In the era of climate change, plants are increasingly exposed to various abiotic stresses such as drought, salinity, and waterlogging. Due to their sessile nature, plants cannot escape these unfavorable conditions, which pose a serious threat to global food security. Among these stresses, drought is considered one of the most severe and widespread, currently affecting about 33% of arable land worldwide which is expected to rise with ongoing climate change. Drought significantly reduces crop growth and yield by impairing photosynthesis, water uptake, and nutrient balance. To address these challenges, several strategies have been developed to enhance plant tolerance to stress. Among them, nanotechnology has gained growing attention in agriculture due to its promising applications. Nanoparticles (tiny materials with dimensions between 1 and 100 nanometers) exhibit unique properties such as high surface area and enhanced reactivity, enabling them to interact with plants more effectively than conventional materials. Their small size allows them to penetrate plant cell walls and membranes, making it easier to deliver nutrients or stress-protective compounds directly into plant tissues. This makes nanoparticles a valuable and sustainable tool for improving plant growth, stress tolerance, and nutrient use efficiency. The current study aims to evaluate the role of silicon and selenium nanoparticles (SiNPs and SeNPs) in enhancing drought tolerance in buckwheat (*Fagopyrum* Spp.), a nutrient-rich but underutilized minor cereal. Buckwheat is valued for its high content of essential amino acids, dietary fiber, vitamins, minerals, and bioactive compounds. Despite its nutritional and agronomic benefits, little research has been conducted on its physiological responses to drought stress, especially at both the biochemical and remote sensing levels. This project will explore how SiNPs and SeNPs, along with their bulk counterparts, affect buckwheat's physiological, biochemical, and morphological traits under drought conditions. A special focus will be placed on understanding the stress tolerance mechanisms activated by these treatments. When exposed to drought, plants naturally generate reactive oxygen species (ROS) as part of their defense response. However, excessive ROS production can damage cellular structures, such as membranes and chlorophyll. To counter this, plants activate their antioxidant defense system. SiNPs and SeNPs have been reported to strengthen this system, reducing oxidative damage and improving stress resilience. In addition to traditional physiological and biochemical measurements, the study will use advanced remote sensing tools to monitor plant responses. Specifically, sun-induced fluorescence (SIF) and hyperspectral reflectance-based vegetation indices (VIs) will be used to assess canopy-level changes in photosynthetic activity and stress status. These non-invasive techniques allow for early detection of stress symptoms and provide valuable insights into plant health. By combining leaf-level physiological and biochemical data with canopy-level remote sensing measurements, this project aims to identify clear, measurable indicators of drought tolerance in buckwheat. These findings will not only enhance our understanding of how SiNPs and SeNPs support plant defense systems but also contribute to the development of practical, eco-friendly strategies for improving drought resilience in crops. Ultimately, the project will help pave the way for sustainable crop production under changing climate conditions.