Differences in sink-strength determining differences in yield between durum and bread wheat

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Introduction

- Durum wheat is most commonly grown in locations with lower precipitations than those in which bread wheat is grown (Acevedo, 1991).
- This implies a belief that bread wheat would be higher-yielding in relatively good environments, whilst durum wheat would be better adapted to relatively lower-yielding conditions (López-Castañeda and Richards, 1994).
- Unfortunately, there have been only few studies in which the performance of both bread and durum wheat were directly compared (Fischer and Mauer, 1978; Josephides, 1993; Palumbo and Boggini, 1994; Zubaidi *et al.*, 1999; Calderini et al., 2006), and their results are not conclusive.

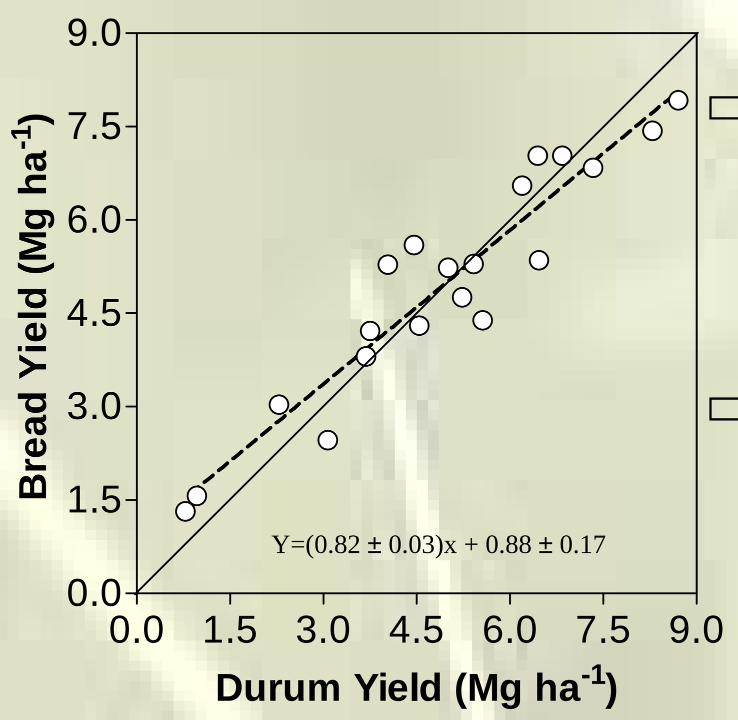
We tested the hypothesis that durum wheat is more adapted than bread to relatively lower-yielding environments and that bread wheat has a superior yielding potential than durum wheat and analysed possible causes; with 3 years of field experiments under a wide range of water and nitrogen treatments.

Materials and Methods

- Three field experiments (2004-05, exp. I; 2005-06, exp. II; 2006-07, exp. III) in the Mediterranean location of Agramunt (Catalonia, NE Spain). In farmers fields
- We compared the performance of both durum (cvs. Simeto, Claudio and Vitron) and bread wheat (Anza, Soisson and Provinciale)
- Under a combination of water x nitrogen treatments en each season. (the range of yields was from less than 1 to more than 8 Mg ha^{-1})
- Sowing date and density were optimal
- We determined yield components at maturity and biomass at flowering and maturity. We also measured canopy reflectance and calculated NDVI

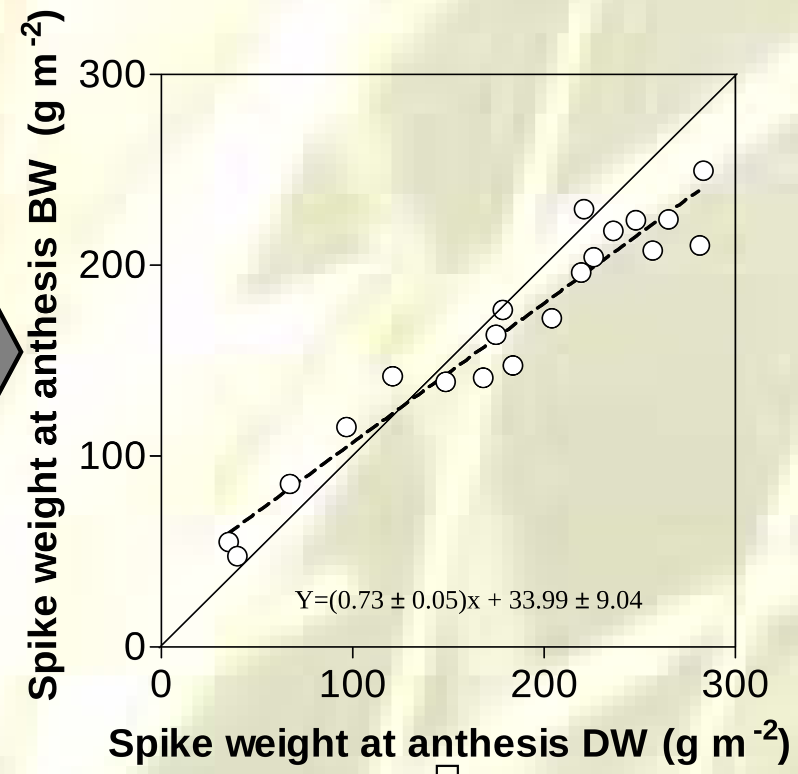
Experimental field in Agramunt, Lleida-Spain.

Results and Discussion

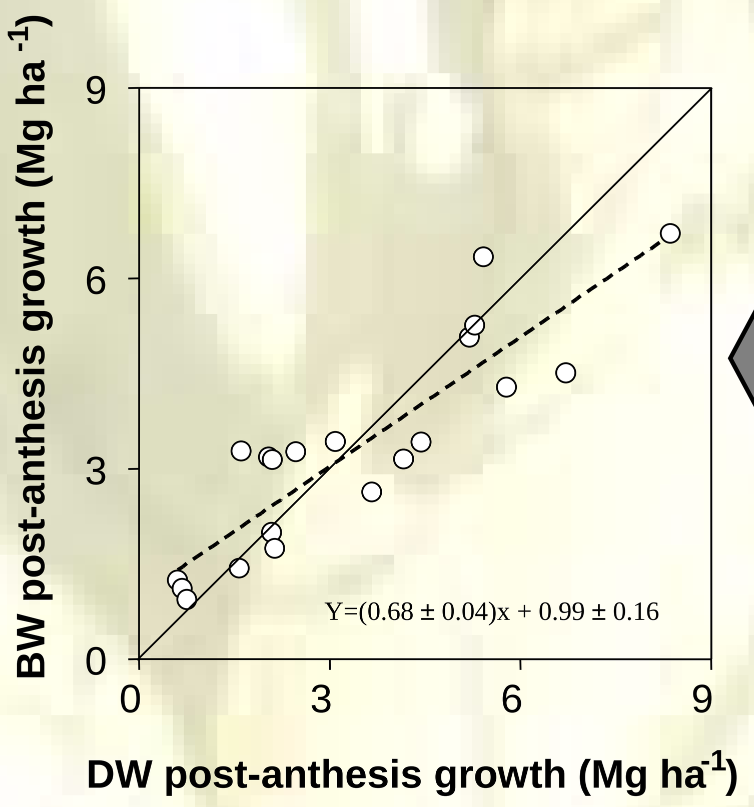


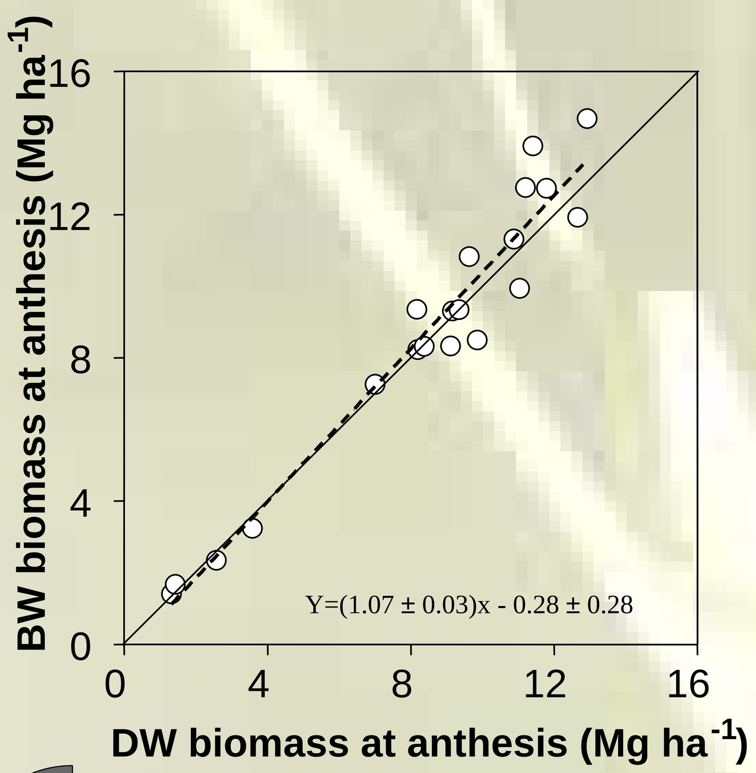
Comparison established over a wide range of conditions which produced a large range of biomass (*c.* 2.3-19.6 Mg ha^{-1}) and yield (*c.* 0.6-8.7 Mg ha^{-1})

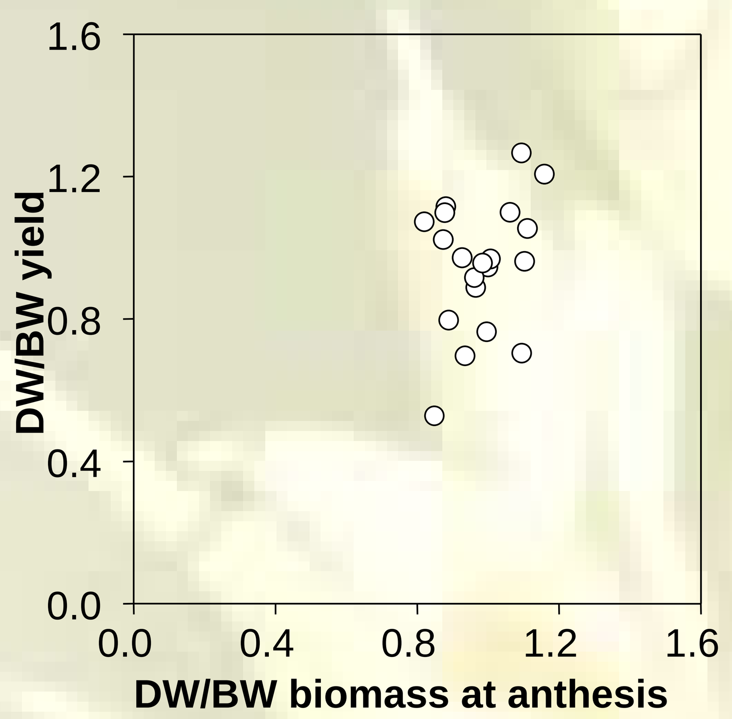
Although averaged yield was similar for both wheats (c. 4 Mg ha^{-1}), bread wheat outyielded durum wheat in severely stressed environments while durum wheat possessed a higher yield potential



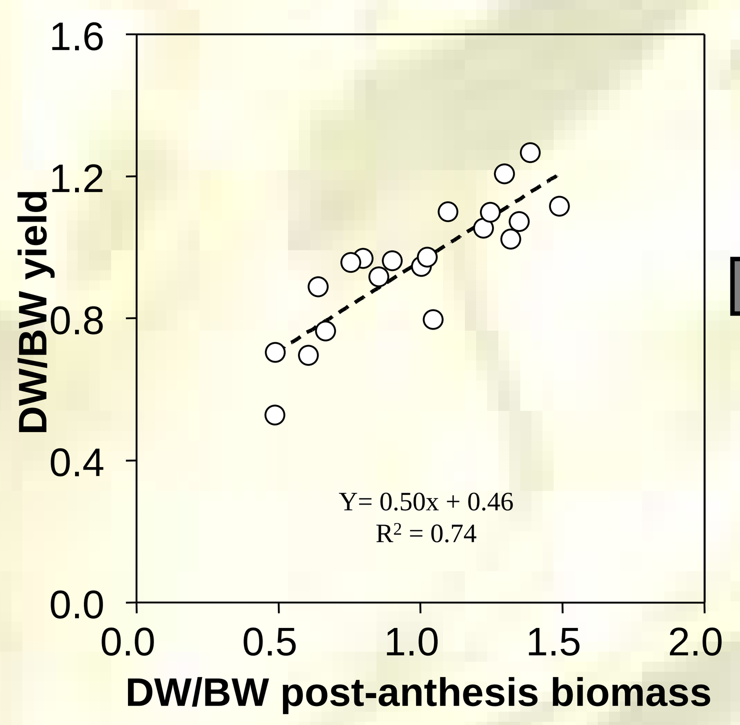
Spike dry weight at anthesis responded similarly to yield and presumably generated differences in sink strength, which might affect the capacity of canopy to grow after anthesis (both wheats grew similarly before anthesis but after anthesis bread wheat grew more than durum wheat in relatively poor environments and *vice-versa*



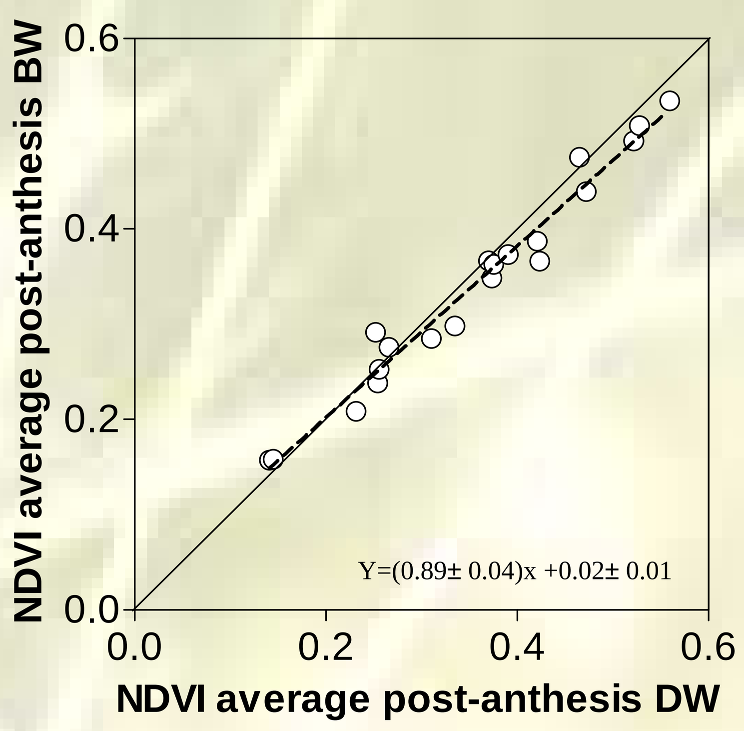




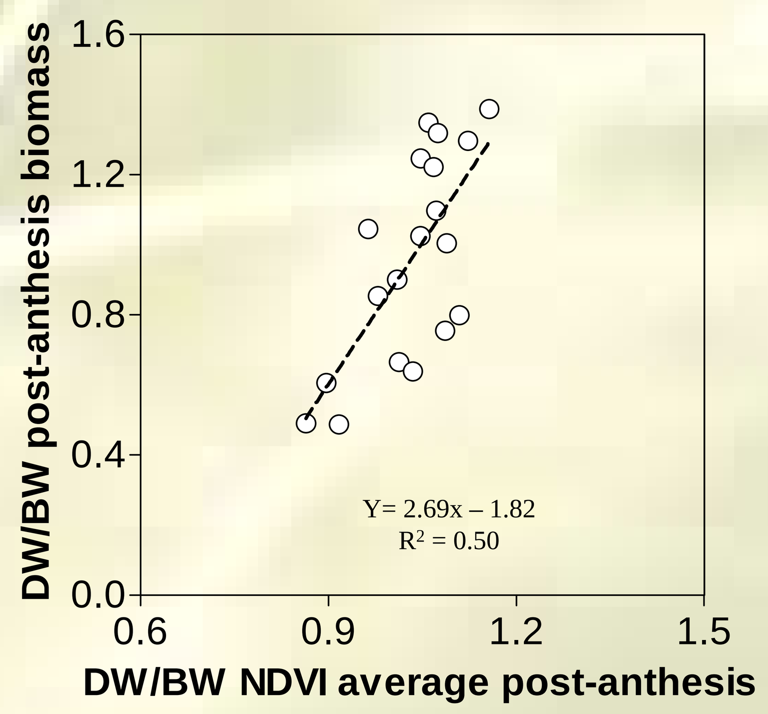
Therefore, there was no relationship between the differences in yield between these wheats and their differences in biomass at anthesis



In contrast their differences in post-anthesis growth explained a large proportion of their differences in yield.



The average NDVI after anthesis (as well as the area under the curve of NDVI vs post-anthesis time; not shown here) showed a similar pattern to those of post-anthesis growth and yield



Consequently the ratio between both wheats in NDVI after anthesis explained a significant proportion of the variation in the ratio of post-anthesis growth

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