

## **Calcium (the Unknown Soldier) in improving the growth, productivity and quality of agricultural crops**

**Calcium** is one of the most essential nutrients necessary for plants. It is one of the most important and effective elements in the growth and improvement of productivity and quality of agricultural crops. Before identifying the physiological roles of calcium, one must first know the most important characteristics and behavior of this element in the field of plant nutrition. Calcium element is a slow-moving nutrient in both plant and soil, which requires its early addition at the beginning of fertilization programs to provide the needs of this element. In addition, the movement of the calcium element is in one direction, from bottom to top in the xylem, and is linked to the movement of transpiration and the water column, unlike the rest of the other elements. Which is characterized by movement in two directions, from bottom to top through the xylem tissues and vice versa, from top to bottom through the phloem tissues. The distribution of calcium is not homogeneous within plant tissues due to its related to the transpiration current. The plant organ that absorbs a high amount of water contains high amount of calcium and vice versa, which needs to additions of this element either as soil and foliar application in the same time, especially in critical physiological stages of the plant's life. (Such as the stage of pollination and fertilization and stage of growth and development of fruits). The absorption of calcium varies depending on the age of plant organ. The concentration of calcium in the leaves is several times the concentration in the fruits. In addition, the absorption of calcium by young fruits is several times than older fruits (that is, the older fruits, is less they absorb calcium), which necessitates to use of calcium in the early stages of fruit life in order to maximize the use efficiency of this element. The mobility and behavior of the calcium element within the plant is linked to the presence of the boron element at low concentrations, for both soil and foliar application, because the presence of the boron element encourages the absorption of the calcium by the plant, in what is known as the synergism effect. Also, the presence of the calcium element with boron reduces the toxicity of boron within the plant especially under excessive doses of boron. In addition, the movement of calcium within plant organs is very low .So it does not move from leaves to fruits or vice versa, and thus deficiency symptoms appear on new leaves. Calcium is found in different forms of compounds, the most important of which is

soluble calcium nitrate, which is used through fertilization under all different irrigation systems, as well as granulated calcium nitrate, which is used through spreader or by hand under flood irrigation conditions, as well as calcium chloride, which is used under Flood irrigation conditions and it is not preferable to use it under saline soils or salt-sensitive crops .Also, liquid calcium nitrate, which is suitable for use under all different irrigation systems. In general, one of the most important physiological roles of calcium in the growth and improvement of productivity and quality of agricultural crops, which is sometimes or often neglected in the use of farm owners. Calcium play a vital role in fertilization programs in order to obtain a high-quality agricultural product in quantity and quality in addition to increasing the storage and marketing capacity of the fruits is as follows:

### **1-The role of calcium in improving soil structure and reducing salt content**

Under the conditions of saline soils and water in which contains high amount of sodium and chloride ions. In addition, sodium is considered one of the chemically active elements that, leads to breakdown of the layers between the soil particles, which in turn leads to the dispersal of the soil particles and the soil structure with lack of permeability and poor drainage. The use of the calcium element leads to a reduction from the harmful effect of salts in the soil by replacing sodium with calcium, which leads to improving soil structure, improving aeration and soil permeability, and improving drainage.

### **2-The role of calcium in improving the growth of roots and meristematic parts of the plant**

Calcium plays a vital role in the formation of the middle lamella, which is the basic layer for formation of cell walls, where pectic acid reacts inside the plant to form insoluble calcium pectate, which is considered the main component of the middle lamella inside the plant. Hence, the importance of calcium in the active, fast-growing parts such as the stem meristem and root hairs is also clear. In addition, root hairs receive high concentrations of calcium to speed up the growth and development of these hairs and increase their ability to penetrate soil particles, which leads to the formation of a strong root system, Subsequently leads to increased plant stability and increased efficiency of absorption of

nutrients while increasing the ability of the root system to resist fungal, bacterial and nematode diseases found in the soil

### **3- The role of calcium on pollination, fertilization and increasing fruit set and reducing fruit drop.**

Calcium is one of the most important elements necessary for the plant, especially during pollination and fertilization, because it has an important role on pollen grains germination, increases pollen tube growth and increases ovules viability. The presence of high concentrations of calcium in the petioles of the fruits reduces the formation of abscission zone that form in the petioles of the fruits. Hence, increasing the number of fruit set, reducing the percentage of fruit drop, and increasing yield and improving quality of fruit.

### **4-The role of calcium in physiological disorder diseases.**

Calcium is considered one of the most important and necessary nutritional elements in the resistance of fruits to physiological disorder diseases, such as cracking in citrus and pomegranates fruits, blossom end rot in tomatoes and peppers, and bitter pit in apples. These diseases appear as a result of a deficiency of calcium in fruits, especially in the early stages of fruits, where the presence of calcium leads to an increase in cell division, and final size of fruits. Hence, increased calcium concentrations in the fruits also lead to an increase in fruits' resistance to fungal, insect and bacterial diseases, while increasing their storage ability.

**Finally**, calcium plays a vital role in the growth and improvement productivity and quality of agricultural crops, which necessitates the need to focus and expand the use of this element in fertilization programs, which is considered one of the most important basic keys in improving the growth, production and quality of crops by improving pollination and fertilization as well as increasing fruit set, reducing fruit drop and improvement quality of fruits and their storage ability.