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Effect of different levels of NPK and organic manures on growth and yield of hybrid maize (*Zea mays* L.)

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Abstract

The field experiment was carried out in farmer's field in Kugaiyur village, Chinnasalem Taluk, Villupuram District,Tamil Nadu, India during *Kharif* season of 2018 in order to evaluate the different levels of NPK and organic manures on growth and yield components of hybrid maize. The field experiment was laid out with eleven treatments and replicated thrice with randomized block design. The treatment consist of inorganic manure as 75 % RDF, 100 % RDF and 125 % RDF with vermicompost, poultry manure and pressmud as organic manures. The significant effect of adding 125 % RDF + vermicompost 5 t ha^{-1} recorded the highest plant height at harvest (182.64 cm), LAI at 60 DAS (6.34), dry matter production at harvest (13339 kg ha^{-1}), cob length (17.92 cm), cob diameter (5.46 cm), number of grains/cob (405.62), grain yield (5780 kg ha^{-1}) and stover yield 7611 (kg ha^{-1}). Control treatment produced a least plant height at harvest (125.68 cm), LAI at 60 DAS (3.32), dry matter production at harvest (6384 kg ha^{-1}), cob length (9.78 cm), cob diameter (2.75 cm), number of grains/cob (140.25), grain yield (2350 kg ha^{-1}) and stover yield 3986 (kg ha^{-1}).

Key words : Vermicompost, Poultry manure, Pressmud, NPK.

Maize (*Zea mays* L.) is one of the most adaptable developing crops, able to thrive in a broad range of agro climatic conditions. Maize is known across the globe as the "Queen of Cereals" because it has the largest genetic production potential of all cereals. It is grown on almost 190 million hectares in 165 countries, with a greater range of soil, temperature, biodiversity, and management approaches, contributing 39 percent to world grain output.

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Maize accounts for 9% of agricultural GDP with a market value of 100 billion at current prices in India[2].

Maize being a C_4 plant, it is very efficient in converting solar energy into dry matter. As heavy feeder of nutrients, maize productivity is largely dependent on nutrient management. Therefore, it needs fertile soil to express its yield potential. Ideal soils are rarely found in nature[1]. Nitrogen, phosphorus and potassium are the key nutrients which greatly influence the yield of crops. The supply of these nutrients is mainly through inorganic fertilizers. Inorganic fertilizers cannot be avoided completely since they are the potential sources of high amount of nutrients in easily available forms. Fertilizer management is one of the most important factors that influence the growth and yield of maize crops[4]. In addition, integration of organic with inorganic fertilizers improves the maize physiological system and modifies physico-chemical properties of the soil.

Integrated nutrient management is a judicious use of organic and inorganic sources of nutrient to crop fields for sustaining and maintaining soil productivity. The conjunctive use of suitable nutrients through organic and inorganic solely or in combination can provide the solutions to the problems such as increase in the price of inorganic fertilizers and deterioration effect of soil fertility and productivity. Hence, judicious application of these combination can sustain the soil fertility and productivity[10].

The field experiment was carried out a farmer's field in Kugaiyur village, Chinnasalem Taluk, Villupuram District, Tamil Nadu situated at 11°54' N latitude & 78° 85' E longitude and an altitude of 138 m above mean sea level during kharif season of 2018. The soil texture is clay loam, with a pH of 7.5 and a conductivity of 0.15 dSm^{-1}. Nitrogen, phosphorus, and potassium availability were low (230.5 kg ha^{-1}), medium (18.5 kg ha^{-1}), and high (280.5 kg ha^{-1}), respectively, at the experimental site. The experiment was laid out in a randomized block design, having eleven treatments and replicated thrice. The following treatments were examined in the experiment *viz.,* T_1 – control, T_2 - 100 % RDF, T_3 - 75 % RDF + Vermicompost 5 t ha^{-1}, T_4 - 75 % RDF + Poultry Manure 2.5 t ha^{-1}, T_5 - 75 % RDF + Pressmud 12.5 t ha^{-1}, T_6 -100 % RDF + Vermicompost 5 t ha^{-1}, T_7 - 100 % RDF + Poultry Manure 2.5 t ha^{-1}, T_8 - 100 % RDF + Pressmud 12.5 t ha^{-1}, T_9 - 125 % RDF + Vermicompost 5 t ha^{-1}, T_{10} - 125 % RDF + Poultry Manure 2.5 t ha^{-1}, T_{11} - 125 % RDF + Pressmud 12.5 t ha^{-1}.

For this experiment, the maize hybrid CO-6 was chosen and it was seeded at a 60 x 20 cm spacing. The recommended fertilizers schedule of 250:75:75 N, P_2O_5 and K_2O kg ha^{-1} were applied as per fertilizer schedule. Urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O) fertilizers were used to supply N, P and K nutrients, respectively. The entire dose of phosphorus and potassium were applied basally. Half dose of nitrogen was applied basally and the remaining half dose of nitrogen was applied as two splits (top dressing) on 25 and 45 days after sowing. The fertilizers were applied at three levels vz., 75% RDF, 100% RDF and 125% RDF along with vermicompost,

poultry manure and pressmud as per the treatment schedule. A need-based approach to plant protection was taken based on the economic threshold of pests and diseases. The gross and net plot sizes were 5.4 x 4.0 m and 4.2 x 3.0 m, respectively. The net plot area was used for the determination of crop yields. The crop observation was taken on 30 DAS, 60 DAS and harvest stage. The crops were harvested manually at physiological maturity and yield was taken at 14% moisture level. Using Gomez and Gomez's[5] method, biometric data obtained from plant samples and computed data were statistically examined. The critical difference was determined at a 5% probability level in cases where the F test indicated that the treatment difference was significant.

Growth parameters :

Among the different NPK levels and organic manures tried out in the experiment, 125 % RDF+ Vermicompost 5 t ha^{-1} recorded the highest plant height at the harvest stage with 182.64 cm. It was followed by 125 % RDF+ Poultry manure 2.5 t ha^{-1} with plant height of 177.88 cm. The least plant height was recorded in the control plot with 125.68 cm. The 125 % RDF+ vermicompost 5 t ha^{-1} applied treatment increased a plant height upto 4.76 cm compared to 125 % RDF+ Poultry Manure 2.5 t ha^{-1} and 56.96 cm compared to control plot. This might be due to application of NPK may be attributed to the fact that nitrogen being an essential constituent of plant tissue favours cell division and enlargement, which together with the adequate quantity of phosphorus and potassium which favours increase in plant height[1,6]. The similar trend was followed in the leaf area index which is calculate at 60 DAS. 125 % RDF+ Vermicompost 5 t ha^{-1} significantly recorded the maximum leaf area index of 6.34 and it was followed by 125 % RDF+ Poultry manure 2.5 t ha^{-1} with 6.09. The control treatment recorded the least value of 3.32. The Effect of vermicompost on leaf area index might be due to synthesis of certain phytohormone and vitamins and more chlorophyll which resulted in higher leaf area index in maize. It also supplies balanced amount of nutrients to stimulate growth and promote root growth resulting in taller plants. It is in conformity with Mahato *et al.*[9].

Highest dry matter production was recorded in 125 % RDF+ Vermicompost 5 t ha^{-1} with 13339 kg ha^{-1} and it was followed by 125 % RDF+ Poultry manure 2.5 t ha^{-1} with 13049 kg ha^{-1} at harvest. Dry matter was increased 2.22 % in 125% RDF along with vermicompost compared with 125% RDF along with poultry manure and 6955 kg was increased compared to control. Favorable effect of vermicompost on DMP could be attributed to increased LAI due to sustained availability of nutrients from combined source of organic (vermicompost) and inorganic fertilizer till the maturity that would have enhanced better biomass production. Similar results was also reported by Haribhushan *et al.*[7]. All the growth parameters were furnished in Table-1.

Yield attributes and yield :

Application of 125 per cent RDF along with vermicompost 5 t ha^{-1} recorded the yield attributes like cob length (17.92 cm), cob diameter (5.46 cm) and number of grains cob^{-1} (405.62). It was followed by 125% RDF

Table-1. Effect of different levels of NPK and organic manures on growth and yield of hybrid maize

Treatment	Plant height at harvest (cm)	LAI at 60 DAS	DMP at Harvest stage (kg ha^{-1})	Cob length (cm)	Cob diameter (cm)	Number of Grains cob^{-1}	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1 – Control	125.68	3.32	6384	9.78	2.75	140.25	2350	3986
T_2 - RDF 100 %	139.72	4.07	10702	12.80	3.75	300.27	4313	6340
T_3 - 75 % RDF + Vermicompost 5 t ha^{-1}	153.78	4.81	11573	14.48	4.31	334.79	4761	6763
T_4 - 75 % RDF + Poultry Manure 2.5 t ha^{-1}	149.24	4.57	11286	13.94	4.13	323.62	4616	6622
T_5 - 75 % RDF + Pressmud 12.5 t ha^{-1}	144.43	4.32	10992	13.37	3.94	311.83	4463	6481
T_6 - 100 % RDF + Vermicompost 5 t ha^{-1}	168.14	5.57	12456	16.19	4.88	370.04	5218	7189
T_7 - 100 % RDF + Poultry Manure 2.5 t ha^{-1}	163.21	5.31	12155	15.60	4.69	357.92	5061	7046
T_8 - 100 % RDF + Pressmud 12.5 t ha^{-1}	158.40	5.06	11862	15.03	4.50	346.13	4908	6905
T_9 - 125 % RDF+ Vermicompost 5 t ha^{-1}	182.64	6.34	13339	17.92	5.46	405.62	5780	7611
T_{10} - 125 % RDF+ Poultry Manure 2.5 t ha^{-1}	177.88	6.09	13049	17.35	5.27	393.94	5529	7472
T_{11} - 125 % RDF+ Pressmud 12.5 t ha^{-1}	173.04	5.83	12754	16.78	5.08	382.05	5374	7331
S.Ed.	2.11	0.11	130.35	0.25	0.08	5.17	67.09	64.11
C.D (P=0.05)	4.53	0.24	280.25	0.54	0.18	11.12	144.25	137.84

along with poultry manure 2.5 t ha^{-1} recorded the cob length (17.35 cm), cob diameter (5.27 cm) and number of grains cob^{-1} (393.94). The control plot recorded the least yield characters of cob length (9.78 cm), cob diameter (2.75 cm) and number of grains cob^{-1} (140.25). It is due to availability of more nitrogen and other nutrients in sufficient quantity throughout their vegetative growth and also increased the efficiency of applied nutrients. The present results are in accordance with the findings of Baradhan and Suresh Kumar,[3] and Sudhakar *et al.*[11].

The grain and stover yield were highest with 125% RDF + Vermicompost @ 5 t ha^{-1} recoded the higher grain yield (5780 kg ha^{-1}) and stover yield (7611 kg ha^{-1}). Higher grain yield owing to application of nitrogen and vermicompost might be attributed to steady release of nutrients to soil for longer duration resulting in better utilization of solar energy and in turn led to enhance the values of yield attributes, which resulted in higher grain yield

of maize. The observed results are in close conformity with finding of Mahapatra *et al.,*[8]. All the yield parameters and yield expressed in Table-1.

Among the different levels of NPK and organic manures tried in the experiment, it can be concluded that 125% RDF + Vermicompost @ 5 t ha^{-1} significantly recorded higher growth and yield of hybrid maize.

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