The Andhra Agric. J 63 (1): 8-13, 2016

Effect of Nitrogen Levels and Weed Control Practices on Growth and Yield of Baby Corn (Zea Mays L.)

B Rama Devi, B Venkateswarlu, K Srinivasulu and P Madhuvani
Department of Agronomy, Agricultural College, Bapatla 522 101, Andhra Pradesh

ABSTRACT

A field experiment was conducted at the Agricultural College Farm, Bapatla to study the effect of nitrogen levels and weed control practices in baby corn. Application of 180 kg N ha^{-1} recorded significantly higher plant height, more number of leaves and drymatter accumulation compared to that of 150 and 120 kg N ha^{-1}. Hand weeding twice (W_2) recorded significantly more plant height, more number of leaves and drymatter accumulation. The number of days taken to 50 percent tasseling, silking and harvest were significantly lowered when the crop was fertilized with 180 kg N ha^{-1}. Hand weeding twice (W_2) recorded significantly less number of days to 50 percent tasseling, silking and harvest. Yield attributing characters like individual cob weight and ear weight were significantly superior with the application of 180 kg N ha^{-1} when compared to 150 and 120 kg N ha^{-1}, whereas, individual ear length and ear girth of baby corn recorded under 180 kg N ha^{-1} were on a par with that of 150 kg N ha^{-1}. Among the weed control practices, hand weeding twice (W_2) recorded significantly more yield attributing characters like individual ear length, ear weight, cob weight, ear weight and ear to cob ratio over the other treatments. Higher cob, ear and husk yields were obtained with the application of 180 kg N ha^{-1} but it was on a par with 150 kg N ha^{-1} in case of cob yield and fresh fodder yield. Among weed control practices, hand weeding twice (W_2) recorded significantly higher cob, fresh fodder and dry fodder yield, but it was on a par with application of @1.0 a.i. ha^{-1} fb 2,4-D amine @ 0.58 kg a.i. ha^{-1} in case of fresh fodder yield.

Key words : Nitrogen levels, Cob yield, Baby corn, Weed control practices.

Baby corn is dehusked maize ear, harvested within 2-3 days of silk emergence but prior to fertilization (Pandey et al., 2000 a). Baby corn is consumed as vegetable due to its sweet flavour. High nutritional value, eco-friendly and crispy nature of baby corn has made it special choice for various traditional and continental dishes apart from canning in the elite society (Singh et al., 2006). The nutrient value of baby corn is comparable to that of several vegetables like cauliflower, cabbage, french bean, spinach, lady's finger, brinjal, tomato, radish etc. (Paroda and Sashi, 1994). It is rich in phosphorus content (86 mg/ 100g of edible portion), when compared to 21 to 57 mg phosphorus content in other commonly used vegetables. It is an amazingly low calorie vegetable, high in fibre content, containing considerable amount of zinc and vitamin B_3. Maize is an exhaustive crop and requires high quantities of nitrogen during the periods of efficient utilization, particularly at 25 days after sowing and pre-tasseling (40 days after sowing) stages for higher productivity (Luikhan et al., 2003). Fertilization is used to improve crop growth, but may aggravate weed problem, wherever heavy doses of fertilizers are applied. Maize is most sensitive to weed competition during its early growth period. The growth of maize plants in the first 3-4 weeks is rather slow and during this period weeds establish rapidly and become competitive. Maximum weed competition in maize occurs during the period of 2 to 6 weeks after sowing, suggesting the importance of maintaining the crop free from weeds during the critical period of weed competition. In order to increase the fertilizer use efficiency by the crop, it is imperative to minimize weed competition, particularly during the critical periods of crop weed competition. Thus, for better utilization of nitrogen fertilizer by the crop, proper weed control measures through cultural and chemical methods must be ensured.

MATERIAL AND METHODS

The field experiment was conducted during the *kharif* season of 2012-2013 at the Agricultural College Farm, Bapatla. The soil was sandy clay loam in texture, alkaline in reaction with p^H 7.3,

Table 1. Effect of nitrogen levels and weed control practices on growth parameters of baby corn.

Treatments	Plant height (cm)	No. of leaves (no./plant)	Drymatter production (kg/ha)	Days to 50% tasseling	Days to silking	Days to harvest
Nitrogen levels (kg ha^{-1})						
120	125.6	10.5	7787	49.9	51.9	59.9
150	133.0	11.2	8689	49.0	50.9	59.4
180	142.0	12.0	9657	48.1	49.8	59.0
SEm±	3.4	0.3	243.5	0.3	0.4	0.2
CD (P=0.05)	10.2	0.9	732.5	0.9	1.1	0.6
CV(%)	7.6	8.0	8.3	2.0	2.2	1.1
Weed control practices						
Weedy check	123.6	10.3	7493	50.1	52.0	60.6
Hand weeding twice at 15 and 30 DAS	141.3	12.2	10000	48.0	50.0	58.3
Atrazine @ 1.0 Kg a.i ha^{-1} as pre emergence						
2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS	134.3	11.3	8687	49.0	51.0	59.5
Pendimethalin @ 1.0 kg a.i ha^{-1} as pre emergence followed by 2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS	130.4	10.9	8086	49.5	51.4	59.8
	138.2	11.7	9289	48.6	50.5	59.0
SEm±	2.7	0.06	308.0	0.27	0.27	0.23
CD (P=0.05)	8.0	0.2	925.0	0.8	0.8	0.7
CV(%)	6.2	4.9	10.9	1.8	1.6	1.2
Interaction	NS	NS	NS	NS	NS	NS

low in organic carbon and available nitrogen (255 kg ha^{-1}), medium in phosphorus (52.5 kg ha^{-1}) and high in available potassium (537.5 kg ha^{-1}). Three levels of nitrogen (N_1= 120, N_2= 150 and N_3= 180 kg N ha^{-1}) alloted to main plots and five weed control practices (W_1: weedy check, W_2: two handweedings at 15 and 30 DAS, W_3: atrazine @ 1.0 kg a.i ha^{-1} as pre-emergence application, W_4: 2,4-D amine @ 0.58 kg a.i ha^{-1} as post-emergence at 30 DAS, W_5: pendimethalin @ 1.0 kg a.i ha^{-1} as pre emergence application + @ 2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS) alloted to sub plots were tested in split plot design with three replications. Baby corn was planted at an inter and intra-row spacing of 45 cm x 20 cm during the second week of July and harvested during last week of September. Nitrogen was applied in the form of urea as per the treatments in two splits one at sowing and second at 30 DAS. Uniform dose of phosphorus (60 kg P_2O_5 ha^{-1}) in the form of single super phosphate was applied at the time of sowing as basal. Potassium (50 kg K_2O ha^{-1}) in the form of muriate of potash was applied at time of sowing as basal.

RESULTS AND DISCUSSION

Effect on growth

It was evident from the data that, the tallest plants were observed with the application of 180 kg N ha^{-1} (142.0 cm) which was on a par with the application of 150 kg N ha^{-1} (133.0 cm). However, 120 kg N ha^{-1} with 125.6 cm recorded in N_1 was statistically comparable with N_2 treatment only. The maximum plant height recorded at higher levels of nitrogen might be due 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. The increased plant height with increasing levels of nitrogen was also reported by Manoj kumar and Singh (2002). Among the weed control practices, the highest plant height was recorded with W_2 treatment *i.e.,* two hand weedings141.3 cm which was on a par with the application of pendimethalin as pre-emergence + 2,4-D amine as post-emergence application (W_5) registering 138.2 cm. Weedy check (W_5) recorded the shortest plants (123.6 cm) which was on a par with the application

Table 2. Yield attributes and yield of baby corn as influenced by nitrogen levels and weed control practices.

Treatments	Ear length (cm)	Ear girth (cm)	Ear weight (g)		Ear to cob ratio	Cob yield (kg ha^{-1})	Ear yield (kg ha^{-1})	Husk yield (kg ha^{-1})
			With husk	With out husk				
Nitrogen levels (kg ha^{-1})								
120	10.2	1.15	43.7	12.4	0.28	9493	2894	6599.1
150	10.7	1.23	46.9	13.7	0.29	10358	3293	7065.0
180	11.8	1.30	50.0	15.5	0.31	11585	3726	7858.9
SEm±	0.3	0.04	1.4	0.4	0.01	355	124	261.8
CD (P=0.05)	1.0	0.1	4.1	1.3	NS	1063	371	785.3
CV(%)	9.2	8.4	8.7	9.8	8.6	10.0	11.1	10.8
Weed control practices								
Weedy check	10.2	1.1	41.7	11.1	0.26	8829	2963	5865.7
Hand weeding twice at 15 and 30 DAS	11.8	1.32	52.5	15.8	0.30	11773	3698	8074.1
Atrazine @ 1.0 Kg a.i ha^{-1} as pre emergence	11.0	1.24	48.4	13.8	0.28	10719	3288	7430.6
2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS	10.6	1.20	46.5	12.7	0.27	9945	3079	6866.9
Pendimethalin @ 1.0 kg a.i ha^{-1} as pre emergence followed by 2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS	11.4	1.28	50.2	14.8	0.29	11129	3495	7634.3
SEm±	0.27	0.04	0.8	0.23	0.01	259	82	172.1
CD (P=0.05)	0.8	0.13	2.3	0.7	0.03	756	239	502.4
CV(%)	7.9	11.1	6.3	5.8	8.4	7.4	7.4	7.2
Interaction	NS	NS	NS	NS	NS	NS	NS	NS

of 2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS (W_4). Congenial environment for baby corn and facilitated it to allow the natural resources efficiently and hence the taller plants in this treatment. Similar results were also reported by Pandey *et al*. (2000).

At harvest, significantly more number of leaves (12.0) were recorded with application of 180 kg N ha^{-1} which was on a par with the application of 150 kg N ha^{-1} (11.2). The lowest number of leaves (10.5) were recorded with application of 120 kg N ha^{-1}. The increased number of leaves with increasing levels of nitrogen was also reported by Joshi and Kumar (2007) and Ashok kumar *et al.* (2008). Significantly the highest number of leaves (12.2) were registered in the treatment receiving two hand weedings (W_2) where as the lowest (10.3) leaves per plant were observed in weedy check (W_1). Similar results were also reported by Anil Dixit and Gautam (1996).

Maximum dry matter accumulation was recorded with application of 180 kg N ha^{-1} (9657 kg ha^{-1}), while the lowest was registered with 120 kg N ha^{-1} (7787 kg ha^{-1}). The increased dry matter 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 dry matter accumulation. Taller plants with more number of leaves with higher dose of nitrogen might have resulted in the higher dry matter accumulation. The dwarfer plants with few number of leaves at lower dose of nitrogen could be the reason for lower dry matter values at lower nitrogens. Choudhary *et al.* (2006).

Application of 180 kg N ha^{-1} reduced the number of days taken to 50 percent tasseling and silking significantly over that of other levels of nitrogen. The delayed tasseling in plots receiving lower dose of nitrogen might be due to low availability of nitrogen to plants. Flowering, fruiting and seed set are essential in crop production. These processes are controlled by environment, particularly photoperiod and temperature, and by genetic or internal factors, particularly growth

Table 3. Nitrogen Uptake (kg ha^{-1}) and quality parameters of baby corn as influenced by nitrogen levels and weed control.

Treatments	Nitrogen content (%)	Nitrogen Uptake (Kg ha^{-1})	Crude fibre (%)	Ash content (%)	Soil available N (kg ha^{-1})
Nitrogen levels (kg ha^{-1})					
120	1.05	83.8	26.9	10.77	149.4
150	1.23	109.4	29.2	11.86	121.3
180	1.4	137.6	31.2	12.96	101.4
SEm±	0.014	4.1	0.30	0.17	3.0
CD (P=0.05)	0.04	12.5	0.9	0.51	9.1
CV(%)	3.7	11.1	3.08	4.4	7.2
Weed control practices					
Weedy check	0.97	74.2	25.45	10.22	203.2
Hand weeding twice at 15 and 30 DAS	1.48	150.0	31.61	13.48	65.9
Atrazine @ 1.0 Kg a.i ha^{-1} as pre emergence	1.23	108.3	29.4	11.88	124.1
2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS	1.1	91.0	28.65	11.09	164.6
Pendimethalin @ 1.0 kg a.i ha^{-1} as pre emergence followed by 2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS	1.35	128.0	30.3	12.68	104.5
SEm±	0.02	3.6	0.26	0.20	4.5
CD (P=0.05)	0.06	10.9	0.79	0.62	13.3
CV(%)	3.7	10.1	2.81	5.1	8.9
Interaction	NS	NS	NS	NS	NS

regulators, photosynthate and mineral nutrient supply e.g., nitrogen (Gardner *et al.,* 1988). Earliness in tasseling with nitrogen application was also reported by Muniswamy *et al.* (2007).

Tasseling and silking were earlier under hand weeding twice (W_2) which was on a par with application of Pendimethalin @ 1.0 kg a.i ha^{-1} as pre emergence + 2,4-D amine @ 0.58 kg a.i ha^{-1} at post-emergence (W_5). Number of days taken to harvest was significantly lower with the application of 180 kg N ha^{-1} and it was on a par with 150 kg N ha^{-1}. Where as, hand weeding twice (W_2) reduced the number of days to harvest significantly over all other weed control methods. In weed control treatments either by hand weeding or by applying herbicides could have resulted in congenial environment for growth with taller plants and more number of leaves per plant. Hence, earliness in flowering. Similar results were also reported by Arvadiya *et al*. (2012).

Effect on yield

Yield attributing characters like individual ear length, ear girth, cob weight and ear weight of baby corn were significantly improved with increase in nitrogen level. Application of 180 kg N ha^{-1} was found superior to 120 kg N ha^{-1} only. The beneficial effects of the higher levels of nitrogen in terms of drymatter accumulation ultimately reflected in increasing the yield contributing characters. A deficiency of mineral nutrients, particularly nitrogen leads to decrease in the photosynthetic activity of isolated chloroplasts. (Spencer and Possingham, 1960). Among the weed control methods, hand weeding twice (W_2) recorded significantly higher cob weight and ear weight over the other methods. With respect to individual ear length and girth this treatment was on a par with application of Pendimethalin @ 1.0 kg a.i ha^{-1} as pre emergence + 2,4-D amine @ 0.58 kg a.i ha^{-1} at 30 DAS (W_5). Ear to cob ratio was significantly higher with two hand weedings (W_5) which was followed by Pendimethalin @ 1.0 kg a.i ha^{-1} as pre emergence + 2,4-D amine @ 0.58 kg a.i ha^{-1} as post-emergence

at 30 DAS (W_5).This might be due to more nutrient availability and lower weed competition under various weed control methods which might have provided better nutrition for development of ear. Similar results were also provided by Arvadiya *et al.* (2012).

Higher cob (11585 kg ha^{-1}), ear (3726 kg ha^{-1}) and husk (7858.9 kg ha^{-1}) yields were obtained with the application of 180 kg N ha^{-1} but it was on a par with 150 kg N ha^{-1} (10358 kg ha^{-1}) in case of cob yield. The positive response to higher level of nitrogen on corn yield could be ascribed to overall improvement in crop growth that enabled the plant to absorb more nutrients and moisture which empowered the plant to manufacture more quantities of photosynthates and accumulating them in sink. Similar findings of response of crop to higher nitrogen levels were reported by Suryavanshi *et al.* (2008). Among weed control measures, hand weeding twice (W_2) recorded significantly higher cob (11773 kg ha^{-1}), ear (3698 kg ha^{-1}) and husk (8074.1 kg ha^{-1}) yield. Higher cob yield observed under hand weedings and herbicidal treatments might be attributed to drastic decrease in weed population and dry matter accumulation by weeds, reduced crop weed competition and thereby better crop growth and yield attributes. These findings are in accordance with the findings of Patel *et al.* (2006).

Effect on nitrogen uptake and quality

The highest nitrogen content (1.4%) and uptake (137.6 kg ha^{-1}) were noticed with application of 180 kg N $ha^{-1.}$ in fodder. The lowest nitrogen content (1.05%) and uptake (83. 8 kg 1 $ha^{-1.}$) were registered in the treatment applied with 120 kg N ha^{-1}. Increasing doses of nitrogen increased the nitrogen uptake progressively by the crop. The increased uptake of nitrogen by the crop due to increasing levels of nitrogen might be due to the combined effect of increasing nitrogen content and increased baby corn yield and stover yield. Similar results were also reported by Singh et al. (2012). The highest nitrogen content of 1.48% in fodder was recorded in the treatment receiving two handweedings. Significantly, the lowest nitrogen content 0.97% was reported in weedy check. Significantly the highest nitrogen uptake 149.9 kg $ha^{-1.}$ was found in W2 treatment i.e handweeding where as the lowest 124.5 kg $ha^{-1}$was recorded in W1 treatment. More was a continuous crop weed completion in weedy check making available nitrogen lower and hence lower nitrogen content in plants. Creating weed free environment in the early and later stages reduced crop weed competition and increasing the availability of nitrogen. Higher available nitrogen might have made the plants to absorb more nutrients that ultimately increase the nitrogen content in the ear.

Crude fibre and ash contents increased significantly with increasing levels of nitrogen up to 180 kg ha^{-1}. The maximum crude fibre (31.18%) and ash content (12.96%) were noticed with the application of 180 kg N. Higher crude fibre percentage and ash content with increased nitrogen level might be due to higher plant height and dry matter accumulation and negative correlation between nitrogen fertilization and crude fibre content. Hand weeding twice (W2) produced significantly higher crude fibre (31.61%) and ash content (13.48%) over the other treatments and it was followed by pendimethalin @ 1.0 kg a.i $ha^{-1.}$ as per emergence fb 2,4-D amine @ 0.58 kg a.i $ha^{-1.}$ as post –emergence at 30 DAS (W5). Many researchers reported negative corelation between nitrogen and crude fibre content. Better weed control through either hand weeding or herbicidal treatment created a weed free environment enabling the baby corn plants to absorb all essential plant nutrients at luxury consumption making baby corn to accumulate more of the essential plant nutrients. The more availability and absorption might have resulted in higher total ash content of baby corn.

The highest soil available N was recorded with application of 120 kg ha^{-1} (149.5 kg ha^{-1}). While lowest available N was noticed with application of 180 kg N ha^{-1} (101.4 kg ha^{-1}). Lower doses of nitrogen reduced the available nitrogen status of soil and after the crop harvest gave high available nitrogen which might be due to lower uptake of nitrogen by the crop. These results are in accordance with findings of Anil kumar *et al.* (2002). With regard to weed control practices weed check recorded maximum soil available The highest soil available N was recorded with application of 120 kg N $ha^{-1.}$ of 149.5 kg ha^{-1}The lowest available N was noticed with application of 120 kg N $ha^{-1}$of 101.4 kg ha^{-1} Lower doses of nitrogen reduced the available nitrogen status of the soil and after the crop harvest gave high available nitrogen which might be due to lower uptake of nitrogen by the

crop. These results are accordance with finding of Anil kumar *et al.,* (2002). With regard to weed control measures, weedy check (W1) recorded maximum soil available N of 203.2 kg N ha^{-1}which was followed by 2,4-D amine @ 0.58 kg a.i ha^{-1} as post emergence (W4) of 164.6 kg ha^{-1}. The lowest available N was noticed with two hand weedings (W2) of 65.9 kg ha^{-1}, which was followed by pendimethalin @ 1 kg a.i ha-1 fb application of 2,4-D amine @ 0.58 kg a.i ha^{-1} as post emergence (W5) of 104.5 kg ha^{-1}. The lower available nitrogen in the soil after crop harvest could be due to the higher nitrogen uptake in the weed free and management treatments.

LITERATURE CITED

Anil Dixit and Gautam K C 1996 Effect of atrazine on growth and yield of winter maize. *Annals of Agricultural Research,* 17(2): 121-124.

Arvadiya L K, Raj V C, Patel T U and Arvadia M K 2012 Influence of plant population and weed management on weed flora and productivity of sweet corn (*Zea mays*). *Indian Journal of Agronomy,* 57(2): 162-167.

Ashok kumar, Rajesh singh, Lalit kumar rao and Singh U K 2008 Effect of integrated nitrogen management on growth and yield of maize (*Zea mays L.*). *Madras Agricultural Journal,* 95(7-12): 467-472.

Choudhary M L, Singh A and Parihar C M 2006&2007 Forage production potential of maize (*Zea mays*) under different nitrogen levels and crop geometry. *Agronomy Digest,* 6&7: 17-18.

Gardner F P, Pearce R B and Mitchell R L 1988 Physiology of crop plants. Pp. 242.

Joshi Y P and Kumar K 2007 Effect of nitrogen levels and seed rates on growth, yield and quality of fodder maize variety 'African Tall'. *Forage Research,* 33(3): 171-173.

Luikhan E, Ranjan J K, Rajkumar K and Marium P S 2003 Effect of organic and inorganic nitrogen on growth and yield of baby corn. *Agricultural Science Digest,* 23(2): 119-121.

Manoj kumar and Singh M 2002 Effect of nitrogen and phosphorus levels on growth and yield of maize (*Zea mays L.*) under rainfed condition of Nagaland. *The Andhra Agricultural Journal,* 49 (3&4): 203-206.

Muniswamy S, Gowda R and Prasad S R 2007 Effect of spacing and nitrogen levels on seed yield and quality of maize single cross hybrid PEHM-2. *Mysore Journal of Agricultural Sciences*, 41(2): 186-190.

Pandey A K, Prakash V, Mani V P and Singh R D 2000 a Effect of rate of nitrogen and time of application on yield and economics of baby corn (*Zea mays*). *Indian Journal of Agronomy,* 45(2): 338-343.

Pandey A K, Prakash V, Singh R D and Mani V P 2000 Effect of herbicides mixtures and cultural practices on maize and associated weeds under mid hills of N-W Himalayas. *Annals of Agricultural Research,* 21(1): 58-64.

Paroda and Sashi 1994 Thailand mei baby corn ki safalta ki kahani. Kheti. 48(1): 15-18.

Patel VJ, Upadhyay PN, Patel JB and Meisuriya M I 2006 Effect of herbicide mixtures on weeds in kharif maize (*Zea mays* L.) under middle Gujarat conditions. *Indian Journal of Weed Science,* 38(1&2): 54-57.

Singh L, Dubey G K, Singh H C and Singh P 2006 Biochemical evaluation of some genotype/ varieties of baby corn for table purposes. *Indian Journal of Agricultural Biochemistry,* 19(2): 143-145.

Spencer D and Possingham J V 1960 The effect of nutrient deficiencies on the hill reaction of isolated chloroplasts from tomato. Australian Journal of Biological Sciences. 13: 441-445.

Sunder singh, S.D. 2001. Effect of irrigation regimes and nitrogen levels on growth, yield and quality of baby corn. *Madras Agricultural Journal,* 88(7-9): 367-370.

Suryavanshi V P, Chavan B N, Jadhav V T and Baig M I A 2008 Response of maize to nitrogen and phosphorus application in vertisols. *International Journal of Tropical Agriculture,* 26 (3-4): 293-296.

(Received on 29.05.2013 and revised on 19.10.2014)