The increasing population and the ever greater demand for food, energy and water force agricultural production to be intensified and result in a greater consumption of artificial fertilizers, which in turn contributes to the progressive degradation of soils and groundwater contamination. How to stop this snowball effect? Solutions to these urgent problems can be found in nanotechnology. This dynamically developing technology contradicts the motto that "small is beautiful but big is can do more". Nanotechnology deals with, among others, the production of nanoparticles (NPs) whose conventional diameter is from 1 to 100 nm. Due to their nanometric size, NPs acquire more effective properties compared to their larger equivalents. This resembles the domino effect: the reduction in the size of particles to the nanoscale determines their larger specific surface area which, in turn, determines their greater solubility, greater conductivity as well as better mechanical, magnetic and optic properties, etc. The nanometric size also provides greater ease in overcoming the cellular barrier in the case of contact of NPs with living organisms. And these two facts may determine the usefulness of NPs in fertilization of plants, in particular those that contain micronutrients such as copper in their elemental composition. Nevertheless, there are still many unknowns concerning the potential of NPs in more effective plant supplementation. One of such gaps is about the mechanisms responsible for NPs distributed within plants. In response to this question, we want to evaluate changes in the expression of proteins and genes, which may contribute to the selection of a pathway along which NPs move. To this end, we will use techniques from the field of molecular biology and proteomics, which will be complemented by spectroscopic methods that serve to analyze metal content in the individual plant parts. The analysis of molecular level effects will also be enriched with evaluation of the physiological condition of plants as well as of yield quantity and quality. Multiparametric evaluation of grains of barley will allow us to determine their suitability for the food industry. The obtained results will expand our knowledge on the role of NPs in plant growth and development and will be useful in determining optimal parameters for application of nanofertilizers. A more effective use of nanocomponents of fertilizers may lead to an increase in the quantity and quality of plant products as well as to enhanced environmental protection by reducing the amount of fertilizer nutrients leached.