WATERLOGGING IN WHEAT AND BARLEY AND ITS EFFECT ON GRAIN YIELD GENERATION

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Introduction

Waterlogging induces reductions in yield of grain crops, but the magnitude of that loss depends on the phenological stage when waterlogging occurs (Setter and Waters, 2003). Under productive conditions, yield losses as a result of waterlogging are consider lower in wheat than in barley. However, it is not well-identified (i) the ontogenic stages where waterlogging is more detrimental to reduce yield and (ii) the ecophysiological mechanisms involved in that reduction.

Objective:

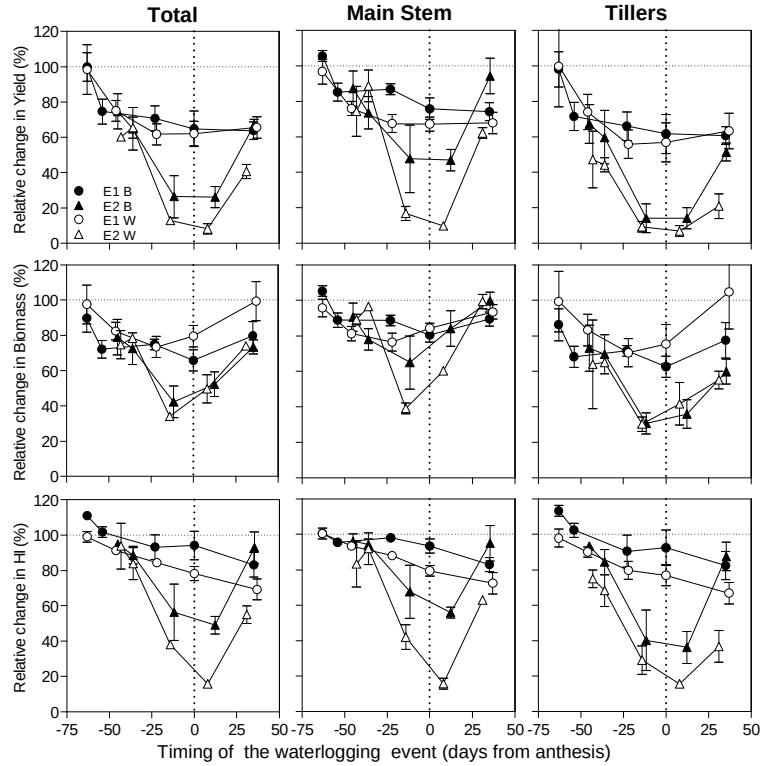
The objective of the work was to study the effect of short-term waterlogging events during ontogeny of wheat and barley on yield generation in order to indentify the most susceptible period to the stress.

Materials & Methods

Two experiments were carried out in pots at the Faculty of Agronomy (University of Buenos Aires, 34°35'S) under contrasting environmental conditions (sowing in July, under greenhouse, E1, and sowing in September, under field conditions, E2), where one wheat cultivar (Baguette 13, W) and one barley cultivar (Scarlett, B) were exposed to five sequences of waterlogging events from emergency to physiological maturity (L1-L4, L4-L7, L7-L10, L10-At, At-PM; where L: number of leaf appeared on the main stem, At: anthesis, PM: physiological maturity) with a duration of 15-20 days each event.

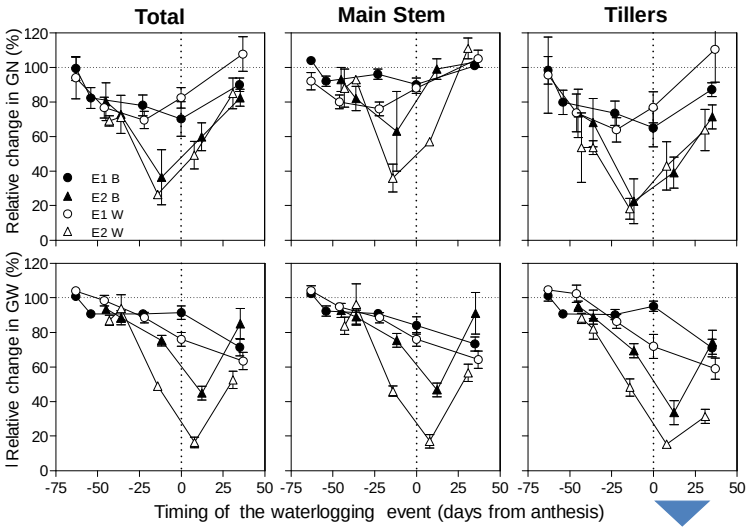
Measurements: Total above-ground biomass at maturity, grain yield and its numerical components were measured for total, main stem and tiller categories. Harvest index was calculated as Grain yield x total biomass at maturity^{-1}.

Results and Discussion



The greatest losses in grain yield took place in treatments around anthesis in both species. Waterlogging events in early vegetative stages did not reduce significantly grain yield (p>0.10).

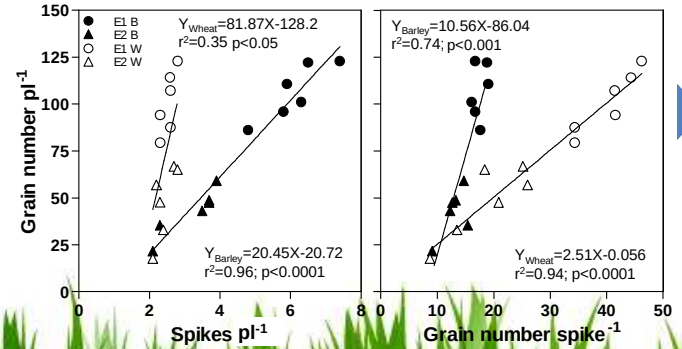
Yield losses were strongly associated with reductions in total biomass at maturity in both species and experiments (r^2=0.98; p<0.001, for all data set). In E2, partition was also reduced, and explained variations in yield (r^2_{E2}=0.89, p<0.001 *vs* r^2_{E1}=0.55, p<0.001)



Barley looked more wilted than wheat during the waterlogging treatments, but that differences were not related to differences between species in grain yield at maturity.

The treatment that produced the major reductions in grain number per plant (GN) was L7-10 (-40 to -20 days from anthesis) and decreases were greater in E2 and in the tiller category.

Grain weight (GW) was strongly reduced by waterlogging in tillers as well as in the main stems in both species, reaching in wheat losses of up 80% compared with the control (shriveled grains) in treatments around anthesis (E2).



In wheat, GN was mainly explained by changes in grain number per spike, while in barley GN was associated to the number of spikes per plant.

Conclusions

Waterlogging negatively affected grain yield of wheat and barley with similar magnitude, but the yield sub-components were differently affected between species. Timing around anthesis was identified as the most susceptible period to waterlogging in wheat as well as in barley. Exposing the crop to a more stressful environment, by delaying the sowing date, magnified the response but it did not modify the sensitive timing to waterlogging.

REFERENCES: Setter TL, Waters I, 2003. Plant Soil 253: 1 -34.

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