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NANO FERTILIZERS AND OPTIMUM CROP PRODUCTIVITY : A REVIEW

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Abstract

Nano fertilizers are the important tools in agriculture to improve crop growth, yield and quality parameters with increase nutrient use efficiency, decrease wastage of fertilizers and cost of agriculture. Nanofertilizers are very effective for precise nutrient management in accuracy agriculture with suitable the crop growth stage for nutrient and may supply nutrient everywhere the crop growth duration. Nanofertilizers raise crop growth up to optimum concentrations further increase in concentration may inhibit the crop growth due to the toxicity of nutrient. Nano-fertilizers supply more surface area for different metabolic reactions in the plant which increase rate of photosynthesis and produce more dry matter and yield of the crop. It is also prevent plant from several biotic and abiotic stress.

Key words : Nanofertilizers, Optimum crop etc.

Introduction

The agricultural development, different parts of the world have guide that fertilizer application is the most efficient measure for increasing crop production, sustainable yield growth and food security. Fertilization rise crop yields at a rate of 30% to 50%, globally. About 40% - 70% of the nitrogen and 80% - 90% of the phosphorus of the utilized fertilizers either are lost into the environment or become unavailable for crops. It not only causes major economic and resources loss but also is accountable for serious environmental impurity (Guo *et al.*, 2005; Stewart *et al.*, 2005) since modern agriculture is generally dependent on inorganic fertilizers, a larger portion is subtracted from the soil after harvest. Today farmers are trying to overcome nutrient deficiencies and move to the genetic limits of plants. The resort to replacing these nutrients is the most preferred (Rajonee *et al*., 2016). Many industrial methods have been used to overcome the problem of fertilizer use and increase economic use. Intervention: Add an appropriate amount of fertilizer to the deep substrate of fertilizers using granular urea; improve awareness about crop response (Brady and Weil, 2005). The most important field in agriculture is the use of slow manure Nitrogen emulsion is a prominent nano fertilizer, which has attracted the attention of soil scientists as well as the environment because of its ability to increase production, improve soil fertility, reduce pollution and make it a suitable environment for microorganisms. In line with the current study, the nutrient release rate of experimental nano-experimental fertilizer and its effects on crop production was paralleled with the average chemical fertilizer(Ahmed *et al.*, 2012). “"Nano" means a billion, so nanotechnology deals with measured materials in a millionth of a meter. Joseph and Morrison, (2006) defined nanotechnology as a nodular or self-assembly of individual atoms, molecules or molecular groups in structures to create material materials with new or substantially different properties. Nanotechnology is the science of very small creature, but is not just implicated with small things. it is a multi-disciplinary science. It includes knowledge from biology, chemistry, physics and other disciplines.

Nanotechnology Applications in Agriculture

Nanotechnologies that provide many nanoscale devices and nanomaterials that have a single role in agriculture such as nanoscale sensors to detect moisture content and nutrient status in soil, as well as on-site water management and on-site nutrients, nanomaterials for effective nutrient management, Nano herbicides). To control selective weeds in crop fields, nano-feeders to increase seed strength, and nano-pesticides to efficiently manage pests. Nanoparticles can be used as herbicide carriers for pesticides such as paracetas. Nanotechnology plays a key role in crop production with environmental integrity, environmental sustainability and economic stability. Nanoparticles produced with the help of nanotechnology can be exploited in the value chain in the entire agricultural production system (Ghaly, 2009; Gutierrez *et al*., 2011; Hamid, 2012).

Nanofertilizers

Nano fertilizer are made from conventional fertilizers, bulk materials for fertilizers or extracted from different plant or plant parts of the plant by several

chemical, physical, mechanical or biological methods with the help of nanotechnology in the development of soil fertility and the productivity and quality of agricultural products. Nanoparticles can be made of materials quite bulk. The physical and chemical properties of the nanofertilizer differ from bulk materials. Similarly, they mentioned (Brunnert *et al*., 2006; Nel *et al*., 2006). Nutrient drainage in the soil can be carried out in a planned manner through the use of nano fertilizer, thereby avoiding water pollution (Naderi and Abedi, 2012). Rock phosphate if use as nano form it may increase availability of phosphorus to the plant because direct application of rock phosphate nano particles on the crop may prohibit fixation in the soil similarly there is no silicic acid, iron and calcium for fixation of the phosphorus hence it increase phosphorus availability to the crop plants (Nanotechnology in Agriculture, Scope and Current Relevance, 2013) Nano fertilizers are characterized by unique properties such as super absorbency, increased production, high photosynthesis activity and significant improvement in the surface area of the leaves. (Iran Nanotechnology Initiative Council 2009). The researchers also found that silicon and titanium compounds in nanoparticles raise the efficiency of nitrate action and reduced the absorption capacity of soybean plants, resulting in increased efficiency of water and fertilizer use. The use of nanomaterials improves the efficiency of elements, reduces soil toxicity, at least to the detrimental effects of high fertilizer intake, and reduces the frequency of fertilizer use (Naderi and Shahraki, 2013). In a recent study Sadaf *et al*. (2017) investigated that wheat productivity and soil quality can be improved by the application of biochars and chemical fertilizers

Effects of Nanofertilizer on Agriculture

Nanofertilizers would be a revolution in the agricultural field. The use of nanofertilizers to control food delivery can be a powerful tool for sustainable agriculture and the environment. Probably no appeal is more appealing than enhancement the efficiency of fertilizers and reducing the negative environmental effects due to chemical fertilizers through nanotechnology. Nanofertilizers, crop yields and greenhouse gas emissions among the technologies whose followers claim to raise crop yields while reducing the environmental damage of agriculture (Lei *et al*., 2007). Nano-fertilizers would replace conventional fertilizers with rapid absorption and improved nutrient emissions to the plant. Little progress has been made in respecting the use of nanoparticles to enhance soil quality and reclaim degraded land. Agricultural plants needs optimized managements as well as convenient weather and soil condition for maximum usage of environment potentials and therefore best performance. Application of Different Nano-particles as Fertilizer: Implement of nanotechnology in agriculture through fertilizer amendment is one of the possible choices to increment in the crop production and feed the world's, rising population. The rising nano-strategies signify that due to the high surface area to volume ratio. Production of inorganic materials from biological systems such as plants and microorganisms, which are present in nano-scale dimensional. The cellular extracts from these organisms can be used to synthesize nano-particles with different size, properties and chemical compositions. Biosynthesis of metal nano-particles can be decreasing from distinct parts of the plant is the best efficient method of synthesis at a very low cost (Pattanayak and Nayak 2012). Nano fertilizers improve availability of nutrient to the growing plant which improve chlorophyll formation, photosynthesis rate, dry matter production and result improve overall growth of the plant (Hediat and Salama, 2012; Suriyaprabha *et al*., 2012). Reported similar result that nano-TiO2treated seed produced plant recorded more dry weight, higher photosynthetic rate, chlorophyll-a formation compared to the control (Zheng *et al.*, 2005). This enhancement translocation of photosynthets from source (leaves) to sink (economic part of the plant it may be grain, tuber, bulb, stem, fiber and leaves.) which result in improve yield and quality parameters from nano-fetilizers treated plants compare to without nano fertilizers treated plants or traditional fertilizers treated plants (Hamid, 2012; Sirisena *et al.*, 2013). Accordingly, improvement of grain yield with the application of nano-K fertilizer is highly correlated with the increase in seeds/panicles also with rising of yield parameters with the application nano fertilizers treated plants compare to bulk nutrient sources. (Lin and Xing, 2007; Farajzadeh *et al.*, 2009).

References

Ahmed, S.; Niger, F.; Kabir, M.H.; Chakrabarti, G.; Nur, H.P. and ImamulHuq, S.M. (2012). Development of Slow Release Nano Fertilizer. Proceedings of the International Workshop on Nanotechnology, Dhaka, Bangladesh.

Brady, N.C. and Weil, R.R. (2005). The Nature and Properties of Soils. 13th Edition, Pearson Education Inc., Upper Saddle River, NJ.

Brunnert I.; Wick P.; Manserp, S.; Grass R.N.; Limbach L.K.; Bruinink A. and Stark, W.J. (2006). Environmental Science & Technology, 40: 4374-4381.

Farajzadeh, M.; Tabrizi, E.; Yarnia, M.; Khorshidi, M.B. and Ahmadzadeh, V. (2009). J. Food Agr. Env., 7(2): 611-615.

Ghaly, A.E. (2009). American J. Biochem. Biotechnol, 5: 210-220.

Guo, M.; Liu, M.; Hu, Z.; Zhan, F. and Wu, L. (2005) Preparation and Properties of a Slow Release NP Compound Fertilizer with Superabsorbent and Moisture Preservation. Journal of Applied Polymer Science, 96: 2132-2138.

Gutierrez, F.J.; Mussons, M.L.; Gaton, P. and Rojo, R. (2011). Nanotechnology and Food Industry. Scientific, Health and Social Aspects of the Food Industry, In Tech, Croatia Book Chapter.

Hamid, R.B. (2012). Arpn J. of Agri. and Biological Sci., 7(4): 233-237.

Hediat, M.H. and Salama (2012). International Research Journal of Biotechnology, 3: 190-197.

Iran Nanotechnology Initiative Council (2009). First nano-organic iron chelated fertilizer invented in Iran. Tehran, Iran.

Lei, Z.; Mingyu, S.; Xiao, W.; Chao, L.; Chunxiang, Q.; Liang, C.; Hao, H.; Xiaoqing, L. and Fashui, H. (2007). Effects of nano-anatase on spectral characteristics and distribution of LHC II on the thylakoid membranes of spinach. Biological Trace Element Research, 120: 273-283.

Lin, D. and Xing, B. (2007) Environ. Pollut., 150: 243-250.

Liu, X.M.; Zhang, F.D.; Zhang, S.Q.; He, X.S.; Fang, R.; Feng, Z. and Wang, Y. (2005). Plant Nutr. Fert. Sci., 11: 14-18.

Naderi, M.R. and Abedi, A. (2012). Application of nanotechnology in agriculture and refinement of environmental pollutants. J. Nanotechnol. 11(1): 18–26.

Naderi, M.R. and Danesh-Shahraki, A. (2013). Nanofertilizers and their roles in sustainable agriculture. Int. J. Agric. Crop. Sci., 5(19): 2229–2232.

Nadi, E.; Aynehband, A. and Mojaddam, M. (2013). Int. J. Biosci., 3: 267-272.

Nanotechnology in Agriculture, Scope and Current Relevance (2013). National Academy of Agricultural Sciences, New Delhi.

Nel, A.; Xia, T.; Madler, L. and Li, N. (2006). Toxic potential of materials at the nanolevel. Sci., 311: 622 -627.

Pattanayak, M. and Nayak, P.L. (2012). Ecofriendly green synthesis of iron nanoparticles from various plants and spices extract. International Journal of Plant, Animal and Environmental Sciences, 3: 68-78.

Prasad, T.N.V.K.V.; Sudhakar, P.; Sreenivasulu, Y.; Latha, P.; Munaswamy, V.; RajaReddy, K.; Sreeprasad, T.S.; Sajanlal, P.R. and Pradeep, T. (2012) J. of plant nutrition., 35: 905-927.

Rajonee, A.A.; Nigar, F.; Ahmed, S. and ImamulHuq, S.M. (2016). Synthesis of Nitrogen Nano Fertilizer and Its Efficacy. Canadian Journal of Pure and Applied Sciences, 10: 3913-3919.

Sadaf, J.; Shah, G.A.; Shahzad, K.; Ali, N.; Sha-hid, M.; Ali, S.; Hussain, R.A.; Ahmed, Z.I.; Traore, B. and Rashid, M.I. (2017). Improvements in wheat productivity and soil quality can accomplish by co-application of biochars and chemical fertilizers. Sci. Tot. Environ., 607-608: 715-724.

Sirisena, D.N.; Dissanayake, D.M.N.; Somaweera, K.A.T.N.; Karunaratne, V. and Kottegoda, N. (2013). Annals of SriLanka Department of Agric., 15: 257-262.

Stewart, W.M.; Dibb, D.W.; Johnston, A.E. and Smyth, T.J. (2005). The Contribution of Commercial Fertilizer Nutrients to Food Production. Agronomy Journal, 97: 1-6.

Suriyaprabha, R.; Karunakaran, G.; Yuvakkumar, R.; Rajendran, V. and Kannan, N. (2012). J. Current Nanosci., 8: 902-908.

Talgar, S.; Jianxiu, G.U.; Changshan, X.U.; Zhikun, Y.; Qing, Z.; Yuxue, L. and Yichun, L. (2011) Nanotoxicology, 1–8.

Zheng, L.; Hong, F.; Lu, S. and Liu, C. (2005). Biol. Trace Elem. Res., 104: 83-91.