Drought-stress tolerance and nitrogen use efficiency in wheat

Increasing root biomass production in European winter wheat for improved drought-stress tolerance and nitrogen use efficiency

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Introduction

Climate change is expected to increase the intensity and frequency of droughts as limiting factors for crop production. In addition, environmentally friendly farming practices require a more restrictive use of nitrogen fertilizers to reduce damage to ecosystems, which occur by escaping nitrogen compounds and/or CO_2 emissions associated with fertilizer production. These negative impacts on climate change need to be reduced while maintaining the quality requirements in the production of baking wheat. Within our project we aim to increase nitrogen use efficiency (NUE) and drought-stress tolerance in wheat (*Triticum aestivum* L. *ssp. aestivum)* by developing near-isogenic lines (NIL) containing introgressions of a major QTL, which confers a larger root system, into german elite winter-wheat material.

Investigating influence of increased root growth for enhanced water and N-uptake

I.) Under semi-controlled conditions using the Drought-Spotter XXL

A.) Complete growth cycle trial in containers

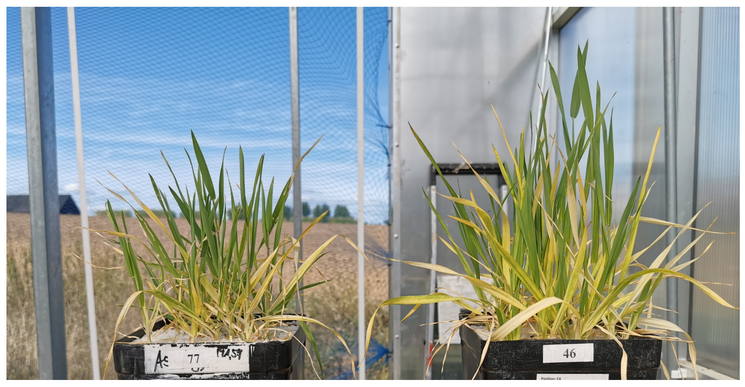
Automatic weight recording and individual irrigation system for each container

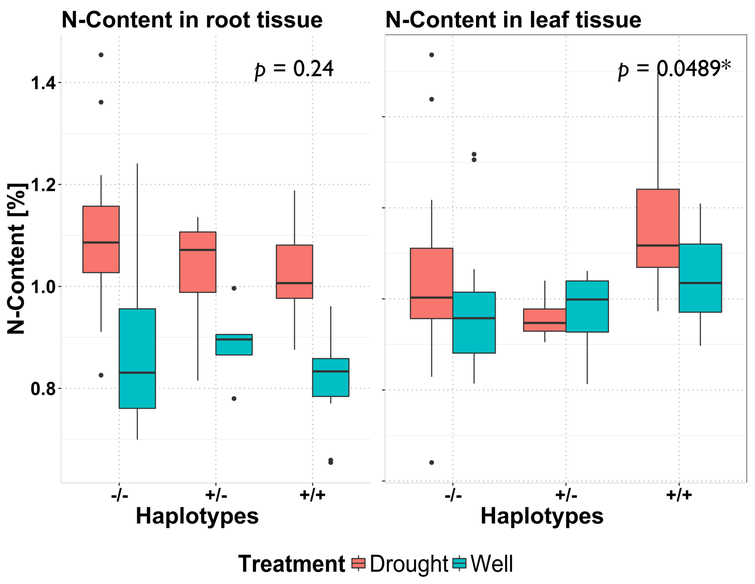
- 4 Genotypes tested
- 4 Irrigation treatments
- Application of ^{15}N fertiliser during heading stage
- Non destructive measurement of above -ground biomass by using PlantEye©

B.) Early growth stage trial in 5L soil pots

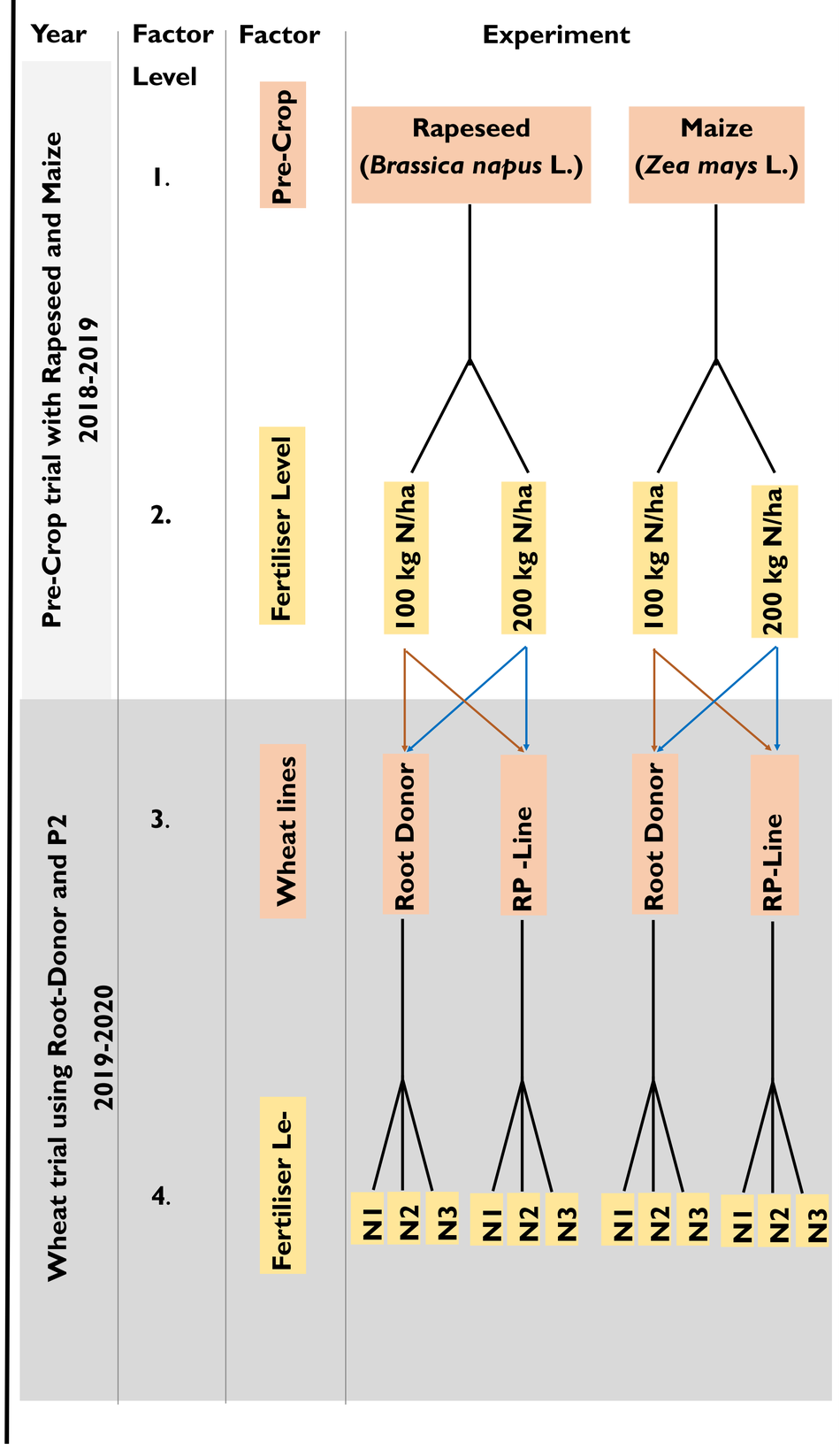
- 8 Genotypes tested (2 root donors & 6 elite varieties)
- 2 irrigation treatments (35% & 70% FK)
- 5L pots filled with 60% sand and 40% soil

Drought Conditions | Well - Watered Conditions





II.) Under field conditions with contrasting crop rotations scenarios and diverging fertiliser levels



Summary

Climate change and increasing unsteady environmental conditions require an improved root system in modern wheat varieties. By introgression of a major QTL for increased root biomass we investigating the relevance of an increased root growth for enhanced water and N-uptake. This question will be clarified through (i) analysis of N-transfer with ^{15}N labelled fertilisers under semi-controlled conditions in container experiments, (ii) field trials conducted at three locations, in order to investigate NUE and yield performance in different fertiliser levels and crop rotation scenarios. As well as (iii) pre-anthesis trials to investigate NupE and NutE within plant compartments under different water regimes

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