Variation in early growth of barley cultivars and landraces in rhizotrons

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Old cultivar, tall, lodging  New cultivar, short  Old cultivar, tall
Grain yield, unexpected success of landraces at low productions sites

Yahiaoui et al. 2014, Plant Breeding
OBJECTIVES

• Assess early growth of barley to evaluate morphological and physiological characteristics that may be related to good agronomic performance in drought stress environments

• Sample the genetic variability of these responses in landraces and cultivars
Overall view of the SCREEN Root LP facility during the experiment

Nagel et al., 2012, Func Plant Biol, GROWSCREEN Rhizo...
6 genotypes

- SBCC042
- SBCC073
- SBCC146

3 landraces
- Cierzo
- Orria
- Scarlett

3 cultivars
- Cierzo
- Orria
- Scarlett

2 treatments
- control
- drought

12 plants per treatment
rhizobox=incomplete block
Duration: 4 weeks

Control treatment
71% water (weight)
Daily watering, 2400 ml

Drought treatment
31% water (weight)
Daily watering, first 2 weeks, gradual withdrawal (1400ml)

Seeds retained by 2.5 mm sieve: 4.9 to 7.1 g/100 seeds
SBCC042: 6.4 g, 100 seeds

SBCC073: 7.1 g 100 seeds

SBCC146: 5.3 g 100 seeds

Scarlett: 4.9 g 100 seeds
Drought, rhizobox 110, 23-06-14

Control, rhizobox 410, 23-06-14
Overall growth
averages + LSD 0.05
Root specific weight, mg/cm

Scarlett
Cierzo
Orria
SBCC042
SBCC073
SBCC146

averages + LSD 0.05
Linear regressions

Control

Drought
Linear regressions

Control

Drought
Leaf area average (cm²) ± standard error of the mean

Control

Drought
Total root length average, cm ± standard error of the mean

Control

Drought
Correlation seed size - growth
WHAT HAVE WE LEARNED FROM THE EXPERIMENT?

• The barley root system shows impressive resiliency under drought conditions

• Under drought, shoot growth is reduced, apparently to allow more profuse root growth to optimize exploration of areas of wet soil

• Overall, landraces are more vigorous than cultivars, although individual genotypic differences exist, particularly involving dry matter partitioning between root and shoot that will be explored further

• Seed size matters and should be controlled, although 4 week-long experiment removes seed size influence

• Growth pattern features may underly the good agronomic performance of some landraces

• Experiment had appropriate throughput for evaluation of a small number of valuable plant materials that should be explored further and wider by other means
GWAS and linkage mapping for grain yield: apparently, same hit on 5HL

GWAS for agronomic, disease, physiological, morphological traits. Grain yield QTL for low production sites found in GWAS and in biparental population (SBCC073 x Orria) by linkage mapping.

Boudiar et al. 2016, Crop & Pasture Science
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