Research Article

iMedPub Journals
http://www.imedpub.com/

European Journal of Experimental Biology
ISSN 2248-9215

2018
Vol.8 No.4:23

DOI: 10.21767/2248-9215.100064

Impression of Disparate Levels of Poultry Manure and Humic Acid on the Yield and Yield Traits of Maize (*Zea Mays L.*)

Abid Hussain[1], Subhanullah[2], Mukhtiar Ali[1*], Waqar Ali[1], Muhammad Tariq[1], Shabir Muhammad[1], Mussadiq Khan Khalil[1] and Muhammad Owais Khan[1]

[1]Department of Soil and Environmental Sciences, The University of Agriculture, Peshawar, Pakistan

[2]Cereal Crops Research Institute, Pirsabak, Nowshera, Pakistan

[*]**Corresponding author:** Mukhtiar Ali, Department of Soil and Environmental Sciences, The University of Agriculture, Peshawar, Pakistan, E-mail: mukhtiar@aup.edu.pk

Received date: March 24, 2018; **Accepted date:** June 27, 2018; **Published date:** July 10, 2018

Citation: Hussain A, Subhanullah, Ali M, Ali W, Tariq M, et al. (2018) Impression of Disparate Levels of Poultry Manure and Humic Acid on the Yield and Yield Traits of Maize (*Zea Mays L.*). Eur Exp Biol Vol. 8 No. 4:23.

Abstract

Use of inorganic fertilizers have some problems to farmers in terms of high cost and short residual effect. Since use of organic fertilizers have a long residual effect but the nutrient requirement of crops is not fulfill in one season. So, using of combination of different organic manures can not only improve soil properties but also fulfill the nutrients requirement of crops. Therefore, a study was carried out aiming use of combinations of organic manures to improve maize yield and quality at the Cereal Crops Research Institute (CCRI), Pirsabak District Nowshera, KP, Pakistan during Kharif 2016. Poultry Manure (PM) and Humic Acid (HA) combinations were used as treatments including T1=Control, T2=2.5 tons PM ha^{-1}+5 kg HA ha^{-1}, T3=5 tons PM ha^{-1}+4 kg HA ha^{-1}, T4=7.5 tons PM ha^{-1}+3 kg HA ha^{-1}, T5=10 tons PM ha^{-1}+2 kg HA ha^{-1} and T6=12.5 tons PM ha^{-1}+1 kg HA ha^{-1}. A basic dose of NPK was applied at the rate of 60:40:30 kg N, P and K ha^{-1}. The results showed that highest days number to tasseling (55) and to silking (56) were recorded when PM and HA were applied at the rate of 12.5 tons PM ha^{-1}+1 kg HA ha^{-1} as compared with control plots. Highest plant height (185.33 cm), leaf area (411.26 cm^2), cob length (17.0 cm), grains number cob^{-1} (413), grain yield (4783.3 kg ha^{-1}), 1000 grain weight (413 g) and stover yield (13197 kg ha^{-1}) were produced when PM and HA were applied at the rate of 12.5 tons PM ha^{-1} and 1 kg HA ha^{-1} as compared with the control plots. It is recommended that use of HA and PM in blending not only improves crop yield but also has a long term residual effect and improve soil properties as well.

Keywords: Maize yield; Humic acid; Poultry manure; Kharif crop; CCRI; Pakistan

Introduction

Maize botanically called *Zea mays L.* belongs to the family *Poaceae*. The mentioned crop is one of the most prevailing cereal crops of the world. Maize ranked 3rd afterward wheat and rice. It is an annual cross-pollinated crop having erect, thick and strong culms or stalk with nodes and internodes having adventitious roots that helps in preventing it from logging. It has a short growth duration and has a potential of higher yield and thus is a great source of food and fodder. Maize and corn meal are used as a staple food in many regions of the world. In industries maize is used for the preparation of corn oil, corn flakes, corn syrups etc. maize is a major source of starch, which can also be used in preparation of plastics, fabrics, adhesives, and many oilier chemical products. It is also used in the production of ethanol, which is a bio-fuel. Maize set up 6.4% of the total grain production in the country which is very good in compare to other cereal crops and contribute alots in the national economy and is used as a virtuous source for food and feed as a fodder. In Pakistan maize is grown on an area of 1053 thousands ha, with production of 3595 thousands tones and average yield is 3416 kg ha^{-1}, while in province it is grown on an area of 510 thousand ha, with total production of 959 thousand tones and average yield is 1881 kg ha^{-1} (MINFAL 2007).

PM is an organic manure which assist in enhancing the nutrient availability and also improving the physical properties of soil. The PM and HA so produced is disposed of in several methods, including burning. However, some farmers are aware of the importance effects of PM and HA its release of different gases and nutrients for a good response in crop growth. Use of PM is therefore mostly used for improving crop productivity in Pakistan. The advantageous impact of the addition of HA to soil is linked with the improvement in physicochemical and biological conditions of soils [1].

It is thought that PM and HA are the small reservoir of N, but is in a very stable form which assists as slow releasing N fertilizer. Various micronutrients are also present in HA that are chelated by that HA [2]. PM makes the soil porous and improve water holding capacity. These chelates (HA and PM) can adjust the supply of micronutrients and thus promoting the activity of microorganisms in soil [3]. HA employs a stimulatory, conditioning and growth enhancing effect on soil when applied in combination with inorganic fertilizers because of its

properties to hold nutrients and to release them when they are required by plants [4]. A commercial hamate consisted of 58% organic matter, 32% ash and 10% moisture. HA contains two fraction of the nutrients of which mostly is present in HA while in fulvic acid form less nutrients is present. The organic basic primary nutrients composition (59% C, 5% H and 36% O) likewise recommend the HA nature. HA is a natural product that implies growth promotion when applied it in combination with inorganic fertilizers.

Materials and Methods

To investigate the impact of PM and HA on the growth and yield of maize crop, an experiment was conducted at the Cereal Crops Research Institute (CCRI), Pirsabak Nowshera Khyber Pakhtunkhawa during Kharif 2016. The experiment was carried out in randomized complete block design with three replications (Table 1).

Table 1. Different levels of Poultry Manure (PM) and Humic Acid (HA).

Treatments	Poultry Manure (t ha^{-1})	Humic Acid (kg ha^{-1})
T1	0	0
T2	2.5	5
T3	5	4
T4	7.5	3
T5	10	2
T6	12.5	1

A plot size of 18.75 m^2 (5 rows, 5 m long and 0.75 m apart) was used. Both the factor levels were applied and mixed in soil before sowing according to the treatments. Basal dose of NPK were applied at the rate of 60:40:30 kg NPK ha^{-1}. Urea was applied in three split applications while all P and K were applied at the time of sowing. Maize variety Azam was used as a test crop. Soil samples were collected and physicochemical characteristics of the experimental site were determined. The soil on which experiment was carried out were alkaline with the pH of 7.66, non-saline having EC 1.34 dSm^{-1}, content of organic matter was low (0.85%) and AB-DTPA extractable P (3.02 mg kg^{-1}) [5-8].

Data on days to tasseling and silking, plant height, leaf area, cob length, grains cob^{-1}, grain yield, 1000 grain weight and stover yield at harvest was recorded during the experiment (Figures 1 and 2).

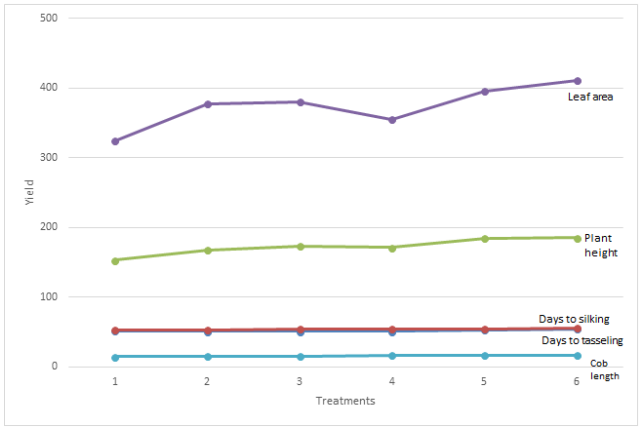

Figure 1. Graphical representation for Leaf area, Days to tasseling, Days to silking, Plant height and Cob length.

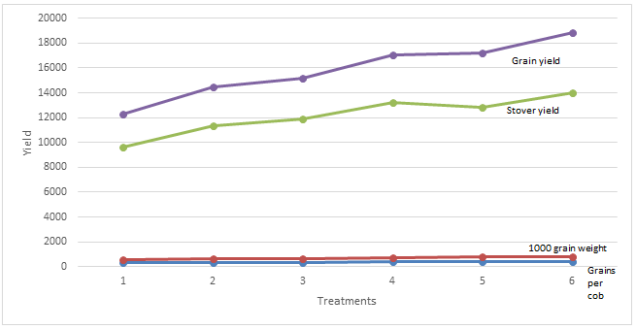

Figure 2. Graphical representation for Grain yield, Stover yield, Grain per cob, 1000 grain weight.

Days to tasseling

Days to tasseling were counted from the data of sowing when 75% tassels appeared in each treatment.

Days to silking

Days to silking were counted from the data of sowing when 75% silks appeared in each treatment.

Plant height

Plant height of five randomly selected plants was measured with the help of meter rod from ground level to the flag leaf and then average plant height was calculated.

Mean Leaf Area

Leaf area was calculated from three randomly selected plants in each plot and three leaves were measured in each plant. Leaf area for individual leaf was determined by measuring the length of leaf blades from their base to the leaf tip and width taken in three parts of leaf (starting point, mid of leaf and end point) and average leaf length (Leaf L) and leaf width (Leaf W) were

calculated from all three plants and multiplied these values with a correction factor (0.75) as shown in the equation given below,

Leaf Area=Leaf L × Leaf W × 0.75

Cob Length

For the parameter cob length five cobs were selected from each plot and cob length was measured with the assist of measuring tape and average cob length was calculated.

Grains per cob

For the above parameter five cobs were randomly carefully chosen from each plot, shelled and the number of grains was counted and then averaged.

1000 Grain weight

Mentioned weight was calculated by taking one thousand counted grains from each plot and their weights were determined by using digital gram scale.

Stover yield at harvest

For stover yield at harvest, whole plots were harvested and weighted with the help of spring balance and then stover yield at harvest ha^{-1} was calculated.

Grain yield

Whole plots (5 rows, 5 m long) were harvested at maturity, cobs were removed, fresh air weight and moisture content (%) at harvest were determined. Then five cobs were randomly sampled, dried, shelled and shelling percentage was determined. Then grain yield (kg ha^{-1}) from each plot was determined using the formula [9-10].

Yield of Maize grain was determined and converted by the following formulas,

Grain Yield (kg plot^{-1})=(100-Moisture (%) at harvest) × Fresh air weight plot^{-1} (kg) × Shelling (%) / (100-Store Grain Moisture (15%)) × 100

Grain Yield (kg ha^{-1})=Grain yield (kg plot^{-1}) × 10000m^2 / Plot size (m^2) × 1 ha

Results

The results revealed that all of the paramaters are significantly affected by differences in the levels of HA and PM (Table 2). Highest plant height were obtained from HA and PM applied at 1 kg+12.5 kg ha^{-1}. Similar is the case with leaf area, cob length, grains cob, 1000 grain weight, stover yield and grain yield, all of them were giving high values when applied HA and PM at 1 kg+12.5 kg ha^{-1}. In Days to tasseling and silking, treatments 1, 2, 3 and 4 were not statistically significant while treatment 5 and 6 showed delayed in tasseling and silking and were significantly different from the mentioned treatments. Plant height was statistically significant, highest plant height were obtained from treatment 6 having PM and HA applied at 12.5 tons and 1 kg ha^{-1}. Treatments effect on leaf area were also statistically significant. More leaf area were obtained from treatment 6 followed by T5 and so on. Long cob length were obtained from T6 fallowed by T5, T4, T3, T2 and the control (14.8 cm) effect on cob length were short in comparison to other treatments. Using PM and HA in combination can abruptly fulfill plant nutrients demand and also improve soil properties that can ultimately help in settling of nutrients in soil for a long period of time. Grains per cob were maximum in T6 (413) by applying PM and HA at 12.5 tons and 1 kg ha^{-1} followed by T5 (400) where PM and HA were applied at 10 tons and 2 kg ha^{-1} and so on. 1000 grain weight were found maximum in T6 where PM and HA were applied at 12.5 tons and 1 kg ha^{-1}, may be due to the high proteins content by uptaking high amount of nitrogen by plant. Similarly stover yield were also found maximum in T6 (13197 kg ha^{-1}) fallowed by T4 (12541 kg ha^{-1}). Grain yield were found maximum in T6 (4783.3 kg ha^{-1}) and were found significantly different from all others treatments [11-15].

Table 2: The effects of Humic Acid (HA) and Poultry Manure (PM) on wheat yield parameters.

Treatments	Days to tasseling	Days to Silking	Plant height	Leaf area	Cob length	Grains cob^{-1}	1000 grain weight	Stover yield	Grain yield
1	52BC	53B	153.00C	324.33C	14.8C	317D	252D	9022C	2682.7E
2	51C	53B	167.67BC	377.33AB	15.0C	339C	274C	10725BC	3161.7D
3	51C	54B	173.00AB	380.45AB	15.3BC	359C	294C	11222AB	3259.0 D
4	51C	54B	171.33AB	355.44BC	16.2AB	380B	315B	12541AB	3799.7C
5	53AB	55A	184.33A	395.29AB	16.3AB	400AB	400AB	12039AB	4336.7B
6	55A	56A	185.33A	411.26A	17.0A	413A	413A	13197A	4783.3A

LSD Test=0.05

All the results were significantly affected by different levels of Humic Acid (HA) and Poultry Manure (PM)

Discussion

Use of inorganic fertilizers in up-to-date intensive cropping system is highly used for enhancing production and completely ignoring organic fertilizers usage. Use of inorganic fertilizers at an increasing rate is very upsetting especially nitrogenous fertilizers and it will be two fold by the end of 2050. Using HA and PM in combinations is very helpful in utilizing nutrients to plants but also improving soil properties. This study was used to evaluate the impact of organic manures different levels on maize yield and yield traits. The effect of HA were been found beneficial over yield parameters [16-17]. Variations in soil, climate, crop species and cultural practices can affect the degree and response of crop towards HA. About 20-45% of wheat and maize crop yield is increases with the application of HA derived from coal in Peshawar valley calcareous soils. Plant growth is improving by the application of HA because of its effect on rhizosphere and root enzymes [18]. PM uses improve plant growth as it provide nutrients as it contains enough essential micronutrients compared to other manures. PM uses are helpful in improving soil fertility status, enhances organic matter content, soil microbes activities and improving water holding capacity of soil. PM's application to soil can enhance crop plant height by 10.6% as by comparing with the control treatment [19]. Maximum number of grains per year were obtained by the application of integrated organic effect due to its long term residual effect. The increment in biomass of maize crop is due the longterm residual effect of organic fertilizers [20]. Integrated usage of organic manures can resulted in enhancement of grain cob^{-1}, harvest index, grain weight and grain yield [21].

Conclusions

The following conclusions are drawn from the results of the conducted research work:

Mixed applications of PM and HA with basal dose of NPK enhance grain yield, grains per cob, 1000 grain weight, cob length and stover yield of maize [22-25].

Plant height and leaf area were significantly increased by the applications of PM and HA along with basal dose of NPK in area under investigation.

Days to tasseling and silking were delayed significantly by the applications of PM and HA with basal dose of NPK [26-31].

References

1. Brannon CA, Sommers LE (1985) Preparation and Characterization of model Humic polymers containing Organic Phosphorous soil. Biological Biochemistry 17: 213-219.
2. Brannon PP, Wilson MA (1981) Humic acid and coal structure study with Magic Angle Spinning. Nature 9: 289-293.
3. Bhardwaj KK, Gaur AC (1970) The Effect of HA on the Growth and Efficiency of N Fixation of Azotobacter Ohroococum. Folia 15: 367.
4. Linchen DJ (1978) 1-IA-FC uptake by Plants. Journal of Plants and Soil 50: 663-670.
5. Agyenim B, Zickermann J, Kornahrens M (2006) Poultry manures effect on growth and yield of maize. West Africa Journal of Applied Ecology.
6. Ahmad F, Tank KH (1991) Availability of fixed phosphate to corn seedlings as affected by HA. Indonesian Journal of Tropical Agriculture 2: 66-72.
7. Ali K, Munsif F, Zubair M, Hussain Z, Shahid M, et al. (2011) Management of organic and inorganic nitrogen for different maize varieties. Sarhad J Agric 27: 525-529.
8. Amujoyegbe BA, Opabode JT, Olayinka A (2007) Effect of organic and inorganic fertilizer on yield and chlorophyll content of maize (Zea mays L) and Sorghum (Sorghum bicolour L Moench). African Journal of Biotechnical 6: 1869-1873.
9. Arif M, Ali K, Munsif F, Ahmad W, Ahmad A, et al. (2012) Effect of biochar, FYM and nitrogen on weeds and maize phenology. Pak J Weed Sci Res 18: 475-484.
10. Boateng S, Zickermann AJ, Kornaharens M (2006) Effect of poultry manure on growth and yield of maize. West Africa J App Eco 9: 1-11.
11. Deksissa T, Short I, Allen J (2008) Effect of soil amendment with compost on growth and water use efficiency of Amaranth. In: Proceedings of the UCOWR/NIWR annual conference: International water resources: challenges for the 21st century and water resources education, July 22-24, 2008, Durham, NC.
12. Farhad, Saleem MF, Cheema MA, Hammad HM (2009) Effect of Poultry Manure levels on the Productivity of Spring Maize (Zea Mays L.). Journal of Animal and Plant Sciences 19: 122-125.
13. Gajri PR, Arora VK, Chaudhary MR (1994) Maize growth responses to deep tillage straw mulching and farmyard manure in a coarse textured Soils of NW India. Soil Use Manage 10: 15-20.
14. Garg S, Bahla GS (2008) Phosphorus availability to maize as influenced by organic manures and fertilizer P associated phosphatase activity in soils. Bioresource Technology 99: 5773-5777.
15. Hakan C, Katkat AV, Asik BB, Turan MA (2010) Effect of foliar-Applied humic acid to dry weight and mineral nutrient uptake of maize under calcareous soil condition. Communication in Soil Science and Plant Analysis 42: 29-38.
16. Hai SMA, Mir S (1998) The lignitic coal derived humic acid and the prospective utilization in Pakistan's agriculture and industry. Science Technology and Development. 17: 32-40.
17. Mishra VK, Srivastava MK, Raizada RB (1998) Testicular toxicity in rat to repeated oral administration of tetramethylthiuram disulfide (Thiram). Indian Journal of Experimental Biology 36: 390-394.
18. Vaughan D, MacDonald IR (1976) Some effects of humic acid on cation uptake by parenchyma tissue. Soil Biology and Biochemistry 8: 415-421.
19. Tahir M, Ayub M, Javeed HMR, Naeem M, Rehman H, et al. (2011) Effect of Different Organic Matter on Growth and Yield of Wheat (Triticum aestivum L). Pak Life Soc Sci 9: 63-66.
20. Talathi MS (2001) Studies on integrated nutrient management in rice based crop sequences. Ph.D. (Agri.) Dissertation, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, India.
21. Ramamurthy V, Shivashankar K (1996) Residual effect of organic matter and phosphorus on growth, yield and quality of maize. Indian J Agron 41: 247-251.

22. Hileman LH (1991) Effect of Rate of Poultry manure Application on Selected soil Chemical properties. Proc of International symposium on livestock wastes. Am SOL of Agric Engineers. St. Jos. Michigan 247-248.

23. Ibeawuchi II, Opara FA, Tom CT, Obiefuna JC (2007) Graded replacement of inorganic fertilizer with organic manure for sustainable maize production in Owerri Imo State, Nigeria. Life Sci J 2: 82-87.

24. Ihsanullah D, Bakhashwain AA (2013) Effect of Humic Acid on Growth and Quality of Maize Fodder production. Pakistan Journal of Botany 45: 21-25.

25. Khattak RA, Muhammad D (2005) Increasing Crop Production through Humic Acid in Salt Affected Soils in Kohat Division (KPK)-First Technical Progress Report 3.

26. Ma BL, Dwyer LM, Gregorich EG (1999) Soil nitrogen amendment effects on nitrogen uptake and grain yield of maize. Agron J 9: 650-656.

27. MINFAL (2007) Ministry of Food, Agriculture and Livestock. Agriculture Statistics of Pakistan. Government of Pakistan Islamabad 18-19.

28. Obi ME, Ebo PO (1995) The effect of organic and inorganic amendments on soil physical properties and maize production in a severely degraded sand loamy soil in Southern Nigeria. Resource Technology 51: 117.

29. Passera C, Nicolao L, Ferretti M, Ghisi R (1991) Effect of Humic Substance on Enzyme activities of S assimilation and Chloroplast ultra-structure of Maize leaves. Photosynthetic Italy 25: 39-45.

30. Sarwar GT, Hussain N, Schmeisky H, Sarwar S, Hussain GN, et al. (2007) Use of compost an environment friendly technology for enhancing rice-wheat production in Pakistan. Pakistan Journal of Botany 39: 1553-1558.

31. Stevenson FJ (1994) Cycles of soil, Carbon, Nitrogen, Phosphorus, Sulfur and Micronutrients. John Wiley and Sons, Inc. New York.