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EVOLUTIONARY POPULATIONS AS A MODEL FOR STUDYING ADAPTATION STRATEGIES TOWARDS DROUGHT-STRESS

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The advent of high-input and intensive monoculture systems, based on genetically similar individuals improved for particular traits, resulted in a decrease of genetic variability that has been linked to the reduced level of resistance and resilience toward climate-change. Therefore, it is overriding to reconsider, in plant breeding programmes, the role of biodiversity and its preservation. An interesting strategy is represented by the adoption of heterogeneous populations as dynamic material able to adapt to climate changes, thanks to the reservoir of genetic variability they embody. There are two ways to develop heterogeneous populations: either by crossing-in all or several combinations of varieties, obtaining a genetic material known as Evolutionary Population (EP), or mixing seeds form different varieties. In this study we considered two EPs that derived by an initial population generated by mixing F2, F3 and F4 seeds obtained from about 2000 crosses of 256 bread wheat parental lines. Since 2010, this population has been grown in two different farms located in Tuscany and Sicily where it has adapted to the different environments, leading to the formation of two distinct populations defined respectively EP_Floriddia and EP_Lirosi. A greenhouse experiment including 315 individuals from each population was arranged in a randomized complete-block design at Open Fields S.r.L (Parma). During the growth period, a severe drought stress was imposed: 0% of the field capacity (FC) was considered as stress-treatment, while the well-watered (70% FC) was considered as the comparison control, both with three replications. Photosynthetic parameters, based on Chlorophyll fluorescence, were considered to monitor plants performance during the drought-stress period, and subsequent recovery, using a

MultispeQ device. In detail, we measured the maximum quantum efficiency of Photosystem II (Fv/Fm), non-photochemical quenching (NPQt, ΦNPQ) and one of its fractions (qL), maximum quantum yield of PSII (Φ2) and the non-regulatory energy dissipation (ΦNO). Further analyses were also performed, including quantification of chlorophyll a and b, measurement of leaf temperature differential (LTD) and monitoring of some phenotypic traits such as stem diameter, spike length, number of seeds per spike, single seed weight and then total grain yield. Analysis of variance of all photosynthetic parameters, LTD and chlorophyll content showed significant variation ($p \leq 0.05$) between drought-stress and well-watered in both EPs and between the two generated populations. The results will be integrated with the above phenotypic traits and grain yield to identify which evolutionary population appears to be more tolerant and resilient to water stress. The future objective of our study is to identify the genetic determinants (QTL) responsible for the adaptation of the EPs, thus individuals showing extreme phenotype will be consider for the selective genotypic process that will be set up.