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THE NUTRIENT USE EFFICIENCY PEOPLE™

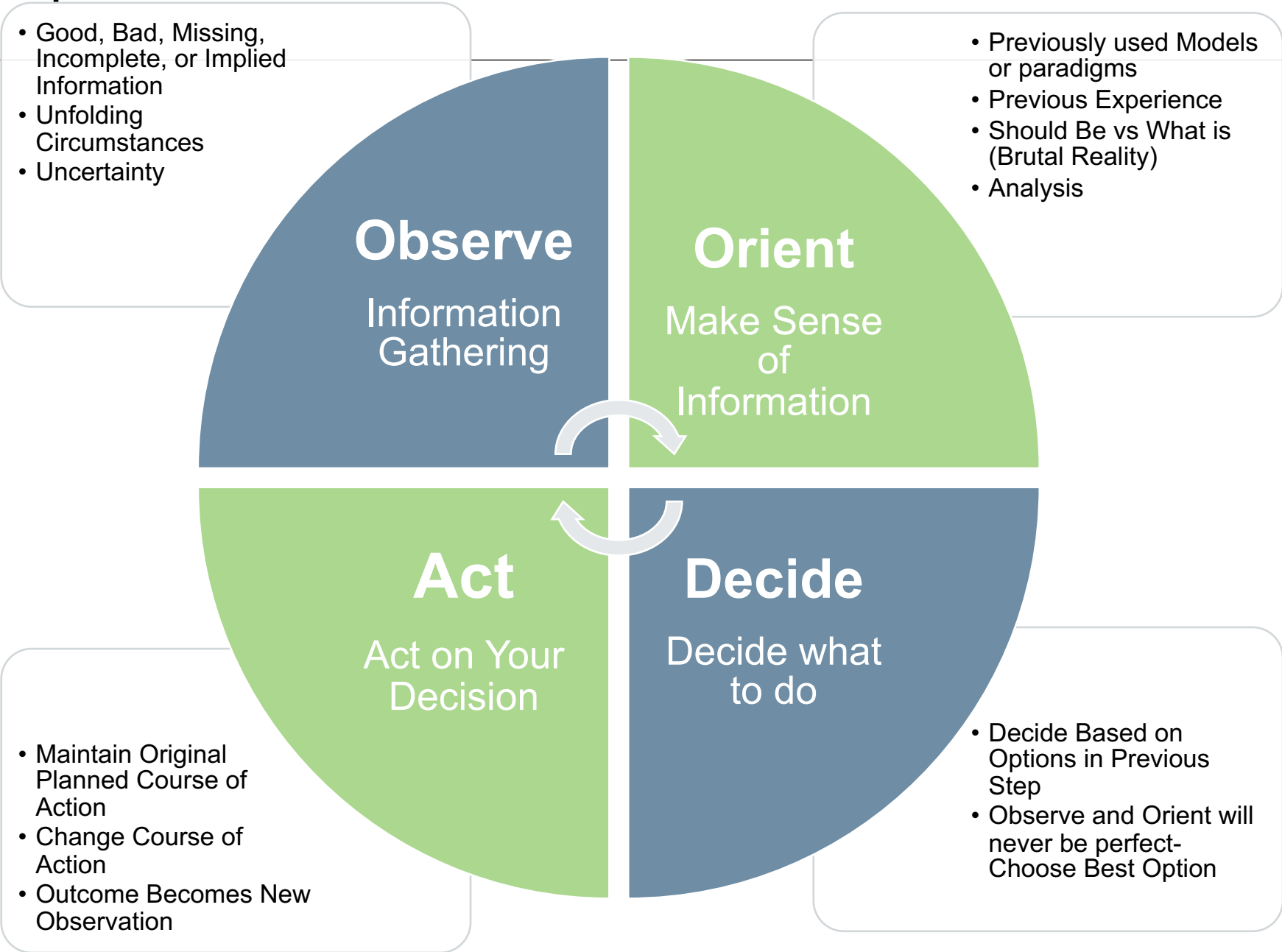
Tips for Improving Nitrogen Efficiency

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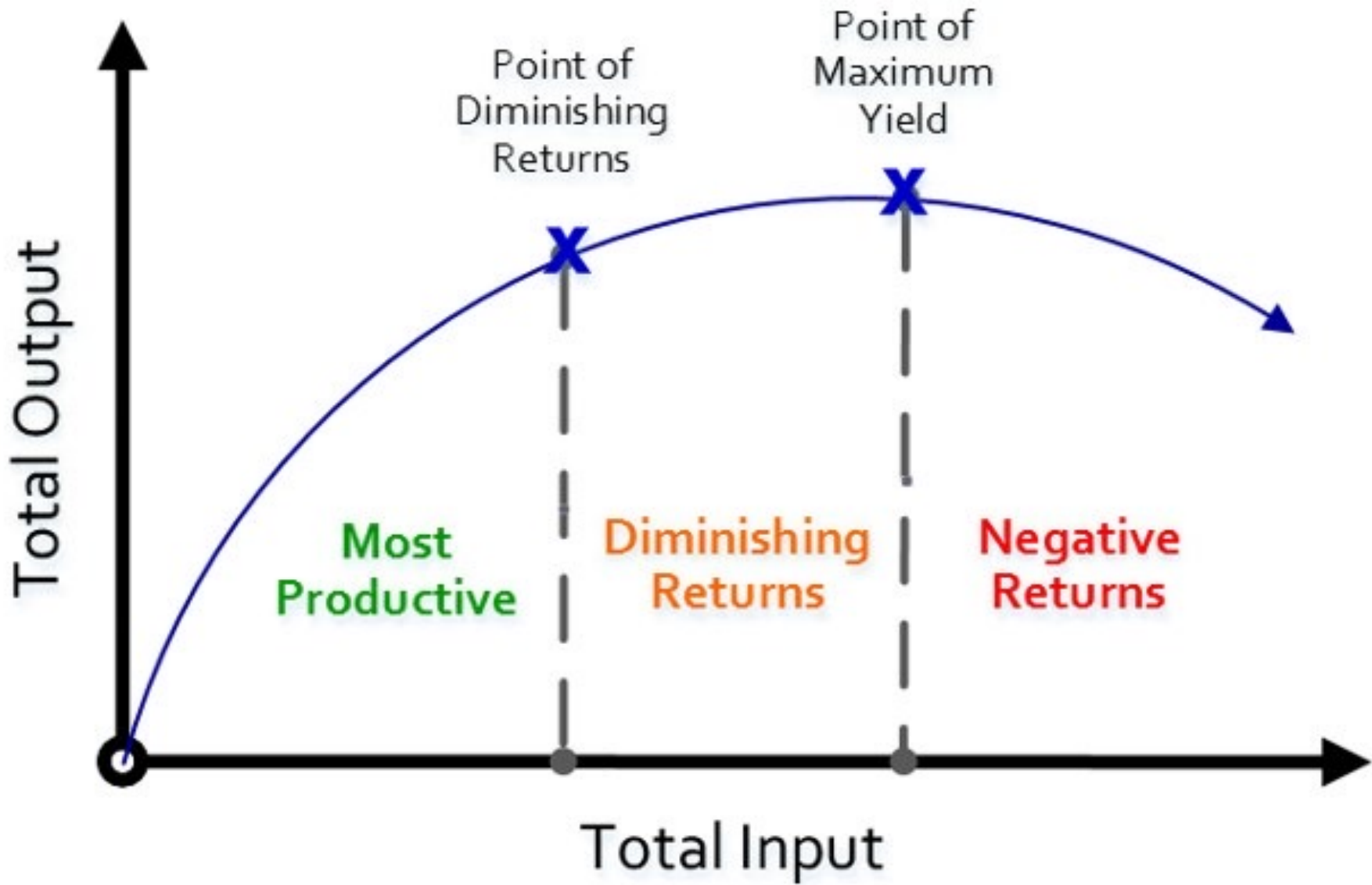
Topics for Today

- The OODA Loop
- Law of Diminishing Incremental Yield
- Pre-Season Planning
- In-Season Decision Making
- Pre-harvest observations
- Post Harvest Metrics and

The OODA Loop



Law of Diminishing Incremental Yield



Pre-season Planning

Information Needed	Tools or Resources
Amount of Nitrogen in the Soil	Soil Sampling <ul style="list-style-type: none">• Depth of Sample (12", 24" 36")• Resolution (Composite, Grids, Zones)
Yield Goal	Previous History <ul style="list-style-type: none">• VRN Yield Goals• Normalized Yield• Realistic Goals
Hybrid Response to Nitrogen	Data from your Seed Company
Source, Timing and Placement	Previous Experience Power and Labor Resources Equipment and Regional Limitations
Protection From Losses	Nitrogen Stabilizers

In-Season Adjustments

Information Needed	Tools or Resources
Stand quality and plant vigor	<ul style="list-style-type: none">• Imagery• Net Effective Stand Percentage• Early season plant digs and root assessment
In-Season Nitrogen Status of Soil	<ul style="list-style-type: none">• LSNT
In-Season Nitrogen status of the plant	<ul style="list-style-type: none">• NDVI• NDRE• Tissue Sampling
Trusted Extended Weather forecast	<ul style="list-style-type: none">• Trusted Apps• Trusted Crop Models
Protection From Losses	Nitrogen Stabilizers

In-Season adjustments can be made multiple times a season

Thoughts on making Adjustments

If using a remote sensing technology: Drones, Planes, Satellites, Sensors mounted to equipment or a handheld unit in Corn.

- Wait until there is sufficient canopy, V8 at the earliest, V12 is better.
- Works best if you have a nitrogen rich Reference zone as small as 20'x20'
- Calculate the Sufficiency Index
 - $SI = (\text{Target area NDRE} / \text{Reference area NDRE})$
- In Season N Rate can be calculated using the Solari Algorithm or the Holland-Scheper Algorithm (See Index)

Current Crop	Future Conditions	Decision
Good/Excellent	Favorable	Unchanged/Increased
Good/Excellent	Unfavorable	Unchanged/Reduced
Below average	Favorable	Unchanged/Reduced
Below average	Unfavorable	Reduced

Pre-Harvest Evaluation

Information Needed	Tools or Resources
Nitrate left in the plant	Stalk Nitrate Testing
Ear to Shank Attachment	Shake 1/1000 th of an acre's plants looking for ear drop
Stalk Quality and Standability	Push 1/1000 th of an acre's plants looking for stalk breakage Dig up some plants looking for Cannibalization and stalk diseases
Break open some Ears	Observe ear weight and kernel depth

Post-Harvest Evaluation

Information Needed	Tools or Resources	Target
Yield	Yield Monitor	Yield Goal or Higher
Calculate Partial Factor Productivity	$PFP = \text{Yield in lbs./lbs. Fertilizer applied}$	60-80
Calculate Partial Nutrition Balance	$PNB = \text{lbs. of Nitrogen Removed in Grain/lbs. of Nitrogen Applied}$.92-1.01
Cost of N per Bushel	Cost of Nitrogen Applied/Bushels	
% of Nitrogen Cost/acre as a part of Gross Profit	$\text{N costs per acre} / \text{Gross Profit per acre} * 100$	
<p>Review notes from planning sessions until now to see what improvements you can make for the next growing season. Compare fields where you made other decisions (Fungicides, PGRs, etc.) and how they compare to this system.</p>		

Conclusion

- There is no Single answer to “What is the best system?”
 - The best system is the one that works for you and your operation
- Small changes can make a big impact
- There is no Absolute “Right” Rate for Nitrogen, there is only staying with in an acceptable range of Optimum

Questions



vlsci.com

VRN: Variable Rate Nitrogen

Normalized Yield: A method to take multiple years of yield data and look at it equally to make decisions

- <https://www.ag.ndsu.edu/publications/crops/yield-mapping-and-use-of-yield-map-data>

LSNT: Late Spring Nitrate Testing

- <https://www.agvise.com/wp-content/uploads/2017/06/Late-spring-soil-nitrate-test-ISU-2017.pdf>

NDVI: Normalized Difference Vegetative Index, Remote sensing method to measure biomass

NDRE: Normalized Difference Red Edge Index, Remote sensing method to measure the amount of Chlorophyll in plants

SI: Sufficiency Index, Measurement of Chlorophyll and biomass compared to a sufficient nitrogen block

- <https://cropwatch.unl.edu/2019/season-nitrogen-management-corn-2019>

PFP: Partial Factor Productivity is the simplest form of crop output efficiency.

PNB: Partial Nutrient Balance measures the Nutrient output per unit of Nutrient input.

- https://www.fertilizer.org/images/Library_Downloads/2014_fue_chapter_1.pdf