Research Article

Integrated management of compost type and fertilizer-N in Maize

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Citation

Babar Iqbal, Muhammad Tariq Jan, Inamullah, Imran, Asad Ali Khan, Zar Muhammad, Shazma Anwar, Shehryar Khan, Shamsuddin Baqa and Amjad Usman. Integrated management of compost type and fertilizer-N in Maize. Pure and Applied Biology. Vol. 4, Issue 4, 2015, pp 453-457. <http://dx.doi.org/10.19045/bspab.2015.44001>

Received: 23/04/2015

Revised: 02/11/2015

Accepted: 12/11/2015

Abstract

To study the integrated management of compost type and Fertilizer-N on maize a field trial was carried out at New Developmental Farm of The University of Agriculture Peshawar, during summer 2012. The experiment was laid out in randomized complete block design having three replications and a plot size of 18m² (4m x 4.5m) having 6 rows 75 cm apart. All plots except control (no compost) were supplied with compost from 3 various sources .i.e. cereal, legume and FYM in such a way that 150 kg N ha⁻¹ was ensured based on nitrogen concentration. These plots either were supplemented with half of recommended N .i.e. 75 kg ha⁻¹ from fertilizer (urea) or without fertilizer-N. Phosphorus was supplied at the rate of 75 kg ha⁻¹. Data was recorded on grains ear⁻¹, ear plant⁻¹, thousand grain weight and grain yield. Compost type significantly affected all parameters. Higher ears plant⁻¹ (1.2) and thousand grain weight (254.33 g) was recorded in FYM compost. Higher grains ear⁻¹ (297) and grain yield (5941 kg ha⁻¹) were recorded in legume compost. Mineral nitrogen were non-significant for all parameters. It was concluded from the data, that legume and FYM based composts either supplemented with N or not, had resulted in compost optimum yield of maize, and thus is recommended for general cultivation in agro-climatic conditions of Peshawar.

Keywords: Maize (*Zea mays* L.); Compost types; Nitrogen; Yield and yield components.

Introduction

Maize (*Zea mays* L.) is an exhaustive and multipurpose cereal crop that provides food for human, feed for animals, and raw material for the industries [1]. It has greater nutritional value as it contains about 72% starch, 10% proteins, 4.8% oil, 8.5% fiber, 3% sugar and 1.7% ash [2]. It is the third most important cereal crop after wheat and

rice, while in the farming system of Khyber Pakhtunkhwa it ranks second after wheat in importance. It was grown on an area of 1083 thousand ha with total production of 4271 thousand tons and national average yield of 3943 kg ha⁻¹ in Pakistan [3].

Fertilization of maize with nitrogen is one of the most important management practice which affects growth and yield of the crop

[4]. N level has a direct effect on chlorophyll content [5]. Alternative forms of fertilizers such as manures (farmyard manures, composts, and green manures, liquid manure) can be used as sources of plant nutrients and at the same time increase N use efficiency and crop yield [6].

Compost is mixture of organic residues and soil that has been piled, moistened, and allowed to decompose in a pit or heap. It is mixed with soil prior to decay process. It may also contain animal dung and urine along with other residues, such as fodder ruminant, stubble, weeds and leaves [7]. Composted organic material can be used as a source of important nutrients for sustainable crop productivity. Application of beef feedlot manure and composted feedlot manure resulted in maize yield similar to that from commercial fertilizer application [5]. Crop yield is usually increased by manure application because of the increased nutrients availability and the improved soil structure [8]. Schlegel (1992) [9] found that composted manure plus fertilizer addition resulted in greater grain sorghum (*Sorghum bicolor* L.) yield than either source applied alone. However, Ahsok *et al.* (2005) [10] reported that compost increase grain yield of maize over control. Use of proper organic and inorganic fertilizer combination, is a key factor in crop production for sustainable agriculture. However, there is limited published work about the application of compost manure along with the inorganic N fertilizer.

The objective of this study was to determine the response of maize productivity to compost manure and inorganic N fertilizer in the agro-climatic condition of Peshawar.

Materials and Methods

Field experiment was conducted at Agronomy Research Farm, The University of Agriculture, Peshawar (Khyber Pakhtunkhawa, Pakistan) ($34^{\circ} 00' N$, 71°

$30^{\circ} E$, 510 MASL) during summer, 2012. Soil type was silt loamy to clay having pH 7.7 - 7.8. The experiment was laid out in randomized complete block design with three replications. Compost quantities were calculated for supplying 150 kg N ha^{-1} based on its chemical composition and applied at sowing either without mineral N or with half of the recommended fertilizer N i.e. 75 kg N ha^{-1} . The crop was sown on June 22, 2012. Plot size was 18 m^2 (4m $\times$ 4.5m) having 6 rows, 75 cm apart and 4 m long. Field was prepared by two ploughing and one planking. Maize variety, Azam was used at a seed rate of 25 kg ha^{-1} and collected from Agronomy Research Farm. Irrigation was applied eight to ten times. Weeding was done two to three times with the help of handhoe. All other agronomic practices were carried out uniformly for all plots. Data was recorded using standard methods ears plant $^{-1}$, grains ear $^{-1}$, thousand grains weight and grain yield. Ears plant $^{-1}$ was calculated by counting the total ears in ten randomly selected plants and then total ears were divided by total number of plants to get average ears plant $^{-1}$. Grains ear $^{-1}$ was calculated by counting the number of rows and number of grains per row in randomly selected five cobs in each plot, and the average product of rows $\times$ grains row $^{-1}$ was recorded as grains ear $^{-1}$. Thousand grains were randomly counted from the seed lot of each plot and were weighed. For grain yield, ears of 2 central rows were threshed, cleaned, sun dried and weighted and then converted in kg ha^{-1} . Data was statistically analyzed according to the procedure described by Steel *et al.* (1996) [11] for randomized complete block design and means were separated by least significant differences test ($P \leq 0.05$) upon significant F test.

Results and Discussion

Ears per plant

Data regarding ears per plant as affected by compost and nitrogen is shown in Table 1. Statistical analysis of the data indicated that organic nitrogen had significantly affected ears per plant while fertilizer nitrogen had non significantly affected ears per plant. The interaction among organic nitrogen and fertilizer nitrogen were also found non significant for ear plant⁻¹. Mean comparison of the data indicated that compost with and without nitrogen using any source i.e. cereal, legume, or FYM had significantly higher ears per plant compared to control treatment. However, among the compost treatments, no differences were observed for ear per plant. Use of compost had significantly affected ears plant⁻¹. It might be due to more availability of nutrients and improved soil properties in compost treated plots. This result is supported by Shah *et al.* [12] who conducted field experiments in 2009 and reported that ears plant⁻¹ can be increased when compost was applied to the field.

Grains per ear

Data regarding grains per ear as affected by compost and nitrogen is shown in Table 1. Statistical analysis of the data indicated that organic nitrogen had significantly affected grains per ear while fertilizer nitrogen had non-significantly affected grains per ear. The interaction among organic nitrogen and fertilizer nitrogen were also found non-significant for grains ear⁻¹. Mean comparison of the data indicated that legume based compost with and without nitrogen had increase grains per ear (297) as compared to cereal based compost and FYM (196). Use of legume compost had improved grains ear⁻¹. This is due to the improved soil structure and more fertilizer availability of nutrients in compost treated plots. This is supported by the findings of Shah *et al.* [13] who conducted experiments in 2009 and

reported that compost application increased grains ear⁻¹.

Thousand grain weight

Data regarding thousand grain weight as affected by compost and nitrogen are presented in table 1. Statistical analysis showed that compost had significantly affected 1000 grain weight while fertilizer nitrogen had non significantly affected 1000 grain weight. The interaction among these was also non significant. Mean values of the data indicated that FYM based compost with and without N had increased 1000 grain weight (254g) as compared to the cereal based compost and legume based compost (204g). 1000 grain weight was higher in FYM compost treatment compared to control. Compost application had significantly affected 1000 grain weight [12]. This improvement in grain yield might be due to the decrease in barrenness, increase in seeds ear⁻¹ and increase in 1000 seeds weight (Pandey *et al.*, 2000) [14].

Grain yield

Data regarding grain yield as affected by compost and fertilizer N are presented in table 1. Statistical analysis showed that compost had significantly affected grain yield while fertilizer nitrogen had non-significantly affected grain yield. The interaction among these was also found non-significant for grain yield. Mean values of the data indicated that legume based compost with and without N had increased grain yield (5941 kg ha⁻¹) as compared to cereal based compost and FYM based compost (2313 kg ha⁻¹). Grain yield was higher in legume compost as compared to control, cereal and FYM compost applied plots. This might be due to the more decomposition of legume compost which resulted in more nutrients availability and improved soil fertility. This was similar to Shah *et al.* [13] who conducted experiment in 2009 who reported that compost application had significantly affected grain

yield. This is also in line with the findings of Mbah and Nneji (2008) [15] who also

reported that maize yield was higher in residue treated plot relative to control.

Table 1. Ears plant⁻¹, grains ear⁻¹, 1000 grains weight (g) and grain yield (kg ha⁻¹) as affected by compost type and fertilizer nitrogen in maize.

Compost type	Ears plant ⁻¹	Grains ear ⁻¹	1000 seed weight (g)	Grain yield (kg ha ⁻¹)
Control	0.9 b	196 b	203.83 c	2313 c
Cereal	1.1 a	278 a	238.00 b	4652 b
Legume	1.1 a	297 a	253.33ab	5941 a
FYM	1.2 a	269 a	254.33 a	5374 ab
LSD (0.05)	0.10	49	15.662	1079
0	1.0	256	232.83	4247
75	1.1	264	241.92	4893
LSD (0.05)	ns	ns	ns	ns
C x N	ns	ns	ns	ns

Means followed by different letter (s) within each category are significantly different using LSD test at $P \leq 0.05$. ns= non-significant

Conclusion and Recommendations

It was concluded from the above results that addition of 75 kg N ha⁻¹ had similar effects on maize performance as compared to no N treated plots while FYM and legume compost has better results for maize productivity as compare to cereal compost. On the bases of the above conclusion, it is recommended that compost (legume with and without nitrogen) increases grain yield of maize (cv. Azam). FYM and legume compost compared with cereal compost is considered better for optimum yield and yield components of maize.

Authors' contributions

Conceived and designed the experiments: MT Jan, B Iqbal & Z Muhammad. Performed the experiments: Z Muhammad, S Khan, Shamsuddin & Imran. Analyzed the data: MT Jan, Inamullah & AA Khan. Contributed reagents/materials/analyses tools: S Anwar & A Usman. Wrote the paper: B Iqbal.

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