# Development and assessment of an updated tool for the design of soil and water conservation structures in the sugar industry of South Africa

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**Abstract:** Sugarcane in South Africa is grown on wide-ranging soils, sometimes in non-ideal climates and on steep topographies where soils are vulnerable to erosion. Sugarcane fields are protected against erosion through, *inter alia*, the use of engineered waterways, contour banks and spill-over roads. A comparison of design norms in the National Soil Conservation Manual and norms used in the sugar industry of South Africa clearly shows discrepancies that need to be investigated. Furthermore, the sugar industry design nomograph was developed based on an unsustainable soil loss limit, does not include any regional variations of climate and the impact on soil erosion and runoff and does not include vulnerability during break cropping. The aim of this research was to develop and assess updated design norms for soil and water conservation structures in the sugar industry of South Africa. The Agricultural Catchments Research Unit (*ACRU*) model estimates event-based erosion and the *ACRU* was used to conduct simulations for the different practices in the sugar industry and the outcome used to build the updated tool for the design of soil and water conservation structures in the sugar industry of South Africa, using MS Access with a graphical user interface. The updated tool is robust, based on sustainable soil loss limits, includes regional variations of climate and their impact on soil erosion and runoff and also includes vulnerability during break cropping. It is more representative of conditions in the sugar industry of South Africa and therefore recommended for use in place of the current sugar industry design norms.

**Keywords:** Agricultural Catchments Research Unit, design norm, soil and water conservation, soil loss, sugarcane, South Africa

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## 1 Introduction

In South Africa, sugarcane is widely grown in adverse climatic and topographic conditions and on a range of soils, hence the soils are at high risk of erosion (Platford, 1987). For areas receiving high rainfall, protection of cropped land has traditionally been achieved through the use of contour banks built across the hillside at low slopes. However, sugarcane is not always grown on relatively

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while in the CoSDT, the *P* factor represents terracing only with harvesting practices varied within the *C* factor since harvesting impacts on sugarcane cover.

**Table 5 Parameters from the CoSDT and the current sugar industry design nomograph**

| Parameter | a | | b | | c | |
|---|---|---|---|---|---|---|
| | CoSDT | Current Sugar Industry Design Nomograph | CoSDT | Current Sugar Industry Design Nomograph | CoSDT | Current Sugar Industry Design Nomograph |
| *K* | 0.38 | 0.28 | 0.38 | 0.28 | 0.38 | 0.28 |
| *C* | 0.01 – 0.60 | 0.11 | 0.01 – 0.60 | 0.11 | 0.01 – 0.60 | 0.11 |
| *P* | 0.15 | 0.08 | 0.15 | 0.14 | 0.15 | 0.77 |

[a] Contour bank spacing for the sandy clay loam (moderate erodibility), 20% slope, water carrying terrace, minimum tillage, no green manuring and mulched with strip/ panel harvesting scenario.

[b] Contour bank spacing for the sandy clay loam (moderate erodibility), 20% slope, water carrying terrace, minimum tillage, no green manuring and burnt and reburnt harvesting scenario.

[c] Contour bank spacing for the sandy clay loam (moderate erodibility), 20% slope, water carrying terrace, conventional tillage, no green manuring and burnt and reburnt harvesting scenario

It is also important to note that Platford (1987) used subjective judgement in the development of the current sugar industry design nomograph and this could be another source of discrepancies.

## 4 Conclusions

The CoSDT accounts for vulnerability during break cropping by including the green manuring agronomic practice while regional variations of climate and their impacts on soil erosion and runoff were addressed through incorporating a drop down menu containing the four regions in the sugar industry in the graphical user interface. Furthermore, it is based on sustainable soil loss limits of 5 t $ha^{-1}$ $year^{-1}$. The robustness of the CoSDT is ensured by the over 46 080 scenarios contained in a database while its simplicity of use is in the fact that practices are selected from drop down menus of the MS Access graphical user interface.

Therefore, the CoSDT is more representative of conditions in the sugar industry of South Africa, and it should be employed in place of the current sugar industry design nomograph developed by Platford (1987). Much as the CoSDT was developed for the sugar industry in South Africa, the methodology may be employed in the development of a similar tool for other crops and/ or areas with similar problems.

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