Cropping Indices of Baby Corn under Inter Cropping with Different Vegetables

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Abstract

The experiment was conducted in farmer's field of Nambal village, Mancherial District, Telangana during rabi season 2022 to assess the performance of baby corn under intercropping with different vegetables. The experiment was laid out in Randomized Block Design and replicated thrice. The treatments consisted of ten inter cropping systems *viz*., (T_1) Baby corn + Radish, (T_2) Baby corn + Fenugreek, (T_3) Baby corn + Amaranthus, (T_4) Baby corn + Radish+ Fenugreek, (T_5) Baby corn + Radish+ Amaranthus, (T_6) Baby corn + Fenugreek + Amaranthus, (T_7) Baby corn (sole crop), (T_8) Radish (sole crop), (T_9) Fenugreek (sole crop), (T_{10}) Amaranthus (sole crop). The results of the present study revealed among the various intercropping systems. All treatments had significant effects on the cropping indices of baby corn but the treatment T_4 proved to be the best in all the cropping indices *viz;* baby corn equivalent yield (BEY), land equivalent ratio (LER), area time equivalent ratio (ATER) and income equivalent ratio (IER) of baby corn.

Keywords: Baby corn, inter crops, baby corn equivalent yield, land equivalent ratio, income equivalent ratio and area time equivalent ratio, cropping indices.

1. Introduction

The growing population in India has resulted in an increase in the demand for food and nutrition. Raising agricultural yield per unit area with limited resources is the only way of meeting increasing demands for food and nutrition. Combining crops is essential to increase production, maintain better soil health, and make the most of growth resources per unit area (tejaswitha 2021). Consequently, in the current Indian farming system, sustainable crop production is important. To achieve sustainability, we have to investigate all possibilities for intensification of agriculture that also provides sustainable nutrition.

Baby corn is a unique cereal with a distinct value addition in terms of nutrition. Fresh milky delicate cob as a natural food cum vegetable. Because of its sweet and succulent flavor, baby corn (*Zea mays* L.) is a favorite Asian food that can be eaten cooked or raw. Many people believe the little ears are produced by dwarf corn plants. Baby corn is the immature ear of fully grown standard varieties; ears are picked two or three days after silk emergence but before fertilization.

Baby corn is dual purpose crop grown round the year in India (Singh *et al*. 2015). An interesting recent development is of growing baby corn for vegetable purpose. Currently, Thailand and China are the world leaders in baby corn production. In India, baby corn is being cultivated under large scale in Meghalaya, Western Uttar Pradesh, Haryana, Maharashtra, Karnataka and Andhra Pradesh. With an annual production of 1147.7 million tonnes from an area of 193.7 million hectares and an average productivity of 5.75 tonnes ha^{-1}, maize is currently grown in 170 countries around the world (FAO STAT, 2020). With a production of roughly 31.51 million tonnes and a productivity of 3.19 tonnes ha^{-1}, maize is grown on an area of 9.86 million hectares in India (Agri. Stat. at a Glance, 2021).

It provides green cobs for human consumption and fodder for livestock within 45-60 days after sowing. It is a low calorie vegetable having higher fiber content without cholesterol, rich in vitamin B and C, potassium, fiber and carotenoids. Due to it is a tall-growing, widely-spaced crop with adequate inter row space, baby corn can be utilized to cultivate short-lived, short-statured beneficial crops while also giving farmers a sustainable yield and income. The act of growing crops together to increase production and reduce the cost of inputs by improving soil fertility and reducing the risk and chances for crop failure, intercropping helps to reduce insect and pest attack, disease, soil erosion, and crop failure (babar *et al.,* 2021). The intercropping system can increase soil fertility, promote the growth of crops, and lower the cost of a product per unit (Batista *et al*., 2016) and (Silva *et al.*, 2017). It has the ability to use resources like light, moisture, and nutrients more effectively than the mono cropping.

Depending on the extent to which the component crops complement each other in using growing resources, different crops are going to have different rooting abilities, canopy structures, heights, and nutrient requirements (bijarnia *et al*., 2022). Growing of potential intercrops including radish (*Raphanus sativus*), fenugreek (*Trigonella foenum-graecum*), and amaranthus (*amaranthus spp*.) ensured more effective use of the land, increased yield stability, diversity of produce, and market opportunities. The intercropping method provides an opportunity to enhance dietary diversity, production stability, decreased insect incidence and weed growth, effective labour usage, intensification of production with restricted resources, as well as return maximization.

Keeping all this in view the present study was conducted to study on the cropping indices and profitability influenced by short duration vegetables based inter cropping system with baby corn.

2. Materials and Methods

A field experiment was carried out during the year of 2022 at farmer's field at Nambal village, Mancherial District, Telangana. The experimental site is geographically located at 18.921674° N latitude and 79.164054° E longitude, with an elevation of 145 m above Mean Sea Level which is located in the northern Agro Climatic Zone of Telangana. The soil of the experimental area was black cotton soil with alkaline pH; medium in organic carbon, low in available nitrogen and medium in available phosphorus and potassium during late rabi season 2022 respectively. Baby corn hybrid G-5414, radish cv. Pusa chetki, local fenugreek and amaranthus were used for the research study.

The experiment was laid out by following the principles of Randomized Block Design, with ten treatments which was replicated thrice. On plot size of 6 m × 3 m with the details are as

follow as; T_1- Baby corn + Radish, T_2- Baby corn + Fenugreek, T_3- Baby corn + Amaranthus, T_4- Baby corn + Radish+ Fenugreek, T_5- Baby corn + Radish+ Amaranthus, T_6- Baby corn + Fenugreek + Amaranthus, T_7- Baby corn (sole crop), T_8- Radish (sole crop), T_9-Fenugreek (sole crop), T_{10}- Amaranthus (sole crop). Bunds were made prior to sowing in accordance with the recommended spacing. Baby corn hybrid G-5414 seeds were sown in line maintaining spacing of 45 cm between rows and 25 cm between plants. Intercrops were sown in-between two baby corn rows. Radish seeds were hand dibbled at a spacing of 10 cm, amaranthus and fenugreek seeds were broad casted in between the rows of baby corn. Recommended dose of nitrogen (150 kg ha^{-1}) as Urea, phosphorus (60 kg ha^{1}) as Single super phosphate and potassium (40 kg ha^{-1}) as Muriate of potash were applied as per the treatment schedule. Fifty per cent of N and K fertilizers along with full dose of P were applied as basal. Remaining half of the N and K were applied as top dressing at 25 DAS.

Calculation of cropping indices

Baby corn Equivalent Yield

Based on the prices of the various crops used in the treatments, the leaf yield of intercrops has been converted to a equivalent yield to that of baby corn.

Baby corn equivalent yield =

Leaf yield of intercrop× Leaf cost of intercrop + yield of baby corn

Cost of baby corn

Land Equivalent Ratio (LER)

For each treatment, the relative area of sole crop that would be required to produce the yield achieved through intercropping was calculated.

For each treatment, the relative area of sole crop that would be required to produce the yield achieved through intercropping was calculated.

LER = yield of baby corn yield of intercrop in inter cropping + in inter cropping

yield of baby corn yield of inter crop

in sole cropping in sole cropping

Income Equivalent Ratio (IER)

IER = gross income of baby corn gross income of inter cropping

In inter cropping + In inter cropping

Gross income of baby corn Gross income of inter cropping

In sole cropping In sole cropping

For each treatment, the relative area of sole crop that would be required to produce the gross income produced through intercropping was calculated.

Area Time Equivalent Ratio (ATER)

It shows the ratio of hectare-days required for sole cropping to hectare-days used for intercropping to produce the same yield.

ATER =

LER of baby corn × Duration of baby corn +LER of intercrop × Duration of intercrop Total duration of inter cropping system.

3. Results and Discussion

Cropping indices

Baby corn Equivalent Yield (BEY)

Among all the treatments of intercropping systems tried, the results presented in Table 2 clearly shows that maximum Baby corn Equivalent Yield (BEY) was obtained with baby corn + radish + fenugreek (T_4) with the value of 10442, which was followed by baby corn + fenugreek + amaranthus (T_6) which recorded the value of 9860 and closely on par with baby corn + radish + amaranthus (T_5). The lowest Baby corn Equivalent Yield was obtained with sole baby corn (T_7). Increased yields from radish and fenugreek in comparison to other intercrops and a higher market price for the inter crops may be the cause of the increased Baby corn Equivalent Yield with T_4 (baby corn + radish + fenugreek). this corroborates with the findings of kumar and singh (2002) reported that the maize grain equivalent yield was higher with maize with fenugreek inter cropping over sole maize. This coincide with the findings of Reddy *et al.,* (2009), Nataraj *et al.,* (2011) and Rathika *et al.,* (2014).

Land Equivalent Ratio (LER)

As regards the intercropping systems tried, the values given in Table 2 depicts that highest Land Equivalent Ratio (2.71) was recorded with baby corn + radish + fenugreek (T_4), which was followed by baby corn + fenugreek + amaranthus (T_6) with the value of 2.52 and closely on par with baby corn + radish + amaranthus (T_5). The lowest Land Equivalent Ratio was obtained with sole baby corn (T_7). The Land Equivalent Ratio is a tool to assess the biological efficiency of inter cropping system. Among the different treatment combinations, the superiority of T_4 (baby corn + radish + fenugreek) intercropping might be due to better performance of fenugreek and radish under partial shade in increased yield of fenugreek and radish. These results were in close conformity with the findings of Sarkar *et al.,* (2011), Rathika *et al.* (2014) and Tejaswitha *et al.,* (2021) in baby corn.

Area Time Equivalent Ratio

The highest Area Time Equivalent Ratio was observed with regards to the intercropping techniques that was recorded with inter cropping treatment of baby corn + radish + fenugreek (T_4) intercropping system with the value of 4.21 and the next best treatment was baby corn + radish + amaranthus (T_5) intercropping system with the value of 3.87, while the lowest value was recorded in sole baby corn (T_7). The highest Area Time Equivalent Ratio was recorded with baby corn + radish + fenugreek (T_4) intercropping might be due to more duration taken by radish crop as compared to other treatments. The results of the present study were consistent with the findings of Rathika *et al.* (2014) and Tejaswitha *et al.,* (2021) in baby corn.

Income Equivalent Ratio

When compared to the intercropping system of baby corn with short duration vegetable crops, the highest Income Equivalent Ratio was recorded with baby corn + radish + fenugreek (T_4) inter cropping system with the value of 2.85, which was followed by baby corn + fenugreek + amaranthus (T_6) crop combination treatment with the value of 2.52 and closely on par with baby corn + radish + amaranthus (T_5). The lowest Income Equivalent Ratio was obtained with sole baby corn (T_7).

This may be due to the baby corn, radish and fenugreek crop combination gross income increases under the intercropping system were greater than the other crop combination and sole cropping of baby corn.

Yield of inter crops

The intercropping system had significant influence on the yield attributes of different component crops, however a sole crop of inter crops recorded greater yield attributes than the intercropping system. This was caused by the fact that in solid stands, where the ideal population was maintained, there was less competition for nutrients and sunlight. This increases the competitive effect of base crops on the growth and development of intercrops. The results of Chhetri (2019) showed a similar tendency.

Table 1: Yield parameters of baby corn as influenced by vegetable inter cropping system

Treatments	Cob yield g plant^{-1}	% over control	Cob yield (t ha^{-1})	% over control	Dry matter production (t ha^{-1})	% over control
T_1	118.76	-4.22	6.1	-16.44	8.1	-14.04
T_2	166.23	0.87	7.3	1.51	9.4	-0.98
T_3	134.26	-2.73	6.5	-10.96	8.7	-8.11
T_4	142.50	-1.14	6.7	-8.22	8.8	-6.62
T_5	88.40	-7.67	5.5	-24.66	7.4	-22.05
T_6	99.92	-6.02	5.7	-21.92	7.6	-20.27
T_7	158.09	0.00	7.19	0.00	9.5	0.00
SEd	**7.26**		**0.18**		**0.19**	
CD (=0.05)	**15.25**		**0.38**		**0.4**	

NS : Non significant

Table.2 Baby corn equivalent yield (BEY), Land equivalent ratio (LER), Area time equivalent ratio (ATER) and Income equivalent ratio (IER) of baby corn as influenced by intercropping with short duration vegetable crops

Treatments	Cob yield (t ha-1)	(BEY)	(LER)	(ATER)	(IER)
T_1	6.1	8837.5	1.72	3.22	1.73
T_2	7.3	9006.25	1.95	2.71	1.96
T_3	6.5	8190	1.68	2.55	1.68
T_4	6.7	10442	2.71	4.21	2.85
T_5	5.5	9642.5	2.37	3.87	2.5
T_6	5.7	9860	2.52	3.07	2.52
T_7	7.19	7300	1.00	1.00	1.00
SEd	**0.18**	**179.14**	**0.08**	**0.17**	**0.16**
CD (=0.05)	**0.38**	**376.21**	**0.18**	**0.36**	**0.34**

Table.3 Yield of intercrops as influenced by intercropping system

Treatments	**Yield of intercrops (t ha-1)**
Baby corn + Radish	4 .1
Baby corn + Fenugreek	1.95
Baby corn + Amaranthus	1.78
Baby corn + Radish + Fenugreek	3.9 + 1.92
Baby corn+ Radish + Amaranthus	3.9 + 1.76
Babycorn+Fenugreek+Amaranthus	1.92 +1.76
Radish (sole crop)	4.6
Fenugreek (sole crop)	2.0
Amaranthus (sole crop)	2.25

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