Effect of Auxin Spraying and Plant Extracts on Two Cultivars of Bean (Vicia Faba L.)

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Abstract

The field-based experiment was conducted during the 2020 – 2021 cropping season to evaluate the response of two types of bean (Vicia faba L.): Luz De Otono (C1) and Aquadulce (C2 for different spray treatments namely, control (T1), 40mg IAA.L-1 (T2) and 10gm of licorice with yeast.L-1 (T3). The treatments were assigned to experimental plots following a randomized complete block design (R.C.B.D). Each treatment replicated three times. Means were compared based on least significant differences (LSD) at 0.05 of probability. Plant height, leaves area, chlorophyll, N and K content in leaves were recorded as parameters. Results showed that the Aquadulce variety significantly increased in most studied measurements. T3 was significant and superior compare to other treatments in plant height (68.28cm), leaves the area (51.5 dcm2), chlorophyll (23.98 SPAD), N(4.623%), and K(3.120%). Results also indicated that the interaction of C2T3 had a significant increase in plant height(68.95cm), leaves the area (57.0 dcm2), chlorophyll, N(4.88%), and K(2.68%).

Keywords: Auxin, Plant Extracts, Vicia faba L., Fabaceae.

1. Introduction

Bean (Vicia faba L.) is a winter crop belong to the legume family (Fabaceae), it is one of the food seed crops which spread cultivated in all countries of the world. Beans are ranked fourth after cowpeas [1]. Concerning its nutritional value, It is one of the main sources of protein consumed by humans, and it is nutritionally important, as its seeds contain a high percentage of protein, which is estimated at 25-40% [2]. In addition, the seeds of the crop contain a high percentage of carbohydrates which in most varieties reach 56% [3]. The phenomenon of failure of flowers and pods is one of the important problems facing producers, as about 80-70% of flowers abort and fall before the plant reaches maturity stage which in turn causes a reduction in yield. With the infinite increase in the population, the yield must be increased by reducing the fall of flowers which lead to an increase in production. [4-6]

The process of contracting requires a hormonal stimulant obtained from pollen grains, which is a rich source of auxin, or from the amino acid tryptophan, which turns into IAA [7]. For human safety, plant extracts are used instead of manufactured auxins because they contain important nutrients and amino acids to improve the growth and flowers fertilization and increase the yield [8]. Recently, plant extracts have been used because their contain growth- plant hormones, amino acids, vitamins and important nutrient elements for plants, in addition to their environmental effect and human health was safety [9]. The aims of research is utilization of plant extracts such as licorice and yeast as substitutes for industrial auxins and study their effect on the growth and yield of the bean.

2. Materials and Methods

A field experiment was carried out in Al-Hamza Al-Sharqi area in Al-Qadisiyah governorate during the agricultural season (2020-2021). The experiment includes the study of two factors: two types of cultivars (Luz De Otono C1 and Aquadulce C2), interaction with three types of fertilization stimulants ( Control T1, 40mg IAA.L-1 T2, and 10gm of licorice with yeast.L-1 T3). At rate of two sprays which started a month after sowing, and a period of 20 days between there. The seeds were sown on rows with 30 cm of distance between plants. Plant height, leaf area, chlorophyll, N and K containing according to the method of [10], were recorded. Randomized Completey Block Design (R.C.B.D) was used with three replicates. The means were compared according to the L.S.D test at the level of 0.05.
Table 1. Soil texture and physical properties and water.

| Soil Separators | Soil Particulate Volume Ratio (%) |
|-----------------|----------------------------------|
| Clay            | 22                               |
| Silt            | 65                               |
| Sand            | 13                               |

| Soil texture  | Silt clay | pH       | EC       |
|---------------|-----------|----------|----------|
| pH Analysis of water irrigation | 7.1       | 4.2      |

3. Results and Discussion

3.1 Plant height

Table 2 showed that the C2 cultivar was significantly superior in plant length (65.78cm) comparing to (61.66cm) in C1. The reason for this that the genetic differences between the cultivars in showing their genetic ability and doubling it and translating it to plant height, this agreement with [5]. Moreover, T3 was highest in plant height (68.28 cm) compare with T1, T2 (59.42, 63.45 cm) respectively. This was maybe due to the presence of licorice and yeast that contributed to cell division and elongation as Licorice root extract contented vitamin B2 and B1 present in the yeast suspension which enters into the enzymatic accompaniments that have an important role in the processes of oxidation and reduction and intervention in metabolic processes in the plant causing their division and expansion [11]. Interaction between cultivars and spray treatments revealed that the combination of C2T3 gave the highest average of 68.95 cm while treatment control C1T1 gave 57.5 cm.

Table 2. Effect of bean cultivars, spray treatments and their interactions on plants height (cm).

| Treatments | Cultivars | Luz De Otono | Aquadulce | Mean of treatment |
|------------|-----------|--------------|-----------|------------------|
| T1 (Control) | C1 | 57.50 | 61.34 | 59.42 |
| T2 (40mg IAA.L⁻¹) | C1 | 59.85 | 67.05 | 63.45 |
| T3 (10gm of licorice with yeast.L⁻¹) | C1 | 67.62 | 68.95 | 68.28 |
| Mean of cultivars | | 61.66 | 65.78 | |
| L.S.D.₀.₀₅ | C=2.106 | T=2.579 | CT=3.648 |

3.2 Leaves area

The results presented in Table 3 showed that Cultivar C2(52.3 dcm²) significantly exceeded C1(44.7 dcm²), this may be due to the nature of genetic variation, which differs in the response to plant extracts to obtain a high value [15]. Furthermore, no significant differences were found between T3 and T2 treatments in the leaves area (51.5 and 50.5 dcm²) respectively as compared with (43.9 dcm²) for T1 treatment. The reason may be due to the increase in the content of chlorophyll (Table 3) and thus will increase the products of photosynthesis and thus will increase the leaf area, this agrees with[9]. The combination of C2T3 Gave a higher leaves area (57.0 dcm²) while the treatment control C1T1 gave the lowest area (43.1 dcm²)

Table 3. Effect of bean cultivars, spray treatments and their interaction on leaf area (dcm²)

| Treatments | Cultivars | Luz De Otono | Aquadulce | Mean of treatment |
|------------|-----------|--------------|-----------|------------------|
| T1 (Control) | C1 | 43.1 | 44.6 | 43.9 |
| T2 (40mg IAA.L⁻¹) | C1 | 45.5 | 55.4 | 50.5 |
| T3 (10gm of licorice with yeast.L⁻¹) | C1 | 45.6 | 57.0 | 51.5 |
| Mean of cultivars | | 44.7 | 52.3 | |
| L.S.D.₀.₀₅ | C=4.25 | T=5.20 | CT=7.36 |
3.3 Chlorophyll content

The results presented in Table 4 showed that, no significant between the two cultivars in related to chlorophyll content. Concerning to the treatments, T3 had the highest Chlorophyll content, 23.98 SPAD, which was significantly higher than the other treatments. This may be due to the inclusion of yeast suspension with licorice root extract on mineral elements (Mg, Zn, N, Fe and Cu) that an important role in the construction of chlorophyll. [13].

| Treatments | Luz De Otono C1 | Aquadulce C2 | Mean of treatment |
|------------|----------------|--------------|------------------|
| T1 (Control) | 18.71          | 19.76        | 19.23            |
| T2 (40mg IAA.L⁻¹) | 20.66          | 22.06        | 21.36            |
| T3 (10gm of licorice with yeast.L⁻¹) | 24.14          | 23.82        | 23.98            |
| Mean of cultivars | 21.17          | 21.88        |                  |
| L.S.D. 0.05 |                  |              | C=N.S           |

3.4 Nitrogen content

Results in table 4 showed no significant differences between the two cultivars (Luz De Otono and Aquadulce) for Nitrogen content. Also, data in the table (4) clarified that significant differences were found between spray treatments in Nitrogen content, T3 was significantly higher than the other treatments with an average of 4.623% which may be explained as the role of nitrogen-containing extracts, in addition to the role of Nitrogen in amino acids and proteins formation, thus increasing the availability and movement of the potassium element inside the plant [13]. There are significant differences in interaction between cultivars and spray treatments, C2T3 gave highest mean that reached to 4.882%, but C1T1 have less value of K+ content (1.712%).

| Treatments | Luz De Otono C1 | Aquadulce C2 | Mean of treatment |
|------------|----------------|--------------|------------------|
| T1 (Control) | 1.712          | 1.773        | 1.743            |
| T2 (40mg IAA.L⁻¹) | 3.446          | 3.499        | 3.472            |
| T3 (10gm of licorice with yeast.L⁻¹) | 4.763          | 4.882        | 4.623            |
| Mean of cultivars | 3.307          | 3.385        |                  |
| L.S.D. 0.05 |                  |              | C=N.S           |

3.5 Potassium content

Based on the results in (Tab.6), the treatment T3 was significantly higher in potassium content (3.12%) compare with anther treatments (Tab.6), the reason for the increase in contrast ratio can be explained by the inclusion of licorice root extract and yeast suspension on the necessary mineral elements.[13]. Cultivar C2(2.684%) significantly than other treatments, this may be due to the nature of genetic variation, which differs in the response to plant extracts to obtain a high value [14, 12]. The combination of C2T3 gave a higher rate3.223% while the C1T1 gave the lowest average of 2.159%.

| Treatments | Luz De Otono C1 | Aquadulce C2 | Mean of treatment |
|------------|----------------|--------------|------------------|
| T1 (Control) | 2.159          | 2.240        | 2.199            |
| T2 (40mg IAA.L⁻¹) | 2.390          | 2.590        | 2.490            |
| T3 (10gm of licorice with yeast.L⁻¹) | 3.017          | 3.223        | 3.120            |
| Mean of cultivars | 2.522          | 2.684        |                  |
| L.S.D. 0.05 |                  |              | C=0.086          |

Table 4. Effect of bean cultivars, spray treatments and their interaction on chlorophyll content (SPAD).

Table 5. Effect of bean cultivars, spray treatments and their interaction on nitrogen content (%).

Table 6. Effect of bean cultivars, spray treatments and their interaction on potassium content (%).
Conclusion

The treatment 10gm of licorice with yeast.L⁻¹ is the best treatment is recommended to give plant height, leaves area, chlorophyll, N and K content in leaves. The interactions between The treatment 10gm of licorice with yeast.L⁻¹ for cultivar Aquadulce recorded highest in most studied measurements.

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