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Integrated nutrient management for increasing growth with sustainability of baby corn

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Abstract: Field experiment was conducted to study Integrated Nutrient Management for increasing Growth with Sustainability of Baby Corn on sandy loam soils, low in available N, high in available P and K for two consecutive kharif seasons of 2014 and 2015. The experiment was laid down in randomized block design having seven treatments i.e. T_1= Control, T_2= 100 per cent recommended dose of N, T_3 = 5 tons of FYM + 100 kg inorganic N ha^{-1}, T_4= 10 tonne of FYM + 75kg inorganic N ha^{-1}, T_5= 15tonne of FYM + 50 kg inorganic N ha^{-1}, T_6= 20tonne of FYM + 25 kg inorganic N ha^{-1}, T_7= 25 tonne of FYM ha^{-1} replicated four times. Significant increase in all growth parameters of baby corn was observed with Integrated Nutrient Management over control. Moreover, among nutrient management treatments, the integration of 5 tonne of FYM with 100 kg of inorganic N ha^{-1} came out to be the best for all growth characters *viz.* plant height, number of leaves per plant, leaf area index and dry matter accumulation.

Key words: Baby Corn; Integrated Nutrient Management; plant height; number of leaves per plant; leaf area index and dry matter accumulation.

Introduction

Baby corn is becoming popular in India because of the increasing demand, market price and higher production potential. Baby corn is the ear of Maize (*Zea mays* L.) plant harvested young, especially when the silk has either not been emerged and no fertilization has taken place, depending on the cultivar grown. The de-husked young ears of baby corn are eaten raw as well as cooked. In the areas adjoining cities or peri-urban areas, multiple crops of baby corn can be raised in a year, which would fetch greater income to the farmers. Moreover, after harvest, the still young plants may be used as fodder for cattle, since it supplies green, soft, succulent, nutritious and palatable fodder with higher digestibility for farm animals. Hence, it will help in fetching extra income to the farmers. Besides, helping in crop diversification and promotion of dairy industry, baby corn also helps in employment generation and value addition as it is used in manufacturing of a number of value added products and preparation of several recipes like soups, pickles, cutlets, deep fried baby corn with meat, rice and other vegetables.

Baby corn is a nutrient exhaustive crop, due to high planting density, the integrated nutrient management (INM) practice is important to retain productivity of the soil along with heavy returns. It has been found that no single source of nutrient is capable of supplying the necessary elements in adequate and balanced proportion and the use of inorganic fertilizers being a costly affair also leads to deterioration of soil health and quality of the produce. However, the use of organic sources alone, do not result in spectacular increase in crop yields, due to their low nutrient status and are also not easily available for a large scale use. Therefore, in the present work, a judicious combination of organic manures and chemical fertilizers may help to maintain soil and crop productivity. It also helps in restoring fertility of soil and improves nutrient use efficiency which is essential for improved and sustainable crop production. It holds great promise in meeting the growing nutrient demands of intensive agriculture and maintaining the crop productivity at a fairly high level.

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Materials and Methods

A field experiment in randomized block design, consisting of 7 treatments with four replications was conducted at the Student's Research Farm, Khalsa College, Amritsar during two consecutive kharif seasons of year 2014 and 2015. The treatments consisted of Control, 100 per cent of recommended N, 5 tonne of FYM ha^{-1} +100 kg inorganic N ha^{-1}, 10 tonne of FYM ha^{-1} +75 kg inorganic N ha^{-1}, 15 tonne of FYM ha^{-1} + 50 kg inorganic N ha^{-1}, 20 tonne of FYM ha^{-1} + 25kg inorganic N ha^{-1} and 25 tonne of FYM ha^{-1}. The soil of experimental field was sandy loam in texture, normal pH (8.2), medium in organic carbon (0.55%), available P_2O_5 (40.5kg/ha), K_2O and low in available N. The field was ploughed and given pre-sowing irritation. After the preparatory tillage, field was divided into 28 different plots of 4.2mx4.2m size. The pretreated seed of variety PMH-1 were sown by Kera method in between the rows by using corn seed at the rate of 16kg ha^{-1} with a spacing of 20x30cm on first fortnight of July for both years. Half dose of nitrogen was applied at the time of sowing to all the plots as per treatment. Remaining half dose of nitrogen was applied at 30 DAS. The field was kept free from weeds by manual hoeing. Plant protection measures and irrigations whenever required were provided in same manner for all the treatments. Regular biometric observations were recorded at periodic intervals of 15DAS, 30DAS, 45DAS and

60DAS by selecting randomly five plants from each plot. Crop was harvested at 2-3 days after silk emergence. The trend of observations was same for both the years; hence data was subjected to pooled analysis for interpreting the results.

Experimental observation Recorded

To assess the effect of various treatments, different plant characters were studied *viz,* Plant height, Number of leaves per plant, Leaf area index, dry matter accumulation and Number of days taken to baby corn formation.

Statistical Analysis

Recorded data was analyzed statistically as per randomized block design (Cochran and Cox., 1963) using CPCS-1 software developed by the department of Mathematics and Statistics, PAU, Ludhiana. The comparisons were made at five per cent level of significance.

Table1: Analysis of Variance

Source of Variation	Degree of freedom
Replication	3
Treatments	6
Error	18
Total	28

Results and Discussion

Effect on plant height

All the treatments significantly increased the plant height of baby corn over control at all observational periods. Tallest plants were observed, where T_3 treatment was applied and though it remained at par with T_2 treatment but improved plant height of baby corn significantly over all the other treatments. The observations taken at 15 DAS indicated that remarkable plant height was attained with the application of treatment T_3 over the treatments T_5, T_6, T_7 and T_1. However, T_3 was found to be statistically at par with the treatments T_2 and T_4. Furthermore, T_4 was recorded statistically superior over the treatments T_6, T_7 and T_1 remained at par with the treatment T_5. Treatment T_5 was found to be statistically superior over treatment T_1, it showed statistically parity with the treatments T_6 and T_7. It was analyzed that at 30 DAS treatment T_3 achieved significantly more plant height than all the other treatments applied to baby corn except T_2 which was found to be statistically at par with treatment T_3. Moreover, treatment T_4 observed a significant increase in plant height over other the treatments T_5, T_6, T_7 and T_1.

A similar trend of plant height as observed at 30 DAS, was followed at 45 DAS and 60 DAS among all the treatments applied to baby corn crop. In 2014 Shinde *et al.,* also found similar results with the application of 100% RDF + 10tonne of FYM over all other treatments and in a long term experiment which was conducted by Gupta *et al.*, (2014) at Samba in J & K on Maize and Gobhi Sarson cropping system, stated that application of 50% RDF+ 50% FYM resulted in significant increase in pant height, primary and secondary branches of gobhi sarson, Lone *et al.,* (2013) stated that a maximum plant height (201cm) was obtained from application of RDF+6 tonne ha^{-1} FYM over other treatment combinations these findings are in close conformity with the results obtained in present investigation (Table 2).

Table 2: Effect of Integrated Nutrient Management on Periodic Plant Height (cm) of Baby corn (pooled data).

Treatment	Periodic Plant Height(cm)			
	15DAS	30DAS	45DAS	60DAS
T_1:Control	26.4	46.9	78.8	132.4
T_2: 100% of recommended Nitrogen	37.8	65.5	120.3	184.1
T_3: 5tonne of FYM+100Kg inorganic N ha^{-1}	38.6	68.4	124.4	189.1
T_4: 10tonne of FYM+75Kg inorganic N ha^{-1}	36.3	64.7	113.7	178.0
T_5: 15tonne of FYM+50Kg inorganic N ha^{-1}	34.4	60.8	104.5	165.9
T_6: 20tonne of FYM+25Kg inorganic N ha^{-1}	32.3	56.9	96.2	154.7
T_7: 25tonne of FYM	31.9	53.0	88.1	143.2
CD(p=0.05)	2.8	3.7	7.2	8.4

Effect on number of leaves per plant

The photosynthetic activity of a plant which influence growth and yield of the crop is also determined by the number of leaves plant is having. The rate of increase in number of leaves was observed to be maximum up to 45 DAS and thereafter decreased as the crop attained maturity.

At 15 DAS of baby corn crop it was recorded that number of leaves produced by baby corn with application of treatment T_3 was statistically at par with the treatment T_2. However, treatment T_3 resulted in statistically significance over the treatments T_5, T_6, T_7 and T_1. It was observed that treatments T_2 at par with treatment T_4 but was found superior over other treatments. On the other hand, treatment T1 (control plot) produced significantly lower number of leaves than all other treatments but remained statistically at par with the treatment T_7. A similar pattern was observed in 30 DAS, 45 DAS and 60 DAS among all the treatments applied to baby corn. In 2012 Shilpashree *et al.,* have been also reported similar results of positive effects on significant plant height, number of leaves, leaf area index with the application of 100% recommended dose of fertilizers applied along with the 7.5 tonne FYM (Table 3).

Table 3: Effect of Integrated Nutrient Management on Periodic number of leaves per plant of Baby corn (pooled data).

Treatment	Number of Leaves Per Plant			
	15DAS	30DAS	45DAS	60DAS
T_1:Control	3.95	6.12	7.34	7.29
T_2: 100% of recommended Nitrogen	5.12	7.31	10.1	11.41
T_3: 5tonne of FYM+100Kg inorganic N ha^{-1}	5.25	7.52	10.1	11.14
T_4: 10tonne of FYM+75Kg inorganic N ha^{-1}	4.93	7.18	9.78	10.73
T_5: 15tonne of FYM+50Kg inorganic N ha^{-1}	4.69	6.80	8.80	9.85
T_6: 20tonne of FYM+25Kg inorganic N ha^{-1}	4.56	6.75	8.75	8.93
T_7: 25tonne of FYM	4.37	6.67	7.96	8.06
CD(p=0.05)	0.23	0.36	0.55	0.85

Effect on Leaf area index

Like total number of leaves, leaf area index also has direct effect on growth and yield parameters of plant. It expresses the capacity of plants to trap solar energy for photosynthesis. It was observed that the rate of increase in leaf area index was very slow in the initial stages of growth and thereafter increased up to crop harvest. However, it was observed that application of treatment T_3 resulted in significantly higher leaf area index over all other treatments applied to the baby corn except the treatment T_2. Moreover, treatment T_2 resulted in significantly higher leaf area index over the treatment T_6, T_7 and T_1 but exhibited statistically parity with treatments T_4 and T_5. Treatment T_5 was found to be significantly better in producing leaf area index over the treatments T_6, T_7 and T_1. Same trend was observed at all the observational stages of the plant *viz.* 15 DAS, 30DAS, 45DAS and 60 DAS. In an experiment conducted at Hamirpur, Verma (2013) stated that application of farmyard manure 75tons ha^{-1} produced significantly plant height and leaf area index as compared to application of 100 kg ha^{-1} nitrogen through inorganic sources (Table 4).

Table 4: Effect of Integrated Nutrient Management on Periodic leaf area index of Baby corn (pooled data).

Treatment	Leaf Area Index			
	15DAS	30DAS	45DAS	60DAS
T_1:Control	0.16	0.32	3.25	4.13
T_2: 100% of recommended Nitrogen	0.31	1.38	6.00	6.55
T_3: 5tonne of FYM+100Kg inorganic N ha^{-1}	0.35	1.55	6.45	6.98
T_4: 10tonne of FYM+75Kg inorganic N ha^{-1}	0.28	1.27	5.70	6.21
T_5: 15tonne of FYM+50Kg inorganic N ha^{-1}	0.27	1.00	5.03	5.73
T_6: 20tonne of FYM+25Kg inorganic N ha^{-1}	0.22	0.79	4.49	5.25
T_7: 25tonne of FYM	0.21	0.56	3.95	4.75
CD(p=0.05)	0.04	0.20	0.48	0.460

Effect on dry matter accumulation

The most important index of plant vigor and yield is the accumulation of the photosynthates during the stipulated growth period. It is calculated for dry matter accumulation which is resulted from the high metabolic activities of the crop plants and indicating solar energy harvesting efficiency of plants under different treatments. Among all the treatments applied to baby corn, application of treatment T_3 resulted in significantly more dry matter accumulation than all other treatments except treatment T_2, which was at par with the treatment T_3 and it resulted in significantly higher dry matter accumulation in baby corn over all other treatments. In the same fashion treatment T_4 was better over all other treatments but was found to be at par with treatment T_5. Treatment T_7 was significantly better than the treatment T_1 in dry matter production. Almost similar pattern was followed at all the observational stages of growth of plant in dry matter accumulation.

This might be due to the improvement in soil physico-chemical properties (*viz.* pH, Bulk density and infiltration rate) and optimum availability of major nutrient and organic carbon which acted as the growth enhancing factor for maize crop. It synchronized release of plant nutrients throughout the crop growth period leading to improved soil fertility and nutrient use efficiency that resulted in increased plant height, number of leaves, leaf area index and dry matter accumulation. Rakib *et al.,* 2011 conducted experiment in West Bengal noticed that the significantly higher leaf area and dry matter accumulation were recorded in the treatment where 75% of recommended dose of NPK + 25% N through FYM was applied and found at par with 100% recommended dose of fertilizers (Table 5).

Conclusion

From the two consecutive year experimentation it can be concluded that, application of 5 tonne of FYM ha^{-1} +100kg inorganic N ha^{-1} is the best combination of organic and inorganic fertilizers for increasing growth with sustainability. This treatment is also responsible for improving physico chemical properties and nutrient status of soil.

Table 5: Effect of Integrated Nutrient Management on dry matter accumulation (q ha^{-1}) of Baby corn (pooled data).

Treatment	Leaf Area Index			
	15DAS	30DAS	45DAS	60DAS
T_1:Control	0.64	1.89	20.55	53.5
T_2: 100% of recommended Nitrogen	1.27	9.40	70.59	112.9
T_3: 5tonne of FYM+100Kg inorganic N ha^{-1}	1.35	10.1	71.96	121.5
T_4: 10tonne of FYM+75Kg inorganic N ha^{-1}	1.18	8.50	65.23	107.7
T_5: 15tonne of FYM+50Kg inorganic N ha^{-1}	1.09	6.49	48.23	95.6
T_6: 20tonne of FYM+25Kg inorganic N ha^{-1}	0.97	4.78	39.75	83.7
T_7: 25tonne of FYM	0.87	3.16	31.07	71.4
CD(p=0.05)	0.12	1.20	31.07	10.2

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