ABSTRACT OF THESIS

Title of thesis: Effects of abiotic stress conditions on physiological performance of maize plant

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Climate change, land degradation, and population growth have increased the demand for crop productivity worldwide, making sustainable agriculture techniques even more important. Abiotic stresses including drought, salinity, and severe temperatures can cause maize (*Zea mays* L.), a major crop around the world, to lose more than 50% of its yield. This study investigates how the physiological performance of maize is affected under different abiotic stress conditions particularly drought and combined drought-heat stress. The impact of these stresses on photosynthesis, transpiration, and chlorophyll content is evaluated using light curve analysis, spectral reflectance techniques, and vegetation indices.

Results show that maize plants germinated in nutrient-rich conditions had much higher photosynthetic activity, as measured by net photosynthesis (Pn), than plants grown in nutrient-deficient conditions, especially when under stress. Reduced photosynthetic efficiency, photochemical efficiency, and transpiration rates result from nutrient deficiencies coupled with heat and drought stress. Chlorophyll amount and plant stress state are strongly correlated with vegetation indices (VIs), such as the Modified red edge normalized difference vegetation index (mNDVI), Photochemical reflectance index (PRI) and Plant sensecene reflectance index (PSRI). Under ideal circumstances, there is also a positive association between net photosynthesis and transpiration; but, under stress, this relationship becomes less pronounced because of stomatal responses that minimize water loss. The results showed that the availability of nitrogen is essential for maintaining photosynthetic adaptability and efficiency under stress. In comparison to nitrogen-deficient plants, full-nutrient plants exhibited greater photosynthetic rates, chlorophyll content, and improved water retention. A lower Fv/Fm ratio, which suggests

decreased efficiency, indicates that the combined heat and drought treatment had a considerable impact on photosynthetic parameters. These findings demonstrate the value of proper nutrient management as well as the possibility of remote sensing indicators for early crop stress detection.

Keywords: Maize, Photosynthesis, Abiotic stress, Heat stress, Drought Stress, Remote sensing, Chlorophyll fluorescence