Proceedings of the 57th Italian Society of Agricultural Genetics Annual Congress
*Foggia, Italy – 16/19 September, 2013*
ISBN **978-88-904570-3-6**

**Poster Communication Abstract – 2.08**

# FIELD ROOT PHENOTYPING OF DIFFERENT MAJOR MAIZE ROOT QTLS

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*electrical capacitance, maize, QTL, root architecture, shovelomics*

One of the big challenges in plant breeding is to improve the efficiency of root systems to acquire water and nutrients. Root architecture is a trait difficult to evaluate directly in the field. At the same time, artificial systems often fail to mimic the complex interaction between the plant and the other soil characteristics. Additionally, large populations must be evaluated in order to reach statistical robustness of phenotypic data and to provide the required genetic resolution for mapping and cloning purposes. The main goal of this study was to test two different methodologies to study maize root architecture in the field and in a relatively large number of plants. The utilized plant material was a set of previously described nearly isogenic lines (NILs) segregating for major root QTLs. The two methodologies were a destructive digging-based approach called Shovelomics (Trachsel et al. 2011, Plant Soil 341:75) and the non-destructive and repeatable analysis of electrical capacitance of the soil in the vicinity of a plant, which was previously shown to correlate with root mass (van Beem et al, 1998 Agronomy J, 90:566). Five pairs of NILs for different root QTLs and additional reference maize inbreds were grown in the field in a replicated experiment. Shovelomics was shown to be labor intensive, however, it permitted a reliable collection of key root morphology traits such as root angle, number and indexes for brace and crown roots and for lateral roots, dry weight and others. Digital images for each plant were also collected and analysed. On the contrary, electrical capacitance showed very low heritability and almost no correlation with root mass or any other root or plant trait. Statistically significant trait differences between members of each pair of NILs were confirmed by the Shovelomics data. In maize, Shovelomics-based phenotyping for root QTL mapping and cloning is probably feasible, in terms of cost and reliability, when in presence of major QTLs segregating in isogenic background.