EFFECT OF RATE AND SOURCE OF ORGANIC MATERIAL ON THE PRODUCTION POTENTIAL OF SPRING MAIZE (*Zea mays* L.)

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A field experiment was conducted to determine the growth, yield and quality performance of spring maize treated with different rate and source of organic materials i.e. poultry manure (PM) and farmyard manure (FYM) in 2006 under agro-ecological conditions of Faisalabad. The treatments included were 10, 15, 20, 25 and 30 t ha\(^{-1}\) FYM and 4, 6, 8, 10 and 12 t ha\(^{-1}\) PM. The results indicated that grain yield of 5.6 t ha\(^{-1}\) was recorded in plots added with 12 t ha\(^{-1}\) PM and it was statistically same as obtained with 10 t ha\(^{-1}\) PM. The increase in yield was attributed to increase in cob length, cob diameter and number of grains per cob. Grain protein percentage (8.15) was also maximum where 12 t ha\(^{-1}\) PM was applied. Effects of different treatments on growth and yield parameters of maize are discussed.

**Keywords:** Maize; organic material; yield.

INTRODUCTION

Maize is an important cereal crop of Pakistan and ranks third in production after wheat and rice. In the advanced countries, about 90% of maize is used for making animal feed and other industrial products. Unlike in the developed countries, the same percentage (80-90) of maize is used as food in the third world (Rajoo, 1998).

Maize is a multipurpose crop, provides food for human beings, feed for animals and poultry and fodder for livestock. It has high nutritional value as it contains about 72% starch, 10% protein, 4.8% oil, 8.5% fibre, 3% sugar and 1.7% ash (Chaudhary, 1993). It is a rich source of raw material for industry where it is being extensively used for the preparation of by products like corn starch, corn oil, dextrose, corn syrup, corn flakes, cosmetics, wax, alcohol and tanning material for leather industry.

In Pakistan, it is grown on an area of 1.02 million hectares with the annual grain production of 2.96 million tones and average grain yield of 2893 kg ha\(^{-1}\). This yield is much lesser than the other countries of the world (GOP, 2007).

In spite of substantial fertilizer use in Pakistan, the crop yield is not increasing correspondingly, which reflect low fertilizer use efficiency (FUE). There are some problems related to chemical fertilizers such as inadequate supply or even unavailability of fertilizer at the time of need, adulteration and high cost (Ahmad, 1994). Further, continuous use of fertilizers creates potential polluting effect in the environment (Oad et al., 2004). Synthesis of chemical fertilizers consumes a large amount of energy and money. However, an organic farming with or without chemical fertilizers seems to be possible solution for these situations (Prabu et al., 2003).

The biggest obstacle to inorganic fertilizer use is its cost. High cost does not favor the use of fertilizers if the yield response and grain price is not high enough, it makes its use unprofitable (Tolessa and Friesen, 2001). Under intensive agriculture, the use of inorganic fertilizers has not been helpful because it is associated with soil acidity, nutrient imbalance and reduction in crop yield (Kang and Joo, 1980). Worldwide revival of the use of organic manures is completely dependent upon the need to use renewable forms of energy and in order to reducing the costs of fertilizing crops (Seifritz, 1982). Improvement in the public health and environmental conditions are also the strong reasons for advocating the use of organic materials (Ojeniyi, 2000). Keeping in view the above facts, the present study was designed to determine the comparative usefulness of organic manures in increasing maize productivity with high quality produce.

MATERIALS AND METHODS

Investigations were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad on a sandy clay loam soil having 0.049% N, 5.08 ppm available phosphorus and 180 ppm potassium. The experiment was laid out in Randomized Complete Block Design and replicated thrice. The treatments included were 10, 15, 20, 25 and 30 t ha\(^{-1}\) FYM and 4, 6, 8, 10 and 12 t ha\(^{-1}\) PM. Net plot size was 3 m x 4 m. Seedbed was prepared by cultivating the soil 2-3 times with tractor mounted cultivator each followed by planking. Maize single cross hybrid (32-W-86) was sown on 16th of February in 2006. Sowing was done by dibbling method (by placing 2 seeds manually per hill at 20 cm apart hills) on 75 cm apart ridges. In this experiment the crop was completely dependent upon the farmyard manure and poultry manure for its...
requirement of N, P and K. Analysis of Poultry and Farmyard manure was carried out to determine the NPK percentage in them. Whole amount of FYM and PM was incorporated in the soil at the time of pre-sowing irrigation. In addition to rainfall received during the growing period of the crop, a total of eleven irrigations were applied as and when needed at different plant growth stages till the physiological maturity of the crop. First irrigation was applied twenty five days after sowing the crop while subsequent irrigations were applied with fifteen days intervals till flowering and from flowering to seed formation irrigations were applied with seven days interval due to high water requirement of spring maize crop. Thinning was done at 3-4 leaf stage to maintain a single plant at each hill. Crop was kept free of weeds by hoeing twice to avoid weed-crop competition. All other agronomic practices were kept normal and uniform for all the treatments.

RESULTS AND DISCUSSION

Cob length and cob diameter are important yield contributing parameters in maize. It contributes substantially to grain yield of maize, because it influences both number of grains per ear and grain size. Largest cob size (4.13 cm) was recorded in plots of T10 treatment, where 12 t ha\(^{-1}\) poultry manure was applied (Table 1) at the time of sowing. However, it was statistically at par with treatment T9 producing cob diameter 4.09 cm. While, the minimum cob diameter (3.55 cm) was observed in T1 treatment, where 10 t ha\(^{-1}\) FYM was applied.

Cob length and cob diameter are important yield contributing parameters in maize. They contribute substantially to grain yield of maize by influencing both number of grains per ear and grain size. The reason of more cob length and cob diameter with 12 t ha\(^{-1}\) poultry manure (T10) and 30 t ha\(^{-1}\) farmyard manure (T5) may be due to more photosynthetic activities of the plant on account of adequate supply of N in these treatments.

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Table 1. Effect of rate and source of organic material on agronomic and quality characteristics of spring maize

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Cob length (cm)</th>
<th>Cob diameter (cm)</th>
<th>No. of grains per cob</th>
<th>1000-grain weight (g)</th>
<th>Grain yield (t ha(^{-1}))</th>
<th>Biological yield (t ha(^{-1}))</th>
<th>Protein content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 = 10 t ha(^{-1}) (FYM)</td>
<td>14.85 h</td>
<td>3.55 g</td>
<td>321.52 g</td>
<td>198.00 d</td>
<td>3.70 g</td>
<td>12.99 f</td>
<td>7.36 d</td>
</tr>
<tr>
<td>T2 = 15 t ha(^{-1}) (FYM)</td>
<td>15.16h</td>
<td>3.59 gf</td>
<td>323.97 g</td>
<td>201.79 d</td>
<td>3.81 f</td>
<td>13.02 f</td>
<td>7.43d</td>
</tr>
<tr>
<td>T3 = 20 t ha(^{-1}) (FYM)</td>
<td>16.71 f</td>
<td>3.63 f</td>
<td>330.00 f</td>
<td>210.05 c</td>
<td>4.47 d</td>
<td>14.19 d</td>
<td>7.69 c</td>
</tr>
<tr>
<td>T4 = 25 t ha(^{-1}) (FYM)</td>
<td>18.55 d</td>
<td>3.88 d</td>
<td>355.52 d</td>
<td>214.78 c</td>
<td>4.78 c</td>
<td>14.66 c</td>
<td>7.78 c</td>
</tr>
<tr>
<td>T5 = 30 t ha(^{-1}) (FYM)</td>
<td>20.89 b</td>
<td>4.04 bc</td>
<td>384.36 b</td>
<td>243.64 a</td>
<td>5.29 b</td>
<td>16.15 b</td>
<td>7.99 b</td>
</tr>
<tr>
<td>T6 = 4 t ha(^{-1}) (PM)</td>
<td>15.92g</td>
<td>3.59 gf</td>
<td>325.58 g</td>
<td>202.04 d</td>
<td>4.10 e</td>
<td>13.85 e</td>
<td>7.49 d</td>
</tr>
<tr>
<td>T7 = 6 t ha(^{-1}) (PM)</td>
<td>17.73 e</td>
<td>3.75 e</td>
<td>346.99 e</td>
<td>212.17 c</td>
<td>4.52 d</td>
<td>14.32 d</td>
<td>7.69 c</td>
</tr>
<tr>
<td>T8 = 8 t ha(^{-1}) (PM)</td>
<td>19.26 c</td>
<td>3.97 c</td>
<td>369.08 c</td>
<td>233.10b</td>
<td>4.86 c</td>
<td>14.84 c</td>
<td>7.94 b</td>
</tr>
<tr>
<td>T9 = 10 t ha(^{-1}) (PM)</td>
<td>21.17b</td>
<td>4.09 ab</td>
<td>385.06 b</td>
<td>244.16 a</td>
<td>5.33 ab</td>
<td>16.40 b</td>
<td>8.03 ab</td>
</tr>
<tr>
<td>T10 = 12 t ha(^{-1}) (PM)</td>
<td>22.05 a</td>
<td>4.13 a</td>
<td>389.46 a</td>
<td>246.59 a</td>
<td>5.60 a</td>
<td>17.16 a</td>
<td>8.15 a</td>
</tr>
<tr>
<td>LSD 5 %</td>
<td>2.1</td>
<td>0.07</td>
<td>4.18</td>
<td>5.05</td>
<td>0.10</td>
<td>0.33</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Means in a column not sharing the same letters differ significantly from each other at 5% probability level.
Effect of organic material in production of maize

The crop grown with 12 t ha$^{-1}$ PM (T$_{10}$) had the maximum seed protein content, SPC (8.15 %). Contrarily, the lowest SPC (7.36 %) was obtained for the crop grown with 10 t ha$^{-1}$ FYM (T$_{1}$). Maximum protein content with 12 t ha$^{-1}$ PM has a very strong relationship with the protein contents of the leaves. It was found that the nitrogen contents of leaves are rapidly converted to protein and during seed development leaf N is transferred to seed for protein production (Strecter, 1972). Therefore, high leaf area index (data not shown) with the same level of poultry manure might be one of the strong reasons for these maximum protein contents with 12 t ha$^{-1}$ PM. This type of improvement in seed protein contents was also reported by Jackson and Smith (1997).

Comparison of different rates of FYM and PM indicated that even three times dose of FYM than PM could not perform equally well in regard of yield and quality of maize, therefore PM should preferably be used @ 10 t ha$^{-1}$ to get maximum economic yield of high quality produce.

REFERENCES


