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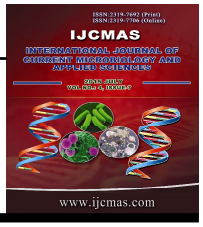


**Original Research Article**

# Baby Corn Based Inter Cropping System as an Alternative Pathway for Sustainable Agriculture

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Baby corn, Intercrops, Equivalent yields, Net returns, B: C ratio

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

An experiment was carried out on baby corn based intercropping system at Agriculture Research Institute, Rajendranagar, Hyderabad during 2007- 08 to identify the suitable baby corn based intercrops. The experiment comprised of 9 treatments consisting of four intercropping systems and five sole crops of main and intercrops *viz*. baby corn + coriander (2:1): baby corn + okra (2:1): baby corn + radish (2:1): baby corn + vegetable cow pea (2:1): sole baby corn: sole okra: sole coriander: sole radish and sole vegetable cowpea. The experiment was laid out in a randomized block design with 3 replications. Higher baby corn equivalent yields (6655 kg $ha^{-1}$) and net returns (Rs 39022 $ha^{-1}$) were obtained, when vegetable cowpea intercropped with baby corn over other vegetables like coriander and radish. However, it is not significantly differed with baby corn + okra intercropping system. Baby corn + vegetable cowpea also recorded the highest B: C ratio (2.42) and it was followed by sole baby corn (2.32). Partial yield loss ($AYL_b$) of radish was -1 indicating that 100 per cent yield loss occurred as compared to its sole crop yield, when grown in association with baby corn.

## Introduction

Maize (*Zea mays* L.) is the world's widely grown highland cereal and primary staple food crop in many developing countries. It is the third most important cereal after rice and wheat as human food, contributing almost nine per cent to India's food basket and five per cent to world's dietary energy supply. It has got immense yield potential and is therefore called as "miracle crop" and also "queen of cereals". Its importance as vegetable is little known to the Indian farmers in spite of the fact that it fetches very lucrative price in national and international markets. Thailand and China are the world leaders in baby corn production. Baby corn cultivation is now picking up in some states of India (Ramachandrappa *et al.,* 2004).

The sweet succulent and delicious baby corn is a medium plant type and provides green ears within 65-75 days after sowing. The introduction of baby corn is considered as suitable choice for improving the income of

farmers. Baby corn is gaining importance as vegetable and salad in and around cities of Telangana State. Being short duration in nature it facilitates to take up second crop simultaneously as intercrop and helps the farmer to get more returns from unit area in a unit time by increasing cropping intensity.

Self-sustaining, low-input and energy-efficient agricultural systems in the context of sustainable agriculture have always been in the centre of attention of many farmers, researchers and policy makers worldwide (Lithourgidis *et al*, 2011). One of the key strategies in sustainable agriculture is restoration of diversity in agricultural ecosystems and its effective management. Intercropping is a way to increase diversity in an agricultural ecosystem. Intercropping not only enhance the productivity but also provides security against the potential risk of monoculture. It provides the diversified needs of the small farmers (Faris *et al*., 1976) whose general practice is subsistence farming.

Normally baby corn is planted in wider rows and a considerable portion of the incident solar radiation falls on bare ground in the early stages of growth. Intercropping with medium duration companion crops ensure better utilization of land and sunlight (Willey, 1979). Beneficial effect of baby corn + vegetable cowpea and baby corn + dolichos bean was reported by Reddy *et al*. (2009). In another study from Karnataka french bean intercropped with baby corn in 1:1 and 2:2 row proportions produced significantly higher baby corn equivalent yield, net returns and B:C ratio (Nataraj *et al*., 2011). Ayodele, and Shittu (2013) showed maize-amaranth intercropping advantages over sole crops with Land Equivalent Ratio (LER) values more than 1.0.

Maize based intercropping system is one of the important cropping systems in Rangareddy district where vegetables are grown predominantly in sequence. However very little information is available on suitable intercrop with baby corn based cropping system, therefore, the present investigation was carried out to find suitable vegetable intercrop with baby corn to increase the yield per unit area and per unit time to fulfill vegetable requirement of peri urban areas.

## Materials and Methods

A field experiment was carried out during rainy season of 2007- 08 at Agricultural Research Institute farm, Rajendranagar, Hyderabad in a randomized block design with 3 replications having $17^0$19' N Latitude, $78^0$23' E Longitude and 542.3 m above mean sea level. The experimental site was red sandy loam, low in available N (225.8 kg N $ha^{-1}$) and high in available $P_2O_5$ (100.8 $P_2O_5$ kg $ha^{-1}$) and $K_2O$ (452.6 kg $ha^1$).The experiment comprised of 9 treatments consisting of four inter cropping systems and five sole crops of main and inter crops *viz*…$T_1$- Baby corn+coriander (2:1): $T_2$- Baby corn+okra (2:1): $T_3$- Baby corn+radish (2:1): $T_4$- Baby corn+vegetable cowpea (2:1): $T_5$- Sole Baby corn: $T_6$-Sole okra: $T_7$- Sole coriander: $T_8$- Sole radish: $T_9$- Sole vegetable cowpea. Baby corn was planted in paired rows (45 x 15 / 75), whereas, vegetables taken as inter crops in between two pairs of babycorn. Sole crops were sown as per their recommended spacing. The required amount of N, P and K fertilizers was applied through urea, DAP and muriate of potash, respectively. Gapfilling and thinning operations were under taken to maintain plant stand. Other cultural operations and plant protection measures were followed as per the recommendations. Detasseling was done as soon as tassels appeared between 48 and 52 days after sowing. Coriander was harvested

for only one time as green leaf. Multiple pickings were taken from baby corn (7), okra (15), vegetable cow pea (8), whereas intercropped radish was completely failed. Immedietly after harvesting their fresh yield was recorded. The total weight of different pickings were added to get the total vegetable yield. At the end the data was analyzed statistically as suggested by Panse and Sukhatme (1967). The index of biological efficiency is the Land Equivalent Ratio (LER) calculated as

$$\frac{Yab + Yba}{Yaa + Ybb}$$

Where: $Y_{ab}$, $Y_{ba}$ are the individual crop yields in intercropping and

$Y_{aa}$, $Y_{bb}$ are the yields of individual sole crops (John and Mini, 2005)

Baby corn equivalent yield was calculated as outlined by Bondyopadhyay (1984)

Baby corn equivalent yield =

$$\frac{\text{Yield of crops x price of crops}}{\text{Price of Baby corn}}$$

Actual yield loss (AYL) was calculated following the procedure laid out by Banik (1996). Actual yield loss is the proportionate yield loss or gain of intercrops in comparison to the respective sole crop i.e it takes into account the actual sown proportion of the component crops with its pure stand where

Actual yield loss (AYL) = $AYL_a + AYL_b$

$AYL_a = \{[ (Y_{ab} / Z_{ab} ) / (Y_{aa} / Z_{aa})]\}$ and
$AYL_b = \{[ (Y_{ba} / Z_{ba}) / (Y_{bb} / Z_{bb})]\}$

Here Y is the yield per hectare (unit area) and Z is the sown proportion subscripts aa and bb refer to pure stands "sole crops of species A and B and ab and ba refer to intercrops. Partial actual yield loss $AYL_a$ and $AYL_b$ represent the proportionate yield loss or gain of species A and B when grown as intercrops, relative to their yield in pure stands. AYL is therefore the sum of the two partials $AYL_a$ and $AYL_b$.

The sign "positive or negative of the AYL score gives a quantitative assessment of advantage / disadvantage accrued under any intercrop situation when the main objective is to compare yield on a per plant basis.

## Results and Discussion

Baby corn equivalent yield is the yield of baby corn plus yield of an intercrop transformed into yield of baby corn. Vegetable cowpea intercropped with baby corn recorded higher BEY (6655 kg $ha^{-1}$) over coriander and radish and was not differed significantly with okra plus vegetable cowpea intercropping system (Table1). Eventhough okra, vegetable cowpea and radish recorded higher sole crop yields, in terms of B:C ratio the baby corn plus vegetable cowpea (2.42) considered as more profitable to get more economic returns (Rs.39,022/-). Radish intercropped with baby corn was failed completely. The results obtained in the present investigation were in conformity with the findings of Nataraj *et al*. (2011) who obtained higher net returns (Rs 1,17,320 and Rs 1,18,080 ha-1) and B:C ratio (3.83 and 3.85) with french bean inter cropped with baby corn in 1:1 and 2:2 row proportions. Reddy *et al*. (2009) also noticed the highest net income of Rs. 87,580 and benefit cost ratio of 3.88 with baby corn+vegetable cowpea inter cropping system.

Land Equivalent Ratio (LER) is the relative area of the sole crop required to produce the yield achieved in intercropping (khan *et al*.,

1998). LER values greater than one in all the intercropping systems except baby corn + radish indicating the yield advantage of intercropping over baby corn alone (Table 2). Total LER ranged between 1.53–1.66 in different inter cropping systems. It means that maximum agronomic advantage of baby corn based intercropping system over mono cropping is 66%. From these experiments highest yield and monetary advantage can be obtained through baby corn+vegetable cowpea intercropping system. However, LER in intercropping treatments compared with mono cropping of baby corn and other sole crops was ascribed to better utilization of natural (land and light) and added (fertilizer and water) resources. Similar mixture advantages have been observed for maize-amaranth (Ayodele, 2013). Ayodele and Shittu (2013) also indicated maize-amaranth intercropping advantages over sole crops with Land equivalent Ratio (LER) values more than one.

The AYL index gave more precise information about inter and intra specific competition between and within the component crops and the behaviour of each species in the intercropping system, as it is based on yield per plant. Quantification of yield loss or gain due to association of other species or the variation of the plant population could not be obtained through partial land equivalent ratios (LERs) where as partial AYL indicates the yield loss or gain by its sign and as well as its value. Thus the $AYL_b$ of radish was -1 indicating that 100 per cent yield loss as compared to its sole crop yield occurred when grown in association with baby corn.

Among all the intercropping systems baby corn intercropped with vegetable cowpea recorded the highest baby corn equivalent yields (6655kgha$^{-1}$) with higher net returns (Rs 39022 ha$^{-1}$ ) and B:C ratio of 2.42 under Southern Telangana Agro Climatic Zone of Telangana state, India.

**Table.1** Productivity and economics of baby corn based intercropping systems with vegetables during Kharif 2007

| Treatment | Seed yield kg / ha | | Baby corn equalent yields kg / ha | Cost of cultivation Rs./ha | Gross returns Rs./ha | Net returns Rs./ha | B:C ratio |
|---|---|---|---|---|---|---|---|
| | Base crop | Inter crop | | | | | |
| **Baby corn + Coriander** | 5230 | 281 | 5304 | 24996 | 53042 | 28046 | 2.12 |
| **Baby corn + Okra** | 5124 | 4317 | 6552 | 31627 | 65517 | 33890 | 2.07 |
| **Baby corn + Radish** | 5213 | 0 | 5213 | 22736 | 52131 | 29395 | 2.29 |
| **Baby corn + Veg. Cowpea** | 5057 | 6040 | 6655 | 27526 | 66548 | 39022 | 2.42 |
| **Sole Baby corn** | 5267 | - | 5267 | 22736 | 52674 | 29938 | 2.32 |
| **Sole Okra** | 7807 | - | 7807 | 40541 | 78071 | 37530 | 1.93 |
| **Sole Coriander** | 523 | - | 418 | 22206 | 4182 | -18024 | 0.19 |
| **Sole Radish** | 11584 | - | 5792 | 28985 | 57920 | 28935 | 2.00 |
| **Sole Veg. Cowpea** | 8586 | - | 6869 | 31500 | 68686 | 37186 | 2.18 |
| **SEm+** | 266.09 | | 255.2 | | | 2551.9 | |
| **CD at 5%** | 566.28 | | 543.1 | | | 5410.0 | |
| **CV %** | 7.6 | | 8.0 | | | 16.2 | |

Price of Baby corn : Rs.10.00 / kg
Price of Okra : Rs.10.00 / kg
Price of Radish : Rs.5.00 / kg
Price of Veg. Cowpea : Rs.8.00 / kg
Price of Coriander : Rs.8.00 / kg

**Table.2** Seed yield, Equivalent yields, Land Equivalent ratio (LER) and Actual Yield Loss (AYL) as affected by different baby corn based cropping system

| Treatment | Seed yield kg ha$^{-1}$ | | Baby corn equalent yields kg ha$^{-1}$ | LER | $AYL_a$ | $AYL_b$ | AYL |
|---|---|---|---|---|---|---|---|
| | Base crop | Inter crop | | | | | |
| Baby corn + Coriander | 5230 | 281 | 5304 | 1.53 | 0.0 | 1.56 | 1.56 |
| Baby corn + Okra | 5124 | 4317 | 6552 | 1.53 | 0.0 | 0.32 | 0.32 |
| Baby corn + Radish | 5213 | 0 | 5213 | 0.99 | 0.0 | -1.0 | -1.0 |
| Baby corn + Veg. Cowpea | 5057 | 6040 | 6655 | 1.66 | 0.0 | 1.25 | 1.25 |
| Sole Baby corn | 5267 | - | 5267 | 0.99 | | | |
| Sole Okra | 7807 | - | 7807 | 0.55 | | | |
| Sole Coriander | 523 | - | 418 | 0.54 | | | |
| Sole Radish | 11584 | - | 5792 | 0.00 | | | |
| Sole Veg. Cowpea | 8586 | - | 6869 | 0.70 | | | |
| **SEm+** | 266.09 | | 255.2 | | | | |
| **CD at 5%** | 566.28 | | 543.1 | | | | |
| **CV %** | 7.6 | | 8.0 | | | | |

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