ROLE OF SEED PRIMING AND ACCLIMATION IN PLANT ADAPTATION TO ENVIRONMENTAL STRESS

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Salinization affects at least 20% of irrigated soil worldwide; this phenomenon involves arid, semi-arid and sub-humid areas, leading to an irreversible degradation of the soil, called desertification. Drought is a long period of unusually low rainfall, leading to water depletion. Salt accumulation in the soil and drought can be severe threats to ecosystems by strongly affecting plant growth and reproduction as well as reducing the biodiversity and metabolism of soil microorganisms.

In recent years, several approaches were used to improve plant tolerance to stress, such as acclimation and seed priming. The latter is a pre-sowing treatment, consisting of the soaking of the seeds in a priming agent, followed by drying the seeds to avoid radicle emergence. A priming agent can provoke abiotic stress to seed, inducing a cross-tolerance to different abiotic stresses [1]. An acclimation to stress can be obtained by a gradual exposure of the plant to stress conditions that can lead the plant to an adaptation to stress and to a better performance [2].

The aim of this project is to verify the possibility to ameliorate the salt and drought tolerance in food crops, such as bean (*Phaseolus* spp.) and tomato (*Solanum lycopersicum* L.). Both tomatoes and beans are glycophytes, very sensitive to drought and salt stresses, which not only compromise their growth but also their yields, causing huge economic loss. In order to determine the best approach, two different methods, i.e. seed priming and acclimation, will be applied and compared.

The first year of the project will be focused on the screening of different species of beans and cultivars of tomato to assess their tolerance to salt and drought stresses. The data obtained will allow the selection of cultivars with different degrees of tolerance. In the second year, experimental trials on seed priming and acclimation will be set up to determine the best protocol. Stress responses of treated and untreated plants will be determined basing on seed germination, growth rate and morphological parameters. During the second year, the effects of the treatments on plant physiology will be investigated, i.e. chlorophylls and carotenoids amount but also TGase activity and polyamines levels will be studied. During the third year, Ca^{2+} and Na^{+} content of the plants will be measured and antioxidant enzymatic activities will be detected. Parallel to morphological and physiological analyses, a machine learning approach will be tested with the aim to establish a data analysis method, based on analytical models, able to automatically determine the effect of stress on plants.

[1] Stassinos, P.M.; Rossi, M.; Borromeo, I.; Capo, C.; Beninati, S.; Forni, C. Enhancement of *Brassica napus* Tolerance to High Saline Conditions by Seed Priming. Plants 2021, 10, 403.
[2] Santangeli, M.; Capo, C.; Beninati, S.; Pietrini, F.; Forni, C. Gradual Exposure to Salinity Improves Tolerance to Salt Stress in Rapeseed (*Brassica napus* L.). Water 2019, 11, 1667.