



Review Article: The Role of Nanotechnology in Improving the Growth of Maize Plant *Zea mays* L

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Abstract

Nanoscience science the studys the infinitesimal world, which is the world of atoms and molecules. The agricultural field faces many challenges, including climate change, the increase in the consumption of agricultural products and the reducing of the cultivated area, which requires the need to advance agricultural development to achieve economic and agricultural stability. Hence the importance of using nanotechnology and technology, which enables the development of modern methods in the possibility of finding and treating many agricultural problems. This is in addition to some of the main challenges related to the field of agriculture, including the low productive efficiency in the cultivated area, the large size of the uncultivated area, the loss of resources, including water, fertilizers and pesticides, and the loss of products. This is in addition to the food security of the developing population, which can be faced through the various applications of nanotechnology. Nanotechnology achieves remarkable achievement rates in community service and environmental development. Yellow corn production is considered one of the most important grain crops in Iraq to confront the basic needs of humans and animals.

Keywords: *Zea mays*, Nanomaterials

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دور تقنية النانو في تحسين نمو نبات الذرة الصفراء *Zea mays L*

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الخلاصة

علم النانو هو العلم الذي يهتم بدراسة العالم متناهي الصغر وهو عالم الذرات والجزيئات، فإذا قلنا عن أحد ابعاد الجسيمات هو 100 نانو متر فهو يندرج تحت مسميات النانو. يواجه المجال الزراعي العديد من التحديات منها التغيير المناخي وزيادة استهلاك المنتجات الزراعية وتفقد المساحة المزروعة مما يستوجب ضرورة النهوض بالتنمية الزراعية لتحقيق الاستقرار الاقتصادي والزراعي، ومن هنا تأتي أهمية استخدام تكنولوجيا وتقنية النانو والتي تمكن من استحداث سبل حديثة في إمكانية إيجاد ومعالجة العديد من المشكلات الزراعية. هذا فضلا عن ان بعضا من التحديات الرئيسية والمرتبطة بمجال الزراعة ومنها انخفاض الكفاءة الانتاجية في المساحة المزروعة، كبر حجم المساحة غير المزروعة، فقدان الموارد ومنها المياه والمخصبات ومبيدات الحشرات وضياع المنتجات. هذا بالإضافة الى الامن الغذائي للزيادة السكانية الكبيرة، ويمكن مواجهة ذلك من خلال التطبيقات المختلفة لتقانة النانو. ان تقنية النانو تحقق معدلات انجاز ملحوظة في خدمة المجتمع وتنمية البيئة. يعتبر انتاج الذرة الصفراء أحد اهم محاصيل الحبوب في العراق لمواجهة احتياجات الانسان والحيوان الاساسية.

الكلمات المفتاحية: الذرة الصفراء، المواد النانوية

Introduction

Zea mays L is one of the important productive crops that occupies the third place after *Triticum aestivum L.* and *Hordeum vulgare L.* in terms of productivity [1]. It is the most responsive crop to fertilizers, especially nitrogen, phosphorous and potassium, and this response is affected by several factors, including environmental, and genetic. Nano-fertilizers reduce the negative effects and damage the agricultural economy by reducing the costs of chemical fertilizers and improve the growth and productivity of corn plants The use of nanomaterials in fertilization programs is an alternative to traditional fertilizers, as it achieves many advantages due to its use

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in smaller quantities, and its high stability under different conditions, which increases the ability to store it for longer periods, and thus achieve many benefits for plants and the environment, as follows:

1. For storage.
2. It is used as a spray on the vegetative system, so the plant benefits from it faster.
3. Fast absorption, allowing it to be used at the required times according to the needs of the plant.
4. The use of nano-fertilizers protects the environment and human health.
5. Increases the profitability of farms due to reducing fertilization and spraying expenses.
6. The use of nano-fertilizers helps to overcome the problems of soil and water pollution and reduce the carbon emissions of traditional fertilizer factories.
7. Nano-fertilizers provide more space for different metabolic reactions in plants, which increase the rate of photosynthesis and produce more dry matter and crop productivity [2].

Literature Review

One of the important developments is the use of nanotechnology, as nano-fertilizers, when used, avoid toxic effects on plants through slow and more specialized delivery of micronutrients, while reducing potential soil pollution and other environmental risks that may occur when using chemical fertilizers added directly to the soil [3]. Nanotechnology using nanoparticles NPs represents a new method for plant nutrition, in addition to adding them in lower quantities than traditional fertilizers [4].

Zn is an important micronutrient for plants because it is involved in many biochemical processes such as protein synthesis [5], zinc is essential for the activity of enzymes such as dehydrogenases, aldolases, isomerases, transphosphorylases and DNA, RNA polymerases, and is also involved in tryptophan synthesis and cell division. maintains membrane structure and photosynthesis and serves as a regulating cofactor in protein synthesis [6, 7].

theory that molecules and atoms can be directly manipulated in the near future, the term nanotechnology was first introduced by Pratima Nikalgio Taniguchi, professor of Tokyo

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University of Science in 1974, and he used this term to describe the precise machines of materials (tools) within the atomic scale to bear dimensions, and in 1986, this word has been paraphrased and redefined by Eric Drexler in a book called *Engines of Creation: The Next Era of Nanotechnology*. He explained this in more detail in his doctoral thesis and later developed in a book entitled *nano systems: Molecular Machines, Fabrication and Computation* [8].

In particular, nanotechnology has the potential to provide effective solutions to many areas related to agricultural problems, and to bridge the gap between large-sized materials and atomic or molecular compounds, nanoparticles offer great scientific benefit, and over the past two decades, there has been a talk about it in detail carried out on the technology of Nanotechnology and focus on its many applications in the agricultural sectors [9, 10]. In order to ensure environmentally friendly agricultural practices and recent advances in nanotechnology by manufacturing slow or controlled fertilizers, pesticides, and herbicides, more attention is paid to the agricultural field [11].

In traditional methods, agricultural chemical fertilizers are generally added to crops by spraying or spreading, and as a result, a very small amount of chemical fertilizer reaches the target, which is much less than the minimum effective concentration required for successful plant growth, and the loss is caused by the leaching of chemicals Degraded or lost by photolysis and hydrolysis as well as by microbial decomposition [12,13], over time nanotechnology has gradually moved from experimental laboratory applications to practical applications. Which in this field has focused on the controlled delivery by delivering the standard amount of necessary and important substances for agricultural chemicals over a period of time and obtaining full biological efficiency while minimizing losses and damages [14].

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