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ASSESSING THE POTENTIAL OF AGERATUM CONYZOIDES IN CONSTRUCTED WETLANDS FOR TREATING DOMESTIC WASTEWATER

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Outline of Presentation

1. Depleting water resources.
2. Wastewater as an alternative resource.
3. Health hazards of untreated wastewater and need for treatment-constructed wetlands (CWs).
4. Field scale monitoring CWs-ICRISAT campus, India.
5. Field testing new plant species in ICRISAT CW.
6. Key findings/conclusions
7. Implementating research findings.

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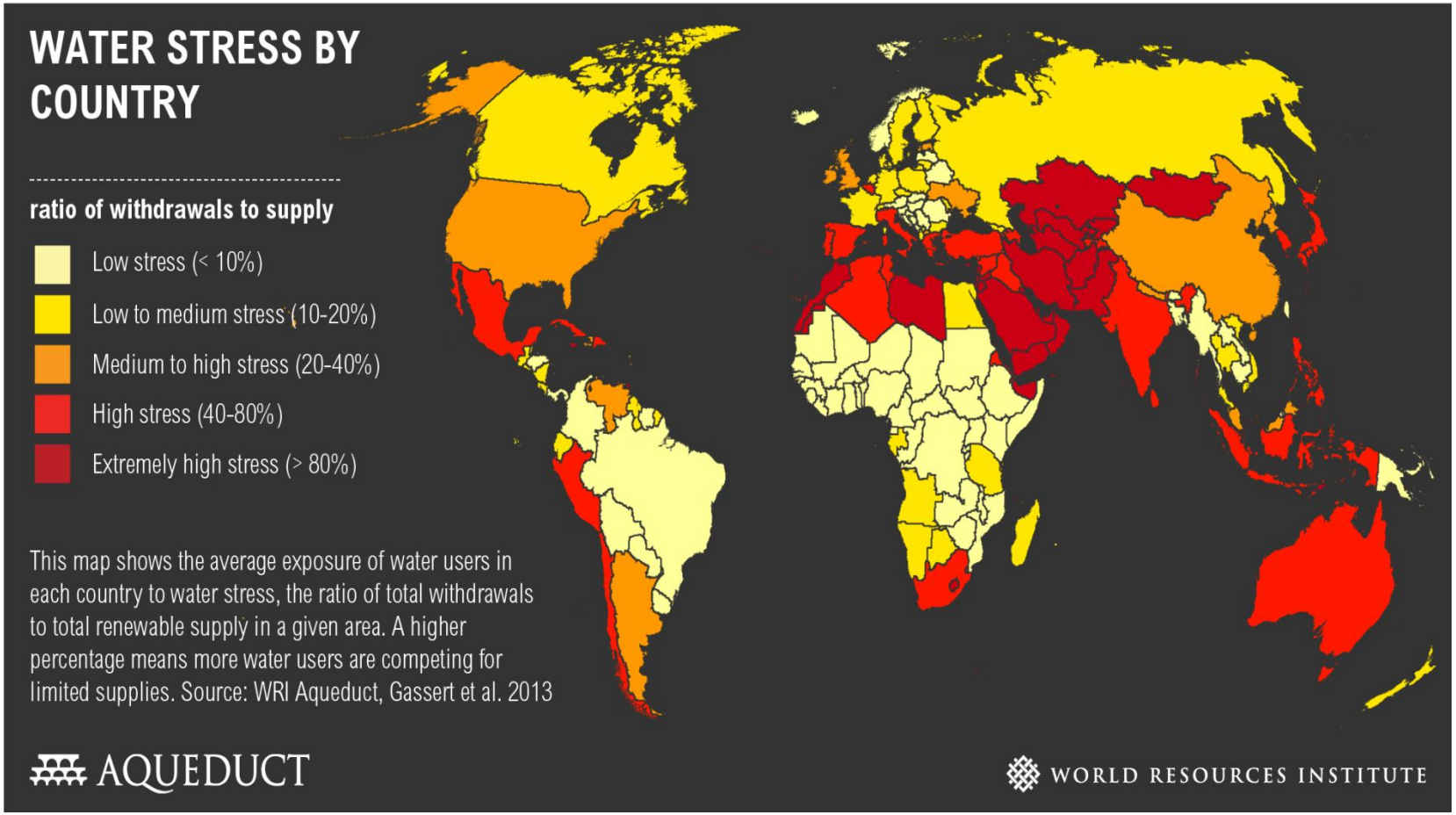
Water crisis

1. Depleting and limited fresh water resources.



Wastewater as a resource

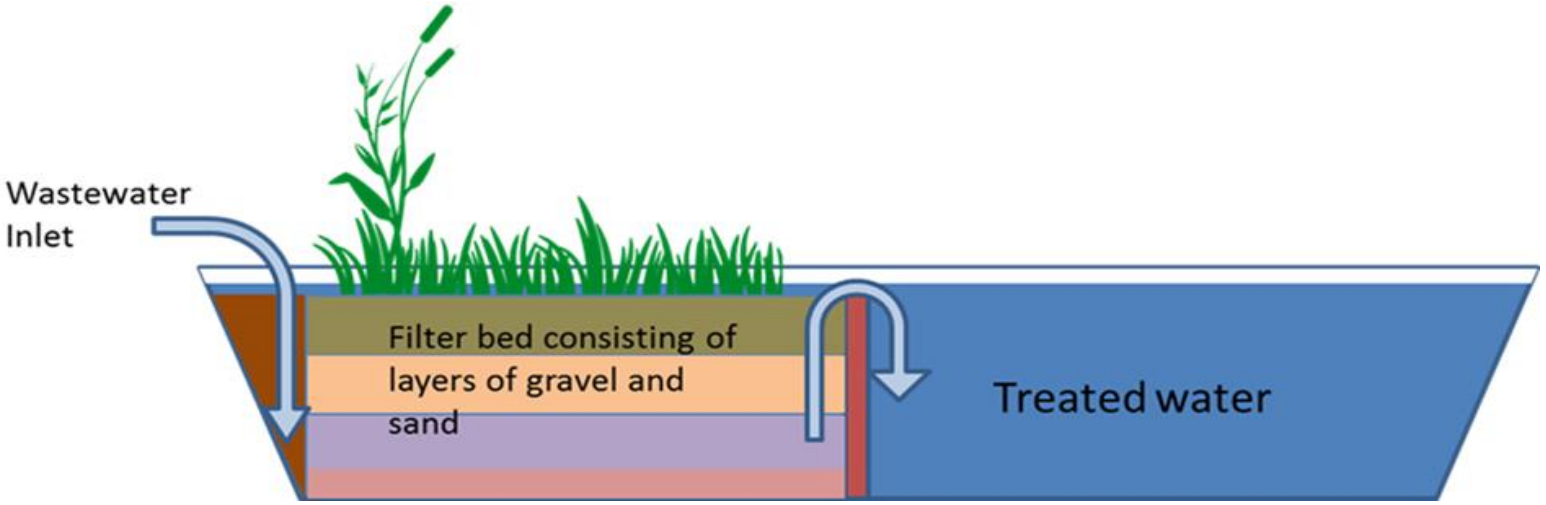
1. **Untreated wastewater peri-urban, urban and rural areas-village near Hyderabad,Telangana, India.**

Untreated wastewater and CWs

1. **Excessive nutrients, pathogens and coliform-health hazards on humans and animals.**

2. **Need for effective, low cost, minimal maintenance wastewater treatment system.**

3. **Constructed Wetlands (CWs)**

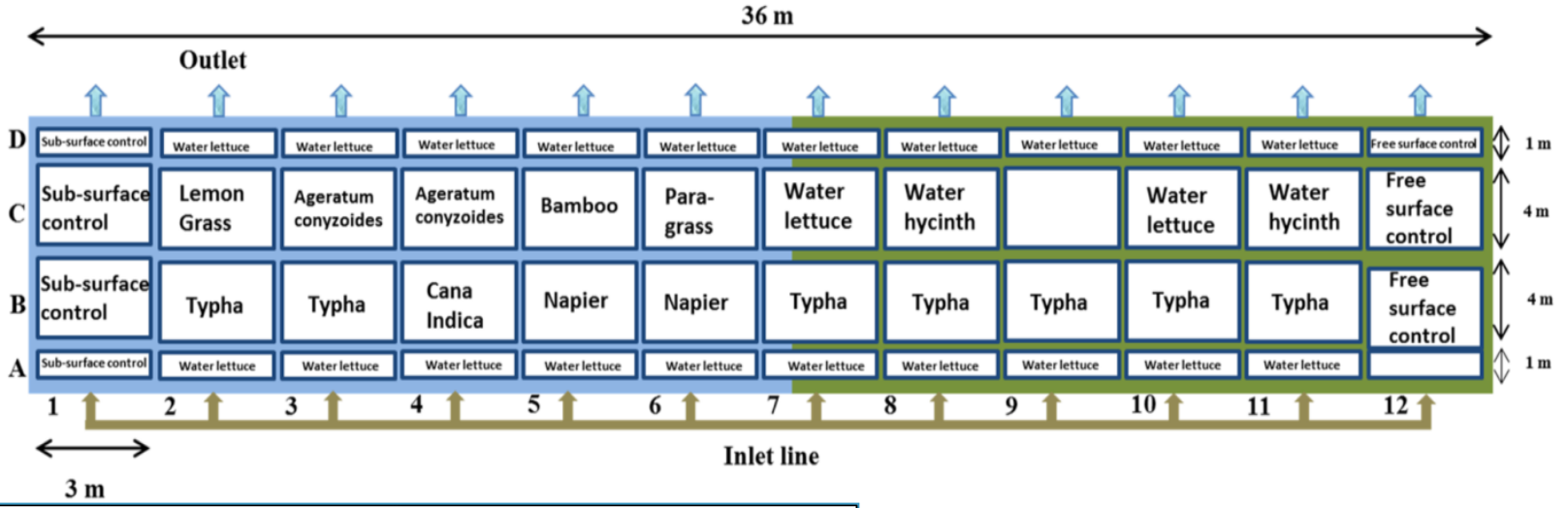


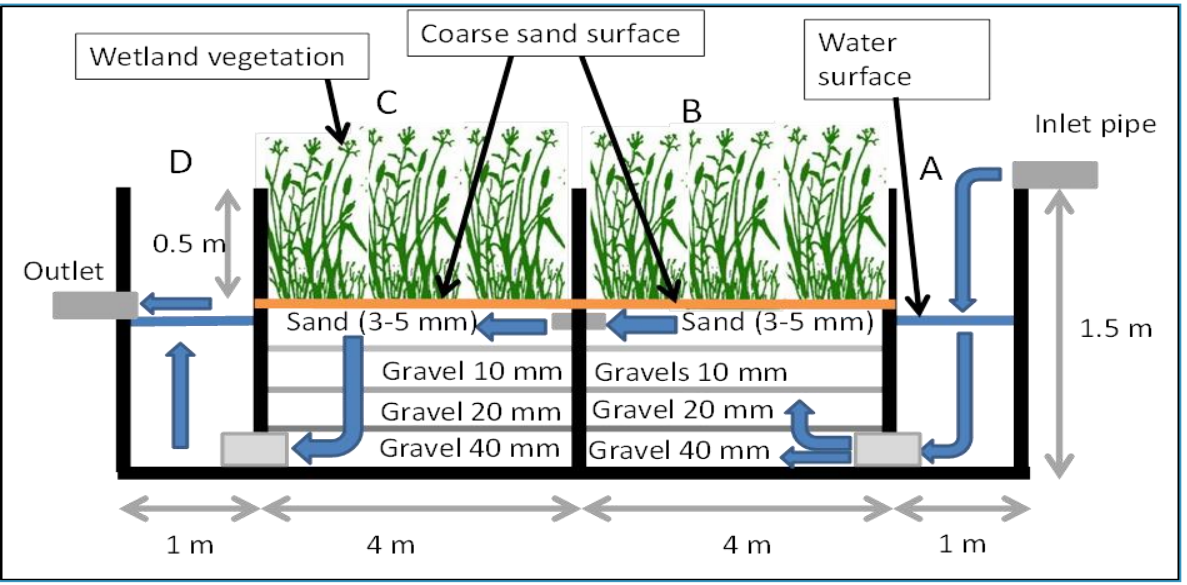
Objectives

1. **Objectives- Field scale CWs in ICRISAT campus**
   -Quantify treatment efficiencies of ICRISAT CWs.
   -Uptake capacity of Ageratum conyzoides and other wetland plants.
   -Determine wetland species-high and low N and P uptake.
   -Nutrient accumulation in coarse sand media.

1. **Implement learnings/conclusions of ICRISAT CWs in watersheds of Karnataka, Telangana, Gujurat and Madhya Pradesh (States of India).**

Decentralized Wastewater Treatment at ICRISAT CWs





- Wetland types
  - Free water surface flow
  - Sub-surface flow

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Performance monitoring

Monitoring parameters	Monitoring frequency
Water quantity (inlet and outlet)	Daily
Wastewater parameters	each week per month
Nutrient contents in coarse sand media and wetland plants	twice each month
Measuring oxidation-reduction potential (ORP)	each week per month

Monitoring parameters

1. **Wastewater-** pH, EC, TDS, TSS, NH_4-N, NO_3-N, phosphate, chemical oxygen demand (COD), sulphate, sodium adsorption ratio parameters (SAR), and heavy metals**.**

2. **Coarse sand-** Total C, N, P and K, sulphur, exchangeable Ca and Mg, heavy metals.

3. **Wetland plants-** Total N, P, and K, sulphur, Ca, Mg, Fe, and heavy metals.

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New plant species ICRISAT CW

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Wastewater (inlet and outlet) July 2014-August 2015

Parameters	Avg Inlet	OT1	OT2	OT3	OT4	OT5	OT6	OT7	OT8	OT9	OT10
NH_4-N (mg/L)	62	20	28	23	30	22	42	49	41	47	39
NO_3-N (mg/L)	2.65	5	1.88	1.71	1.95	2.14	1.41	1.45	1.41	1.72	1.93
Phosphate (mg/L)	15	9	5.7	4.5	8.24	4.45	3.52	5.17	4.92	3.89	3.93
COD (mg/L)	176	96	96	64	128	64	64	96	64	96	96
Sulphate (mg/L)	25	8.7	8.8	10.2	11.3	12.7	10.7	4.6	13.4	13.5	5.0

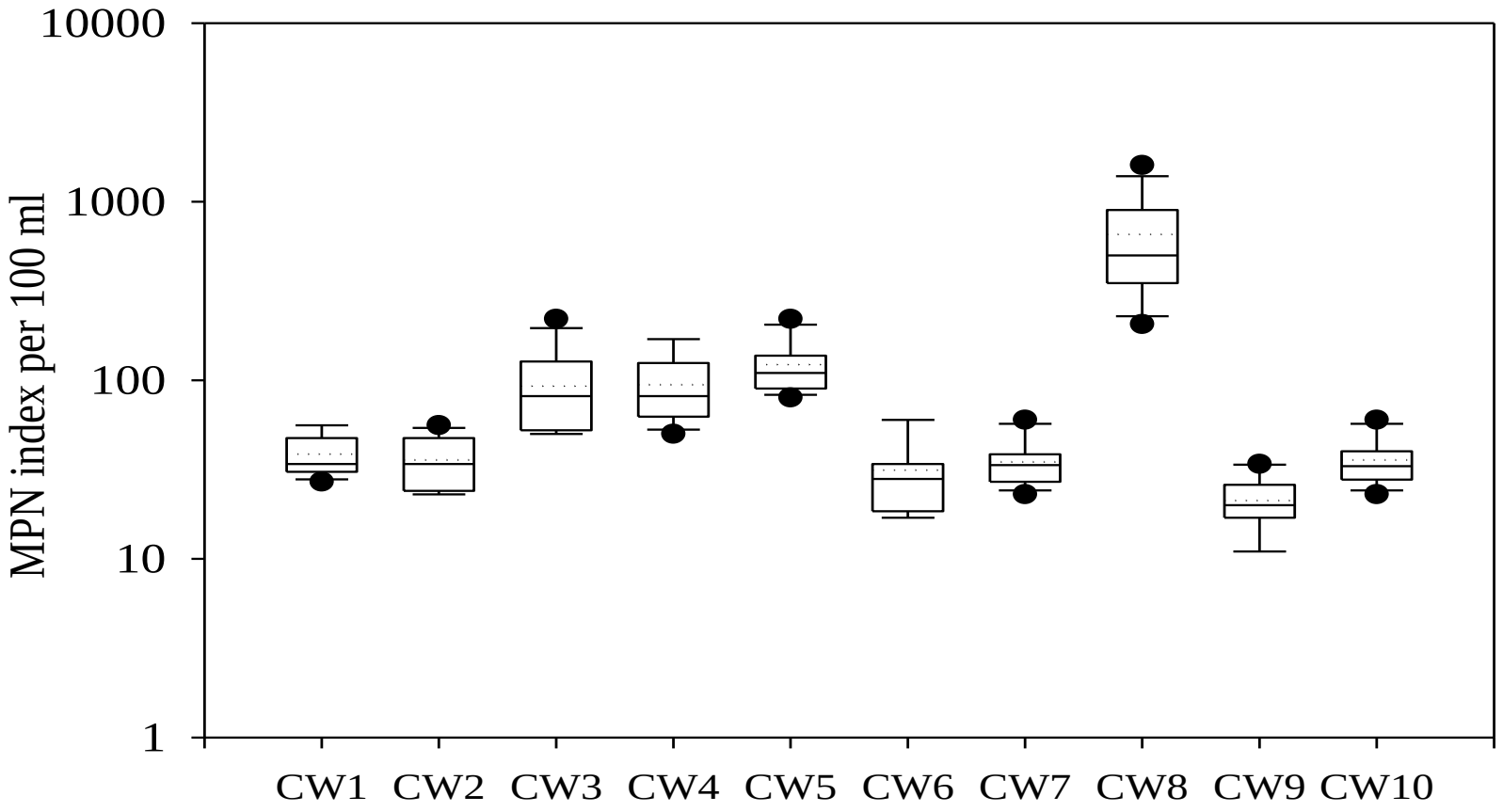
Nutrient accumulation CWs July 2014-August 2015

Nutrient accumulation	Subsurface treatments (1-5)	Free water surface treatments (6-10)
Total nitrogen (mg/kg)	242	228
Total phosphate (mg/kg)	138	144
Total sulphur (mg/kg)	7.5	33
Total potassium (mg/kg)	425	419
Available phosphate (mg/kg)	9	9

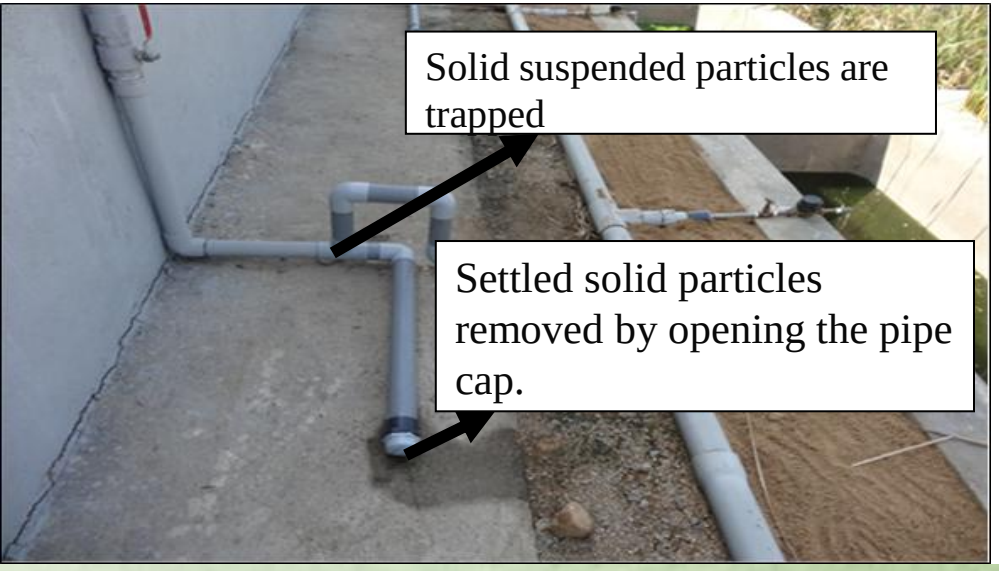
Nutrient accumulation CWs July 2014-August 2015

Wetland plant species	Average total nitrogen uptake (mg/kg)	Average total phosphorus uptake (mg/kg)	Average total sulphur uptake (mg/kg)
Typha latifolia	21725	2944	4153
Ageratum conyzoides	32608	4047	3938
Canna indica	27103	3455	1176
Lemon grass	18485	2798	773
Napier	16340	2335	1065
Water lettuce	35923	10173	4355
Water hyacinth	23678	5946	1691
Hybrid napier	21770	2603	1655
Bamboo	27918	1178	672
Marigold	21259	3537	2509
Paragrass	30495	6267	268

Pathogen reduction



Maintainence activities



Conclusions/Learnings

1. Treatment efficiency of major parameters
   - NH_4-N 21-68%; NO_3-N-19-47%;COD-27-64%; phosphate-40-74% and sulphate-46-82%.
2. Nutrient contents.
3. High nitrogen removal wetland plants.
4. High phosphate removal wetland plants.
5. Low nutrient removal plants.
6. Fodder value besides nutrient uptake.

Implementing learnings

States of India	CWs – Planned/completed
Andhra Pradesh	15
Telengana	6 (2 complete)
Karnataka	10 (1 complete)
Maharashtra	2
Uttar Pradesh	1 (complete)
Madhya Pradesh	1
Gujarat	1

Acknowledgement

Sincerely acknowledge the **efforts** of the entire wastewater team of ICRISAT-IDC as any field study is possible due to collaborative team work. Thank you IDC wastewater team members.

Field scale experiments using domestic wastewater and fresh water for irrigation

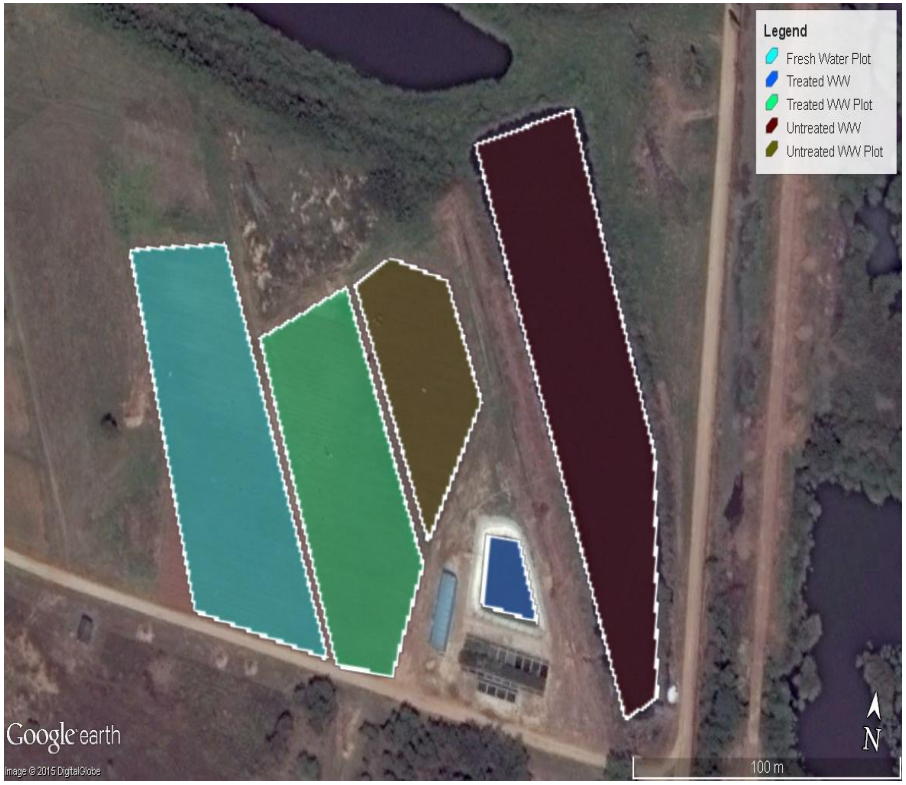
Objective: To assess effect of domestic wastewater as irrigation on crop and soil

Crops

- Maize – Chickpea – Veg
- Soybean – Sorghum - Veg

Water sources

- Domestic wastewater
- Fresh water



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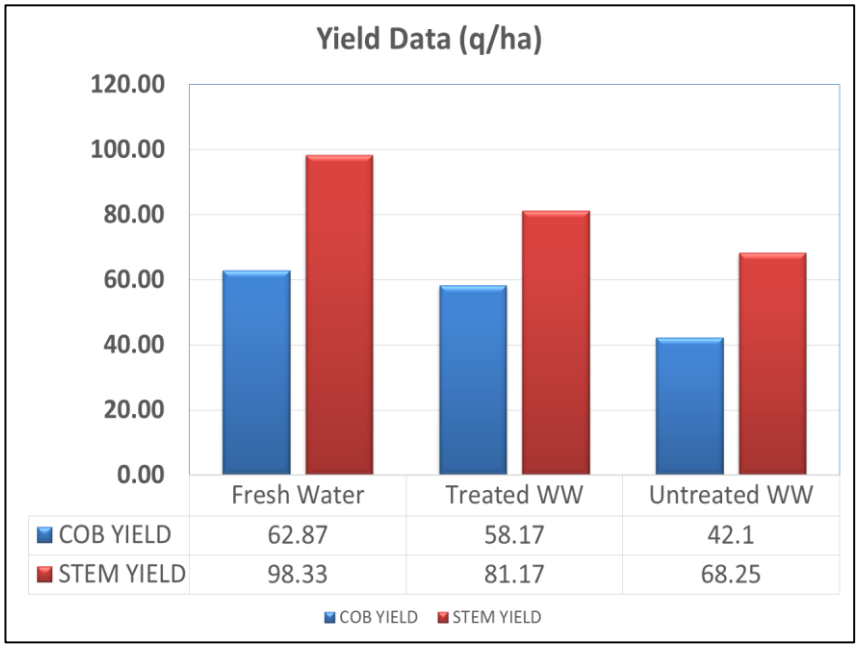
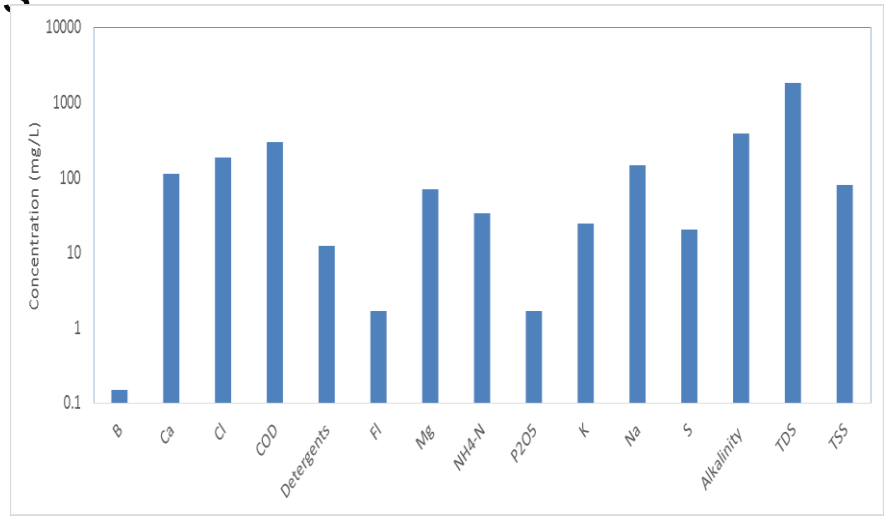
Field scale experiments



Work plan
Second crop season
Soil quality and crop growth parameters
Soil moisture monitoring

Decentralized Wastewater Treatment System at Kothapally Village

1. Source: ~500 households
2. Volume : Approx. 80 m^3 per day
3. Initial assumptions for designing the DWT
1. Average size of house hold = 5
2. Average daily use of water per person = 40 liters
3. Wastewater generation (percentage of water use) = 80%
4. Hydraulic retention time = 3 days
5. Width of wetland = 4 m
6. Depth of wetland = 0.8 m
7. Length of wetland- 21 m.



Decentralized Wastewater Treatment System at Kothapally Village

1. Number of CW : 2
2. Total capacity (3 days HRT): 40 m3/day
3. Filter media
1. Gravel 40 mm size
2. Gravel 20 mm size
3. Gravel 10 mm size
4. Sand
4. Vegetation
1. Canna indica
2. Typha