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Biostimulants Influence (Licorice and Yeast Extract) on Vegetative Growth of Faba Bean (*Vicia faba* L.)

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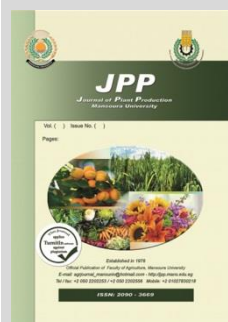


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ABSTRACT

Biostimulants are natural organic materials that have been shown to enhance plant growth and development when applied in small quantities. Where influence several metabolic processes such as photosynthesis, nucleic acid synthesis, ion uptake etc. The experiment was carried out in the laboratory of Agriculture Faculty, Derna University, Libya, using a Random Design (CRD) in 3 replicates, to study the effect of two concentrations of licorice roots extract, and dry yeast extract on the vegetative growth of faba bean. Faba bean seedlings were treated on 3 different times of interval 10 days, where the first treatment was carried out when the first leaf appeared. The results of the variance analysis showed that there were significant differences between the treatments under study. Foliar applications were enhanced vegetative growth characteristics such as (plant height, number of leaves/plant, leaf area, fresh weight/shoot, as well as dry weight/shoot) during the three sampling stages (after 45 from planting, after 60 days from sowing, and 75 days after sowing). When yeast extract, and licorice extract were used at the second concentration (4 g/l), the plant height increased by 79.3%, and 86.6% compared to the control as the average of the three stages, respectively. Licorice extract 4 g/l produced a significant effect on the number of leaves/plant, fresh weight (g.), and dry weight (g) at a 5% level of significance, whereas was a significant difference in leaf area (cm²/plant), when used yeast extract (4g/l), compared with control (water treatment only).

Keywords: Biostimulants, Faba bean, Licorice extract, Yeast extract, Vegetative growth.



INTRODUCTION

Faba bean (*Vicia faba* L.), which known also broad bean, one of the major leguminous crops grown in the world. (According to FAO, STAT, 2018). Faba bean is the fourth most important legume crops, after pea, chickpea and lentil in the world, and is the most important winter legume crop in Libya. Globally about 4.56 million tons of dry faba bean grains are produced, and the harvested area is 2.56 million hectares, with Asia and Africa producing 80% of the production of the dry faba bean grains, with an area of 72% (FAOSTAT, 2022) It is considering an essential food crop for human nutrition and livestock feed in the Middle East, and North Africa, the Mediterranean region, the Nile Valley, Ethiopia, due to its high- protein seeds content (20 and 40%). Also, it is a good source of dietary fiber and B-complex vitamins. (Tafere *et al.*, 2012). Where had been cultivated for 8,000 years before it spread to Western Europe (Metayer, 2004). In addition, Faba bean is a good soil fertilizer, as it increases the nitrogen content of the soil has by nitrogen fixation symbiosis (Dashadi *et al.*, 2011).

In view of the many problems that have emerged from the expansion of the use of agricultural chemicals, mineral fertilizers and its negative effects on both humans, animals, and agricultural lands, there has been a call for the so-called ecological agriculture in order to limit the widespread of agricultural chemicals, rationalize the use of mineral fertilizers to preserve the environment, and the use of environmentally friendly organic materials that are not harmful to humans (Mady M.A.,2009), through the

application of some of the treatments that it will improve crop productivity and reduce the use of chemicals.

The use of biostimulants, plant extracts, and organic materials are environmentally safe solutions, as it contains natural growth regulators and many nutrients such as yeast, seaweed extracts, and licorice extract, . The licorice plant contains many chemical compounds that have an effect similar to the effectiveness of steroid hormones, as it is one of the building hormones that leads to an increase in the formation of proteins, so it increases the growth rate. The roots of licorice also contain compounds that have similar growth regulators effect, and a wide range of minerals, amino acids, vitamins, and carbohydrates, in addition to mevalonic acid, which has a role in the biosynthesis of gibberellins. Given that licorice extract contains different compounds that have an effect on plant growth and development, many studies have been conducted to find out the effect of this extract on plant growth and production, and it was found that it has an improved effect on the vegetative and flowering growth of many plants.

Dry yeast extract is a rich source of phytohormones (gibberellins, auxins and cytokinins), amino acids (lysine, tryptophan, etc.), a source of nutrients for plants because it contains many macro elements (NPK, etc.), micronutrient (co, Fe, etc.) and vitamins (B1, B2, B6, and B12) (Bevilacqua *et al.*, 2008). Khalil mention in 2015 that yeast has a role in improving vegetative growth and yield.

The aim of this study is to investigate the effect of licorice root extract, and dry yeast extract on the vegetative growth of faba bean (*Vicia faba* L.)

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MATERIAL AND METHODS

Experiment description:

A laboratory experiment was carried out during the 2021 growth season at the Faculty of Agriculture, Derna University, Libya, to study the effect of licorice extract, and yeast extract by two different concentrations as a foliar application on the faba bean vegetative growth. The experiment was carried out in pots using a Completely Randomized Design (CRD) with three replicates, where each replicate contains 20 seeds, and a local variety (veto) was grown on 24 October 2021.

Extracts preparation:

Licorice root extracts and dry yeast were prepared by soaking dried licorice root powder in a concentration of 2, and 4 g/l of distilled water, as well as soaking dry yeast in a concentration of 2, and 4 g/l of distilled water, then filtered for foliar application to plants.

Foliar application:

The foliar applications of biostimulants were added at 3 different times of interval 10 days, where the first treatment was carried out when the first leaf appeared, after (8 day) from sowing date

Measurements:

The investigated morphological characteristics included plant height (cm), number of leaves/plant, wet fresh weight (g.), dry weight (g.), and leaf area (cm²/plant, according to Abdel C. G. 1994.), were calculated during the three study stages (Average for 5 plants in 3 replications), 10 days after each foliar spray treatment.

Statistical analysis:

The responses to the treatments were statistically analyzed according to Gomez and Gomez 1982, by analysis of variance (ANOVA), using L.S.D at 5% for comparison between the different treatments by using the SPSS program.

RESULTS AND DISCUSSION

The morphological characteristics of vegetative growth of faba bean were affected by foliar application with different concentrations of yeast extract (2, and 4 g/l), as well as licorice extract (2, and 4g/l) in the 2021 winter growing season. The investigated morphological characteristics included plant height (cm), number of leaves/plant, fresh weight (g.), dry weight (g.), and leaf area (cm²/plant).

Results presented in Figure (1), and Table (1) clearly show that all concentrations of yeast extract and licorice root extract increased significantly the height of faba bean plant where the maximum significant increase in plant height was detected when faba bean plant was treated with 4 g/l., where the increase reached 131%, 62.1%, and 66.7% in the 3 stages, respectively compared with control. The enhancing effect of these extracts (yeast, licorice) may be due to and

being a natural source of phytohormones, especially cytokinins, these results are in agreement with what was mentioned by Amer (2004), Nassar *et al.*, (2011), and Abdel-Hakim *et al.*, (2012), Mokhtar *et al.*, 2020 on bean plant.

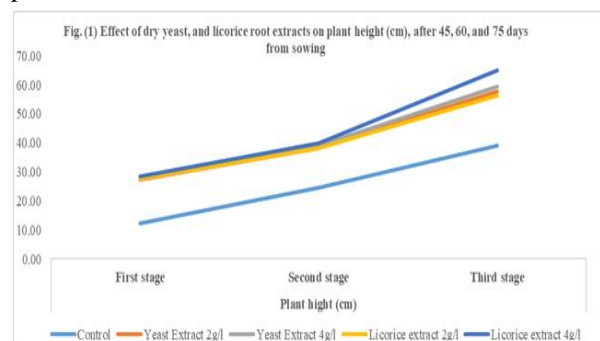


Figure 1. Effect of dry yeast, and licorice root extracts on plant height (cm), after 45, 60, and 75 days from sowing

Number of leaves per plant

It is clear from figure (2), and table (1) that all treatments of extracts concentrations under study increased significantly number of leaves on plant of faba bean except for using yeast in concentration 2g/l., when use of yeast extract at a concentration of 2 g/l did not had significant differences when compared to the control. The highest number of leaves/ plant was recorded when used licorice of 4g/l., where the increase reached 125.31, 64.7% , and 121.7% in the 3 stages, respectively compared with control. The results of applying yeast extract at a concentration of 4 g/l, and licorice roots extract 2g/l, had a positive effect, and these increased the number of leaves, and there were statistically significant differences compared with control. Abbas confirmed these findings in 2013 on faba bean plants stated that number of leaves significantly increased by foliar application with yeast extract.

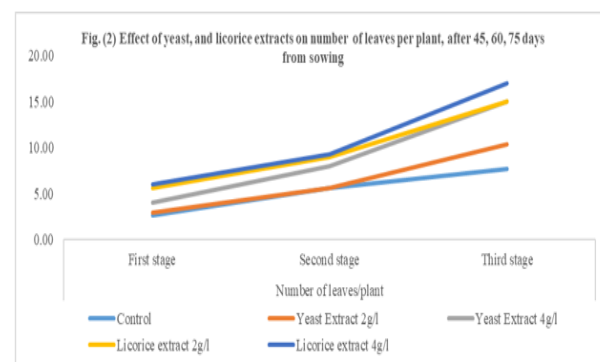


Figure 2. Effect of dry yeast, and licorice root extracts on number of leaves/plant after 45, 60, and 75 days from sowing

Table 1. Effect of dry yeast, and licorice root extracts on plant height (cm), and number of leaves per plant

| treatment | Concentration | Plant height (cm) | | | Number of leaves/plant | | |
|------------------------|---------------|-------------------|---------|---------|------------------------|---------|---------|
| | | 45 days | 60 days | 75 days | 45 days | 60 days | 75 days |
| Control | water | 12.3 | 24.7 | 39.0 | 2.7 | 5.7 | 7.7 |
| Dry yeast extract | 2 g/l | 27.3 | 38.2 | 57.7 | 3.0 | 5.7 | 10.3 |
| | 4 g/l | 28.0 | 39.2 | 59.3 | 4.0 | 8.0 | 15.0 |
| Licorice roots extract | 2 g/l | 27.5 | 38.2 | 56.3 | 5.7 | 9.0 | 15.0 |
| | 4 g/l | 28.5 | 40.0 | 65.0 | 6.0 | 9.3 | 17.0 |
| LSD _{0.05} | | 0.47 | 0.06 | 0.88 | 0.21 | 0.27 | 1.01 |

Leaves area (cm²/plant)

Figure (3) shows the effect of using foliar spraying with dry yeast extracts and licorice roots on the area of bean plant leaves, whereby the positive effect of all the different treatments and concentrations used during the three stages of plant growth is evident. Statistically significant differences emerged between all treatments as well as compared to the control, we find that the increase in the area of plant leaves exceeded the control by more than 5 times when using yeast extract, and licorice roots extract at a concentration of 4 g/l during the first growth stage (after 45 days from sowing), respectively. The increase was also in the second stage at the same concentration of yeast and licorice to 672.5%, 710%, compare with control, respectively. On the other hand, the increase in the third stage was more than three times the control with the same concentration of yeast and licorice (4g/l), respectively.

The results also show the superior performance of bean plants when plants were treated with licorice extract at a concentration of 2 g/l than when using yeast extract at the same concentration (2 g/l) during the three different stages of faba bean growth. The average increase in leaf area when using licorice root extract at a concentration of 2 g/l was 292%, 30% compared to the control, and yeast extract at the

Fresh and dry weight of shoot/plant

The data presented in table (2) and figure (4) showed the significant effect of biostimulants on the fresh, and dry weight of faba bean plants in all treatments under study compared to control. However, the use of licorice roots extract at a concentration of 4 g/l had the best effect during the three phases of the study, where the increase in fresh weight was 87.9%, 162.5%, and 114% compared to the control in the three stages, respectively. This was also reflected on the accumulation of dry matter, where the dry

same concentration (2 g/l), which led to an increase of leaf area 202% compared with control (dry yeast extract 2 g/l). Also find that, the average increase in leaf area during the three stages of faba bean growth was 452 %, 480 % compared to the control when spraying bean plants with dry yeast extract at a concentration of 4 g/l, and licorice root extract at the same concentration (4g/l), respectively.

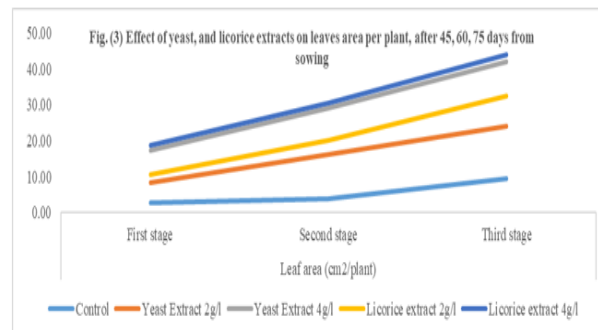


Figure 3. Effect of dry yeast, and licorice root extracts on leaves area (cm²/plant) after 45, 60, and 75 days from sowing

weight increased during the three stages, and the highest dry weight was also recorded when using licorice root extract at a concentration of 4g/l. The moisture content of faba bean plants ranged from 75% to 88%, where we find that the lowest dry matter accumulation rate was for untreated plants in the three stages, and it reached 12%, 14%, and 15%, On the other hand, the highest dry matter percentage recorded at the use of foliar spray with licorice root extract 4g/l amounted to 25%, 20% and 22%, respectively.

Table 2. Effect of dry yeast, and licorice root extracts on fresh and dry weight of shoot/plant

| treatment | Concentration | fresh weight (g/plant) | | | dry weight (g/plant) | | |
|------------------------|---------------|------------------------|---------|---------|----------------------|---------|---------|
| | | 45 days | 60 days | 75 days | 45 days | 60 days | 75 days |
| Control | water | 20.17 | 30.70 | 48.40 | 2.46 | 4.91 | 7.74 |
| Dry yeast extract | 2 g/l | 27.90 | 53.00 | 61.60 | 2.79 | 5.83 | 8.01 |
| | 4 g/l | 28.20 | 64.70 | 86.40 | 4.79 | 10.35 | 13.82 |
| Licorice roots extract | 2 g/l | 31.30 | 65.60 | 92.50 | 5.95 | 9.84 | 17.58 |
| | 4 g/l | 37.90 | 80.60 | 103.60 | 9.48 | 13.70 | 18.65 |
| LSD _{0.05} | | 2.19 | 3.45 | 4.59 | 0.78 | 1.07 | 1.03 |

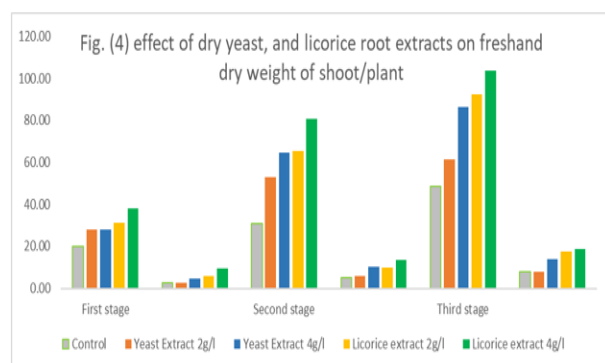


Figure 4. Effect of dry yeast, and licorice root extracts on fresh and dry weight of shoot/plant after 45, 60, and 75 days from sowing

CONCLUSION

The above-mentioned results conclude that the use of biostimulants (Licorice root extracts or dry yeast extract) as foliar applications, on faba bean, gave enhancement

effects of plant vegetative growth. Through the results obtained, we find that the use of licorice root extract with a concentration of 4 g/L had the best effect on the vegetative growth characteristics of faba bean plants such as plant height, number of plant leaves, leaf area, and dry matter accumulation rate.

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تأثير المحفزات الحيوية (خلاصة عرق السوس والخميرة) على النمو الخضري للفاول البلدي (*Vicia faba* L.)

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المخلص

المحفزات الحيوية هي مواد عضوية طبيعية ثبت أنها تعزز نمو النبات وتطوره عند استخدامها بكميات صغيرة. حيث تؤثر على العديد من العمليات الأيضية مثل التمثيل الضوئي وتخليق الحمض النووي وامتصاص الأيونات وما إلى ذلك. أجريت التجربة في معمل كلية الزراعة بجامعة درنة بليبيا باستخدام التصميم العشوائي التام في 3 مكررات لدراسة تأثير مستخلص جذور عرق السوس، ومستخلص الخميرة الجافة على النمو الخضري لحبوب الفول البلدي. تم معاملة نباتات الفول البلدي في 3 أوقات مختلفة بفواصل 10 أيام، حيث أجريت المعاملة الأولى عند ظهور الورقة الأولى، وذلك باستخدام تركيزين من (مستخلص عرق السوس، ومستخلص الخميرة). أظهرت نتائج تحليل التباين وجود فروق ذات دلالة إحصائية بين العلاجات المستخدمة والتركيزات المستخدمة. تم تعزيز خصائص النمو الخضري في التطبيقات الورقية مثل (طول النبات، عدد الأوراق / النبات، مساحة الورقة، الوزن الرطب، وكذلك الوزن الجاف) خلال مراحل أخذ العينات الثلاث بعد (45، 60، و 75 يوم بعد البذر). عند استخدام مستخلص الخميرة ومستخلص عرق السوس في التركيز الثاني، زاد ارتفاع النبات بنسبة 79.3%، و 86.6% مقارنة بالشاهد (كنترول) كمتوسط للمراحل الثلاث على التوالي. أعطى مستخلص عرق السوس 4 جم / لتر تأثيراً معنوياً على عدد الأوراق / نبات، والوزن الرطب (جرام)، والوزن الجاف (جرام) عند مستوى معنوي 5%، بينما كان هناك فرق معنوي في مساحة الورقة (سم² نبات) عند استخدام مستخلص الخميرة (4 جم / لتر) مقارنة بمعاملة الكنترول.