Plant Archives Volume 2 No. 2, 2020 pp. 4544-4546 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF NUTRIENT MANAGEMENT ON YIELD AND UPTAKE OF MAIZE

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Abstract

A field experiment was conducted in Experimental Farm, Faculty of Agriculture, Annamalai University to evaluate the response of maize (JK1009) with different organic sources like seasoned pressmud, FYM, vermicompost, biocompost, *Azospirillum* + Phosphobacteria, Flyash, Neemcake combined with inorganic fertilizers. There were ten treatment combinations replicated thrice in randomized block design in *Typic Haplusterts.* The soil was clay loam in texture with available nitrogen, phosphorus and potassium of 227, 18.5, 323.3 kg ha^{-1} which fell in fertility status of low, medium and high respectively. Application of seasoned pressmud @ 12.5 t ha^{-1} with 75 per cent recommended dose of fertilizers recorded the highest cob yield of 4402 kg ha^{-1} and stover yield 6563.4 kg ha^{-1}. The highest grain uptake of nitrogen (204.5 kg ha^{-1}) and phosphorus (33.5 kg ha^{-1}) was registered in the treatment receiving seasoned pressmud @ 12.5 t ha^{-1} with 75 per cent RDF. The maximum grain uptake of potassium (178.11 kg ha^{-1}) were recorded the treatment receiving flyash @ 12.5 t ha^{-1} with 75 per cent recommended dose of fertilizer.

Key words : Maize, Seasoned pressmud, Flyash, Grain yield and Stover yield.

Introduction

Maize (*Zea mays* L.) is one of the most impor-tant cereal crops grown all over the globe as poor man's food and also as cattle and poultry feed with the intention of achieving green revolution intensive research in maize has been started anticipating its importance as food and feed The success of future agriculture depends upon

sustainability of production systems. This has necessitated research on use of organic manures. It helps farmers to reduce inputs of commercial fertilizers, thereby increasing profit margin. The safety of environment as well as public health is also important reasons for advocating increased use of organic materials. The objectives was to study the direct effect of organics and fertilizers on the yield and nutri-ent uptake pattern in maize crop.

Materials and Methods

The field experiment was conducted at Annamalai University experimental farm.

The field experiment treatment details included

T_1 - Control; T_2 - 100% recommended dose of fertilizer (RDF); T_3 - 75% recommended dose of fertilizer (RDF), T_4 - Farmyard manure 12.5 t ha^{-1} + 75% RDF, T_5 - Seasoned Pressmud 12.5 t ha^{-1} + 75% RDF, T_6 - Flyash 12.5 t ha^{-1} + 75% RDF, T_7 - Vermicompost 2.5 t ha^{-1} + 75% RDF, T_8 - Biocompost 2.5 t ha^{-1} + 75% RDF,

T_9 - Micronutrient mixture 12.5 kg ha^{-1} + 75% RDF, T_{10} - Azospirillum + Phosphobacteria 2 kg ha^{-1} + 75% RDF, T_{11} - Neem cake 0.1 kg ha^{-1} + 75% RDF.

A fertilizer schedule of 135:62.5:50 kg of N, P_2O_5 and K_2O kg ha^{-1} was followed. The experimental design followed was randomized block design. The cobs from

Table 1: Physico-chemical properties of experimental soil.

A. Mechanical properties	Content
Clay (%)	47.15
Silt (%)	15.20
Fine sand (%)	22.11
Coarse sand (%)	15.20
Textured classification	Clay loam
Taxonomical classification	*Typic Haplustert*
B. Physico-Chemical Properties	
pH	7.9
EC (dSm^{-1})	0.92
CEC (C mol (p^+) kg^{-1})	27.42
C. Chemical properties	
Organic carbon (g kg^{-1})	3.8
$KMnO_4$-N (kg ha^{-1})	227 (Low)
Olsen-P (kg ha^{-1})	18.5 (Medium)
NH_4OAC-K (kg ha^{-1})	323.3 (High)

Table 2: Effect of organic sources and industrial by products on grain yield (kg ha^1) maize.

Treatment	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1 - Control	2096	2968.8
T_2 - 100% recommended dose of fertilizer (RDF)	2642	4258.4
T_3 - 75% recommended dose of fertilizer (RDF)	2356	3609.2
T_4 - Farmyard manure 12.5 t ha^{-1} + 75% RDF	4100	5903.1
T_5 - Seasoned Pressmud 12.5 t ha^{-1} + 75% RDF	4402	6563.4
T_6 - Flyash 12.5 t ha^{-1} + 75% RDF	2278	3289.5
T_7 - Vermicompost 2.5 t ha^{-1} + 75% RDF	3806	5560.3
T_8 - Biocompost 2.5 t ha^{-1} + 75% RDF	3513	5241.1
T_9 - Micronutrient mixture 12.5 kg ha^{-1} + 75% RDF	2572	3969.3
T_{10} - Azospirillum + Phosphobacteria 2 kg ha^{-1} + 75% RDF	3224	4898.7
T_{11} - Neem cake 0.1 kg ha^{-1} + 75% RDF	2996	4577.6
SEd	77.90	103.6
CD (p=0.05)	162.50	214.99

the net plot were harvested separately. The dry weight of stover obtained from each plot was recorded and expressed in kg ha^{-1}. Five plants at random were cut close to the ground level from the sampling row for DMP estimation at the time of harvest. Samples were sun dried for 3 days followed by overdrying at 70^0C till constant weight was obtained to record dry weight and expressed in kg ha^{-1}.

Nutrient uptake =

$$\frac{\text{Nutrient content (\%)} \times \text{total dry matter yield (kg ha}^{-1}\text{)}}{100}$$

Standard procedures were followed for soil and plant analysis.

Results and Discussion

Physico-chemical properties of xperimental soil

The initial soil sample collected from the experimental site before the commencement of experiment was analyzed for the various physico-chemical properties (Table 1). From the textural composition of soil it was inferred that the soil was clay loam. The cation exchange capacity of the soil was 27.42 C mol (p^+) kg ha^{-1}. The pH was 7.9 with EC of 0.92 dSm^{-1}. The organic carbon content was 3.8 g kg^{-1}. The available nitrogen, phosphorus and potassium content of the soil was 2.27, 18.5 and 323.3 kg ha^{-1} respectively recording biomedium and high status of soil fertility.

Application of different organic sources and in-dustrial by products had significant influence on cob yield. The grain yield of maize cob was significantly influenced by the application of different organic sources (Table 2). The highest cob yield of 4402 kg ha^{-1} and stover yield (6563.4 kg ha^{-1}) were recorded in the plots which received seasoned pressmud @ 12.5 t ha^{-1} and 75 per cent Recommended Dose of Fertilizer. The applica-tion of nutrients through inorganic sources also might have increased the yield of maize. The beneficial effect of nu-trients as maize cobs may be due to increased supply of nutrients to the crop. Similar results were obtained by Kale and Bano (1992).

The highest nitrogen uptake of 204.5 kg ha^{-1} was recorded in the treatment that received Seasoned Pressmud @ 12.5 t ha^{-1} combined with 75 per cent RDF (Table 3). It might be due to the greater availability of nitrogen in soil which enhanced the growth of plants and ultimately lead to higher accumulation of nutrients in their parts along with highest total uptake. The enhanced release of nitro-gen from the organic sources increases the nitrogen uptake by maize plants. This is accordance with the finding of Roy and Singh (2006).

The highest phosphorus uptake of 33.5 kg ha^{-1} table 3 was recorded in treatment of Seasoned Pressmud @ 12.51 ha^{-1} with 75 per cent RDF (T_5) and it was found to be significantly superior to the rest of treatments involv-ing integrated and sole application of organic sources. In-crease in soil available nutrients and nutrient (N, P and K) uptake were reported due to application of

Table 3: Effect of organic sources and industrial by products on nitrogen, phosphorus and potassium uptake (kg ha^{-1}) in maize at harvest stage.

Treatment	N uptake	P uptake	K uptake
T_1 – Control	116.1	20.1	133.1
T_2 - 100% recommended dose of fertilizer (RDF)	178.7	25.8	148.9
T_3 - 75% recommended dose of fertilizer (RDF)	173.2	23.1	142.1
T_4 - Farmyard manure 12.5 t ha^{-1} + 75% RDF	199.8	32.6	169.5
T_5 - Seasoned Pressmud 12.5 t ha^{-1} + 75% RDF	204.5	33.5	172.8
T_6 - Flyash 12.5 t ha^{-1} + 75% RDF	169.3	22.3	178.1
T_7 - Vermicompost 2.5 t ha^{-1} + 75% RDF	197.2	31.7	164.7
T_8 - Biocompost 2.5 t ha^{-1} + 75% RDF	195.6	30.0	160.0
T_9 - Micronutrient mixture 12.5 kg ha^{-1} + 75% RDF	177.3	25.4	145.6
T_{10} - Azospirillum + Phosphobacteria 2 kg ha^{-1} + 75% RDF	187.4	28.7	157.2
T_{11} - Neem cake 0.1 kg ha^{-1} + 75% RDF	183.2	26.9	152.3
SEd	2.56	0.33	2.21
CD (p=0.05)	5.35	0.70	4.60

pressmud (Rajk-howa *et al.,* 2009).

The highest potassium uptake of 178.1 kg ha^{-1} table 3 was recorded in the treatment that received Flyash @ 12.5 t ha^{-1} integrated with 75 per cent RDF (T_6). This would be ascribed to the accumulation of dry matter content in plant in the above treatment warranting higher potassium uptake. Availability of nitrogen increased the uptake of potassium. This particular treatment could have increased the exchangeable and water soluble potassium. Among the various sources of organic manures, the po-tassium uptake of plant arranged in descending order by treatments is as follows. Flyash > Pressmud > Farmyard manure> Vermicompost > Biocompost. Similar trends of results were reported by Roy and Singh (2006).

Acknowledgement

We acknowledge the University Authorities for permitting us to conduct field trial in Annamalai University Experimental Farm, Annamalainagar.

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