DOI: 10.15740/HAS/AU/12.TECHSEAR(5)2017/1233-1236 *Agriculture Update*
Volume **12** | TECHSEAR-5 | 2017 | 1233-1236
Visit us : *www.researchjournal.co.in*

RESEARCH ARTICLE :

Effect of flyash and organic manures application on growth and yield of maize (*Zea mays* L.)

■ **GEETANJALI, K. NARAYANA RAO, M.V. RAVI, ASHOK KUMAR GADDI, MAHADEVASWAMY AND SHYAMARAO KULKARNI**

ARTICLE CHRONICLE :
Received :
15.07.2017;
Accepted :
30.07.2017

SUMMARY : A field experiment was conducted during the *Kharif* 2015 to study the growth and yield of maize as influenced by application of flyash and organic manures. The results revealed that the growth parameters of maize were favourably increased with application of flyash with organic manures and highest plant height (195.2 cm), number of leaves per plant (13.30) and dry matter production (283.89 g plant^{-1}) were reported in treatment receiving flyash @ 15 t ha^{-1} + municipal compost @ 15 t ha^{-1} along with RDF over other treatment combinations. The yield and yield components of maize were also influenced by combined application of flyash and different organic manures. The significantly highest average number of grain rows per cob (14.53), average number of grains per row (43.80), test weight (43.39 g), grain yield (8530 kg ha^{-1}) and stover yield (13272 kg ha^{-1}) recorded in the treatment receiving flyash @ 15 t ha^{-1} + municipal compost @ 15 t ha^{-1} along with RDF.

How to cite this article : Geetanjali, Rao, K. Narayana, Ravi, M.V., Gaddi, Ashok Kumar, Mahadevaswamy and Kulkarni, Shyamarao (2017). Effect of flyash and organic manures application on growth and yield of maize (*Zea mays* L.). *Agric. Update*, **12**(TECHSEAR-5) : 1233-1236; **DOI: 10.15740/HAS/AU/12.TECHSEAR(5)2017/1233-1236.**

KEY WORDS :
Maize, Flyash, Municipal compost, Vermicompost, FYM, RDF, Growth, Yield parameters

Author for correspondence :
GEETANJALI
Department of Soil Science and Agricultural Chemistry, College of Agriculture, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA
Email : geetrainbow88@gmail.com

See end of the article for authors' affiliations

BACKGROUND AND OBJECTIVES

Maize (*Zea mays* L.) is the world's third most important cereal crop after wheat and rice. It is one of the leading crop cultivated over an area of 184.2 mha and productivity of 5.57 t ha^{-1} in the world. In India, it is grown over an area of 9.5 mha with an average productivity of 2.45 t ha^{-1} (FAO STAT, 2014). In Karnataka, maize is cultivated over an area of 1.38 mha with an average productivity of 2.88 t ha^{-1} which is far below the potential. Similarly, in Raichur district area and productivity is 850 ha and 32.87 q ha^{-1}, respectively (FAO STAT, 2015)

Flyash is a resultant waste produced from the combustion of coal in thermal power plants. Its disposal poses a serious problem considering storage space and cost involved in it and dust pollution arising out of its fineness. About 130 coal-based thermal power stations in India are producing over 165 million tons flyash per year. Presence of essential plant nutrients such as N, P, K, Ca, Mg, S and micronutrients make it a source of plant nutrients (Pandey and Singh, 2010) and increases yield of several crops by its application. Apart from nutrition, flyash

generation is increased to 300 million tons per annum in 2017 and it expected to increase 900 million tons per annum by 2031-32. This will lead to major environmental problem. Both in disposal as well as in utilization, utmost care has to be taken to safeguard the interest of human life, wild life and environment (Central electricity authority India, 2012-13). A considerable amount of research has been carried out to blend flyash with varieties of organic and inorganic materials, like animal manure, poultry manure, sewage sludge, composts, pressmud, vermicompost, biochar, bio inoculants, *etc*. In combination with organic manure, flyash can enhance soil microbial activities, nutrient availability and plant productivity (Sikka and Kansal, 1995). Hence, keeping these above facts in view, present investigation was undertaken.

RESOURCES AND METHODS

The field experiment on effect of flyash and organic manures application on growth and yield of maize was conducted during the *Kharif* 2015 at Agricultural college farm, Raichur, situated on the latitude of 16° 15' N latitude and 77° 20' E longitude with an altitude of 389 meters above the mean sea level and is located in North Eastern Dry Zone of Karnataka. The soil of the experimental site was medium black and clay loam in texture with the available nitrogen (117.51 kg ha^{-1}), phosphorus (55.36 kg ha^{-1}), potassium (188.61 kg ha^{-1}), sulphur (14.39 kg ha^{-1}) and organic carbon content (5.10 g kg^{-1}) (Table A). The experiment included eight treatments consisted of T_1: Control, T_2: Flyash @ 30 t ha^{-1}, T_3: FYM @ 10 t ha^{-1}, T_4: Muncipal compost @ 30 t ha^{-1}, T_5: Vermicompost @ 5 t ha^{-1}, T_6: Flyash @ 15 t ha^{-1} + FYM @ 5 t ha^{-1}, T_7: Flyash @ 15 t ha^{-1}+ Muncipal compost @ 15 t ha^{-1}, T_8: Flyash @ 15 t ha^{-1} + Vermicompost @ 2.5 t ha^{-1}.

Certified seeds of C-818 were used for investigation. Recommended dose of fertilizers were applied as per the treatment details. The amendments like flyash, municipal compost, vermicompost and FYM were analysed before using for experiment (Table B) and were applied 30 days before sowing as per treatments. Nitrogen, phosphorus and potassium were applied in the form of urea, diammonium phosphate (DAP) and muriate of potash (MOP), respectively and zinc was applied in the form of $ZnSO_4$ @ 25 kg ha^{-1}. All these nutrients were applied 5 cm away from the seed line and 5 cm deep in to soil. Basal dose of fertilizer (half of nitrogen and full dose of phosphorus and potassium) was applied at the time of planting and remaining half of nitrogen was applied at 30 DAS. Five plants per plot were selected randomly in the net plot area and tagged for observations at critical stages (30, 45, 60 DAS and at harvest) for recording growth and yield parameters.

Table A : Initial properties of soil of experimental site

Particulars	Values
Soil pH	8.02
EC (dSm^{-1})	0.25
OC (g kg^{-1})	5.10
Nitrogen (N)	117.51
Phosphorus (P_2O_5)	55.36
Potassium (K_2O)	188.61
Sulphur (S)	14.39
Iron (mg kg^{-1})	5.68
Copper (mg kg^{-1})	1.24
Manganese (mg kg^{-1})	12.43
Zinc(mg kg^{-1})	0.52

Table B : Properties of amendments used in experiment

Particulars	FA	FYM	MC	VC
Soil pH	7.98	7.00	7.65	6.97
EC (dS m^{-1})	1.86	0.70	2.80	1.50
OC (%)	1.50	11.50	17.24	31.60
Total N (N) (%)	0.056	0.98	1.3	3.5
Total P (P_2O_5) (%)	0.082	0.014	0.72	0.258
Total K (K_2O) (%)	2.100	1.500	2.28	0.870
Total S (S) (%)	0.550	0.680	0.57	0.60
Total Fe (mg kg^{-1})	13.02	25.60	350.64	39.80
Total Cu (mg kg^{-1})	1.70	3.40	6.98	3.50
Total Mn (mg kg^{-1})	9.40	125.6	135.2	136.50
Total Zn (mg kg^{-1})	28.50	20.32	118.70	29.84

OBSERVATIONS AND ANALYSIS

In the present study, the application of FA @ 15 t ha^{-1} + MC @ 15 t ha^{-1} along with RDF exerted significant influence on the grain and stover yield of maize. The highest grain and stover yield was obtained with application of FA @ 15 t ha^{-1} + MC @ 15 t ha^{-1} along with RDF (8530 kg ha^{-1} and 13272 kg ha^{-1}, respectively) and it was at par with T_6 and T_8, these treatments were significantly superior over control (Table 1). An increase in grain yield due to increase in yield components especially average number of grain rows per cob, average number of grains per row and higher test weight. This is

Table 1 : Effect of fly ash and organic manures application on test weight and yield of maize

Treatments	Test weight (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1: RDF	36.5	4010	6492
T_2: FA @ 30 t ha^{-1}	37.56	6023	9511
T_3: FYM @ 10 t ha^{-1}	37.89	5300	8427
T_4: MC @ 30 t ha^{-1}	37.42	5830	9222
T_5: VC @ 5 t ha^{-1}	39.56	5970	9432
T_6: FA @ 15 t ha^{-1} + FYM @ 5 t ha^{-1}	38.65	6906	10835
T_7: FA @ 15 t ha^{-1}+ MC @ 15 t ha^{-1}	43.39	8530	13272
T_8: FA @ 15 t ha^{-1} + VC @ 2.5 t ha^{-1}	39.97	7500	11727
S.E.±	1.25	54.55	915
C.D. (P=0.05)	3.73	162.4	2723

Table 2 : Effect of fly ash and organic manures application on yield parameters of maize

Treatments	Number of grain rows cob^{-1}	Number of grains row^{-1}
T_1: RDF	13.00	30.53
T_2: FA @ 30 t ha^{-1}	13.20	37.47
T_3: FYM @ 10 t ha^{-1}	12.93	36.53
T_4: MC @ 30 t ha^{-1}	12.80	37.80
T_5: VC @ 5 t ha^{-1}	13.40	40.07
T_6: FA @ 15 t ha^{-1} + FYM @ 5 t ha^{-1}	13.53	40.80
T_7: FA @ 15 t ha^{-1}+ MC @ 15 t ha^{-1}	14.53	43.80
T_8: FA @ 15 t ha^{-1} + VC @ 2.5 t ha^{-1}	14.20	41.00
S.E.±	0.73	1.04
C.D. (P=0.05)	1.01	3.09

due to interaction of flyash and manures in combination with the fertilizer meet the crop demand sufficiently (Arivazhagan *et al*., 2011), it increases crop growth and yield hence all the treatments which includes flyash and manures attained healthy and vigorous growth of crop, more seed setting and increased seed weight.

Higher test weight of (45.19 g), average number of grain rows per cob (14.53) and average number of grains per row (43.80) were obtained with application of (T_7): FA @ 15 t ha^{-1} + MC @ 15 t ha^{-1} along with RDF over other treatments. And lowest test weight of (36.5 g) average number of grain rows per cob (13.00) and average number of grains per row (30.53) recorded in the control treatment. Selvakumari *et al*. (2000) reported that the yields were highest when flyash applied in combination with compost and fertilizer.

A significantly higher number of leaves (13.30) and plant height (195.2 cm) with the treatment (T_7): FA @ 15 t ha^{-1} + MC @ 15 t ha^{-1} along with RDF recorded at harvest (Table 3). It was at par with (T_6) and (T_8) over control and rest of the treatments was due to balanced supply of plant nutrients through application of FA and organic manures along with RDF it will helps in promoting plant growth. The results of this investigation are consonance with the findings of Das *et al*. (2013), who also opinion that the significantly increasing plant height due to the improvement in availability of native soil nutrients and synchronized uptake of nutrients.

Highest dry matter accumulation was recorded in the treatment (T_7) : FA @ 15 t ha^{-1} + MC @ 15 t ha^{-1} along with RDF (283.89 g plant^{-1}) and it was at par with the treatment of T_6: FA @ 15 t ha^{-1} + FYM @ 5 t ha^{-1} along with RDF (267.22 g plant^{-1}) and T_8: FA @ 15 t ha^{-1} + VC @ 2.5 t ha^{-1} along with RDF soil application (275.83 g plant^{-1}) and significantly superior over other treatments. Increased in dry matter productions in the treatments were attributed to higher photosynthetic capacity of plants, which depends upon number of leaves, plant height. Similar results were reported by Meena *et al.* (2006). Both flyash and organic manures are the main source of major and micronutrient. Hence, its application to soil improves the availability of these nutrients in soil upon decomposition and increased the crop growth and yield of maize.

Table 3 : Effect of fly ash and organic manures application on growth parameters of maize at harvest

Treatments	Plant height	Number of leaves per plant	Total dry matter production (g plant^{-1})
T_1: RDF	136.0	11.00	238.06
T_2: FA @ 30 t ha^{-1}	177.6	12.30	255.83
T_3: FYM @ 10 t ha^{-1}	168.1	12.00	239.39
T_4: MC @ 30 t ha^{-1}	173.3	11.30	246.50
T_5: VC @ 5 t ha^{-1}	176.9	11.70	248.61
T_6: FA @ 15 t ha^{-1} + FYM @ 5 t ha^{-1}	184.2	13.00	267.22
T_7: FA @ 15 t ha^{-1}+ MC @ 15 t ha^{-1}	195.2	13.30	283.89
T_8: FA @ 15 t ha^{-1} + VC @ 2.5 t ha^{-1}	188.0	13.00	275.83
S.E.±	5.4	0.23	8.5
C.D. (P=0.05)	16.2	0.68	36.0

Note: NPK @ 150:75:37.5 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} was applied for all treatments

Conclusion :

From this study, it can be concluded that application of flyash and organic manures increased the growth and

yield of maize, among the treatments T_7: FA @ 15 t ha^{-1} + MC @ 15 t ha^{-1} along with RDF recorded highest followed by T_6: FA @ 15 t ha^{-1} + FYM @ 5 t ha^{-1} and T_8: FA @ 15 t ha^{-1} + VC @ 2.5 t ha^{-1}. Hence, combined application of both flyash and organic manures going to increase nutrient status of soil, improves the soil properties hence there will be tremendous increase in growth and it leads to higher yield and benefit to growers.

Authors' affiliations :

K. NARAYANA RAO, M.V. RAVI AND ASHOK KUMAR GADDI, Department of Soil Science and Agricultural Chemistry, College of Agriculture, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA

MAHADEVASWAMY, Department of Agricultural Microbiology, College of Agriculture, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA

SHYAMARAO KULKARNI, Department of Agronomy, College of Agriculture, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA

REFERENCES

Arivazhagan, K., Ravichandran, M., Dube, S. K., Mathur, V. K., Khandakar, R. K., Yagnanarayana, K., Pasha, M. M. K., Sinha, A. K., Sarangi, B. D., Tripathi, V. K. M. and Gupta, S. K. (2011). Effect of coal flyash on agriculture crops: showcase project on use of flyash in agriculture in and around thermal power station area of national thermal power corporation Ltd., India. *World of coal ash conference*, Denver, USA.

Central electricity authority India, 2012-13, Annual report on fly-ash utilization.

Das, B.K., Choudhury, B.H. and Das, K.N. (2013). Effect of integration of flyash with fertilizers and FYM on nutrient availability, yield and nutrient uptake of rice in Inceptisols of Assam, India. *Internat. J. Res. Tech.*, **2**(11): 2278-7763.

FAOSTAT (Food and Agriculture Organization of the United Nations Statistics Division), 2014. *http://faostat.fao.org/default.aspx*.

FAOSTAT (Food and Agriculture Organization of the United Nations Statistics Division), 2015. *http://faostat.fao.org/default.aspx*

Meena, M.C., Patel, K.P. and Rathod, D.D. (2006). Effect of Zn and Fe enriched FYM in mustard, *Brassica juncea* (L.) czern and coss yield and quality. *J. Oilseeds Res.*, **22**(2): 331-335.

Pandey, V. C. and Singh, N. (2010). Impact of flyash incorporation in soil systems. *Agric. Ecosyst. Environ.*, **136** : 16–27.

Selvakumari, G., Bhaskar, M., Jayanthi, D. and Mathan, K.K. (2000). Effect of integration of flyash and fertilizers and organic manure on nutrient availability, yield and nutrient uptake of rice on Alfisols. *J. Indian Soc. Soil Sci.*, **48** : 268-278.

Sikka, R. and Kansal, B.D. (1995). Effect of flyash application on yield and nutrient of composition rice, wheat and on pH and available nutrient status of soils. *Bioresource Tech.*, **51** : 199–203.