Exploring genetic variation to improve salinity tolerance in faba bean

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Faba bean (*Vicia faba* L.) is one of the most important high protein cool-season grain legumes; however; it is sensitive to salinity stress. Breeding for improved salinity tolerance of faba bean is needed to improve its productivity on saline soils. This study was designed to assess the level of genetic variation for salt tolerance among 22 faba bean genotypes, including 17 Australian varieties, and identification of new genetic resources with desirable combinations of salt tolerance sub-traits. Faba bean genotypes were grown in soil and treated with 0 mM (control) and 100 mM NaCl (salt treated) for 21 days. Salinity tolerance sub-traits related to plant growth (plant height, shoot and root dry biomass), ion accumulation (Na^+, K^+, Cl^-contents in leaf, shoot and root) and photosynthesis (leaf chlorophyll contents, stomatal conductance and leaf chlorosis) were measured in control and salt treated plants. A significant variation was noted amongst the varieties, with PBA Nasma, PBA Zahra, Doza and PBA Samira identified as tolerant varieties and Manafest, Nura and Fiesta as sensitive ones. The most tolerant varieties (PBA Nasma and PBA Zahra) possessed better ability to maintain higher leaf K^+/Na^+, low leaf Cl^- accumulation, lower root K^+/Na^+ and less leaf chlorosis, resulting in higher total (shoot and root) dry biomass production. Leaf and shoot Na^+ and Cl^- contents, considered as major salt tolerance sub-traits, exhibited significant positive correlation with leaf chlorosis, but not with total dry biomass (shoot and root). However, the root Na^+ contents were positively correlated with total dry biomass and negatively correlated with leaf Na^+ level. The ability of plants to accumulate higher Na^+ contents in roots and restrict its transportation to leaves was associated with salt tolerance. These results also suggest that different salt tolerance sub-traits varied independently, and higher salt tolerance could be achieved through different combinations of salt tolerance sub-traits.