



Information for research project

Call: Competition for financial support of basic research projects - 2020
Main scientific area: Agricultural sciences
Contract No: KP-06 H 46/5
Initial date and duration of the project: 27.11.2020, 36 M
Project title: Elaboration of algorithms for optimization of the methods for qualitative and quantitative analysis of onion (<i>Allium cepa</i> L.) by fluorescence spectroscopy
Research organization: Maritsa Vegetable Crops Research Institute
Principal investigator: Galina Todorova Pevcharova, professor, PhD



Abstract of the research project

The interaction of light with food plays an important role in optical diagnostics for non-invasive assessment of their quality. Optical methods of analysis allow a study of small penetration depths with high sensitivity without compromising the integrity of the sample. Onion is a vegetable crops where defects in the interior without visible manifestation on the surface of the bulbs could be existed. They are most often associated with genotypic affiliation or are caused by decay processes as a result of storage in warehouses. For this reason, it could serve as a model vegetable crop in the development of algorithms for optimizing methods for qualitative and quantitative analysis by spectroscopy. Onions are a heterogeneous medium. It contains particles smaller than the wavelength of visible light which play a role of independent sources emitting incoherently in a turbid environment. Their waves propagate independently in all directions due to which the turbid medium fluoresces. The standard methods for determination of certain chemical and physical components in onions are relatively slow and require expensive consumables. The proposed project includes research related to the optimization of the time for evaluation of onions using classical and laser-induced fluorescence spectroscopy. They could prove their potential in studying the quality of onions during storage and could also be used to assess the degree of drought in the soil on which the plants are grown. During the implementation of the project it will be possible to record the emission spectra of onion genotypes grown in optimal and reduced irrigation stored under conditions of a warehouses through the developed experimental installations based on fluorescent signals. The formulation of algorithms for optimizing the time for analysis of texture, dry matter, content of mono- and disaccharides, color parameters, darkening and bruising of tissues, freshness control, the presence of internal defects and inhomogeneities in onions will support the breeding process in its initial stages when a large set of samples for a short time is necessary to be assessed. By the created database and the developed algorithms an analysis will be possible to perform using statistical methods of matrix optics. The algorithms will be a solid basis for detecting existing internal defects that cannot be registered by standard onion grading methods and will help to reliably determine commodity losses in the bulb storage process. The experimental systems during the design activities will be adjusted and operated using the principles of modern optoelectronics. They are not currently used in the EU for onion analysis. The project is interdisciplinary. Its application requires knowledge in the fields of: optoelectronics, mathematics, physics, signal theory, chemistry, biology and vegetable production. This knowledge will be applied through a systematic engineering approach to achieve the project objectives.