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Modelling Yield Responses of Pearl Millet to Different Crop Management Strategies in Semi-arid Areas

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Abstract

Drought, limited and highly variable rainfall and poor soil fertility are primary agricultural production limiting factors (APLF) for semi-arid agro-climates in Tanzania. Understanding strategies to reduce their effects on crop production is important for providing alternative solutions, in particular to food-insecure farmers. The authors identified four upgrading strategies (UPS) from existing literature that are suitable in reducing risks of crop failures. These UPS are field scattering, contour strips and tied ridges, shift planting/sowing dates and micro-fertilisation. In Tanzania, these UPS so far have sparsely been adopted to only limited areas. However, consistently annual crop failures have been reported throughout the country. This calls for a systematic approach that can help to inform where the four UPS are effective in reducing risks of crop failure.

The aim of this paper is to evaluate the DSSAT (v4.7) Cropping System Model (CSM) applied to these four UPS for reducing the risk of APLF. In particular, we tested the ability of the model to inform on how these UPS can help to minimise the yield loss of pearl millet for farmers separated by small distances. We used the field data collected from pearl millet experiments conducted in semi-arid Dodoma, Tanzania during season 2015/2016 for calibration and 2016/2017 for validation of the model. Our results show that the DSSAT model is highly suitable in informing about the agricultural production risks and alternative management options. The model adequately simulated the yield responses to optimisation of the four UPS. Thus, applying DSSAT for fine-tuning the four UPS to different site conditions helps in reducing the crop production risks.

Keywords: Agricultural production risk, DSSAT model, pearl millet, upgrading strategies, yield gap

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