

## Original Research Article

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

**Comment [A1]:** This manuscript is important to the scientific community

#### **ABSTRACT**

Rice – Fallow land due to growing of longer duration variety of Rice by farmers affect timely sowing of rabi crop and land remains fallow due to inadequate moisture in 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> 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> 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 cropping system.

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

#### **INTRODUCTION**

Rice fallow (11.7 million ha) is a mono-crop rice-based production system in India. The rice-fallow areas are mostly concentrated in the parts Satna district about 14000 ha. The reasons for fallowing after rainy season are lack of irrigation, fast depletion of the soil residual moisture and poor socio-economic condition of the farmers along with some regional constraints such as free grazing of cattle. Besides this, the late harvesting of long duration rice (150–160 days) delays the sowing of winter crops that, in turn, aggravates the moisture and terminal heat stresses in winter crops. Unfavourable 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 rice-based cropping system can only be the alternative option. Crop like oilseeds and pulses are gaining more attention owing to higher price due to increase market demand. Inclusion of these crops in a sequence, changes the economics of the cropping sequences [1].

#### **METHOD AND MATERIAL**

On farm testing on rice were conducted during 2020-21 at farmer's fields of Satna district to Assessment of Rice- Mustard & Rice- Chickpea through conservation agricultural practices under Rice- Fallow cropping system.10OFTs were conducted with randomly selected farmer's fields in Naugawan and Shahpur villages of Majhgawan block of Satna. Direct seeding of short duration variety of Rice (MTU 1010) followed by zero tillage sowing of Mustard or Chickpea by utilizing the

**Comment [A2]:** Experimental research methods need to explain the research design used in this research

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 assessment of Rice- Mustard & Rice- Chickpea through conservation agricultural practices under Rice- Fallow cropping system. Geographically, Satna is in the Satpura and Kaymore Plateau range at an elevation of 313 metres 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 readily available nitrogen, low phosphorus and but more readily available potassium. The soil reaction was close to neutral. The conventional rice-wheat cropping system has been observed on the ground since 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 were 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 by 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:

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

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

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

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

## RESULT AND DISCUSSION

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

The average of yield and rice equivalent yield of all the cropping system are presented in (Table 1). The highest yield (Rice 42.90 qha<sup>-1</sup> +Mustard 16.18 qha<sup>-1</sup>) and REY (42.12 q ha<sup>-1</sup>) was recorded in Rice- Mustard cropping system followed by Rice-Chickpea cropping (Rice 42.90 qha<sup>-1</sup>+ Chickpea 14.04 qha<sup>-1</sup>) and REY (37.84 qha<sup>-1</sup>) over rice-fallow (Rice 45 qha<sup>-1</sup>).The present result is in conformity 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 (qha <sup>-1</sup> )	Rice Equivalent Yield (qha <sup>-1</sup> )
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 (₹164943ha<sup>-1</sup>) net monetary return (₹103608ha<sup>-1</sup>) 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 (₹ha <sup>-1</sup> )	Gross Monetary Return (₹ha <sup>-1</sup> )	Net Monetary Return (₹ha <sup>-1</sup> )	Benefit-Cost Ratio
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 (kg ha<sup>-1</sup>day<sup>-1</sup>) and system profitability (ha<sup>-1</sup>day<sup>-1</sup>) are presented in (Table 3). Data showed that the effect on system productivity was highest value in Rice-Mustard cropping system 36.97kg ha<sup>-1</sup> day<sup>-1</sup>)after Rice-Chickpea cropping (35.11 kg ha<sup>-1</sup> day<sup>-1</sup>) over Rice-fallow cropping system(33.90kg ha<sup>-1</sup> day<sup>-1</sup>). The System profitability was highest value in Rice-Mustard (₹470.94 ha<sup>-1</sup> day<sup>-1</sup>) after Rice-Chickpea cropping system (₹431.56 ha<sup>-1</sup> day<sup>-1</sup>) over Rice-fallow cropping system(₹392.75ha<sup>-1</sup> day<sup>-1</sup>)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 (kg ha <sup>-1</sup> day <sup>-1</sup> )	System profitability (₹ ha <sup>-1</sup> day <sup>-1</sup> )
T <sub>1</sub> (Rice (Variety with maturity above 125 days)	33.90	392.75

T2 (Rice (MTU-1010)-Mustard (Pusa Mustard 28)	36.97	470.94
T3 (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 used by diversifying 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.

### [Acknowledgments]

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**Comment [A3]:** If anyone helped with the study, the author should include a acknowledgments

**Comment [A4]:** References are still very lacking, need to be added.