

Crop production in sodic soils: Can the corn take the water of the Btn horizon?



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INTRODUCTION

The area under agricultural crops in the Salado Basin of Argentina grew exponentially since 2005 to the present day. The soils of this region have a natric (Bt) horizon with high special heterogeneity where sectors with greater sodium salts accumulations are observed, interspersed with sectors where these chemical limitations to the plant growth are absents. There is evidence to the Bt horizon limit the root growth and water absorption by the plants

The aim of this work was to evaluate the role of the Bt horizon with different degrees of sodicity in the provision of water to the corn crop.

METHODOLOGY

An experiment was carried out in field plots in the Chascomús Integrated Experimental Farm (MDA-INTA) (35° 44' S; 58° 03' O). Plot were arranged in a randomized complete design with three treatments and six repetitions:

- 1) Drought: crops plots with limited water recharge due to rainfall from V₁₁ to harvest. (Fig 1 A)
- 2) Control: crops plots with water recharge doue to rainfall (Fig 1 B)
- 3) Bare soil: plots without crops and rainwater recharge.

The gravimetric moisture was determined every 7 days, every 0.2 m up to 1 m depth. The water absorption was regarded as the difference between treatment in each measurement moment. To determine the hydric state of the crop, the water potential in the leaf was measured at pre-dawn and at noon with a pressure pump (Scholander et al., 1965). The grain yield of corn and the sodicity of natric horizon was related



Fig 1. Inter-row of the Drought plots with polyethylene films (A) and inter-row of the Control plots without polyethylene films (B)

RESULTS

The corn crop was able to absorb until leaving a remnant of 45% of water in the Bt (Fig 2).

This residual water was higher due to increases in ESP, for this reason higher levels of water stress associated with increases in ESP were observed in critical period of yield determination (Fig 3).

The yields were between 6848-10983 kg ha⁻¹, decreasing 1.2% for each unit increase in ESP (Fig 4).

The corn roots were able to absorb to the 1 m in the soil profile, this absorption depth was reduced by 0.02 m for each increase in ESP (Fig 5).

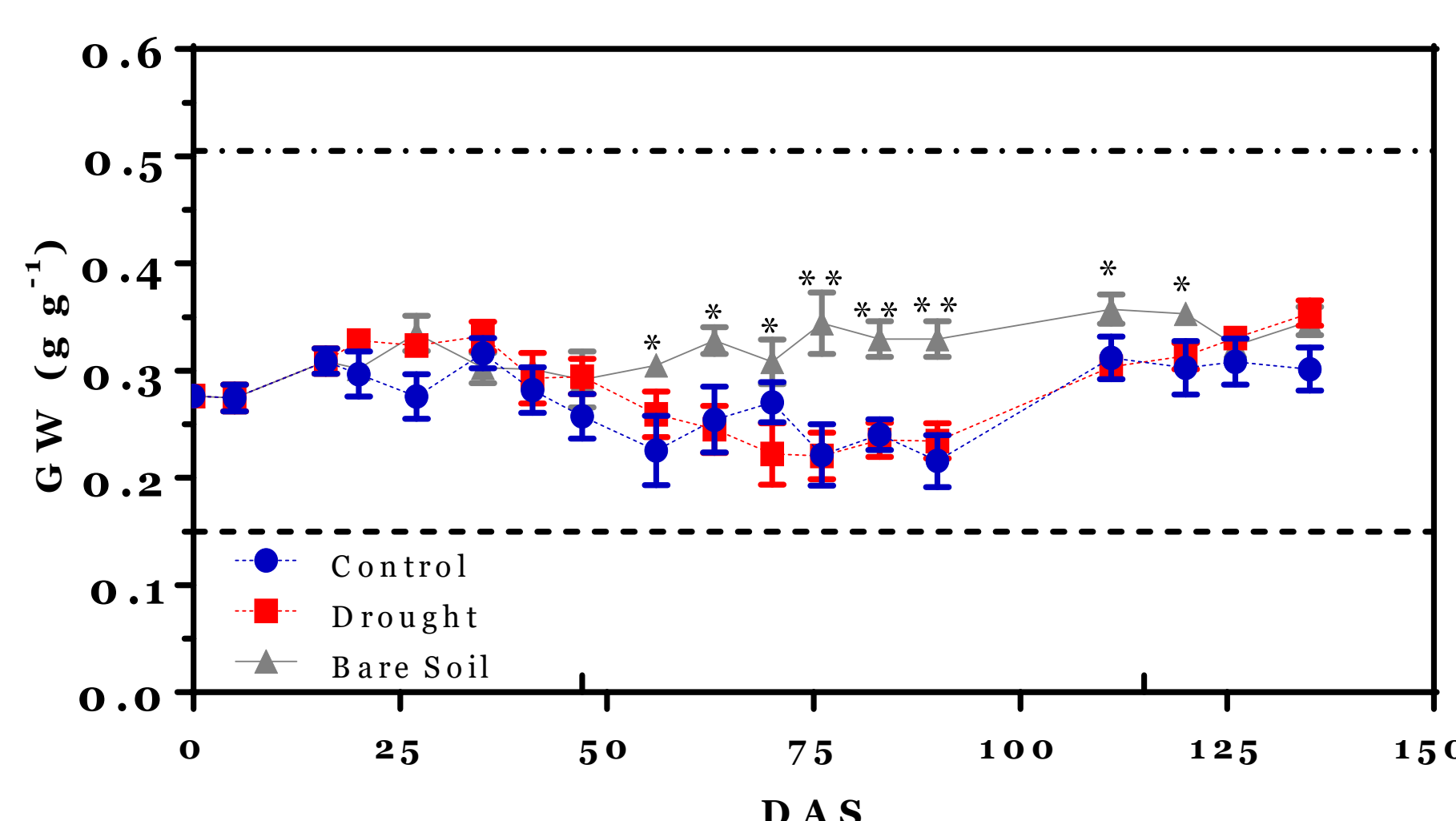


Fig 2. Gravimetric water (GW) in Bt of Control Plots (Blue), Drought Plots (Red) and Bare soil Plot (Grey), days after sowing corn (DAS)

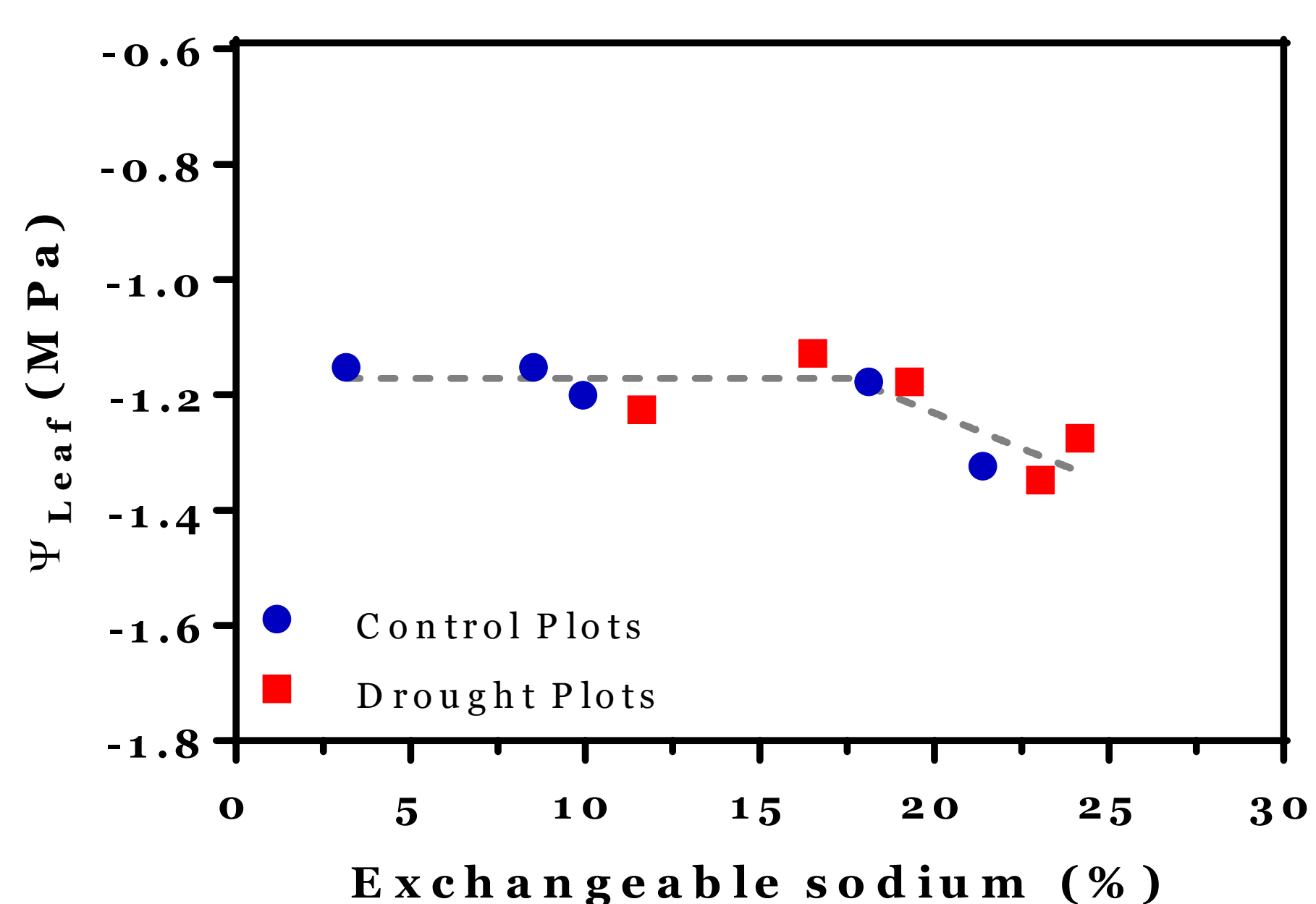


Fig 3. Relationship between the water potential in the leaf and ESP of Bt in Control plots (Blue) and Drought plots (Red)

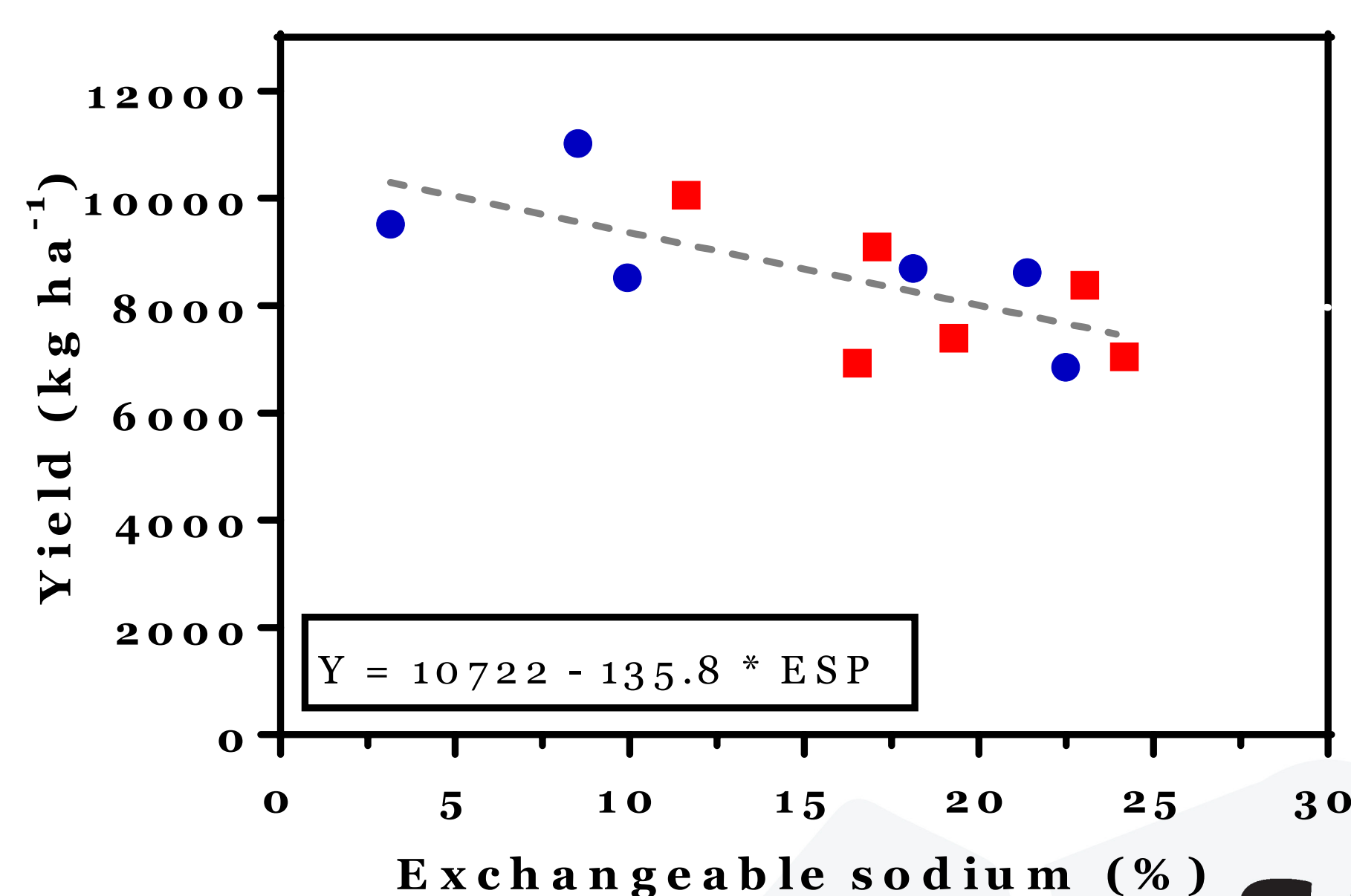


Fig 4. Relationship between the grain yield and ESP of Bt in Control plots (Blue) and Drought plots (Red).

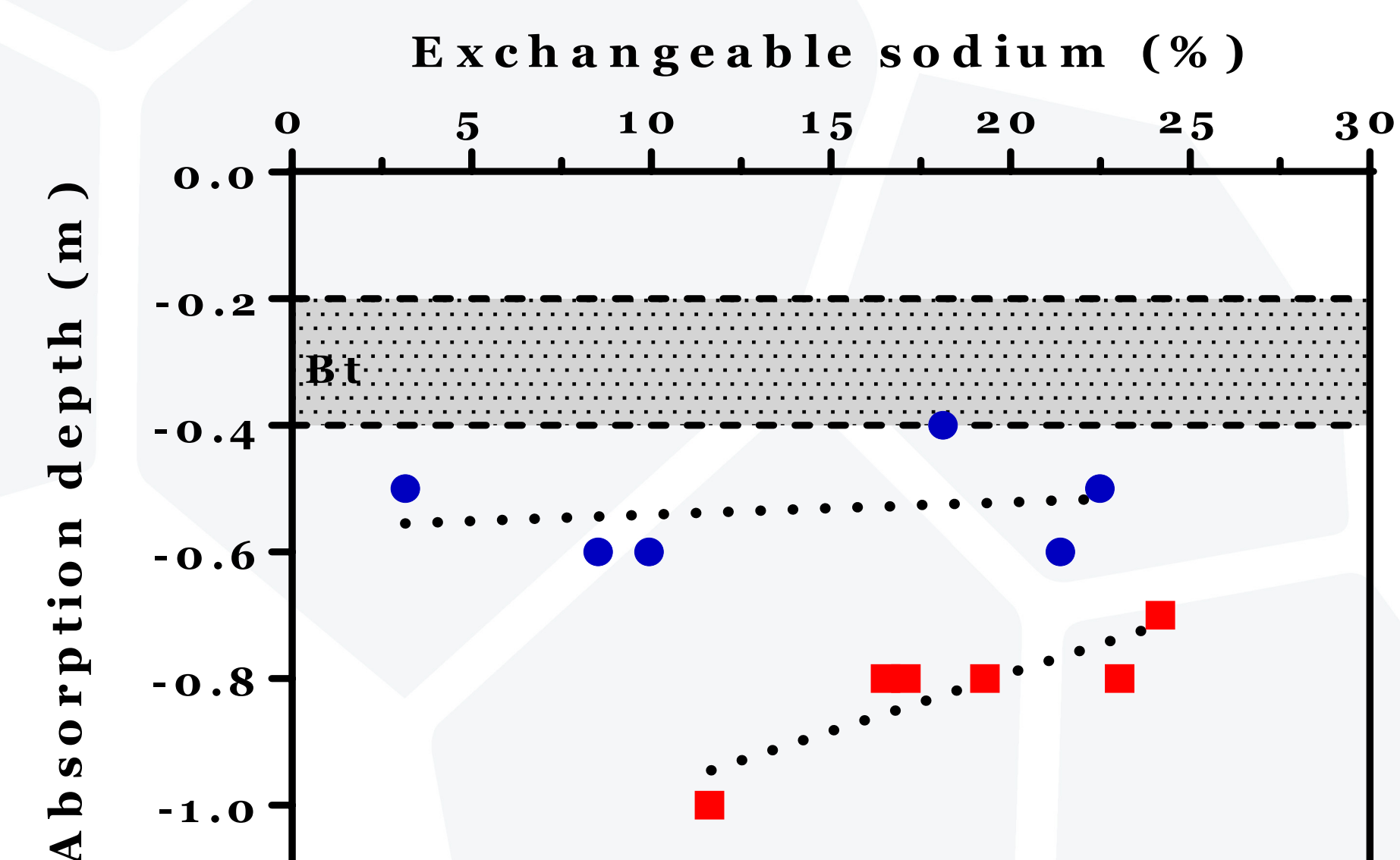


Fig 5. Relationship between the grain yield and ESP of Bt in Control plots (Blue) and Drought plots (Red)

DISCUSSION

The magnitude of desiccation of the natric horizon differs from that reported by Taboada y Alvarez (2008), who mention much lower values. In our study, the natric Bt presented clay contents 10-12% lower and a thickness 10-15 cm less than those of the quoted work. These two parameters could have explained the differences in the results achieved.

The reduction in corn yield is among those reported for soybean and sunflower crops (Gupta y Sharma, 1990), However, these results bring novelty, since the information available in the literature regarding the effect of ESP on maize yield is still scarce (Page et al., 2021).

CONCLUSIONS

The corn crop was able to extract water from the natric Bt horizon and consequently, access the groundwater from the deepening of roots in the soil profile.

Increasing ESP values reduced the productivity of the corn crop because of physical restrictions on water absorption and reductions of root deepening.

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