

PROJECT TITLE

Root Dynamics Under Varying Water Supply

CONSORTIUM

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SUMMARY OF THE REPORT

Hydropatterning is a phenomenon consisting in the preferential growth of lateral roots in wet areas of the soil [1]. The objective of this experiment was to induce this phenomenon by creating conditions of soil moisture heterogeneity in a soil profile divided in four layers by vaseline barriers. This was possible thanks to rhizons inserted in each layer, which were used to inject water pulses.

We also wanted to test whether this phenomenon becomes reversible whenever the soil moisture conditions change, namely if lateral growth is interrupted in the previously moist layer and promoted in a newly wetted layer.

Zea mays was the species used in the experiment, which consisted in two treatments and one control, each one of them having seven replica.

The plants were kept in a growth room at 23°C and were exposed to a light/dark period of 10 and 14 hours, respectively.

Layer 1 and layer 2 were the layers subjected to water injections, in the treatments. The pulses consisted in rewatering only the layer of interest up to 15% for four consecutive days. One layer received the first water pulse and the other layer received the second water pulse after the VWC halved in the previously wetted layer. The controls were kept at 15% VWC in each layer for the entire duration of the experiment.

The Soil Water Profiler (SWaP) was used every day to measure soil moisture in each layer and to determine how it varied due to root water uptake.

The columns were weighed every day to calculate transpiration. Shoot length and leaf number were also measured.

The MRI was used to image the root systems undestructively every night in order to observe the root development over time and if the roots were responding to the treatments..

At the end of the experiment leaf area was measured and the roots were collected destructively from each soil layer and scanned for a final measurement in length.

The data collected have not been analyzed yet. However, it was proved that the vaseline barriers are a good method for creating an hydraulical isolation between soil layers. We also observed preferential lateral root growth in wet soil areas and we noticed that the differences in water uptake rates between layers appeared to be consistent with the differences in root abundance between layers.

At first look, it appears that the the root system started to grow more laterals in the soil layer wetted by the first water pulse as soon as two days after its application, as visible in the left-hand side of Fig. 1. This behavior continued until when the VWC in that layer halved and the second pulse was applied in the other layer. At this point, there seems to be an interruption in root growth in the firstly wetted layer and a promotion in root growth in the newly wetter layer, as visible in the right-hand side of Fig. 1.

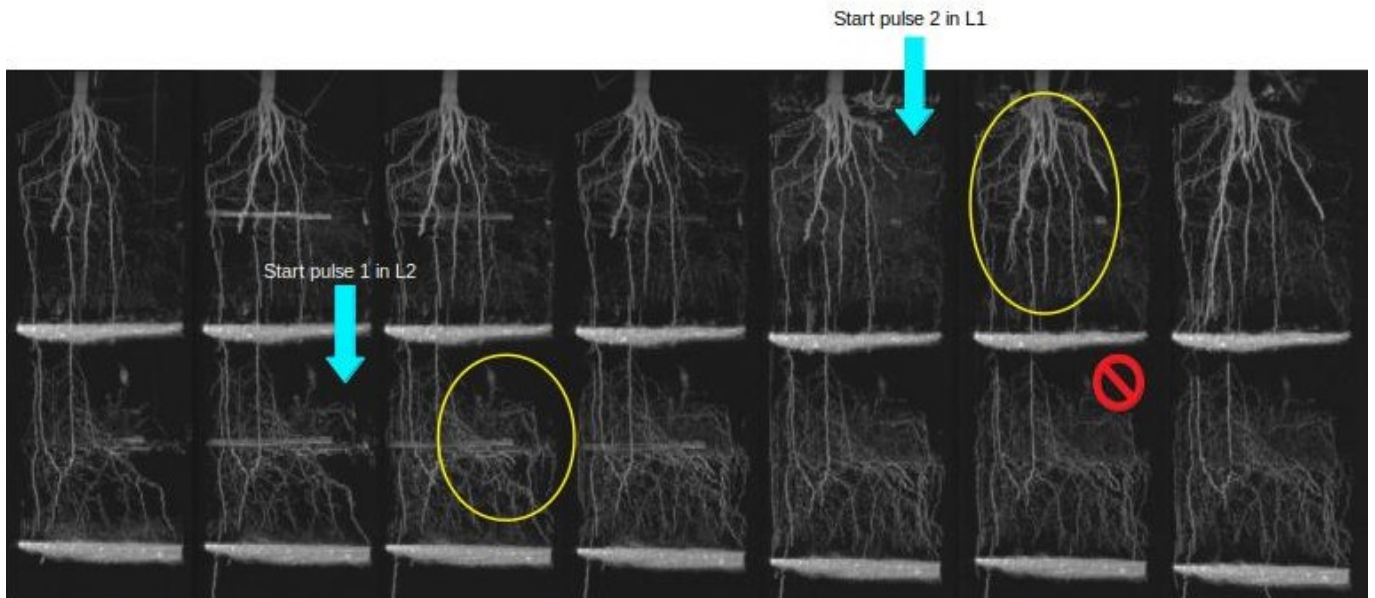


Figure 1: Succession of MRI images taken every forty-eight hours. An increase in lateral growth is observable in layer 2 forty-eight hours after the start of pulse 1. Forty-eight hours after starting applying pulse 2 there appears to be an interruption in root growth in layer 2 and a promotion in root growth in layer 1.