ALTERNATE WETTING AND DRYING (AWD) IRRIGATION TECHNOLOGY: IMPACT ON THE YIELD OF RICE GROWN WITH PERI-URBAN ANAEROBIC BAFFLED REACTOR (ABR) EFFLUENTS

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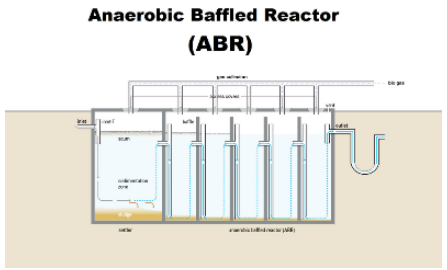

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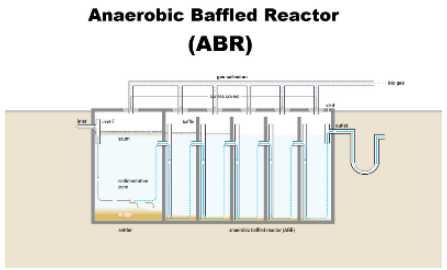
13 -15 November 2018, White River, Mpumalanga, South Africa

OUTLINE

1. INTRODUCTION
2. RESEARCH PROBLEM AND OBJECTIVE
3. MATERIALS & METHOD
4. RESULTS AND DISCUSSION
5. CONCLUSION



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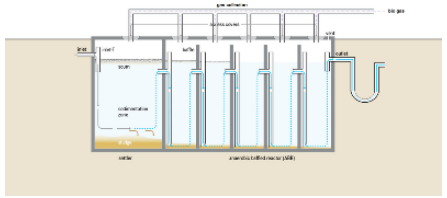
INTRODUCTION

- Water is a very valuable resource (Al-Rashed & Sherif, 2000)
- Need to preserve and access lower quality water for irrigation
- Urbanization and population, responsible for increase in volume of wastewater (Qadir *et al.*, 2010)
- The discharge of ABR effluent from DEWATS can cause pollution (Singh *et al.*, 2009)

Anaerobic Baffled Reactor (ABR)



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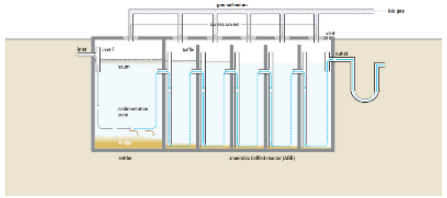
INTRODUCTION

- Recycling of wastewater; a common practice due to nutrient worth
- The nutrient-rich effluent serves as fertilizer (N120 Vs N 519 kg/ha)
- UP settlements in developing nations like South Africa needs DEWATS (Alghobar and Suresha, 2016)
- Physico-chemical properties & heavy metals

Anaerobic Baffled Reactor (ABR)



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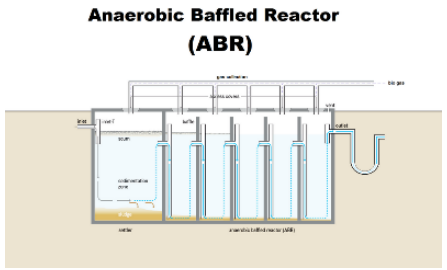
INTRODUCTION

- Rice, main staple food for more than 1/2 of the world's populace (Seck *et al.*, 2010)
- Principal consumer of water (about 2 500 litres for 1 kg of rice)
- SA has one of the highest rice consumption (14 kg/capita/year).
- International market is the source of rice consumed in SA (Center (2007))
- Level of production in South Africa is not known



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Research Problem

- Need to dispose off the nonstop volume of ABR effluent
- No reported use of ABR effluent with irrigation management techniques in RSA and other parts of the world

Objective

To evaluate the effects of Irrig. mgt. tech. using ABR effluent on the growth and yield of rice.

Hypothesis

Hypothesized that irrigation techniques with ABR effluent have a significant effect on the growth and yield of rice

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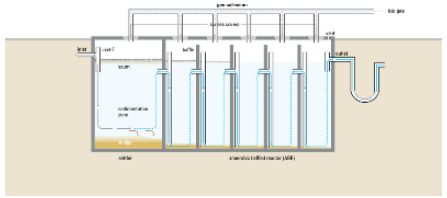

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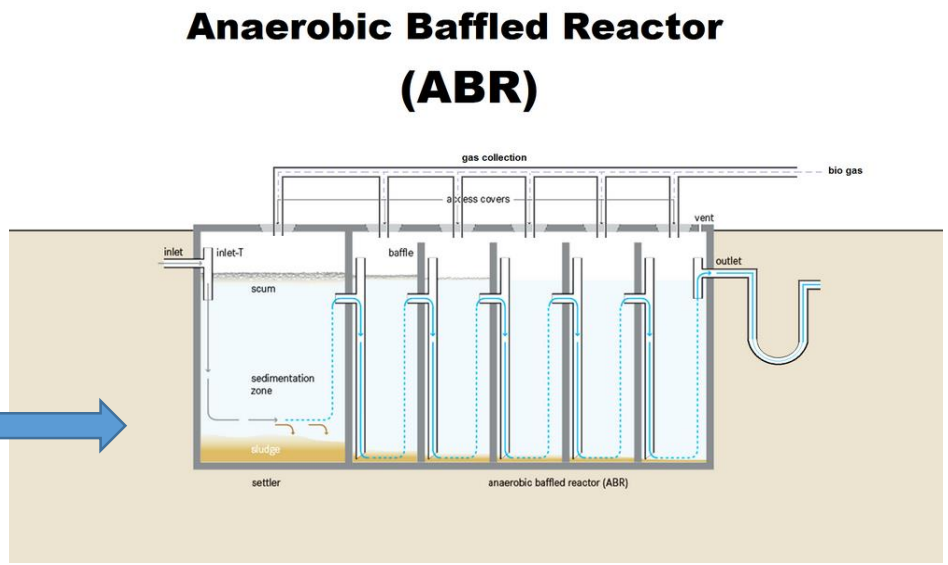
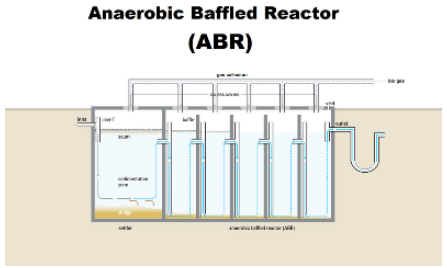
METHOD

STUDY SITE: Newlands east, Durban, RSA, 1000mm rainfall, 20.50ºC



CROP SELECTION: water, nutrient and need to be cooked before eating



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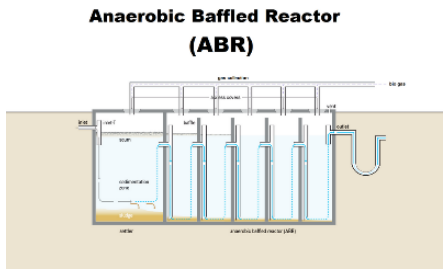
METHOD

Plot layout

- Cut-off drains trenched to collect field run-on and off

What are Irrig mgt tech:

- AWD
- CFI (control)
- WWF



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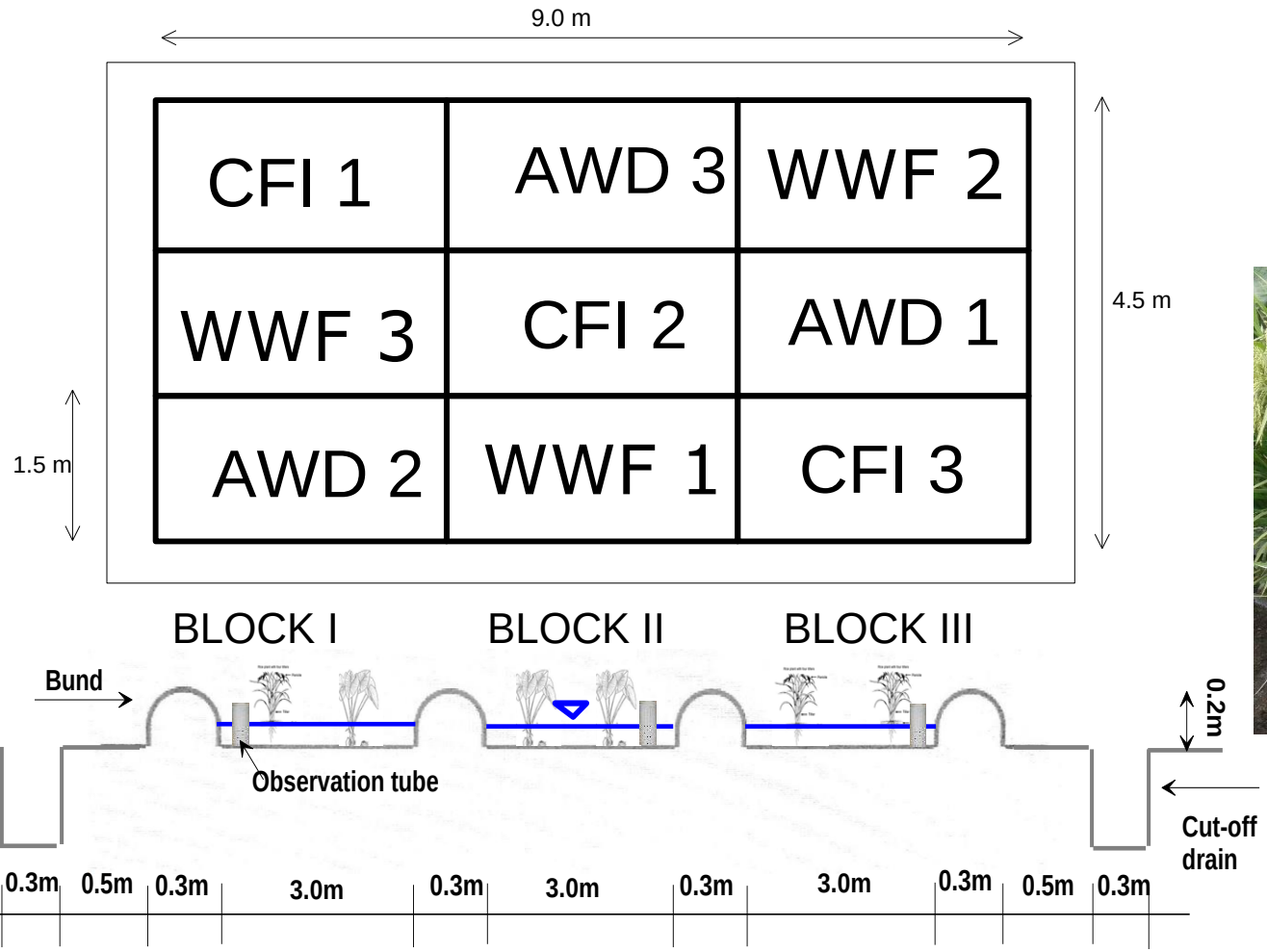
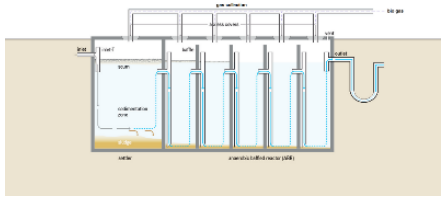
METHOD

EXPTL SETUP

- Trials laid out in RCBD with 3 replications



Anaerobic Baffled Reactor (ABR)



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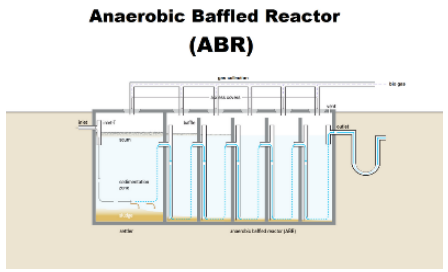
METHOD

Plot layout

- Plot size L (3m) x W (1.5m)
- Bunds are 30 cm wide and 20 cm high.
- Plastic sheeting (250 microns) buried to a depth of 0.6 m
- Tube or observation well (40 cm by 10 cm) inserted in each plot



METHOD

Plot layout & crop establishment

Established for 2 weeks with fresh water before transplanting.

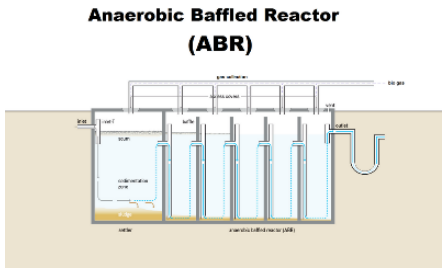
CFI

AWD

WWF

Crop spacing was 0.25 by 0.25 m

Equivalent of 160,000/ha same with Pascual and Wang, 2016 while Oliver *et al.*, 2008 & Fonteh *et al.*, 2013 (267,000)



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METHOD
DATA COLLECTION & ANALYSIS

- Data collected on 4 plants per plot at 3 replications
- Growth, yield parameters and WP.
  - LAI-2200C Plant Canopy Analyzer for LAI
- No of irrig and TWU (Irrig + rainfall)
- ANOVA by GenStat 18th edition
  - Normality test (Skewness and Kurtosis for numerical and Normal Q-Q plots for graphical outputs)
  - Significant difference at $P \leq 0.05$
  - Duncan's multiple range test for means separation

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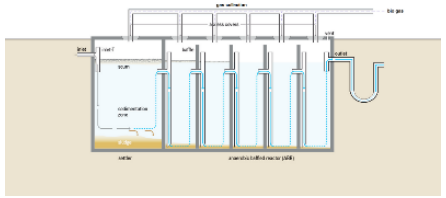

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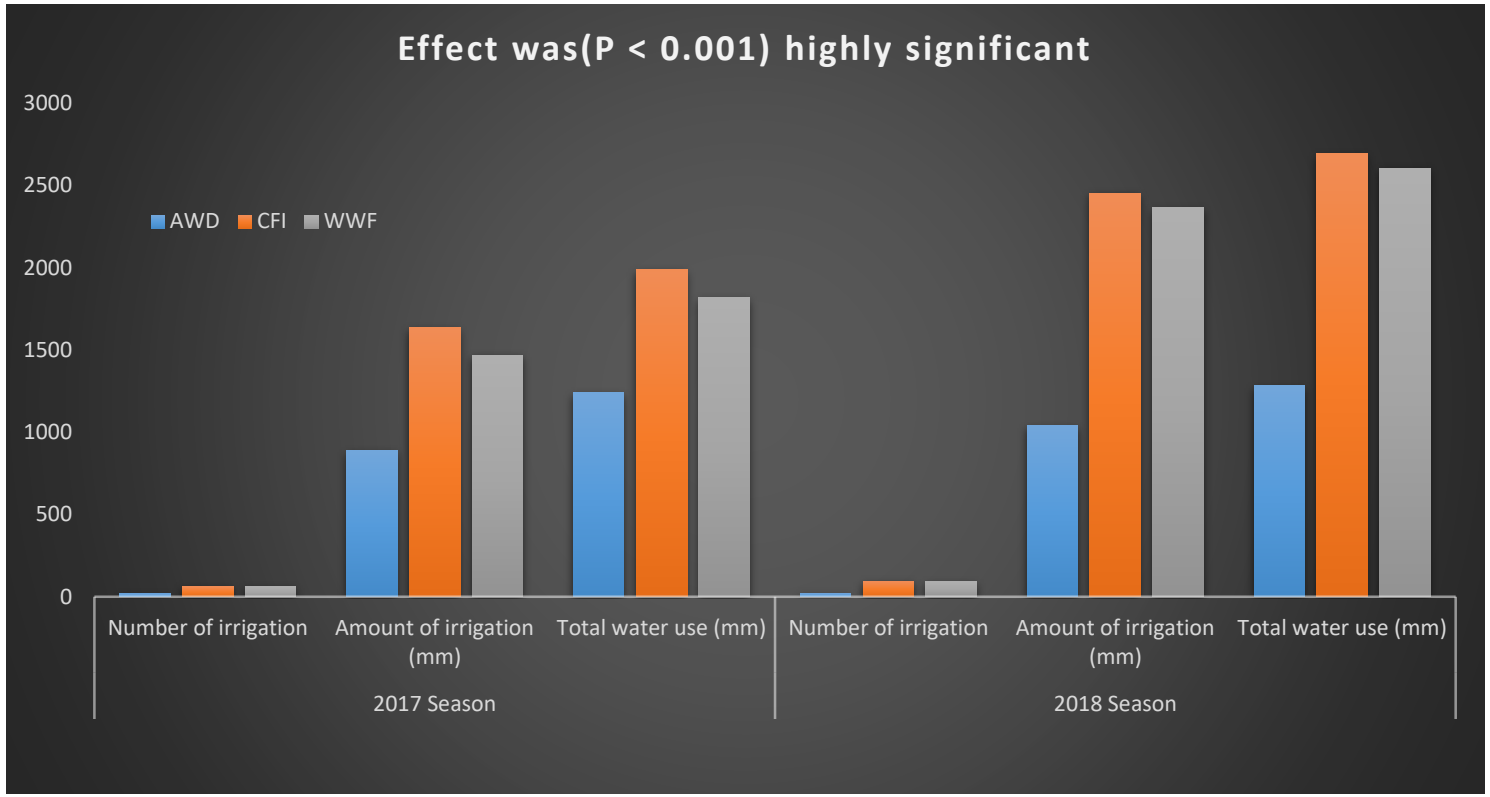
RESULT AND DISCUSSION

Effect on number of irrigations, amount and total water use

The difference was as result of frequent of irrigation according to treatments



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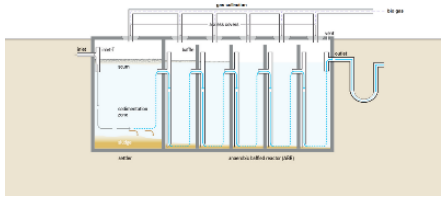

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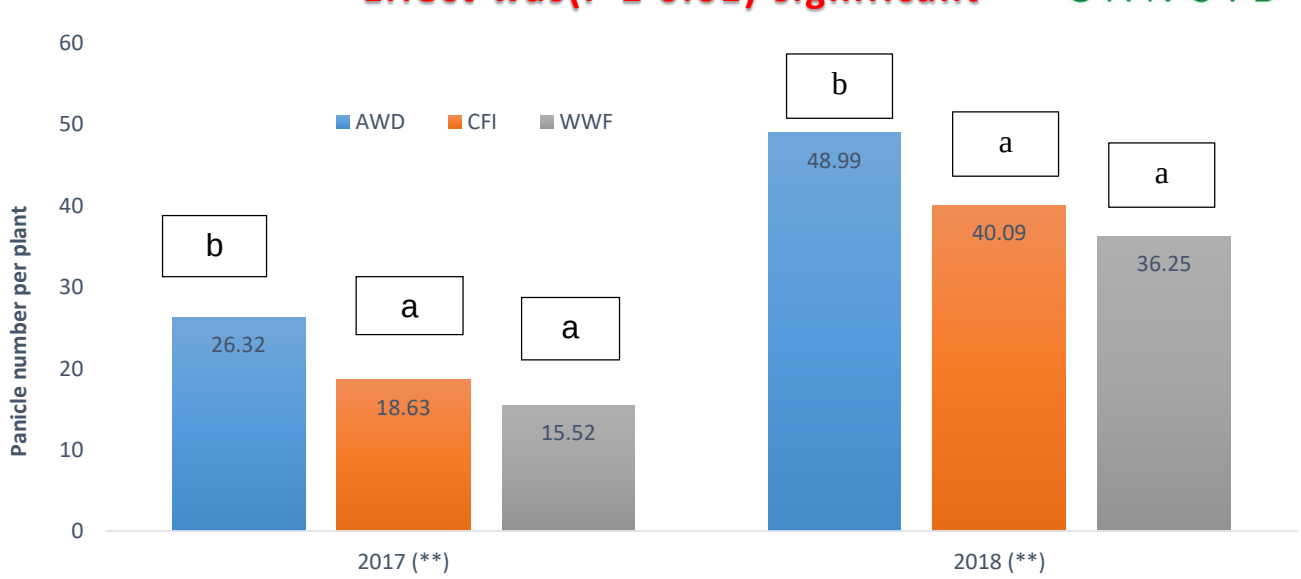
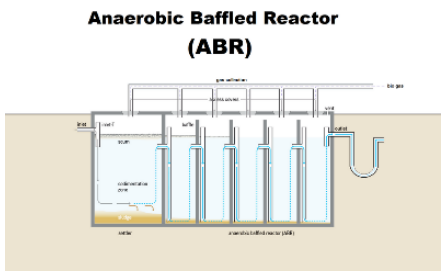
RESULT AND DISCUSSION

Effect on growth parameters

- The effects of irrigation management techniques using ABR were significant (P ≤ 0.01) on panicle number/plant
- LAI has max and min value with AWD and CFI (Agreed with [Pascual & Wang (2016)]





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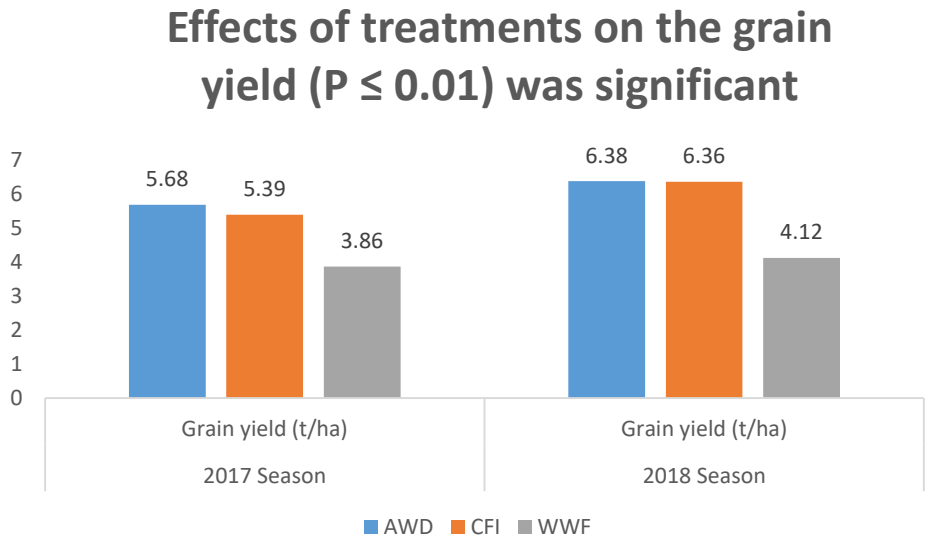
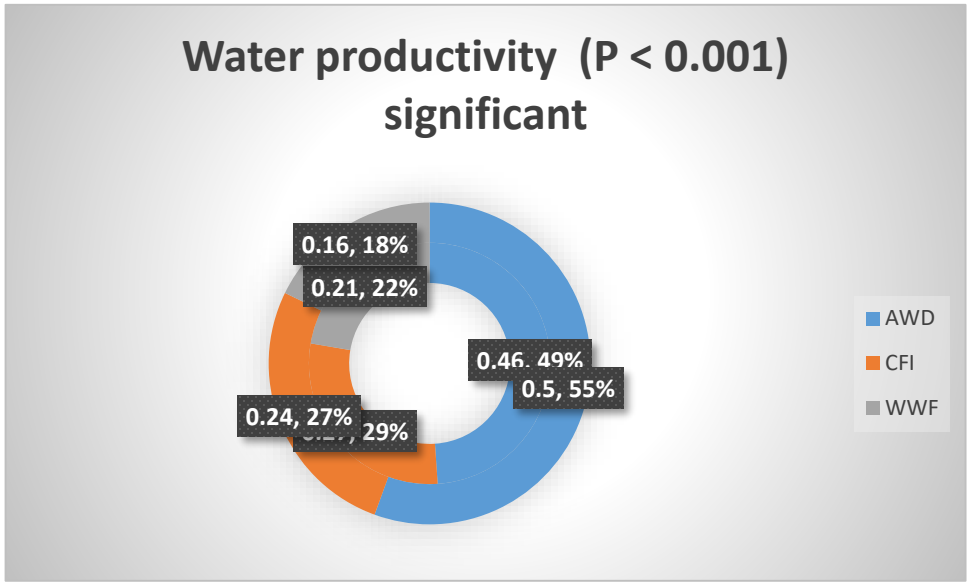
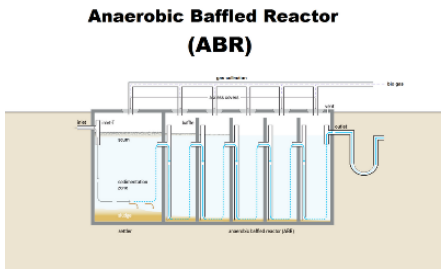
RESULT AND DISCUSSION

Effect on yield and WP

AWD was higher than CFI but the diff was not significant







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RESULT AND DISCUSSION

Effect on yield and yield components

- Highest grain yields of 5.68 and 6.38 t/ha was obtained in treatment AWD for 2017 & 2018 resp.
- Equivalent to highest WP
- Within the range of the supplier yield data (4.5-6.5), Oliver *et al.* (2008)-5.86 to 6.86 t/ha and Fonteh *et al.* (2013)-5.7 to 6.5 t/ha - these are inorganic fertilized cultivation
- Higher than what Akintayo *et al.* (2011) (3.2 t/ha) reported (same FARO 44)- may be due to effect of ABR effluent

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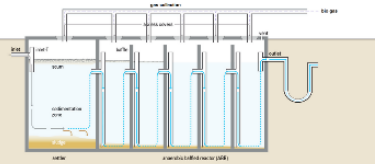

CONCLUSION

- Rice performed well with AWD treatments
- No significant increase from flooded rice (CFI)
- The yield obtained was as a result of water reuse (ABR effluent) without inorganic fertilizer
- Highest WP was also obtained under AWD treatments, hence,
- Adoption of AWD should be encouraged in rice production.
- Hypothesis was rejected for growth parameters but accepted for the grain yield.

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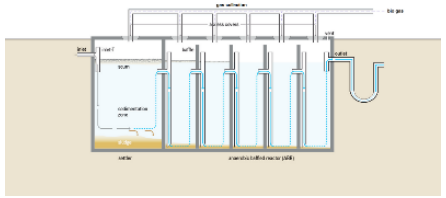

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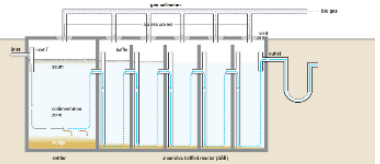
Recommendation

- Recommended that more household be connected to the sewer
- And increase the volume of ABR effluent for irrigation purposes

Anaerobic Baffled Reactor
(ABR)



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Anaerobic Baffled Reactor
(ABR)