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Effect of Organic Manures on Growth, Yield Attributes and Yield of Babycorn (*Zea mays* L.)

Snehaa A.[1], C. Ravikumar[2]*, M. Ganapathy[3], S. Manimaran[2], G. B. Sudhagar Rao[2], A. Karthikeyan[2]

[1]Scholar, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608002; [2]Assistant Professor, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608002; [3]Professor, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608002.

ABSTRACT

Aim: The present investigation was carried out to evaluate the suitable organic manure to sustain the soil fertility, yield of baby corn and also opt a best alternate crop for rice fallow pulses presumably in missing season..

Materials and Methods: Field experiments were conducted in the Experimental Farm of the Department of Agronomy, Annamalai University, Annamalai Nagar during summer and kharif season of 2017 in Randomized block design to study the response of baby corn (Zea mays L.) to different organic manures for their growth, yield attributes and cob and green fodder yield..

Result: Among the different treatments, RDF (150:60:40 kg NPK ha-1) had a positive effect on the growth, yield attributes, cob and green fodder yield in baby corn for I and II crops which was at par with the application of vermicompost @ 5 t ha-1. The lowest values of growth, yield attributes and yield were recorded by Farm compost @ 5 t ha-1.

Conclusion: Application of fertilizer may be good in the short term for getting maximum yield and net income to the farmers; but, in the long run, to increase the corn quality and sustain the soil fertility, T3 vermicompost @ 5 t ha-1 treatment is the best and thus this practice can be recommended to the maize growing farmers in Tamil Nadu.

Key Words: Organic manure, Growth, Yield, Baby corn, Vermicompost, FYM

INTRODUCTION

Maize is the third most important cereal crop in India as well as in the world. A recent trend is of growing maize for vegetable purpose, which is commonly known as 'baby corn'. It is a small young cob or ear or the female inflorescence before pollination or fertilization. The important attributes relevant to baby corn are early maturity, synchronized ear emergence and small palatable yellow kernels (Kumar and Kalloo, 1998). The early harvest and sale of baby corn ears before dry spells provides higher profits and untranslocated photosynthates left in green stover becomes valuable source for nutritious green fodder to live stock giving impetus to diary, meat production. Thus baby corn is safe for consumption in fresh state. Its economic potential is further enhanced owing to the availability of green, soft, succulent nutritious, palatable fodder with higher digestibility (Ramachandrappa et al., 2004). Baby corn provides the valuable nutrition which lack in most people's diet. It is extremely high in potassium, B vitamins, thiamine, riboflavin, niacin, folates that helps in brain function and improves memory and low in fat that helps in weight loss goals. The yellow corn contains more carotenoid content, but baby corn is plucked white which contains lesser content of carotenoid. The lesser quantity of carotenoid reduces the risk of heart diseases and cancer. Also it has better glycemic index than the regular corn making it a good substitute.

Baby corn has a short growing period (60-75 days), so that a farmer can grow four or more crops per year depending upon the agro-climatic conditions. Corn has always had high nutrient demands and already puts a great strain on soil and fertilizer nutrient sources. Large quantities of N, P, K, Ca, Mg, and S are removed with the grain and stover from the

Corresponding Author:
C. Ravikumar, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608002.
Email: ravikumarchinnathambi@gmail.com

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soil. Trace elements are also removed and must be replaced. Use of inorganic fertilizers for increasing cereal production is inevitable in the present circumstances where cereal crop needs and livelihood issues of the people have sustained national priority. But this has declined the soil fertility in the long term. The only way out to this gloomy scenario is to develop sustainable and nutrient balance through organic farming, which would increase the cereal crop production substantially without harming the precious environment. Organic manures and bio-fertilizers serve as an alternate to chemical inputs and are being increasingly used in vegetable production today. Organic manure serves as an alternate practice to mineral fertilizers for improving soil structure (Dauda et al., 2008) and microbial biomass (Suresh et al., 2004). In addition to that, the cultivation of baby corn can lead to at least double return to the farmer unlike normal grain maize (Dass et al., 2004).

One hundred grams of baby corn are found to be rich in 89.1% Moisture, 1.9 g Protein, 0.2 g Fat, 0.06 g Ash, 8.2 mg Carbohydrate, 28 mg Calcium, 86 mg Phosphorus and 11mg Ascorbic Acid (Thavaprakash et al., 2005). Keeping this in view, the present investigation was under taken to identify and quantify the suitable organic source for the cultivation of organic babycorn which can minimize the consumption of time, labour, energy and concomitantly increased the growth and yield of baby corn.

MATERIALS AND METHODS

Field experiments were conducted during summer and kharif seasons of 2017 in the experimental farm, Annamalai Univeristy, Tamilnadu, ($11^0$24 North latitude. $78^0$41 East longitude and +5.79 MSL) in order to study the effect of different organic manures on growth and yield of organic baby corn in north Cauvery deltaic regions where the baby corn can be act as a best alternate crop for rice fallow pulses presumably in missing season. The climate at the experimental farm is moderately warm with hot summer months. The maximum temperature ranged from 30.1°C to 39.2°C with a mean of 34.47°C and the minimum temperature ranged from 18.9°C to 28.6°C with a mean of 24.1°C. The relative humidity ranged from 79 to 88 per cent with a mean of 84.8 per cent. The mean hours of bright sunshine were 7.9 hrs for the study period. The textural class of experimental soil was clay loam with 43.1% of clay, 14.2% silt and 41.8% of sand in the surface (0-15cm) soil. The surface soil posses pH 7.8, Electrical conductivity 0.72, organic carbon of 0.52 and the available N, P and K Viz., 162.4, 24, 285 kg/ha respectively. The experiments were laid in RBD, comprising 8 treatments with three replications. T_1 - RDF (150:60:40 NPK kg ha^{-1}), T_2 - Farm yard manure @ 12.5 t ha^{-1}, T_3 - Vermicompost @ 5 t ha^{-1}, T_4 - Fish Amino Acid @ 10 *l* ha^{-1}, T_5 - Farm Compost @ 12.5 t ha^{-1}, T_6 - Neem Cake @ 1 t ha^{-1}, T_7 - Mahua Cake @ 1 t ha^{-}, T_8 - EM Inoculated Farm Yard Manure @ 12.5 t ha^{-1}.

2.1. Fish amino acid

Materials required:

1. Fish trash (head, bone, intestine, etc)
2. Jaggery
3. Clay pot/plastic jar or glass jar
4. Net rubber band/thread

Preparation:

Remove the fish intestines and chop into fine pieces (10kg of fish waste with 2kg of jaggery) powder the jaggery and add it. Add these 2 to broad mouthed glass jar or plastic jar that is just the right size (not too big) (ratio up to 2/3 of its volume). Cover the jar with the lid or net, tighten it and mix it well by shaking the jar. Within 30 days it will be fermented, filter it using nylon mesh to get 300-500ml solution changed into honey like syrup.

2.3. Enriched Microorganism inoculated farm yard manure:

Materials required:

1. 1litre of EM solution
2. 1kg of jaggery
3. 180kg of Farm yard manure
4. 10 litres of water.

Procedure

Farm yard manure (180kg) is heaped in 4×2×1 dimension.1 litre of EM solution diluted in 10 litres of water and 1 kg of jaggery is added to the solution. 1:10 ratio of EM :water and jaggery mixed solution is sprinkled on the heaped farm yard manure and mixed well thoroughly. This farm yard manure inoculated with EM solution is covered with gunny bags and left up to 7-10 days. EM solution helps for easy decomposition of farm yard manure.

Crop management

The experimental field was ploughed to a depth of 15 to 20 cm two weeks before sowing by tractor and levelled. The soil in the field was brought in to a fine filth. Laying of plots and allocation of treatments were carried out according to the treatment schedule which were randomized. Channels were laid to facilitate irrigation of plots individually. The fertilizer recommendation for baby corn is 150:60:40 kg of N, P_2O_5 and K_2O ha^{-1} respectively. Nitrogen was applied as urea (46 per cent N), phosphorous as single super phosphate (16 per cent P_2O_5) and potassium as muriate of potash (60 per cent K_2O) half dose of N and half dose of K_2O were applied on 20 DAS only on the controlled plot. Baby corn seeds were treated with *Azospirillum* (600 g ha^{-1}) and phosphobacteria (600 g ha^{-1}) for 24 hours before sowing as per treatment schedule. Seeds were dibbled with a spacing of 60 cm between the

rows and 20 cm within the plants. Two seeds were dibbled at a depth of 1-2 cm and then covered with the soil.

Plant protection measures against pest and diseases were taken up as and when required. The tassels were removed immediately after their emergence and before the tassels turned to pink colour to avoid fertilization of the cob. If the silk gets pollinated, the kernel starts developing within hours and the cob would become hard and unfit for consumption of baby corn as vegetable. Hence, detaselling was done as and when emergence of tassel. Topping refers to nipping or the removal of terminal portion from the uppermost node to induce better cob development and to avoid fertilization of the cob. Topping beyond 9th, 10th, and 11th internodes was done at 47, 50, and 53 DAS respectively. From each net plot area, young ears together with the sheath were harvested immediately after emergence (1 - 3cm) of silk. Five to six harvests with in an interval of two days were carried out. The ears from net plot area of each plot were harvested separately, weighed and expressed as green cob yield in kg ha^{-1}. Green fodder was harvested at the time of every topping treatment imposed and after the last harvest of ears, weighed and expressed in t ha^{-1}. Five plants from each plot were chosen by simple random sampling method and were tagged. These tagged plants were used for recording all biometric observations at different stages of crop growth.

STATISTICAL ANALYSIS

The data recorded were statistically analysed and whenever the results were found significant, the critical differences were arrived at 5 per cent level and drawn statistical calculations (Panse and Sukhatme, 1978).

RESULTS

Growth Attributes

Statistically analyzed results described that the effect of different sources of organic manure application had a positive influence on all growth traits. Application of recommended dose of inorganic fertilizer (T_1) (150:60:40 kg ha^{-1} NPK) recorded the higher values of plant height (61.4 and 64.7cm), LAI (3.6 and 4.1), DMP (850.3 and 920.7 kg ha^{-1}) and CCI (16.0 and 16.8) for summer and kharif seasons. Among the different organic sources (T_3) vermicompost @ 5 t ha^{-1} recorded the higher values of growth attributes Viz., plant height (59.6 and 62.21cm), LAI (3.5 and 3.8), DMP (812.3 and 893.5 kg ha^{-1}) and CCI (15.5 and 16.3) @ 30 DAS for summer and kharif seasons and it was at par with T_1. Application of vermicompost recorded high degree of aggressiveness with inorganic fertilizers.

Yield attributes

Organic sources significantly influenced the yield components and yield in both the crops. Among the different treatments T_1(150:60:40 kg ha^{-1} NPK) recorded the higher values of yield attributes viz., the number of cobs (2.98 and 3.14), cob length (26.1 and 26.4 cm), cob girth (2.1 and 2.2 cm), cob weight (28.9 and 30.2 g), cob yield (6565.0 and 7020.8 kg ha^{-1}) and fodder yield (3300 and 3546 kg ha^{-1}) for summer and kharif seasons and that was on par with T3 (vermicompost @ 5 t ha^{-1}).

DISCUSSION

Growth Attributes

Among the different organic sources (T_3) vermicompost @ 5 t ha^{-1} recorded the higher values of growth attributes Viz., plant height, LAI, DMP kg ha^{-1} and CCI @ 30 DAS for summer and kharif seasons and it was at par with inorganic fertilizers applied treatment (T_1). Application of vermicompost recorded high degree of aggressiveness with inorganic fertilizers. This might be due to better enhancement of physico - chemical properties of soil which leads to impart soil structure as well as slow releasing pattern and steady supply of nutrients thorough out the period of crop growth. Application of organic manures may have helped improve physico-chemical properties of the soil, imparting favourable soil structure for root growth and soil enzymes (the latter continue to break down organic matter in the soil to release nutrients and make them available near the rhizosphere for absorption by plant roots, thereby improving fruit quality) (Chaoui *et al,* 2003).

In addition to that the influence of organic fertilization through vermicompost on LAI could be attributed by increment of metabolic process in plants which seems to have promoted meristematic activities causing apical growth. This result is in agreement with the findings of Atarzadeh *et al*. (2013). This was in line with the studies of Choudhary and Jat (2004) and Jinjala *et al.* (2016).

Yield attributes

Among the different treatments T_1(150:60:40 kg ha^{-1} NPK) recorded the higher values of yield attributes viz., the number of cobs, cob length, cob girth, cob weight , cob yield and fodder for summer and kharif seasons and that was on par with T_3 (vermicompost @ 5 t ha^{-1}). Application of recommended dose of fertilizers increased the number of cobs per plant, cob girth and individual cob weight. This might be due to wide availability of nutrients throughout its growth period resulting in huge biomass production that leads to availability of photosynthates, metabolites and nutrients to develop reproduction structure. This present results are in line with the findings of Edwin *et al*. (2003), Thavaprakash *et al*. (2008) and in addition increment of fodder yield Singh

et al. (2011) and Lone *et al*. (2013). Apparently, the higher yield (cob yield and fodder) and yield attributes viz., number of cobs per plant, cob girth, cob length and individual cob weight in vermicompost received plots could be due to better interception, absorption and utilization of radiation energy leading to higher photosynthetic rate and finally more accumulation. The overall improvement reflected into better source- sink relationship, which in turn enhanced the yield and yield attributes (Madhavi *et al.,* 1995), similar results were also reported by Gurmeet *et al.* (2016), Thavaprakash *et al.* (2007), Uwah *et al.* (2014).

The fodder yield increased in both inorganic and vermicompost received plots due to higher plant height and dry matter production per plant. Also the two possible mechanisms was due to the regulatory role of nitrogen in production of amino acids and plant hormones responsible for cell division and enlargement and higher nitrogen facilitating optimum development of photosynthetic apparatus captures the incident light more efficiently. This was in concomitant with the findings of Tariq *et al.,* (2011).

Table 1: Effect of different organic manures on the growth attributes

Treatments	Plant height in cm		LAI		DMP kgha^{-1}		CCI @ 30 DAS	
	Summer	Kharif	Summer	Kharif	Summer	Kharif	Summer	Kharif
Ti- RDF (150:60:40 NPK kg ha^{-1})	61.4	64.7	3.6	4.1	850.3	920.7	16.0	16.8
T_2- FYM @ 12.5 t.ha^{-1}	54.6	56.4	2.9	3.1	730.8	821.0	13.6	15.3
T_3- VC@ 5 t ha^{-1}	59.6	62.21	3.5	3.8	812.3	893.5	15.5	16.7
T_4- FAA @10 *l*.ha^{-1}	51.5	52.5	2.4	2.6	691.2	765.7	12.9	14.0
T_5 –Farm.comp@12.5 t ha^{-1}	41.9	44.1	1.1	1.2	565.3	610.7	10.2	10.2
T_6- Neem oilcake 1 t.ha^{-1}	48.3	48.9	2.0	1.9	650.3	714.6	12.1	12.6
T_7- Mahua oil cake 1 t ha^{-1}	44.9	47.6	1.6	1.4	605.7	658.9	11.2	11.5
T8- EM inoculated FYM 12.5 t ha^{-1}	56.5	58.2	3.1	3.3	768.7	843.1	14.1	15.7
S.E(m)	1.3	1.41	0.1	0.22	18.1	19.3	0.2	0.29
CD(P= 0.05)	2.9	3.14	0.3	0.49	38.9	43.0	0.6	0.65

Table 2: Effect of different organic manures on the yield attributes

Treatments	No. of cobs per plant		Cob length (cm)		Cob girth (cm)		Individual cob weight (gm)	
	Summer	Kharif	Summer	Kharif	Summer	Kharif	Summer	Kharif
Ti- RDF(150:60:40 NPK kg ha^{-1})	2.98	3.14	26.1	26.4	2.10	2.21	28.9	30.2
T_2- FYM @ 12.5 t.ha^{-1}	2.68	2.59	23.1	24.02	1.58	1.76	26.0	25.7
T_3- VC@ 5 t ha^{-1}	2.90	2.97	25.4	25.9	2.00	2.13	28.0	29.3
T_4- FAA @10 *l*.ha^{-1}	2.54	2.48	20.3	22.43	1.29	1.42	24.1	23.9
T_5- Farm.comp@12.5 t ha^{-1}	2.10	1.02	15.8	15.4	0.43	0.98	19.6	18.0
T_6- Neem oilcake 1 t.ha^{-1}	2.41	2.21	19.1	19.0	1.00	1.11	22.5	21.9
T_7- Mahua oil cake 1 t ha^{-1}	2.26	1.98	17.7	17.3	0.70	0.67	21.1	19.8
T_8- EM inoculated FYM 12.5 t ha^{-1}	2.77	2.67	24.1	24.61	1.74	1.87	26.3	26.9
S.E(m)	0.05	0.07	0.5	0.58	0.11	0.08	0.6	0.7
CD(P= 0.05)	0.12	0.20	1.1	1.18	0.25	0.17	1.3	1.5

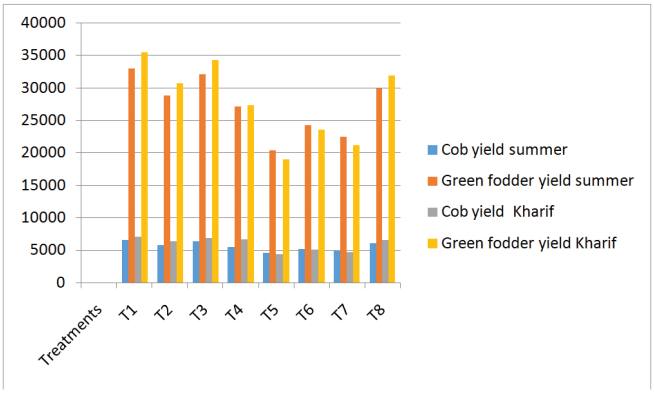

Figure 1: Effect of different organic manures on cob and green fodder yield in both summer and Kharif season of 2017.

Table 3: Effect of different organic manures on baby corn and green fodder yield

Treatments	Baby corn yield (kg ha^{-1})		Green fodder yield (t ha^{-1})	
	Summer	Kharif	Summer	Kharif
Ti- RDF (150:60:40 NPK kg ha^{-1})	6565	7020.5	33.0	35.5
T_2- FYM @ 12.5 t.ha^{-1}	5810	6375.0	28.9	30.7
T_3- VC@ 5 t ha^{-1}	6400	6890.7	32.1	34.3
T_4- FAA @10 *l*.ha^{-1}	5500	6710.0	27.2	27.4
T_5- Farm compost @12.5 t ha^{-1}	4585	4378.0	20.4	19.0
T_6- Neem oilcake 1 t.ha^{-1}	5200	5102.0	24.3	23.6
T_7- Mahua oil cake 1 t ha^{-1}	4899	4700.0	22.5	21.2
T_8- EM inoculated FYM 12.5 t ha^{-1}	6099	6537.3	30.0	31.9
S.E(m)	136.0	139.0	0.7	0.93
CD(P= 0.05)	291.7	309.9	1.5	2.07

CONCLUSION

From the results of the experiments it can be concluded that application of recommended dose of fertilizer and also organic treatment vermicompost @ 5 t ha $^{-1}$ which was on par with chemical fertilizer was found to be the most efficient in increasing the corn yield, green fodder yield in baby corn. Application of fertilizer may be good in the short term for getting maximum yield and net income to the farmers; but, in the long run, to increase the corn quality and soil quality vermicompost treatment is best and thus this practice can be recommended to the maize growing farmers in Tamil Nadu.

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