

“Root and shoot phenotypic traits and their expression in response to sowing density in spring barley (*Hordeum vulgare*)”

Vera L. Hecht¹, Vicky M. Temperton², Kerstin A. Nagel¹, Uwe Rascher¹, Dagmar van Dusschoten¹, Johannes A. Postma¹

¹Forschungszentrum Jülich GmbH, Institute of Bio-and Geoscience –IBG-2: Plant Science, Wilhelm-Johnen-Straße, 52425 Jülich

²Institute of Ecology, Leuphana University Lüneburg, Scharnhorststr. 1, 21335 Lüneburg

Plants almost always grow within a population, however, most of our knowledge of plant growth comes from plants grown as single plants. To identify traits relevant to field, i.e. agronomic conditions, it is critical to investigate plants in populations and not only as single plants. Individuals growing in the same substrate will interact with each other within a defined volume over time. The extent, however, to which the variability of traits, especially root traits, in single plants and individuals in a population differs from each other was still unclear. Further, even less was known about sowing density effects on the whole plant: allocation between root and shoot as a consequence of sowing density.

In my PhD, I studied the influence of sowing density on plant shoot and root growth and architecture. I performed various experiments (field experiments, rhizotron experiments, one pot experiment) using two spring barley (*Hordeum vulgare* L.) cultivars and one introgression line (a cross of a German spring barley cultivar and an Israeli wild accession). I grew the plants as single plants and at different sowing densities and collected data on both shoot and root.

In the field experiments, I found that sowing density affected root length density, specific root length, tiller formation, and yield in the field. The alterations in root traits could be explained by changes in seminal and nodal root counts. Further, I will discuss sowing density in the context of lab to field translation, illustrating the challenge by a case study. In the case study, the high tillering and high rooting phenotype of an introgression line in comparison to its German parent, selected in the greenhouse, was only partly expressed in the field, depending on sowing density.

References:

- Hecht *et al.* (2016) Sowing density: A neglected factor fundamentally affecting root distribution and biomass allocation in field grown barley (*Hordeum vulgare* L.). *Front Plant Sci* 7:1–14. doi: 10.3389/fpls.2016.00944
- Hecht *et al.* (2018) Plant density modifies root system architecture in spring barley (*Hordeum vulgare* L.) through a change in nodal root number. *Plant Soil*. doi: 10.1007/s11104-018-3764-9