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STRATEGIE INTEGRATE PER AFFRONTARE LE SFIDE CLIMATICHE E AGRONOMICHE NELLA GESTIONE DEI SISTEMI AGROALIMENTARI

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The new seed-applied fungicide Sedaxane improves drought tolerance in early growth stages of maize

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Introduction

Research is now discovering new fungicides having bio-stimulating effects, and this may have an interest under abiotic stress conditions. The purpose of this work is to evaluate the effects of the seed-coating treatment Maxim XL (Syngenta), widely used in maize, in combination or not with the new SDHI fungicide Sedaxane on plant growth and transpiration under progressive water stress.

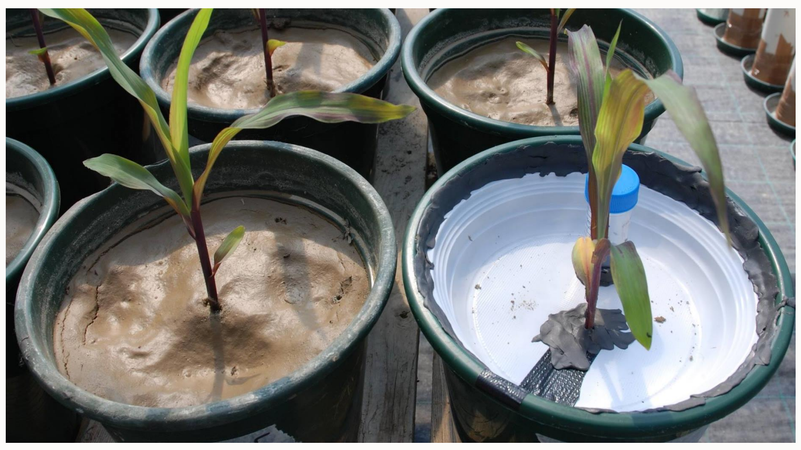

Fig 1: Example of two maize pots of the trial: optimal water supply (left) and progressive water stress (right).

Materials and Methods

The SY-HYDRO maize hybrid (Syngenta, FAO class 600) was pot cultivated during 2016. 6-L PVC pots were filled with a mixture of sand and silty-loam soil (1:1 w/w) and placed in a greenhouse, following a completely randomised experimental design (n = 4).

Three seed-coatings:

- **Untreated controls**
- **Maxim XL** (Fludioxonil + Metalaxil)
- **Maxim XL + Vibrance** (the latter at 2.5 mL/50 Kseeds with 50% w/w of Sedaxane)

Factorially combined with two water regimes:

- **Optimal water supply**
- **Progressive water stress**

At the 3-leaf stage, the soil was irrigated at field capacity and pots carefully sealed to avoid evaporation (Fig. 1). During the experiment all pots were daily weighed to determine daily water transpiration: under optimal water supply water was restored daily, but not in stressed plants. The trial lasted 45 days. The relative transpiration (RT, % of maximum traspiration) was plotted against the fraction of transpirable soil water (FTSW) and regressed with a linear plateau model.

At harvest, free phenolic acids (caffeic, syringic, vanillic, p-coumaric and t-ferulic) were detected in shoot tissues by HPLC.

Results

Under optimal water supply, fungicide-treated plants transpired a greater amount of water compared with untreated controls, due to a higher shoot and root growth. Under progressive water stress, the dynamics of leaf transpiration over FTSW differed among treatments: transpiration started to decrease at a FTSW value of **28%** with Maxim XL, and at **30%** with Maxim XL + Vibrance (Fig. 2). Untreated controls showed an early stomatal closure (FTSW = **38%**).

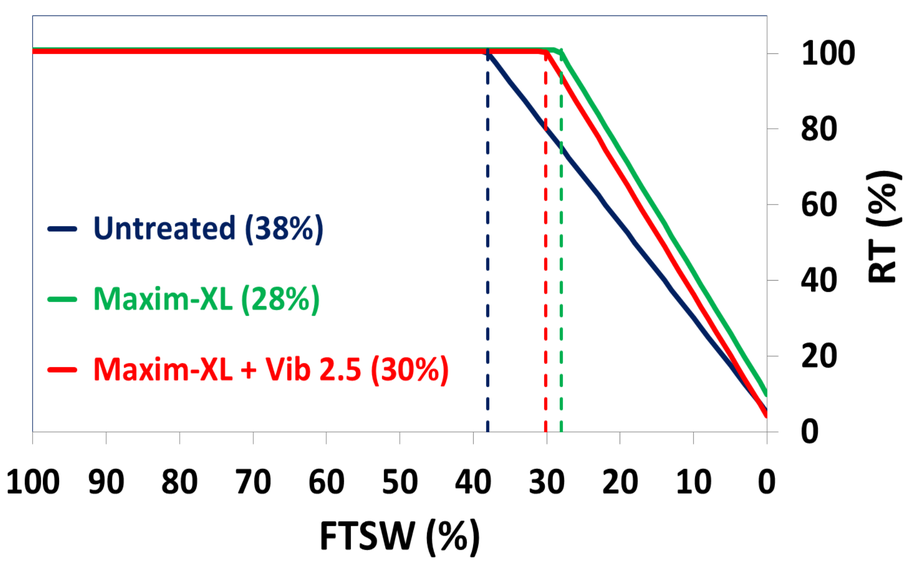

Fig. 2: Linear plateau regressions of relative transpiration (RT) plotted vs. fraction of transpirable soil water (FTSW) of pot-cultivated maize under progressive water stress. Transpiration measured over 27 days after pot closure. In brackets: FTSW at which RT starts to decline.

The biosynthesis of phenolic acids was stimulated by water stress, with high increase with Vibrance, mainly due syringic acid (Fig. 3). Also under optimal water supply, Vibrance significantly increased these antioxidants (**+47%** vs. controls), particularly syringic and caffeic acids.

These physiological changes are considered positively in view of the many positive functions exerted by phenolic acids in plants. Basing on recent literature, Sedaxane is thought to affect the expression of key genes in plant physiology, and this may help the plant to overcome stressful conditions.

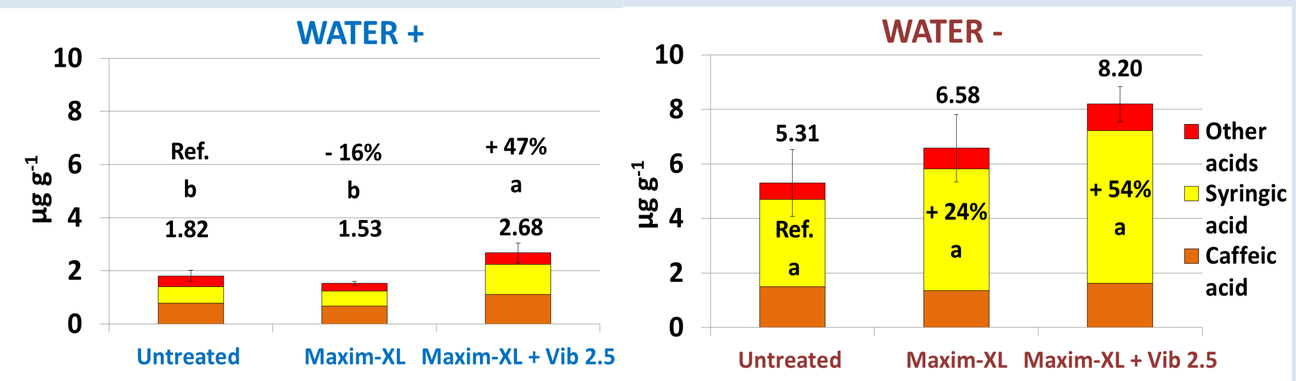

Fig. 3: Antioxidant activity (phenolic acids) (mean ± S.E., n = 4) in shoot tissues of pot-cultivated maize under optimal water supply (water +) and in progressive water stress (water -) (Newman-Keuls test, P≤0.05). Letters for statistical comparisons.

Conclusions

Under progressive water stress, plants treated with seed-applied fungicides can delay the stomata closure in early stages, thus increasing resilience to fluctuating soil water availability and possibly protecting yield potential of maize.

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