UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

IPSP National Research Council of Italy Institute for Sustainable Plant Protection

FIELD PHENOTYPING THE IMPACT OF SALT STRESS ON TOMATO IN MEDITERRANEAN CONDITIONS

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INTRODUCTION

Soil Salinity is one of the main abiotic environmental challenges to sustainable crop production in the world's major arable regions. Tomato (*Solanum lycopersicum* L.), a member of the Solanaceae family, is amongst the most significant crops largely cultivated in open fields as well as under protected colture. It is significantly affected by salinity stress, influencing the crop performance, yield and quality.

MATERIAL AND METHODS

A field trial in a Mediterranean environment involving 48 tomato genotypes (*S. lycopersicum* var. *cerasiforme*), is in progress in Policoro (MT, Southern Italy) for screening a reference non redundant collection of worldwide genetic resources for salinity tolerance. The experimental trial, realized according a split plot design with 4 repetitions, included four irrigation treatment with normal water (NW, Ece 0,04 DS m-1), irrigation with low-salinized water (SW1, Ece 5 DS m-1), with medium-salinized water (SW2, Ece 10 DS m-1) and with highly-salinized (SW3, Ece 20 DS m-1) water. Physiological and agronomic pre- and post-harvest parameters are going in measurements.

Remote sensing surveys were performed with UAVs (Matrice 300 RTK, DJi, Shenzhen, PRC) equipped with a thermal camera (DJi Zenmuse XT2) and a multispectral sensor for the detection of the NDVI index (Double 4K NDVI/NDRE, Sentera, MN, USA). The flights over the experimental field were performed at an altitude of 60 m AGL and at a ground speed of 2 m/s. The images taken from the sensors were processed to obtain ortho-mosaics and three-dimensional photogrammetry (Metashape, Agisoft, St. Petersburg, RU), from which the various parameters were obtained and then compared with the ground measurements. Multispectral images were processed to obtain vegetation indices and biovolume of the crop. Plants were manually harvested at physiological maturity to obtain shoot biomass, yield, and yield components.

SPAD values of the four healthy and fully expanded uppermost leaves were determined on three randomly selected plants from each plot in the field.

Obtained indices relative variation in response to salinity stress were estimated according to the following formula:

$$[(TS/TC) \times 100]-100$$

where TS and TC represents the average trait performances of a genotype under salt stress and control conditions, respectively. The relative variations (%var) data were used to generate radar charts by means MS Excel software.

Principal component analysis and between-groups average linkage hierarchical clustering were performed using SPSS 28.0 for Windows.

RESULTS

The first results of the experiment show a high data quality and large phenotypic and physiological diversity in the investigated tomato genotypes. Irrigations with highly-salinized water strongly affected morpho-phisiological traits in genotypes. However, several more tolerant accessions exhibited a lower phenotypic impact from the stress induced by saline treatments.

The PCA resulted in two principal components overall including 82% of the overall variance. In particular, component 1 positively associated with the relative additive variation in NDVI, VOL and H whereas component 2 positively associated with the additive variation in SPAD at the stressing treatments of increasing intensity. Most tolerant genotypes expressed less negative reduction in measured variables referring to higher value on both components mostly including clusters 3, 4 and 5. Also, tissue samples will be collected from selected accessions within applied treatments for RNA extraction and RNAseq analysis to model genome-wide expression profiles contributing to salinity tolerance in tomato.

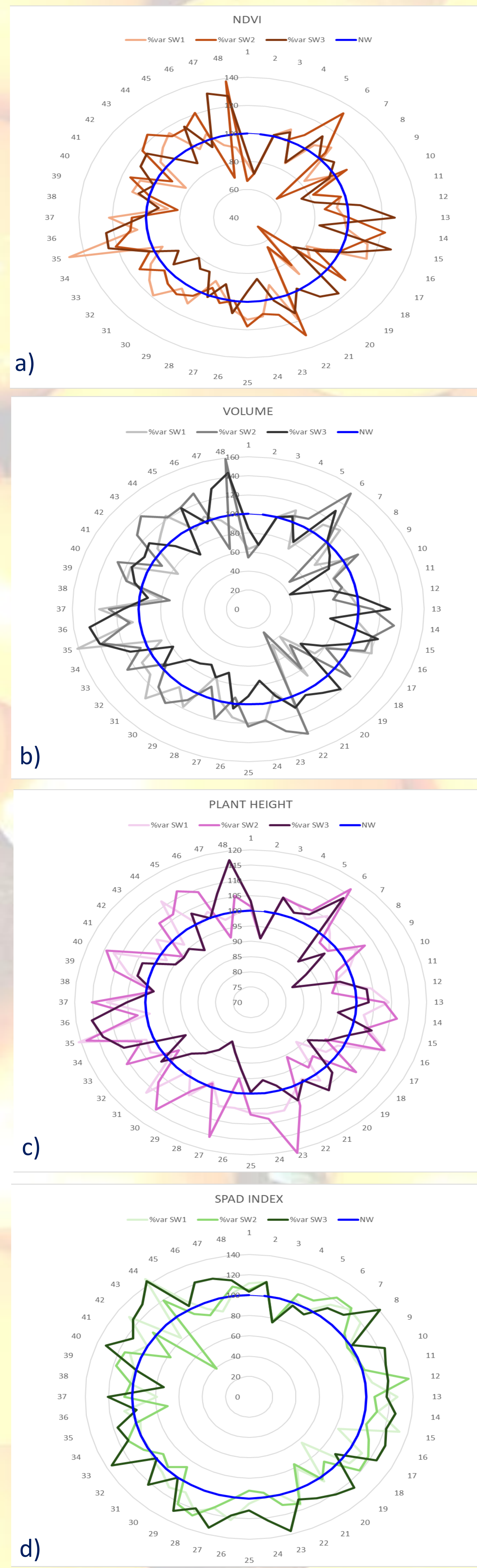
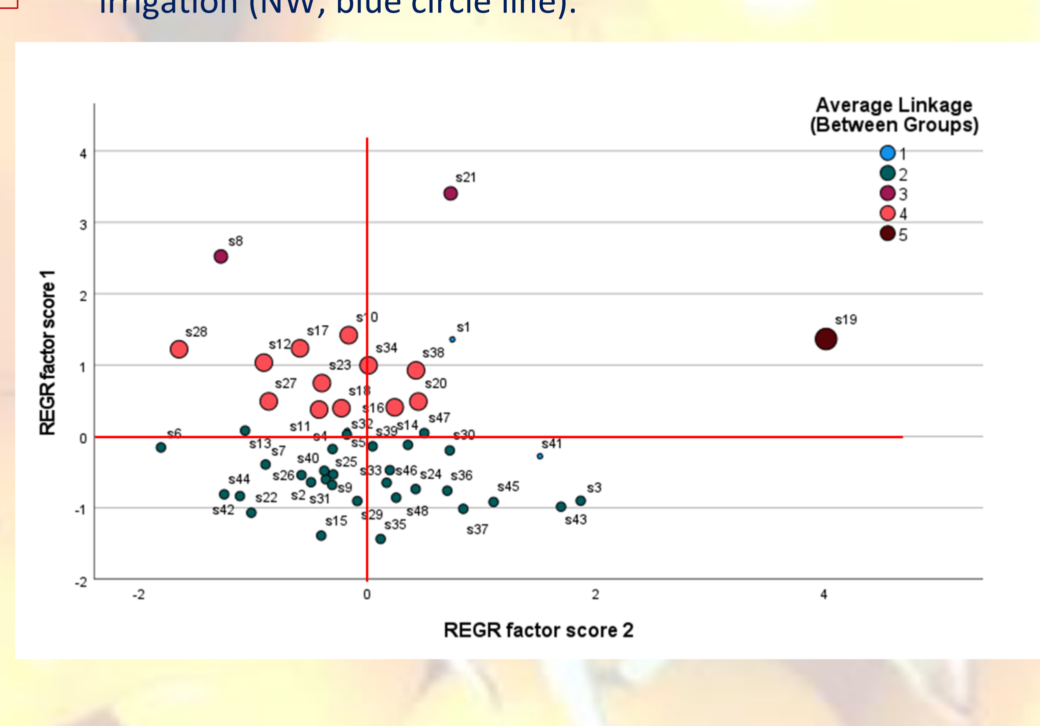


Fig 1. Relative percentage variations of obtained traits (a: NDVI, b: biovolume, c: plant height and d: Spad Index) in response to the three different salinity irrigation water content (SW1, SW2 and SW3) compared to control irrigation (NW, blue circle line).

Rotated Component Matrix[a]

	Component 1	Component 2
sNDVI	.955	.134
sVOL	.955	.150
sH	.657	-.121
sSPAD	.040	.985

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.



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