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"Solidarity in a competing world — fair use of resources"

Hydraulics and Uniformity Performances of an Innovative Bamboo Drip System

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Abstract

With respect to technical performance, drip irrigation is the most promising approach to raise irrigation efficiency and thus improve productivity of growing crops. But in West-Africa as in many developing regions in the world, the lack of financial resources for establishing, operating and maintaining drip systems is the main reason for their non-adoption by smallholder farmers. A promising attempt to step out of this dilemma is an innovative bamboo-drip system that would have the advantages of conventional plastic systems, but be less costly. This study was initiated to support that option, and aimed at assessing hydraulics and uniformity performances of that system. To construct the bamboo-drip system, bamboo culms were harvested in the wild, 20 cm internodes cut and their inner part slightly coated with candle wax to reduce friction head loss. Conventional glue was used to join the internodes and form bamboo pipes. Emitters were hand-made and of ball-pen ink tube. Laboratory tests were carried out at 80, 60, 40 and 20 cm pressure heads, to determine inherent variabilities in hydraulics and emitter flow uniformity in the bamboo system. For inherent variabilities in hydraulics, Coefficients of variation of emitter flow were determined with regards to the bamboo material, emitter precision and emitter plugging, and compared to ASAE EP405.1 standards. This revealed that emitter plugging, due to singularities in bamboo segments, is the most important factor causing emitter flow to vary in the bamboo system. For flow uniformity test, Christiansen uniformity coefficient was determined. Comparisons with ASABE EP458 standards revealed that emitter flow uniformity in the bamboo system is at least fair; but at 20 cm head, performance in terms of uniformity becomes poor. The test revealed that creating pipes with more uniform internodes is a promising approach to reduce emitter flow variation and improve uniformity. As a consequence, this highlights the fact that bamboo cultivation in a uniform environment is the prerequisite for bamboo-drip introduction in rural and peri-urban West-Africa.

Keywords: Flow, irrigation, uniformity, variation

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