academicresearchJournals

Vol. 3(8), pp. 219-223, August 2015
DOI: 10.14662/ARJASR2015.042

ISSN: 2360-7874
http://www.academicresearchjournals.org/ARJASR/Index.htm

Academic Research Journal of Agricultural Science and Research

Full Length Research

Impact of Farmyard Manure and Nitrogen, Phosphorus, and Potassium on Maize Crop

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Accepted 21 June 2015

This study explores the variations of maize growth performance and yield under application doses of Nitrogen (N), Phosphorus (P) and Potassium (K) fertilization and different doses of farm yard manure (FYM). The experiment was conducted in University College of Agriculture, University of Sargodha, Sargodha, during the maize growing season of 2013. A field trial was carried outto examine the comparative efficiency of organic and inorganic fertilizers on different yield related traits. Nine treatments with five replications were used according to Randomized Complete Block Design (RCBD) in contrast to organic manures and its combination with inorganic fertilizer. Data were recorded on germination percentage, plant height, leaf area, plant wet weight and plant dry weight. The highest value were recorded for seed emergence percentage, leaf area, fresh and dry weight in T1 (20% Organic matter) while lowest value were recorded for seed emergence percentage, leaf area and fresh weight in T9 (control).This study concluded that the proper use of inorganic and organic substance increase the crop yield and also maintain the soil fertility status. However, Organic matter with the recommended rates of inorganic fertilizers could be recommended to maize crop growing farmers.

Key words: organic matter, nitrogen, phosphorus, and potassium, maize.

Shakoor A, Ashraf M, Shah L, Ali A, Khan A, Sher A, Misbahullah, kamran M (2015). Impact of Farmyard Manure and Nitrogen, Phosphorus, and Potassium on Maize Crop. Acad. Res. J. Agri. Sci. Res. 3(8): 219-223.

INTRODUCTION

One of the members of the cereal family that has added great value to man and animals is maize (Zea mays L). It ranks third following wheat and rice in world production (FAO, 2002). Widely grown in the humid tropics and sub-Saharan Africa, the crop serves for food and livelihood for millions of people today (Enujeke et al., 2013). In developed countries, maize is source of such industrial products as corn oil, syrup, corn flour, sugar, brewers' grit and alcohol (Dutt, 2005). As an energy supplement in livestock feed, maize is cherished by various species of animals, including poultry, cattle, pigs, goats, sheep and rabbits. The numerous uses of maize notwithstanding, yield in Africa has continuously declined to low as 1 tha^{-1} due to such factors as rapid reduction in soil fertility and

Table 1. Experimental material used in the study.

Treatments (T)	Doses
T1	20%FYM
T2	16% FYM
T3	13%FYM
T4	10%FYM
T5	8%FYM
T6	6%FYM
T7	4%FYM
T8	2%FYM
T9	Control

negligence of soil amendment materials. Manures and fertilizers are the life wire of improved technology contributing about 50 to 60% increase in productivity of food grains in many parts of the world, irrespective of soil and agro-ecological zone. Several organic materials such as cattle dung, poultry dropping, pig dung and refuse compost have been recommended to subsistence farmers in West Africa as soil amendments for increasing crop yield. Sobulo and Babalola (1992) reported that poultry dropping and cattle dung increased root growth of maize and the crop extracted soil water more efficiently for increased grain yield. Stefan (2003) indicated that fresh poultry dropping contain 70% water, 1.4% N, 1.1% P2O5 and 0.5% K2O while dried poultry manure contains 13% water, 3.6% N, 3.5% P2O5 and 1.6% K2O. Among the different sources of organic manure which have been used in crop production, poultry manure was found to be the most concentrated in terms of nutrient content. Kostchi et al, (1989) observed that application of poultry manure improved the availability of some minerals in the soil, and especially the transfer of nutrients from rangeland to the crop plant. According to Brady and Weil (1999), poultry manure mineralizes faster than other animal manure such as cattle or pig dung; hence it releases its nutrients for plant uptake and utilization rapidly. Application of poultry manure increases carbon content, water holding capacity, aggregation of soil, and decreases bulk density (Egerszegi, 1990). It also increases the water soluble and exchangeable potassium and magnesium which enhance crop yield (Jackson et al, 1999).

MATERIAL AND METHOD

The experiment was conducted at the University College of Agriculture, University of Sargodha, Pakistan during the year 2014. The experiment was designed according to randomized complete block (RCB) design contain nine numbers of treatment with five replications. Table 1

Firstly roni irrigation was given to pots for the preparation of seed bed. After that 45 pots were purchased and were filled with well pulverized soil of 7 kg. Soil was mixed by rubbing against hands. All pots were leveled and straws and pebbles were removed. The fertilizers doses were calculated by comparing the weight of 1 hectare soil with 7 kg soil. Source of nutrition were nitrogen (Urea), phosphorus (DAP), potassium (MOP).

Full doses of DAP and MAP was applied at time of first irrigation and preferably DAP was mixed in soil before irrigating the pots, but, urea was preferably was applied in split doses first at time of first irrigation and other half on 3rd irrigation. Organic fertilizer was incorporated in soil by using farmyard manure as source. Duration of crop was 90 days and after each 15 days plant height was taken for analytical purpose. After 45 day pant leaf samples was taken for laboratory analysis. Firstly, five seeds were sown in each pot but after 30 days a single healthy one left in the pot remaining was uprooted. All cultural practices were done and proper care was taken of plants. The data collected during the maize crop season were statistically analyzed by using the computer statistical program Mstat-C. Analysis of variance technique was employed to test the overall significance of the data, while the least significance difference (LSD) test at P = 0.05 was used to compare the differences among

Table 2. Mean square of the evaluated plant growth parameters.

Parameters	Replications (df-4)	Treatments (df-8)	Error (df-32)
Seed germination (%)	5.87	212.09**	5.80
Plant height after 25 days	3.32	7.22**	0.72
Plant height after 50 days	3.00	10.49**	1.11
Leaf Area	10.31	48.90**	12.82
Plant fresh weight	3.19	15.25**	0.51
Plant dry weight	2.52	2.99**	0.40

** = Highly significant at P≤0.01

Table 3. Effect of organic and inorganic fertilizer on various morphological components.

Treatments	Seed germination (%)	Means after 25 days (inches)	Means after 50 days (inches)
T1	85.40f	11.71c	18.25d
T2	77.40c	11.14bc	17.80cd
T3	81.40cd	11.86bc	17.20bcd
T4	85.26ef	11.98bc	16.80bc
T5	83.46ef	11.85c	16.20b
T6	72.20b	10.60b	17.60cd
T7	72.20b	10.93bc	17.00bcd
T8	78.60cd	10.31b	17.40bcd
T9 (Control)	67.00a	10.35a	13.80a
LSD	3.11	1.10	1.36

treatment means (Steel et al., 1980).

RESULTS AND DISCUSSION

Data regarding germination percentage, maximum values of germination % age (85.40) were recorded in T1 while the minimum values were recorded in T9 (67.00) are presented in Table 3. The result showed that all the treatments were statistically significant to each other for seed germination. The results indicated that application of farm yard manure with the recommended fertilizer have a favorable effect on the germination of maize crop. These results are similar with those reported by Shahnazand Sheikh (1980) who observed increase in % germination when the levels of farm yard manure application were increased. Maximum plant height of 11.85 inches was obtained in the treatment of T5 after 25 days of seed germination, while after 50 days, highest plant height of 18.25inches was recorded in the treatment of T1. Lowest plant height of 8.35 and 13.80 inches was recorded in control as T9 after 25 and 50 days, respectively (Table 2). From the result it was showed that the following treatment as T1, T2, T3 and T5 were significantly higher compared to other treatments but was statistically significant to each other. It was concluded from the results that the plant height increased by addition of farm yard manure with the addition of

Table 4. Effect of organic and inorganic fertilizer on various morphological components.

Treatments	Leaf Area	Fresh weight (g)	Dry weight (g)
T1	60.20d	10.40e	4.00bc
T2	57.00bcd	8.80d	4.00c
T3	58.80cd	7.40c	3.60abc
T4	56.60bcd	8.80d	3.80bc
T5	58.00bcd	7.60c	3.20abc
T6	55.80bcd	6.80bc	3.60abc
T7	54.80bc	6.00ab	2.80a
T8	53.40ab	6.00ab	3.00ab
T9 (Control)	50.00a	5.40a	3.10ab
LSD	4.62	0.92	0.82

recommended fertilizer for maize crops. These results also confirmed the findings carried out by Borin and Sartori (1989). Data regarding leaf area, maximum leaf area (60.20) was recorded in T1 followed by T3, while minimum leaf area (50.00) was noted in control treatment as T9 are presented in Table 4. The result exhibited that T1, T3, T5 and T2 had significant effect on leaf area of maize crop. The result showed that all the treatments were statistically significant to each other for leaf area. The results are in line with those reported by Pietz et al. (1982) who observed a decline in leaf area with lower rates of organic matter application. For fresh plant weight, maximum value (10.40g) was recorded in T1 followed by T2 and T4 (5.78g) while minimum (5.40g) was showed in T9. The results of all treatments were significantly different to one another. It showed that applications of organic matter with inorganic fertilizer were having favorable effect on the fresh plant weight of maize crop. For dry plant weight the data are presented in Table 4 as maximum values of dry plant weight (4.00g) were recorded in T1 and T2 while the minimum values were recorded in T7 (2.80g). The result exhibited that all the treatments were statistically significant to each other for dry plant weight. The results indicated that application of organic matter with the recommended fertilizer rate was having favorable effect on the germination of maize crop.

CONCLUSIONS

Application of organic and inorganic fertilizers contributed greatly towards the growth and yield contributing attributes of the maize crop. From the data it was concluded that combination of organic and inorganic fertilizers increased maize yields. Increasing rates of natural fertilizers incorporated into the Haplic Luvisol ensured successive release of the available sulphur forms to the soil solution and resulted in a greater content of this nutrient in the maize plants.

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