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EFFECT OF ORGANIC AND INORGANIC SOURCES OF NITROGEN ON GROWTH AND YIELD ATTRIBUTES OF SUMMER MAIZE (*ZEA MAYS L.*)

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ABSTRACT

An experiment was conducted at the research farm center of Samhiggin Bottom institute of agriculture Science and Technology to investigate the effect of organic and inorganic source of Nitrogen on growth and yield attributes of summer Maize (Zea mays.L). The experiment is a three factorial combination testing Urea, Farmyard manure (FYM) and poultry manure (PM) at the various rates. *The result gives a significant outcome on plant height, number of leaves and dry weight with the combination of 90 kg N + 15 kg N FYM + 15 kg N through PM ha*$^{-1.}$

KEYWORDS: *Urea, FYM, and PM*

INTRODUCTION

Maize is one of the world's leading crops cultivated in many parts of the world. It is one of the important cereal crops in the world agricultural economy, both as food grains for human, especially in the developing world, and fodder and feed for cattle and poultry and industry (Choudhary, R. 2012). Nitrogen is the key element in crop growth and is the most limiting nutrient that reduce yield in maize plant in Indian soils and many parts of the world (Mio *et al.*, 2007). The importance of nitrogen for increasing the yield has been widely accepted. Nitrogen is a vital plant nutrient and a major yield determining factor required for maize production. It is an important nutrient for the growth of maize. Balko and Russel, (2000) reported that Nitrogen fertilization had variable effect on the ear number per plant and ear length of maize. Lack of nitrogen may interfere with some metabolites in maize; it is the basis of plant growth and makes up to 4% of dry matter of plants. Studies have shown that the use of conventional fertilizer alone as sources of nutrients to plants, especially in intensive cultivation, that may not be enough. It has also some detrimental consequences on the soil like depletion of micronutrients, which may lead to decrease in crop yield (Hepperly *et al*., 2009). It also gradually leads to decrease in soil structures and leaching of the excess fertilizer to pollute ground water and the surrounding areas, thus causing great pollution (Singh, 2000).

The organic manures are other sources of nitrogen, which have been in use for ages and are used to increase soil fertility and yield (Kolay,2007; Mir and Quadri, 2009). Apart from supplying almost all the nutrients for plants, organic manures also improved the physical, chemical and biological properties of the soils (Darzi and HajSeyed, 2012). Organic

fertilizers have beneficial effect, including, increased soil organic matter, cation exchange capacity and buffer capacity, increased mobility and availability of P and micronutrients due to organic matter complexation, increased soil water and nutrients holding capacity, improved soil structure, decreased bulk density, increased infiltration and reduced frequency of plant diseases (John *et al*.,2016; Oson and Papworth 2006)

Deficiency of nitrogen on maize causes yellowing of leaf margins and decrease in grain yield. It also affects plant weight, dry matter production, decrease in chlorophyll and soluble protein content and poor plant growth (Ding *et al.,* 2005). The present study was initiated to investigate the effect of different sources of organic and inorganic nutrients on growth and yield of Maize.

MATERIALS AND METHODS

The experiment was conducted at the research Farm, School of Agriculture,Allahabad SHUATS, during the Zaid season.The Crop Research Farm is located at 25^0 24' 42" N latitude 81^0 50' 56"E longitudes and 98 m altitude above the mean sea level. This area is situated on the right side of the river *Yamuna* and by the opposite side of Allahabad Rewa Road about 5 km away from Allahabad city. The soil of the experimental field located in the Central Gangetic alluvium is neutral. Pre-sowing soil samples were taken from a depth of 0 to 25 cm with the help of an auger and mixed thoroughly to prepare a composite sample. The composite samples were used for the chemical analysis. The soil was sandy loam in texture, low in organic carbon and medium in available nitrogen. The experiment is a three factorial laid out in Randomized Block Design, comprising of 10 treatment combinations each replicated three times. Treatments were randomly arranged in each replication, divided into 10 plots. The experimental field was thoroughly ploughed by tractor followed by harrowing and brought to fine tilth. Stubbles and weeds were picked up from the field and the land was leveled with the help of rake and the plots were demarcated according to layout. Fertilizers were applied as side placement, for which 4-5 cm deep furrows were made along the seed rows with a hand hoe. The nutrient sources were urea, and organic fertilizer (Farm yard manure and Poultry manure) at the rate of 120, 90,60, 45 and 30 kg ha^{-1}. Nitrogen was applied in three split doses ½ nitrogen, at the time of sowing and remaining ¼ nitrogen at 30 days after sowing and ¼ nitrogen at 60 days after sowing. Seeds were drilled at 3-4 cm depth in a straight line at a distance of 25 cm plant to plant and 60 cm row to row distance.

Plant heights were measured with the help of scale from the ground level up to the growing tips. The observations of the tagged plants were recorded at different growth stages, *viz*., 20, 40, 60, 80 and 100 DAS. The average height of plants of each replication was recorded. Similarly, the number of green leaves of maize was also recorded by counting. Dry weight of maize $plant^{-1}$ with root was recorded at 20, 40, 60,80 and 100 DAS by uprooting three plants randomly in each plot. These plants were chopped into small pieces and air dried. After air drying samples from each plot were kept in an electric oven at 70˚C for 72 hours. The average dry weight of samples was recorded and expressed in g $plant^{-1}$

RESULT AND DISCUSSIONS

The result for the routine analysis indicate the soil reaction to be neutral (pH 7.8) which is in conformity with what Das (2016) reported on soil of the area. The soils are alluvial in origin and soil reaction ranges between neutral and calcareous in nature. The EC value recorded was 0.7 mmhos/cm and it falls within the low salinity classification value as suggested by Dunkle and Merkle (1984). The organic carbon and nitrogen of the soils both falls within the deficiency class

which is typical characteristics of the Alluvial soil of the area describe by Biswal and Mukherjee (2016), they characterized the soils to be inherently deficient in N P and organic matter but not in potassium and lime. Soil texture is Sandy Loam (Table 1)

Effect of Organic and Inorganic Fertilizer on Plant Height of Summer Maize

There were significant influenced ($P<0.05$) treatments on the height of maize plant at different sampling time (20 DAS, 40 DAS, 60 DAS, 80 DAS and 100 DAS). The highest plant height (177.44cm) was recorded with treatment T_4 which was found to be statistically significant. The increment in plant height in treatment T_4, through a combination of urea,farmyard manure (FYM) and poultry manure (PM) at the rate of 90:15:15 might be due to incorporation of organic and inorganic nutrient sources, balanced carbon, nitrogen ratio, more organic matter buildup, better root proliferation, sustainable nutrient availability, accelerated transport and higher concentration of plant nutrients. These might have lead to better assimilation of photosynthetates and their efficient translocation from source to sink, resulting in an improvement in overall yield besides having a very fruitful effect on soil properties. Unagu *et al*.,(2013) reported an increase in Maize plant height as a result of application of organic and inorganic fertilizer and attributed it to an abundant supply of nutrients which is directly correlated to plant growth. The least value in plant height 125.22cm at 100DAS was recorded with T1, this could be due to inadequate supply of enough nutrients. The result obtained in this data clearly shows a significant difference among the treatments as the concentration increases, there is a corresponding increase in plant height with the exception of T3.T6 T9 and T10 where there is a sharp decrease in height. In case of T3, T6 and T9 the decrease in plant height might be due to the absence of FYM in the combination which has the capacity to hold nutrients and water and provide excellent site for cation exchange capacity for the proper utilization by the plant. In the case of T10 the decrease may be due to rapid volatilization loss of nitrogen from PM thereby reducing proper uptake of nitrogen to facilitate growth (Table2).

Effect of Organic and Inorganic Fertilizer on Number of Leaves in SUMMER Maize Plant

The result of combined application of organic and inorganic fertilizer recorded a significant difference ($P<0.05$) in treatments on the number of leaves in maize plants (Table 3). The highest number of leaves (13.66) recorded at 80DAS and 100DAS was obtained by application of treatment 4 (90kg N (urea),15kg FYM, and 15kg PM respectively. The increase could be attributed to the influence of the organic manures which is capable of improving the water holding capacity of the soil, improving soil aeration, enhancing the cation exchange capacity thereby allowing the plant to absorb nutrients. A similar observation was reported by Horst and Hardter (2006), they reported that organic matter improves soil moisture storage, decrease soil erosion and then minimize leaching of nutrients, especially nitrogen, contribute to Phosphorus availability and stimulates soil biological activities thereby enhancing nutrient uptake and facilitating vegetative growth.

Effect of Organic and Inorganic Fertilizer on Dry Weight of Summer Maize Plant

There was a significant effect ($P<0.05$) of treatments on dry weight on summer maize plant as shown in Table 4. The highest value of 143.45g was recorded with application of treatment 4 at 100 DAS, which is the combination of urea, farmyard manure (FYM) and poultry manure (PM) at the rate of 90kg, 15kg and 15kg respectively. The lowest value of 115.92g at 100 DAS was recorded with T1 (control).The increased in dry weight could be attributed to enhanced photosynthesis as a result of a steady supply of nutrient supply by the combine application of organic and inorganic fertilizers. The enhance photosynthesis will lead to rapid manufacture of food and rapid translocation to various parts of the

plant parts which leads to accumulation of food and nutrients thus leading to increased in dry matter. Choudhary and Kumar (2013) reported an increase in the uptake of nitrogen, phosphorus and potassium with application of poultry manure and vermicompost in maize, which lead to increase in dry weight concentration of maize plant.

Table 1: Physical and Chemical Properties of Soils of the Field

Soil Parameters	Values
pH(H_20)	7.8
EC dS/m	0.7
Organic carbon	0.42%
Organic matter	0.72
Total N (g/kg)	197
Available P (mg/kg)	23
Available K (mg/kg)	278
Sand	61.70
Silt	27.10
Clay	13.19
Textural Class	Sandy Loam

Table 2: Effect of Organic and Inorganic Nitrogen on Plant Height of Summer Maize

Treatments		Plant Height (cm)				
		20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
1	120 kg Nitrogen ha^{-1}	16.09	57.32	78.55	124.44	125.22
2	90 kg Nitrogen + 30 kg Nitrogen through FYM ha^{-1}	20.05	60.10	123.18	154.88	153.88
3	90 kg Nitrogen + 30 kg Nitrogen through PM ha^{-1}	21.22	67.36	135.11	148.77	147.66
4	90 kg Nitrogen + 15 kg Nitrogen FYM + 15 kg N through PM ha^{-1}	22.94	80.89	158.77	178.66	177.44
5	60 kg Nitrogen + 60 kg Nitrogen through FYM ha^{-1}	22.44	76.88	154.55	174.33	173.66
6	60 kg Nitrogen + 60 kg Nitrogen through PM ha^{-1}	21.55	75.00	147.89	160.77	159.66
7	60 kg Nitrogen + 30 kg Nitrogen FYM + 30 kg N through PM ha^{-1}	21.67	74.29	149.77	171.77	170.99
8	30 kg Nitrogen + 90 kg through FYM $ha^{-}1$	21.44	66.23	155.33	172.11	170.89
9	30 kg Nitrogen+ 90 kg through PM ha^{-1}	20.77	71.11	139.33	142.18	139.00
10	30 kg Nitrogen + 45 kg N FYM + 45 kg Nitrogen through PM ha^{-1}	21.33	62.00	126.22	140.00	153.00
F- test		NS	S	S	S	S
S. Ed. (±)		1.922	3.078	7.209	5.738	6.976
CD (P = 0.05)		-	6.353	14.878	11.844	14.399

FYM – Farm Yard Manure ; PM - Poultry Manure

Table 3: Effect of Summer Maize to Different Sources of Organic and Inorganic Nitrogen on Number of Leaves

Treatments		Number of Leaves Per Plant				
		20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
1	120 kg N ha^{-1} (260 kg urea)	4.60	7.77	10.00	12.00	11.66
2	90 kg N + 30 kg N through FYM ha^{-1}	4.81	8.00	11.00	12.22	12.11
3	90 kg N + 30 kg N through PM ha^{-1}	5.26	8.11	11.66	13.55	13.55
4	90 kg N + 15 kg N FYM + 15 kg N through PM ha^{-1}	5.88	8.66	12.22	13.66	13.66
5	60 kg N + 60 kg N through FYM $ha^{-}1$	5.85	8.61	12.22	13.66	13.33
6	60 kg N + 60 kg N through PM ha^{-1}	5.33	8.55	12.00	13.33	13.66
7	60 kg N + 30 kg N FYM + 30 kg N through PM ha^{-1}	4.77	8.22	12.11	13.44	13.11
8	30 kg N + 90 kg through FYM $ha^{-}1$	4.85	8.44	11.22	13.33	13.33
9	30 kg N + 90 kg through PM ha^{-1}	5.29	8.55	11.55	13.22	13.22
10	30 kg N + 45 kg N FYM + 45 kg N through PM ha^{-1}	4.74	8.22	10.77	13.00	13.00
F- test		S	NS	NS	NS	NS
S. Ed. (±)		0.387	0.498	0.659	0.671	0.781
CD (P = 0.05)		0.799	-	-	-	-

.FYM – Farm Yard Manure ; PM - Poultry Manure

Table 4: Effect of Summer Maize to Different Sources of Organic and Inorganic Nitrogen on Dry Weight

Treatments		Dry Weight(g)				
		20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
1	120 kg N ha^{-1}	0.57	4.11	58.32	93.32	115.92
2	90 kg N + 30 kg N through FYM ha^{-1}	0.69	5.15	73.11	116.80	142.30
3	90 kg N + 30 kg N through PM ha^{-1}	0.75	5.80	88.84	96.29	116.56
4	90 kg N + 15 kg N FYM + 15 kg N through PM ha^{-1}	0.79	6.05	90.12	120.15	143.45
5	60 kg N + 60 kg N through FYM ha^{-1}	0.81	5.76	90.00	120.02	142.73
6	60 kg N + 60 kg N through PM ha^{-1}	0.70	5.26	81.81	113.46	135.71
7	60 kg N + 30 kg N FYM + 30 kg N through PM ha^{-1}	0.74	5.54	89.20	117.80	137.26
8	30 kg N + 90 kg through FYM ha^{-1}	0.77	5.72	87.57	117.47	141.18
9	30 kg N + 90 kg through PM ha^{-1}	0.72	5.52	87.38	120.27	142.29
10	30 kg N + 45 kg N FYM + 45 kg N through PM ha^{-1}	0.67	5.35	82.35	119.29	142.02
F- test		NS	NS	S	S	S
S. Ed. (±)		0.155	0.723	3.827	5.084	5.036
C D (P = 0.05)		-	-	7.899	10.493	10.394

FYM – Farm Yard Manure ; PM - Poultry Manure

CONCLUSIONS AND RECOMMENDATION

This experiment generally shows that combine application of organic and synthetic fertilizer has the potentials in increasing the yield of maize crop in the field. Therefore, farmers should be encouraged to keep on combining the two components on their farms. Based on the outcome of this research, the following dose can be recommended for future use by the farmer, when the need arises - 90 kg N + 15 kg N FYM + 15 kg N through PM ha^{-1}

REFERENCES

1. *Balko and Russel, (2000). Response to inbred line to N fertilizer. Agron Journal, 72:723-728.*
2. *Biswas,T.D. and Murkherjee.S.K. (2016)Text Book of Soil Science second edition Mc Graw Hill education private limited P.387*
3. *Choudhary, R. (2012). Effect of integratoed nutrient management on quality protein maize Zea mays L. Crop Res. 44 (1 & 2): 26-29 Printed in India.*
4. *Swagatika Srichandan et al., Influence of Level and Time of Nitrogen Application on Different Growth Parameters in Baby Corn (Zea Mays L), International Journal of Agricultural Science and Research (IJASR), Volume 5, Issue 6, November-December 2015, pp. 211-216*
5. *Choudhary, V.K. and Kumar.P.S (2013) Maize production, economics and soil productivity under different organic source of nutrients in eastern himalayan region, India International Journal of Plant Production 7 (2): 1735- 8043*
6. *Darzi, M.T., Haj Seyed Hadi, M.R.(2012). Effects of organic manure and nitrogen fixing bacteria on some essential oil components of coriander (Coriandrum sativum). Int. J. Agri.Crop Sci., 4(12): 787 792.*
7. *Das,D.K.,(2016) Introductory Soil Science, Kalyani Publishers India. Chapter 11 p 182*
8. *Ding,L., Kwana.K.J., Jian.G.M., Biswal.D.K., Xu.H., Li,F., Li.H.Y, (2005) Effect of Nitrogen Deiciency photosynthetic Trait of Maize Hybrid Released in different years Ann Bot 95(5): 925-930.*

9. *Dunkle,E.C., and Merkle.F.G (1984) The conductivity of Soil extraction in relation to germinatio and growth of certain plant. Soil Sci.Soc. Amer. Proc. 8:185-188*
10. *Hepperly, P., Lotter, D., Ulsh, C.Z., Siedel, R., Reider, C. (2009). Compost, manure and synthetic fertilizer influences crop yields, soil properties, nitrate leaching and crop nutrient content. Compost Sci.Utilizat. 17: 117 126.*
11. *Horst, W. J. and Harder, R. (2006) Rotation of maize with cowpea improves yield and nutrient use of maize compared to maize monocropping in an alfisol in the northern Guinea Savanna of Ghana. Journal of Plant and Soil 160:171- 181.*
12. *Hannah K. Asangla & T. Gohain, Effect of Fodder Yield and Quality Attributes of Maize (Zea Mays L.) + Cowpea (Vigna Unguiculata L.) Intercropping and Different Nitrogen Levels, International Journal of Agricultural Science and Research (IJASR), Volume 6, Issue 2, March-April 2016, pp. 349-356*
13. *John,L.H., Samuel,L.T.,Wermer,L.,James,D.B.(2006) Soil Fertility and Fertilizers An Introduction to Nutrient Management, Pearson India Education Service p 413*
14. *Kolay, A.K. (2007). Manures and fertilizers. New Delhi, India. Atlantic Publishers and Distributors.*
15. *Mio,Y., D.J. Mulla.J.A., Hernandez.M.W. and Robert.P.C (2007) Potential impact of precision nitrogen management on corn yield, protein content and test weight. Soil Sci.Soc.A.MJ. 71:1490-1499*
16. *Mir, S.A., Quadri, S. (2009). Decision support systems: concepts, Progress andIssues A Review. In: Lichtfouse, E. (Ed.), Climate change, intercropping, pest control and beneficial microorganisms, sustainable. Agriculture Reviews 2. Springer Science Business Media B.V. Dordrecht, Netherlands. Pp. 373-339*
17. *Oson, B.M., Papworth, L.W. (2006). Soil chemical changes following manure application on irrigated alfalfa and rainfed timothy in southern Alberta. Can. J. Soil Sci., 86(1): 119 132.*
18. *Singh, R.B. (2000). Intensive agriculture during the green revolution has brought significant land and water problems relating to soil degradation over exploitation of ground water and soil pollution due to the uses of high doses of fertilizers and pesticides. Agric. Ecosyst. Environ.,82: 97 103.*
19. *Swagatika Srichandan, A. K. Mangaraj & A. Mohanty, Effect of Level and Time of Nitrogen Application in Baby Corn (Zea Mays L.), International Journal of Applied and Natural Sciences (IJANS), Volume 4, Issue 6, October-November 2015, pp. 29-34*
20. *Unagwu, B.O. Asadu C.L. and Ezeaku. P. I.(2013) Residual Effects of Organic and NPK Fertilizers on Maize Performance at Different Soil pH Levels Journal of Agriculture and Veterinary Science,Volume 5: PP 47-53*