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Residual Nitrogen Effect of Mungbean (*Vigna radiata*): Affected by Regulated Deficit Irrigation?

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Abstract

Dryland areas in South and Central Asia are experiencing low agricultural yields and food scarcity under growing conditions with severe water shortages, heat stress, and limited arable land due to saline soils. Mungbean (*Vigna radiata*) is gaining attention as a short-season crop, tolerating dryland conditions, fixing atmospheric nitrogen (N) and hence decreasing soil nutrient depletion. It is a source of high-quality protein for human consumption and could serve as a multipurpose crop if residues were used as fodder or green manure. However, using pulses for N input in cropping systems requires improvements in the accuracy to estimate N balances and N benefits for following crops, since grain and above-ground residues are removed at harvest. Moreover, the effect of drought on N translocation within the plant is unclear.

This work aims to quantify N accumulation, N partitioning between above- and belowground parts by mungbean accessions when influenced by water stress, the effect of drought on mungbean residue decomposition, soil microbial activity and N input to the soil.

In 2016 and 2017, two greenhouse pot experiments were conducted at the University of Hohenheim investigating potential adaptive strategies, N translocation in the plant and biological N fixation of four mungbean varieties under three levels of regulated deficit irrigation (RDI) with increasing degrees of water stress (45, 65, and 80 % deficits of available water capacity). Differences in the response to drought stress between the accessions were determined by stable isotope analysis. Additionally mungbean residues incorporated in potted soil were exposed to the same RDI treatments in a third trial in 2018 to assess the effect of drought on decomposition of the plant material, microbial activity and N release.

The results indicated that around 20 % of the total mungbean biomass is allocated belowground, accumulating 6–9 % of the total plant-N and 12–17 % of total plant-C, being not significantly affected by drought, but by variety. Moreover, a higher water deficit inhibited the activity of microorganisms and resulted in a slower N release, contributing to a higher N availability in the soil for subsequent crops when rewatered. This indicates an unexpected potential of new mungbean varieties for drylands.

Keywords: Deficit irrigation, nitrogen partitioning, residual effect, stable isotopes, *Vigna radiata*, water stress

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