

# Original Research Article

## Assessment of Rice- Mustard & Rice- Chickpea through conservation agricultural practices under the Rice- Fallow cropping system in Satna district of Madhya Pradesh

### ABSTRACT

Rice – Fallow land due to the growing of a longer more extended duration variety of Rice by farmers affects the timely sowing of rabi crop, and land remains fallow due to inadequate moisture in the field along with terminal heat stresses (about 14000 ha area) in district Satna (M.P.). The trial consisted of three treatments viz., T<sub>1</sub>- Rice (Variety with maturity above 125 days) in kharif- Rabi fallow, T<sub>2</sub>- Rice (MTU-1010)-Mustard (Pusa Mustard 28), T<sub>3</sub>- Rice (MTU-1010)-Chickpea (RVG-202). Rice cropping system recorded higher Rice equivalent yield over rice-fallow by 42.12 qha<sup>-1</sup>, system productivity 36.97 kg ha<sup>-1</sup> day<sup>-1</sup>, profitability by ₹470.94 ha<sup>-1</sup> day<sup>-1</sup>. The rice-cropping system recorded higher Rice equivalent yield over rice-fallow by 42.12 q ha<sup>-1</sup>, system productivity 36.97 kg ha<sup>-1</sup> day<sup>-1</sup>, profitability by ₹470.94 ha<sup>-1</sup> day<sup>-1</sup>, and net return ₹103608ha<sup>-1</sup>. Similarly, Rice-Chickpea cropping system gave 37.84 qha<sup>-1</sup> Rice equivalent yield, 35.11 kg ha<sup>-1</sup> day<sup>-1</sup> higher productivity, ₹ 431.56 ha<sup>-1</sup> day<sup>-1</sup>. The Rice-Chickpea cropping system gave 37.84 q ha<sup>-1</sup> Rice equivalent yield, 35.11 kg ha<sup>-1</sup> day<sup>-1</sup> higher productivity, ₹ 431.56 ha<sup>-1</sup> day<sup>-1</sup>, and net return ₹94942ha<sup>-1</sup> higher profit than rice-fallow cropping system. Thus, from the present study, it can be concluded that rice-chickpea and rice mustard cropping systems are an appropriate and effective way to use fallow land under Rice-Fallow appropriate and effective ways to use fallow land under the rice-fallow cropping system.

**Keywords:** Rice, Mustard, Chickpea, cropping system, yield, Rice equivalent equivalent Yield

### INTRODUCTION

Rice fallow (11.7 million ha) is a ~~more crop mono-crop~~ rice-based production system in India. The rice-fallow areas are mostly primarily concentrated in the parts Satna district of Satna district, about 14000 ha. The reasons for following after the rainy season are lack of irrigation, fast depletion of the soil residual moisture and poor socio-economic condition of the farmers along with, poor socio-economic condition of the farmers, and some regional constraints such as free grazing of cattle. Besides this, the late harvesting of long duration long-duration rice (150–160 days) delays the sowing of winter crops, which, in turn, aggravates the moisture and terminal heat stresses in winter crops. Unfavorable physical attributes of soil owing to puddling (wet tillage), soil compaction. Unfavorable physical attributes of soil owing to puddling (wet tillage), soil compaction, and acidic soil reaction further add to the poor performance of winter crops in rice fallow areas. ~~To replace the rice by any other crop is very difficult during rainy season due to prevailing soil and climatic condition of the region, intensification and diversification of~~ Replacing rice with any other crop is very difficult during the rainy season due to the region's prevailing soil and climatic conditions; intensification and diversification of the rice-based cropping system can only be the alternative option. Crops like oilseeds and pulses are gaining more attention due to higher prices ~~due to increase~~ Crops

**Comment [m1]:** \*\* My opinion for title\*\*  
"Enhancing Crop Productivity and Sustainability: A Study of Conservation Agricultural Practices in Rice-Mustard and Rice-Chickpea Systems within the Rice-Fallow Cropping System in Satna District, Madhya Pradesh, India"

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**Comment [m2]:** \*\* Clarity\*\* The figures are easy to understand. It would be difficult for international researchers to understand the meaning of Rabi and kharif crops, elaborate them.

**\*\* Unit\*\*** It would be better to show the return and benefits on US Dollar. It helps other researchers to get easily into the research finding.

**\*\* Objectify\*\*** State the objective of using Pusa Mustard 28, what are the conditions required for it, What is the meaning of 28 in Pusa, Is it native to the study area?. Mention them in the Section Material and Methods. Do similar to MTU-1010, RVG-22 and etc

like oilseeds and pulses are gaining more attention owing to higher prices due to increased market demand. Including these crops in a sequence changes the economics of the cropping sequences [1].

## METHOD AND MATERIAL

On-farm testing on rice was conducted during 2020-21 at farmer's fields of Satna district to assess Rice-Mustard & Rice-Chickpea. On-farm testing on rice was conducted during 2020-21 at farmer's fields of Satna district through conservation agricultural practices under Rice-Fallow cropping system to assess Rice-Mustard & Rice-Chickpeas through conservation agricultural practices under the Rice-Fallow cropping system. 10 OFTs were conducted with randomly selected farmer's fields in Naugawan and Shahpur villages of Majhgawan block of Satna. Direct seeding of short duration short-duration variety of Rice (MTU 1010) followed by zero tillage sowing of Mustard or Chickpea by utilizing the residual soil moisture of rice field. The trial consisted of three treatments viz., T<sub>1</sub>- Rice (Variety with maturity above 125 days) in kharif- Rabi fallow, T<sub>2</sub>- Rice (MTU-1010)-Mustard (Pusa Mustard 28), T<sub>3</sub>- Rice (MTU-1010)-Chickpea (RVG-202). With this objective in mind, a field experiment was conducted at Krishi Vigyan Kendra, Majhgawan (Satna) during 2020-21 to assess Mustard & Rice-Chickpea through conservation agricultural practices under Rice, a field experiment was conducted at Krishi Vigyan Kendra, Majhgawan (Satna) during 2020-21 to assess Mustard & Rice-Chickpea through conservation agricultural practices under the Fallow cropping system. Geographically, Satna is in the Satpura and Kaymore Plateau range at an elevation of 313 meters above mean sea level and between 24°51'15" and 24°57'30"N latitude and 80°43'30" and 80°54'15"E longitude. The place has a subtropical climate characterized by a hot and dry summer and a chilly winter. The farmer's fields had sandy loam soil with a shallow depth, very low-deficient readily available nitrogen, low phosphorus, and more readily available potassium. The soil reaction was close to neutral. The conventional rice-wheat cropping system has been observed on the ground for the last 15 years.

The yields of all the crops in the sequences were converted into Rice Equivalent Yield (REY) for comparison between different cropping systems. The REY of the systems was calculated in terms of rice using the formula given by Kumar et al. [2]

**Rice equivalent Yield (REY) ( $q\ ha^{-1}$ )** =  $\sum Y_i \times P_i / P(p)$

where, Y<sub>i</sub>= yield of non-rice crops; P<sub>i</sub>= price of respective crops and P(p)= price of rice.

**Gross monetary returns (GMR):** Based on the prices of output prevailing at the time of harvest, treatment-wise GMR ( $\text{₹}\ ha^{-1}$ ) was computed.

**Net monetary returns (NMR):** Based on the current market price of inputs and outputs, the NMR ( $\text{₹}\ ha^{-1}$ ) was worked out using the following formula.

Net monetary returns ( $\text{₹}\ ha^{-1}$ ) = [Gross monetary returns ( $\text{₹}\ ha^{-1}$ )] - [Total cost of cultivation ( $\text{₹}\ ha^{-1}$ )]

**Benefit: cost ratio:** It was calculated by using the formulae given below:

**Comment [m3]:** \*\* Literature Review\*\* Seems like the literature review is not sufficient.

The study must consider why is author consider this assessments. What other researchers had done before in recent years?  
The study must state the objective, research gap .

**Comment [m4]:** \*\*Data\*\* study was conducted on 2020-21. It would be better to show that how did you the crop yield data. It could be crop sampling from irrigable to non irrigable land. Crop cutting survey is an another measuring method. Please elaborate them

$$\text{Benefit: cost ratio} = \frac{\text{Gross monetary returns } (\text{₹ ha}^{-1})}{\text{Total cost of cultivation } (\text{₹ ha}^{-1})}$$

Productivity values in terms of  $\text{kg ha}^{-1} \text{ day}^{-1}$  were calculated by dividing the production of the sequence by system duration in days and profitability in terms of  $\text{₹ ha}^{-1} \text{ day}^{-1}$  was obtained by dividing net returns of the sequence by were calculated by dividing the production of the sequence by system duration in days, and profitability in terms of  $\text{₹ ha}^{-1} \text{ day}^{-1}$  was obtained by dividing net returns of the sequence by the total duration of the sequence [3]. Different efficiencies were computed by using the following formulae:

$$\text{System productivity } (\text{kg ha}^{-1} \text{ day}^{-1}) = \frac{\text{Total seed yield produce } (\text{kg ha}^{-1})}{\text{No. of days required in production}}$$

$$\text{System profitability } (\text{₹ ha}^{-1} \text{ day}^{-1}) = \frac{\text{Net monetary return } (\text{₹ ha}^{-1})}{\text{No. of days required in production}}$$

## RESULT AND DISCUSSION

### Effect on yield and Rice equivalent Yield (REY):

The average of yield and rice equivalent yield of all the cropping system yield and rice equivalent yield of all the cropping systems are presented in (Table 1). The highest yield (Rice  $42.90 \text{ qha}^{-1}$  + Mustard  $16.18 \text{ qha}^{-1}$ ) and REY ( $42.12 \text{ q ha}^{-1}$ ) was recorded in Rice- Mustard cropping system followed by Rice-Chickpea cropping (Rice  $42.90 \text{ qha}^{-1}$  + Chickpea  $14.04 \text{ qha}^{-1}$ ) and REY ( $37.84 \text{ qha}^{-1}$ ) over rice-fallow (Rice  $45 \text{ qha}^{-1}$ ). The present result is in conformity conforms with the findings of Kalita et al. [4] and Sharmah et al. [5]

**Table 1: Effect of treatments on Grain yield Rice equivalent yield of different cropping systems**

Treatments	Grain Yield ( $\text{qha}^{-1}$ )	Rice Equivalent Yield ( $\text{qha}^{-1}$ )
T <sub>1</sub> (Rice (Variety with maturity above 125 days))	45.76	-
T <sub>2</sub> (Rice (MTU-1010)-Mustard (Pusa Mustard 28))	42.90+16.18	42.12
T <sub>3</sub> (Rice (MTU-1010)-Chickpea (RVG-202))	42.90+14.04	37.84

### Effect on economics of cropping systems:

The gross monetary returns, net monetary returns and benefit: cost ratio was affected by rice-based cropping systems (Table-2). Rice-Mustard cropping system recorded higher in Gross monetary return ( $\text{₹}164943 \text{ ha}^{-1}$ ) net monetary return ( $\text{₹}103608 \text{ ha}^{-1}$ ) and Benefit Cost Ratio (2.69) followed by Rice-Chickpea cropping system over Rice-Fallow cropping system. The present result is in conformity with the findings of Kalita et al. [4] and Sharmah et al. [5]

**Table 2: Effect of treatments on economics of different cropping systems**

Treatments	Cost of cultivation ( $\text{₹ha}^{-1}$ )	Gross Monetary Return ( $\text{₹ha}^{-1}$ )	Net Monetary Return ( $\text{₹ha}^{-1}$ )	Benefit-Cost Ratio

**Comment [m5]:** \*\* Clarity\*\* In this research, it was not expressed that the agricultural region is arid or non-arid. Is there any Irrigation facility? How could that affect the selected mixed cropping pattern?

T <sub>1</sub> (Rice (Variety with maturity above 125 days)	35755	88776	53021	2.48
T <sub>2</sub> (Rice (MTU-1010)-Mustard (Pusa Mustard 28)	61335	164943	103608	2.69
T <sub>3</sub> (Rice (MTU-1010)-Chickpea (RVG-202)	61705	156647	94942	2.54

#### Effect on System productivity and profitability of rice-based cropping systems

The effect of different rice-based cropping sequences on system productivity ( $\text{kg ha}^{-1}\text{day}^{-1}$ ) and system profitability ( $\text{ha}^{-1}\text{day}^{-1}$ ) are presented in (Table 3). Data showed that the effect on system productivity was highest value in Rice-Mustard cropping system ( $36.97\text{kg ha}^{-1}\text{day}^{-1}$ ) after Rice-Chickpea cropping ( $35.11\text{ kg ha}^{-1}\text{ day}^{-1}$ ) over Rice-fallow cropping system ( $33.90\text{kg ha}^{-1}\text{ day}^{-1}$ ). The System profitability was highest value in Rice-Mustard ( $\text{₹}470.94\text{ ha}^{-1}\text{ day}^{-1}$ ) after Rice-Chickpea cropping system ( $\text{₹}431.56\text{ ha}^{-1}\text{ day}^{-1}$ ) over Rice-fallow cropping system ( $\text{₹}392.75\text{ha}^{-1}\text{ day}^{-1}$ ) The present result is in conformity with the findings of Kalita et al. [4] and Sharmah et al. [5]

**Table 3: Effect of treatments on System Productivity and System profitability of different cropping systems**

Treatments	System Productivity ( $\text{kg ha}^{-1}\text{ day}^{-1}$ )	System profitability ( $\text{₹ ha}^{-1}\text{ day}^{-1}$ )
T <sub>1</sub> (Rice (Variety with maturity above 125 days)	33.90	392.75
T <sub>2</sub> (Rice (MTU-1010)-Mustard (Pusa Mustard 28)	36.97	470.94
T <sub>3</sub> (Rice (MTU-1010)-Chickpea (RVG-202).	35.11	431.56

#### CONCLUSION

It can be concluded that Rice-fallow cropping of Satna district of Madhya Pradesh can effectively be use by diversified with inclusion of Mustard or Chickpea during *rabi* season which can act as viable systems in productivity and economical point of view. Among all the tested cropping sequences, Rice-Mustard is the feasible sequence in terms of both productivity as well as economical point of view followed by Rice-Chickpea cropping system.

**Comment [m6]:** \*\*Findings\*\* Rice fallow cropping with Mustard or Chickpea is a critical finding. It would be better if the economic benefits could be shown in the figures.

#### REFERENCES

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