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# Influence of Cropping Systems on productivity in Tunga Bhadra Project Area

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***ABSTRACT****: A field experiment was carried out in farmer's field near Agriculture Research Station, Siruguppa of Bellary district (Karnataka), during* kharif *and* rabi *2014-15, the experiment was conducted to study the Influence of cropping systems on productivity in Tunga Bhadra project (TBP) Area. Significantly higher rice equivalent yield (REY) was recorded in cotton-sesame cropping system (13117 kg ha$^{-1}$) compared to rest of the cropping systems. Significantly higher system productivity was recorded with maize-chickpea (35.94 REY kg ha$^{-1}$ day$^{-1}$) cropping system and it was significantly superior over existing rice-rice (26.89 REY kg ha$^{-1}$day$^{-1}$) cropping systems. The cotton-sesame and maize-chickpea crop sequences are more productive and sustainable as they improve fertility status of soil when compared to other cropping sequences and can be a better option for the farmers of the Tunga Bhadra Project area, Karnataka.*

***Key words****: Cropping system, Alternate cropping system, Rice equivalent yield, System productivity.*

## INTRODUCTION

Rice (*Oryza sativa* L.), occupies a pivotal place in Indian agriculture. It is the staple food for about 70 per cent of population and a source of livelihood for about 120-150 million rural households. It accounts for about 43 per cent of total food grain production and 55 per cent of cereal production in the country. Rice is a primary energy source or high calorie food and it contains less protein than wheat.

The system of rice cultivation is most water consuming and utilizes about 60 per cent of total available irrigation water [1]. Traditional low land rice grown with continuous flooding in Asia has relatively required high water input. Since, the rice is cultivated under continuously flooded ecosystem and it is associated with sequestration of N in resistant lignin compounds formed from the large amounts of retained crop residues. Diversification and intensification of rice-based or alternate cropping system for paddy-paddy to increase productivity per unit resource is very pertinent. Crop diversification shows lot of promises in alleviating these problems besides, fulfilling basic needs for cereals, pulses, oilseeds, vegetables and also regulating farm income, withstanding weather aberrations, controlling price fluctuation, ensuring balanced food supply, conserving natural resources, reducing the chemical fertilizer and pesticide loads, ensuring environmental safety and creating employment opportunity [2]. In this context, efforts are being made to promote diversification of rice based cropping sequence or development of an alternate cropping systems to paddy-paddy in our country as well as TBP area with cereals, legumes and oil seed crops for sustaining the productivity and meet out demand for vegetables, pulses and oilseeds. Therefore, keeping all these points in view, the present investigation was carried out.

## MATERIAL AND METHODS

A field experiment was conducted at farmer's field near Agriculture Research Station, Siruguppa of Bellary district (Karnataka) to study the influence of cropping systems on productivity in TBP area, during *kharif-rabi* 2014-15. The soil of the experimental site

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was medium black with the soil pH of 8.01, EC 0.54 dS $m^{-1}$, available N 240.80 kg $ha^{-1}$, available $P_2O_5$ 22.90 kg $ha^{-1}$ and available $K_2O$ 347.49 kg $ha^{-1}$. Experiment was laid out in randomised block design with seven sequential cropping systems as treatments in three replication. Treatment details are five rice based cropping systems *viz*., rice-maize, rice-sorghum, rice-chickpea, rice-sesame and rice-rice. Two non rice based cropping systems *viz*., maize-chickpea and cotton-sesame. All the crops under the above seven rice-based cropping sequences were chosen on the basis of their prevalence in the region. The rice–rice system is the major cropping sequence while the other crops, *viz*., sorghum, maize, sesame, cotton and chickpea are also taken by the farmers after harvesting of rice. Recommended dose of N, P and K ( kg N, $P_2O_5$ $K_2O$ $ha^{-1}$) were applied to the soil in the form of urea, di-ammonium phosphate and muriate of potash to all the crops at the time of sowing and subsequent N applications were done by following package of practice and details of the treatments are shown in Table 1. All agronomical packages of practices were followed to raise the crops in different cropping sequences.

Yield and yield parameters of rice and other crops in the cropping system were recorded. Economic yields of component crops were converted into rice-equivalent yield (REY), taking into account the prevailing market prices of different crops in the cropping sequences. The REY values were computed as per the following formula given by [3].

$$REY\,(kg\,ha^{-1}) = \frac{(YCC\ X\ MPCC) + yield\ of\ main\ crop\,(kg\,ha^{-1})}{Price\ of\ main\ crop\,(₹\,ha^{-1})}$$

Whereas, YCC= Yield of component crop (kg $ha^{-1}$), MPCC=Market price of component crop ($ha^{-1}$). System productivity values in terms of kg REY $ha^{-1}$ $day^{-1}$ were worked out for the total production by means of rice equivalent yield in a crop rotation divided by year duration. The data of each crop season were statistically analyzed separately. Fisher's method of analysis of variance was applied for analysis and interpretation of the data as given by [4]. The level of significance used in 'F' test was at p = 0.05. Critical difference values were calculated whenever 'F' was significant. In other cases, values of standard error of means have been provided [5].

## RESULTS AND DISCUSSION

### Rice equivalent yield and System Productivity

Among different cropping systems cotton-sesame produced significantly higher rice equivalent yield (13117 kg $ha^{-1}$) compared to rest of the cropping systems (Table. 2). The yield varied from 9.32 to 33.60 per cent over existing rice-rice (9816 REY kg $ha^{-1}$) cropping system. Whereas, minimum rice equivalent yield was noticed with rice-sesame (8342 REY kg $ha^{-1}$) system. Significantly higher system productivity was recorded with maize-chickpea (35.94 REY kg $ha^{-1}day^{-1}$) cropping system and it was significantly superior over rice-sesame (22.85 REY kg $ha^{-1}day^{-1}$), rice-sorghum (24.17 REY kg $ha^{-1}$ $day^{-1}$) and existing rice-rice (26.89 REY kg $ha^{-1}day^{-1}$) cropping systems and these results were in conformity with finding of [6], who reported that inclusion of legume during summer/*rabi* in rice based cropping system resulted

**Table 1**
**Details of Crop, season, cultivar, spacing, recommended dose of fertilizer and total cropping duration of the experiment**

| *Sequence cropping system* | *Crop* | *Season* | *Cultivar* | *Spacing (cm)* | *Recommended dose of fertilizers (N, $P_2O_5$, $K_2O$ kg $ha^{-1}$)* | *Total cropping duration (Days)* |
|---|---|---|---|---|---|---|
| Rice-maize | Rice | *Kharif* | BPT-5204 | 20 x 10 | 150:75 :75 | 253 |
| | Maize | *Rabi* | NK-6240 | 60 x 20 | 150:75:37.5 | |
| Rice-sorghum | Rice | *Kharif* | BPT-5204 | 20 x 10 | 150:75 :75 | 253 |
| | Sorghum | *Rabi* | NSH-18 | 45 x 15 | 100:75:40 | |
| Rice-chickpea | Rice | *Kharif* | BPT-5204 | 20 x 10 | 150:75 :75 | 241 |
| | Chickpea | *Rabi* | JG-11 | 30 x 10 | 25:50:00 | |
| Rice-sesame | Rice | *Kharif* | BPT-5204 | 20 x 10 | 150:75 :75 | 238 |
| | Sesame | *Rabi* | DSS-9 | 30 x 15 | 25:50: 25 | |
| Maize-chickpea | Maize | *Kharif* | NK-6240 | 60 x 20 | 150 :75:37.5 | 212 |
| | Chickpea | *Rabi* | JG-11 | 30 x 10 | 25: 50:00 | |
| Cotton-sesame | Cotton | *Kharif* | AJITH-155 | 90 x 60 | 150:75:75 | 260 |
| | Sesame | *Rabi* | DSS-9 | 30 x 15 | 25:50: 25 | |
| Rice-rice | Rice | *Kharif* | BPT-5204 | 20 x 10 | 150:75 :75 | 286 |
| | Rice | *Rabi* | Gangavathi sona | 20 x 10 | 150:75 :75 | |

**Table 2**
**Crop yield, rice equivalent yield (REY), system productivity, straw/haulm/stover/stalk yield and harvest index as influenced by different cropping systems**

| *Sequence cropping system* | *Crop yield (kg ha$^{-1}$)* | | *REY (kg ha$^{-1}$)* | | *Total REY (kg ha$^{-1}$)* | *System productivity (kg REY ha$^{-1}$day$^{-1}$)* | *Straw/haulm/stover/stalk yield (kg ha$^{-1}$)* | | *Harvest index (%)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Kharif* | *Rabi* | *Kharif* | *Rabi* | | | *Kharif* | *Rabi* | *Kharif* | *Rabi* |
| Rice-maize | 5329 | 7372 | - | 6031 | 11361 | 31.13 | 5833 | 8477 | 47.74 | 46.51 |
| Rice-sorghum | 5291 | 3809 | - | 3532 | 8823 | 24.17 | 5929 | 4609 | 47.16 | 45.25 |
| Rice-chickpea | 5285 | 1975 | - | 5446 | 10731 | 29.40 | 5931 | 2390 | 47.12 | 45.25 |
| Rice-sesame | 5361 | 615 | - | 2981 | 8342 | 22.85 | 5944 | 1236 | 47.42 | 33.22 |
| Maize-chickpea | 7691 | 2075 | 6292 | 5723 | 12015 | 32.92 | 8971 | 2511 | 46.16 | 45.25 |
| Cotton-sesame | 4288 | 559 | 10405 | 2712 | 13117 | 35.94 | 7647 | 1124 | 34.83 | 33.22 |
| Rice-rice | 5395 | 5031 | - | 4421 | 9816 | 26.89 | 5929 | 5986 | 47.64 | 45.66 |
| S.Em.± | 114 | 81 | - | - | 216 | 0.60 | 199 | 96 | 0.79 | 0.18 |
| CD (p=0.05) | 352 | 250 | - | - | 668 | 1.80 | 606 | 294 | 2.45 | 0.55 |

in an increased in productivity and profitability. The higher rice equivalent yield indicates that the residual advantage of a legume crop on the succeeding maize besides contribution in total system productivity. Similarly, rice-maize and rice-chickpea cropping systems ranked second and third respectively with system productivity. This might be due to higher production potential of maize along with the good market price of chickpea and rice that yielded better grain yield than rest other cropping systems. The chickpea in maize-chickpea and rice-chickpea cropping system also markedly contributed to the system productivity besides enhancing the productivity of succeeding crops and consequently resulted in higher crop equivalent yield and system productivity which was almost equal to the conventional rice-rice cropping system and similar results were also reported by [7].

Based on findings of this experiment it can be concluded that under conditions of Tunga Bhadra Project area cotton-sesame and maize-chickpea cropping systems proved to better in terms of rice equivalent yield and system productivity. Hence these cropping systems were found to be alternate cropping systems to existing rice-rice system.

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