Comparison of Proximal Remote Sensing Devices for Estimating Physiological Responses of Eggplants to Root-Knot Nematodes

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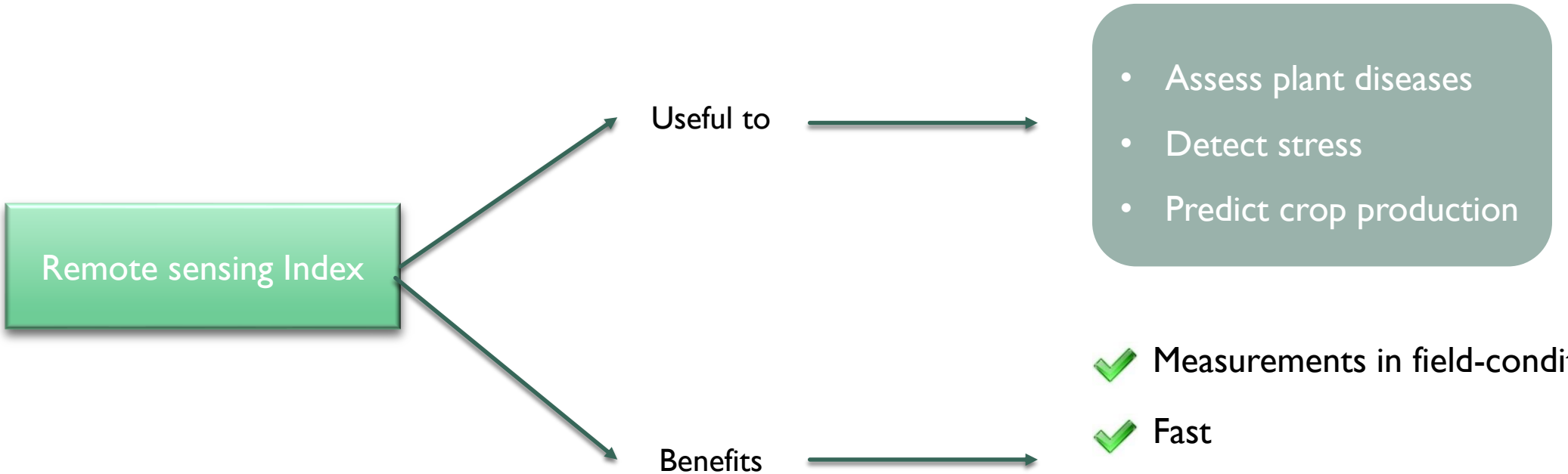
INTRODUCTION



INTRODUCTION

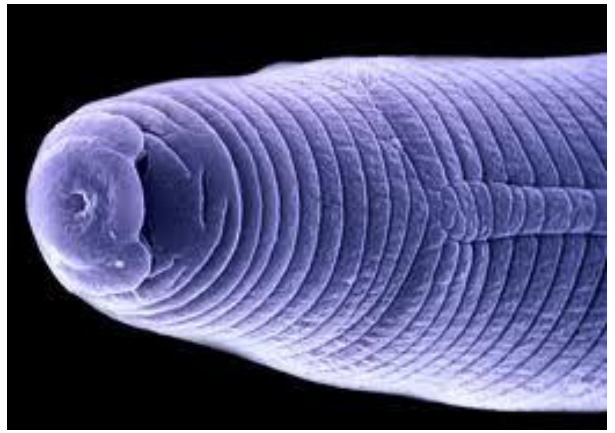
EGGPLANT

Solanum melongena

Interest components:

- Phytochemical
- Nutraceutical

Threatened by



Meloidogyne javanica

CAUSES OF THE ROOT-KNOT NEMATODE:

- Root damages
- Restriction of nutrient and water uptake
- Limit the production

INTRODUCTION

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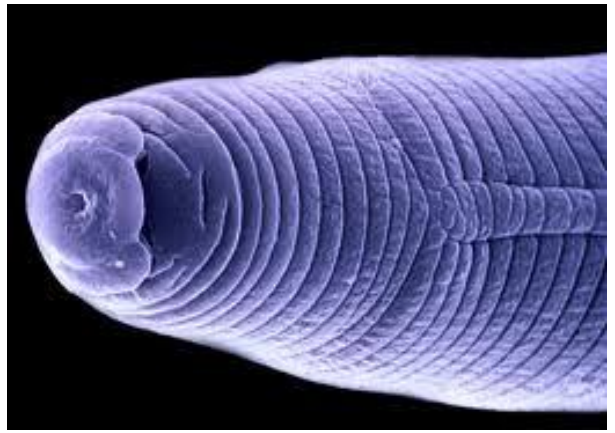


Meloidogyne javanica

POSSIBLE SOLUTION:

Use of rootstocks tolerant for grafting the eggplants

Solanum torvum

INTRODUCTION

AIM OF THE STUDY

Compare different proximal remote sensing approaches at plant and single leaf to assess the effect in eggplant of grafting with the tolerant species *Solanum torvum*, and conclude which is more convenient to assess the eggplant response to nematode effects.

EXPERIMENTS

Plant material and growing conditions

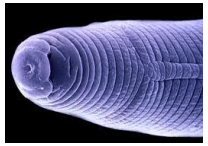
Agropolis. ESAB

Conditions

Total plots: 20

x 4/plot → 80

1/2  + 

Soil infested with 

EXPERIMENTS

Data collection

1st October. 15:00-17:00

Leaf based measurements

Sensor

Dualex

Traits

- Chlorophyll (Chl)
- Flavonoid (Flav)
- Anthocyanin (Anth)
- Nitrogen balance index (NBI)
- Chl/Flav

Sensor

MultispeQ

Traits

- Quantum yield of photosystem II (PSII)
- Photochemistry (Φ_{II})
- Non-photochemical quenching (Φ_{NPQ})
- Other unregulated non-photochemical losses (Φ_{NO})
- Relative chlorophyll content (Rel Chl)

EXPERIMENTS

Canopy-based measurements

Sensor

Camera Llumix GX7

Traits

- RGB picture

Software

- MosaicTool

Sensor

GreenSeeker

Traits

- Normalized Vegetation Index (NDVI)

Sensor

PhotoTemp™

Traits

- Temperature

Sensor

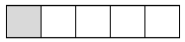
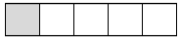
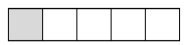
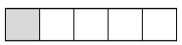
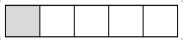
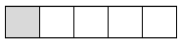
Traits

- Temperature
- RGB picture

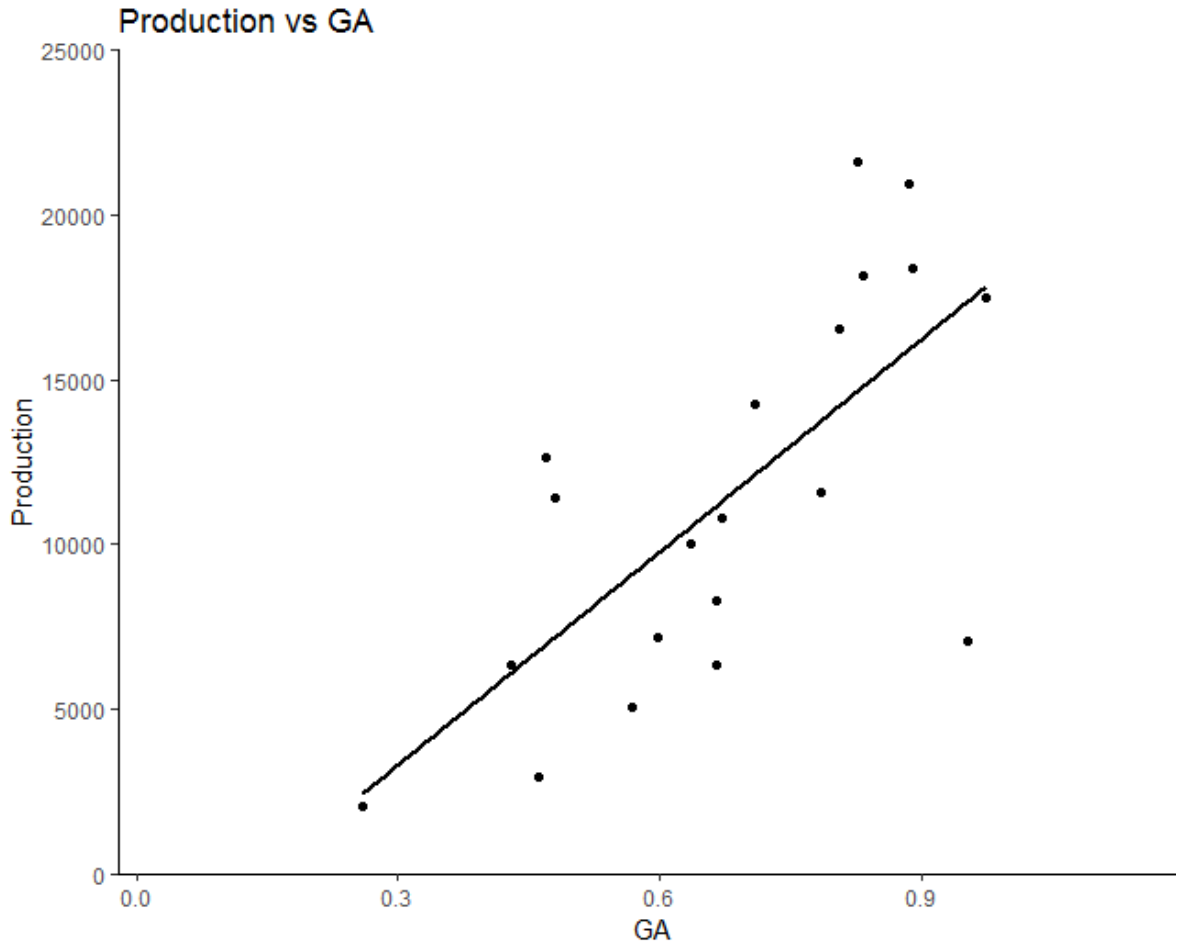
Software

- CerealsMobile

RESULTS AND DISCUSSION

Measurement level	Sensor/Technique	Trait	Accuracy		Sampling difficulty	Sampling time	Post-processing	Destructiveness	Cost
			ANOVA	R					
Leaf-based	Dualex	Chlorophyll content	ns	0.422					
		Anthocyanyn content	ns	0.105					
		Flavonoids content	ns	-0.270					
		NBI	ns	0.277					
	Photosynq	Phi2	ns	0.438					
		PhiNO	ns	-0.169					
		PhiNPQ	ns	-0.388					
		Rel Chl	ns	0.526					
		Fv'/Fm'	ns	0.335					
Canopy-based	GreenSeeker	NDVI	*	0.601					
	RGB images	Hue	*	0.662					
		GA	**	0.706					
		GGA	*	0.635					
		NGRDI	**	0.642					
	Infrared gun	Canopy temperature	**	-0.618					
	Thermal camera + RGB	Hue	**	0.590					
		GA	*	0.472					
		GGA	**	0.547					
		Canopy temperature	ns	-0.157					
		CT[GA]	ns	-0.154					
		CT[GGA]	ns	-0.154					

RESULTS AND DISCUSSION



Correlations between production and RGB parameters are >0,6

CONCLUSIONS

- Single-leaf measurements did not show significant differences between grafted and non-grafted plants and with low correlations → Root-knot nematodes did not affect leaf chlorophylls.

- Plant-based measurements showed significant differences between both types of plants and higher yield correlations with yield.

- RGB indexes showed best correlations with yield. Plant temperature also performed well assessing differences. However, both categories of remote sensing traits (smartphone) were worse. → importance of how and when the temperature measurements are taken.

- Dualex and Photosynq better if measured in an earlier phenological stage.

- Canopy-based measurements permit to study the whole plot at once (without the need of replicates) and showed the best results.

- RGB indexes are presented as a promising remote sensing technique mainly due to its user friendly and low-cost nature. It should be noted that this measurement can be easily taken with a simple smartphone.