



*Advancing for a  
better tomorrow*

# 2019 SOUTH EAST ASIA SUGARCANE SUMMIT

JULY 7-10, 2019 | KHAO YAI, THAILAND







***Advancing for a  
better tomorrow***

## **Irrigation and drainage in a changing climate**

Robert Quirk

**75** years **AUSTOFT**

**CASE IH**  
AGRICULTURE

## The topics for today

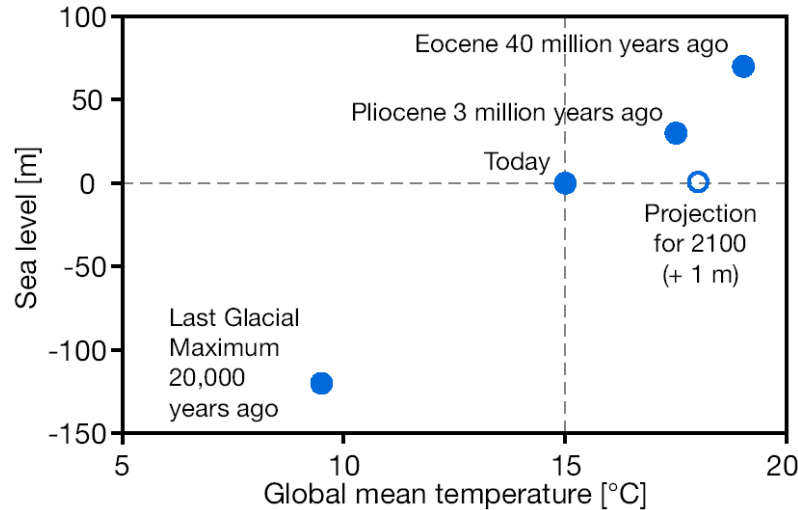
- Changing climate and how we will have to learn to deal with it
- Changing weather patterns will require a different approach than we have had in the past
- We will require better drainage even on elevated land
- Irrigation will become more necessary, and the effective use of our water will become more critical
- We can expect longer periods with out effective rainfall and more intense rainfall when the rains come
- Changing CO<sub>2</sub> levels?
- The mechanization of the industry

## Living with a changing climate

- The predictions of how quickly the climate is changing
- In the 1990's some predictions were made of where the climate / temperatures would be in 2030 these have already been reached
- Some areas around the globe will go from 3-5 days a year above 40°C to over 30 days. Last year some parts of Australia and India registered days up to around 50°C

# Long-Term ('Equilibrium') Sea Level Rise and Temperature: Paleo Data Indicates Approx. 20m per °C

Reference: WBGC Archer 2006



## Quirk Farm Characteristics

- Northern NSW, Australia, 28 Degrees South
- 106 Hectares
- 0.5 Metre above Mean Sea Level
- Average Rainfall 1600mm
- Marine Mud overlaid with 100mm Peat
- 16 km Drains / Reduced to 10 km
- 11.75% Average CCS
- Average production 7-9,000 tons





## Quirk Farm History

- Held in Family for 110 Years
- Growing Sugar for 80 Years
- “Full Circle” 1949 Green Cane Harvesting to Green Cane Harvesting Today



## Wet and Dry: Intense rainfall and longer dry periods



Difference in Drainage



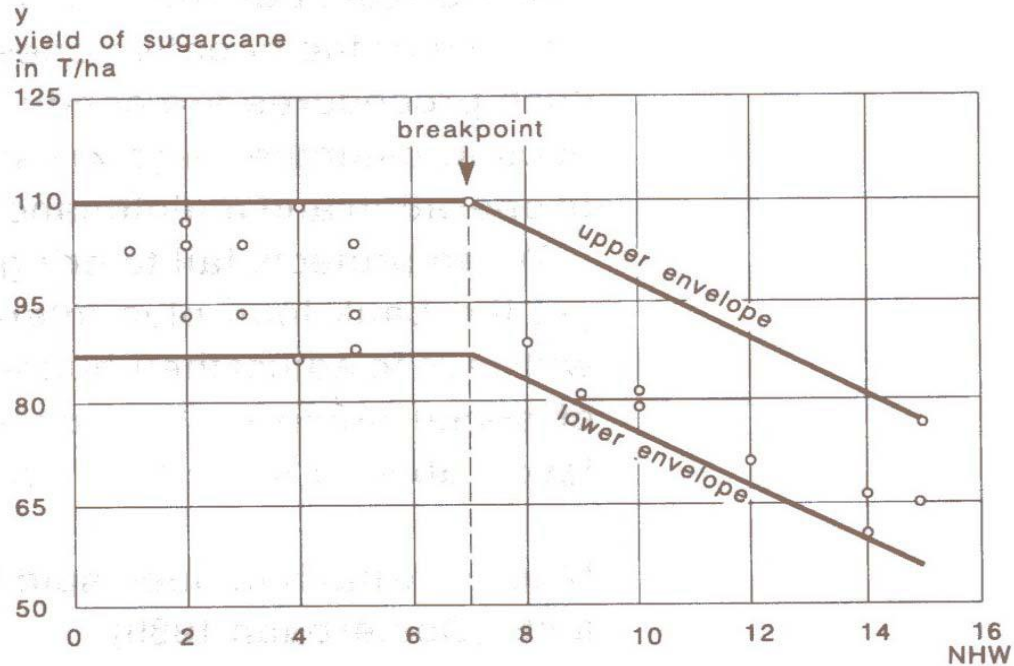
Flooding



Waterlogging



# Yield Response to Waterlogging



# Waterlogging

Water logging is the major obstacle for sustainable agriculture. Plants subjected to water logging suffer from substantial yield losses. Under natural environmental conditions, plants often get exposed to transient or permanent water logging. Flooding induces a number of alterations in important soil physiochemical properties like soil pH, redox potential and oxygen level. Thus, the plants growing on the waterlogged soil face the stressful environment in terms of hypoxia (deficiency of O<sub>2</sub>) or anoxia (absence of O<sub>2</sub>). These oxygen deficient conditions substantially hamper plant growth, development and survival. Plants under O<sub>2</sub>-restrictive environment exhibit metabolic switch from aerobic respiration to anaerobic fermentation.

*Waterlogging stress in plants: A review*

*Muhammad Arslan Ashraf, Department of Botany, University of Agriculture, Faisalabad.*

# Building Carbon Content

- Minimum Input Oats
- OM Incorporation
- Urea Application



## What we have changed

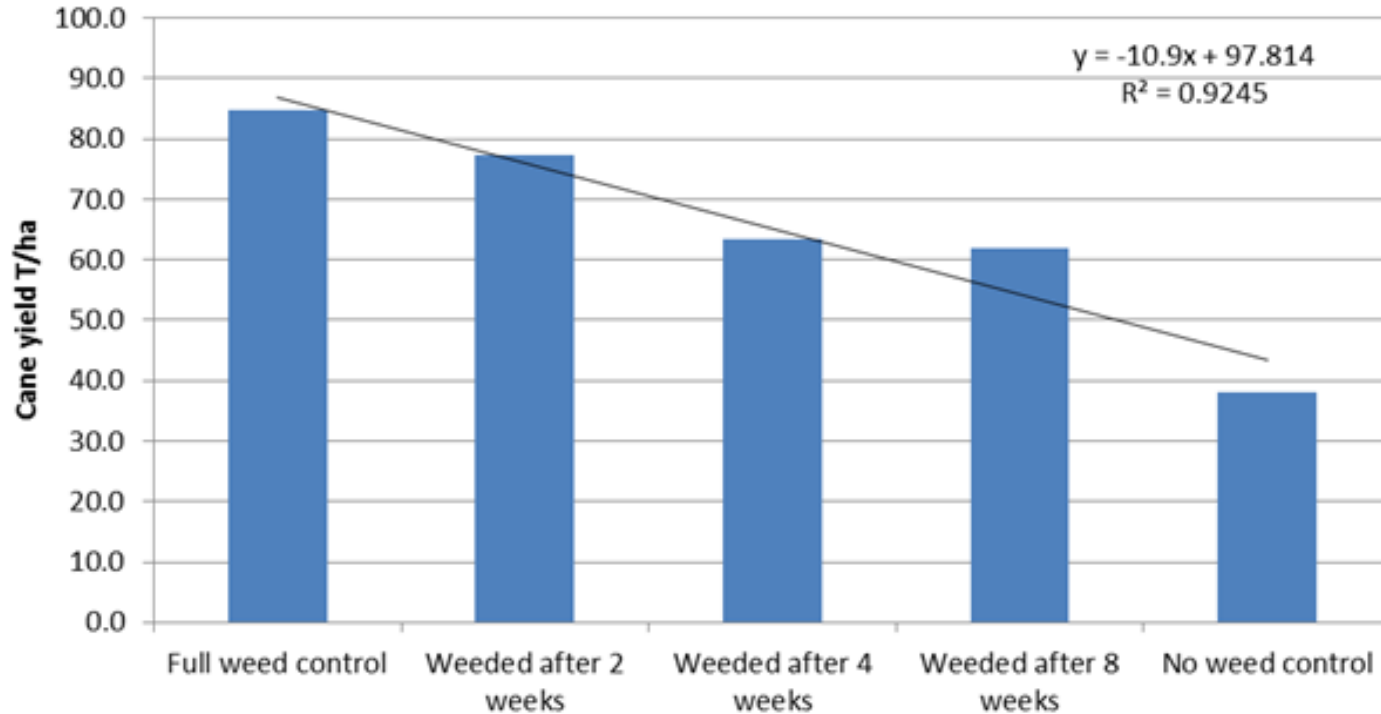




# Weed Control



## Effect of weed competition on cane yield (T/ha)







# Results of Changing My Farming System

- Flotation Almost Eliminated
- Fertiliser Application Reduced by 30%
- Herbicide Application Reduced by 50%
- Fuel Usage Cut by 47%
- Tractor Hours Reduced by 40%
- Labour Component cut by 66%
- Eliminated the Use of Phosphorous Fertilisers for 10yr
- OM Reduces the Discharge of Heavy Metals
- OM Promotes beneficial fungi
- OM helps provide bio available nutrients
- Macro-Fauna Introduced and Sustained
- Soil Biota Population has Positively Evolved and Increased
- Productivity Increased by 75%
- Unit Cost Decreased by 50%



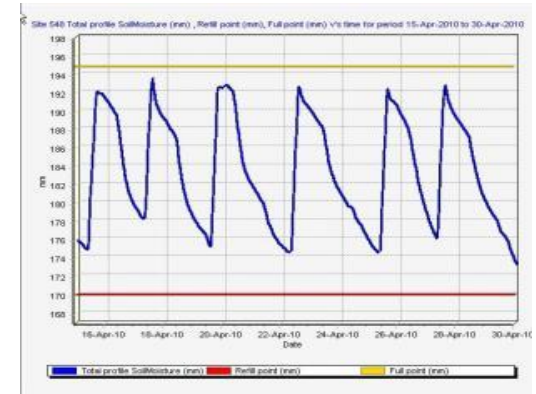
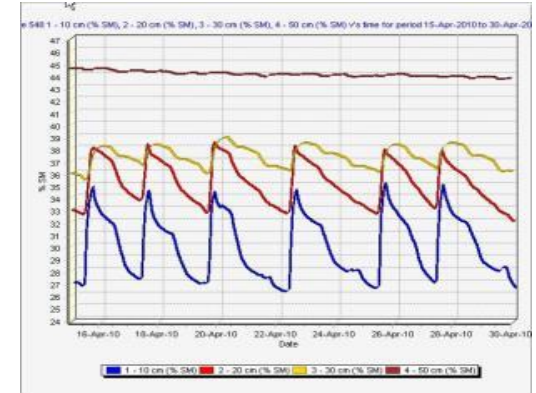


## Importance of Soil Moisture Management

- Can identify specific depth of root activity
- Match irrigation depth with rooting depth
- Correctly match plant water use with application
- Prevent over/under irrigation
- Ability to pulse irrigate to maximise lateral movement to:
  - Control deep infiltration
  - Reduce risk of nutrient leaching

## Crop Performance

- Improve stool recovery and stalk numbers/m
- Maximize stem elongation
- Maximize nutrient uptake and plant metabolism

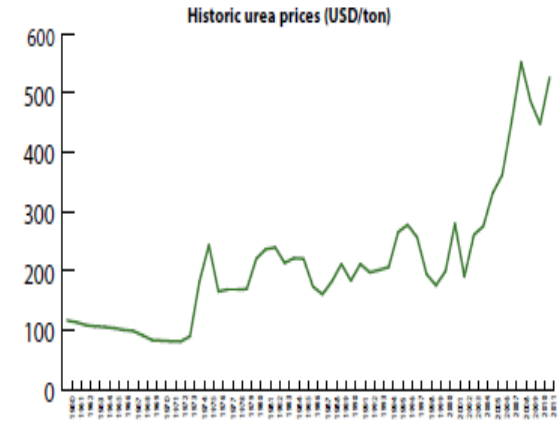


## Fertiliser Management

- Cost of fertiliser only goes one way = UP
- Potential legislation pressure to reduce rates applied
- Cost of application of fertilizers (fuel, labour, machinery)

### Benefits of Drip

- Fertiliser use efficiency is very high = 85%+
- No run-off or leaching following high rainfall event
- Essential elements are placed where roots are most active
- Scheduling can be used to match product and rate with crop growth stage
- Injection systems can be automated
- Potential to maintain yield with reduced level of inputs



Source: Agricultural Prices, National Agricultural Statistics Service, USDA.

## Trash Blanket

- Trash blanket production can reduce irrigation requirements
- Social or political pressure may restrict ability to burn cane, pre and post harvest
- Trash on wet soils can restrict stool recovery
- Flood/overhead irrigation can create water logged situations
- SDI system suits trash blanketing practice as water is applied in root zone
- Hydrogen Peroxide can be applied to aerate root zone



# Key Industry Drivers that Influence Sugar Production and Potential for Drip

- Cost of water
- Environmental legislation and challenges
- Cost of pumping (where applicable)
- Implementation of trash blanket production
- Precise crop management practices
- Change in cultivation/cropping system;
  - Minimum tillage
  - Controlled traffic

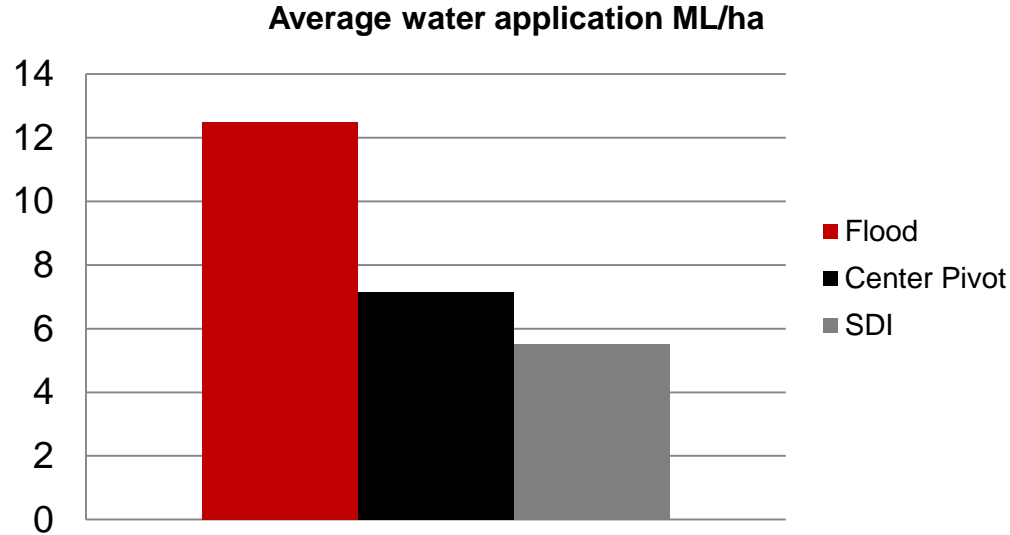




## Efficient use of natural resource - Water

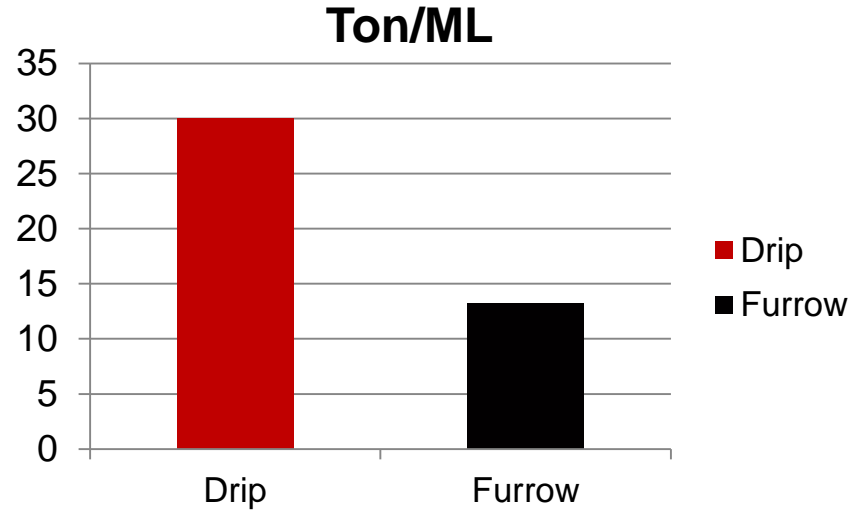
- Irrigation can be controlled to manage sugar content in cane
- Irrigation can be applied to enhance stool recovery post harvest
- Fertilizer can be applied to stimulate young shoot growth
- Alternative products could be considered that enhance stool recovery (e.g. Hydrogen Peroxide)

## Water Use Efficiency (ML/Ha)



Water Consumption will change according to rainfall and temperature variation

## Water Use Efficiency (ML/Ton)



- 30 ton cane / ML on SDI system(average yield 165 ton/HA)
- 13.2 ton cane / ML on equivalent yielding flood system

## Robert Quirk

- Over half of the global crop is still manually harvested
- Commercial and environmental considerations are dictating a transition to mechanical harvesting
- Robert Quirk has been managing this transition over the last 40 years.





# Harvester Losses Solutions

- Maintenance
  - Sharpening/replacing



# Harvester Losses Solutions

- Positioning
  - GPS



# Yield Decline Solutions

- Row Width
  - Match machinery track width to row pitch





# Yield Decline Solutions

- Compaction
  - Minimise ground pressure



END