Project Objective. The aim of the research is to determine the possibility of carrying out biofortification (enrichment) of selected herbal plants species in selenium and iodine with the use of inorganic iodine (potassium iodide) and selenium as well as organic forms of iodine (5-iodosalicylic acid and 3,5-diiodosalicylic acid) including the effect of **salicylic acid (abbreviated: SA)** on the process. The aim of the research is to analyse the changes that may occur under the influence of applied compounds in the chemical composition and health-promoting properties of herbal plants, also after post-harvest processing of plant material.

Description of basic research. The research plan includes tasks related to the introduction of iodosalicylates into **herbal plants**. The use of iodosalicylates in biofortification is justified as they are naturally occurring compounds in plants. To date, iodosalicylates have not been used in research on iodine biofortification of herbal plants. Research proposed in the project will include the application of iodosalicylates separately and together with selenium; potassium iodide and selenium in combination with SA will also be tested along with the positive control of the study, i.e. iodides alone. The research will include the analysis of transformations of iodine compounds in herbal plants, including the synthesis of: iodotyrosine, iodine derivatives of benzoic acid and PDTHAs (plant-derived thyroid hormone). In addition, the research plan will investigate the transformations in herbal plants of selenium (in the form of SeO_4^{2-}) to seleno organic compounds (SeMet, SeOMet, Se_2Cys_2, SeMetCys) exhibiting higher health-promoting properties for humans than the SeO_4^{2-} ions; the effect of additional application of iodine and salicylic acid will also be evaluated.

The grant includes research with the following herbal plant species: angelica (*Angelica archangelica* L.), St. John's wort (*Hypericum perforatum* L.), California poppy (*Eschscholzia californica* Cham.), basil (*Ocimum basilicum* L.), lemon balm (*Melissa officinalis* L.), oregano (*Origanum vulgare* L.), dill (*Anethum graveolens* L.), caraway /meridian fennel/ (*Carum carvi* L.), sage /Salvia/ (*Salvia officinalis* L.) and thyme (*Thymus vulgaris* L.). Herb species from different botanical families, with bioactive substances belonging to different chemical groups and thus exerting a variety of medicinal/health effects on the human body were selected for the study. Herbal plants will be grown in a hydroponic nutrient film technique system (NFT). Iodine and selenium compounds will be applied to nutrient solutions containing all other plant nutrients. The application of iodine and selenium, in addition to causing the biofortification effect, can boost the health-promoting properties of these plants, by increasing the content of bioactive compounds and polyphenols in plants. SA applied for fertilization with inorganic iodine and selenium can stimulate their uptake by plants, while enriching them with SA and products of its metabolism in plants. The completion of the research will make it possible to evaluate the effect of iodine and/or selenium applied without or together with SA on the yield and chemical composition of herbaceous plants, including the content of: macro- and micronutrients, bioactive substances, nutraceuticals, vitamins as well as antioxidant capacity of the herbal plants. It is also planned to investigate the stability of selenium (selenates and resulting seleno amino acids) and iodine (iodides and iodosalicylates and their metabolites, among others: iodotyrosine, 4-iodobenzoic acid, 2,3,5-triiodobenzoic acid, PDTHA) during post-harvest processing of herbs, including the most typical processes, *i.e.*: blanching and freezing; drying under variable thermal conditions at +30°C and +60°C as well as pesto production. **These issues have not yet been recognized in scientific research.**

Reasons for taking up the research topic. One of the effects of years of intensive agricultural production is a reduction in the supply of minerals, including selenium and iodine, in food. This is due to the fact that crop varieties bred as a result of the green revolution have a lower mineral content than traditional varieties grown earlier. The problem of deficient content of the aforementioned elements in soils, and insufficient its transfer to plants and food, consequently, is also of great importance, particularly in areas of endemic deficiency. Currently, several billion people have symptoms of nutrient deficiency or suffer from the related so-called “hidden hunger.” In particular, iodine and selenium deficiency affect 30% and 15% of the population, respectively. Natural supplementation of deficient mineral content in food can take place through biofortification (enrichment) of crops with these nutrients, which falls within the scope of functional food production. This has been proven to be one of the cheapest and relatively effective processes for counteracting or alleviating mineral deficiencies in humans. The herbal plants included in the project (some of which are also spices) can be excellent carriers of iodine and selenium to the human diet. Numerous studies on the effects of selenium alone or iodine alone on plants have been conducted worldwide for several decades. Work on the topic of simultaneous application of both elements is rare. It is therefore justified to conduct research on the biofortification of herbal plants in selenium and iodine with the additional application of SA, especially taking into account their mutual influence on metabolic processes in plants and the possibility of modifying health-promoting properties, which is particularly important in the case of herbal plants.