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"Bridging the gap between increasing knowledge and decreasing resources"

Can *in-situ* Rainwater Harvesting or Conservation Tillage Practices Reduce Climate-Related Risk for Maize Based Systems in the Limpopo Province, RSA?

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Abstract

In Limpopo Province, small-scale farmers (SSF) are predominantly located in marginal areas and reliant on rainfall. Constraints related to SSF, dry-spells, erratic rainfall with high evaporative demand, limited possibilities for expanding irrigation, scarcity of prime farmland are amongst the reasons for low productivity and hence food insecurity. To mitigate inter-seasonal climate-related risk, SSF water productivity under rain-fed agriculture needs to be enhanced, and one way is through adoption of technologies for improving soil-water storage and usage such as *in-situ* rainwater harvesting (WHi). Numerous studies across southern Africa suggest that this technology has the potential to increase rainwater productivity and thereby increase yields and reduce risk of crop failure.

In this study, strategies for improving water-use-efficiency (WUE) and hence reduction of climate-induced risk on crop production were evaluated. Based on preliminary field data and literature, a series of tillage practice scenarios were developed to compare maize performance under WHi and conservation (Con) tillage practices with a conventional (Baseline) tillage practice as control. These practices were identified for their adaptive capacity to reduce climate-related risk. The scenarios were evaluated using APSIM model for a 49 year (1960–2009) daily climate record and linked with GIS to analyse the spatial-temporal interactions of climate, soil and management on crop performance.

Preliminary simulations of on-station (Polokwane -23.8700 S, 29.4500 E) field trials (basal N application 50 kg ha^{-1}) showed that on average, there was a small difference in grain yield (Con 1.69 and WHi 1.73 t ha^{-1}) between the two practices, whereas the Baseline treatment had a grain yield of only 0.96 t ha^{-1}. This difference between the two practices was largely due to differences in management (i.e. fallow-phase weeds control, residues and N-fertiliser application) rather than the effect of tillage. Con and WHi have a positive effect on the WUE, with a WUE of about 25 kg grain/ha/mm compared to the Baseline WUE of 17 kg grain/ha/mm. Further analysis of driest (Baseline 0.0, Con 0.9 and WHi 1.0 t ha^{-1}) and wettest (Baseline 1.9, Con 2.4 and WHi 2.6 kg ha^{-1}) year in 5 suggests that the use of WHi is likely to result in slightly higher yields compared to other practices.

Keywords: APSIM model, climate-related risk, conservation tillage, *in-situ* rainwater harvesting

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