

Wild and Marine Plant Extracts, Safe and Alternative System to Reduce Damage of Mineral Fertilizers and Stress Cases in Vegetable Crops. A review

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ABSTRACT

At the present time the population of the globe has exceeded 7 billion people and this increase in population has been accompanied by an increase in the demand for food, and the population's need for food can be met by raising productivity by increasing the rates of added chemical fertilizers, especially when planting vegetable crops compared to other crops due to the short growth period of vegetable crops, therefore, the focus was largely on increasing productivity regardless of the quality and safety of the food product of vegetable crops. Statistics have shown in many studies that the high consumption of fruits, leaves, stems, tubers and roots of vegetable crops treated with chemical fertilizers exacerbate the harmful effect on public health and increased pollution of the environment and soil by increasing the amount of nitrates and harmful chemicals in the parts that are eaten by the plant, so the recent trend in agriculture has been focused on the use of wild plant extract and seaweed extracts, they are substances that encourage growth of plants with few concentrations, as they contain more than one group of substances that encourage growth, such as axins, gibberelins, and cytokines, some small and major nutrients, in addition to containing some amino acids, adding it to the soil improves its physical, chemical and biological properties, increases the ability to retain moisture, increases the activity of microorganisms, increases the growth of the root and vegetative complex and yields, resists vital stresses, increases the efficiency of nutrient absorption from the soil, increases photosynthesis, as well as its function as antioxidants through its role in increasing activity Some enzymes.

Keywords: Wild extracts. Seaweed extracts. Stresses.

Introduction

Several studies in which researchers endeavor to increase the productivity of vegetable crops in terms of quantity and quality, where it was found that foliar spraying or adding chemical fertilizers to the soil in the fields of commercial production of vegetable crops has contributed effectively to increasing the production of these crops and improving plant growth (Eugeniusz and Katarzyn, 2013; Alsheikh, 2017; Ibraheem *et al.*, 2019; AL-Bayati *et al.*, 2019; Allela *et al.*, 2019). However, the fears that accompany the use of chemical fertilizers from an environmental and health standpoint and the high costs of using these fertilizers require researchers to search for alternative means that are safe from a health point of view and produce naturally (Bayoumi and Hafez, 2006; Zodape *et al.*, 2008; Morsy *et al.*, 2009; Mohammed, 2009; Ahmed and Shalaby, 2012). These means are the use of seaweed plant extracts and natural wild herbs with an inhibitory effect for transpiration and stimulating radical growth and resistance to extreme conditions (Odell, 2003), and for the purpose of stimulating plant growth and improving the quantitative, qualitative and storing qualities in the best condition and for the longest possible period, as well as the importance of these natural extracts in reducing water consumption and increasing the efficiency of plant use of the moisture content of the soil and stimulating the growth of roots and improving their ability to absorb (Jamal, 1998), as well as the ability of many extracts to inhibit the growth of some microorganisms and harmful fungi of potato root and tubers which cause significant damage to plant growth and yield (Oosterhaven *et al.*, 1996 and Soliman and Badeaa, 2002).

The researchers found that there are many plants, including herbs, which if the extract preparation from them and applied on whole plants or part of them or on the soil may lead to reduce the incidence of some bacterial, fungal and viral diseases and control weeds then increasing the yield (Khalid, 2003; Ersin *et al.*, 2008; Muhammed *et al.*, 2009; Jahan *et al.*, 2012).

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Natural extracts play a positive role in increasing the moisture content of leaves, increasing the leaf content of chlorophyll and maintaining the turgor pressure of plant cells (Jannin *et al.*, 2013 and Battacharyya *et al.*, 2015). This may be due to the role of these substances in reducing the transpiration rate, preserving cells and reducing water loss through stomata or containing gums materials helps to retain water in cells, and these extracts also contain iron, magnesium, and nitrogen elements that make up the chlorophyll molecule (Reeta and Bhatnager, 2011). In addition to containing compounds similar in behavior to the behavior of the growth regulator of gibberellins, Wasfi (1995) mentioned that gibberellins compounds have a stimulate effect in building the chlorophyll molecule and delay the demolition of chlorophyll. Al-Shahwani and Al-Sahaf (2009) mentioned that plant extracts contain clikoside substances that increase the concentration of cellular juice in the leaves and make them retain water. These results are consistent with Blunden and Lin (1997), Jensen (2004). Natural extracts play an important role in increasing vegetative growth and productivity in various vegetable crops. Ibraheem (2012) mentioned that the aqueous extract of licorice root plant and the seaweed extract called sulameine contain many nutrients, axins, gibberellins and cytokinines which stimulated vegetative growth and encouraged the division and elongation of plant cells in the potato plant, and to the role of physiological extracts in striking a balance in the biological processes within plant tissues (Stephenson, 1986)., and to the role of these extracts in stimulating the antioxidant enzymatic system in plant cells, especially increasing the activity of Superoxide dismcataase, Glutathione reductase and Ascorbate peroxidase enzymes, and thus increasing the resistance of plants to endure harsh conditions (Jamal, 1998)., and this is reflected in the increase in growth and productivity indicators in many of vegetable crops. Odell (2003) stated that plant extracts containing axins, amino acids and other plant hormones stimulate the growth and development of the root and vegetative growth, increase plants resistance to stress and water stress and prevent vitamin oxidation (C and E) that are present in chloroplast, which increases the efficiency of photosynthesis, these the results are consistent with what Jensen (2004) stated that spraying potato plants with natural extracts resulted in a significant increase in the characteristics of vegetative and root growth. Seaweeds particularly the brown algae are a source of polysaccharides, sterols, N-containing compounds e.g. betaines, macro- and micronutrients, and also growth-promoting substances such as auxins, cytokinins, gibberellins, and steroids (Khan *et al.*, 2009 and Craigie 2011). Potter (2005) showed that adding plant extracts creates a strong branched root system, thereby stimulating better absorption of water and nutrients from the soil and forming a strong vegetative population, and this is in line with what El-Bayati found (2013) and Daoud (2013) that adding marine extracts has caused an increase the vegetative growth of two potato varieties (Latona and Desirre), which caused a significant increase in some characteristics of vegetative growth. Lucini (2015) and Elansary *et al.* (2016) found that under abiotic stress (water stress) the application of *Ascophyllum nodosum* seaweed extract could improve leaf gas exchange mainly by reducing stomatal closure. Several studies have recorded a clear increase in the characteristics of the quantitative yield of vegetable plants when using plant extracts in fields planted with vegetable crops (Blunden, 1977; Norrie, 1996; Lopez, 1997; Riely, 2002; Jensen, 2004; AL- Bayati, 2013; Siddagangaib, 2010; Daoud, 2013; Hayat *et al.*, 2018 and Ibraheem *et al.*, 2020).

Methods of using natural extracts in production fields:

Natural extracts are used either as a compost where they are placed with soil preparation when planting or mixed with agricultural media, or as a liquid extract or as a powder and can be used in various ways, including:

1- Spraying on vegetative growth: As the foliar spray of solutions containing natural extracts rich in nutrients will lead to the absorption of nutrients directly from the aerial parts of the plant and the nature of absorption varies according to the plant in terms of skin composition, the thickness of the epidermis, the size and nature of the stomata. Most of the researchers used this method in the production fields such as (Abdel-Mawgoud *et al.*, 2010; Obiad *et al.*, 2011; Ismael, 2012; Bozorgi, 2012 and Rouphael *et al.*, 2017).

2- Addition to the soil: When adding natural extracts to the soil, the roots absorb water and enough nutrients, and the greater absorption of water takes place in the root capillaries region and then the elongation area. As for the amount of water absorbed through the root cap and the meristem region,

there is little. Some of the researchers used this method in the production fields like (Helmy, 1992; Ibraheem, 2015; and Eisa, 2016).

The mechanism of water absorption, including nutrients through the roots, is still a topic of debate and scientific debate to this day, but it is generally suggested that there are two types of absorption:

A- Passive Water Absorption:

Accordingly, the entry of water to the roots occurs as a result of the effectiveness of the vegetative part (especially the leaves), while the roots themselves play the role of the absorption surface and the transporting channel only, and in this way the greater part of the water is entered into the plant as the evaporation of water from the leaf cells through stomata leads to an increase in negative osmotic potential and less inflation in the leaf cells and thus the free energy of water (water potential) in the leaf cells becomes less any more negative, and then the leaf cells absorb water from the neighboring and last cells from the carrier cells the leaf and so on until absorbed water is from stem cells, the root, and then the soil solution. Although the loss of water in the transpiration process is the main cause of negative force, the loss of water in any other way, such as its entry into vital reactions and growth processes, leads to the occurrence of negative absorption of water.

B- Active Water Absorption: The absorption of water and nutrients occurs under this method due to the activity of the activity of the cells of the root system of the plant. It requires the exchange of vital energy that is prepared from the breathing process and it proceeds with either an osmotic or non-osmotic mechanism and the use of energy in it directly or indirectly is as follows:-

1- The non-osmotic mechanism:

According to the mechanism, the water, which is soluble, is transported from the soil solution to the root cells with the help of the energy released from the breathing process, and the direction of its movement is opposite to the concentration slope from the low concentration of water to the high concentration of water, and this requires direct energy supply to overcome the diffusion laws that run under the concentration slope., and this condition happening when the plant is very thirsty or the soil is dry, which causes the plant to wither temporarily or both.

2- The osmotic mechanism:

According to this method, energy is used, but indirectly, as the water in which enough of the solutes are transported from the soil to the internal parts of the root according to the osmotic mechanism from the high concentration of water to the low concentration, water is transmitted through the epidermal of the root to the dermis to endodermis, then the cylinder vascular tissue, phloem and finally to xylem as a result of increased concentration of solubles toward the inner cells of the root (Muhammad, 1985). Ibraheem's study (2012) showed that the addition of aqueous extract of licorice roots concentrates 4 g. L⁻¹ and seaweed extract Solamain at a concentration of 4 ml. L⁻¹ to potato plants soil field has achieved significant results in the average weight and size of the tuber, the yield of one plant, and total and marketing yield of tubers, which may not show a direct effect compared to the method of adding to the soil, as well as a result of containing these two extracts in their composition on the element of calcium that enters in the formation of cell walls through its association with pectin and the formation of calcium peptides that increase the rigidity of the walls as well as its role in stimulating the growth, elongation and division of cells (Abu Dahi and Yunus, 1988). Therefore, the method of adding to the soil was superior to the method of foliar spray due to the proximity of the contact area between the root group of plants and these extracts, which reflected positively on the mentioned characteristics and these results were consistent with, and with what Reeta and Bhatnager (2011) found that adding three botanical extracts in a way addition to the soil significantly outperformed the method of foliar spray in all traits of tomato plant variety Pusa Ruby and with Daoud (2013), which reached a significant increase when adding seaweed extract Alga 600 to the soil of potato plants in the average of one plant yield and the total and marketing yield of tubers compared to the method of foliar spray.

3- Adding soil and foliar spraying system (fusion method):

Abdel Wahed (2020) reached a significant increase in the total chlorophyll ratio in leaves and number of leaves and many of the characteristics of the quantitative yield of summer squash plant by

adopting the method of adding soil and foliar spraying system (fusion method) when using the Acadian seaweed extract at a concentration of 2 and 4 ml. L⁻¹. The results have explained that the adoption of the merging method compared to the method of adding to the soil, as the foliar spray method is considered to be highly efficient in absorbing the nutrients contained in marine extracts, and this method may have led to the arrival of the pH to the optimum level of leaves and thus the conditions have become suitable for absorbing the nutrients needed by the plant, which is reflected positively and spiritually in increasing vegetative growth (Brayan,1999). Also, the participation of both the method of foliar spray and adding to the soil with each other (merging) may lead to the plants reaching the optimal food balance condition appropriate to the growth of plants because the two application methods(fusion method) provided plants with the necessary nutrients.

Based on the above, we can deduce the following.

- 1- Using wild plant and seaweed extracts may help us reduce soil and water pollution problems.
- 2- Reducing the use of chemical fertilizers, which reduces the residual effect of chemical fertilizers, which may lead to climate changes that are inappropriate for humans and plants.
- 3- The quantities of natural fertilizers in agriculture are very small when compared to chemical fertilizers, which leads to an increase in the economic yield and a reduction in the problems of soil and air pollution.
- 4- Reducing the use of insecticides and fungicides from using natural plant extracts in agriculture reduces the quantities of pesticides used in the control and thus reducing the biological stresses.
- 5- Improving the characteristics of the vegetative growth of many vegetable crops that were fertilized with natural fertilizers
- 6- Improving the quality of vegetable products by increasing the percentage of nutrients in vegetable plants treated with natural plant extracts.

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