USING NATIVE AFRICAN SPECIES TO SOLVE AFRICAN WASTEWATER CHALLENGES: AN IN-DEPTH STUDY OF TWO VETIVER GRASS SPECIES

Effiom Oku[1], Kwabena Asubonteng[1], Catherine Nnamani[2], Itam Michael[3] and Paul Truong[3]

[1]United Nations University Institute for Natural resources in Africa, Ghana & Coordinator, Vetiver Network, Ghana and Nigeria.

[2] Ebonyi State University, Nigeria

[3]The Vetiver Network International (TVNI), Technical Director and Director for Asia and Oceania, Brisbane, Australia

What we know and the challenges

Plate 1. Water drainage way in a city in Nigeria

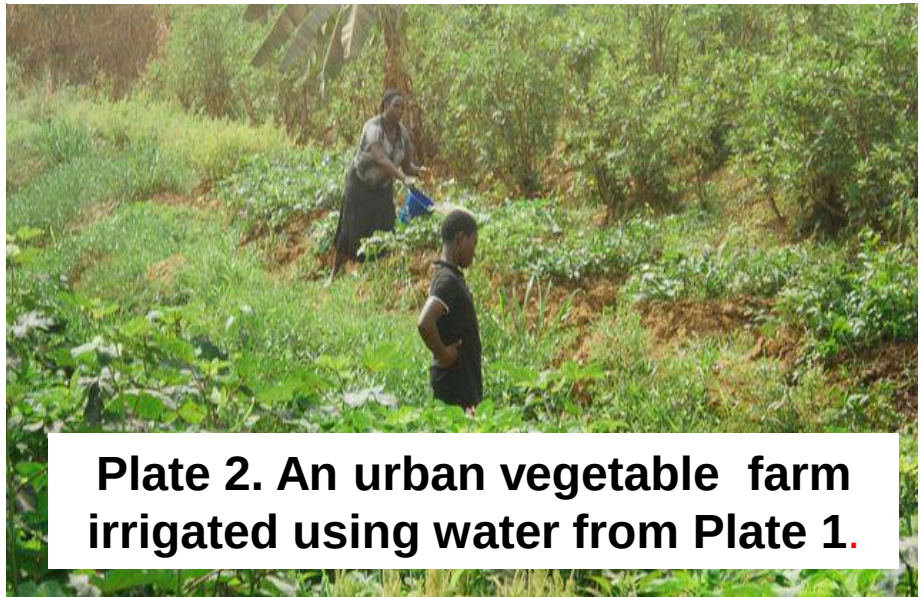


Plate 2. An urban vegetable farm irrigated using water from Plate 1.

- Wastewater management challenge is a global issue (Plate 1&2) (UNEP, 2010 and Kumar 2011).
- Most industrial effluents in Sub Sahara Africa are discharged into environment untreated.
- Settling pond popular in wastewater management in Africa (Nikiema *et al*., 2013)
- Conventional treatment technologies are very limited and climate change is impacting.

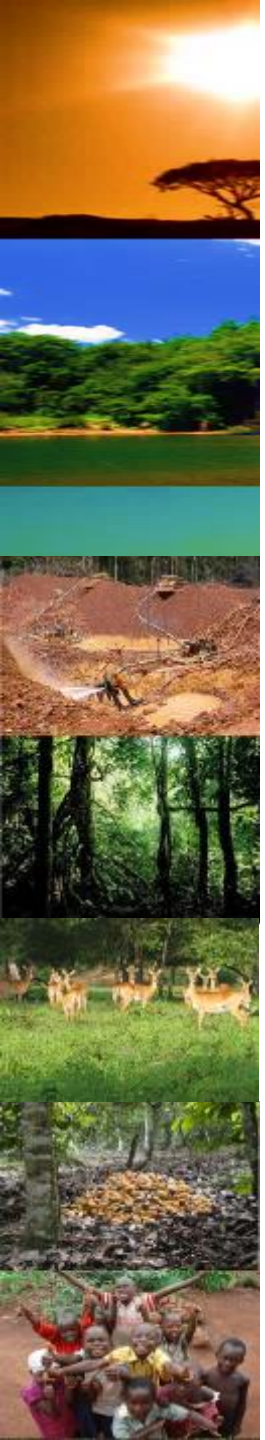
UNITED NATIONS UNIVERSITY
UNU-INRA
Institute for Natural Resources in Africa

What we know and the challenge

Plate 3 shows *Chrysopogon zizanioides* (A) and *Chrysopogon nemoralis* (B)

(Source:www.vetiver.org)

- South Indian *spp* is effective in wastewater treatment (Truong and Hart, 2001; Truong, *et al*., 2006)
- Three *spp* of vetiver grass are known (Truong *et al*., 2006).
- All known *spp* of vetiver have different potentials, some for erosion control as in plate 3. (Truong *et al*., 2008).
- Use of vetiver in Africa is not common and still at its infancy (Babalola, *et al*., 2007: Oku, 2011).



What we do not know

- The effectiveness of African *spp* in removing contaminants in wastewater.

Objective

- To study the effectiveness of African *spp* in wastewater treatment and compare with well known South Indian *spp*.

Methodology

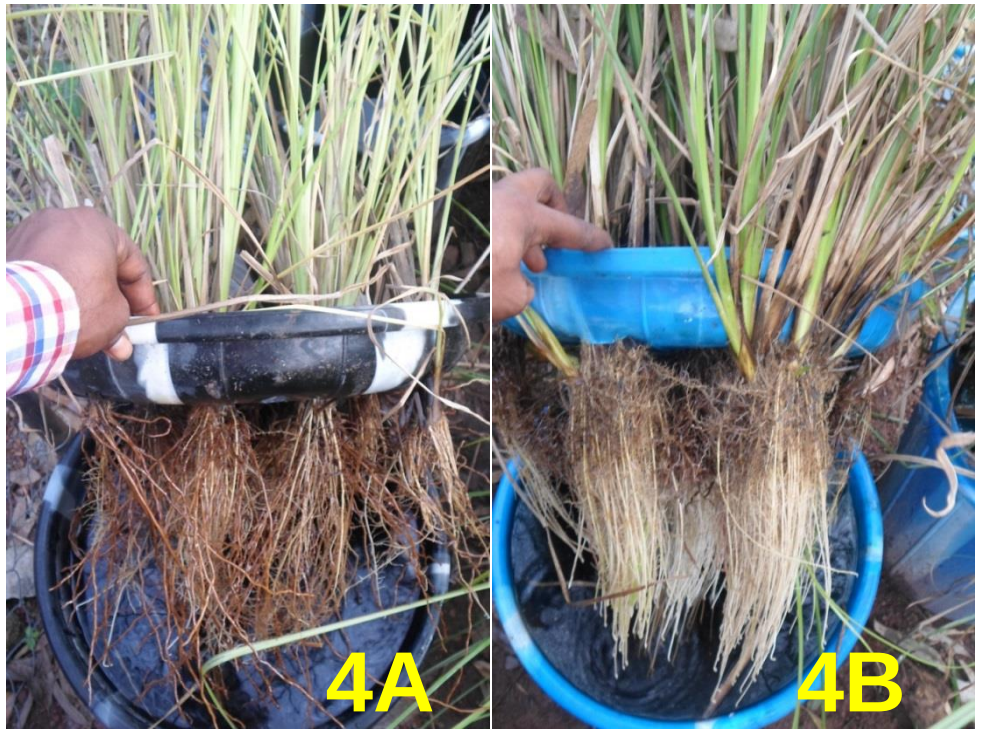
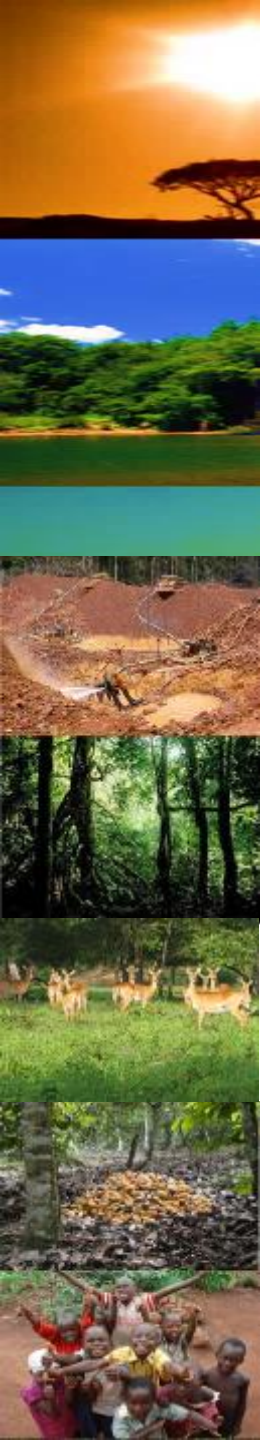


Plate 4 Set-up with South Indian *spp* (4A) and African *spp* (4B) floating in effluent from fertilizer company.

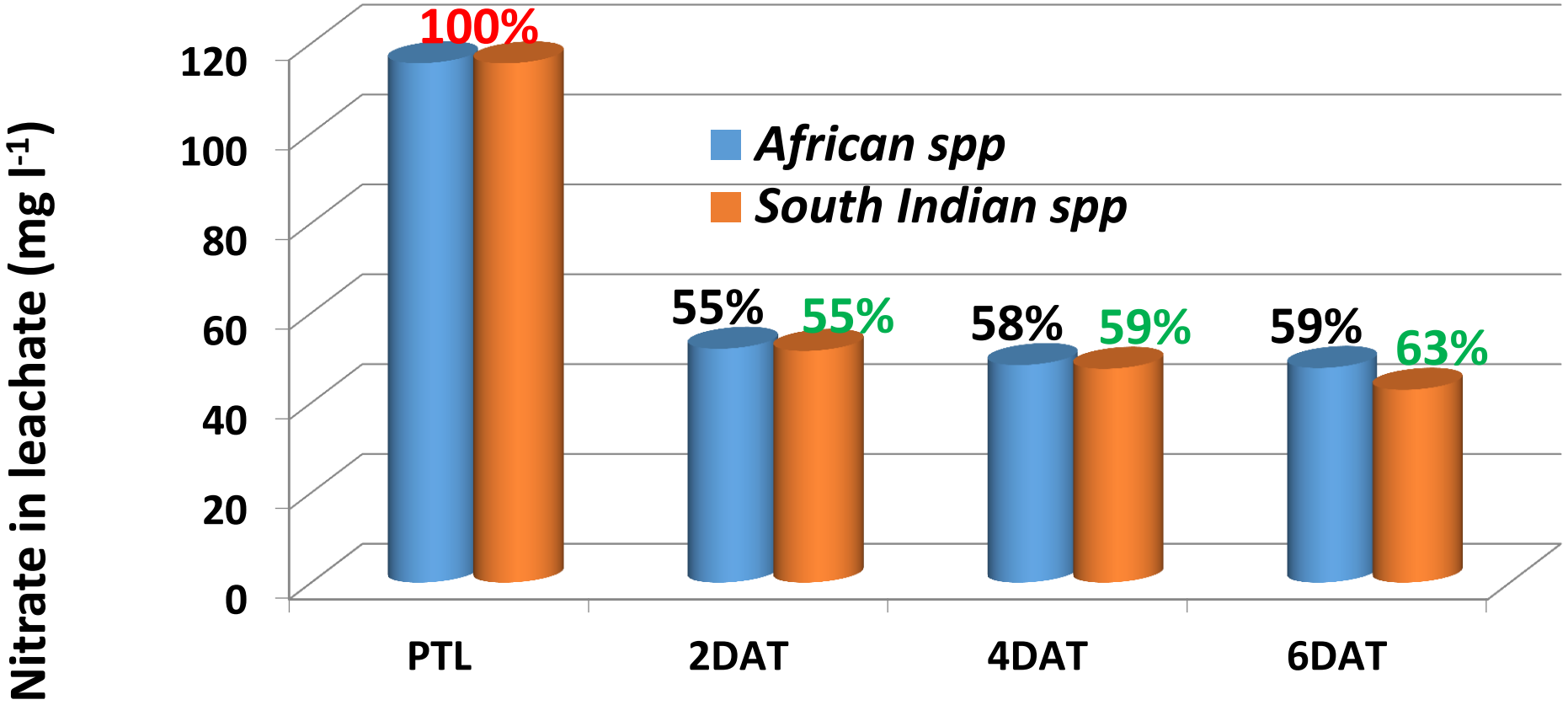
- Effluents collected from quarry site, fertilizer company and untreated public dump site.
- Vetiver raised hydroponically for root and shoot establishment.
- Floating raft with established vetiver immersed in effluents as in Plate 4 (Truong *et al*., 2008).



Methodology

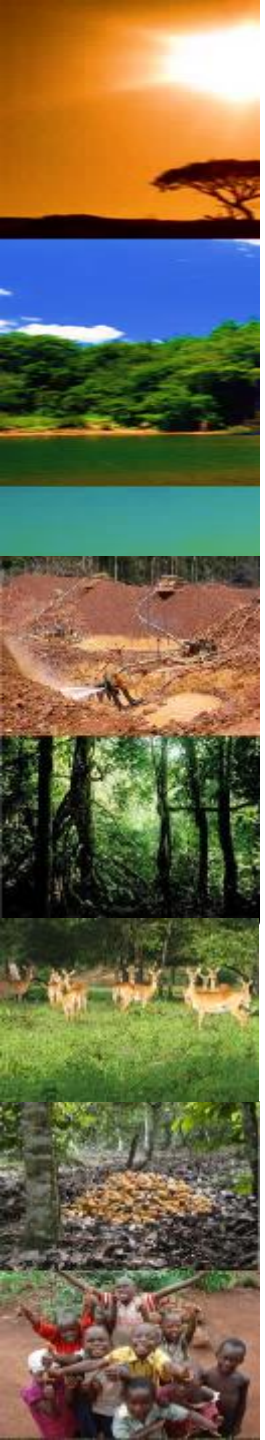
- Pre-and post-treatment contaminants determined included, heavy metals, pH, BOD, COD (FEPA,1991; APHA, 2001; WHO, 1989; and Udo *et al*., 2011).
- Treated effluents collected after 2, 4 and 6 days for laboratory analysis.
- Contaminant levels compared with safe levels by FAO/WHO.

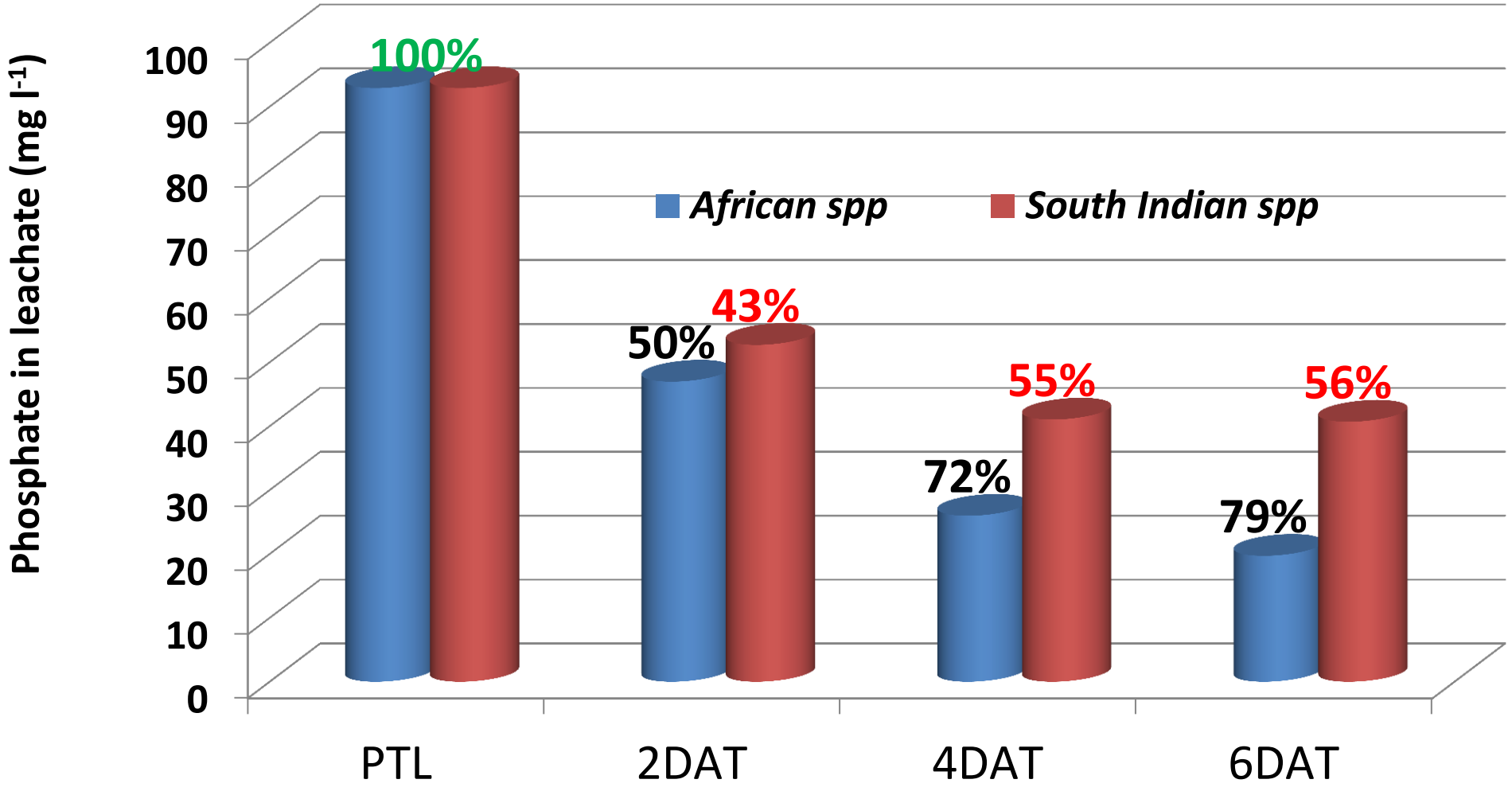
Results and Discussion



PTL = pre-treatment, contaminant levels, DAT = days after treatment; AL = allowable limit

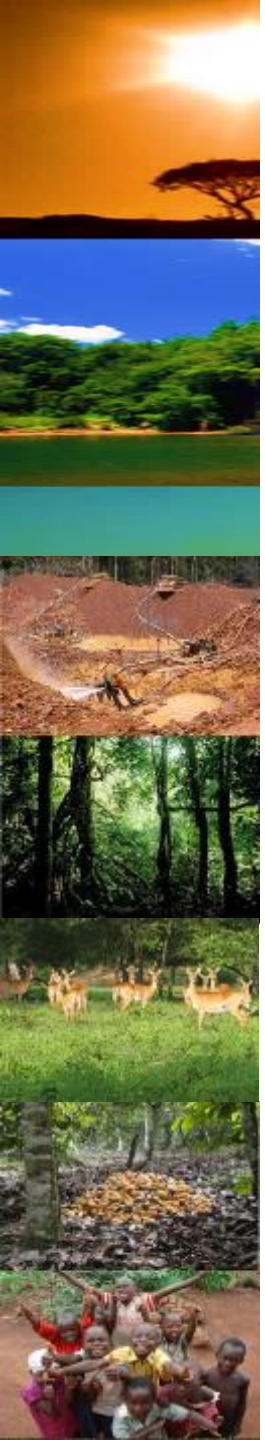
Fig 1: Pre level and post-treatment, nitrate removal rate in public dump untreated leachate in Abakaliki, Nigeria.

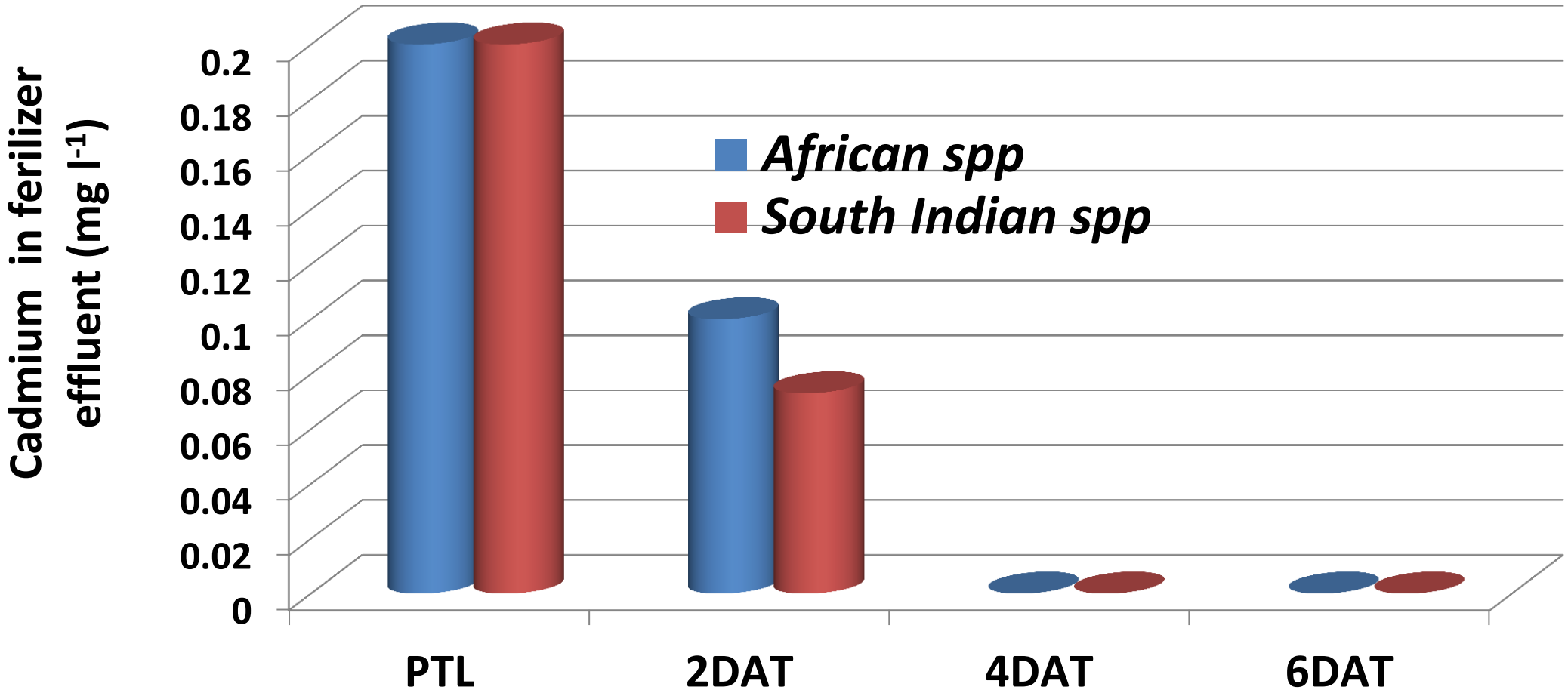




PTL = pre-treatment, contaminant levels, DAT = days after treatment; AL = allowable limit

Fig 2: Pre-level and post-treatment phosphate removal rate in public dump untreated leachate in Abakaliki, Nigeria.

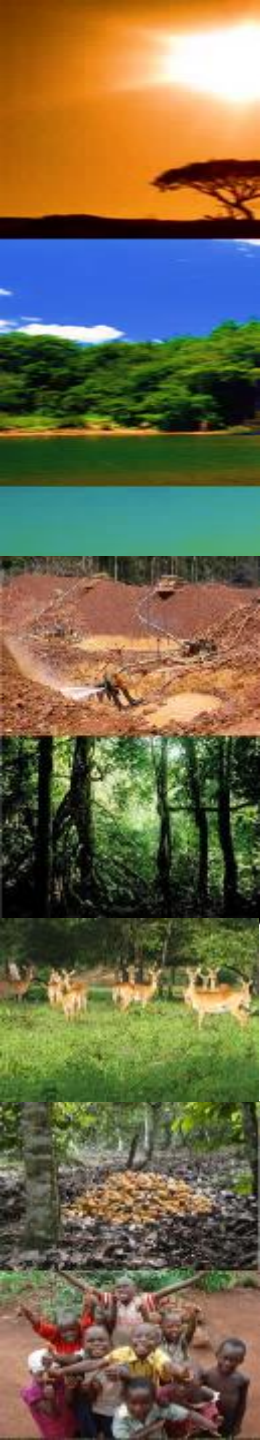


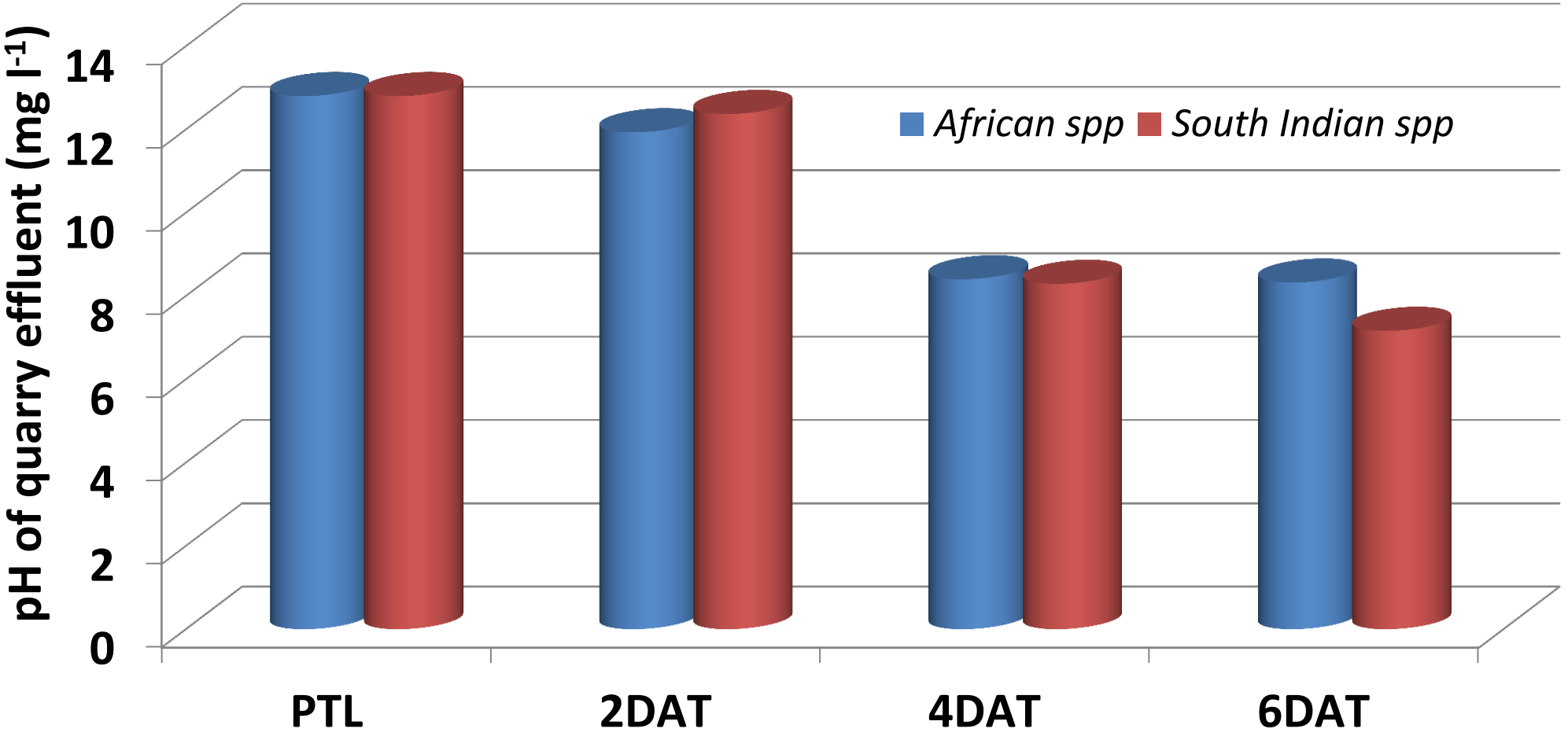


PTL = pre-treatment, contaminant levels, DAT = days after treatment; AL = allowable limit

Fig 3: Pre level and post-treatment, Cd removal rate in fertilizer industry effluent in Abakaliki, Nigeria.

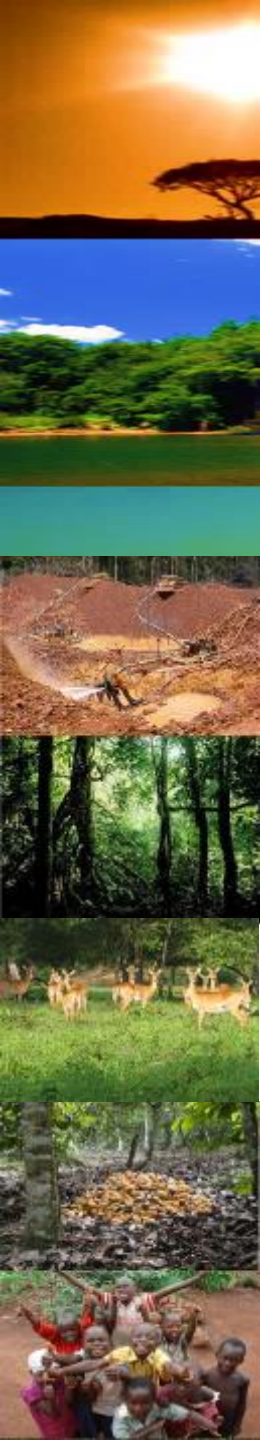
UNITED NATIONS UNIVERSITY
UNU-INRA
Institute for Natural Resources in Africa

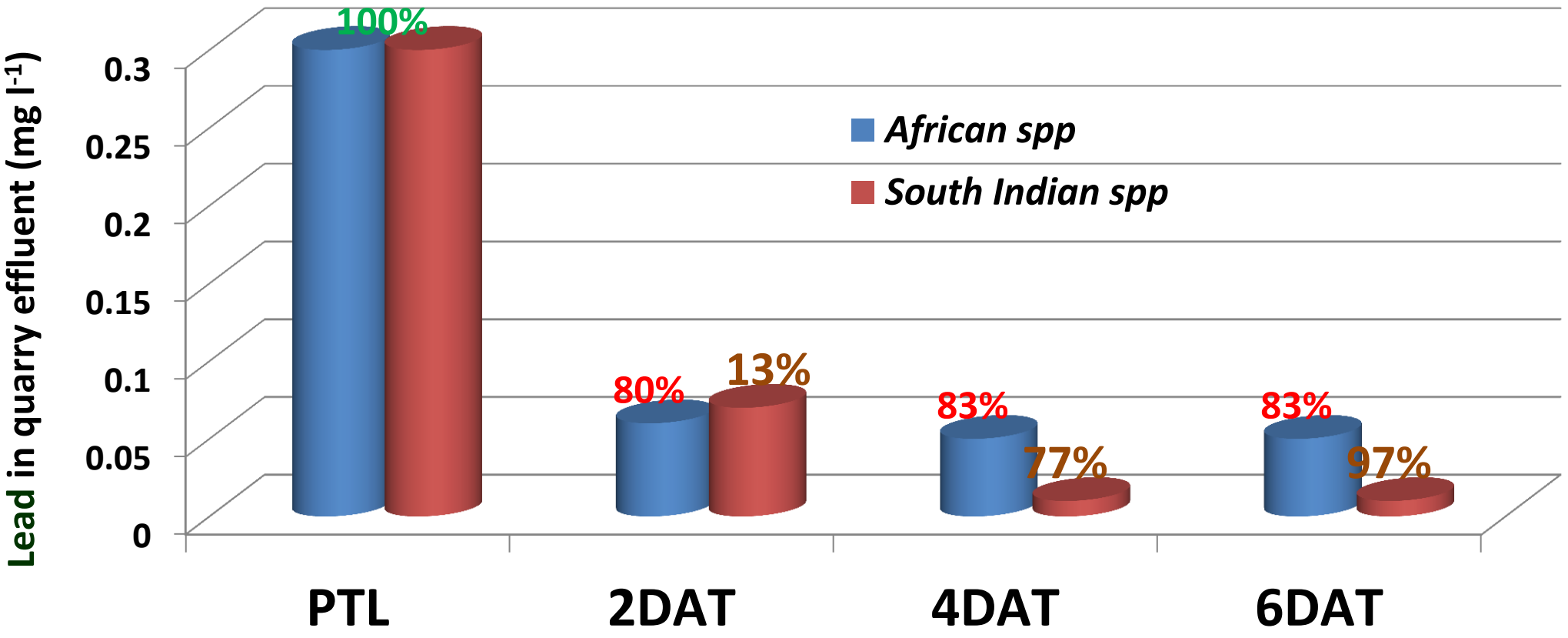




PTL = pre-treatment, contaminant levels, DAT = days after treatment; AL = allowable limit

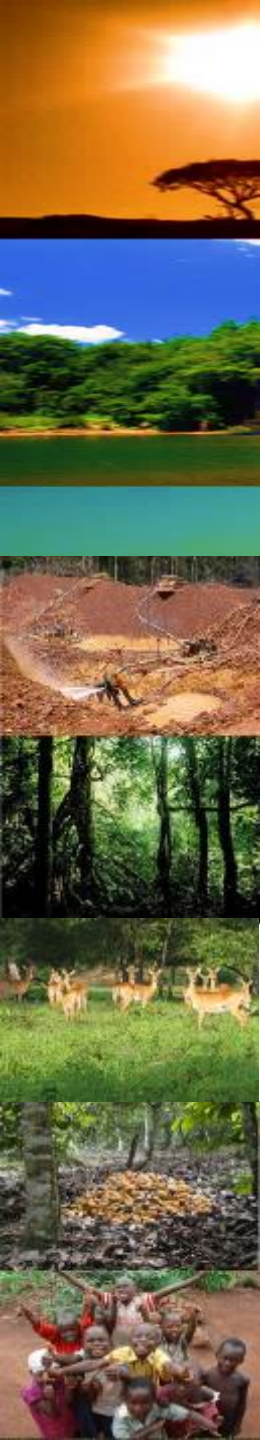
Fig 4: Pre and post-treatment, pH levels in quarry effluent collected in a city in Abakaliki, Nigeria.





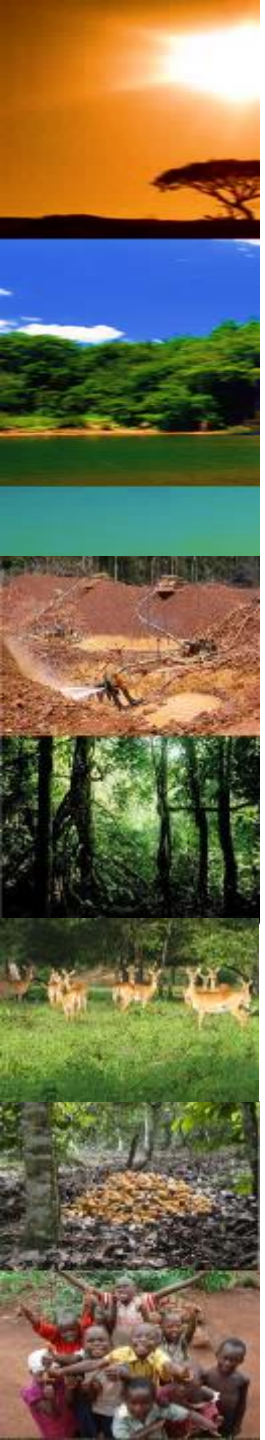
PTL = pre-treatment, contaminant levels, DAT = days after treatment; AL = allowable limit

Fig 5: Pre and post-treatment, Pb levels in quarry effluent in Abakaliki, Nigeria.



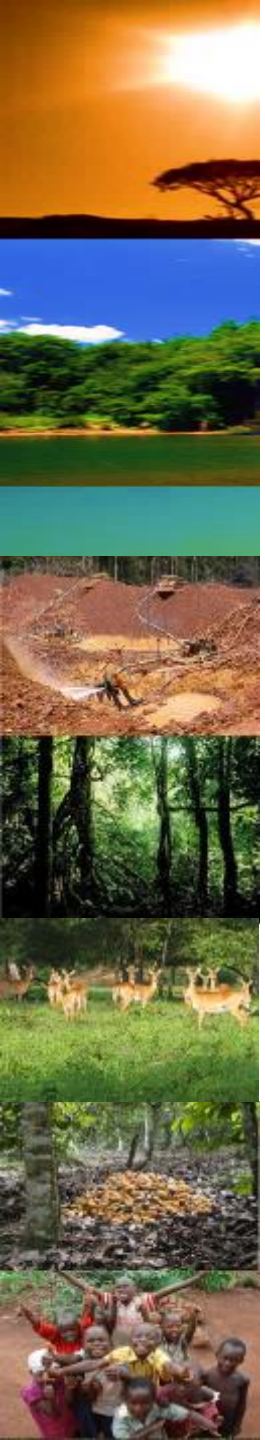
Conclusion

- African *spp* of vetiver grass is as good as South Indian *spp*.
- African *spp* was more effective in removing phosphate while, South Indian *spp* was more effective on nitrate.
- Both *spp* improved pH.
- Both *spp* should be combined where possible for maximum industrial benefit.
- Africa can rely on its endemic *spp* for commercial and micro scale wastewater treatment.
- Production of hybrid of the two *spp* is needed.



Acknowledgement

First author acknowledges the ***African Women in Agricultural Research and Development*** **(AWARD)** for partly sponsoring this trip to enable him present this paper at this conference.



Thank you

Questions!!!

UNITED NATIONS UNIVERSITY

UNU-INRA

Institute for Natural Resources in Africa

www.inra.unu.edu