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# Nanotechnology an Option in Mexican Agriculture

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**Abstract**

In Mexico, agriculture is increasingly less profitable, due to this situation its contribution to the country's economy decreases day by day, which has encouraged the import of food, thus causing poverty and migration, food dependency and other undesirable situations for the healthy development of society in general, not only the rural population but also the urban population is affected, so all the technologies that can change this scenario are sought and explored, one of them being Nanotechnology, despite the benefits of nanotechnology, as is always the case, it is not applied in agriculture as most of the most widely used technologies in the world today, such as mechatronics, and other modern technologies such as neural networks, Artificial vision, and internet of things , this is also happening with nanotechnology, De la Revision made only some Authors have done the rest of the research only publishing revisions of research done abroad, so it is proposed that decision makers support researchers who really do work on this discipline that is so promising at present for the good of our agriculture , this being the objective of this work will review what has been done in this field in this regard in the nation.

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## Introduction

In Mexico, agriculture is becoming less profitable, due to this situation, its contribution to the country's economy decreases day by day, which has encouraged food imports, thus causing poverty and migration, food dependency and other undesirable situations for he healthy development of society in general, not only the rural population but also the urban population is affected, so all the technologies that can change this scenario are sought and explored, one of them being nanotechnology. In Mexico there are few Research in this regard, like all the technologies that can change the fate of our agriculture, is of little importance to decision-makers and researchers, however the opposite is true in the world, researchers and decision-makers already act on it and there are various investigations with applications in agriculture. This being the objective of this work to review what has been done in this field in this regard in the nation.

## Agriculture and Nanotechnology in the World

Metallic nanoparticles such as copper, zinc, iron and silver; and those derived from carbon have notable physiological and biochemical effects in plants, so they could also have applications in packaging for food coatings to extend shelf life or post-harvest, such as for use in Nanosensors,

Nanopesticides, Nanofertilizers and for the genetic improvement of plants [1].

However, a careful examination of the advantages and disadvantages of using these materials is required. In this sense, and although we are on the right path to identify and evaluate the risks derived from the use of nanoplaguicides, we still have a long way to go to generate all the necessary scientific evidence, at least to equip it with what is currently used. To assess these risks in the case of conventional pesticides.

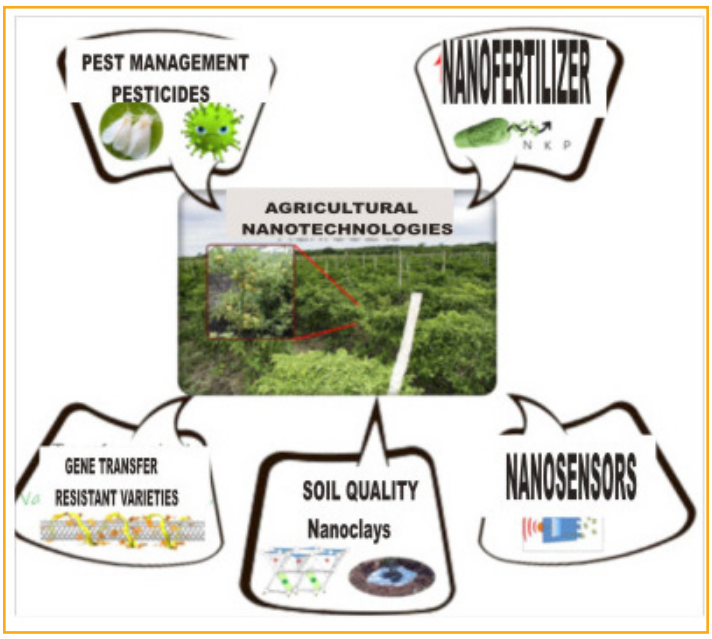


**Figure 1:** Agricultural nanotechnologies Adapted from [2].

Nanotechnologies occupy a prominent position for the transformation of agriculture and food production. Nanometer-sized materials provide an efficient means of distributing fertilizers and other substances, in a controlled and directed manner. This is called "smart delivery systems" in agriculture. Size is a determining factor in the plant: Nanomaterials (NMs) interaction. This determines the ability of NMs to penetrate the biological barriers of plants and, therefore, their effectiveness as Nanocarriers of these substances. In turn, the characteristics of the biological barriers are genotype-specific and may vary due to growth conditions [2].

**Nanotechnology in Mexico**

Sodium selenite is used to prevent selenium deficiency known as nutritional muscular dystrophy or white muscle disease. In ruminants, selenium supplements are transformed partiality in insoluble form by ruminal microorganisms and its process decrease the selenium absorption in digestive gastrointestinal. However, the objective in this research was focused in encapsulated sodium selenite to be release into of a pH less than four, similarity to an intestinal environment. The release of selenium from nanoparticles was higher in acid pH (less than 4), this condition may represent a better availability of the mineral in the small intestine [3].

Regarding agro nanotechnology, research advances indicate that metallic NPs such as copper, zinc oxide and iron, when applied at low concentrations (with 50 ppm or less), can increase the percentage of seed germination; increase its vigor and promote greater growth of various plant families such as nightshades (tomato and chili) and cucurbits (cucumber and melon). High concentrations above 100 ppm have also been found to cause phytotoxic effects in seedlings in most cases [4].

Carry out studies at CIQA and UAAAN with tomato seeds, where treatments were applied for 24 h in Petri dishes and on filter paper, with different levels of NPsCu and MPsCuSO4 (CuSO4 micro particles) in concentrations of: 0, 0.5, 1, 5, 10 and 50 ppm, and then the seed was sown between Anchor paper. The results indicate that the NPsCu at 5 and 10 ppm promoted the germination vigor of the seeds, statistically surpassing both treatments to the control [5].

Concludes that the application of nitrogen-fixing microorganisms plus a Nanohybrid can substitute 50% of N without affecting the development of the plants, with this, one would be talking about saving nitrogen element that has a positive impact on the economy and the environment, achieving the development of sustainable crops [6].

**Discussion and Conclusions**

In Mexico, despite the benefits of nanotechnology, as is always the case, it is not applied in agriculture as most of the most widely used technologies in the world today, such as mechatronics, and other modern technologies such as neural networks, Artificial vision, and internet of things, this is also happening with nanotechnology, of the review made only some authors have done the rest of the research only publishing envisions of research done abroad, so it is proposed that decision makers support researchers who really do work on this discipline that is so promising at present for the good of our agriculture [7-10].

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