

URINE AND URINE DERIVED PRODUCTS AS PLANT NUTRIENT SOURCES

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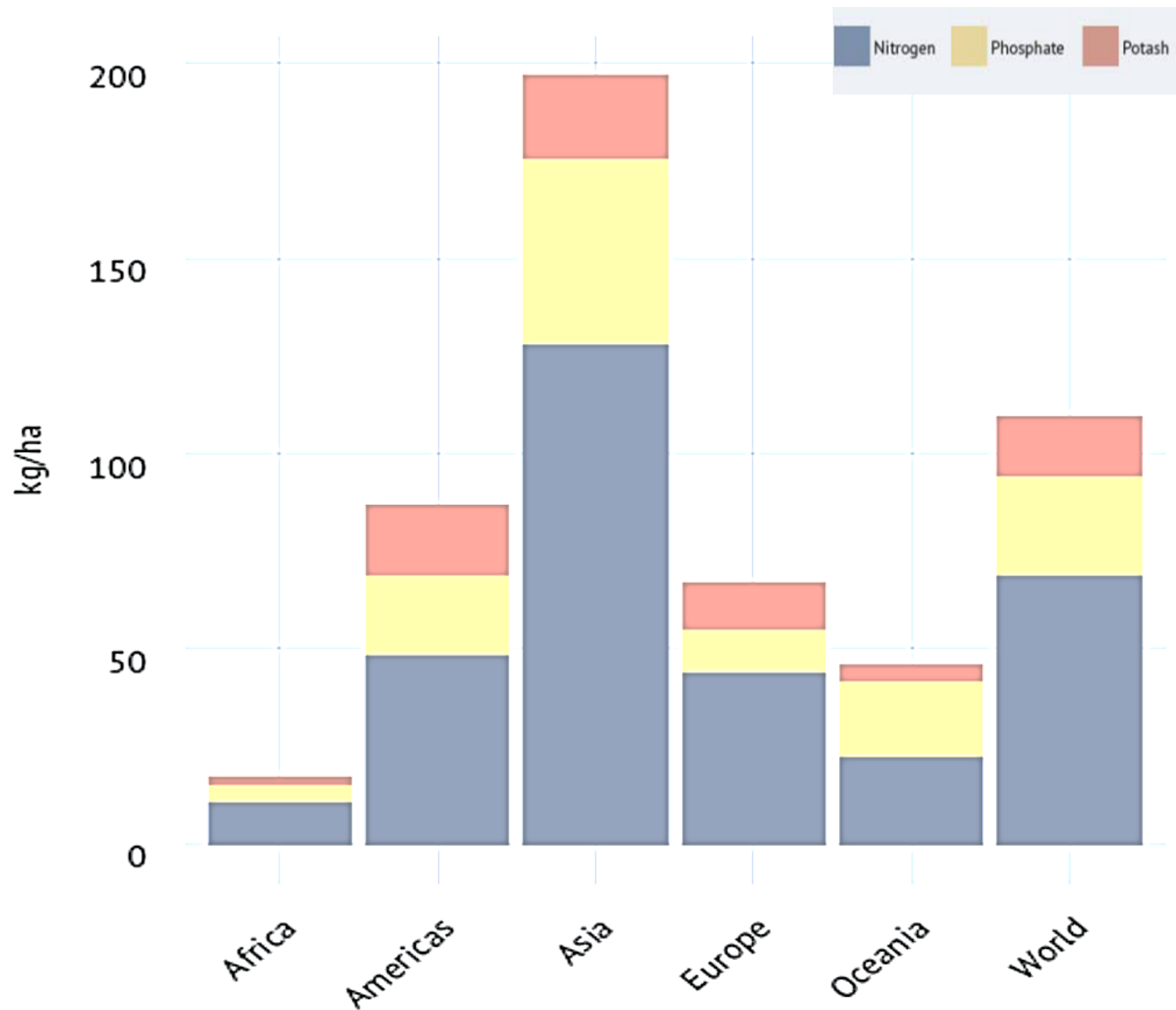
Poor and degraded soils



Source: A better climate for disaster risk management. Climate and Society No. 3, International Research Institute for Climate and Society (IRI)



- Poor and degraded soils with low fertility and organic matter limit agricultural productivity among many smallholder farmers in sub-Saharan Africa (SSA).



Opportunities to the fertilizer problem

Sanitation challenges ...as an opportunity



- Sanitation challenges provide an opportunity for nutrient recovery.
- Each person produces approximately 5.7 kg of nitrogen, 0.6 kg of phosphorus and 1.2 kg of potassium per year in form of excreta Wolgast (1993)

Urine treatment systems



Struvite

More than 91% P recovery

Magnesium
source
 $MgCl_2$,
 $MgSO_4$,
 MgO

Stored urine



Drying



Struvite
effluent

Antonini et al., (2012), Ryu et al.,
(2012) and Cabeze et al., (2011)

Nitrified Urine Concentrate (NUC)



**Packaged
as fertiliser**

Aim and objective

- to generate knowledge on the use of urine –based plant nutrient sources such as struvite, stored urine and nitrified urine concentrate on soils, crop growth, biomass production and yield.
- Objective
 - To determine effectiveness of urine-based fertilizers as plant nutrient sources for maize and perennial rye grass production under controlled and field conditions

MATERIALS AND METHODS

Experimental site

- The experimental site was located at Newlands Mashu Durban ($30^{\circ}57'E$, $29^{\circ}58'S$).



Field experiment



- A single factor analysis laid out using a Randomized Complete Block Design (RCBD)

- 5 treatments

Positive control

Negative control
NUCxstruvite

NUC

Stored urine

Replicated 4 times = 20
experimental units (3 x 1m plots)

Tunnel experiment



- Plant nutrient sources
 - Negative control
 - Positive control
 - NUCxStruvite
 - NUC
 - Stored Urine
- Soils
 - Inanda
 - Sepane
 - Catref
- 5x3 factor experiment replicated 4 times= 60 experimental units (2 L pots)



- **Plant nutrient sources**

- Negative control
- Positive control
- NUCxStruvite
- NUC
- Stored Urine

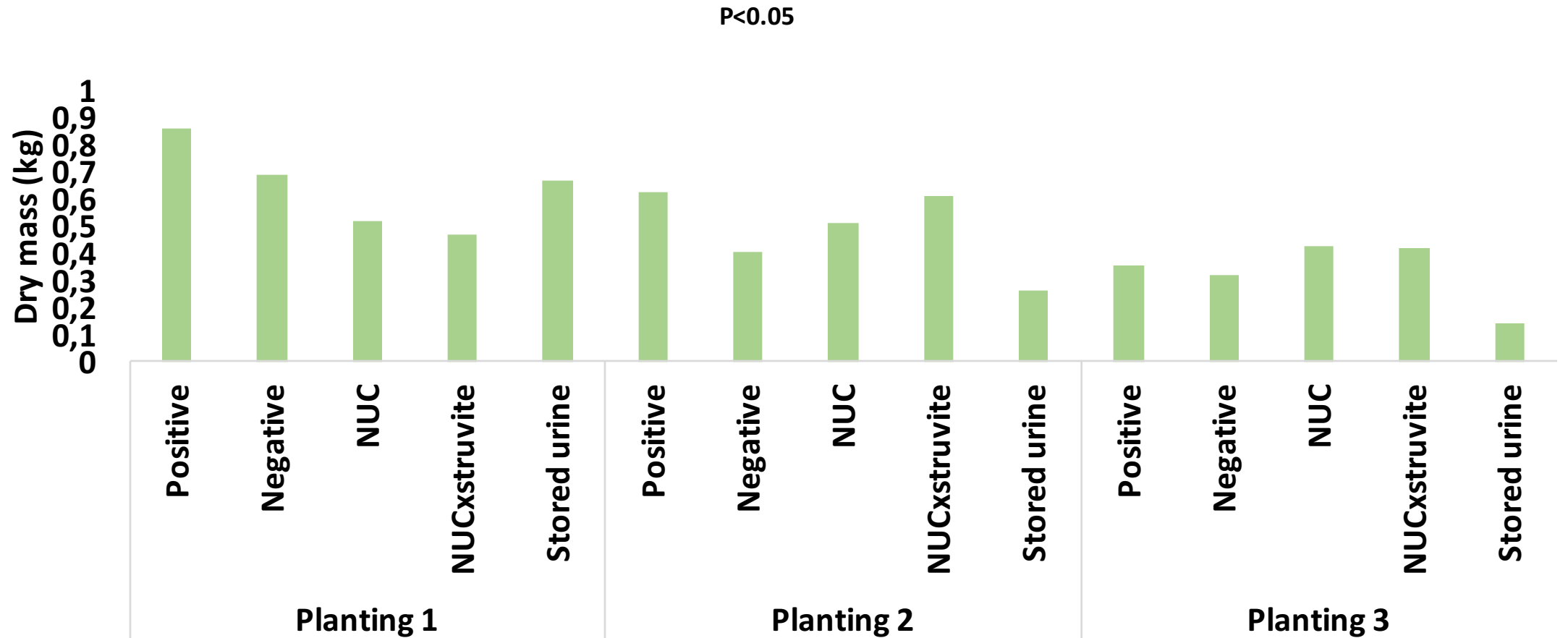
- **Soils**

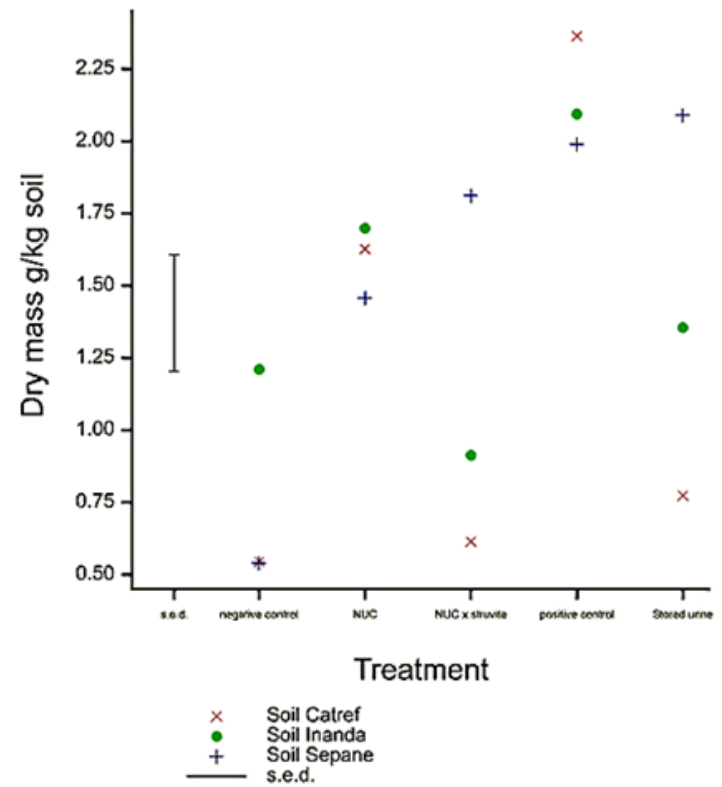
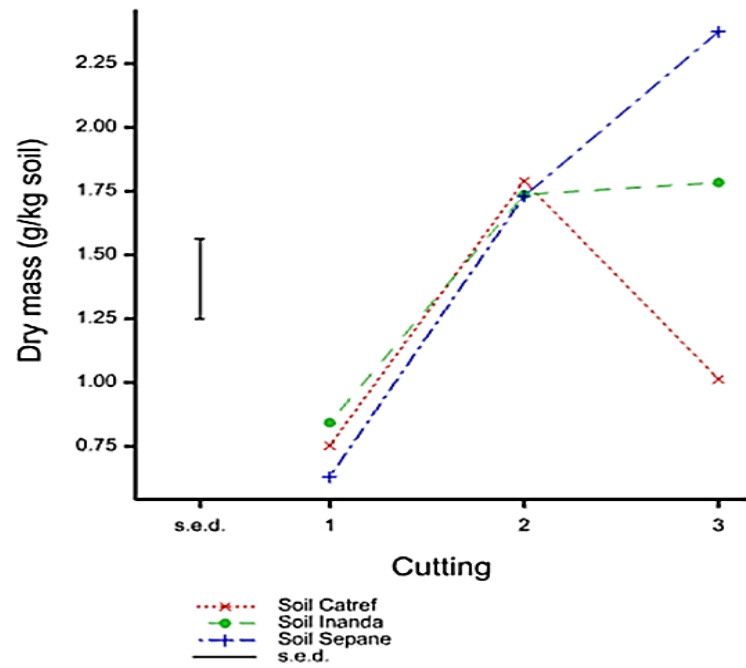
- Inanda
- Sepane
- Catref

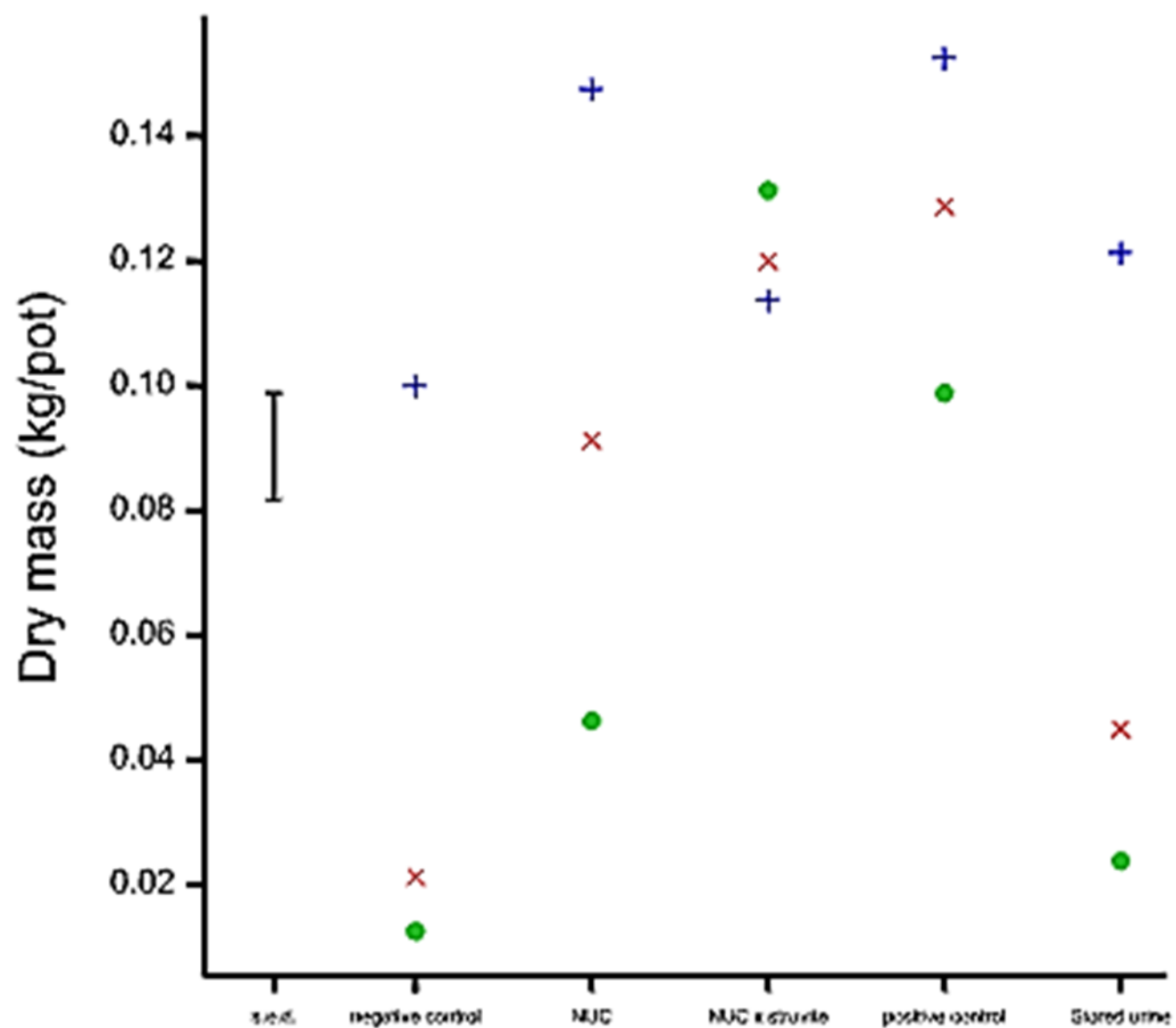
- 5x3 factor experiment replicated 4 times= 60 experimental units (20 L pots)

RESULTS

Effects of treatments on maize biomass production







Treatment

- x Soil Catref
- Soil Inanda
- + Soil Sepane

Summary and conclusion

- Initially the chemical commercial fertilizers outperformed the urine based fertilizers but with time the urine based fertilizers were comparable to the chemical commercial fertilizers with respect to biomass production
- Urine derived products could provide a viable option to crop production, however it is recommended that management practises when using these fertilizers should consider the time and method of application, which should coincide with critical growth stages.
- Soil type significantly affects the effectiveness of urine derived products

Recommendations for future research

- Extensive field studies on poor soils and different crops should be done.
- Further research with real human urine is required to account for the fate of undesired urine compounds

ACKNOWLEDGEMENTS

