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Effect of different doses of N and farm yard manure on growth, yield and yield contributing characters of baby corn (*Zea mays* L.) under Uttarakhand condition

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Abstract
The field experiment conducted on Effect of different doses of N and farm yard manure on growth, yield and yield contributing characters of baby corn (*Zea mays* L.) under Uttarakhand condition at the Students' Research Farm Uttaranchal (PG) College of Bio-Medical Sciences & hospital, Dehradun during the *Kharif* season of 2016. The experiment was carried out in randomized complete block design (RCBD) having 7 treatments viz. T_1 (Control), T_2 (100 percent of recommended inorganic N), T_3 (5 tonnes of FYM ha^{-1} + 100 kg inorganic N ha^{-1}), T_4 (10 tonnes of FYM ha^{-1} + 75 kg inorganic N $ha^{-1)}$, T_5 (15 tonnes of FYM ha^{-1} + 50 kg inorganic N ha^{-1})T_6 (20 tonnes of FYM ha^{-1} + 25 kg inorganic N ha^{-1})and T_7 (25 tonnes of FYM ha^{-1}) with four replications. It revealed from present study that significantly higher time period for cob formation was taken by the control plot treatment T_1 and maximum numbers of cobs per plant, cob length, cob girth and cob weight were obtained with treatment T_3. Highest baby corn yield and fodder yield were obtained with treatment T_3, which was significantly better than all other treatments except, treatment T_2.

Keywords: Cob per plant, yield, inorganic, cob weight, cob girth and cob length etc.

Introduction
Baby corn is the ear of maize (*Zea mays* L.) plant harvested young, especially when the silk have either not been emerged or just emerged, and no fertilization has taken place, depending on the cultivar grown. It is generally harvested early, while the ears are very small and immature. Baby corn cultivation, being a recent development, has proved an enormously successful venture in countries like Thailand, China, Taiwan, Zambia, Zimbabwe etc. Baby corn is also gaining popularity in USA, Europe and Southeast Asia. Nutritive value of baby corn is very high as it contains 89.1 percent moisture, 0.20 g fat, 8.20 mg carbohydrates, 1.90 g protein, 28.0 mg calcium, 86.0 mg phosphorus, 0.10 mg iron, 0.05 mg thiamine, 0.08 mg riboflavin, 11.0 mg ascorbic acid, 0.03 mg niacin etc, per 100 g of edible portion (Das *et al.*, 2008). It is also rich in crude fibers and fibrous proteins which help to prevent intestinal cancer. Moreover, baby corn is considered cholesterol free, so is considered good for human heart. Thus, the demand for baby corn is rapidly increasing in urban areas of India too, because of its high nutritive value. Therefore, Effect of different doses of N and farm yard manure on growth, yield and yield contributing characters of baby corn (*Zea mays* L.) under Uttarakhand condition''

Materials and Methods
The field experiment conducted on Effect of different doses of N and farm yard manure on growth, yield and yield contributing characters of baby corn (*Zea mays* L.) under Uttarakhand condition at the Students' Research Farm Uttaranchal (PG) College of Bio-Medical Sciences & hospital, Dehradun during the *Kharif* season of 2016. The experiment was carried out in randomized complete block design (RCBD) having 7 treatments viz. T_1 (Control), T_2 (100 percent of recommended inorganic N), T_3 (5 tonnes of FYM ha^{-1} + 100 kg inorganic N ha^{-1}), T_4 (10 tonnes of FYM ha^{-1} + 75 kg inorganic N $ha^{-1)}$, T_5 (15 tonnes of FYM ha^{-1} + 50 kg inorganic N ha^{-1})T_6 (20 tonnes of FYM ha^{-1} + 25 kg inorganic N ha^{-1})and T_7 (25 tonnes of FYM ha^{-1})with four replications. 5 plants selected randomly from each plots. Data related to yield and yield attributes recorded viz. Number of days taken to corn formation, Number of cobs per plant, corn length, corn girth, Green cob weight, Baby cob weight, Baby corn yield and green fodder yield.

Recorded data was analyzed statistically as per randomized block design (Cochran and Cox, 1963), using OPSTAT software developed by the Department of Mathematics Statistics, CCS HAU, Hisar. The comparisons were made at five percent level of significance.

Result and Discussion:

The data related to number of days taken from sowing to cob formation depicted in table-1.

Table 1: Effect of integrated nutrient management on number of days taken to cob formation of baby corn (*Zea mays* L.)

Treatment	Number of days taken to cob formation
T_1 Control	61.5
T_2 100 percent of recommended N	57.0
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	56.5
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	58.7
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	59.6
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	59.8
T_7 25 tonnes of FYM ha^{-1}	60.7
C D (p = 0.05)	1.2

Table-1 reveals that significantly lesser number of days were taken by baby corn plants for cob formation in plots received treatment T_3 (5 tonnes of FYM + 100 kg inorganic N ha^{-1}) as compared to all other treatments except treatment T_2, where recommended dose of N was applied. Contrary to it, significantly higher time period for cob formation was taken by the control plot treatment T_1 over all other treatments except treatment T_7 which exhibited statistical parity with treatment T_1.

The table-2 reveals, maximum numbers of cobs per plant were obtained with treatment T_3, equally closely followed by treatment T_2 and T_4, which were at par with it statistically. However, control plot treatment T_1 was observed lower number of cobs per plant.

Table 2: Effect of integrated nutrient management on number of cobs per plant of baby corn (*Zea mays* L.)

Treatment	Number of cobs per plant
T_1 Control	1.43
T_2 100 percent of recommended N	3.00
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	3.00
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	3.00
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	2.80
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	2.37
T_7 25 tonnes of FYM ha^{-1}	1.89
C D (p = 0.05)	0.19

The Table 3, it is revealed that the treatment T_3 (5 tonnes of FYM + 100 kg N through inorganic source) was significantly superior to all the other treatments which was statistically at par with treatment T_2 where, recommended dose of nitrogen was applied.

Table 3: Effect of integrated nutrient management on length (cm) of baby corn (*Zea mays* L.)

Treatment	Baby corn length (cm)
T_1 Control	7.15
T_2 100 percent of recommended N	8.94
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	9.13
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	8.75
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	7.96
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	7.73
T_7 25 tonnes of FYM ha^{-1}	7.47
C D (p = 0.05)	0.21

On contrary to it, statistically lowest baby corn length was observed in control plot treatment T_1. The percent increase with treatment T_3, T_2, T_4, T_5, T_6 and T_7 over the control T_1 was found to be 128%, 125%, 122%, 111%, 108% and 104% respectively in baby corn length.

It revealed from table 4; treatment T_3 (5 tonnes of FYM + 100 kg N through inorganic source) produced significantly greater baby corn girth than all the other treatments except treatment T_2 (100% recommended dose of nitrogen) which was found to be at par with it.

However, statistically lower baby corn girth was recorded with the control plot treatment T_1. The percentage increase in baby corn girth with treatments T_3, T_2, T_4, T_5, T_6 and T_7 over the control plot treatment T_1 was 139%, 134%, 131%, 124%, 119% and 107% higher respectively(table5).

Table 5: Effect of integrated nutrient management on girth (cm) of baby corn (*Zea mays* L.)

Treatment	Baby corn girth (cm)
T_1 Control	3.79
T_2 100 percent of recommended N	5.11
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	5.27
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	5.01
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	4.73
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	4.53
T_7 25 tonnes of FYM ha^{-1}	4.06
C D (p = 0.05)	0.19

It revealed from table 6; all the treatments where N was applied whether through organic or inorganic sources have significantly affect the green cob weight of baby corn than control plot treatment. Maximum green cob weight was obtained with the application of treatment T_3. Treatment T_3 (5 tonnes of FYM+ 100 kg N through inorganic source) was significantly higher in green cob weight production of baby corn over all other treatments except, treatment T_2 which was at par with T_3. However, it was observed that green cob weight recorded under control plot treatment T_1 was significantly lower as compared to all other treatments followed by T_7. The increase in green cob weight with the application of treatments T_3, T_2, T_4, T_5, T_6 and T_7 was 166%, 156%,147%, 136%, 125%, 113% higher respectively as compared to the control plot treatment.

Table 6: Effect of integrated nutrient management on green cob weight (g) of baby corn (*Zea mays* L.)

Treatment	Green cob weight (g)
T_1 Control	32.7
T_2 100 percent of recommended N	51.2
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	54.3
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	48.1
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	44.4
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	40.9
T_7 25 tonnes of FYM ha^{-1}	37.1
C D (p = 0.05)	3.19

FYM: Farmyard manure

Table 7: Effect of integrated nutrient management on baby cob weight (gm) of baby corn (*Zea mays* L.)

Treatment	Baby cob weight (gm)
T_1 Control	6.70
T_2 100 percent of recommended N	10.4
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	10.6
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	10.1
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	8.75
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	8.24
T_7 25 tonnes of FYM ha^{-1}	7.80
C D (p = 0.05)	0.35

It revealed that table 7 statistical analysis it is concluded that treatments T_3 was found to be superior to all the other treatments and produced statistically similar baby cob weight which is statistically at par with T_2. Significantly lower baby cob weight than all the other treatments were recorded with treatment T_1. A percent increase of 158%, 156%, 143%, 130%, 123% and 116% was observed in baby cob weight with treatment T_3, T_2, T_4, T_5, T_6 and T_7 respectively over the control plot treatment T_1.

It revealed that table 8 all the treatments, where nitrogen was applied through organic or inorganic sources, have significantly affected the baby corn yield than control treatment. Further, highest baby corn yield was obtained with treatment T_3, which was significantly better than all other treatments except, treatment T_2, where recommended dose of nitrogen (i.e. 125 kg ha^{-1}) was applied, was statistically at par with the treatment T_3. Among rest of the treatments, T_1 treatment produced significantly lower baby corn yield followed by T_7. The increase in yield of baby corn with treatment T_3, T_2, T_4, T_5, T_6, T_7 over control plot treatment (T_1) was 211%, 202%, 200%, 178%, 160%, 135% higher, respectively.

The higher baby corn yield with integrated nutrient management practices may be due to the favourable soil physicochemical properties like soil structure, water-holding capacity and synchronized release of plant nutrients throughout the crop growth period, which increased the yield contributing characters like cob length, cob girth, baby corn weight etc. hence, ultimately increased the baby corn yield.

Table 8: Effect of integrated nutrient management on yield (q ha^{-1}) of baby corn(*Zea mays* L.)

Treatment	Baby corn yield (q ha^{-1})
T_1 Control	9.15
T_2 100 percent of recommended N	18.49
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	19.31
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	18.38
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	16.35
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	14.63
T_7 25 tonnes of FYM ha^{-1}	12.39
C D (p = 0.05)	0.85

Data presented in table 9, all the treatments where nitrogen was applied whether through organic or inorganic sources, have significantly affected the fodder yield than control treatment. Further, highest yield was obtained with treatment T_3 in which nitrogen was applied through 5 tonnes of FYM and remaining 100 kg through inorganic fertilizer to meet the nitrogen requirement of the crop which was found to be at par with the treatment T_2.

Table 9: Effect of integrated nutrient management on green fodder yield (q ha^{-1}) of baby corn (*Zea mays* L.)

Treatment	Green fodder yield (q ha^{-1})
T_1 Control	177.8
T_2 100 percent of recommended N	299.4
T_3 5 tonnes of FYM+100 kg inorganic N ha^{-1}	312.3
T_4 10 tonnes of FYM + 75 kg inorganic N ha^{-1}	289.1
T_5 15 tonnes of FYM + 50 kg inorganic N ha^{-1}	269.2
T_6 20 tonnes of FYM + 25 kg inorganic N ha^{-1}	242.3
T_7 25 tonnes of FYM ha^{-1}	210.4
C D (p = 0.05)	13.09

Among rest of the treatments, T_1 treatment produced significantly lower fodder yield than other treatment. The increase in fodder yield with treatment T_3, T_2, T_4, T_5, T_6, T_7 over control plot treatment (T_1) was 176%, 168%, 163%, 151%, 136%, 118% higher respectively.

Increased fodder yield with integrated nutrient management might be due to the better soil conditions created with the incorporation of farmyard manure which resulted in regular supply of plant nutrients to the plants and increased buffering capacity of soil and hence result in increased fodder yield.

Summary and Conclusion:

Therefore, it concluded that application of FYM and chemical fertilizers in a particular combination that initiates early cob formation, Number of cobs per plant and cobs per plant in treatments involving integrated nutrient management practice. It is revealed that application of FYM and chemical fertilizers in a particular combination that leads to an increase in baby corn length, baby corn girth, with treatments having integrated nutrient management strategy.

The higher baby corn yield with integrated nutrient management practices may be due to the favourable soil

physicochemical properties like soil structure, water-holding capacity and synchronized release of plant nutrients throughout the crop growth period, which increased the yield contributing characters like cob length, cob girth, baby corn weight etc. hence, ultimately increased the baby corn yield. Highest yield was obtained with treatment T_3 in which nitrogen was applied through 5 tonnes of FYM and remaining 100 kg through inorganic fertilizer to meet the nitrogen requirement of the crop which was found to be at par with the treatment T_2.

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