Sugarcane, Water Tables, and Best Management Practices in the Everglades Agricultural Area

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General BMP Principles

Phosphorus moves with the drainage water.
General BMP Principles

P moves with drainage water.

Therefore,

• Let excess water be removed more by evapotranspiration and seepage, and less by pumping.
General BMP Principles

P moves with drainage water.
Therefore,

• Let excess water be removed more by evapotranspiration and seepage, and less by pumping.

• Reduce pumping rates if you must pump.
General BMP Principles

Phosphorus is made available by microbial oxidation of the soil.
General BMP Principles

P is made available by microbial oxidation of soil.

Therefore,

• The more we can reduce rates of soil microbial oxidation (soil subsidence), the more we can reduce P discharge.
General BMP Principles

Management practices for BMPs often are similar to management practices to control microbial oxidation and conserve soil.
General BMP Principles

BMP Management ≈ Soil Conservation
Practices Management Practices
General BMP Principles

Not moving water to public canals, which often means:
General BMP Principles

• Keep fields flooded
• Keep water tables near the surface
Purpose of Presentation

• Report research results that help sugarcane growers in Florida:

Meet BMP Regulations

and
Purpose of Presentation

Meet BMP Regulations
and
Conserve their Muck Soils
While
Purpose of Presentation

Meet BMP Regulations
and
Conserve Muck Soils while
Optimizing Yields
Sustainable Agriculture

√ Meet BMP Regulations
√ Conserve Muck Soils
√ Optimize Yields
Wet Conditions

√ Meet BMP Regulations
√ Conserve Muck Soils
x Optimize Yields
Can Research Help?

Improve Sugarcane Yields under Wet Conditions
Lysimeter Research
16 Fiberglass Lysimeters

6 ft x 10 ft x 3 ft deep
Two Key Time Periods

1. After June 1 or after sugarcane covers the row

2. Before June 1
After June 1
Summarizes about 10 years of results.
Therefore most findings and recommendations are with confidence.
After June 1

Key Results
Yield Gains from Flooding

• Repeated cycles of 4-days flood followed by 12 days drainage to 20” may moderately improve yields.

• Can say confidently that 2-day floods will increase yields.
Yield Gains from Flooding: Needs for New Research

• How much longer than 2-4 days can we flood and still have yield gains?

• Can drainage be less than 20” from the soil surface?

• What is the minimum duration of drainage needed between floods? < 12 days?
Sustain Yields with Flooding

Flooding for up to 2 weeks is not harmful (no yield gain, no yield loss) if drainage depth is about 20 inches below the soil surface and if drainage duration between floods is at least 1 week.
Why Yield Losses?

Flooding gets all the attention, but flooding of < 2 weeks is not what is causing yield losses. Rather, it is long-duration exposure to water-table depths of about 6 inches below the soil surface that is causing yield losses in sugarcane.
Summary of Research on Flooding Sugarcane:

• Rob Gilbert and others have shown that 3 months of flooding reduces yields.
• My research has shown that up to 4 days of flood is beneficial and 2 weeks of flooding is neutral to yields.
Flooding to Sustain Yields

Need for New Research:

• How much longer can we flood beyond 2 weeks without yield losses?
Flooding to Sustain Yields
Need for New Research:

• Can drainage duration between floods be for less than 1 week?
• 6” drainage depth is bad; 20” is good. Is there a point between 6 and 20” drainage depth that would support optimum yields?
Summary—After June 1

Rainfall→Floods for 2 - 4 days

√ Meet BMP Regulations
√ Conserve Muck Soils
√ √ Optimize Yields
Summary - After June 1

Rainfall → Floods for 4-14 days

√ √ Meet BMP Regulations
√ √ Conserve Muck Soils
√ Optimize Yields
Summary-After June 1

Drain water to 20” below surface; do not drain to only 6”

Meet BMP Regulations
Conserve Muck Soils
√ Optimize Yields
Before June 1
Before June 1

- This research has only 2 years complete. Still sorting out variable results. Results and recommendations are not clear. Need for more research is crucial.
Early Flooding

No Early Flooding
Young Cane Plant-Cane Crop

If water table is managed at 16”, expect cane yields to decline if there is flooding. The longer the flood duration from 0 to 6 days, the greater the decline in cane yield.
Young Cane Plant-Cane Crop

If water table is managed at 6”, expect no loss in cane yields after flood durations up to 6 days.
Summary—Before June 1
Plant Cane

Rainfall→Floods for 2 - 6 days
Drainage to 6”

✓ Meet BMP Regulations
✓ ✓ Conserve Muck Soils
✓ ✓ Optimize Yields
Young Cane
First Ratoon

Flooding for 2 - 4 days had higher cane yields than floods of 0 or 6 days.
This was true for both drainage depths: 6 and 16”.
Young Cane
First Ratoon

If no flooding, the 16” water-table depth had higher cane yields than 6” water-table depth.
Summary—Before June 1
First Ratoon

Rainfall→Floods for 2 – 4 days
Drainage to 6”

√ √ Meet BMP Regulations
√ √ Conserve Muck Soils
√ √ Optimize Yields
Summary - Before June 1
First Ratoon
Rainfall → Floods for 2 – 4 days
Drainage to 16”

√ Meet BMP Regulations
√ Conserve Muck Soils
√ √ Optimize Yields
Summary - Before June 1
First Ratoon

No Rainfall/No Flooding
Drainage to 16"

√ Meet BMP Regulations
Conserve Muck Soils
√ √ Optimize Yields
Why is Sugarcane Moderately Tolerant to Flooding and Water near the Soil Surface?
Reasons for Sugarcane Flood Tolerance

Stalk Aerenchyma

Some Wild Ancestors Adapted to Wet Conditions

Growers and Researchers have been selecting flood tolerant varieties for decades
Aerenchyma
Saccharum Spontaneum
Thank You

What Questions do You Have?