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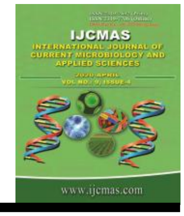

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# Effect of Maize + Pigeonpea Intercropping System on Yield, Equivalent Yield of Maize and Economics under Delayed Onset of Monsoon in Northern Transition Zone of Karnataka, India

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**A B S T R A C T**

Field experiment was conducted on medium black soil during *Kharif* 2017 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the performance of maize and pigeonpea under different row proportions and planting geometry under delayed onset of monsoon. The experiment was laid out in RCBD design with eleven treatments and replicated thrice. The treatments comprised of sole maize, sole pigeonpea with two genotypes (TS3R and GRG-811), two row proportions of maize and pigeonpea (2:1 and 4:2) with planting geometry of 60 x 20 cm and 75 x 20 cm for maize and 120 x 20 cm for pigeonpea. Among all treatments sole maize (98.64 q ha$^{-1}$) and pigeonpea cv. TS3R and GRG -811 (16.5 and 14.9 q ha$^{-1}$ respectively) recorded significantly higher grain yields over intercropping systems. Significantly higher maize equivalent yield was recorded with maize + pigeonpea cv. TS-3R (4:2) with 60 cm × 20 cm spacing (111.5 q ha$^{-1}$) .Gross returns (Rs.1,35,193 ha$^{-1}$), net returns (Rs.77,957 ha$^{-1}$) and B:C ratio (2.4) was also higher with maize + pigeonpea cv. TS3R (2:1) with 60 x 20 cm as compared to sole crop of maize or pigeonpea and other intercropping systems.

**Keywords**

Black soil, Pigeonpea, Planting geometry

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## Introduction

Globally maize (*Zea mays* L.) is one of the important cereal crops. In India, it ranks third after rice and wheat. In India, it is grown on an area of 8.81 million ha with a production of 22.57 million tons and with a productivity of 2563 kg ha$^{-1}$.In Karnataka, maize is grown on an area of 1.36 million ha with a production of 4.09 million tons and a productivity of 3020 kg ha$^{-1}$ (Anon., 2016). Pigeonpea (*Cajanus cajan* L Mill sp.) is an important food-legume and pulse crop of India. In India, pigeonpea occupies an area of about 3.96 million ha with a total production of 2.56 million tonnes, with an average productivity of 646 kg $ha^{-1}$ and Karnataka occupies an area of 0.65 million hawith a production of 0.24 million tonnes and productivity of 368 kg $ha^{-1}$ (Anon., 2016).Intercropping is an age old practice of growing simultaneously two or more crops in the same piece of land. The main concept of intercropping is to get increased total productivity per unit area and time, besides equitable and judicious utilization of land resources and farming inputs including labour(Willey, 1979).Maize yields are higher when sown with the normal onset of monsoon and also maize based intercropping systems are recommended under normal onset of monsoon.

However, in recent years there is a delay in onset of monsoon rains by one month. Maize when grown as sole crop, it will be there in the field up to November, under this situation sowing of rabi crops is very difficult. Under late sown conditions, options for growing intercrops with maize are limited. Pigeonpea is a long duration crop and respond well for delayed sowing up to second forthnight of July. Therefore it is the best option for intercrop with maize under delayed sowing conditions. After harvesting of maize crop, pigeonpea remains in the field which utilizes soil moisture due to *rabi* rains as well as cyclonic rains if any in the month of November and December. Therefore pigeonpea acts as a remunerative crop to compensating non sowing of *rabi* crops, due to delayed sowing of maize. In recent years both maize and pigeonpea fetching higher price in the market and hence proved to be economically beneficial when grown as intercrop (Willey, 1979). However there is no any recommendations of maize + pigeonpea intercropping system under delayed on set of monsoon that to with different maturity group of pigeonpea varieties.

## Materials and Methods

A field experiment was conducted on maize + pigeonpea intercropping system under delayed onset of monsoon with replacement series during *Kharif* season, at the Main Agriculture Research Station, University of Agricultural Sciences, Dharwad, Karnataka. The experiment was laid out in RCBD design with three replications comprising eleven treatments. The treatments consisting of $T_1$:Maize + Pigeonpea cv. TS3R (2:1) with 60 cmx20 cm, $T_2$:Maize + Pigeonpea cv. TS3R (4:2) with 60 cmx20 cm, $T_3$:Maize + Pigeonpea cv. TS3R (2:1) with 75 cmx20 cm, $T_4$:Maize + Pigeonpea cv. TS3R (4:2) with 75 cmx20 cm, $T_5$:Maize + Pigeonpea cv. GRG-811 (2:1) with 60 cmx20 cm, $T_6$:Maize + Pigeonpea cv. GRG-811 (4:2) with 60 cmx20 cm, $T_7$:Maize + Pigeonpea cv. GRG-811 (2:1) with 75 cmx20 cm, $T_8$:Maize + Pigeonpea cv. GRG-811 (4:2) with 75 cmx20 cm planting geometry for maize, $T_9$: Sole maize with 60 cmx20 cm, $T_{10}$: Sole pigeonpea cv. TS3R with 120 cmx20 cm and $T_{11}$: Sole pigeonpea cv. GRG-811 with 120 cmx20 cm spacing.

The soil of the experimental site was clay in texture with pH 7.7 and EC 0.46dS $m^{-1}$. The initial nutrient status of soil was good with available nitrogen (321.1 kg $ha^{-1}$), phosphorus (32.0 kg $ha^{-1}$) and potash (263.9 kg $ha^{-1}$). The maize hybrid used in the trial was NK-6240 and pigeonpea varieties used in the trials were TS3R and GRG-811, which was sown in a plot size of 9.0 m × 4.0 m for all treatments except sole pigeonpea (8.4 m × 4.0 m). Seeds were sown on 17$^{th}$ July 2017 to a depth of 5 cm with different row spacing and row proportions. Recommended dose of fertilizers (RDF) @ 100:50:25 and 25:50:00 kg N: $P_2O_5$ : $K_2O$ $ha^{-1}$ for maize and pigeonpea respectively, was applied commonly to all treatments.

Observations on yield parameters namely grain weight $cob^{-1}$ (g), number of kernel rows cob$^{-1}$, number of kernels row$^{-1}$, test weight (g), grain yield of maize and grain yield of pigeonpea were recorded as per standard methods. A gross return per hectare was calculated by taking into consideration of the price of the product that was prevailing in market after harvest and grain yield per hectare and expressed in rupees per hectare (Rs. ha$^{-1}$).The net return per hectare was calculated treatment wise by subtracting the total cost of cultivation from gross returns and expressed in rupees per hectare (Rs. ha$^{-1}$). B:C ratio was calculated based on gross and net returns.

$$\text{Benefit cost ratio} = \frac{\text{Gross returns (Rs. ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs. ha}^{-1}\text{)}}$$

Maize equivalent yield (MEY) was calculated by considering prices of two crops with the following formula.

$$\text{MEY for intercrop} = \text{Maize yield} + \frac{\text{Pigeonpea yield} \times \text{Price of pigeonpea}}{\text{Maize price}}$$

$$\text{MEY for sole crop} = \frac{\text{Pigeonpea yield} \times \text{Price of pigeonpea}}{\text{Maize price}}$$

Further the obtained readings were subjected to Fisher's method of analysis of variance was used for analysis and interpretation of the data as outlined by Panse and Sukhatme (1967).

## Results and Discussion

### Yield attributes of maize

Yield attributes of maize significantly influenced by different planting geometry and row proportions. Higher grain weight cob$^{-1}$, number of kernel rows cob$^{-1}$, number of kernels row$^{-1}$ were recorded with intercropping of maize + pigeonpea at 4:2 row ratio as compared to 2:1 row proportion and sole maize (Table. 1). This was due to wider spacing reduced competition between the plants and enhanced availability of resources which lead to increased photosynthesis there by translocation of photosynthates from source to sink. Similar results have been reported by Jat*et al.* (2014), Lingaraju*et al.* (2008), Padhi and Panigrahi (2006) and Thimmegowda (2012).The yield attributes of pigeonpea was significantly influenced by growth parameters of pigeonpea.

### Grain weight cob$^{-1}$

Significantly higher grain weight per cob was recorded by maize + pigeonpea cv. TS-3R (4:2) with 75 cm×20 cmspacing (181.0 g cob$^{-1}$). However, it was found on par with maize + pigeonpea cv. GRG-811 (4:2) with 75 cm×20 cm spacing (175.8 g cob$^{-1}$), maize + pigeonpea cv. GRG-811 (2:1) with 75 cm×20 cm spacing (174.1 g cob$^{-1}$) and maize + pigeonpea cv. TS-3R (4:2) with 75 cm×20 cm spacing (169.1 g cob$^{-1}$). Significantly lower grain weightper cob was recorded by maize + pigeonpea cv. GRG-811 (2:1) with 60 cm×20 cm spacing (157.0 g cob$^{-1}$) (Table. 1)

### Number of kernel rows cob$^{-1}$

Significantly higher number of kernel rows was recorded with maize + pigeonpea cv. TS-3R (4:2) with 75 cm×20 cmspacing (15.6 cob$^{-1}$) and significantly lower grain weight was recorded with maize + pigeonpea cv. GRG-811 (2:1) with 60 cm×20 cm spacing (13.8 cob$^{-1}$) and maize + pigeonpea cv. TS-3R (2:1) with 60 cm×20 cm spacing (13.8 cob$^{-1}$).

However, it was found on par with maize + pigeonpea cv. GRG-811 (2:1) with 75 cm×20 cm spacing (15.3 cob$^{-1}$), maize + pigeonpea cv. GRG-811 (4:2) with 75 cm×20 cm spacing (15.0 cob$^{-1}$), maize + pigeonpea cv. TS-3R (2:1) with 75 cm×20 cm spacing (15.0 cob$^{-1}$), sole maize with 60 cm×20 cm spacing (14.8 cob$^{-1}$) and maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (14.5 cob$^{-1}$) (Table 1).

## Number of kernels row$^{-1}$

Significantly higher number of kernels per row was recorded by maize + pigeonpea cv. TS-3R (4:2) with 75 cm×20 cm spacing (37.7) and found on par with maize + pigeonpea cv. GRG-811 (4:2) with 75 cm×20 cm spacing (37.7), maize + pigeonpea cv. GRG-811 (2:1) with 75 cm×20 cm spacing (36.3), maize + pigeonpea cv. TS-3R (2:1) with 75 cm×20 cm spacing (36.3) and sole maize with 60 cm×20 cm spacing (35.7). Significantly lower number of kernels per row was recorded by maize + pigeonpea cv. GRG-811 (2:1) with 60 cm×20 cm spacing (33.4 kernels row$^{-1}$) (Table. 1)

## Test weight

The test weight did not show any significant variation among different intercropping systems with varied row proportions and sole maize (Table 1).

## Grain yield of Maize

Significantly higher grain yield was recorded by sole maize (98.64 q ha$^{-1}$) as compared to rest of the treatments. Among intercropping systems, higher grain yield was recorded by maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (88.57 q ha$^{-1}$) and found on par with maize + pigeonpea cv. GRG-811 (4:2) with 60 cm×20 cm spacing (85.93 q ha$^{-1}$). Significantly lower grain yield was recorded with maize + pigeonpea cv. TS-3R (2:1) with 75 cm×20 cm spacing (56.75 q ha$^{-1}$) and found on par with maize + pigeonpea cv. GRG-811 (2:1) with 75 cm×20 cm spacing (58.56 q ha$^{-1}$) (Table. 2).

## Seed yield of pigeonpea

Seed yield was significantly influenced by intercropping system. Significantly higher seed yield (16.5 q ha$^{-1}$) was recorded in sole pigeonpea cv. TS-3R with 120 cm×20 cm spacing as compared to sole pigeonpea cv. GRG-811 with 120 cm x 20 cm spacing and intercropping systems. Among different intercropping systems, significantly higher seed yield (7.5 q ha$^{-1}$) was recorded in maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing. However, significantly lower seed yield (3.2 q ha$^{-1}$) was recorded in maize + pigeonpea cv. GRG-811 (2:1) with 75 cm×20 cm spacing (Table. 2).

## Maize equivalent yield (MEY)

Significantly higher maize equivalent yield was recorded with maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (111.5 q ha$^{-1}$). Howeverit was on par with maize + pigeonpea cv. GRG-811 (4:2) with 60 cm×20 cm spacing (105.8 q ha$^{-1}$). Significantly lower maize equivalent yield was recorded with sole pigeonpea cv. GRG-811 with 120 cm×20 cm spacing (45.4 q ha$^{-1}$) and it was found on par with sole pigeonpea cv. TS-3R with 120 cm×20 cm spacing (50.2 q ha$^{-1}$) (Table. 3 and Fig. 1).

## Economics

## Cost of cultivation

The results revealed that the cost of cultivation was lower (Rs. 39,238 ha$^{-1}$) in sole pigeonpea cv. GRG-811 with 120 cm×20 cm spacing and sole pigeonpea cv. TS-3R with 120 cm×20 cm spacing (Rs. 39,970 ha$^{-1}$).

**Table.1** Yield attributes of maize at different growth stages as influenced by maize + pigeonpea intercropping system

| **Treatment details** | **Yield attributes of maize** | | | |
|---|---|---|---|---|
| | **Grain weight cob$^{-1}$ (g)** | **No. of Kernel rows cob$^{-1}$** | **No. of Kernels row$^{-1}$** | **Test weight (g)** |
| **$T_1$:**Maize + Pigeonpea cv. TS3R (2:1) with 60 cm·20 cm | 160.5 | 13.8 | 33.6 | 37.2 |
| **$T_2$:**Maize + Pigeonpea cv. TS3R (4:2) with 60 cm·20 cm. | 164.1 | 14.5 | 34.0 | 37.5 |
| **$T_3$:**Maize + Pigeonpea cv. TS3R (2:1) with 75 cm·20 cm | 169.1 | 15.0 | 36.3 | 37.7 |
| **$T_4$:**Maize + Pigeonpea cv. TS3R (4:2) with 75 cm·20 cm | 181.0 | 15.6 | 37.7 | 38.3 |
| **$T_5$:**Maize + Pigeonpea cv. GRG-811 (2:1) with 60 cm·20 cm | 157.0 | 13.8 | 33.4 | 36.9 |
| **$T_6$:**Maize + Pigeonpea cv. GRG-811 (4:2) with 60 cm·20 cm | 160.5 | 14.1 | 33.9 | 37.5 |
| **$T_7$:**Maize + Pigeonpea cv. GRG-811 (2:1) with 75 cm·20 cm | 174.1 | 15.0 | 36.3 | 38.0 |
| **$T_8$:**Maize + Pigeonpea cv. GRG-811 (4:2) with 75 cm·20 cm | 175.8 | 15.3 | 37.0 | 38.0 |
| **$T_9$:** Sole maize with 120 cm·20 cm | 168.1 | 14.8 | 35.7 | 37.6 |
| **$T_{10}$:** Sole pigeonpea cv. TS3R with 120 cm·20 cm | - | - | - | - |
| **$T_{11}$:** Sole pigeonpea cv. GRG-811 with 120 cm·20 cm | - | - | - | - |
| **S.Em. ±** | **5.0** | **0.4** | **1.0** | **1.09** |
| **C.D. (P = 0.05)** | **15.0** | **1.2** | **3.0** | **NS** |

NS: Non significant

**Table.2** Grain yield of maize and pigeonpea as influenced by maize + pigeonpea intercropping system

| Treatment No. | Treatment details | Grain yield of maize (q $ha^{-1}$) | Grain yield of pigeonpea (q $ha^{-1}$) |
|---|---|---|---|
| $T_1$ | Maize + Pigeonpea cv. TS-3R (2:1) with 60 cm·20 cm | 63.85 | 5.4 |
| $T_2$ | Maize + Pigeonpea cv. TS-3R (4:2) with 60 cm·20 cm. | 88.57 | 7.5 |
| $T_3$ | Maize + Pigeonpea cv. TS-3R (2:1) with 75 cm·20 cm | 56.75 | 4.2 |
| $T_4$ | Maize + Pigeonpea cv. TS-3R (4:2) with 75 cm·20 cm | 72.68 | 4.8 |
| $T_5$ | Maize + Pigeonpea cv. GRG-811 (2:1) with 60 cm·20 cm | 61.24 | 4.3 |
| $T_6$ | Maize + Pigeonpea cv. GRG-811 (4:2) with 60 cm·20 cm | 85.93 | 6.5 |
| $T_7$ | Maize + Pigeonpea cv. GRG-811 (2:1) with 75 cm·20 cm | 58.56 | 3.2 |
| $T_8$ | Maize + Pigeonpea cv. GRG-811 (4:2) with 75 cm·20 cm | 67.82 | 4.5 |
| $T_9$ | Sole maize with 60 cm·20 cm | 98.64 | - |
| $T_{10}$ | Sole pigeonpea cv. TS-3R with 120 cm·20 cm | - | 16.5 |
| $T_{11}$ | Sole pigeonpea cv. GRG-811 with 120 cm·20 cm | - | 14.9 |
| | **S.Em. ±** | **2.09** | **0.3** |
| | **C.D. (P = 0.05)** | **6.29** | **0.9** |

**Table.3** Maize equivalent yield (MEY) and Economics of Maize as influenced by maize + pigeonpea intercropping system

| Treatment No. | Treatment details | Maize equivalent yield (q $ha^{-1}$) | Cost of cultivation (Rs. $ha^{-1}$) | Gross returns (Rs. $ha^{-1}$) | Net returns (Rs. $ha^{-1}$) | B:C ratio |
|---|---|---|---|---|---|---|
| **$T_1$** | Maize + Pigeonpea cv. TS-3R (2:1) with 60 cm·20 cm | 80.4 | 54,703 | 97,635 | 42,932 | 1.8 |
| **$T_2$** | Maize + Pigeonpea cv. TS-3R (4:2) with 60 cm·20 cm. | 111.5 | 57,236 | 1,35,193 | 77,957 | 2.4 |
| **$T_3$** | Maize + Pigeonpea cv. TS-3R (2:1) with 75 cm·20 cm | 69.2 | 52,681 | 84,671 | 31,990 | 1.6 |
| **$T_4$** | Maize + Pigeonpea cv. TS-3R (4:2) with 75 cm·20 cm | 87.3 | 54,453 | 1,06,249 | 51,796 | 2.0 |
| **$T_5$** | Maize + Pigeonpea cv. GRG-811 (2:1) with 60 cm·20 cm | 74.2 | 54,219 | 90,392 | 36,173 | 1.7 |
| **$T_6$** | Maize + Pigeonpea cv. GRG-811 (4:2) with 60 cm·20 | 105.8 | 56,544 | 1,28,525 | 71,981 | 2.3 |
| **$T_7$** | Maize + Pigeonpea cv. GRG-811 (2:1) with 75 cm·20 cm | 68.3 | 52,745 | 83,454 | 30,709 | 1.6 |
| **$T_8$** | Maize + Pigeonpea cv. GRG-811 (4:2) with 75 cm·20 cm | 81.6 | 54,221 | 99,388 | 45,167 | 1.8 |
| **$T_9$** | Sole maize with 60 cm·20 cm | 98.6 | 60,522 | 1,20,524 | 60,002 | 2.0 |
| **$T_{10}$** | Sole pigeonpea cv. TS-3R with 120 cm·20 cm | 50.2 | 39,970 | 57,726 | 17,756 | 1.4 |
| **$T_{11}$** | Sole pigeonpea cv. GRG-811 with 120 cm·20 cm | 45.4 | 39,238 | 52,257 | 13,019 | 1.3 |
| | **S.Em. ±** | **3.4** | **-** | **2,503** | **2,503** | **0.05** |
| | **C.D. (P = 0.05)** | **10.2** | **-** | **7,384** | **7,384** | **0.14** |

Among intercropping systems higher cost of cultivation was recorded by maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing and maize + pigeonpea cv. GRG-811 (4:2) with 60 cm×20 cm spacing (Rs. 57,236 and 56,544 $ha^{-1}$ respectively) (Table. 3)

## Gross returns

Significantly higher gross returns was noticed (Table. 3) with maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (Rs. 1,35,193 $ha^{-1}$) and it was on par with maize + pigeonpea cv. GRG-811 (4:2) with 60 cm×20 cm spacing (Rs. 1,28,525 $ha^{-1}$). Significantly lower gross returns were recorded with sole pigeonpea cv. GRG-811 with 120 cm×20 cm spacing (Rs. 52,257 $ha^{-1}$) and it was on par with sole pigeonpea cv. TS-3R with 120 cm×20 cm spacing (Rs. 57,726 $ha^{-1}$).

## Net returns

Significantly higher net returns was noticed with maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (Rs. 77,957 $ha^{-1}$) and it was on par with maize + pigeonpea cv. GRG-811 (4:2) with 60 cm×20 cm spacing (Rs. 71,981 $ha^{-1}$). Significantly lower net returns was recorded with sole pigeonpea cv. GRG-811 with 120 cm×20 cm spacing (Rs. 13,019 $ha^{-1}$) and it was on par with sole pigeonpea cv. TS-3R with 120 cm×20 cm spacing (Rs. 17,756 $ha^{-1}$) (Table. 3).

## B:C Ratio

Significantly higher B:C ratio was noticed with maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (2.4) followed by maize + pigeonpea cv. GRG-811 (4:2) with 60 cm×20 cm spacing (2.3). Significantly lower B:C ratio was recorded with sole pigeonpea cv. GRG-811 with 120 cm×20 cm spacing (1.3). However, it was on par with sole pigeonpea cv. TS-3R with 120 cm×20 cm spacing (1.4) and it was furnished in (Table 3).

Grain yield of maize varied significantly due to different planting geometry and row ratios. In the present study, the results indicated that the sole maize recorded significantly higher grain yield (98.64 q $ha^{-1}$) when compared to the intercropping systems this was due to higher plant population (83,333 $ha^{-1}$) and higher number of cobs. Among intercropping systems, higher grain yield was recorded with maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (Table 2). This was due to higher plant population (55,555 $ha^{-1}$), but per plant yield was higher in maize + pigeonpea cv. TS-3R (4:2) with 75 cm×20 cm spacing because as spacing increases competition for light, moisture and nutrient decreases which lead to increased number of kernel rows $cob^{-1}$, number of kernels $row^{-1}$ and test weight. Lower yield was recorded with maize + pigeonpea cv. TS-3R (2:1) with 75 cm×20 cm spacing, which was due to lower plant population (44,444 $ha^{-1}$). Similar results of higher yield under sole maize compared to intercropping systems were reported by Marer *et al.* (2007), Lingaraju *et al.* (2008), Thimmegowda (2012), Dania *et al.* (2014) and Jonas *et al.* (2016).

Yield attributes of maize significantly influenced by different planting geometry and row proportions. Higher grain weight $cob^{-1}$, number of kernel rows $cob^{-1}$, number of kernels $row^{-1}$ were recorded with intercropping of maize + pigeonpea at 4:2 row ratio as compared to 2:1 row proportion and sole maize crop. This was due to wider spacing reduced competition between the plants and enhanced availability of resources which lead to increased photosynthesis there by translocation of photosynthates from source to sink. Patra *et al.* (1990) reported that maize with legumes grown at 4:1 row proportion has significantly enhanced yield attributing characters of maize. Similar results have been reported by Jat *et al.* (2014), Lingaraju *et al.* (2008), Padhi and Panigrahi (2006) and Thimmegowda (2012).

Irrespective of row proportions, planting geometry and pigeonpea population, intercropping of maize + pigeonpea recorded significantly higher maize equivalent yield as compared to sole crop of pigeonpea. The maize equivalent yield obtained in intercropping of maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing and maize + pigeonpea cv. GRG-811 (4:2) with 60 cm×20 cm spacing recorded higher maize equivalent yield (111.5 q $ha^{-1}$ and 105.8 q $ha^{-1}$ respectively) over sole maize and pigeonpea (Table 3). Higher maize equivalent yield realized under intercropping system was attributed to better performance and yields of both component crops under intercropping system. Sharma *et al.* (1994) recorded higher maize equivalent yield under intercropping systems over sole crops in maize + soybean system. Suresh (2005) also recorded higher maize equivalent yield (80.76 q $ha^{-1}$) under intercropping system of maize + pigeonpea with 4:2 row ratio.

The present investigation revealed that significantly higher maize equivalent yield was recorded with maize + pigeonpea cv. TS-3R (4:2) with 60 cm×20 cm spacing (111.5 q $ha^{-1}$). Gross returns (Rs.1,35,193 $ha^{-1}$), net returns (Rs.77,957 $ha^{-1}$) and B:C ratio (2.4) was also higher with maize + pigeonpea cv. TS3R (2:1) with 60 x 20 cm as compared to sole crop of maize or pigeonpea and other intercropping systems.

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