan 800 (IET-20672)	89,230.00	2.37

Sources: Rathindra Krishi Vigyan Kendra (2024), Rathindra Krishi Vigyan Kendra (2025) and Rathindra Krishi Vigyan Kendra (2026).

Table 4: Difference in net return (Rs./ha) and difference in B:C ratio in front line demonstration programmes organized by Rathindra Krishi Vigyan Kendra in favour of *Ekangi* over newly released improved high yielding varieties of *Kharif* Rice.

Year	Crop	Difference in net return (Rs./ha) in favour of <i>Ekangi</i>		Difference in B:C ratio in favour of <i>Ekangi</i>	
2023-24	Ranidhan (IET-19418)	6,09,900.00	IV*	4.06	IV**
	Chandra (MTU-1153)	6,35,590.00	I*	4.30	I**
	CR Dhan 800 (IET-20672)	6,17,710.00	III*	4.17	III**
2024-25	Ranidhan (IET-19418)	5,94,860.00	VI*	3.84	V**
	Chandra (MTU-1153)	6,26,960.00	II*	4.24	II**
	CR Dhan 800 (IET-20672)	5,95,960.00	V*	3.84	V**
2025-26	Ranidhan (IET-19418)	5,91,700.00	VIII*	3.10	VIII**
	Chandra (MTU-1153)	6,26,960.00	II*	3.28	VI**
	CR Dhan 800 (IET-20672)	5,92,570.00	VII*	3.11	VII**

*Rank regarding difference in net return (Rs./ha) in Front Line Demonstration Programmes organized by Rathindra Krishi Vigyan Kendra in favour of *Ekangi* over newly released improved high yielding varieties of *Kharif* rice.

**Rank regarding difference in B: C ratio in Front Line Demonstration Programmes organized by Rathindra Krishi Vigyan Kendra in favour of *Ekangi* over newly released improved high yielding varieties of *Kharif* rice.

Sources: Rathindra Krishi Vigyan Kendra (2024), Rathindra Krishi Vigyan Kendra (2025) and Rathindra Krishi Vigyan Kendra (2026).

Further to analyse the data gained from the FLD Programmes, organised by the scientists of the Rathindra Krishi Vigyan Kendra, it is to be noted that across all the demonstration programmes, *Ekangi* enjoyed overwhelmingly higher net return (Rs./ha), ranging from Rs. 6,35,590.00/ha against *kharif* rice Var. Chandra (MTU-1153) in 2023-24 to Rs. 5,91,700.00/ha against *Kharif* Rice Var. Ranidhan (IET-19418) in 2025-26 and higher B:C ratio over newly released Improved high yielding varieties of *Kharif* Rice, ranging from a highest of 4.30 against *kharif* rice Var. Chandra (MTU- 1153) in 2023-24 to 3.10 against *Kharif* Rice Var. Ranidhan (IET-19418) in 2025-26 (Table 4).

CONCLUSION

The Front Line Demonstration Programmes organized by the Scientists of the Rathindra Krishi Vigyan Kendra over last few Years, especially in the last three (3) years *i.e.*

2023-24, 2024-25 and 2025-26 clearly showed that *Ekangi* has a massive edge over three (3) newly released Improved high yielding varieties of *Kharif* Rice *viz.* Ranidhan (IET-19418), Chandra (MTU-1153) and CR Dhan 800 (IET-20672) in terms of economics *viz.* net return (Rs./ha) and B:C ratio. This carries significance in the backdrop presence of 13 (thirteen) numbers of the Community Development (CD) Blocks *viz.* Murarai-I, Murarai-II, Rampurhat-I, Rampurhat-II, Mayureswar-I, Muhammad Bazar, Suri-I, Suri-II, Dubrajpur, Khayrasole, Illambazar, Bolpur-Srniketan and Labpur of Birbhum district, where considerable Red Lateritic soil situation (Sonam, 2022) with mainly *Kharif* Rice - fallow farming system along with predominantly prevails. This is because *Ekangi*, as a Crop of Drought resistance capacity and totally rainfed, covering the fields within 3 Months, preventing Soil erosion due to heavy rain or heavy wind, lowering soil water evaporation

loss and maintaining the Soil Water table properly, is a potential crop with huge positive crop economics and can be utilised to replace *Kharif* Rice in mono-cropped farming situations of Red Lateritic Zones.

ACKNOWLEDGEMENT

The present study was supported by primary data and statistical analysis of the data generated from the Front Line Demonstration (FLD) Programmes organized by the Rathindra Krishi Vigyan Kendra.

Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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