

**PROJECT TITLE**

Characterization of the early stage root architecture and morphology of 25 tef genotypes from contrasting agro-climatic zones in Ethiopia - and their response to nutrient availability

**CONSORTIUM**

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## SUMMARY OF THE REPORT

Tef, *Eragrostis tef* (Zucc.) Trotter, a member of the Poaceae family, is an ancient agricultural crop of the highlands of Ethiopia and one of the most important cereals in eastern Africa. The exploration of tef genetic resources through breeding programs is key. In particular, a comprehensive understanding of root system traits will allow breeding high yielding and yield stable cultivars under future climatic conditions and low input agronomic systems. The project thus comprises four WPs of which three are finalized: 1) Screening seedlings' root phenotypic plasticity under different N availabilities at the 2D-RSAT platform in Nottingham, 2) Characterisation of mature root phenotypic plasticity under different N availabilities at BOKU, 3) Determination of genotypic diversity, and 4) Interference modeling of seedlings to mature RSA; the later task as well as data integration is ongoing.

Among the 25 genotypes screened at seedling stage (WP1), considerable differences were found among studied root traits such as emergence and tip angle, average and total length of roots, number of primary roots and laterals, and convex hull. While no systematic differences were identified for cultivars vs. landraces, the differential N fertilisation had a profound effect on angles of laterals and root tips, as well as primary emergence angles and tip angles of primary growth axes. Similar, root length and branching rates of seedlings were affected by N fertilisation. As convex hull provided most significant differences between genotypes, it was used to identify eight genotypes with widely contrasting RSA. Six genotypes of those genotypes were subsequently used for an in-depth characterisation of RSA of mature plants. Significant effects of treatments and genotypes were observed for shoot traits, with generally higher values under high nitrogen (N+) conditions. Total belowground biomass and seminal root count increased for certain genotypes under N+, however vertical root distribution was unaffected by nitrogen levels but varied significantly between several genotypes. Root:shoot ratios were mainly affected by aboveground biomass. Morphological root traits were not significantly affected by nitrogen levels but differed between genotypes. Pearson correlations revealed that morphological root traits were rather independent from both RSA and shoot traits; however, negative correlations were found between specific root length and root diameter. In sum, WP2 provided a comprehensive characterization of teff root traits, showcasing, however, a greater plasticity of teffs' shoot traits compared to root traits in relation to N availability. Genetic characterisation in WP3 (UPGMA Dendrogram) revealed the close relationships among 2 of the cultivars (Balami and Beten) while two other cultivars clustered rather with the included landraces. Interference modelling (WP4) to related seedling to mature RSA is ongoing.