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"Bridging the gap between increasing knowledge and decreasing resources"

Nitrogen Fixation and Drought Resistance of Selected Forage Legumes for Smallholder Farmers in Uganda

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Abstract

To improve feed availability for smallholder farmers in East Africa, we investigated the biomass production, drought resistance and nitrogen fixation of five forage legumes (*Lablab purpureus*, *Desmodium uncinatum* cv Silverleaf, *Desmanthus virgatus*, *Macroptilium bracteatum* cv Burgundy bean, and *Canavalia brasiliensis*) in a field trial in Uganda. The crops were grown under rain-fed conditions (control) and with additional irrigation (irrigated) and harvested five times at two-monthly intervals (first harvest in the wet season, two following in the dry season, last two in the wet season again). On average, the soil water content of the control plots was about 14 % lower than in the irrigated ones (measured at five occasions throughout the season). Before herbage harvests, the youngest leaves of the forage crops were sampled for stable carbon (C) and nitrogen (N) isotope analysis for an indication of intrinsic water-use efficiency and N fixation, respectively. The total herbage dry matter production of the legumes was on average about 600 g m^{-2}, with small, albeit not significant differences among species and between irrigation treatments (6.2 versus 5.7 kg ha^{-1} in irrigated and non-irrigated treatments, respectively). N yields were largest from *L. purpureus* and *C. brasiliensis* due to a combination of large biomass production and N content. The N isotopic values were most depleted for *L. purpureus* and *D. uncinatum*, intermediate for *M. bracteatum* and *C. brasiliensis* and most enriched for *D. virgatus* ($p < 0.001$), suggesting a potentially larger proportion of N derived from air for *L. purpureus* and *D. uncinatum*. *Canavalia brasiliensis* had most enriched C signatures. This suggests an efficient

intrinsic water use of this forage legume. Based on yields, N fixation and water use, *L. purpureus* and *C. brasiliensis* seem the most promising legumes under the conditions tested.

Keywords: Intrinsic water-use efficiency, irrigation, stable isotopes, yield

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