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IDENTIFYING ROOTING TRAITS FOR OPTIMAL NUTRIENT UPTAKE

ABSTRACT

The importance of early canopy closure to maximize sugar beet yield is well understood. Early root growth and nutrient uptake are therefore important to allow rapid canopy expansion. Stevanato *et al.* (2010) found positive relationships between root elongation rate, nutrient uptake and root yield. Our current work is evaluating the diversity in rooting traits in UK and European germplasm and exploring relationships between rooting traits, nutrient uptake and ultimately yield. The aim of the work is to enable nutrient uptake efficiency to be selected for within sugar beet breeding programmes: either using a seedling screen or molecular markers.

Sugar beet varieties were grown for two weeks within hydroponic growth pouches in controlled environment rooms and image analysis was used to gain root phenotype data including root length, area and branching. The same varieties were grown for eight weeks in a controlled glasshouse; root length and area was measured along with leaf area, nitrogen content and dry weight.

The hydroponic study found differences between varieties in total root length at 14 days ($P < 0.001$). In the glasshouse experiment, there were differences between the varieties in leaf area and leaf and root dry weight ($P < 0.05$), with similar ranking of the varieties for the three parameters. Positive relationships were found between early rooting traits (root length, root diameter, total root weight) and leaf nitrogen content ($P < 0.001$) and there was also a positive relationship between lateral root number in the hydroponic study, and N uptake in the glasshouse ($P < 0.05$).

Working with breeders, this work has now been extended to a wider range of breeding lines. The next step will be to establish field experiments to determine whether the differences in early growth and nutrient uptake are also seen in the field and, if so, whether these translate to yield.
