TALLER RED METRICE 2012

NUTRIENT UPTAKE AND UPTAKE EFFICIENCY OF WHEAT AT DIFFERENT DEVELOPMENT STAGES UNDER SOIL ALUMINUM TOXICITY AT FIELD CONDITIONS

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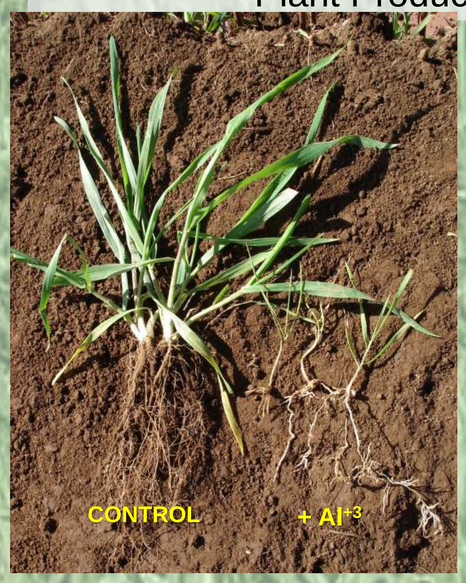

INTRODUCTION

Soil acidity is an important constraint for agriculture regarding that acidic soils account for a third of agricultural land in the world. The negative effect of soil Al toxicity on grain yield and biomass accumulation has been attributed to decreases of root growth, however, most of the evidences showing this have been carried out in short term experiments under controlled conditions. Few studies have been carried out under field conditions.

OBJECTIVE: The objective of this study was to quantitatively evaluate the effect of different soil Al levels on shoot and root responses, nutrient uptake (N, P, K and Ca) and nutrient uptake efficiency at three different development stages of two wheat cultivars contrasting in Al toxicity sensitivity.

MATERIALS AND METHODS

Two field experiments were conducted in an Andisol soil in Valdivia-Chile (39º 38`), during the 2005/6 (S1) and 2006/7 (S2) growing seasons. In both experiments, treatments cons Dalcahue.INIA and an Al-sensitive: Domo.INIA cultivar) and 5 soil Al levels (0.3–25.3% at S1 and 0.5-61.3% of soil Al saturation). In both experiments, soil samples were taken for accounting P, K, Ca and Al soil content. Shoot and root biomass were sampled at double ridge (DR), anthesis (An) and maturity (PM). Plant samples were weighted and chemical analysis carried out. Roots were sampled by a pinboard monolith up to 60 cm at DR and 130 cm at An and PM from each plot. Nutrient uptake efficiency (UPE) was calculated as the ratio between nutrient uptake by the crop to nutrient supply, which has been estimated as the element available.

RESULTS AND DISCUSSION

Biomass accumulation both in shoots and roots were significantly ($p < 0.001$) affected by exchangeable soil Al and cultivars at DR, An and PM stages as it is shown in Figure 1.

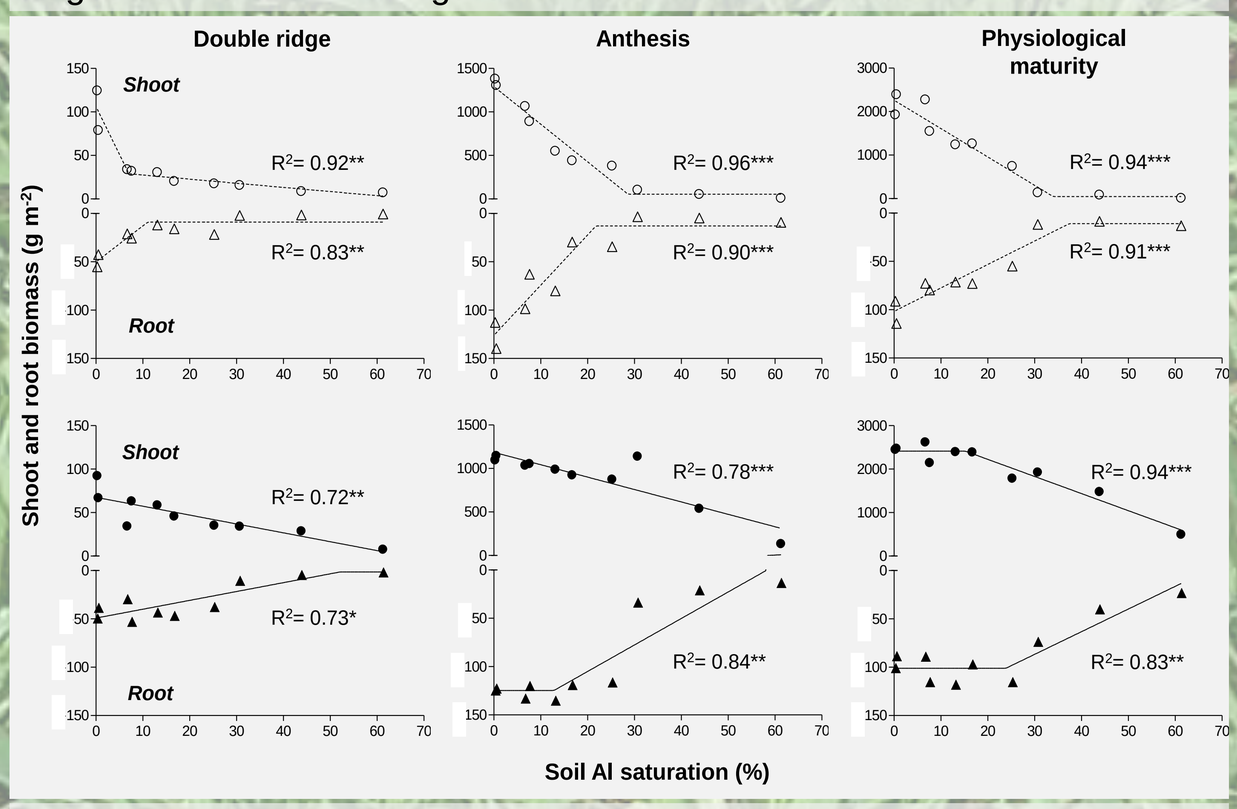

Figure 1. Relationship between shoot (circles) and root (triangles) biomass and soil Al saturation at DR, An and PM stages, for the Al-tolerant (closed symbols) and Al-sensitive (open symbols) cultivars evaluated during the two growing seasons.

Shoot biomass was well associated to root biomass ($p < 0.001$) at the three evaluated stages as it is shown in Figure 2.

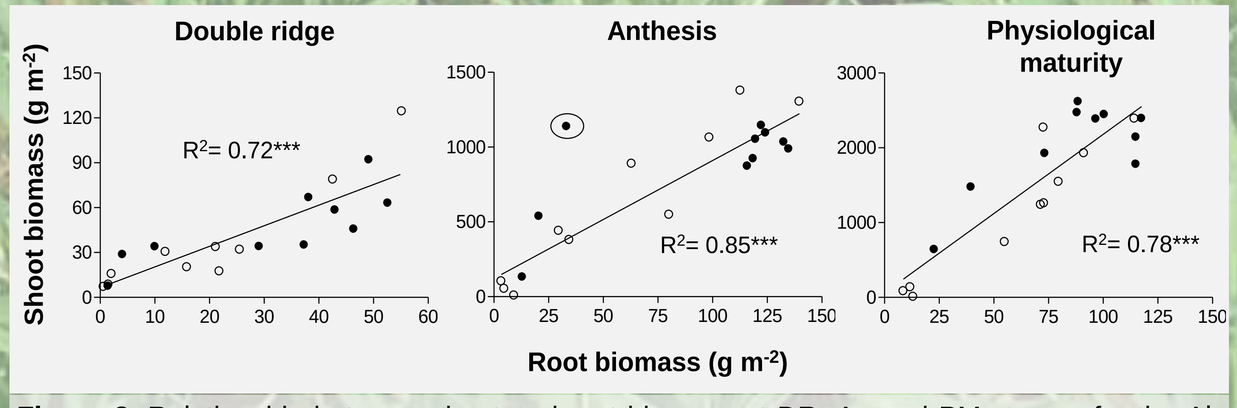

Figure 2. Relationship between shoot and root biomass at DR, An and PM stages, for the Al-tolerant (closed circles) and Al-sensitive (open circles) cultivars evaluated during the two growing seasons.

Nutrient (N, P, K, and Ca) uptake and nutrient uptake efficiency were significantly affected ($p < 0.05$) by soil Al saturation at each developmental stage. at each developmental stage. as it is shown in Figure 3.

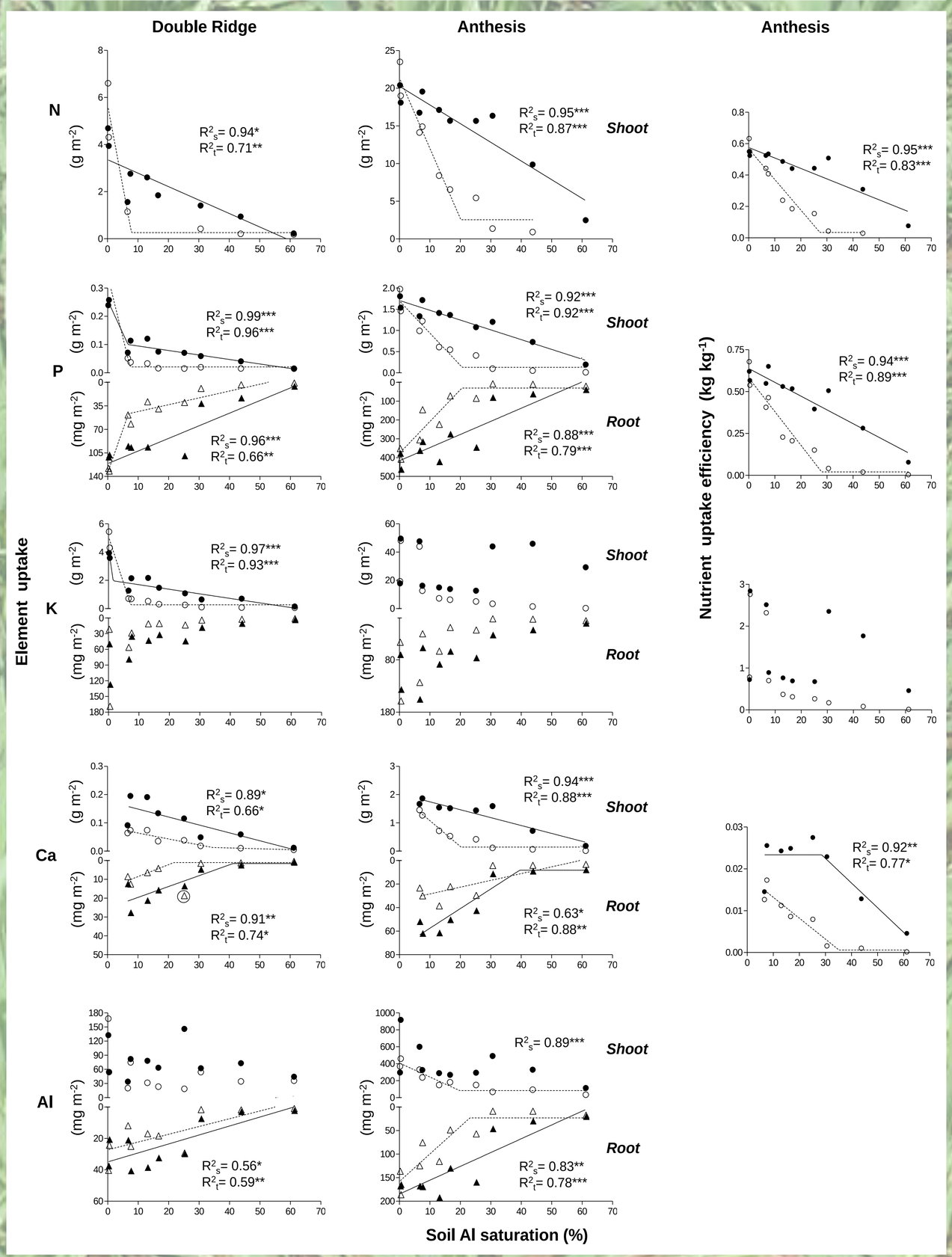

Figure 3. Relationship between element uptake (N, P, K, Ca and Al) or nutrient uptake efficiency and soil Al saturation in shoots (circles) and roots (triangles), at DR and An stages, for the Al-tolerant (closed symbols) and Al-sensitive (open symbols) cultivars evaluated during the two growing seasons.

CONCLUSIONS

- ✓ Both shoot and root biomass of wheat were affected by soil Al concentration, but with different sensitivities depending on the cultivar and phenological stage.
- ✓ Root biomass was a well descriptor of shoot biomass under soil Al toxicity irrespective of the cultivar.
- ✓ Nutrient uptake and uptake efficiency were strongly affected by soil Al concentration. The drop in nutrient uptake and uptake efficiency was higher in later stages of crop development.

SRV held a postgraduate scholarship from CONICYT. This study was funded by Ph.D. Thesis Project 1310-32-28 (R&D, UACH, competitive grant), Project C-13855 (8) (Fundación Andes, competitive grant).