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ESSENTIAL NUTRIENTS AND THEIR INTERACTION WITH SURROUNDING ENVIRONMENTAL CHANGES: A REVIEW ARTICLE

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Abstract :
A detailed explanation of how plants obtain nutrients and knowledge of the role of each element in the life and functions of the plant. It includes the activities and chemical processes of these elements within the plant to provide the opportunity to increase the productivity of a unit area and remove excess salts in the soil. Fertilizers added by not using fertilizers are an opportunity to complete all the elements necessary for plant growth in a proper manner, rather than concentrated. It has only three elements (K.P.N) for the purpose of preventing plants from contracting many diseases (fungi, insects and viruses) because the lack or absence of nutrients will make the plant prey to pests, element is considered necessary if it meets the following conditions. When it enters, it enters directly into the structure of the plant material or one of its organs, without this element, the plant cannot complete its life cycle, and its deficiency leads to the appearance of certain deficiency symptoms on the plant that disappear unless it is added, as it can replace any another element in all its functions is due to all the environmental changes that cause the biological reactions that occur in the plant and its surrounding conditions

Keywords: Environmental change , Nutrition Plant , Minerals.

Introduction

A review Article Problem: The plant needs food, such as building protoplasm and all the enzymes necessary for the vital processes necessary for growth, building tissues to support and maintain the protoplasm, as well as transferring nutrients from one plant organ to another.
A review Article Objective : The presence of nutrients is necessary for the plant, as it can replace any deficiency due to changes and surrounding conditions that cause

biological reactions, leading to phenotypic, physiological, and even genetic changes in the plant.

The method of the article: They are divided into two groups, major and minor. This division does not depend on their importance to plants, however based on their quantity in the plant, because all nutrients are equal in terms of their importance to the plant and the most important (K.P.N).

1-INTRODUCTION

Nutrients in plants are important through how the plant obtains it needs for various nutrients, how to absorb them, and tracking their entry from the plant environment, the soil solution and the atmosphere into the cytoplasm and the sap in the plant cell, and studying the opinions, hypotheses and theories related to their absorption and the factors that affect their readiness in the soil and their absorption by the plant roots, diagnosing the symptoms of their deficiency and toxicity, and how to treat them, as well as studying trace elements or the rare and various physiological changes of nutrients and clarifying their role in plant life according to [1].

The importance of nutrients in plants is unique because they are necessary for the continuation of life on the surface of the Earth. Therefore, this is important for human life as well, things are made up of atoms of nutrients, which source is from minerals, rocks, oceans, and atmospheric air. After weathering, rocks and minerals turn into soil as for the oceans and seas, lakes, rivers, and streams are formed, and thus these nutrients are transformed into large and small plants, such as rice and giant redwood trees, which may reach a height of more than 100 meters, and then humans and animals will feed on these plants [2].

Green plants on land, algae, and plants in the oceans, seas, lakes, and rivers are the most important organisms in our living world because they carry out the process of photosynthesis, as they convert solar energy into chemical energy that these organisms exploit to perform their various vital functions. Water is about 85% of the plant's weight, and 15% consists of dry matter, which originally consists of proteins and acids consisting of cellulose, hemicellulose, lignin, pectin, cytoplasm, fats, enzymes, and vitamins[3].

1-1 Sections of nutrients:

It is divided into two groups according [4], major and minor. The division is not based on their importance to plants based on their quantity in the plant, because all nutrients are equal in terms of their importance to plants

First: The Macronutrient group: These are the nutrients that the plant needs in large quantities, and their content is estimated in the dry matter, the range of 0.1 - 0.6% (i.e. in the range of 1 - 60 mg/g) includes: Carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, Magnesium and sulfur.

Second: Micronutrient group: These are the nutrients that the plant needs in small quantities, and their content is estimated in the dry matter, the range of 1 - 200 ppm and includes: Iron, copper, manganese, zinc, boron, molybdenum, sodium and chrom..

Third: Archaeological elements (Trace): This is an incorrect term that expresses the smallest elements because not every rare element is an element include : Cadmium and lead, .they are rare elements, but they are not micronutrients.

Fourth: Beneficial elements: It is an element that is beneficial to a particular plant and does not have any beneficial or beneficial effect on another plant such as cobalt is useful for legumes the formation of a vitamin necessary for the formation of bacterial nodules, but it is not useful for astrology and Silicon is beneficial for patients, and its benefit has not yet been proven for astrologers and sodium is beneficial for diabetes mellitus it increases the sugar content in the plant.

Fifth: Rare elements (toxic): They are toxic elements, even if they are found in small concentrations in plants include: phosphorus, Bromine, iodine, aluminium, nickel, vanadium, selenium, methium, arsenic, barium, Cadmium, strontium, mercury, lead, cadmium and titanium.

Nutrient elements according [5] can be divided on the basis of their physiological and biological functions first group include (S, C, H, O, N) , it is involved in the synthesis of organic plant matter (carbohydrates, proteins, fats) and activating enzymes.

The second group: includes (Si, B, P) ,participates in energy transfer and the formation of ester

The third group maintaining the osmotic quality of plant cells and formation of enzymes and proteins include (K, Na, Mg, Ca, Mn, CI).

The fourth group transferring electrons that are involved in the oxidation and reduction process that occurs inside the plant include (Fe, Cu, Zn, Mo).

Plants need nutrients to build their various tissues, which is known as mineral nutrition to living organisms are divided into two main categories according [6]:

1- Autotrophic: They are organisms that depend on themselves to form and manufacture their nutritional needs, and these organisms need inorganic materials to be converted into organic compounds, these organisms are characterized by containing chlorophyll.

2- Heterotrophic: These are living organisms that require a supply of organic and inorganic materials necessary for their nutrition, and they can do so establishing its own food needs and not relying on it.

In plant life nutrients play a role, as they are included in the components of organic compounds, the most important of which are important carbohydrates, proteins, fats, nucleotides, enzymes, and others, these elements also lead to achieving anionic balance in plant tissues presence of these elements in the cell juice of the plant cell affects the osmotic pressure of the cell, the pH of the cell juice, and other parts of the cell, and affects oxidation and reduction reactions, as they prevent or receive an amount of energy, and affect the dissolution, validity, and movement of some compounds in plants, and they also help remove excess ions or compounds from plant tissues by converting them into insoluble substances. Mineral nutrition for plants includes essential nutrients for plant life[7].

Macronutrients when plants needs it in large quantities, its concentration in the plant is < 1000 parts per million, source is the atmospheric air, which is H, O, and C in legumes N, P, K, Ca, Mg, S are sourced from the soil and Micronutrients when plants needs it in small quantities, and its concentration in the plant is > 500 parts per million, and all of it is taken from soil Fe, Mn, Zn, Cu, B, Mo, Cl[8] .

Ability of elements to be utilized by plants to benefit from these elements, they are either available, which is the form in which the plant can absorb the element easily. It includes the form of the element in solution and its exchanged form, in addition to the form of the element that is stabilized but subject to dissolution or unavailable or unavailable, which is the form in which the plant cannot benefiting from the existing element depends on several different environmental factors such as pH degree, Soil moisture, Ambient air, Organic materials and Plant type with condition surrounding it [9].

1-2 Plant absorption of nutrients

The process of absorption of nutrient ions by the plant and their transfer within it includes several stages, the most important of which ion touches the surface of the root and then moves from the outer surface of the root to its interior absorption, then moves nutrient from root to shoot. In general, there are two ways to absorb ions , elements transfer of ions from the outer surface of the root to the inside of the root according[10] include :

A-Passive absorption: Non-metabolic absorption is a natural process, such as absorbing water with a piece of sponge, the ions move with the water without the need for metabolic processes. In this case, the plasma membrane does not interfere

in transporting ions, they are transported through it naturally, that is, the plasma membrane takes a negative position in the transport process or absorption, and therefore this absorption process is called “negative absorption.”.

B-Active, positive, or biological absorption: It has been found that passive absorption cannot be responsible for the high accumulation of salt within tissues plant, as it was found that many ions continue to enter the plant tissue, at a relatively small rate, for a period for a long time, after the period of free diffusion has ended, such ions enter the cytoplasm of cells and accumulate in the gap, and cannot move from it to the external solution again, this is a continuous and slow accumulation of ions against the concentration slope, it requires metabolic energy, as it was found that when activity is inhibited tissue metabolism and absorption rate also decrease, this method is called ion absorption by active, biological, or positive absorption, because the cells must do work to move the ion from the solution outer to the gap. There is ample evidence that the energy needed for this comes from respiration .It was also found in this area that the respiratory rate and the rate of absorption of ions decrease with a lack of oxygen in solution. It was also found that there is a positive correlation between the respiratory rate and the absorption rate of the element, the rate of respiration increases the rate of accumulation of mineral ions in plant tissue. It has been possible to prove that absorption ions depend on respiration, through the inhibition of respiration by some toxic substances such as cyanide [10,11].

1-3 Symptoms of nutrient deficiency

1- Nitrogen: Plants absorb nitrogen in the form of NO_3 , NH_4 +, the importance of nitrogen for plants is of high value, as it is involved in the synthesis of protein, which is considered the basic compound in protoplasm of cells and in the synthesis of chlorophyll and nucleic acids, Enzymes, some hormones, and coenzyme conjugates and encourages growth, especially in the growth stages vegetative also increases the protein content of leaves and grains[12]. Symptoms of nitrogen deficiency appear on the lower or older leaves first become pale green, and then turn yellow, the size of other plant organs is also less than also the plant growth is slow and wooden, natural size and do not appear on new leaves until after a while from its appearance on older leaves. In cases of severe deficiency, it dries up yellow the upper leaves take on the color deficiency in some plants may be accompanied by plant discoloration other than chlorophyll, the appearance of a purple color in the leaf petioles and veins, as a result of the formation of a pigment ,the color sometimes appears in anthocyanin plants when there is a lack of nitrogen[11,12].

2- Phosphorous: Plant absorbs phosphorus in the form PO_2 , HPO_4 , the importance of phosphorus to the plant involved in the formation of enzymes - proteins and nucleic acids – DNA some - phytin and RNA - ATP, ADP, NAD, NADP - Fats - energy transformation and transfer - genetic characteristics of cell division. Phosphorus plays a role in root growth, especially adventitious and increases the rate of sprouting and fruit setting, which increases production to reduce the harmful effect of excess nitrogen in the soil. Symptoms of phosphorus deficiency appear on the lower or older leaves or stems are weak and fibrous, and the buds may fall off and growth is slow, symptoms of phosphorus deficiency on the leaves of monocot plants differ from dicotyledonous leaves. In monocotyledonous plants wheat, barley, corn, a deficiency results element causes a red or purple color to appear in different areas on the leaf at one stage [13].

3- Potassium: The plant absorbs potassium in the form of K, importance of potassium for plants activating the process of photosynthesis through its role in activating the enzymes involved in photosynthesis, this process, it has been proven that its deficiency leads to a slowdown in the process of photosynthesis and an increase in respiration which affects the assimilation of carbon, and thus the synthesis of carbohydrates sugars and starch.

In the transport of carbohydrates and protein from leaves to places essential and play role store them in fruits or in roots and tubers found relationship between K concentration and protein metabolism in plants. K deficiency leads to accumulation of dissolved nitrogen compounds, while the plant's protein content decreases and regulating the permeability of cell membranes to elements within the plant and regulates the plant's utilization of water by regulating the process of opening and closing the stomata, thus reducing transpiration, the thickness of cell walls when it is deficient, vascular tissues become weak[14]. Symptoms of potassium deficiency appear first on the lower or older leaves in the form of slight yellowing on the edges of the leaves at first, followed by progression yellowing along the veins, then the color of the edges changes to brown, this condition is called scorch, then the edges dry to ability to lie down and increased susceptibility to diseases accumulation of dissolved. The poor production of fruits and seeds and their low quality that may not be due to its deficiency in the soil, but may be due to increase absorption despite the availability of K in the soil[15].

4-Calcium: The plant absorbs calcium in the form of Ca^{+2}, this element plays a major role basic layer for the formation of cell walls has an essential role in determining the degree of permeability of cell walls. and role in seed germination and enzyme activation, and its role in processes cell elongation, and protecting plants

from toxicity Symptoms of calcium deficiency is an immobile element within the plant to appear on new leaves and meristematic tissues active first, yellowish green color appears on new leaves, and as the deficiency continues, it appears sometimes its edges are wavy, like decaying spots on new leaves, and their edges curl downwards growth is irregular - the roots are short and thick and the tops die developing stems, leaves and roots, and growth stops appears more clearly on the fruits than on the leaves, where it appears brown, icy spot that appears clearly in the winter season, when breathing decreases[16].

5- Magnesium: The plant absorbs magnesium in the form of Mg+2, it is included in the formation of the chlorophyll molecule for both chlorophyll a and b, necessary for the process of cell division, where Mg and Ca are involved cellulose fibers when building cell walls, a cofactor in most enzymes that activate phosphorylation , formation processes, Nucleic acids from pyrophosphate ,ribosome stabilization and synthesis proteins. Symptoms of magnesium deficiency element within the plant appear on older leaves first yellow, mottled spots spreading throughout the leaf and brown spots also appear on the edges and tops of the leaves, in most parts, the plants show yellowing between the veins starting from the edges of the leaf, yellow to brown, then these tissues die[17].

1-4 Transfer of mineral elements from the root to the shoot

For every mineral nutrients transmitted from the root to the shoot, the ions of the absorbed elements by the root of the ground solution must cross the cortex, and then enter the xylem cells of the root. The mechanism of salt transport in wood is almost similar to the mechanism of active transport in individual cells to collect ions within its gaps, the evidence for this is that under certain conditions, the concentration of mineral elements inside, the wood is several times larger than its counterpart in the ground solution, and the accumulation of mineral elements in the wood, also inhibited when the rate of respiration decreases, or by depriving the roots of oxygen[18].

From this it is clear that the absorption and transfer of nutrients by plant roots occurs through passive absorption and active absorption, and dead system, which represents the areas in the root that are occupied by free spaces , and these include the interspaces, and the gaps filled with water for the elements dead wood, and cell walls. In this system, free diffusion of water and ions dissolved in it occurs until reaches the endoderm layer. Symplastic system, which represents the volume or portion of the root occupied by protoplasts, the cytoplasm parts include vacuoles, and given that these parts and vacuoles are connected to each other by

plasmodium's, which pass from one cell to another. Therefore, the cytoplasm of all cells of the cortex is connected to each other through plasmodesmata, and these are considered pathway for the transport of mineral elements through the protoplasts of different cells.

1-5 Factors affecting the readiness of nutrients according [19,20].

A- (pH): It is one of the most important factors that affect the readiness of nutrients in the soil. Phosphorus is deposited in acidic soils in the form of iron and aluminum phosphate because the increase in hydrogen ions leads to increased mineral decomposition of clay and the release of aluminum and iron, which bind with phosphate to form compounds, it is poorly soluble and not ready, and therefore it is difficult for the plant to absorb and benefit from it, under the circumstances alkaline, especially soils containing high amounts of calcium carbonate, which leads to raising the soil pH.

Phosphate is deposited in the form of calcium phosphate, which is not ready for absorption by the plant as for the minor elements increases with a decrease in soil pH, while the availability of the molybdenum element increases by increasing the soil pH, in general, nutrients are more available around the neutralization point It depends on the pH of the soil, as it results from directly

B- Organic matter: It decomposes organic acids that lower the pH of the soil. In addition, the organic matter improves the properties of the soil chemical, physical and biological, it is also a good source of many nutrients such as nitrogen and phosphorus and sulfur. Organic matter tends to form chelate compounds with cations elements hold them tightly and prevent them from sedimentation processes because the chelating compounds hold the element and coat it more than one exampl compounds combine with calcium and aluminum and increase phosphorus readiness in the soil, organic matter improves soil structure, increases microbial activity, and increases efficiency of sandy soils to retain water and clay soils to get rid of excess water.

C-Calcium carbonate $CaCO_3$: The calcium carbonate content has a direct effect on the degree of soil interaction and its quantity previously, increasing the concentration of calcium carbonate leads to the precipitation of phosphorus in the form of calcium phosphate, so it is reduces the availability of phosphorus, and the tendency of calcium to form chelating compounds with organic matter may be a reason due to iron deficiency, calcium replaces iron compounds containing iron, and iron is excreted into the soil solution and turns into a ferric hydroxide complex that is not suitable for plant nutrition, leading to the appearance combined with the

substance useful for building soil, it causes paleness or yellowing on the plant leaves, but calcium has an effect. Organic matter in the composition of the granular structure of soil.

D-Soil microorganisms: There are multiple organisms in the soil that affect the readiness of the elements, the nutritional value in it is responsible for the process of nitrification and reverse nitrification, and it is responsible for the process of fixing nitrogen. It has also been proven that there are mycorrhizal fungi that lead to an increase in the absorption of phosphorus through the cells and give responsible for the breakdown and decomposition of organic matter through the process of mineralization and the release of nutrients ready to be absorbed into the soil solution, sulfur bacteria also work to oxidize metallic sulfur into a form sulfate absorbed by the plant is in this form, and the oxidation of divalent manganese to quaternary manganese in the soil solution , when these organisms die, these ions return to the soil, and the activity of microorganisms during their analysis of the substance increases lead to the secretion of organic acids such as humic acid, fulvic acid, these acids role in reducing the degree of soil interaction relatively and thus increasing the readiness of nutrients.

E-Type of clay minerals: There are two types of clay minerals: 1:1 clay minerals and minerals and Clay 2:1, the difference between them is that clay minerals 1:1 consist of a layer of tetrahydra silica and a layer of alumina. Octa-hydra clay minerals 2:1 consist of two layers of silica tetra-hydra, with a layer of alumina octa-hydra between them. Hydra: 1:1 clay minerals such as kaolinite cannot expand with moisture or contract with dryness and therefore cannot stabilizing ammonium and potassium ions between its layers, but it has eight groups of hydroxyl ions ability to retain phosphate ions is higher, which reduces the readiness of phosphorus in such soils, while clay minerals ammonium between its units in case of drought, and when moistened by irrigation, the layers expand and come out into the soil solution the plant, these minerals contain four groups of hydroxyl ions, so their capacity decreases it becomes a good resource.

Nutrient absorption and related theories of these mineral , more studies in the field of plant nutrition have shown that the transfer of water molecules and mineral ions from a solution soil passes through the cell wall of the root epidermis and cortex through the process of diffusion faces little resistance because the cell wall contains pores that allow water molecules and ions to pass through it freely, this is called free space. It represents 10% of the size of the root cells, while the remaining 90% represents the part which water molecules and ions have difficulty spreading. The hypotheses and theories related to the absorption of metal ions in free space are

called free absorption passive absorption because it occurs without the expenditure of energy by the plant, so it is known as active absorption active absorption because it is done by energy from a living plant. Studies have also shown that the plant cell wall as well as the plasma membrane carry charge negativity, such as soil colloids clay and humus, is caused by carboxyl groups that are due to pectic acid in the cell wall and to the phosphate groups that belong to the phosphotides in the plasma membrane, and therefore the negatively charged groups by attracting cations to it and preventing them from escaping again into the soil solution, while it repels negative anions charge and expel it out of the cell . That occurs in both living and dead cells, and this is further evidence that diffusion through free space is not related to exerting energy by the plant[17,20].

2- Conclusions and Recommendations

Nutrients are essential for plant life, and their presence improves the performance of processes ح hysiologically, it increases the value of the final product, meaning it is involved in quality improvement processes. Absence does not affect the plant because the plant completes its life cycle, and without it can complete its life cycle., element is considered necessary deficiency or absence of this element leads to the failure of the plant to complete its life cycle, and the plant can eliminate this effect and the symptoms of deficiency disappear if the plant is provided with this element at the appropriate time, as any other element takes its place in the event of its absence. The elements enter directly into the structure of the plant, even if in a small way, and their direct impact on the plant itself in terms of its metabolism and nutrition, such as the construction of the cell protoplasm, which consists of protein, fats, carbohydrates, etc., the formation of most of the enzymes necessary for vital processes and growth, the construction of plant tissues that support and protect the cells, and the permeability of the cellular membranes of plants.

Author contributions

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