EFFECT OF RECOMMENDED DOSE OF FERTILIZER AND ZINC SULPHATE ON GROWTH, YIELD AND YIELD CHARACTERS OF HYBRID MAIZE

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Abstract: A field experiment was conducted to study the effect of recommended dose of fertilizer and zinc sulphate on growth, yield and yield characters of hybrid maize in sandy loam soil of Vanniyarpalayam Village belongs to vadalapakkam series (*Typic Rhodustalf*), low in organic carbon, low in alkaline $KMnO_4$–N, and low in Bray-P and medium in NH_4OAc-K. Field experiment was conducted with seven treatments *viz*., T_1 - 50% RDF, T_2 - 100% RDF, T_3 - 150% RDF, T_4 - 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1}, T_5 - 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + Neem cake @ 200 kg ha^{-1}, T_6 - 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + *Azotobacter* @ 2 kg ha^{-1}, T_7 - 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + Neem cake @ 200 kg ha^{-1} + *Azotobacter* @ 2 kg ha^{-1}. The experiment was carried out in Randomized Block Design (RBD) with four replications and tested with maize var. Dhanvi-166 as test crop. The results of the study indicated that the application of 150 % recommended dose of fertilizer, zinc sulphate @ 25 kg ha^{-1} and neem cake @ 200 kg ha^{-1} along with *Azotobacter* @ 2 kg ha^{-1} was significantly superior in increasing grain (7620.48 kg ha^{-1}) and Stover yield (8951.91 kg ha^{-1}), growth characters *viz*., plant height, leaf area index and dry matter production and yield characters *viz.*, cob length, cob girth, number of grains $cob^{-1}$and hundred seed weight. The various levels (50 %, 100% and 150%) of recommended dose fertilizer alone treatments gave the lower values of growth, yield and yield attributes than the other combined application treatments Application of 50% recommended dose fertilizer registered lower values of growth, yield and yield parameters.
Key words: Nitrogen, Phosphorus, Potassium, Zinc sulphate, Neem cake, *Azotobacter* and Maize.

I. Introduction

Maize is the third most important cereal next to rice and wheat, in the world as well as in India. It is a versatile crop and can be grown in diverse environmental conditions and has multiple uses. In India, maize is cultivated over an area of 8.26 million hectares with a production of 19.30 million tonnes and the average productivity is 2337 Kg ha^{-1} (Agricoop, 2017-2018). In Tamil Nadu, maize is cultivated in an area of 0.20 million hectares with a production of 0.24 million tonnes and productivity of 1189 kg ha^{-1} (crop report, 2017). Among the plant nutrients, macro nutrients such as nitrogen, phosphorus and potassium play a crucial role in deciding the maize growth and yield. The responds of crops to macronutrients varies widely from place to place, depending upon the fertility level of soil and other environmental conditions. This necessitates the study on the response of crop to different levels of NPK fertilizer. Maize has high yield potential and responds greatly to applied fertilizers. Therefore, proper management of nutrients is essential to realize maximum potential of the crop and to get higher economic benefit (Amanulah *et al*., 2010). The deficiency of micronutrients may emerge when the supply of micronutrients to the soil is less compared to removal through crop harvest which in turn limits crop productivity (Shukla *et al*., 2009). Neem (*Azadiracta indica*) tree is found abundant in the study area and its leaves, seeds were grown to contain substantial nutrients thus can serve as an alternative organic materials for sustained productivity of soil. Neem seed contains oily azadiractin compound which has medicinal and insecticidal properties thus when extracted from the seed residues are left popularly known as neem seed cake (NSC) (Garba and Oyinlola, 2014). Azotobacter has beneficial effects on crop growth and yield through, biosynthesis of biologically active substances, stimulation of rhizospheric microbes, producing phyto pathogenic inhibitory (Somers *et al.*, 2004).

II. Materials and Methods:

A field experiment was conducted to study the effect of macro and micro nutrient fertilizers on yield maximization of maize in sandy loam soil. The initial soil of the experimental site had a pH–6.0 and EC-0.40 dSm^{-1}. The soil was low in available N (182 kg ha^{-1}), P (9.3 kg ha^{-1}) and medium in available K (235 kg ha^{-1}) respectively. The low status of DTPA-Zn is 1.05 mg kg^{-1}. The treatment imposed viz., T_1- 50% RDF, T_2- 100% RDF, T_3 - 150% RDF, T_4- 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1}, T_5 - 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + Neem cake @ 200 kg ha^{-1}, T_6 - 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + *Azotobacter* @ 2 kg ha^{-1}, T_7- 150% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + Neem cake @ 200 kg ha^{-1} + *Azotobacter* @ 2 kg ha^{-1}. The experiment was laid out in Randomized Block Design (RBD) with four replications using maize var. Dhanvi-166 as test crop. A fertilizer dose

of 135: 62.5: 50 kg of N, P and K per hectare for maize was applied as urea, single super phosphate and muriate of potash, respectively. Entire N, P_2O_5 and K_2O were applied as basal. A required quantity of zinc sulphate @ 25 kg ha^{-1} was also applied as basal as per the treatment schedule. Composted neem cake @ 200 kg ha^{-1} were applied basally and well incorporated into the soil as per the treatment schedule. The biofertilizer namely *Azotobacter* @ 2 kg ha^{-1} was applied to all the experimental plots. The growth characters of plant height, leaf area index (LAI) and Dry matter production (DMP) noticed at the stages of 30, 60 DAS and at harvest stage. Yield and yield attributes viz., cob weight, cob length, cob girth, number of grains per cob, 100 seed weight, grain yield and stover yield were recorded.

III. RESULT AND DISCUSSION

Growth characters

The available NPK in the soil was significantly influenced by various treatments. The maximum plant height (135.36, 247.10 and 253.57 cm) leaf area index (2.51, 5.38 and 5.86) and dry matter production (5747.72, 7850.41 and 10144.46 kg ha^{-1}) at the time of 30, 60 DAS and harvest stage of maize were obtained from the treatment with 150 % recommended dose of fertilizer, zinc sulphate @ 25 kg ha^{-1}, neem cake @ 200 kg ha^{-1} along with *azotobacter* @ 2 kg ha^{-1} followed by treatment with 150 % recommended dose of fertilizer, zinc sulphate 25 kg ha^{-1} plus neem cake @ 200 kg ha^{-1} recorded growth parameters viz., plant height (134.45, 246.35 and 253.96 cm) leaf area index (2.44, 5.29 and 5.73) and dry matter production (5733.63, 7809.94 and 10111.67 kg ha^{-1}). The various levels (50 %, 100% and 150%) of recommended dose fertilizer alone treatments gave the lower values of growth attributes than the other combined application treatments (Table. 1). Application of different levels of recommended dose of fertilizer, neem cake, *azotobacte*r and micro nutrient increased the soil physical properties as well as to enhance the microbial activities and provide stable supply nutrient to the maize crops, might be the reason for the increased values on growth components viz., plant height, leaf area index and dry matter production. This could be due to optimum and sustained availability of micronutrients during the entire growth phase of maize because of the supply of nutrients through soil. This is confirming with the findings of Paramasivan *et al*. (2011)

Yield and yield attributes:

The yield attributes such as cob weight, cob length, cob girth, number of Grains per cob, hundred seed weight, grain and stover yield were significantly influenced by various treatments. The maximum cob weight (212.5 g), longest cob (25.51 cm), maximum cob girth (13.74 cm), highest number of grains per cob (420.72) and hundred seed weight (30.51 g) were obtained from the treatment with150 % recommended dose of fertilizer, zinc sulphate @ 25 kg ha^{-1}, neem cake @ 200 kg ha^{-1} along with *azotobacter* @ 2 kg ha^{-1} followed by the treatment with 150 % recommended dose of fertilizer, zinc sulphate 25 kg ha^{-1} plus neem cake @ 200 kg ha^{-1} (211.60 g), (25.35 cm), (13.46 cm), (412.84) and (29.94 g). The different levels (50 %, 100% and 150%) of recommended dose fertilizer alone treatments gave the lower values of yield attributes than the other combination treatments (Table. 2). Significantly higher grain and stover yields (7620.48 and 8951.91 kg ha^{-1}) were recorded with the application of 150 % recommended dose of fertilizer, zinc sulphate @ 25 kg ha^{-1}, neem cake @ 200 kg ha^{-1} along with *azotobacter* @ 2 kg ha^{-1}. The application of 150 % recommended dose of fertilizer, zinc sulphate @ 25 kg ha^{-1} along with neem cake @ 200 kg ha^{-1} resulted in the next highest grain and stover yields (7442.15 and 8651.66 kg ha^{-1}) respectively. The increased in grain yield of maize might be due to the highest growth attributes in maize and enhanced level of nutrients applied to the crop. The different levels (50 %, 100% and 150%) of recommended dose fertilizer alone treatments recorded the lower grain and stover yield than the other combination treatment (Table. 2). This might be due to highest growth parameters in maize. An regular supply of nitrogen to plant from soil during growth period by more assimilation rate and they are the building blocks of plant which resulted in slower leaf senescence which might be the reason for increased yield attributes in the treatment similar results was reported by Gahlout *et al*. (2010), Hammad *et al*. (2011) and Wasnik *et al*. (2012).

IV. Conclusion

The results of the study showed that for increased growth characteristics and yield of maize in sandy loam soil, application of 150 % recommended dose of fertilizer, zinc sulphate @ 25 kg ha^{-1}, neem cake @ 200 kg ha^{-1} along with *azotobacter* @ 2 kg ha^{-1} was identified as best treatment combination to recommend to the farmer's of cuddalore district to realize the maximum net profit in maize yield.

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Table 1. Effect of macro and micronutrient fertilizers with organic sources of nutrients on plant height (cm), Leaf area index and Dry matter production (kg ha^{-1}) of maize

Treatments	Plant height (cm)			Leaf area index			Dry matter production (kg ha^{-1})		
	30 DAS	60 DAS	Harvest stage	30 DAS	60 DAS	Harvest stage	30 DAS	60 DAS	Harvest stage
T_1	123.10	232.94	239.05	1.31	4.24	4.53	4620.91	6289.36	8312.83
T_2	125.62	235.41	240.76	1.53	4.49	4.81	4885.61	6656.26	8785.83
T_3	128.34	240.16	246.53	1.92	4.68	5.11	5234.55	7127.79	9356.53
T_4	129.95	243.82	249.20	2.15	4.98	5.36	5584.82	7522.56	9908.85
T_5	134.45	246.35	253.96	2.44	5.29	5.73	5733.63	7809.94	10111.67
T_6	130.91	244.10	250.13	2.22	5.08	5.49	5598.64	7664.63	9946.69
T_7	135.36	247.10	253.57	2.51	5.38	5.86	5747.72	7850.41	10144.46
SEd	0.46	0.56	0.65	0.05	0.06	0.08	120.32	166.13	214.69
CD (p=0.050)	1.02	1.24	1.44	0.12	0.15	0.18	264.71	365.49	472.33

Table 2. Effect of macro and micronutrient fertilizers with organic sources of nutrients of maize on cob weight cob^{-1}(g), cob length (cm), cob girth (cm), No of grains per cob, Hundred seed weight (g), grain yield (kg) and stover yield (kg).

Treatments	Cob weight (g)	Cob length (cm)	Cob girth (cm)	No of grains per cob	Hundred seed weight(gm)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1	150.03	16.35	7.14	304.18	25.96	5578.64	6526.48
T_2	161.40	17.98	7.60	335.25	27.75	6048 .22	6986.00
T_3	175.10	20.46	8.84	360.51	28.02	6487.84	7464.63
T_4	190.92	21.13	11.26	386.83	28.96	6809.42	7902.74
T_5	211.60	25.35	13.46	412.84	29.94	7442.15	8651.66
T_6	200.10	21.57	11.60	395.16	29.73	7018.44	8192.35
T_7	212.5	25.51	13.74	420.72	30.51	7620.48	8951.91
SEd	5.08	0.23	0.16	9.59	0.36	134.34	178.38
CD (p=0.050)	11.18	0.51	0.36	21.10	0.80	295.55	392.45