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Effect of plant population and sources of nitrogen on growth and yield of baby corn (*Zea mays* L.)

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ABSTRACT

A field experiment was conducted at Research Farm of School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema Campus during kharif season of 2014 to study the response of baby corn (Zea mays L.) to plant population and nitrogen application. The experiment was laid out in split plot design replicated thrice with twelve treatments. Three plant populations were kept in the main plots while the four nitrogen doses were allotted in the sub-plots. The results revealed that plant spacing of 30 cm x 25 cm significantly enhanced cob yield (5.08 t ha^{-1}) while the highest fodder yield (30.31 t ha^{-1}) was recorded with the spacing 20 cm x25 cm. In general, higher values of growth and yield attributes were recorded with space of 30 cm x 25 cm except those of plant height and CGR. Application of 75% N through urea+ 25% N through FYM resulted in maximum value of growth attributes like plant height (147.49 cm), leaf area index (2.24), crop growth rate (3.73 g day^{-1}), stem girth (1.79 cm), emergence of baby cob (51.35 days) and yield attributes likecorn length (8.66 cm), corn weight (6.22 g) and minimum values in control. Application of 75% N as fertilizer + 25 % N as FYM increased the corn (6.02 t ha^{-1}) and fodder yield (27.54 t ha^{-1}) by 3.81 and 10.28 t ha^{-1}over control (2.21 and 17.26 t ha^{-1}), respectively.

Keywords: Baby corn, spacing, plant population, nitrogen, FarmYard Manure

INTRODUCTION

Baby corn (Zea mays L.) is the cob of maize harvested at a very young stage, especially when the silks have just emerged, and no fertilization has taken place. The dehusked young ears of baby corn can be eaten as a vegetable, whose delicate sweet flavour and crispiness are much in demand. Importantly it is free from pesticides and its nutritional value is comparable to popular vegetables like cauliflower, cabbage, tomato, eggplant and cucumber. Its by-products such as tassel, young husk, silk and green stalks provide excellent cattle feed. Due to a short duration crop, the farmers can grow four crops in a year, and the production of baby corn generates employment amongst the rural poor. Attention is now being paid to explore its potential in India, for earning foreign exchange besides higher economic returns to the farmers. Plant population and nutrient management (particularly nitrogen) has greatly influenced the crop growth and yield. Maize has very high potential but due to lack of proper information on fertilizer management (Golada *et al.*2017), it gives poor yield.Maize has been recognized as a heavy feeder and uses more nitrogen than any other nutrient element. Nitrogen plays an important role in crop life and is one of the most important nutrients needed by plants in large quantities (Reddy *et al.* 2018). It is highly associated with the dark green colour of stem and leaves, vigorous growth, branching, more number of leaf production and size enlargement. Nevertheless, the imbalanced use of fertilizer without application of organic manures led to the deterioration of soil structure, environmental and groundwater pollution etc. Hence the use of organic sources of nutrients not only supply essential nutrients but also has some positive interaction with chemical fertilizers to increase their efficiency and thereby to improve the soil health in longer perspectives. A spatial arrangement of plant governs the shape and size of the leaf area plant^{-1}, which in turn influences efficient interception of radiant energy and proliferation and growth of shoots and their activity. Maximum yield can be expected only when plant population allows individual plant to achieve their maximum inherent potential. Thus, there is need to work out an optimum plant spacing by adjusting inter and intra row spacing in relation to other agronomic factors. Further, it is found that plant spacing significantly influenced the nutrient uptake of baby corn (Aravinth *et al.* 2011). Keeping in view these

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aspects, the present investigation was undertaken using maize as test crop.

MATERIALS AND METHODS

A field experiment was carried out at research farm, School of Agricultural Sciences and Rural Development, Nagaland University campus, Medziphema during *Kharif* season, 2014. The experimental site is located at an altitude of 310 meters above mean sea level with the geographical location at 25^0 45/ 43// North latitude and 95^0 53/ 4// East longitude. The soil of the experimental field was sandy loam in texture, well-drained, acidic in reaction (pH 4.6), low in organic carbon (3.3 g kg^{-1}), medium in available N (351 kg ha^{-1}) and available P (19 kg ha^{-1}) and high in available K (330 kg ha^{-1}).The experiment was laid out in split plot design replicated thrice with 12 treatments. Three plant populations *i.e.,* 20 cm x 25 cm (2,00,000 plants/ha), 30 cm x 25 cm (1,33,333 plants/ha) and 40 cm x25 cm (1,00,000 plants/ha) were kept in the main plots while the four nitrogen doses, N_1: control, N_2:recommended dose of nitrogen,N3:75% N through urea+ 25 % N through FYM and N_4 : 50% N through urea + 50 % N through FYM were allotted in the sub-plots. Sowing of baby corn hybrid variety HM-4 was done on June 17, 2014 by using seed rate of 25 kg ha^{-1}. A uniform dose of 40 kg P_2O_5 and 30 kg K_2O ha^{-1} was applied in all the plots. Fifty per cent of N and full quantity of P_2O_5 and K_2O were applied just before the sowing as basal application. The remaining nitrogen was top-dressed at 25 DAS. The growth parameters such as plant height, stem girth, LAI, CGR and RGR were recorded at harvest. The yield attributes *viz*. days to cob emergence, number of cobs $plant^{-1}$**,** corn weight, corn length and finally cob and fodder yield and harvest index were recorded during course of investigation. The data thus obtained were analysed statistically using analysis of variance technique for various parameters at 5% level of significance.

RESULTS AND DISCUSSION

Growth attributes

A critical analysis of the data (Table 1) revealed that the different plant population influenced the growth attributes of the crop. The maximum values of growth attributes (plant height, LAI and CGR) were recorded with S_1 (20cm x 25 cm) which were significantly superior over to rest of the treatments. The increase in these characters were attributed to availability of energy sources for prolonged time from integrated sources of nutrients.These findings are in agreement with those of Moosavi *et al.* (2012) who reported higher plant height and LAI in closer spacing due to interplant competition over light and proper exploitation of ground area, respectively. The maximum CGR (3.37g^{-1} day^{-1}) was recorded with spacing of 20cm x 25 cm which was statistically superior to other treatments. These results are in accordance with those of Biswas *et al.* (2002). Maximum stem girth was recorded with 40cm x 25 cm spacing and it was significantly superior over other treatments (Moosavi *et al.*2012). The increase in stem girth may be due to the intensified inter-plant competition for environmental parameters (light, water, space). However, the effect of plant population on RGR was non-significant.

Table 1: Effect of plant population and nitrogen doses on growth attributes (at harvest) of baby corn

Treatment	Plant height (cm)	Stem girth (cm)	LAI	CGR (g day^{-1})	RGR (gg^{-1} day^{-1})
Spacing					
S_1 (20 cm x 25 cm)	142.50	1.34	2.98	3.37	0.01
S_2 (30 cm x 25 cm)	136.02	1.56	2.03	2.46	0.02
S3 (40 cm x 25 cm)	126.67	1.70	1.47	2.22	0.02
S. Em.±	2.98	0.06	0.03	0.18	0.002
CD (P=0.05)	11.68	0.23	0.13	0.72	NS
Nitrogen doses					
N_1 (Control)	119.67	1.32	2.06	1.82	0.02
N_2 R D N @80 kg	130.62	1.45	2.15	2.23	0.02
N_3 75% N as urea + 25% as FYM	147.49	1.79	2.24	3.73	0.02
N_4 50% N as urea + 50% as FYM	142.47	1.57	2.19	2.94	0.01
S. Em.±	2.54	0.04	0.02	0.19	0.003
CD (P=0.05)	7.55	0.11	0.05	0.56	NS

From the perusal of the data (Table 1), it was apparent that all the doses of nitrogen had significantly beneficial influence on growth attributes and maximum values of growth attributes were recorded with the application of 75% N through fertilizer + 25% N through FYM. Application of 75% N through fertilizer + 25 % N through FYM and 50% N as fertilizer + 50 % as FYM were statistically at par in respect of plant height and LAI. Application of 75% N through fertilizer + 25% N through FYM was significantly superior to other treatments in respect of stem girth. This may be due integrate use of fertilizer which supplied nutrients to plant in optimum quantity at proper time. This result was in concordance with the findings of Ram *et al.* (2006) and Baht *et al.*(2013).

Yield attributes and yields

The plant population has failed to show any significant effect on days to cob emergence (Table 2). The maximum number of cobs (2.03) was recorded in medium plant population (30cm x25 cm) and it was statically at par with higher plant population (40cm x25 cm). Corn weight was recorded maximum (5.94 g) with plant spacing of 40 cm x 25 cm, which was significantly superior to rest of the treatments. Plant spacing did not show any significant effect on corn length while, maximum corn length (8.07 cm) was recorded with spacing of 40cm x 25cm. The cob yield was recorded highest (5.08 t ha^{-1}) with spacing of 30cm x25 cm and proved statistically at par with spacing of 20cm x25 cm and significantly superior over the higher plant spacing (40cm x 25 cm). Fodder yield was recorded maximum (30.3 t ha^{-1}) with spacing of 20cm x25 cm which was at par with 30cm x25 cm spacing. Higher plant count per unit area significantly contributed to the fodder yield as well as corn and cob yield due to increased plant density (Dar *et al.* 2014 and Golade *et al.* 2017). In respect to harvest index, the plant population failed to show any significant effect on it.

Table 2: Effect of plant population and nitrogen doses on yield attributes and yield of baby corn

Treatments	Days to emergence of cob	Cobs $plant^{-1}$	Corn weight (g)	Corn length (cm)	Cob yield (t ha^{-1})	Fodder yield (t ha^{-1})	Harvest Index (%)
Spacing							
S_1 (20 cm x 25 cm)	53.56	1.53	4.75	7.51	4.81	30.31	12.92
S_2 (30 cm x 25 cm)	53.15	2.03	4.78	7.73	5.08	29.00	14.09
S3 (40 cm x 25 cm)	52.27	1.78	5.94	8.07	3.80	16.40	18.08
S. Em.±	0.52	0.07	0.23	0.18	0.18	1.39	1.01
CD (P=0.05)	NS	0.27	0.90	NS	0.72	5.47	NS
Nitrogen doses							
N_1 (Control)	54.88	1.36	4.26	6.62	2.21	17.26	11.33
N_2 R D N @80 kg	53.56	1.67	4.92	7.56	4.57	23.54	16.33
N_3 75% N as urea + 25% as FYM	51.35	2.16	6.22	8.66	6.02	27.54	19.35
N_4 50% N as urea + 50% as FYM	52.27	1.96	5.71	8.23	5.46	24.51	18.00
S. Em.±	0.25	0.07	0.27	0.10	0.17	0.98	0.91
CD (P=0.05)	0.75	0.21	0.79	0.31	0.52	2.91	2.71

The minimum days to cob emergence was recorded with application of 75% N as urea + 25 % N as FYM. The maximum number of cobs and corn weight were recorded with 75% N as urea + 25 % N as FYM and it was at par with 50% N as urea + 50 % N as FYM. The corn length, cob and fodder yield were recorded highest with 75% N through urea +25 % N as FYM which was significantly superior to other nitrogen doses. The yield attributing parameters like cobs $plant^{-1}$, corn weight and corn length decreased with control. It showed that combined effect of inorganic nutrients (NPK) and FYM played an important role in plant nutrition due to their synergistic effect. Baby corn responded well to integrated nutrient management, especially to FYM which might be owing to favorable effect on soil condition and release of plant nutrients throughout the crop growth. Inorganic nutrients have positive influence on source-sink relationship as evident from remarkable improvement in plant height and dry matter accumulation and ultimately on yields. Lack of fertilizer resulted in less number of cobs,

and light cobs which had low cob and fodder yield (Table 2). These findings are in close accordance with the findings of Singh *et al.* (2013). Significant difference was recorded in harvest index due nitrogen application. Application of 75% N as urea + 25 % N through FYM recorded the highest harvest index (19.35%) which was found statistically at par with application of 50% N through urea + 50 % N through FYM. These findings are in close accordance with the findings of Mohsin*et al.* (2012).

On the basis of our findings, it can be concluded that the closer spacing of 30 cm x25 cm along with 75% N through urea + 25 % N as FYM was found to be the most suitable for obtaining higher yield of baby corn.

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