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PLANT EMPOWERMENT

*Optimizing Irrigation to
Maximize Crop Performance*



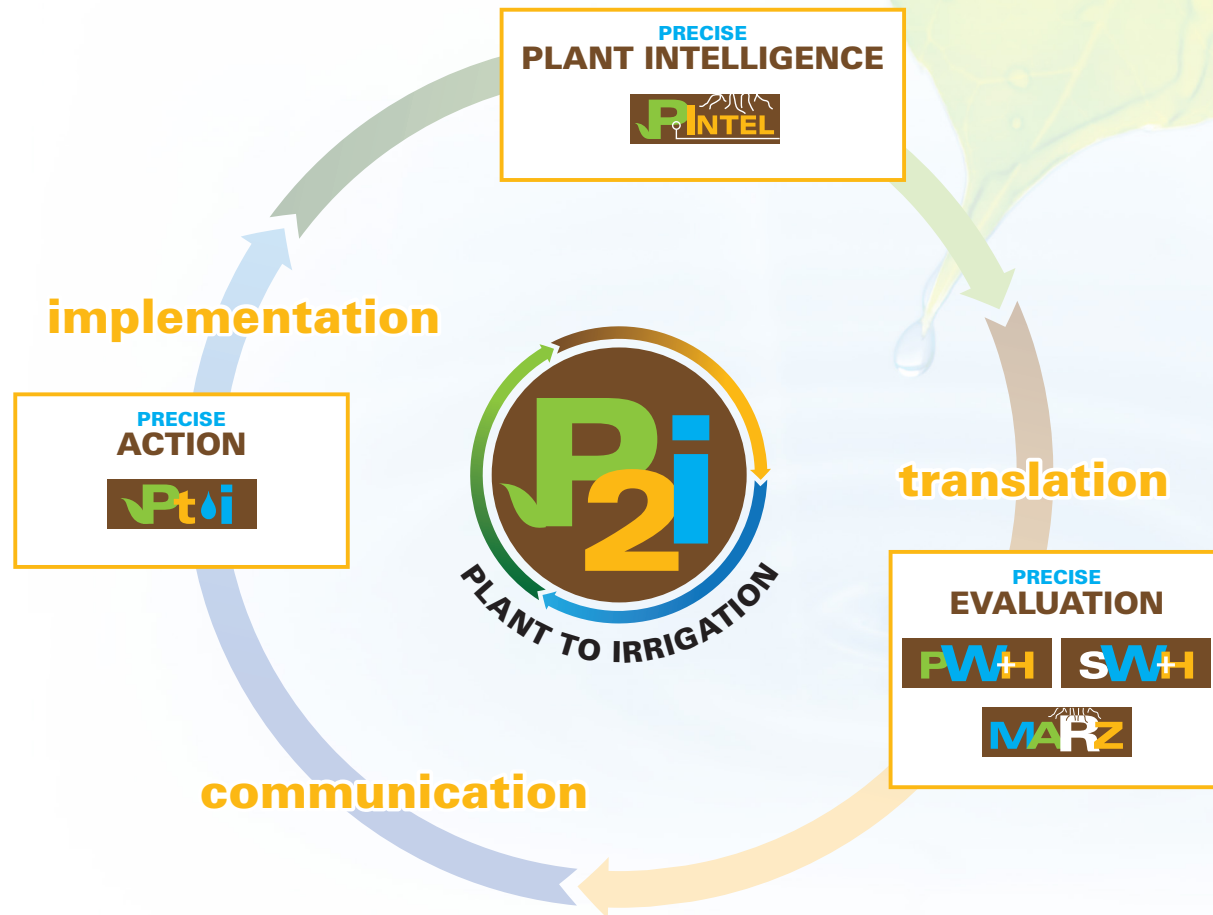
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Changing The Way Your Farm Operates



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Plant Empowerment Cycle





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The Fact of the Matter

The traditional irrigation practice of alternatively flooding and drying out is counter productive

- Upsets the sensitive balance of the environment that the plants, and their roots, live in
- Induces plant stress which undermines
 - **Yield potential**
 - **Quality targets**
 - **Harvest timing**



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Traditional Irrigation Decisions

Human Interpretations

- Prescriptions
 - Predictive Environmental and Weather Station Models
- Physical Plant Symptoms
 - Wilted Plants
- Growth Stage
- Previous Year's Success/Failure
- Instinct

KEY POINTS

- Humans try to out guess the needs of the plant
- Untimely irrigation decisions are costly



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Traditional Irrigation Decisions

What are the shortfalls?

- Unnecessary short and long-term plant stress
 - Irrigation Amount/Duration: *Too much or too little*
 - Irrigation Timing: *Too soon or too late*
 - Plant Nutrition: *Too deep or bad timing*

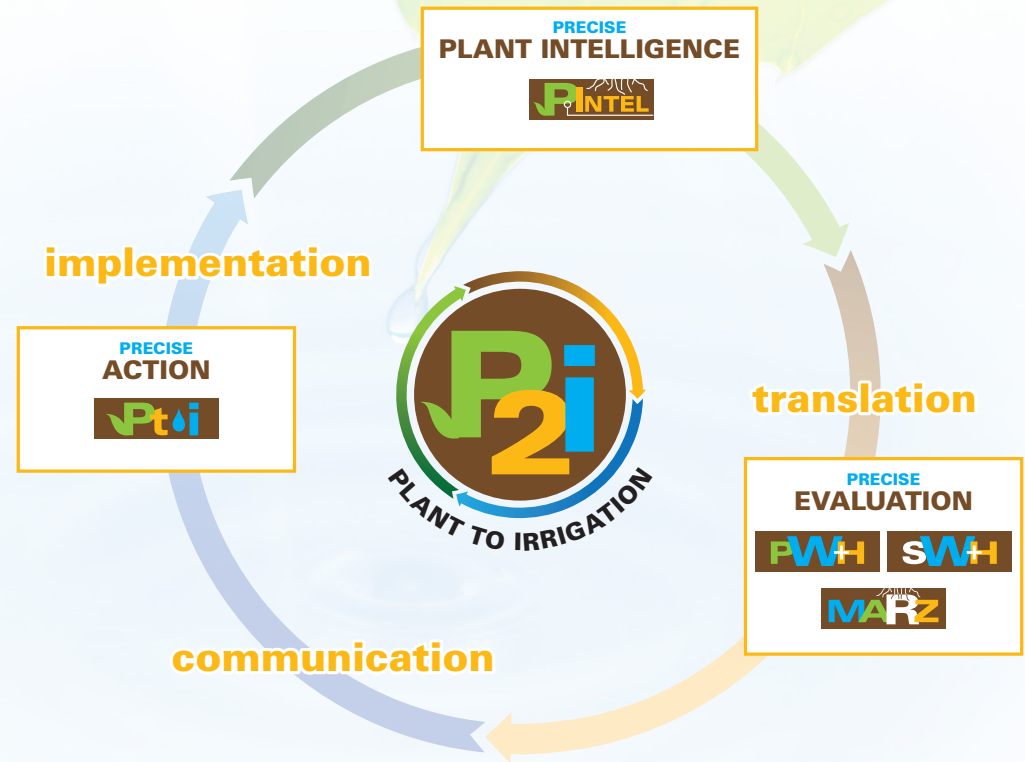
KEY POINT

➤ Traditional irrigation does NOT address the plant's real-time needs

Thoughts on Irrigation

KEY POINTS

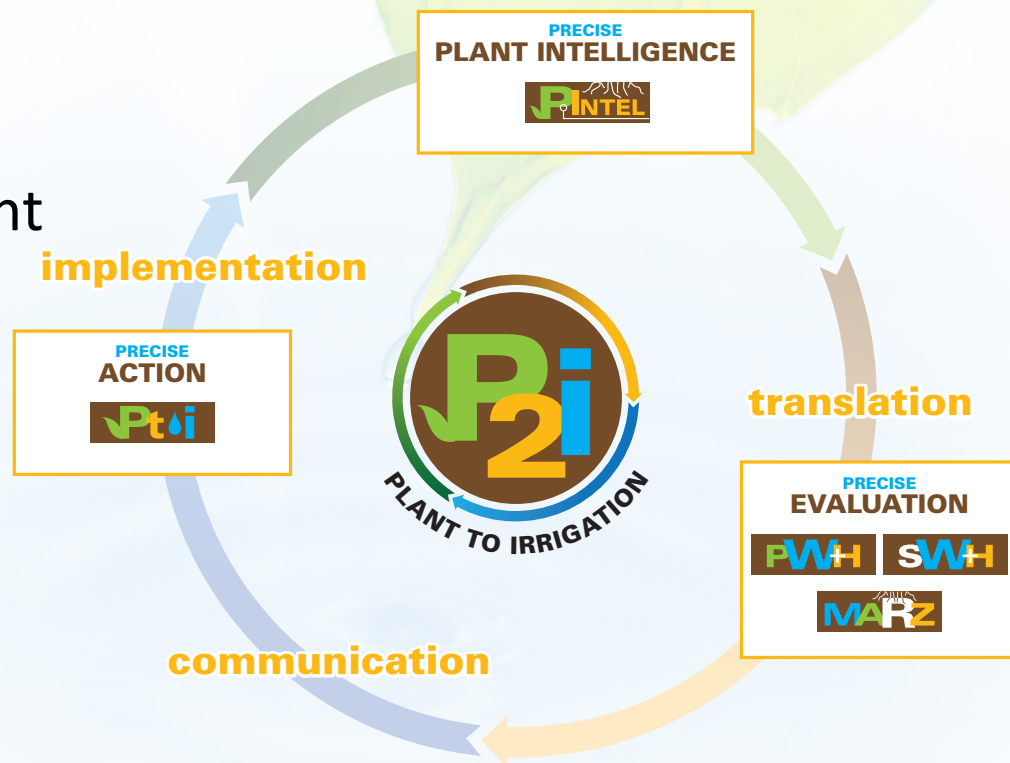
- Irrigation is an investment
- Irrigation deserves thorough understanding and management expertise
- How do we use irrigation to maximize returns?



Plant Empowerment Cycle

Core Elements

1. Precise Plant Intelligence
 - Translated from the plant
2. Precise Evaluation
 - Communicated to the machine
3. Precise Action
 - Implemented back to the plant



KEY POINT

- Put into practice to meet the precise crop needs—instantly

What are the principles behind this methodology? Where do we start?

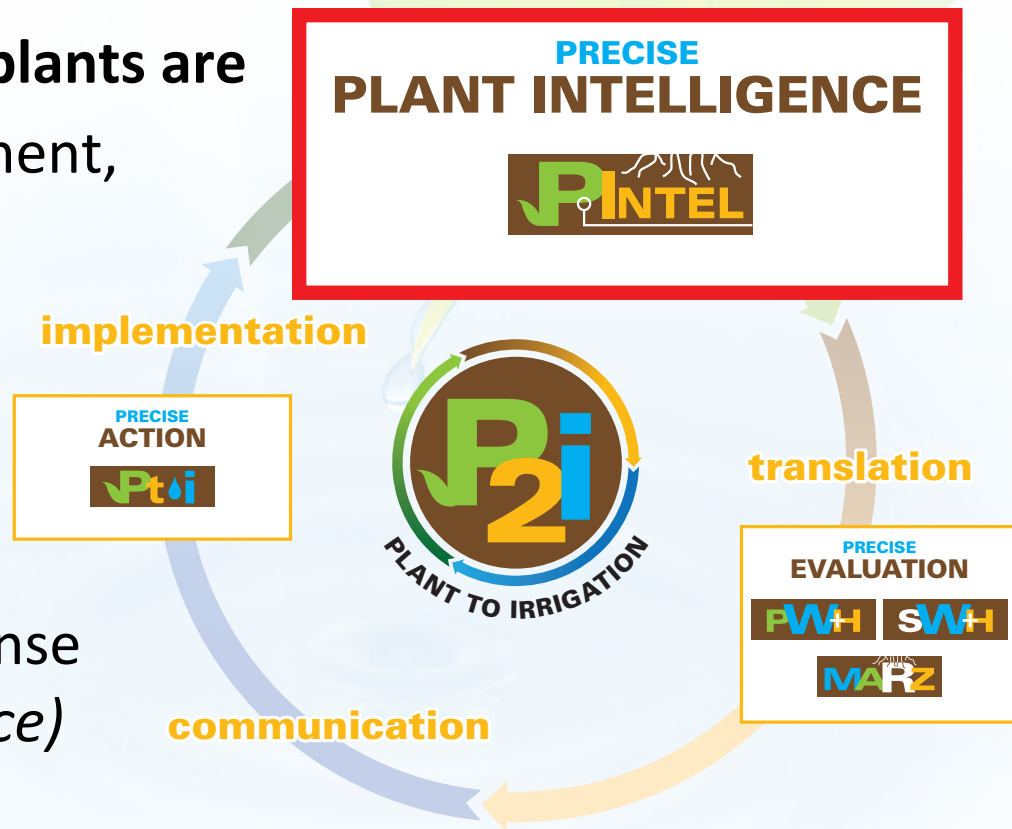
1) Precise Plant Intelligence

We accept the premise that plants are

- Aware of their environment, instantly adapting to changing conditions

...and that their root system

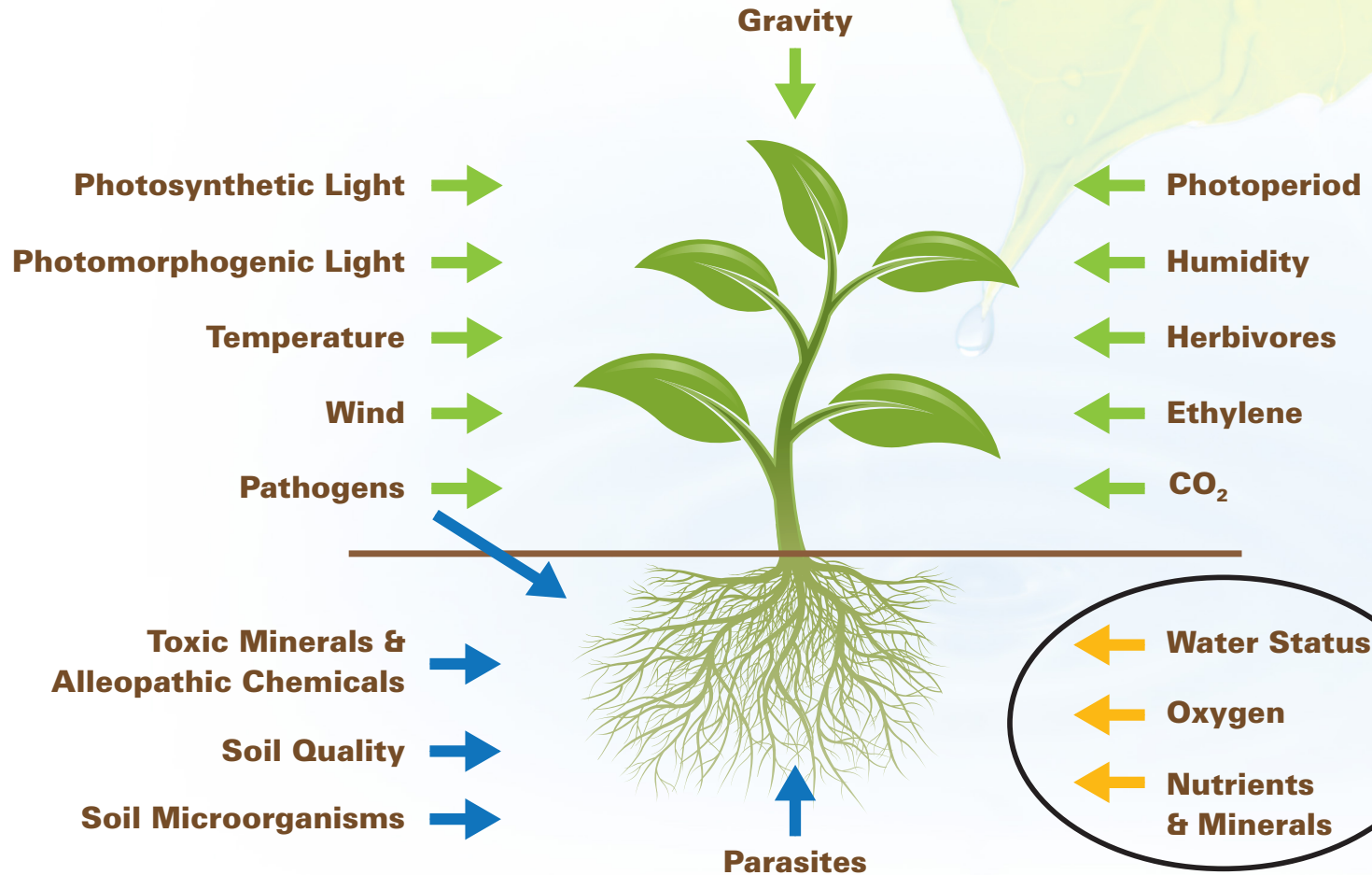
- Acts as a nerve center playing a key roll in formulating plant response (*underground intelligence*)



KEY POINT

➤ Plant Intelligence is **WHAT** drives irrigation decisions

Interrelated Plant Senses





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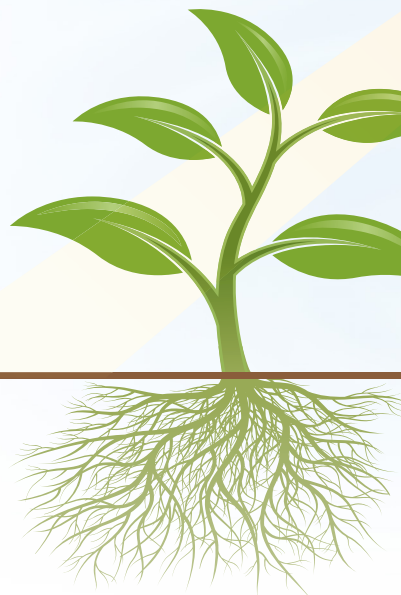
The Intelligent Plant

PLANT GROWTH

The plant grows best when
PHOTOSYNTHESIS, **RESPIRATION**,
and **TRANSPIRATION** are in balance.



Water + Oxygen Balance
Nutrient Location



Light
Carbon Dioxide

=> **PHOTOSYNTHESIS**

Oxygen

=> **RESPIRATION**

Water

=> **TRANSPIRATION**

← Water

← Nutrients

Uptake by
root hairs



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2) Precise Plant Evaluation

With our patent-pending analytics, we translate information from the Intelligent Plant to perform Precise Evaluation

The most important analytic factors:

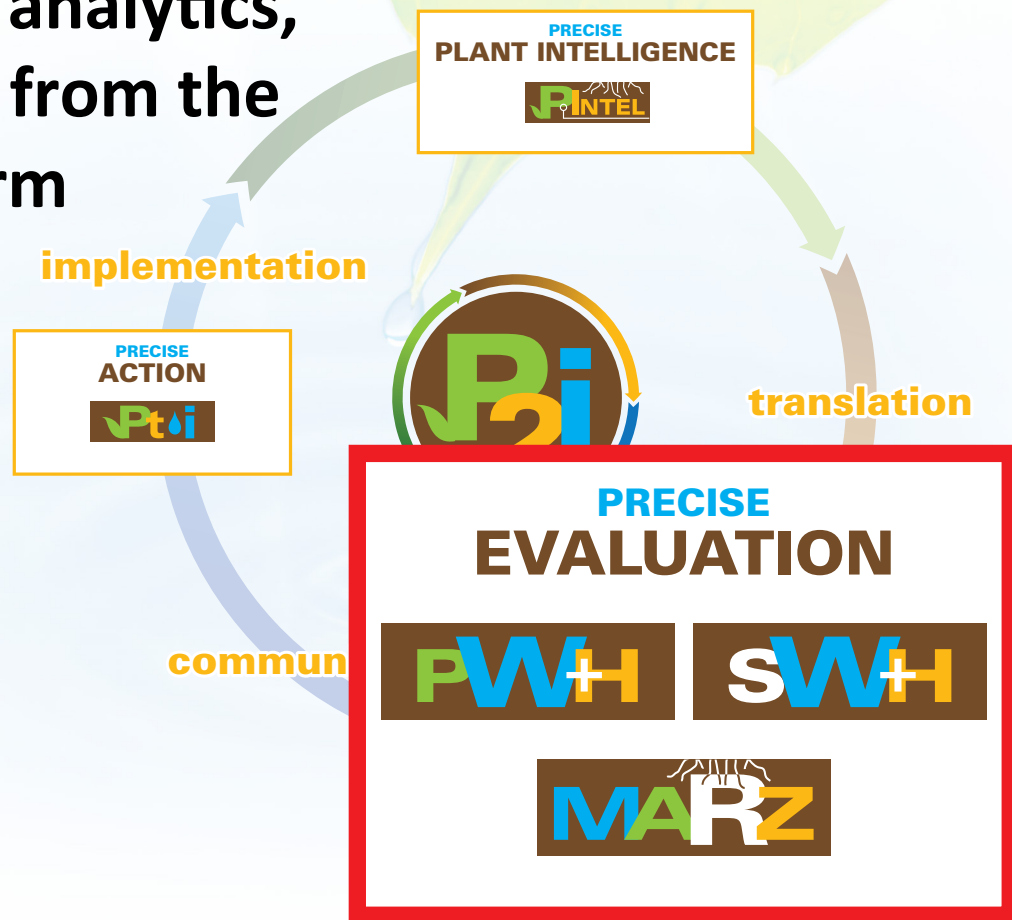
A.Plant Water Health

B.Soil Water Health

C.Most Active Root Zone (MARZ)

KEY POINT

➤ Precise Plant Evaluation is WHY we make irrigation decisions



A) Plant Water Health

***Plant Water Health* is the indication of when the plant needs water**

- Science and practice of understanding plant intelligence
 - Proper water and oxygen ratios maximum root performance
 - Positive and negative effect on the plant's performance
- Defined as a real-time condition
 - Plant's yield potential is measured against the effects/impact of water stress (i.e. oxygen deficit and/or water deficit)
 - Duration of the stress

KEY POINT

➤ Overcoming the succession of soil moisture stress related factors that limit plants from achieving their full genetic potential.



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B) Soil Water Health

***Soil Water Health* is when the soil is out of balance**

- **Healthy soil = proper water and oxygen balance**
 - Computations enhance crop production
 - Oxygen Deficit Stress – Root systems require oxygen for respiration to carry out their functions
 - Water Deficit Stress – When the water supply to roots become limiting, or transpiration rate becomes intense
 - Measurables take place within the Most Active Root Zone (MARZ)

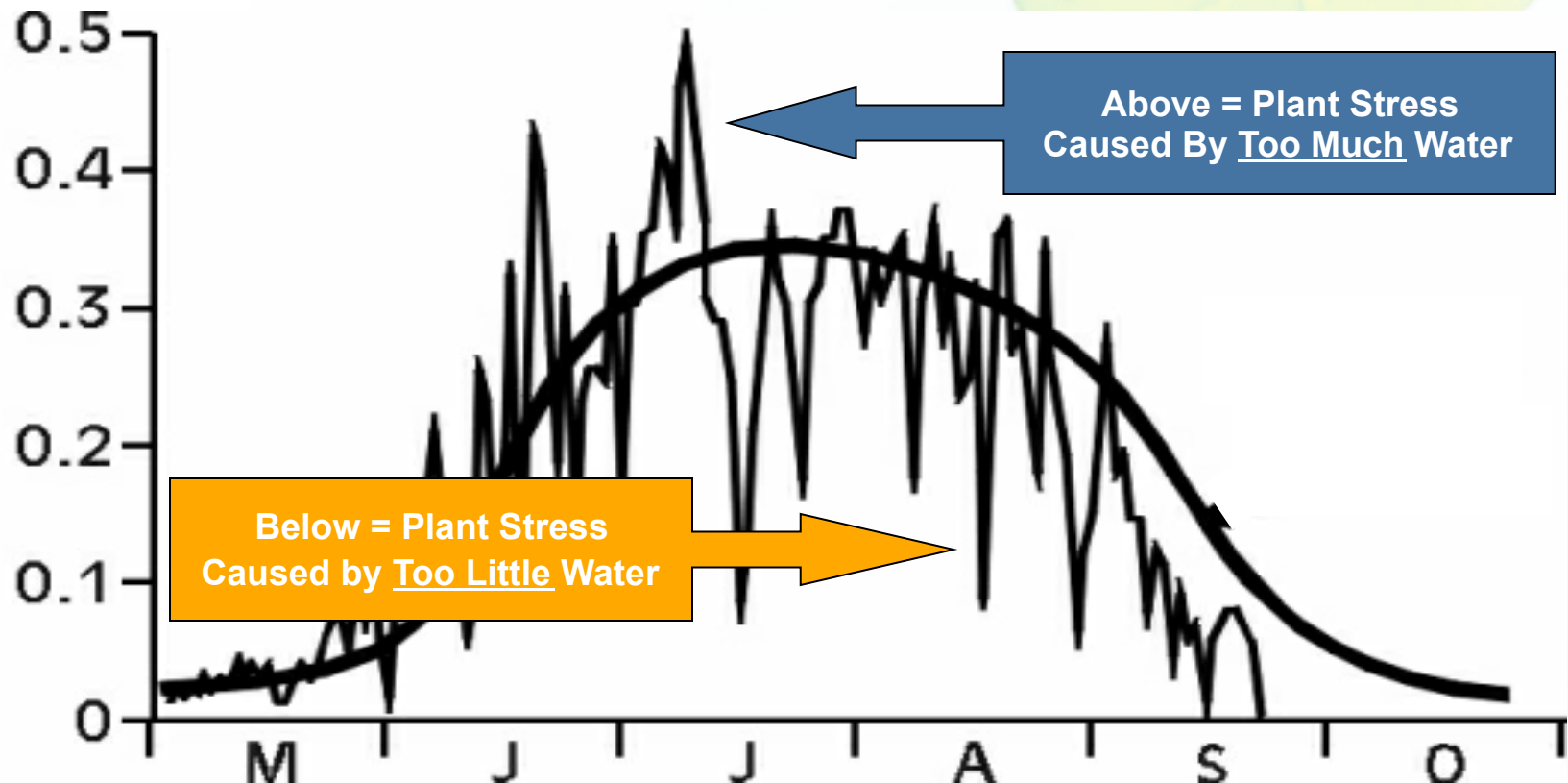
KEY POINTS

- When water & oxygen imbalances occur - the plant is unable to optimize production
- Successful agriculture depends upon proper *Soil Water Health*



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Plant Stress Management



KEY POINT

- The goal is to tightly manage irrigation to the optimal needs of the plant.



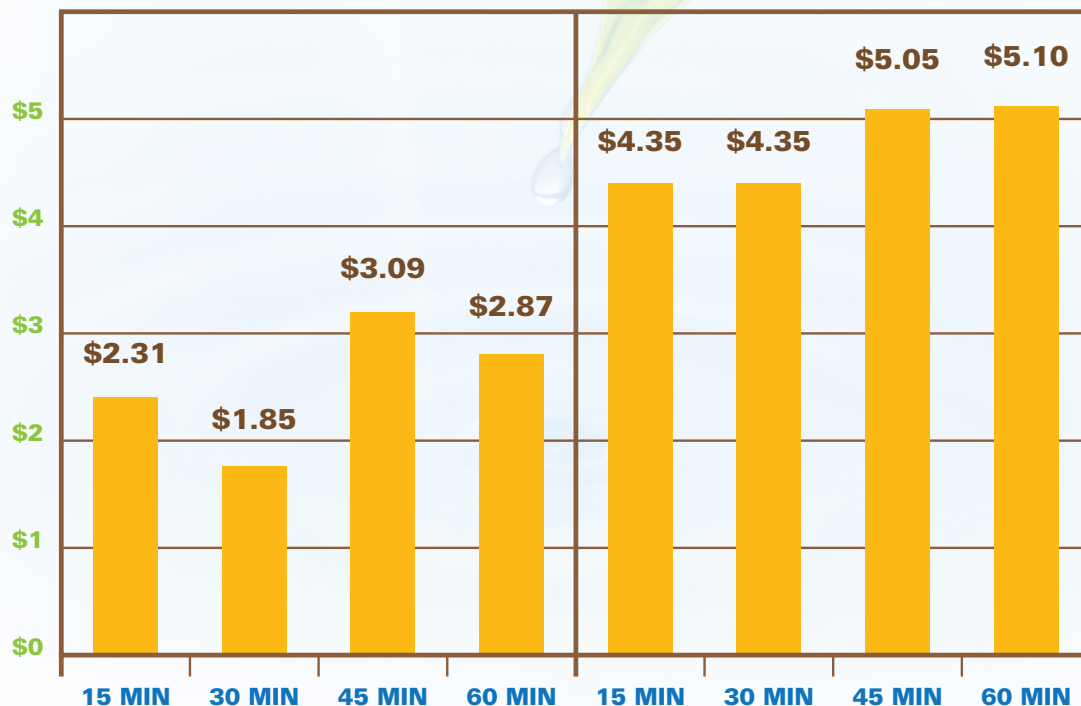
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Why Plant Stress Matters

KEY POINTS

- Not optimizing plant productivity has a cost
- Opportunity costs are calculated 96 times per day

OPPORTUNITY POTENTIAL 100% STRESS FREE





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B) Most Active Root Zone



KEY POINT

- MARZ is the indication of WHERE the plant needs water



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2) Precise Evaluation

When we precisely determine the plant's needs related to the ***Most Active Root Zone (MARZ)***, we dramatically improve ***Plant*** and ***Soil Water Health*** in order to reduce ***Plant Stress*** on the crop.





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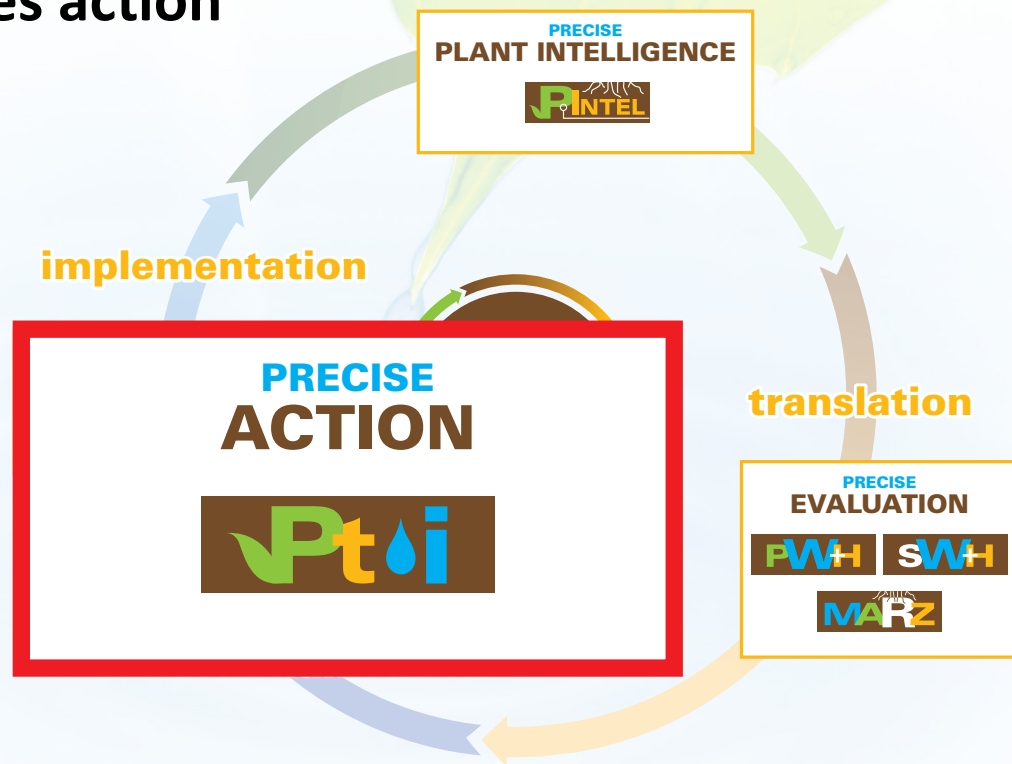
3) Precise Action

***Plant Triggered Irrigation* takes action without human intervention.**

—Meet precise crop demands for water without the side effects of negative plant stress

—Supports real-time communication between...

- The growing plant (P)
- Action taking irrigation machines/devices (I)



KEY POINT

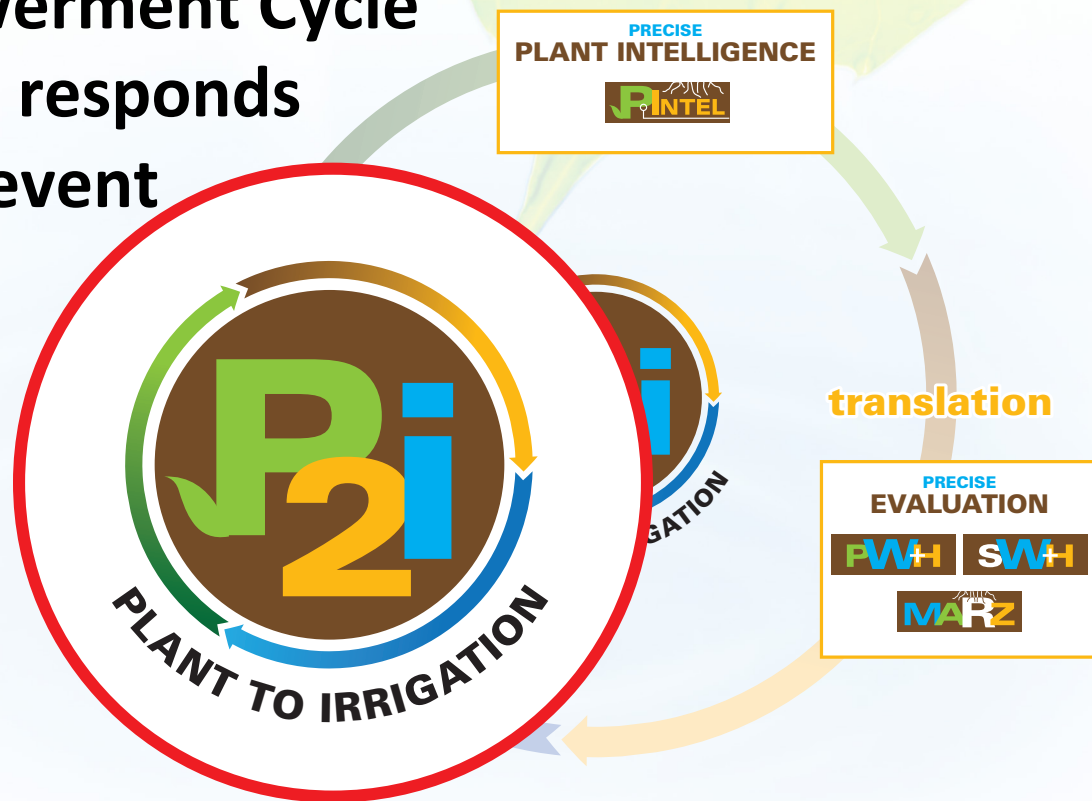
➤ Plant Triggered Irrigation is **HOW** we implement irrigation

Plant to Irrigation (P2i)

Once the Plant Empowerment Cycle is completed the plant responds to a precise irrigation event

KEY POINT

➤ The P2i system is designed to do it all over again in real-time

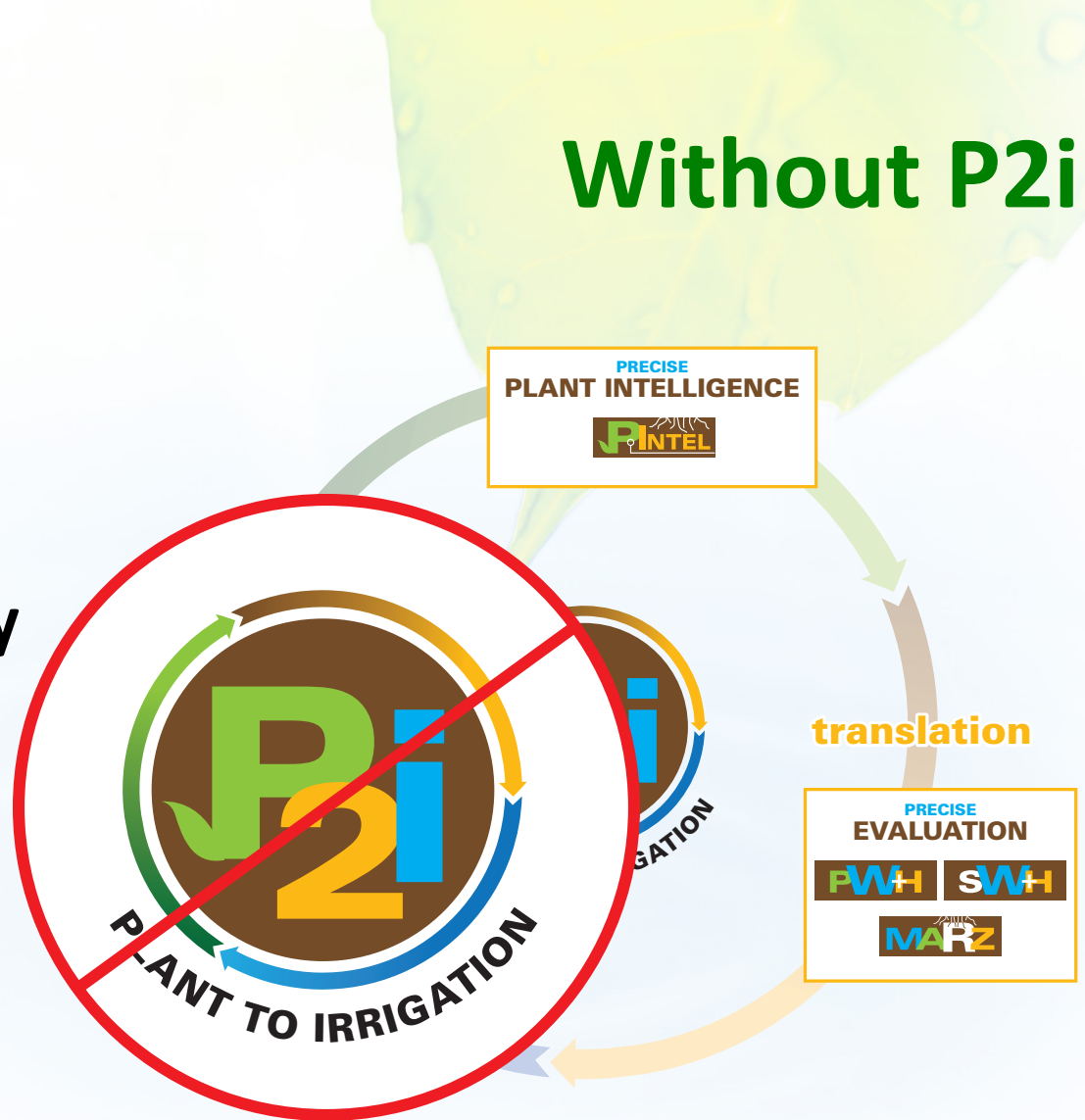




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Without the P2i process:

The precise and timely application of water to meet precise plant needs—that reduces crop stress for improving yields—*would be impossible!*





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Ag Management Strategies

Every Ag Management Strategies project we conduct

- Permits growers to see and grapple with
 - Yield Impact principles
 - How to bring this opportunity to life
- Designed for any grower seeking to
 - Set goals early
 - Achieve long-lasting success

KEY POINT

➤ It's a dramatic departure from the vast majority of analyses available to growers. Here's why...



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Ag Management Strategies

51 Ag Management Strategies projects were conducted in multiple states for 2015

- If we were able to reduce *Plant Stress* completely yield/revenue improvement of 37.6% is potentially available

Yield Impact Analysis
37.6%

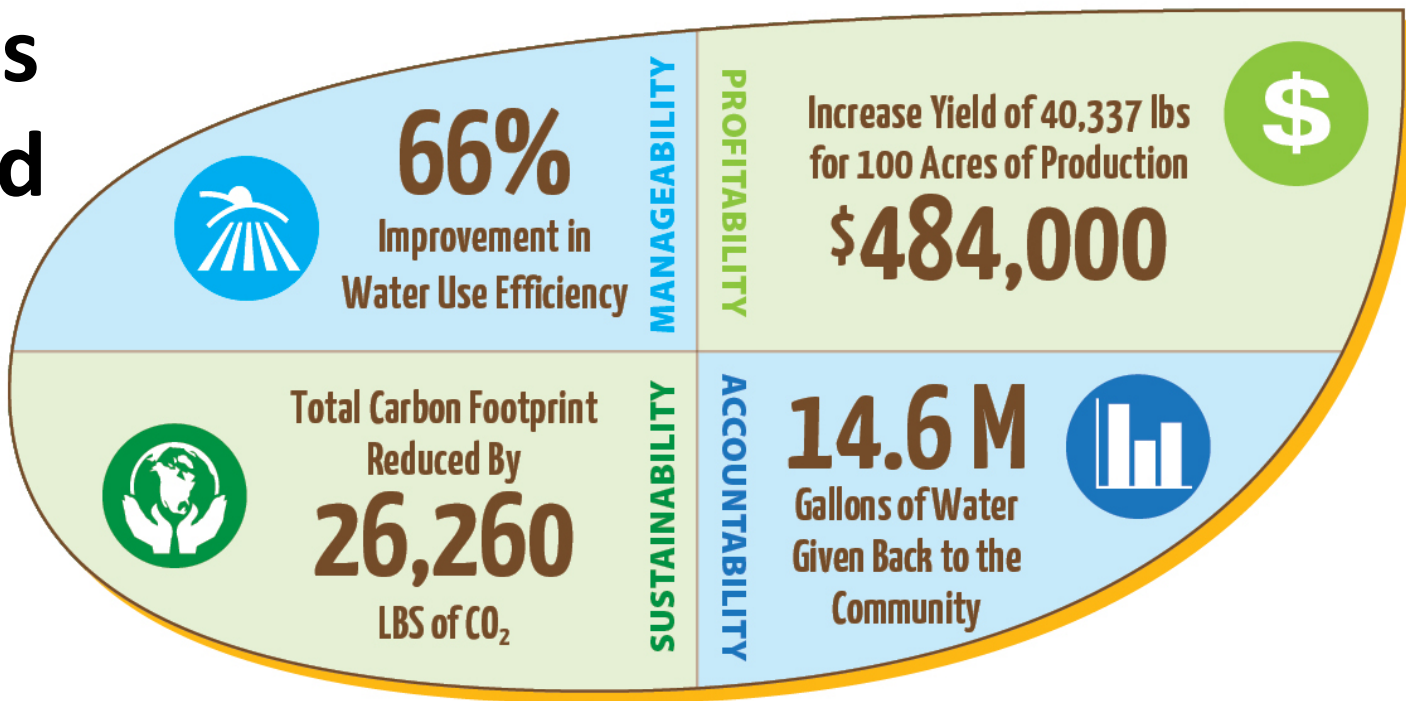


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Measuring Outcomes

Measure
Outcomes
Compared
to Goals

CLEMSON UNIVERSITY – WATERMELON YIELD & USE EFFICIENCY





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P2i - Summary

- ***Plant Intelligence*** is what drives irrigation decisions
- ***Plant Water Health*** is when the plant needs water
- ***Soil Water Health*** is when the soil is out of balance
- ***MARZ*** (Most Active Root Zone) is where the plant needs water
- ***Plant Triggered Irrigation*** is how information is implemented into an irrigation action
- ***Plant to Irrigation*** (P2I) is the process used to utilize irrigation as an optimization tool



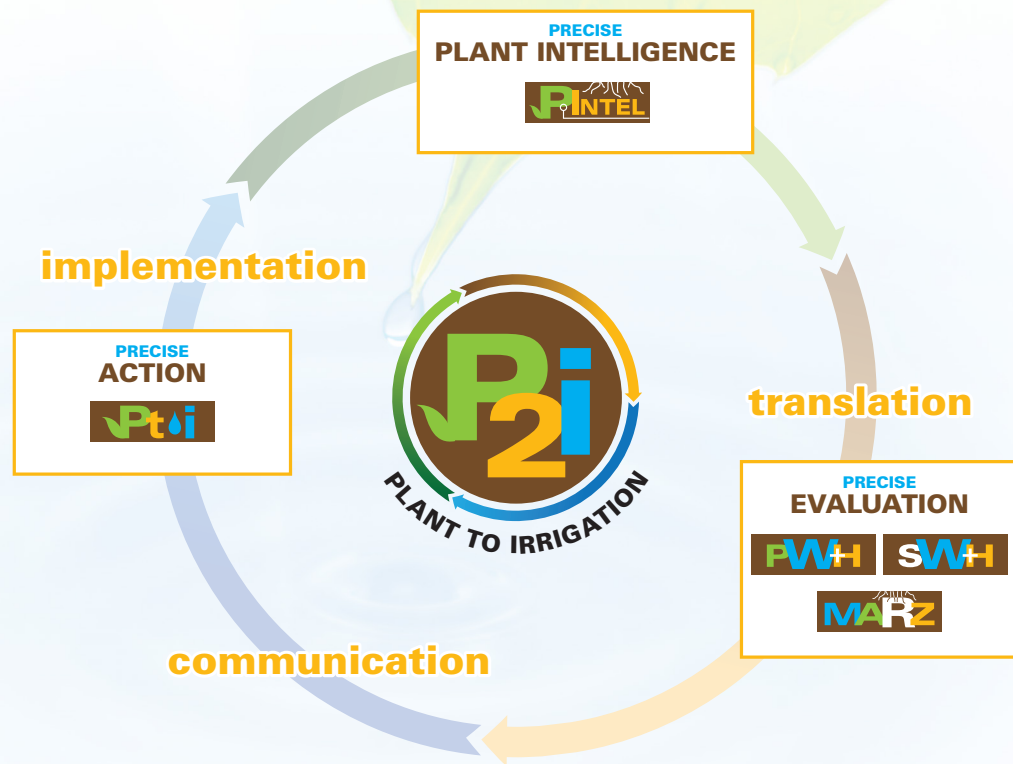
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P2i

P2i is a comprehensive and powerful framework—

- Translation of the plant's needs
- Communication of an instantaneous evaluation
- Implementation of precise actions

—that is designed to reduce stresses on the plant that impact the opportunity for higher yields



KEY POINT

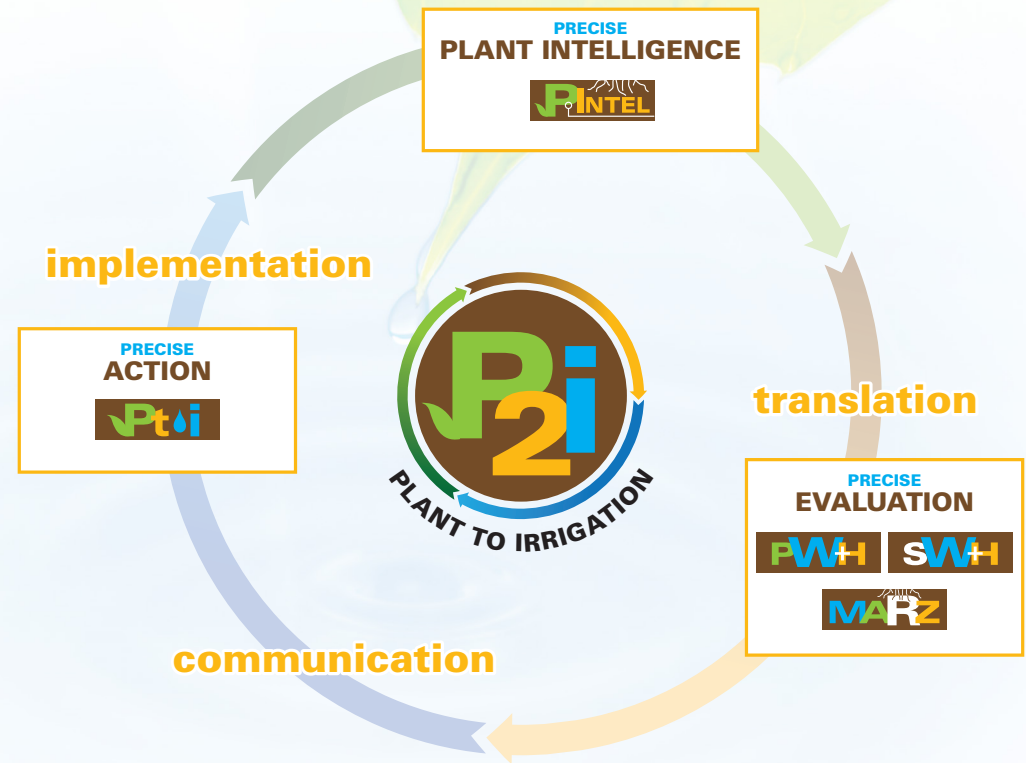
➤ Without P2i - YOU CAN'T DO IT!



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That's why P2i, in conjunction with *Ag Management Strategies*, is an innovation and optimization process that will change the way your farm operates.

Innovation





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Ag Management Strategies

How do I put into practice such a leading-edge optimization methodology on my farm?

**Contact Lee Rain today to discuss how
Ag Management Strategies
might be right for you.**