Due to global warming, the environment is changing rapidly, which may lead to frequent and unpredictable environmental events such as drought. With an increasing demand for food but decreasing available fertile land and changes in climate, the identification of suitable methods to maintain plant productivity is one of the important factors which can provide high yields under suboptimal conditions. After Russia and China, the European Union is the major producer of buckwheat, but still, its cultivation is not getting priority due to the lack of knowledge regarding cultivation and processing. Under the rapidly changing climate, these alternative crops may play an important role in fulfilling human nutrient needs. Buckwheat is one of the ancient crops which has higher requirements for water availability, but it is considered tolerant to various biotic and abiotic stresses and considered to be more suitable for their growth in poorer conditions. In recent times, Silicon has been observed as an efficient agricultural biostimulant that improves plant growth and development through several mechanisms, which include a decrease in evapotranspiration and improvement of photosynthetic mechanisms. SIF offers the big potential to quantify the actual photosynthesis and to monitor plant status at the canopy and ecosystem levels. Understanding the correlation between Sun-induced fluorescence (SIF), gross primary productivity (GPP), and leaf-level fluorescence is still in its initial phase. Thus, through this work, we will try to achieve the following specific aims: 1) to understand the basic mechanism of silicon action in buckwheat under drought stress by studying the changes in anatomy, and primary and secondary metabolism. 2) to detect changes in SIF and evaluate the relationship between SIF, reflectance, leaf-level chlorophyll fluorescence photosynthetic parameters, and GPP on agricultural plots in irrigated, non-irrigated, Silicon treated, and non-treated conditions, with an ambition to choose the high yield variety under drought. The experiment under the controlled environment will be conducted in the Czech Republic, whereas the field experiment on the same buckwheat varieties will be conducted in Poland. This approach will give several advantages in understanding the basic mechanism of drought tolerance induction by Silicon and the practical understanding under the field conditions. The originality and innovativeness of the project objectives lie in: a) the simultaneous analyses of photochemical and non-photochemical processes at whole leaves and plants in the canopy. b) the combination of detailed analyses at the leaf level will significantly contribute to the better spatial and temporal characterization of heterogeneity and variability. c) the analysis of buckwheat and its varieties under field conditions with the application of Silicon as an antitranspirant and efficient agricultural biostimulant. d) the interconnection of two laboratories and experts in two different areas. e) the collection of the high-quality and unique set of data from the field conditions, which will include regular SIF, reflectance, leaf area index, CO2 flux measurement, and multispectral and thermal images with the use of the unmanned aerial vehicle at the canopy level as well as leave level plant fluorescence measurement. f) the plant level and canopy level data will be collected and validated through the use of a radiative transfer model, which will ultimately help to understand the vegetation, its structure, and the influence of environmental factors, and Silicon to a greater extend. Through this work we will 1) identify the buckwheat phenotype connected to drought tolerance and contribute to breeding genotypes more suitable for future climatic conditions 2) if the application of Si in the field condition will help in the development of a methodology to increase the buckwheat yield in water-limited conditions that will be helpful for farmers. 3) build a further understanding of different photosynthetic processes being impacted under the influence of Si action and thus will help to understand the mechanism behind the action of Si in detail. 4) help to understand the SIF and its correlation with photosynthesis in detail. 5) develop a radiative transfer model and its potential to help in a better understanding of satellite data. Thus this interdisciplinary work has great potential in the development of the different scientific fields.