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Effect of different organic manures on yield, soil physical & chemical properties of irrigated baby corn

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Abstract

Field Experiments were conducted at Krishi Vigyan Kendra, TANUVAS, Namakkal during *Kharif* 2021 and *Summer* 2022 to study the effect of different organic and biological sources of nutrients on yield, soil physical and chemical properties. The 75 percent (101.25 kg N ha⁻¹) and 100 percent (135 kg N ha⁻¹) recommended dose of Nitrogen was supplied through different organic sources such as Vermicompost, Composted poultry manure, Farm yard manure, Neem cake, Castor oil cake, Groundnut oil cake and Biofertilizer consortium involving *Azospirillum*, *Phosphobacteria* and *Azotobacter*. The soil physical and chemical properties were analyzed after harvest of the Baby corn crop. The results revealed that soil physical properties like Bulk density (1.14, 1.14 Mg m⁻³), Particle density (1.95, 2.01 Mg m⁻³), Total porosity (46.40, 45.42%) & Hydraulic conductivity (3.15, 3.35 Cm hr⁻¹) were improved by application of 75% N through Vermicompost + 25% N through Neem cake during *Kharif* 2021 and *Summer* 2022 respectively. The chemical properties like pH (8.30, 8.30) and EC (0.23, 0.23 dSm⁻¹) were decreased and Organic carbon (0.56, 0.59%), Cation exchange capacity (21.00, 21.20 Cmol (p+) kg⁻¹) were significantly influenced with 75% N through Vermicompost + 25% N through Neem cake during *Kharif* 1999 and *Summer* 2000 respectively. The highest young cob yield was recorded (12070, 13712 kg ha⁻¹) with application of 75% N through Vermicompost + 25% N through Neem cake compared to other sources of organic nutrients.

Keywords: Baby corn, Vermicompost, FYM, composted poultry manure, neem cake, bulk density, particle density, organic carbon

Introduction

Maize (*Zea mays*), the most widely produced cereal crop for grain and fodder purpose is called as “Natural Agricultural Resource” after sugarcane. Maize occupies a pivotal position among the food grains produced in Tamil Nadu. During the recent pasts, maize has extended its potentiality into the field of vegetable production. The corn ear used as vegetable for cooking purpose is popularly known as “Baby corn”. Baby corn is young fresh and finger like green ears are harvested before or just at the time of silk emergence and fertilization. Consistent growth in agriculture production becomes possible only if the health of the crop production, the environment including soil is taken care of. Of late, there is a growing interest among the farmers to cultivate crops under organic farming system because of the escalating cost of inorganic fertilizers, decreased soil fertility, environment and health concerns due to pesticides usage and expected premium prices for organically produced crops (Ramesh *et al*, 2005) [7]. One of the important aspects in organic farming is the soil fertility, nutrient management of crops & cropping system to optimize crop productivity. The use of manure from livestock is an important way of recycling nutrients to the soil. Organic manures influence the soil productivity through their effect on soil physical, chemical and biological properties. Information regarding the influence of various organic manures on the crop productivity, soil fertility and health is very important to the farmers engaged in organic farming. The present experiment was conducted with an objective to study the effect of different organic manures viz, composted poultry manure, farm yard manure, vermicompost, oilcakes and biofertilizer consortium on yield and soil properties of irrigated Baby corn.

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Materials and Methods

A field experiments were conducted during *kharif 2021* and summer 2022 at KVK Farm, Krishi Vigyan Kendra, TANUVAS, Namakkal. The soil was sandy clay loam in texture (Coarse sand 25.60%, fine sand 27.80%, silt 15.60%, clay 33.0%) with pH of 8.10, organic carbon 0.31% and EC 0.28 dSm⁻¹. The available soil nitrogen, phosphorous and potassium were 225.5, 18 and 415 kg ha⁻¹ respectively. The soil bulk density, particle density, porosity and hydraulic conductivity were 1.42 mg m⁻³, 2.5mg/m⁻³, 42.85% and 1.98 cm hr⁻¹ respectively.

The treatments include 11 sources of different combination of nutrients viz.,

1. T₁- Control (without any organic and inorganic sources).
2. T₂- 75% of Nitrogen as Composted Poultry Manure alone (CPM).
3. T₃- 75% of Nitrogen as CPM + 25% of Nitrogen as Neem cake.
4. T₄- 75% of Nitrogen as CPM + Biofertilizer consortium**
5. T₅- 75% of Nitrogen as Farm yard manure alone (FYM)
6. T₆- 75% of Nitrogen as FYM + 25% of Nitrogen as Neemcake.
7. T₇- 75% of Nitrogen as FYM + Biofertilizer consortium**
8. T₈- 75% of Nitrogen as Vermicompost alone.
9. T₉- 75% of Nitrogen as Vermicompost + 25% of Nitrogen as Neem cake.
10. T₁₀- 75% of Nitrogen as Vermicompost + Biofertilizer consortium**
11. T₁₁- 75% of Nitrogen as Oilcakes (Groundnut + Castor + Neem cake) alone.
12. T₁₂- 75% of Nitrogen as Oilcakes (Groundnut + Castor + Neem cake) + Biofertilizer consortium**

(** - Azospirillum + Phosphobacteria + Azotobacter).

Table 1: The nutrients content of various organic manures given below

Name of the organic manure	Nitrogen (%)	Phosphorous (%)	Potassium (%)
Composted Poultry manure	2.40	1.89	1.40
Farm yard manure	0.56	0.45	0.72
Vermicompost	2.50	1.29	1.41
Neem cake	5.0	1.10	1.50
Groundnut oilcake	6.0	1.3	1.5
Castor oilcake	5.1	1.9	1.4

Quantity of different organic manures applied per hectare for 75% and 25% substitution (dry weight basis)

Farm yard manure	- 20250 kg ha ⁻¹ (75% substitution)
Composted poultry manure	- 4219 kg ha ⁻¹ (75% substitution)
Vermicompost	- 4050 kg ha ⁻¹ (75% substitution)
Neem cake	- 675 kg ha ⁻¹ (25% substitution)
Groundnut oilcake	- 662 kg ha ⁻¹ (25% substitution)
Castor oilcake	- 562 kg ha ⁻¹ (25% substitution)

Recommended dose of NPK kg per hectare for Maize is 135:62.5:50 kg ha⁻¹.

The doses of organic manure were calculated based on Nitrogen equivalence of crop was applied on dry weight basis, two weeks before sowing. The entire quantity of phosphorous and potassium were applied at the time of sowing through single super phosphate and muriate of potash. For plant protection in baby corn, Neem oil 3% and Neem Seed Kernal Extract (NSKE) 5% were sprayed as prophylactic against insects. The total rainfall received during *Kharif 2021* (July-September) was 52.2 mm and during Summer 2022 (January - March) was 65.9 mm.

soil samples from 0-30 cm depth were collected before the start the experiment and after harvest of the crop and analysed for physical and chemical properties.

Results and Discussion

Productivity of Baby corn

The effect of nitrogen application through various organic sources on baby corn yield varied significantly with different treatments. The yield values ranged from 5604 kg ha⁻¹ and 5141 kg ha⁻¹ to 12070 and 13712 kg ha⁻¹ during *kharif 2021* and *summer 2022*, respectively (Table.2). Highest young cob yield was recorded 12070 and 13712 kg ha⁻¹ with application of 75% of nitrogen as vermicompost + 25% of nitrogen as neem cake (T₉) during *kharif 2021* and *summer 2022*, respectively. The treatment T₉ was closely followed by T₁₀ which recorded a young cob yield of 9858 and 10995 kg ha⁻¹ during in both seasons. The control treatment (T₁) recorded the lowest young cob yield of 5604 and 5141 kg ha⁻¹ during *kharif 2021* and *summer 2022*, respectively.

Soil Physical properties

There was marginal improvement in the soil physical properties like bulk density, particle density, total porosity and hydraulic conductivity at the time harvest of the crop compared to the initial level in all the treatments. The treatment T₉ (75% of nitrogen as vermicompost + 25% of nitrogen as neem cake) registered the lowest bulk density of 1.14 and 1.14 Mg m⁻³, particle density of 1.95 and 2.01 Mg m⁻³ during *kharif 2021* and *summer 2022*, respectively (Table.3) and the values were significantly lower than in control treatment (T₁).

During *kharif 2021*, treatment T₉ registered the highest total porosity values (46.40%) than other treatment and followed by T₄ and T₃. During summer 2022 also the total porosity values indicated a similar trend as that of *Kharif 2021*. The lowest total porosity values were recorded in control treatment (T₁) in both the season (41.76 and 39.18%). The treatment T₉ recorded the highest hydraulic conductivity of 3.15 and 3.35 cm hr⁻¹ in both seasons which was significantly higher than the control(T₁). The lowest hydraulic conductivity was recorded in control treatment (2.06 and 2.26 cm hr⁻¹) in both the season.

There was no significant variation in bulk density under different organic manures treatment, but particle density was significantly reduced under organic manures applied treatments. The total porosity and hydraulic conductivity were significantly increased with organic manures application. Decreased bulk density, increased total porosity and hydraulic conductivity of soil is mainly due to the action of gum compounds, polysaccharides and fulvic acid compounds of organic matter on the soil structure (Manickam, 1993) [6]. Maheswarappa *et al* (1999) [5] also reported decreased bulk density and increased porosity in soil with organic manures application. Vasanthi *et al*, (1999) [9] also observed significant reduction in the bulk density in vermicompost treated plots.

Soil Chemical properties

The results indicated that application of 75% of nitrogen as vermicompost + 25% of nitrogen as neem cake (T₉) significantly recorded the highest percent of organic carbon (0.56 and 0.59%) during *kharif 2021* and *summer 2022*, respectively (Table.4) which was followed by T₃ and was on par with T₄, T₁₀ and T₆. The control treatment (T₁) recorded the least organic carbon (0.30 and 0.32%) content during in both seasons. The lowest pH values of 8.30 were observed with 75% of nitrogen as vermicompost + 25% of nitrogen as neem cake (T₉) followed by

T₈ during both seasons. The highest soil pH values (8.56 and 8.53) were registered in control treatment (T₁). Application of organic manures recorded significantly decrease of Electrical conductivity (EC) over control treatment (T₁). The treatment T₉ recorded the lowest EC values (0.23 and 0.23 dSm⁻¹) registered in both season which were on par with T₃ and T₆. The highest EC values were observed in control treatment which was significantly superior to other treatment. The cation exchange capacity (CEC) of soil due to application of different organic manure treatments varied from 14.00 to 21.00 cmol(p+) kg⁻¹ during *kharif 2021* and 14.40 to 21.20 cmol (p+) kg⁻¹ during *summer 2022*. The treatment T₉ were recorded highest CEC of 21.00 and 21.20 cmol(p+) kg⁻¹ in both seasons and was followed by T₁₀, T₈ and T₃. The lowest CEC was observed in control

treatment (14.00 and 14.40 cmol (p+) kg⁻¹).

In general, there was improvement in soil organic carbon content and Cation exchange capacity under different organic manure treatments. The increase in organic carbon level was mainly because of the organic matter added to the soil by the manures (Basu and Rege, 1972; Acharya and Rajagopal, 1983; Das *et al.*, 1986) [3, 1, 4]. Ajwa and Tabataba (1994) [2] reported that the quantity of soil organic carbon content was positively correlated with the nitrogen concentration in the organic manures. No significant variation in pH and EC of the soil was observed with the application of different organic manure treatments. The organic matter could influence the soil pH by liberation of CO₂ and organic acids (Singh and Singh, 1976) [8].

Table 2: Effect of different organic manures on young cob yield (kg ha⁻¹)

Treatments	Baby corn young cob yield	
	<i>Kharif 2021</i>	<i>Rabi 2022</i>
T ₁ - Control	5604	5141
T ₂ - 75% N as CPM alone	8083	8495
T ₃ - 75% N as CPM + 25% N as NC	9153	9400
T ₄ - 75% N as CPM + BC	8849	8850
T ₅ - 75% N as FYM alone	6995	6765
T ₆ - 75% N as FYM + 25% N as NC	8795	8705
T ₇ - 75% N as FYM + BC	7920	7879
T ₈ - 75% N as VC alone	9038	8995
T ₉ - 75% N as VC + 25% N as NC	12070	13712
T ₁₀ - 75% N as VC + BC	9858	10995
T ₁₁ - 75% N as OC alone	7333	7277
T ₁₂ - 75% N as OC + BC	7874	7508
S Ed	612	737
CD (P=0.05)	1270	1529

CPM - Composted poultry manure, NC - Neem cake, FYM - Farm yard manure, BC - Biofertilizer consortium, VC - Vermicompost, OC - Oilcakes

Table 3: Effect of different organic manures on soil physical properties after harvest of the crop

Treatments	Bulk density (Mg m ⁻³)		Particle density (Mg m ⁻³)		Total Porosity (%)		Hydraulic Conductivity (cm hr ⁻¹)	
	<i>Kharif 2021</i>	Summer 2022	<i>Kharif 2021</i>	Summer 2022	<i>Kharif 2021</i>	Summer 2022	<i>Kharif 2021</i>	Summer 2022
T ₁ - Control	1.38	1.35	2.23	2.27	41.76	39.18	2.06	2.26
T ₂ - 75% N as CPM alone	1.23	1.21	2.20	2.18	44.00	41.08	2.54	2.78
T ₃ - 75% N as CPM + 25% N as NC	1.18	1.73	2.15	2.00	45.00	44.68	2.98	3.15
T ₄ - 75% N as CPM + BC	1.19	1.20	2.19	2.08	45.50	42.22	2.66	2.82
T ₅ - 75% N as FYM alone	1.25	1.22	2.25	2.16	44.73	42.05	2.30	2.46
T ₆ - 75% N as FYM + 25% N as NC	1.18	1.16	2.09	1.98	43.60	44.42	2.86	3.11
T ₇ - 75% N as FYM + BC	1.19	1.20	2.13	2.20	43.97	42.52	2.46	2.58
T ₈ - 75% N as VC alone	1.18	1.20	2.10	2.17	43.73	41.35	2.78	2.94
T ₉ - 75% N as VC + 25% N as NC	1.14	1.14	1.95	2.01	46.40	45.42	3.15	3.35
T ₁₀ - 75% N as VC + BC	1.18	1.19	2.07	1.94	43.00	40.37	2.94	3.15
T ₁₁ - 75% N as OC alone	1.21	1.21	2.15	2.11	43.76	42.45	2.46	2.70
T ₁₂ - 75% N as OC + BC	1.19	1.18	2.22	2.03	42.86	43.28	2.66	2.78
S Ed	0.02	0.02	0.09	0.11	1.65	2.13	0.14	0.14
CD (P=0.05)	NS	NS	0.18	0.21	3.43	4.42	0.29	0.29

CPM - Composted poultry manure, NC - Neem cake, FYM - Farm yard manure, BC - Biofertilizer consortium, VC - Vermicompost, OC - Oilcakes

Table 4: Effect of different organic manures on soil chemical properties after harvest of the crop

Treatments	Organic carbon (%)		pH		Electrical Conductivity (dS m ⁻¹)		Cation Exchange capacity** (cmol(P+) kg ⁻¹)	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T ₁ - Control	0.30	0.32	8.56	8.53	0.27	0.27	14.00	14.40
T ₂ - 75% N as CPM alone	0.45	0.48	8.43	8.40	0.26	0.25	19.00	19.30
T ₃ - 75% N as CPM + 25% N as NC	0.54	0.55	8.43	8.37	0.24	0.24	20.00	20.10
T ₄ - 75% N as CPM + BC	0.51	0.54	8.43	8.47	0.26	0.26	19.70	20.00
T ₅ - 75% N as FYM alone	0.40	0.43	8.50	8.47	0.26	0.26	19.00	19.90
T ₆ - 75% N as FYM + 25% N as NC	0.46	0.53	8.40	8.43	0.24	0.24	19.20	20.20
T ₇ - 75% N as FYM + BC	0.44	0.46	8.53	8.43	0.25	0.25	19.50	20.00
T ₈ - 75% N as VC alone	0.48	0.49	8.36	8.37	0.25	0.24	20.40	20.70
T ₉ - 75% N as VC + 25% N as NC	0.56	0.59	8.30	8.30	0.23	0.23	21.00	21.20
T ₁₀ - 75% N as VC + BC	0.51	0.54	8.36	8.40	0.25	0.25	20.50	20.60
T ₁₁ - 75% N as OC alone	0.41	0.45	8.46	8.47	0.26	0.26	18.00	19.00
T ₁₂ - 75% N as OC + BC	0.45	0.45	8.53	8.37	0.26	0.25	18.20	19.50
S Ed	0.02	0.01	0.08	0.07	0.01	0.01	-	-
CD (P=0.05)	0.04	0.03	0.16	0.15	0.02	0.02	-	-

CPM - Composted poultry manure, NC - Neem cake, FYM - Farm yard manure, BC - Biofertilizer consortium, VC - Vermicompost, OC - Oilcakes:

**Data not statistically analysed.

Conclusion

Results of the study indicated that combination of vermicompost + neem cake was found effective in recording higher baby corn yield, improvement in soil physical and chemical properties followed by vermicompost + biofertilizer consortium, composted poultry manure + neem cake and farm yard manure + neem cake. Vermicompost is a good source of organic manure containing the vital plant nutrients and also growth promoting substances. Use of vermicompost and earthworms improve the soil fertility by improving various physical and chemical properties of soil.

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