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Effect of Integrated Nutrient Management on Growth and Yield of Baby Corn (*Zea mays* L.)

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A B S T R A C T

An experiment was conducted during *Kharif* 2008 and 2009, at farmer's field of Shettahalli Village, Mandya District, Karnataka, India, to know the effect of Integrated nutrient management of organic manures and fertilizers on growth and yield of baby corn. Results revealed that, application of recommended dose of fertilizer (150:75:40 kg $N:P_2O_5:K_2O$ ha^{-1}) + 10 t FYM recorded significantly higher baby corn yield (17.67q ha^{-1}) and green fodder yield (36.53 t ha^{-1}) compared to other treatments. Whereas, significantly lower baby corn yield (10.33 q ha^{-1}) and green fodder yield (25.69 t ha^{-1}) were recorded in the treatment with the application of only recommended dose of only fertilizer (150:75:40 kg $N:P_2O_5:K_2O$ ha^{-1}).

Introduction

Baby corn is a vegetable crop that can potentially improve the economic status of farmers (Das *et al.*, 2008). In addition to its sweet, succulent, and delicious taste, baby corn's nutritional value is comparable to other vegetables such as cauliflower, cabbage and tomato. Globally, baby corn has attracted an increasing number of peoples' preference due to the enhancement of living standards and shift in dietary habit from non-vegetarian to vegetarian. Baby corn is used in preparing a wide variety of traditional and intercontinental dishes, besides being canned. Baby corn is consumed locally as fresh vegetable, fried or cooked with meat. When baby corn is harvested good quality green fodder is also obtained. The succulent green fodder of high quality adds enormously to the total returns to the farmers, resulting in higher profit per unit area per unit time compared to grain maize. Although, baby corn has been developed as an export vegetable that can generate foreign exchange, it is serving the local people with nutritious vegetable. Despite its great nutritional importance and economic security to the farmers only limited scientific research has been reported on baby corn, resulting in insufficient knowledge and lack of standard technologies that hamper the popularization of baby corn production (Muthukumar *et al.*, 2007; Thavaprakaash and Velayudham, 2008). Baby corn, being a very

recent domestication, cultivation practices need to be standardized before it finds a prominent place in most of the intensive cropping systems due to its short duration nature. In order to popularize its cultivation among the farming community, it is essential to standardize its agro techniques not only for its potential yield but also for its quality babies and fodder. Hence, with this background a study on Integrated nutrient management was taken to meet the yield potentiality of the crop.

Materials and Methods

An experiment was conducted during *Kharif* 2008 and 2009, at farmer's field of Shettahalli Village, Maddur Taluk, Mandya District, Karnataka, India situated in $12^0$18' to $13^0$04' N latitude and $76^0$79' to $77^0$20'E longitude with an altitude of 695 meters above the MSL located in the Agro Climatic Zone - 6 (Southern Dry Zone). The soil of experimental site was sandy clay loam in texture. The soil pH was 6.8 with an electrical conductivity of 0.14 dSm^{-1}. The soil was low in available nitrogen (210.8 kg ha^{-1}), medium in available phosphorus (24.6 kg ha^{-1}) and potassium (168.0 kg ha^{-1}). The organic carbon content was low (0.46 **%).** Nutrients composition of organic manures used in the experiment were N: 0.56 %, P: 0.21 % and K: 0.45 % (Farm yard manure), N: 1.80 %, P: 1.10 % and K: 1.58 % (vermicompost) and N: 3.21 %, P: 2.16 % and K: 1.72 % (poultry manure). Methods followed for nitrogen, phosphorus and potassium analysis were Micro Kjeldahl method (Piper, 1966), Vanadomolybdic yellow colour method (Jackson, 1973) and Flame photometer method (Jackson, 1973), respectively. The experiment was laid out in a randomized block design with eight treatments, *viz.* T_1: Recommended dose of fertilizer (150:75:40 kg $N:P_2O_5:K_2O$ ha^{-1}), T_2: 50 % N through FYM + balance N, P and K through fertilizer, T_3: 50 % N through vermicompost + balance N, P and K through fertilizer, T_4: 50 % N through poultry manure + balance N, P and K through fertilizer, T_5 : 100% N through FYM + balance P and K through fertilizer, T_6: 100% N through vermicompost + balance P and K through fertilizer, T_7: 100% N through poultry manure + balance P and K through fertilizer, T_8: RDF (150:75:40 kg N: P_2O_5: K_2O ha^{-1}) + 10 t FYM ha^{-1} and replicated thrice. The nitrogen contents in organic manures viz., FYM, vermicompost and poultry manure were determined and the amount of these materials required for substituting recommended dose of nitrogen as per the treatment was calculated and applied 15 days prior to sowing and were thoroughly mixed in the soil. Fertilizer N was applied as per the treatments in two equal splits *viz*., first half at the time of sowing as basal dose and remaining half was applied as top dressed at 20 days after sowing.. Entire quantity of phosphorus and potassium were applied as basal dose. Baby corn (variety PAC 792) seeds were sown with recommended spacing (45 x 20 cm). Five plants were randomly selected in each plot of each replication, These plants were tagged for the purpose of recording observations on growth parameters *viz.*, plant height, leaf area, total dry matter production and yield parameters *viz.*, length of baby corn (cm), girth of baby corn (cm), number of babies per plant, weight of baby corn (g), baby corn yield, fodder yield. Tassels were removed as and when they emerged. This was done to avoid pollination. If the silk gets pollinated, the kernels would start developing within hours and the cob would become hard and fetches less market value. Harvesting was done at three days after silk emergence. Similarly, baby corn and fodder yield from each net plot in each replication was recorded and extrapolated to hectare basis. The analysis and interpretation of the data was done using the Fisher's method of analysis and variance techniques as

given by Panse and Sukatme (1967). The level of significance used in 'F' and 't' test was P=0.05 probability level and wherever 'F' test was found significant, the 't' test was performed to estimate critical differences among various treatments.

Results and Discussion

Effect of integrated source of nutrients on growth parameters of baby corn

The pooled data on plant height, leaf area per plant and total dry matter production per plant are presented in Table 1. Application of recommended dose of fertilizer (150:75:40 kg NPK ha^{-1}) + FYM (10 t ha^{-1}) recorded significantly tallest plant (184.16 cm) with largest leaf area (4492 cm^2/plant) and highest total dry matter production (138.18 g $plant^{-1}$) compared to other treatments. This might be due to higher nutrient concentration. This is because under the influence of favourable nutrition, growth of crop would be triggered to produce elevated stature of growth components. The organic manure like FYM has predominant role in the improvement of soil fertility, physical-chemical properties and biological activity, besides its nutrient combinations. All the factors might have improved the crop growth. The leaf area is known to be dependent on nutrition and thus attributed to increase cell division and cell elongation of leaves (Watson, 1952).Increase in leaf dry matter was mainly due to increase in number of leaves produced per plant and better uptake of nutrients.

Among the graded levels organic manures, application of 50 per cent N equivalent vermicompost in combination with balance application of NPK through inorganic fertilizer recorded superior growth parameters of baby corn such as plant height, leaf area plant $^{-1}$ and total dry matter production which is on par with application of 50 per cent N equivalent through poultry manure in combination with balanced application of NPK through inorganic fertilizer as compared to 100 per cent N equivalent through organic manures like FYM, vermi compost and poultry manure in combination with balance P and K through inorganic fertilizers. The results are in conformity with the findings of Subbaiah and Kumaraswamy (1996). Combined application of manures and fertilizers ensure the release of readily available nutrients in adequate quantity to promote early growth as compared to sole organic manuring treatments, in which nutrients are available slowly over a long period of time.

Effect of integrated source of nutrients on yield parameters of baby corn

The pooled data on yield and yield parameters are presented in Tables 2 and 2a. Results revealed that, significantly higher baby corn yield (17.69 q ha^{-1}) and green fodder yield (36.53 t ha^{-1}) were recorded in the treatment with application of recommended dose of fertilizer (150:75:40 kg NPK ha^{-1}) + FYM (10 t ha^{-1}) compared to other treatments. The extent of increase in baby corn yield was 7.94 per cent over the treatment which received recommended dose of fertilizer (150:75:40 kg NPK ha^{-1}). The increase in yield might be due to increase in yield parameters of baby corn such as length of baby corn, girth of baby corn, weight of baby corn and number of babies per plant. The increase in green fodder yield of baby corn recorded in this treatment was attributed to increase in plant height, number of leaves, leaf area, leaf area index and total dry matter production. The leaf area was correlated to increased fodder yield, since leaf area is an indicative of the assimilatory surface area providing the synthesis and accumulation of more photosynthates and dry matter production. These results are in conformity with the findings of Negalur

(2000) and Naganagouda (2001). Number of babies plant^{-1} (2.23), weight of baby corn (18.17 g), and length of baby corn (10.76 cm) were highest with the application of recommended dose of fertilizer (150:75:40 kg NPK ha^{-1}) + FYM (10 t ha^{-1}) compared to other treatments. This might be due to higher dry matter accumulation and effective partitioning of the assimilates to sink, as a result of availability of nutrients coinciding with physiological needs of the crop. The results are conformity with the findings of Natarajan (1990) and Shashidhara *et al.*, (1998).

Among the graded levels organic manures, significantly higher yield and yield parameters of baby corn such as length of baby corn, weight of baby corn and number of babies plant^{-1} were recorded due to application of 50 per cent N equivalent through vermicompost in combination with balance NPK through inorganic fertilizers and which was on par with application of 50 per cent N equivalent through poultry manure in combination with balance application of NPK through inorganic fertilizer as compared to 100 per cent N equivalent through organic manures like FYM, vermicompost and poultry manure in combination with balance P and K through commercial inorganic fertilizers. This indicated that baby corn responded well to combined application of organics and inorganic manures, especially to vermicompost which might be owing to favourable effect on soil condition and synchronized release of plant nutrients throughout the crop growth period and inorganic nutrients have positive influence on source-sink relationship as evident from remarkable improvement in plant height and dry matter accumulation and ultimately yields were increased. The results are in conformity with the findings of Dadarwal *et al.*, (2009).

Table.1 Growth parameters of baby corn as influenced by organic manures and fertilizers

Treatments	Plant height (cm)			Leaf area (cm^2 plant^{-1})			Total dry matter production (g plant^{-1})		
	2008	2009	Pooled	2008	2009	Pooled	2008	2009	Pooled
T_1	176.5	180.9	178.7	4045	4226	4135	122.0	135.3	127.0
T_2	160.5	165.7	163.1	3418	3513	3466	94.8	110.0	99.2
T_3	168.5	174.4	171.4	3788	3936	3862	110.7	121.7	115.8
T_4	165.1	169.2	167.1	3685	3783	3734	104.7	113.9	108.6
T_5	150.2	154.7	152.4	3103	3277	3190	69.42	91.22	73.48
T_6	156.2	157.3	156.7	3363	3496	3430	86.62	102.8	91.09
T_7	153.4	160.3	156.8	3262	3312	3287	76.65	94.17	80.63
T_8	182.7	185.5	184.1	4401	4583	4492	132.6	147.2	138.1
S.Em ±	**5.91**	**5.02**	**4.17**	**132**	**147**	**109**	**5.32**	**5.28**	**3.48**
C.D at 5 %	**17.9**	**15.2**	**12.6**	**400**	**447**	**331**	**16.15**	**16.0**	**10.5**

T_1: RDF (150:75:40 kg N: P_2O_5: K_2O ha^{-1}) DAS: Days after sowing
T_2: 50% N through FYM + balance N, P and K through fertilizer. RDF: Recommended dose of fertilizer
T_3: 50% N through Vermicompost + balance N, P and K through fertilizer.
T_4: 50% N through poultry manure + balance N, P and K through fertilizer.
T_5: 100% N through FYM + balance P and K through fertilizer.
T_6: 100% N through Vermicompost + balance P and K through fertilizer.
T_7: 100% N through poultry manure + balance P and K through fertilizer
T_8: RDF (150:75:40 kg N: P_2O_5: K_2O ha^{-1}) +10 t FYM ha^{-1}

Table.2 Yield parameters of baby corn as influenced by organic manures and fertilizers

Treatments	Length of baby corn (cm)			Girth of baby corn (cm)			Number of babies plant^{-1}		
	2008	2009	Pooled	2008	2009	Pooled	2008	2009	Pooled
T_1	9.80	10.26	10.03	4.67	4.86	4.76	2.02	2.16	2.09
T_2	8.04	8.25	8.15	3.90	4.10	4.00	1.63	1.85	1.74
T_3	9.03	9.75	9.39	4.47	4.52	4.50	1.88	1.96	1.92
T_4	8.57	8.63	8.60	4.20	4.31	4.26	1.73	1.88	1.81
T_5	5.90	6.82	6.36	3.57	3.28	3.42	1.45	1.40	1.43
T_6	7.47	7.87	7.67	3.73	3.97	3.85	1.57	1.76	1.66
T_7	6.69	7.60	7.15	3.64	3.55	3.60	1.50	1.68	1.59
T_8	10.63	10.89	10.76	4.90	4.95	4.93	2.10	2.36	2.23
S.Em ±	**0.69**	**0.69**	**0.51**	**0.27**	**0.30**	**0.19**	**0.07**	**0.16**	**0.10**
C.D at 5 %	**2.11**	**2.10**	**1.54**	**0.81**	**0.91**	**0.57**	**0.20**	**0.50**	**0.31**

T_1: RDF (150:75:40 kg N: P_2O_5: K_2O ha^{-1}) DAS: Days after sowing
T_2: 50% N through FYM + balance N, P and K through fertilizer. RDF: Recommended dose of fertilizer
T_3: 50% N through Vermicompost + balance N, P and K through fertilizer.
T_4: 50% N through poultry manure + balance N, P and K through fertilizer.
T_5: 100% N through FYM + balance P and K through fertilizer.
T_6: 100% N through Vermicompost + balance P and K through fertilizer.
T_7: 100% N through poultry manure + balance P and K through fertilizer
T_8: RDF (150:75:40 kg N: P_2O_5: K_2O ha^{-1}) +10 t FYM ha^{-1}

Table.2a Yield and yield parameters of baby corn as influenced by organic manures and fertilizers

Treatments	Weight of baby corn (g)			Baby corn yield (q ha^{-1})			Fodder yield (t ha^{-1})		
	2008	2009	Pooled	2008	2009	Pooled	2008	2009	Pooled
T_1	17.64	17.86	17.75	15.40	17.33	16.37	33.25	35.34	34.29
T_2	16.28	16.45	16.36	12.50	13.67	13.08	27.93	29.75	28.84
T_3	17.26	18.12	17.69	14.88	15.78	15.33	31.09	33.23	32.16
T_4	16.78	17.05	16.92	13.13	14.00	13.57	28.23	30.23	29.23
T_5	14.73	15.35	15.04	9.83	10.82	10.33	24.57	26.82	25.69
T_6	15.78	16.15	15.97	11.50	13.12	12.31	26.92	28.87	27.89
T_7	15.24	15.87	15.56	10.57	11.56	11.06	26.34	27.32	26.83
T_8	17.97	18.37	18.17	16.59	18.76	17.67	34.81	38.24	36.53
S.Em ±	**0.67**	**0.50**	**0.46**	**0.62**	**1.33**	**0.72**	**1.63**	**1.74**	**1.10**
C.D at 5 %	**2.04**	**1.51**	**1.39**	**1.88**	**4.02**	**2.20**	**4.93**	**5.28**	**3.33**

T_1: RDF (150:75:40 kg N: P_2O_5: K_2O ha^{-1}) DAS: Days after sowing
T_2: 50% N through FYM + balance N, P and K through fertilizer. RDF: Recommended dose of fertilizer
T_3: 50% N through Vermicompost + balance N, P and K through fertilizer.
T_4: 50% N through poultry manure + balance N, P and K through fertilizer.
T_5: 100% N through FYM + balance P and K through fertilizer.
T_6: 100% N through Vermicompost + balance P and K through fertilizer.
T_7: 100% N through poultry manure + balance P and K through fertilizer
T_8: RDF (150:75:40 kg N: P_2O_5: K_2O ha^{-1}) +10 t FYM ha^{-1}

These results concluded that application of RDF + 10 t FYM recorded significantly higher baby corn yield (17.67q ha^{-1}) and green fodder yield (36.53 t ha^{-1}). Whereas, significantly lower baby corn yield (10.33 q ha^{-1}) and green fodder yield (25.69 t ha^{-1}) were recorded in the treatment with the application of only RDF (150:75:40 kg $N:P_2O_5:K_2O$ ha^{-1}). Similarly, application of 50 per cent N equivalent organic manures viz. vermicompost, poultry manure and FYM in combination with balance application of NPK through inorganic fertilizer recorded highest yield of baby corn and green fodder yield as compared to 100 per cent N equivalent through organic manures in combination with balance P and K through inorganic fertilizers.

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