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## Finding Strategies to Mitigate Drought Stress in Grain Legumes in Semi-Arid Eastern Kenya

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### Abstract

The threat of climate change implies the urgent need to design flexible cropping systems which are more resilient to the impacts of increased rainfall variability and drought. This is of special importance for the mainly rain-fed based small-scale farming systems in semi-arid Eastern Kenya, where grain legumes are an important component. Although legume species such as lablab (*Lablab purpureus*) and cowpea (*Vigna unguiculata*) are more productive and adapted to drought, beans (*Phaseolus vulgaris*) are by far the most widely cultivated grain legumes. During the short rains of 2012/13, field trials were conducted at KARI-Katumani, in Eastern Kenya to compare the agronomic performance of local grain legumes and to evaluate their production potential under different watering regimes. Three legumes (beans, cowpea and lablab) were subjected to three watering regimes; rain-fed, partly irrigated (rain + supplementary irrigation 50 mm per week till bud formation) and fully irrigated (rain + supplementary irrigation 50 mm per week till physiological maturity). Response to water regimes was significantly different for the three species. Water-use-efficiency (WUE) of lablab was lowest (3 kg grain ha<sup>-1</sup> mm<sup>-1</sup>) and therefore yields were fairly stable over all watering regimes reaching 1.2 to 2 t ha<sup>-1</sup>. In comparison to the yield of the fully irrigated treatment (1.9 t ha<sup>-1</sup>), yield reduction in beans was 50% (1 t ha<sup>-1</sup>) under rain-fed conditions. Cowpea displayed the biggest variation between treatments with yields of rain-fed (0.9-1.5 t ha<sup>-1</sup>), partly irrigated (1.5-1.9 t ha<sup>-1</sup>) and fully irrigated (2.5-3.1 t ha<sup>-1</sup>) plots reflected in the highest WUE (5.3-5.7 kg grain ha<sup>-1</sup> mm<sup>-1</sup>). Results give evidence that beans have a relative advantage to escape drought due to their short growing period, whereas with rainfall over 450 mm cowpea would be a better intensification option. Lablab seemed to be less affected by long dry spells than cowpeas or beans. In order to stabilise production with increasing rainfall variability, getting the right mixture of different legume species on farm would be a sustainable risk management strategy to design resilient farming systems and increase food security. These options are investigated using crop modelling and via the analysis of long term weather data with further on-farm trials in the region planned for 2013/14.

**Keywords:** Drought tolerance, Kenya, farming systems, food security, grain legumes