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

Alaa A. A. Awad¹; Mona A. O. Allafe² and M. M. Y. Kateesh³

¹ Biology Science Department, Faculty of Education, Tobruk University, Libya

² Environmental Sciences Department, Faculty of Natural Resources and Environmental Sciences, Tobruk University, Libya

³ Marine Sciences Department, Faculty of Science, Albyda, Omar Al-mukhtar University



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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 (S 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 become a powder. Dried fish scales powder was used as raw materials and added to the soil used in agriculture as an organic fertilizer and soil amendment at the rates mentioned above (1%, and 2%).

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,

* Corresponding author.

E-mail address: alaa.education2023@gmail.com

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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

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

Morphological characteristics	(Treatment) Fish scales powder			LSD 0.05
	Control (without adding)	Concentration 1%	Concentration 2%	
Plant height (cm)	21.00 ± 2.65	32.90 ± 7.72	45.00 ± 1.73	9.62
Leaf area (cm ²)	16.77 ± 2.25	55.99 ± 9.06	96.6 ± 14.73	20.12
Number of leaves/seedling	3.67 ± 2.89	5.67 ± 1.53	7.00 ± 1.00	3.94
The number of lateral roots/seedling	5.33 ± 1.53	11.00 ± 1.00	11.57 ± 1.40	2.66
Root length (cm)	2.63 ± 0.71	5.70 ± 1.70	7.00 ± 0.86	2.35
Lateral root length (cm)	3.83 ± 0.76	4.23 ± 0.25	8.83 ± 0.76	1.48
Stem diameter (cm)	1.70 ± 0.61	1.93 ± 0.40	4.33 ± 0.29	0.91
Seedling dry weight (g)	2.27 ± 0.46	2.33 ± 0.20	10.98 ± 1.00	1.29
Seedling wet weight (g)	8.30 ± 0.30	8.19 ± 0.27	16.06 ± 0.32	0.59

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 seen in the average plant height of rice fields.

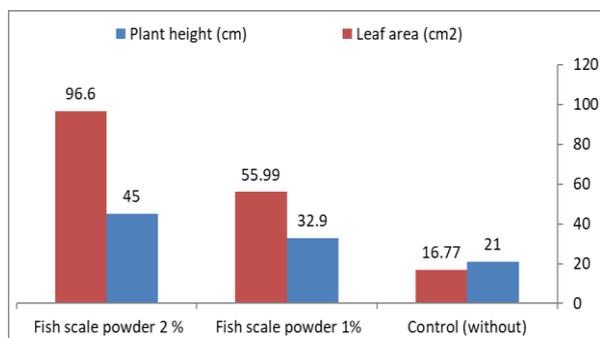


Fig. 1. Effect of using fish scales powder on plant height (cm), and leaf area (cm²) of white maize seedlings

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

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 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.

for both concentrations compared to the control. However, the differences were not significant between both concentrations were used (1%, and 2%).

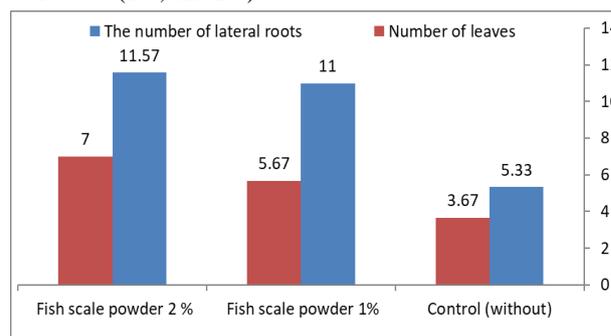


Fig. 2. Effect of using fish scales powder on number of lateral roots, and number of leaves of white maize seedlings

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

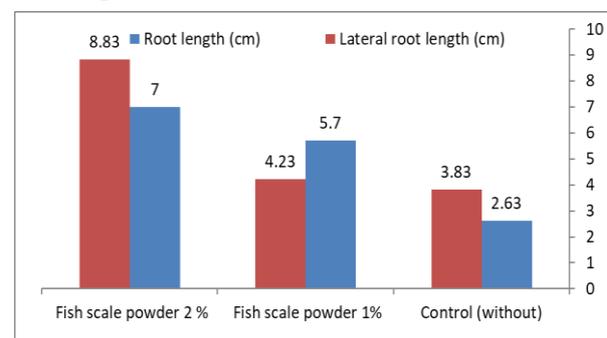


Fig. 3. Effect of using fish scales powder on root length (cm), and lateral roots length (cm) of white maize seedlings

The results show that using fish scales powder as an organic fertilizer and as an agricultural soil improver enhanced the growth and spread of roots, as it led to an increase in the average root length by 116.73% and 166.16% when using 1% and 2% of fish scales powder, respectively, compared to the control. . On the other hand, the increase in

the length of lateral roots reached 10.44% and 130.55% for both concentrations, respectively, compared to the control. This demonstrates the positive effect of using fish scales powder on enhancing the spread of the root system of corn seedlings, which may be attributed to improving the natural and chemical properties of the soil and increasing its content of organic matter (Sarkar, *et al.*, 2018; Alkhafaji, and Elkheralla, 2019; Alegre, *et al.*, 2023)

The data shown in Figure 4 shows the effect of using fish scales powder on the wet and dry weight of maize seedlings.

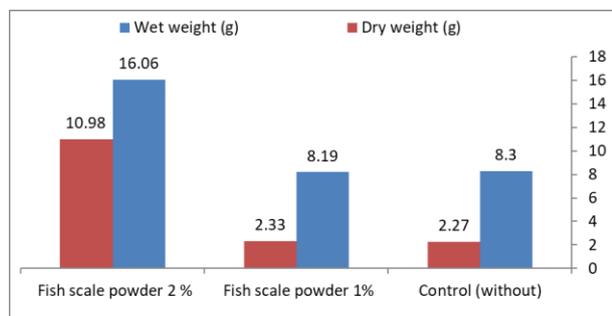


Fig. 4. Effect of using fish scales powder on wet and dry weight (g) of white maize seedlings

The results show that there are no significant differences between using the first concentration of fish scales powder (1%) and the control on the average wet and dry weight of seedlings. On the other hand, using fish scales powder at a concentration of 2% led to an increase in the mean of wet weight of seedlings by 93.49% and 96.09% compared to the control and 1% concentration, respectively, the mean of dry weight also increased by approximately 4 times compared to the control and using the concentration 1%. The positive effect of using fish scales powder was proven by Alkhafaji, and Elkheralla, 2019, which explained attribute to the fact that adding fish scales improves growth indicators as a result of improving the physical and chemical properties of agricultural soil, which may lead to increasing plant ability of absorption and growth (Sahaf, 1989). The increase in the mean of wet and dry weight may be due to increase chlorophyll concentration in the leaves which contain many essential elements in the synthesis of chlorophyll, such as nitrogen, which helps build chlorophyll, which is reflected in the accumulation of dry matter (Matlupe, and A.N. 1984).

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.

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تأثير استخدام مسحوق قشور السمك على صفات نمو بادرات الذرة الشامية

إلاء عوض¹، منى اللافي² و موسى قطيش³

¹ قسم العلوم البيولوجية - كلية التربية - جامعة طبرق - ليبيا

² قسم العلوم البيئية - كلية الموارد الطبيعية وعلوم البيئة - جامعة طبرق - ليبيا

³ قسم علوم البحار - كلية العلوم - البيضاء - جامعة عمر المختار - ليبيا

المخلص

أجريت التجربة في أصص بلاستيكية في معمل كلية الموارد جامعة طبرق ليبيا خلال عام 2022 باستخدام التصميم العشوائي الكامل في 4 مكررات (كل مكررة تحتوي على 5 أصص) لدراسة تأثير استخدام قشور الأسماك كسماد عضوي على صفات نمو بادرات الذرة البيضاء. أضيف مسحوق قشور السمك إلى التربة الزراعية قبل الزراعة بتركيزين مختلفين مقارنة بمعاملة المقارنة (0، 1، 2%)، وبعد مرور 14 يوماً أظهرت نتائج تحليل التباين وجود فروق معنوية بين التراكيز المختلفة. أدت إضافة مسحوق قشور السمك إلى تحسين صفات النمو الخضري مثل (متوسط ارتفاع النبات، عدد الأوراق / بادرة، متوسط مساحة الأوراق سم² / بادرة، متوسط الوزن الغض، وكذلك الوزن الجاف / بادرة). أدت إضافة مسحوق قشور السمك بمعدل 1% و 2% إلى زيادة متوسط ارتفاع البادرات بنسبة 56.67% و 114.3%، كما زاد متوسط المساحة الورقية بنسبة 238.9% و 476% على التوالي مقارنة بالشاهد (بدون إضافة مسحوق قشور السمك). بالرغم من عدم وجود فروق معنوية عند إضافة مسحوق قشور السمك بنسبة 1% على الوزن الغض والجاف مقارنة بالشاهد (بدون إضافة مسحوق السمك)، إلا أن إضافته بنسبة 2% أدت إلى زيادة متوسط الوزن الغض للبادرات من 8.3 إلى 16.06 جرام/بادرة، وكذلك ارتفع متوسط الوزن الجاف من 2.27 إلى 10.98 جرام/بادرة مقارنة بالشاهد (بدون استخدام مسحوق قشور السمك).

الكلمات الدالة: قشور السمك، السماد العضوي، الذرة البيضاء