

Silicon Nano-particle: Role in Agriculture

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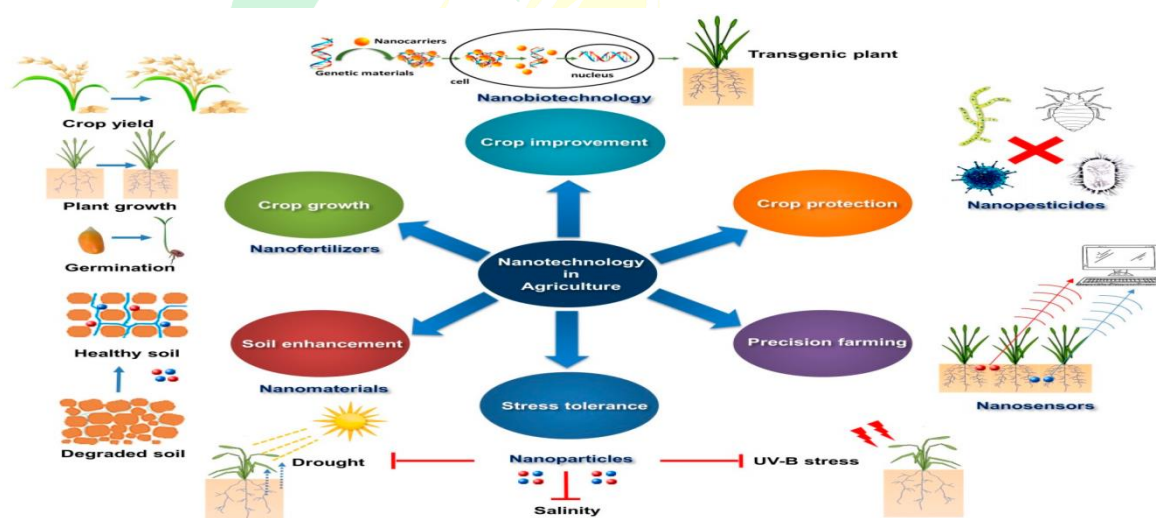
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Introduction

Nanoparticles are basically fine particles whose dimensions are about 100nm or even less. Because of their unique size and dimensions they are used in the agriculture sector. The human eye cannot see the physical and chemical behaviour which it causes to its counterparts.



What is the role of silicon in agriculture?

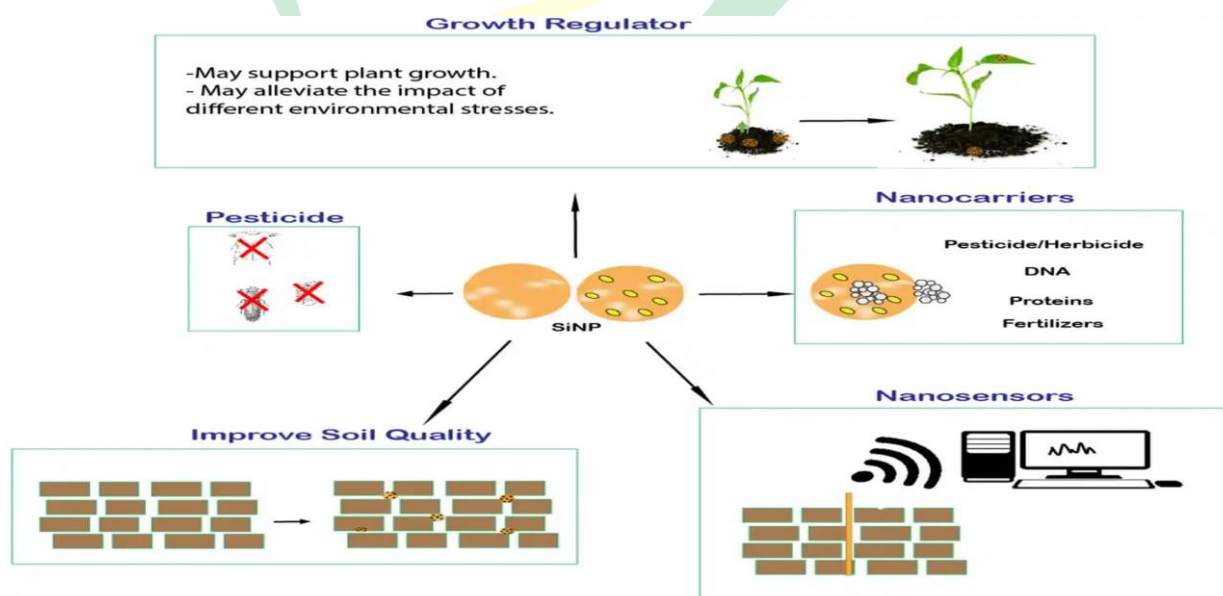
The element silicon whose atomic number is 14 is the member of group 14 of the periodic table. It has a dynamic role in promoting the growth and the yield of the crops. The use of silicon in crops makes them stronger with thick stems and small internodes. It also helps tackling several abiotic stresses like temperature, salinity, UVB-rays etc and at the same time prevents the crop from getting affected by several bacterial and fungal diseases.

Nano-capsules and nano-chips are used as fertilizers, herbicides or pesticides for the proper and slow distribution of the nutrients to the plants. They are also used as nano-sensores. The use of Si-NPs helps the farmer to cope with the damages caused by the biotic and abiotic

stresses. Si-NPs are used in various fields like food processing, treatment of waste-water, agriculture, and many more.

Advantages:

- The use of Si-NPs helps in slow releasing of the chemicals to the plants which helps in providing a proper dosage of the agrochemicals to the plants. It is suitable for delivery of boron, urea and nitrogenous fertilizers.
- They can be efficient in their roles as herbicides as they remove weeds without leaving any harmful residues in the soil. They are eco-friendly herbicides and do not hamper the environment.
- The unique property of the Si-NPs gives them a smooth entry in the plant system. This property is the key to the fast development and plant growth of the crop which is ultimately seen on the yield of the crop.
- Si-NPs are also used as pesticides and show their effectiveness on adult insects as compared to larvae. This could be the result of the dehydrating nature of the silica which ultimately kills the insects. It even damages the trachea, spiracles and waxy coating of the insect and protects the plants from their infestation.
- Helps in the efficient germination of the seed and growth of the seedling as experimented and proved on a tomato plant.



Response of Si-NPs on plants facing abiotic stress:

There are number of strategies which are carried out by genetic-engineering in the agricultural sector to develop some modified gene varieties to control the production and quality damage of the plants under stress conditions. The use of Si-NPs has reduced this burden. As the Si-NPs have a very high mobility it easily enhances the water uptake and root hydraulic conductance of the plant under water stress condition.

The salinity stress condition is also reduced by the use of silicon fertilizers. This is proved by an experiment which was conducted on Basil plant. A/c to the results of the experiment the content of chlorophyll was reduced in the condition of salinity stress but the use of Si-NPs led to increase in the content. When the seedling of wheat is treated prior with the Si-NPs it saves the plant and the yield of the wheat it saves the plant and the quality from the UV-B stress. When Si-NPs are used in the squash plant it showed an improve in the germination of the seed and an enhanced photosynthetic matter in the plant. Salinity stress of the tomato plant is reduced by the use of the Si-NPs which increases the seedling length, fresh weight and germination rate of the plant.

Conclusion:

This article shows the potential of Si-NPs and how it can turn the latest technologies in the area of agriculture. In the era of sustainable agriculture, the introduction of the nanotechnology is bliss for the environment. There are several experiments which are going on Si-NPs and are yet to be introduced in the field. It can easily be extracted from wastes like rice husk and can be stored even at room temperature or at -4°C . It has the current focus because the excessive use of the chemical based fertilizers and pesticides has already degraded the environment and there is an urgent need for the introduction of eco-friendly measures. Seeing the various success of introduction of silicon nanoparticles in agriculture researchers are giving emphasis on this for the healthy functioning of the environment in contrast to the conventional inputs.