Influence of Usage Fish Scale Powder on Zea Mays L. Seedlings Growth Characteristics

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ABSTRACT

The experiment was conducted in plastic pots in the laboratory of Resources Faculty, Tobruk University, Libya in 2022, using a Completely Randomized Design (CRD) in 4 replicates (each replicate contains 5 pots) to study the effect of usage fish scales as organic fertilizer on growth characteristics of white maize seedlings. Fish scales powder was added to agricultural soil pre-sowing at two different concentrations compared to the control treatment (0, 1%, and 2%). After 14 days later the results of the variance analysis showed that there were significant differences between the various concentrations. Fish scale powder adding enhanced vegetative growth characteristics such as (mean of plant height, number of leaves/seedling, mean of leaf area cm²/seedling, mean of fresh weight, as well as dry weight/seedling). Adding fish scale powder at a rate of 1% and 2% increased the mean of seedlings height by 56.67% and 114.3%, and mean of leaf area also increased by 238.9% and 476%, respectively compared to the control. Although there were no significant differences when adding fish scales powder at 1% on wet and dry weight compared to the control, adding it by 2% led to an increase in the mean of wet weight of seedlings from 8.3 to 16.06 g/seedling, also the mean of dry weight increased from 2.27 to 10.98 g/seedling compare with control (without usage fish scale powder).

Keywords: Fish scales, organic fertilizer, Zea mays

INTRODUCTION

Recently, achieving sustainable development, which is one of the most important basic goals of the United Nations, is considered one of the greatest challenges facing the world, as well as developing countries, with an ever-growing in the world’s population and the consequent increase consumption food (Santana, et al., 2019). Implementing effective agricultural practices is crucial to achieving effective sustainability (Santana, et al., 2019), through reducing the expansion of the use of agricultural chemicals, especially mineral fertilizers, to replace them with organic fertilizers to preserve agricultural soil from deterioration and improve agricultural crop productivity, hence, preserving human health (Adam, et al., 2022). As these traditional crop production inputs are becoming depleting and harmful to our environment and ecosystem, it will threaten all life on Earth (Alegre, et al., 2023).

Fish consumption globally has increased, with estimates for 2015 pointing towards further growth beyond 20 kg, the fish scales as waste materials being inedible are discarded (Sarkar, et al., 2018). According to (Alkhafaji, and Elkheralla, 2019), the chemical composition of fish scales contains 18% organic matter, 8.94% Potassium, 7.27 % Phosphorus, 2.83% Nitrogen. Therefore, it can be used as an organic fertilizer that improves the chemical and physical properties of the soil, reduces the use of chemical fertilizers, and thus improves the quality and productivity of crops. According to Organic Materials Review Institute, there are 154 commercial fish-fertilizer products, and very few of which have been investigated in scientific research to verify their role as organic fertilizers, by usage of some commercially available fish-based fertilizers, such as fish-scale meal, fish pellets, hydrolyzed fish extracts, and fish emulsion, which gave significant results, and positive effects on agricultural and horticultural activities (Ahuja, et al., 2020).

The present study aimed to evaluate the efficacy of usage the fish scale powder as organic fertilizer and its effects on seedling growth of white maize.

MATERIALS AND METHODS

Experiment description:

A laboratory experiment was carried out in the 2022 at the Faculty of Resources, Tobruk University, Libya, to study the effect of fish scales powder by two different concentrations as organic fertilizer and soil amendment on the seedling white maize characteristics. The experiment was carried out in pots using a Completely Randomized Design (CRD) with two concentrations of fish scales powder in addition control, and four replications were utilized. In every replicate there were five plastic pots; ten seeds of white corn (3 HYBRID variety) were planted in each pot.

Preparation of fish scale powder:

The fish scales (freshwater fish) were cleaned and washed, then dried at a temperature of 55°C to 60°C for 24 hours. After complete drying, they were crushed well to an emulsion, which gave significant results, and positive effects on agricultural and horticultural activities (Ahuja, et al., 2020).

Measurements:

14days later of planting, the morphological characteristics of maize seedling were determined, including the mean of plant height (cm), the mean of leaves number,
and roots number/seedling, the mean of wet weight, dry weight (g/seedling), and leaf area (cm²/seedling).

**Statistical analysis:**

The statistical analysis of data was conducted according to Gomez and Gomez (1984), by variance analysis (ANOVA), and using L.S.D at 5% level of probability to compare between means of treatments by using the SPSS software program.

**RESULTS AND DISCUSSION**

The data presented in the following Table 1 shows the effect of adding fish scales powder as an organic fertilizer on the morphological characteristics of maize seedlings. The results showed clear significant difference between all the studied traits except for the average number of leaves/seedling when using fish scales powder by 2% compared to the control. On the other hand, when comparing the two concentrations of adding fish scales powder (1% and 2%), there was a difference between the performance of maize seedlings, where there was a clear significant differences between some of the studied traits such as the mean of plant height, leaf area, length of lateral roots, seedling diameter, and wet, and dry weight of seedling, but there were no significant differences between both concentrations on the mean number of leaves/seedlings, number of roots, and root length.

Table 1. Effect of using fish scales powder on the morphological characteristics of white maize seedlings

<table>
<thead>
<tr>
<th>Morphological characteristics</th>
<th>Control (without adding)</th>
<th>Concentration 1%</th>
<th>Concentration 2%</th>
<th>LSD 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height (cm)</td>
<td>21.00 ± 2.65</td>
<td>32.90 ± 7.72</td>
<td>45.00 ± 1.73</td>
<td>9.62</td>
</tr>
<tr>
<td>Leaf area (cm²)</td>
<td>16.77 ± 2.25</td>
<td>55.99 ± 9.06</td>
<td>96.6 ± 14.73</td>
<td>20.12</td>
</tr>
<tr>
<td>Number of leaves/seedling</td>
<td>3.67 ± 2.89</td>
<td>5.67 ± 1.53</td>
<td>7.00 ± 1.00</td>
<td>3.94</td>
</tr>
<tr>
<td>The number of lateral roots/seedling</td>
<td>5.33 ± 1.53</td>
<td>11.00 ± 1.00</td>
<td>11.57 ± 1.40</td>
<td>2.66</td>
</tr>
<tr>
<td>Root length (cm)</td>
<td>2.63 ± 0.71</td>
<td>5.70 ± 1.70</td>
<td>7.00 ± 0.86</td>
<td>2.35</td>
</tr>
<tr>
<td>Lateral root length (cm)</td>
<td>3.83 ± 0.76</td>
<td>4.23 ± 0.25</td>
<td>8.83 ± 0.76</td>
<td>1.48</td>
</tr>
<tr>
<td>Stem diameter (cm)</td>
<td>1.70 ± 0.61</td>
<td>1.93 ± 0.40</td>
<td>4.33 ± 0.29</td>
<td>0.91</td>
</tr>
<tr>
<td>Seedling dry weight (g)</td>
<td>2.27 ± 0.46</td>
<td>2.33 ± 0.20</td>
<td>10.98 ± 1.00</td>
<td>1.29</td>
</tr>
<tr>
<td>Seedling wet weight (g)</td>
<td>8.30 ± 0.30</td>
<td>8.19 ± 0.27</td>
<td>16.06 ± 0.32</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Figure 1 shows the effect of using fish scales powder on the mean of plant height (cm), and the mean of leaf area (cm²) of maize seedlings. The data showed the positive effect of adding fish scales powder, as it led to an increase in the average seedling height by 56.67% and 114.29% when adding 1% and 2% of fish scales powder compared to the control, respectively. It also led to an increase in the average leaf area from 16.77 cm²/seedling when planting without adding fish scales powder to the agricultural soil (control) to 55.99 cm²/seedling and 96.6 cm²/seedling when adding fish scales powder at a rate of 1%, and 2% respectively. These results were consistent with what Alkhafaji, and Elkheralla explained in 2019, that the use of fish scales powder as an organic fertilizer led to an increase in plant height, as well as the leaf area, which it attribute to improving soil properties quality, due to the effect of organic matter in fish scales, which is characterized by a high content of nutrients such as nitrogen, phosphorus and potassium. (Sarkar et al., 2018) also that the use of fish scales as organic fertilizer led to an increase in the average plant height of rice fields.

![Fig. 1. Effect of using fish scales powder on plant height (cm), and leaf area (cm²) of white maize seedlings](image1)

The following graph 2 shows the effect of using fish scales powder on the average number of leaves/seedling and the average number of lateral roots/seedling in white maize. Although adding fish scales powder led to an increase in the mean number of leaves/seedling, this increase was not significant at both concentrations. However, there were significant differences in the average number of lateral roots for both concentrations compared to the control. However, the differences were not significant between both concentrations were used (1%, and 2%).

![Fig. 2. Effect of using fish scales powder on number of lateral roots, and number of leaves of white maize seedlings](image2)

The following graph (3) shows the effect of using fish scales powder on both the average root length and lateral roots in maize plants.

![Fig. 3. Effect of using fish scales powder on root length (cm), and lateral roots length (cm) of white maize seedlings](image3)
improves the physical and chemical properties of agricultural soil and enhances the growth and productivity of agricultural crops from waste that has no economic value. Therefore we recommend adding fish scale powder at a rate of 2% to enhance crop growth without harming the environment and achieve one of the sustainable development goals.

REFERENCES


CONCLUSION

From the results presented and discussed, it is clear that it is easy to obtain high quality organic fertilizer that improves the physical and chemical properties of agricultural soil and enhances the growth and productivity of agricultural crops from waste that has no economic value. Therefore we recommend adding fish scale powder at a rate of 2% to enhance crop growth without harming the environment and achieve one of the sustainable development goals.