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Effect of Varying Level of Nitrogen and Intercropping on Growth, Yield Attributing Characters and Yield of Baby Corn (Zea Mays L.)

Girraj Sharma, B Venkateswarlu, P V N Prasad and P Madhu Vani
Department of Agronomy, Agricultural College, Bapatla – 522101

ABSTRACT

A field experiment was conducted at the Agricultural College Farm, Bapatla, to study that effect of varying levels of nitrogen and intercropping on growth, yield attributing characters and yield of baby corn (*Zea mays* L.). The highest plant height (167.3 cm), drymatter accumulation (11599 kg ha^{-1}), per day productivity (30.5 g m^{-2} day^{-1}) ear length & ear girth (13.93 cm & 1.55cm), ear weight with husk (62.5 g), baby corn cob yield (17048 kg ha^{-1}) and green fodder yield (58.8 t ha^{-1}) were recorded in Baby corn paired rows + Greengram. Application of 125% RDN gave the highest plant height (168.4 cm), drymatter accumulation (12,222 kg ha^{-1}), per day productivity (31.5 g m^{-2} day^{-1}), ear length & ear girth (14.50 cm &1.57 cm), ear weight with husk (61.6 g), baby corn cob yield (17369 kg ha^{-1}) and green fodder yield (59.9 t ha^{-1}).

Key words : Baby corn, Intercropping, Nitrogen, Growth and Yield.

Baby corn is the dehusked corn ear, harvested within 2-3 days of silk emergence but prior to fertilization (Pandey *et al*. 2000). Baby corn is consumed as vegetable due to its sweet flavour and nutritive value. It provides carbohydrates, proteins, fat, minerals and vitamins in palatable, wholesome, hygienic and digestible form. It is rich in phosphorus content (86 mg/100 g edible portion in comparison to 21 to 57 mg phosphorus content in other commonly used vegetables).

Corn being an exhaustive crop and its requirement for fertilizers especially for nitrogen is prominent. Nitrogen is the essential constituent of chlorophyll, protoplasm and enzymes. Further, it governs utilization of phosphorus and potassium. It is an important factor for better vegetative growth and boosting up the yield of cereals (Shrivastava and Sinha, 1992). Intercrops are known to help in residual nutrient build up of the soil. Deliberate introduction of legumes as inter crops in baby corn not only takes care of the weed suppression but also helps in the utilization of atmospheric nitrogen being fixed by it in the current growing season. (Patra et al. 2000)

MATERIAL AND METHODS

A field experiment was conducted during *kharif* 2013 at the Agricultural College Farm, Bapatla, on a sandy loam soil which was, slightly alkaline in reaction with p^H 7.4, medium-in organic carbon (0.52 %) and low in available nitrogen (258 kg ha^{-1}), high in available phosphous (53.9 kg ha^{-1}) and high in available potassium (539.8 kg ha^{-1}).

The treatments consisted of C_1: Sole baby corn, C_2: Baby corn in paired row, C_3: Baby corn in paired row + Soybean, C_4: Baby corn in paired rows + Blackgram, C_5: Baby corn in paired rows + Greengram as factor – A and N_1= 100 % RDN, N_2= 75% RDN and N_3= 125% RDN as factor-B which was laid out in a Randomized Block Design with factorial concept and the treatments were replicated thrice. Baby corn hybrid G-5414 was sown along with intercrops in lines according to the specific row arrangements on 9 th july, 2013 by adopting a spacing of 45 cm X 20 cm. Nitrogen through urea as per treatments and uniform dose of phosphorous and potassium @ 50 kg P_2O_5 and 60 kg K_2O ha^{-1} through Single superphosphate and Muriate of potash, respectively were applied to the plots. Entire quantity of phosphorus and potassium were applied as basal whereas nitrogen was applied in two equal splits i.e. one at the time of sowing and the other 30 days after sowing. Additional quantity of fertilizer was not applied to intercrops. The crop was maintained adopting by normal package of practices and data were collected and analysed statistically by adopting the standard procedures as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant height of 167.3 cm which was significantly height registered by baby corn in paired rows + greengram and was on a par with baby corn in paired rows + blackgram and 162.4 cm in paired rows of baby corn + soybean (162.4 cm), The least plant height of 153 cm was recorded in sole baby corn and was statistically comparable to taller plant in paired row planting of baby corn (157 cm). The better performance of baby corn might be due to better availability of moisture and nutrients and less wed competition under intercropped situation. The poor performance of baby corn in sole cropping and paired row planting could be attributed to more exposure of inter row spacing to outer atmosphere and more weed competition, due to lower availability of moisture and nutrients. Similar result of reduced plant height under sole cropped situation was also reported by Sakthivel *et al*. (2003), and Reddy *et al.* (2009). Applying 125% RD of nitrogen resulted in significantly with 168.4 cm taller plants, was the maximum and was followed by 161.2 cm taller plants with 100% RD of nitrogen (161.2 cm). However, the lowest 153.4 cm plant height was registered with 75% RDN application (153.4 cm). This increase in plant height might be due to improved assimilation of nitrogen with increasing levels of nitrogen resulting in increased plant height and cell division and cell elongation as promoted by nitrogen. Adequate nitrogen supply increased the amount of cell plasma and chlorophyll, which is a factor for growth of the crops. Under adequate nitrogen supply, cells elongate extensively along the main axis leading to more growth of internodes and increases the length of stem. Similar result of taller plant at higher nitrogen levels and shorter plants at lower nitrogen was also reported by Prathyusha *et al*. (2013) and Ayub *et al*. (2013).

Drymatter accumulation was the highest in paired row planting of baby corn + greengram intercropping, (11599 at kg ha^{-1} harvest) which was significantly superior over sole baby corn only. Sole crop of Baby corn registered significantly the lowest drymatter accumulation (9443 kg ha^{-1}). The increased drymatter accumulation in baby corn under intercropped situation with legumes might have occurred owing to the improved nitrogen supply through symbiotic nitrogen fixation by legumes and its subsequent transfer to baby corn. Similar resulted were also reported by Eskandari and Ghanbari (2009) and Solanki *et al* .(2011). The highest values of drymatter 12,222 kg ha^{-1} was recorded by the treatment receiving 125% recommended dose of nitrogen. The lowest values of drymatter 9246 kg ha^{-1} was registered by the treatment receiving over 75% recommended dose of nitrogen during at harvest, respectively. The increased drymatter production with more nitrogen application might be due to the fact that nitrogen fertilization made the plants more efficient in photosynthetic activity, enhancing the carbohydrate metabolism and ultimately the increasing drymatter accumulation. These results are in accordance with the findings of Ayub *et al.*(2013), Prathyusha *et al.* (2013).

Sole crop of baby corn recorded (54.3 days and 58.5days) the highest no. of days for 50% silking and harvesting but was statistically comparable with (53.4 days & 57.6 days) recorded in paired row sowing of baby corn. Significantly the lowest number of days to 50% silking and harvest (51.6 days & 56.4 days) was registered in baby corn in paired rows + greengram and the treatment was statistically comparable with (52.2 days & 56.8 days) and (52.9 days & 57.4 days) recorded in baby corn in paired rows + blackgram and baby corn in paired rows + soybean, respectively.Under sole cropping and paired row planting the condition for more photosynthesis were congenial and this might have prolonged the vegetative growth of baby corn reverse is the case under intercropped situation where there is competition for resources by the component crops. This could be the reason for the shortened vegetative growth. 54.6 days and 58.7days for 50% silking and harvesting the highest, was observed in the treatment receiving 75% RDN. It was followed by (52.5 days & 57.5 days) by 100% RDN treatment. Significantly the lowest (i.e. 51.6 days & 56.1 days) was registered by 125% RDN. These results are in accordance with the findings of More *et al.* (2014).

Per day productivity (g m^{-2} day^{-1}) at harvest was the highest with Baby corn in paired rows + Greengram intercropping system which was 30.5 g m^{-2} day^{-1}, respectively and was followed by Baby corn in paired row + Blackgram intercropping system. Significantly the lowest per day productivity 24.6 g m^{-2} day^{-1} was recorded in sole baby corn at harvest (Table 1) respectively. There was a better

Table 1. Growth components of baby corn as influenced by nitrogen level and intercropping.

Treatment	Plant height at harvest (cm)	Drymatter accumulation at harvest (kg ha^{-1})	Days to 50 % silking	Days to harvest	Per day productivity at harvest (g m^{-2} day^{-1})
Intercropping					
(C_1) Sole baby corn	153.0	9443	54.3	58.5	24.6
(C_2) Baby corn in paired row	157.0	10229	53.4	57.6	26.3
(C_3) Baby corn in paired row+Soybean	162.4	10864	52.9	57.4	28.4
(C_4) Baby corn in paired row+Blackgram	166.0	11315	52.2	56.8	29.7
(C_5) Baby corn in paired row+Greengram	167.3	11599	51.6	56.4	30.5
S.Em±	2.92	466.38	0.47	0.39	1.11
CD (P = 0.05)	8.3	1351.1	1.4	1.2	3.2
Nitrogen levels (kg ha^{-1})					
N_1 100% RDN	161.2	10602	52.5	57.5	27.7
N_2 75% RDN	153.4	9246	54.6	58.7	24.5
N_3 125% RDN	168.4	12222	51.6	56.1	31.5
S.Em±	2.14	361.26	0.31	0.29	0.86
CD (P = 0.05)	6.0	1046.5	0.9	0.8	2.5
Interaction (P X N)					
S.Em±	4.77	807.82	0.71	0.68	1.93
CD (P = 0.05)	NS	NS	NS	NS	NS
CV (%)	9.4	13.1	1.9	2.8	12.0

utilization of natural resources by the components in the intercropping system. Further, baby corn in competition with the legumes grew taller to avail more natural resources producing that corn is a heavy feeder. (Pandey and Tomer, 1989). Further the symbiotic nitrogen released through the legumes component made baby corn further to accumulate more drymatter making the plants taller more nutrient uptake and these all favorable growth parameters and nutrient uptake might have resulted in more productivity of baby corn. Similar results were also reported earlier by Thavaprakash *et al.* (2005), Birteeb *et al*.(2011).

Maximum per day productivity was obtained with the application of 125 per cent RDN (31.5 g m^{-2} day^{-1} during harvest) while the lowest per day productivity (g m^{-2} day^{-1}) at harvest was obtained with the application of 75 per cent RDN (24.5 g m^{-2} day^{-1} during harvest). Corn crop absorbs nutrients in large amounts throughout the growth period and nitrogen is the major limiting factor for drymatter production and quality improvement (Pandey and Tomer, 1989). More available nitrogen might have resulted into taller plants and resulted in larger photosynthetic surface to intercept more radiant energy which might have ultimately resulted in more drymatter accumulation. Hence higher per day productivity of corn at higher nitrogen levels. Similar reports of higher per day productivity at higher nitrogen levels were also given by Patel *et al. (2006),* Khatun *et al.* (2012).

Baby corn in paired rows + greengram registered (13.93 cm, 1.55cm & 62.5 g) ear length, ear girth, and ear weight with husk significantly the highest which was comparable with (13.71 cm, 1.50 cm & 59.8 g) in baby corn paired rows + blackgram and (13.54 cm, 1.46 cm, & 56.6 g) in baby corn paired rows + soybean. Significantly the least ear length, ear girth, and ear weight with husk (12.40 cm, 1.38 cm & 48.9 g) were recorded in sole baby corn which was comparable with (12.80 cm, 1.42 cm & 55.3 g) of baby corn in pairs only. Baby corn intercropped with legumes available better environment for growth and development and these treatments have the added advantage of more nitrogen availability due to leguminous intercrops.

Table 2. Yield attributes, cob yield and fodder yield of baby corn as influenced by nitrogen level and intercropping.

Treatment	Ear length (cm)	Ear girth (cm)	Ear weight With husk (g)	Baby corn Cob yield kg ha^{-1}	Fodder yield (t ha^{-1})
Intercropping					
(C_1) Sole baby corn	12.40	1.38	48.9	13228	47.8
(C_2) Baby corn in paired row	12.81	1.42	55.3	14530	52.6
(C_3) Baby corn in paired row+Soybean	13.51	1.46	56.6	15603	55.4
(C_4) Baby corn in paired row+Blackgram	13.71	1.50	59.8	16416	57.3
(C_5) Baby corn in paired row+Greengram	13.93	1.55	62.5	17048	58.8
S.Em±	0.36	0.04	2.07	511	2.79
CD (P = 0.05)	1.1	0.1	5.9	1481	7.0
Nitrogen levels (kg ha^{-1})					
N_1 100% RDN	13.17	1.47	56.2	15269	54.3
N_2 75% RDN	12.04	1.35	52.3	13457	47.9
N_3 125% RDN	14.50	1.57	61.6	17369	59.9
S.Em±	0.28	0.03	1.53	396	1.92
CD (P = 0.05)	0.8	0.1	4.4	1147	5.5
Interaction (P X N)					
S.Em±	0.63	0.09	4.10	885	5.02
CD (P = 0.05)	NS	NS	NS	NS	NS
CV (%)	10.2	8.4	12.6	10.9	14.8

This made baby corn under intercropped situation to grow taller, and to accumulate more drymatter, taller plants with higher drymatter accumulation offered better translocation of the stored food from source to sink which might have resulted in more ear length , ear girth and ear weight. Similar results were also reported Sakthivel *et al*. (2003), Rehman *et al.* (2010) and Amini *et al.* (2013)

Significantly the highest ear length, ear girth and ear weight with husk (14.50 cm 1.57 cm and 61.6 g) was found in the treatment receiving 125% RDN and was followed by (13.17 cm, 1.47 cm and 56.2 g) applying 100% RDN. Significantly the lowest ear length ear girth and ear weight with husk (12.04 cm, 1.35cm and 52.3g) were registered by applying 75% RDN. More *et al*. (2014) also reported similar findings.

Significantly the highest baby corn cob yield and green fodder yield (17048 kg ha^{-1} and 58.8 t ha^{-1}) were observed in baby corn pairs +greengram,(16416 kg ha^{-1} and 57.3 t ha^{-1}) in baby corn pairs + blackgram, and (15603 kg ha^{-1} and 55.4 t ha^{-1}) in baby corn pairs + soybean whichwere statistically superior to the sole baby corn (13228 kg ha^{-1} and 47.8 t ha^{-1}). Better growth parameters, higher drymatter accumulation high yield attributes in intercropping treatments might have resulted in more baby corn yield and fodder yield too. Similar results of higher baby corn yield and fodder with intercropping was also reported by Thavaprakas *et al.* (2010), Surve *et al.* (2011) and Amini *et al.* (2013).

The highest baby corn cob yield and green fodder yield (17369 kg ha^{-1} and 59.9 t ha^{-1}) were found in the treatment receiving 125% of RDN and was followed by (15269 kg ha^{-1} and 54.3 t ha^{-1}) in the treatment receiving 100% RDN. Significantly the lowest baby corn cob yield and green fodder yield (13457 kg ha^{-1} and 47.9 t ha^{-1}) was registered in the treatment receiving only 75% RDN. The liberal fertilization and enhanced nitrogen uptake might have resulted in the improvement of growth parameter drymatter production and the yield attributes resulting in increased cob yield and fodder yield. The present findings are in agreement with those of Jat *et al*. (2013), Eliakira *et al*. (2014),More *et al.* (2014) and Naresh *et al.* (2014).

Interaction between intercrops and nitrogen was not significant with regard to all the data presented.

CONCLUSION

Among the intercrops treatments, paired row planting of baby corn + greengram intercropping system (C_5) manifested the superior performance with significant increase in the plant height, drymatter accumulation, ear length, yield attributing characters (ear girth and ear weight with husk), baby corn cob yield and green fodder yield. Application of 125% RDN was significantly superior with 100% RDN recorded higher plant height, drymatter accumulation, ear length, yield attributing characters (ear girth and ear weight with husk), baby corn cob yield and green fodder yield.

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