Contribution to the improvement of greenhouse cuttings of oregano: Origanum majorana

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Abstract- Until today. Oregano is considered as one of the most interesting medicinal plants. Since the isolated compounds of this plant are used in various industries (pharmaceuticals, agri-food, cosmetics and perfumery), this leads to a great demand for domestication for large-scale cultivation. With this in mind, our study is committed to proposing a strategy for improving the success rate of oregano cuttings under greenhouse conditions. As a working methodology, we proposed the study of the effect of several parameters on the rate of greenhouse cuttings, namely the nature of the substrate, the effect of certain products on the rate of rooting and the effect of the position of the cuttings in relation to the mother plant. With a total of 540 cuttings carried out, we obtained a percentage of success according to the nature of the substrate varying respectively from 32.95%, 34.09% and 32.95% for the sandy substrate, mixture 1/2 sand 1/2 compost and 1/3 sand 1/3 compost 1/3 peat. For the effect of the rooting products, we obtained respectively 22.64%, 20.88%, 26.17%, .29% for willow water, a product based on AIB, a product based on mineral matter and amino acids and a product based on free amino acid and polysaccharides.Our results showed that the cuttings from the apical part, gave the highest rates, and also showed that the success of the cuttings of oregano also depends on the position in the greenhouse.

Index Terms- Greenhouse, Substrate, Apical part, cuttings.

I. INTRODUCTION

Asexual orvegetative propagation is a plant propagation technique in which fragments are used to create a whole plant. This can be done using the stem, leaf, root or other explants. There are other modes of asexual propagation commonly used in commercial plant propagation, such as grafting, layering. Vegetative propagation is the most important method of propagation for many commercial horticultural crops [1]. In the absence of successful plantings, research had to be invested to save the oldest trees. While it is easy to reproduce a young plant, it is often much more difficult to obtain vegetative copies when the trees are very old [2]. There are many factors involved in the production of plants using vegetative propagation, but there are many factors that affect the percentage of success of cuttings, which are: the time of year, the age and health of the mother plant, the type of rooting medium, temperature, air circulation, light and many other factors play an important role in the success of the operation [1]. The formation of adventitious roots is a key stage in the vegetative propagation of woody or horticultural species, and problems associated with rooting cuttings often result in significant economic losses.

The objective of our work is to improve the success rate of cuttings as well as the growth rate of oregano in greenhouses. To achieve these objectives, we proposed to study the effect of several parameters: the nature of the substrate, the effect of certain products on the rooting rate, the effect of the position of the cutting in relation to the mother plant, and finally the effect of the location of the pots in the greenhouse.

II. MATERIALS AND METHODS

This study was carried out on the species of oregano (Origanum Majorana) which is has a great medicinal and economic interest. The cuttings were taken from healthy mother plants, which we purchased from a recognized nursery.

The cuttings were taken between March and April.

1.Place of experience

The tests were carried out in a plastic tunnel greenhouse at the Faculty of Science Ibn Tofail Kenitra. To ensure good shading of the cuttings, a white screen was installed 1.5m high above the cuttings inside the greenhouse.

2.Choosing the location of plastic bags in the greenhouse

In our study, we wanted to study the effect of the location of the bags in the different parts of the greenhouse (central, side and bottom). For this reason, three environments were chosen.

3.The choice of the parts of the plant; apical, basal and median

Three types of cuttings were taken from the mother plants and are: woody cuttings (taken from the basal part of hardened branch), semi-woody cuttings (taken from the middle part of the twig with axillary buds) and herbaceous cuttings (taken from the apical part of twigs with apical buds).

4.Choice of substrate

Three types of composition were chosen for the purpose of knowing the effect of substrate composition on

rooting and budburst of cuttings. A control substrate (soil) was adopted, plus two other substrates were tested (figure 1).

- Substrate1: composed of soil only
- Substrate2: composed of ½ soil + ½ compost (dead leaves of maritime pine)
- Substrate3: composed of 1/3 soil + 1/3 compost (dead leaves of maritime pine) + 1/3 peat.

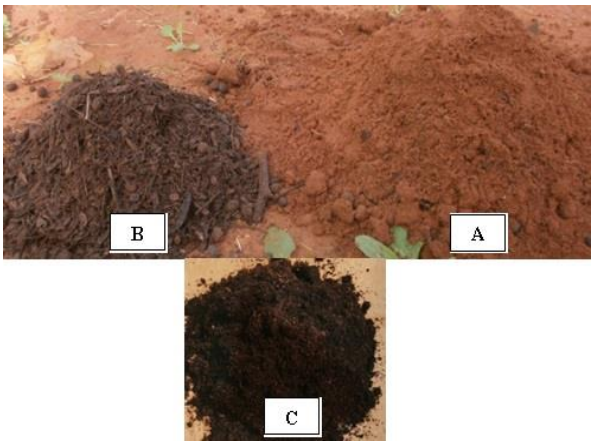

Figure 1: Types of substrates used (A: soil, B: compost, C: peat)

An experimental device has been adopted, this device consists of 20 plastic bags (block) for each type of cuttings (A: apical, M: median, B: basal) to make 60 bags for each type of substrate (S1: substrate 1, S2: substrate 2, S3: substrate 3) for a final number of the bags for each medium (M1: medium 1, M2: medium 2, medium 3) is 180 plastic bags, while the total number for the three media is 540 bags.

5.Preparation of products for treating cuttings

- Preparation of product (P1) based on indole-3-butyric acid (IBA)

  For the product based on indole-3-butyric acid is used without dilution according to the product instructions.

- Preparation of product (p2) based on mineral materials We proceeded to a dilution according to the product's instructions using tap water.

- Preparation of product (p3) based on Azoxystrobin

  We proceeded to a dilution according to the product's instructions using tap water.

- Preparation of willow water

  It consists of cutting 5 cm fragments from a weeping willow mother plant without specificity. For 1 kg of the willow fragments, we added 3 Litres of tap water, which we incubated for 3 weeks. The resulting solution will be used as watering water for the cuttings. The solution that was obtained will contain a plant hormone (salicylic acid).

6.Cultivation

Cuttings are taken in the morning with a length that varies from 2cm to 7cm containing 3 to 4 knots. And then, all the cuttings have undergone a physical treatment which consists in making longitudinal incisions in the epidermis at the base of the cuttings before planting them.Once prepared, the cuttings underwent a chemical treatment which consists in soaking cuttings in rooting products (willow water, p1, p2, p3) (photo 2) for 10s in the 4 products, plus a control which did not undergo any treatment to have the effect of the tested products. After soaking the cuttings, they are sunk into the tested substrate with 2/3 of the cuttings sunk in.The watering was carried out in the morning in the form of a light sprinkling of water. The duration between two waterings is between 2 to 3 days according to the need.

7.Measured parameters

The parameters measured were the percentage of successful cuttings and the average length of the aerial part. The measurements were taken one month after the trial was set up.The results obtained underwent statistical analysis using SPSS software coupled with Excel.

III. RESULTS AND DISCUSSION

1. Percentage of successful cuttings

A. In the middle 1 (edge of the greenhouse)

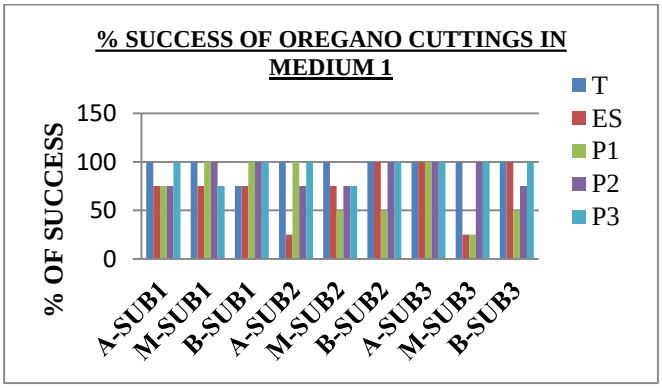

Figure 2: Variation of the survival rate of oregano cuttings in (%) according to the type of treatment (T: control; E.S: willow water;

P1: BIA product 1; P2: mineral product 2; P3: mineral product 3 and amino acids and polysaccharides), the type of substrate and the type of cutting in medium 1.

The success rate of cuttings for oregano varies according to the type of treatment, the type of substrate and also according to the position of the cuttings in the mother plant (Figure 2). From the histogram, there is a remarkable variation in the percentage of success of the oregano cuttings obtained in each substrate (sub1, sub2, sub3) as well as in each type of cuttings (A, M, B) treated with different products (E.S, P1, P2, P3).

- Concerning substrate 1 composed of soil, the three types of cuttings have almost the same survival rate, and cuttings treated with P1, P2, P3 also the control have the highest percentage of success, while cuttings treated with willow water give the lowest percentage of survival in the three types of cuttings. It is observed that there is not a significant difference between the three types of cuttings as well as between the means of different treatments.
- In substrate 2 composed of compost soil, we did not record differences between the means of three types of cuttings and between the treated cuttings, this is confirmed by the ANOVA test which shows that there is no significant difference between the three types of cuttings and also between the different treated cuttings.
- In substrate 3 composed of soil-compost-peat, cuttings from the apical part show the highest percentage of survival (100%) for all treated and untreated cuttings, while cuttings from the middle part show the lowest percentage. Control cuttings of each type of cuttings had the highest rate.

Statistical analysis does not reveal a significant difference between the different parameters studied ($p>0.05$).This is confirmed by [3] and [4]who considered that oregano is a plant that particularly appreciates dry soils, and that its cultivation is possible in all types of soils.

B. In the middle 2 (middle of the greenhouse)

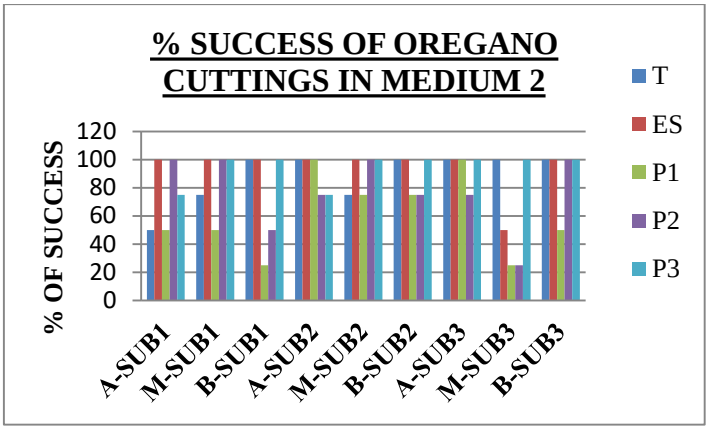

Figure 3: Variation in the survival rate of oregano cuttings in (%) according to the type of treatment (T: control; E.S: willow water; P1: product 1 based on BIA; P2: product 2 based on mineral matter; P3: product 3 based on mineral matter and amino acids and polysaccharides), the type of substrate and the type of cutting in medium 2.

The percentages of success of the cuttings obtained in the three substrates (Figure 3) varied between the three types of cuttings and between the cuttings obtained from treatment with the training products tested. For all three types of cuttings, cuttings treated with ES yielded similar survival percentages higher than other treatments in Substrate 1 and 2, while cuttings treated with P1 had the lowest success rate in Substrate 1. The results of the analysis of variance showed no significant effect between the three types of cuttings. In Substrate 3, the cuttings were untreated (control) and the cuttings treated with ES, P2 and P3, so the best results were recorded in the cuttings treated with the mineral, amino acid and polysaccharide product. In the same sense, experiments have shown that the elements N, P, K, Ca and Mg are the most necessary for plant development [5]and according to [6] and[7], Nitrogen is necessary for the development of many organic compounds of plants, such as amino acids, proteins, nucleic acids, chlorophyll pigments, some Enzymes and Alkaloids. While the median cuttings subjected to the various treatments have

the lowest survival rate, statistical analysis by the ANOVA test reveals no significant difference between the means of survival for the three types of cuttings. However, for the substrate type factor, no significant effect is found. Cuttings grown in all three substrate types react in the same way.

C. In the middle 3 (at the bottom of the greenhouse)

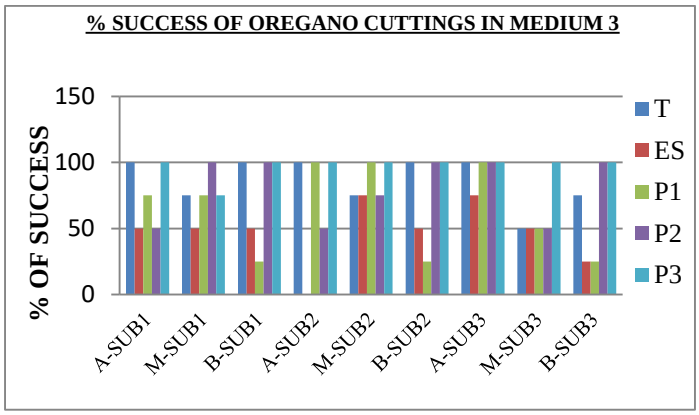

Figure 4: Variation of the survival rate of oregano cuttings in (%) according to the type of treatment (T: control; W.S: willow water; P1: product 1 based on BIA; P2: product 2 based on mineral matter; P3: product 3 based on mineral matter and amino acids and polysaccharides), the type of substrate and the type of cutting in medium 3.

Figure 4 shows that the survival rate of oregano cuttings varies by substrate type:

- In Substrate 1, it was found that for all three types of cuttings, the highest percentage survival was found in cuttings treated with P2 and P3, and also found in cuttings that were not treated (control). While the cuttings treated with E,S, the success percentage is 50% for all three types of cuttings. Statistical analysis did not reveal any significant difference between the three types of cuttings and between the different treatments.
- Whereas in Substrate 2, the survival rate for ES treated cuttings from the apical part is zero. The highest success rate of 100% is found in cuttings that have undergone P3 treatment in all three types of cuttings.[6] and [8]consider that, together with nitrogen, phosphorus constitutes the protein phosphatins, also plays an important role in carbohydrate metabolism and enzyme synthesis. Statistical analysis did not reveal any significant difference between the three types of cuttings and between the different treatments.
- In Substrate 3, the highest survival rate is obtained in apical cuttings for all treatments. Cuttings from P3 treatments achieved the highest percentage 100% in all three types of cuttings. According to the statistical results, the comparison of the means by the ANOVA test reveals that the difference between the means obtained in the 3 substrates is insignificant (P>0.05).

2. Study the length of the aerial part

A. Effect of rooting products on stem length

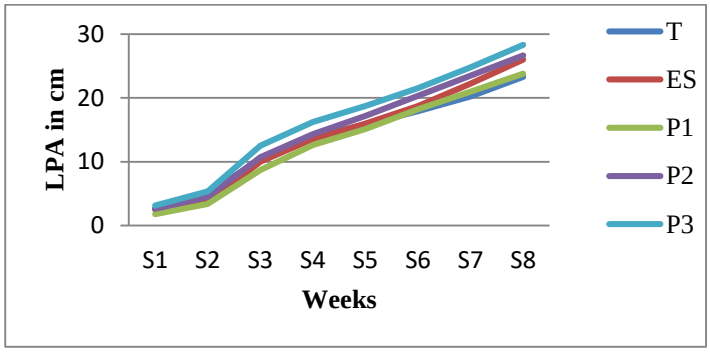

Figure 5: Evolution of oregano stem length as a function of the type of treatment and time in the week.LPA: length of the aerial part, T: control, E.S: willow water, P1: product 1, P2: product 2, P3: product 3.

The stem length of the treated cuttings (Figure 5) also depends on the type of substrate, the location in the greenhouse and the position of the cuttings in the parent bed. it appears that the length of the oregano stem varies according to the type of rooting products. In fact, stem length increases slowly between week 1 and week 2 in all cuttings depending on the treatment. Afterwards there is a slightly rapid increase from week 2 with a slight dominance in cuttings treated with the mineral, amino acid and polysaccharide product, which reached an average of 28.33cm in week 8, followed by cuttings

treated with the mineral material product with an average of 26.7cm, and for cuttings treated with willow water they reached an average of 26.03cm, while for cuttings treated with the BIA product, and the control they reached, 23.81 and 23.29cm respectively. Statistical analysis revealed that there was no significant difference between cuttings that had undergone different treatments. [9] showed that in bush roses, periods of nitrogen deprivation followed by unrestricted feeding increased basal branching.

B. Effect of substrate on stem length

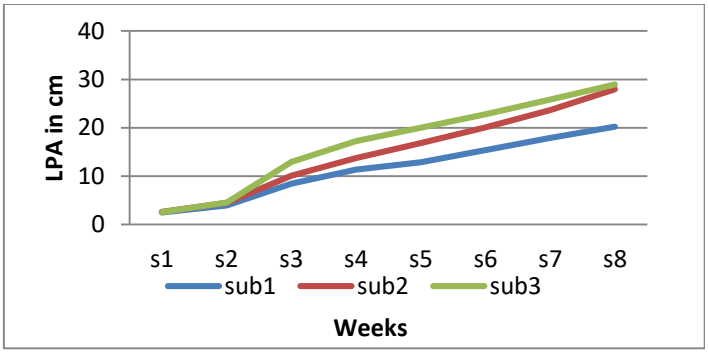

Figure 6: Evolution of Oregano stem length as a function of substrate type and time in the week.

Figure 6 shows the evolution of oregano stem length as a function of time in the week with the three types of substrates (sub1: soil; sub2: soil + compost; sub3: soil + compost + peat) The stem length in the three substrates is also dependent on the type of cuttings, the location in the greenhouse and the position of the cuttings in the mother plant. After a week of cultivating the oregano cuttings, we notice that the length of the stems is almost similar in the three substrates. After the 8th week of cultivation, the length of oregano stems in the three substrates averages 20.22: 27.98 and 28.96 for substrates 1, 2 and 3 respectively. So, we notice that there is not a remarkable difference between the means of stem length in the three types of substrates, this is confirmed by the one-factor ANOVA test.

C. Typical effect of the position of cuttings on stem length

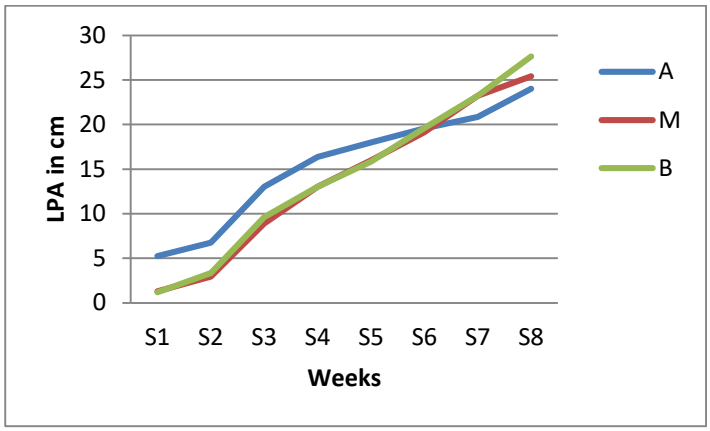

Figure 7: Evolution of oregano stem length as a function of the type of cuttings and time in the week

The stem length for all three types of cuttings is also dependent on the type of substrate, the location in the greenhouse and the position of the cuttings in the mother plant. After one week of cultivating three types of oregano cuttings (Figure 7), we found that the length of the stems of the basal and middle part is almost the same: 1.19 cm and 1.3 cm, while for the apical part the length is 5.25 cm. Knowing that, at t0 the length of the stems of the apical part is between 3 and 4cm while the length of the medial and basal part is equal to 0.From week 6, the length of the stems of the apical part decreased compared to the other two parts (median, basal), and from week 7 the length of the basal part increased to reach the highest average of 27.65cm in week 8, followed by the median part with an average of 25.4cm, while a low average of 24.03cm was found in the apical part. From these results, we found that there is no difference between the means of stem length in the three types of cuttings. This is confirmed by the ANOVA test which then shows a non-significant difference between the means of length of the three types of cuttings ($p<0.001$).

D. Effect of location of pots in the greenhouse on stem length

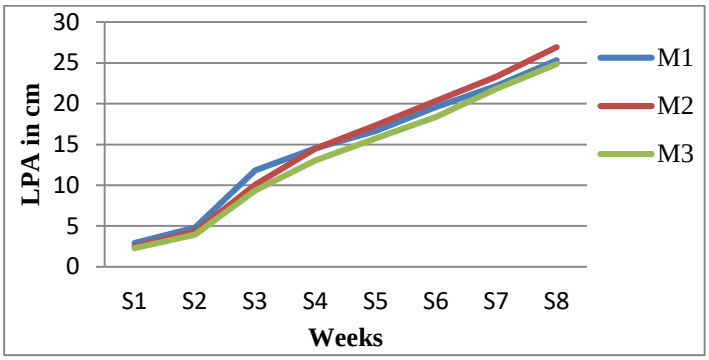

Figure 8: Effect of the middle of the pot location in the greenhouse on the length of oregano stems versus time (week).

The effect of the three environments tested in oregano is manifested by an increase in the length of the aerial portion every eight weeks (Figure 8). Stem length in all three media is also dependent on substrate types, types of cuttings and the position of the cuttings in the mother plant. Indeed, the length of the aerial part recorded after one week is on average 2.9; 2.5 and 2.3cm respectively for media 1, 2 and 3.Then, during week 2, we see that there is a slow increase in stem length in all three media, and from week 3 onwards we notice that there is a slightly rapid increase in stem length which by week 4 has reached 11.84cm in medium 1 and 10.05cm in medium 2 and 9.36cm in medium 3.From the 8th week, the length of the aerial part increases again and reaches 25.34cm, 26.92cm and 24.84cm in the 1, 2 and 3 weeks respectively. According to the statistical results, the comparison of the means by the ANOVA test reveals that the difference between the means obtained in the 3 media is insignificant.

IV. CONCLUSION

Thearomatic and medicinal plant sector (MAP) in Morocco is full of potential thanks to the diversity of its species. The maximum of these species contains products for medicinal and aromatic use. These plants are used in various industries (pharmaceutical, food processing, cosmetics and perfumeries) which leads to a great demand for domestication for large-scale cultivation. Propagation of the species studied (oregano) by cuttings not only improved cuttings in tunnel greenhouses, but also saved (money and time). The power of success of cuttings is different depending on the species. Some species have a high survival power while others have a low survival power. This work allowed us to know the effect of a few parameters on the survival capacity of the species studied, namely the type of cuttings, substrate type, the effect of rooting products and the effect of the environment. In our work, we have found that apical cuttings treated with BIA products require less time for root release than treated cuttings. On the other hand, it should be remembered that in oregano, best results can be obtained without taking into account several parameters such as the substrate used, type of cutting, treatments and the location of the pots in the greenhouse. Therefore, with the minimum of expense, we will be able to get a good yield.

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