Improved sustainability of blueberry production through optimization of preharvest factors

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MSc Agric in Agronomy

Problem Statement

Investigating the problems, challenges and to see them as opportunities

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Problems

Limited research on blueberry nutrition

Quality is impacted due to environmental conditions in the Western Cape

Combination contributed to problematic post-harvest quality characteristics

Challenges

New varietal developments

Understanding the impact of nutrition on preharvest and post-harvest factors

Increase input cost of production of blueberries

Fluctuating price trends due to supply and demand

Opportunities

Contribution to optimising preharvest practices

Investigate the correlation between nutrition on the pre-harvest aspects, the post-harvest quality characteristics and performance

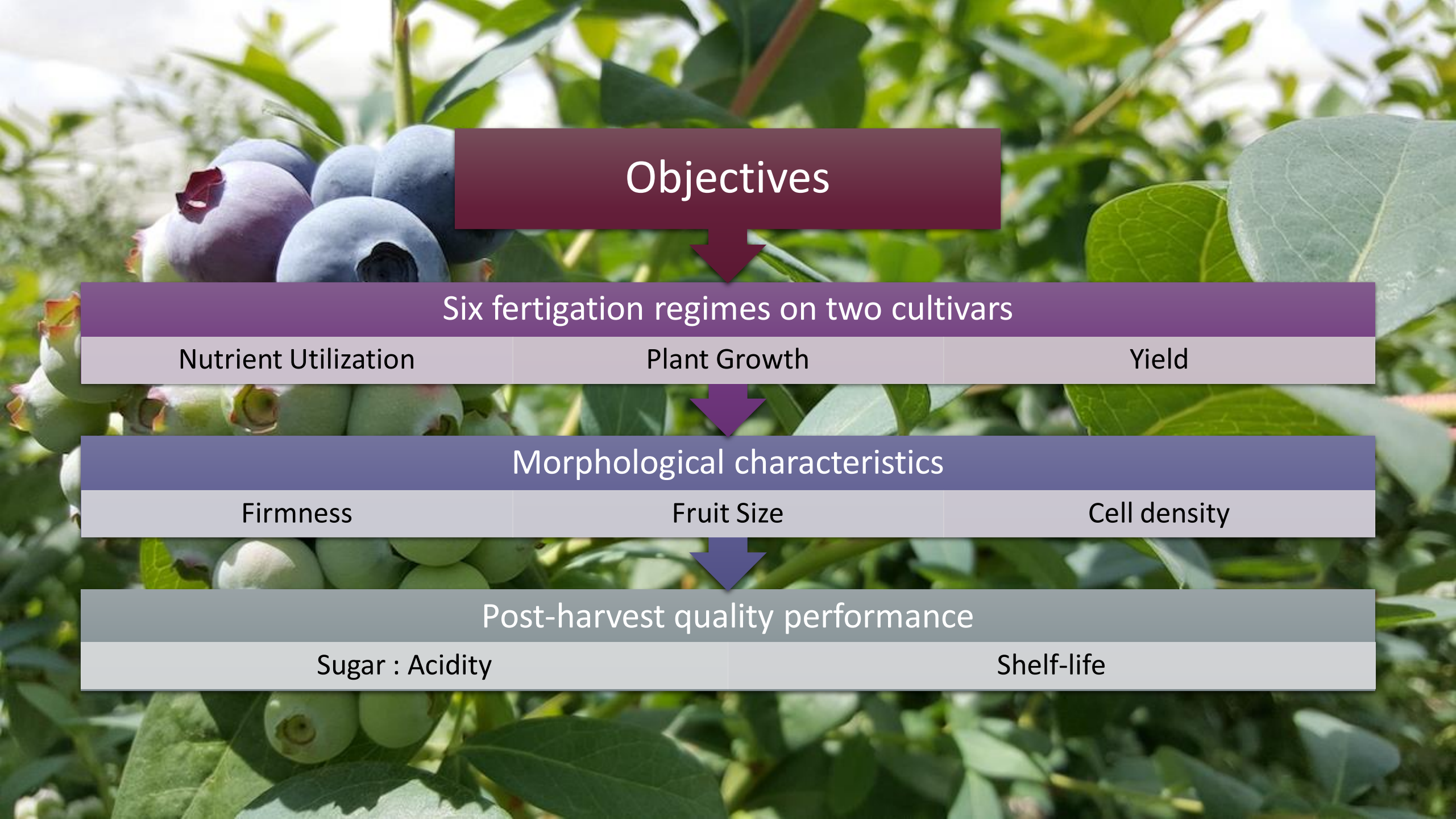
Utilization of Horiba Laquatwin and Atago Devices for improving management practices

Aim

To evaluate the effect of crop nutrition

On the nutrient utilisation, growth, yield, fruit morphological quality characteristics and performance of blueberries

Assessing the optimum nutritional requirement without compromising on quality


Objectives
Six fertigation regimes on two cultivars
Nutrient Utilization
Plant Growth
Yield
Morphological characteristics
Firmness
Fruit Size
Cell density
Post-harvest quality performance
Sugar : Acidity
Shelf-life

Methodology

Process of conducting this research project

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Planning

Determine trial concept

Research and gaps analysis

Plan trial layout

Parameters to measure

Resource Acquisition

Audit for resources

Get resources

Setup and Execution

Preparation of area

Setup trial as planned

Monitoring

Data Sampling and Interpretation

Sampling and Data Collection

Statistical Analysis and Modelling

Interpretation

Writing and Findings

Writing

Discussions

Conclusions

Findings

Treatment and Statistical Layout of Trial

Split plot design with 6 treatments

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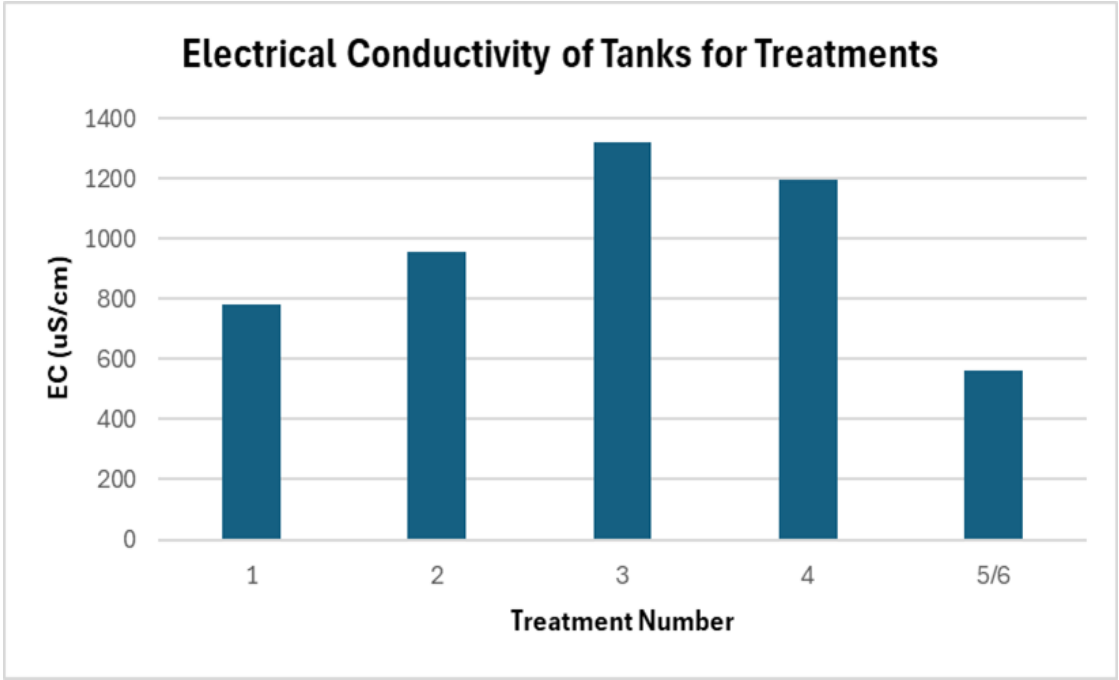
Treatment 1 740 uS/cm	• BWSA Trial Plot Regime
Treatment 2 950 uS/cm	• Universal Steiner solution • Regime for Blueberries • (Combrink, 2019)
Treatment 3 1340 uS/cm	• Universal Steiner solution **with an addition of 50% mEq/L**
Treatment 4 1200 uS/cm	• Universal Steiner solution **with an addition of 25% mEq/L**
Treatment 5 550 uS/cm	• Universal Steiner solution **with subtraction of 50% mEq/L**
Treatment 6 550 uS/cm	• Universal Steiner solution **with subtraction of 50% mEq/L** • With the addition of Ericoid mycorrhizal and Endophytic Fungi (MycoRoot – Super Booster)

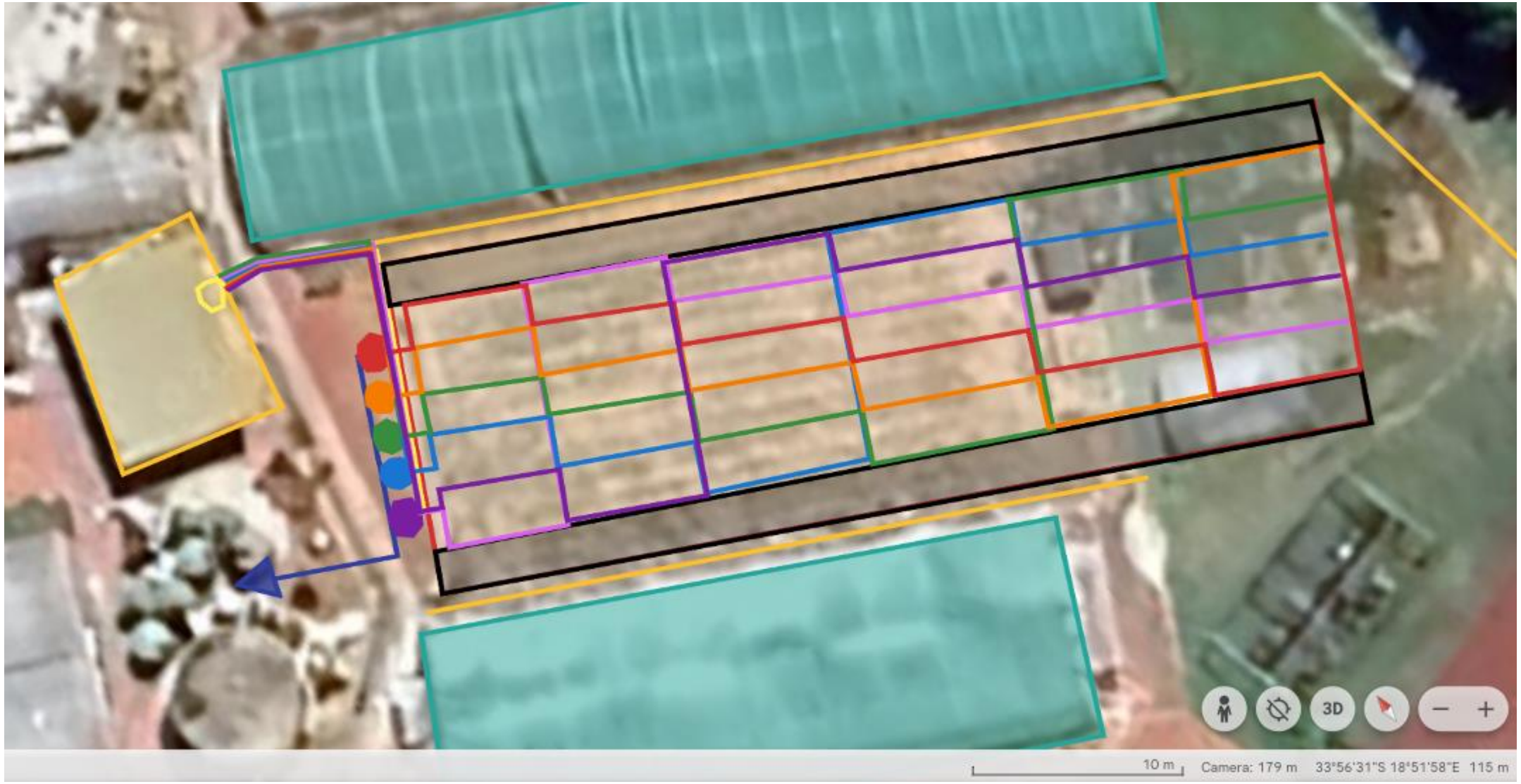
EC(Electrical conductivity) - Indication of concentration of ions in feeding water
mEq/L – Equivalent mass of dissolved chemical



Location and Experimental layout

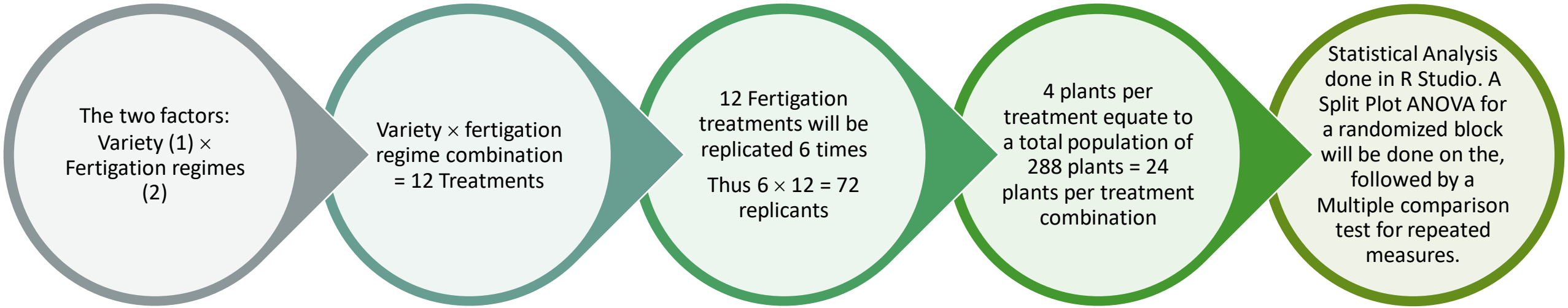
Google Earth Project Viewer

https://earth.google.com/earth/d/16aH5Bh1vWBfZ4hisNd04tEUOM89tIvAQ?usp=sharing



Statistical Analysis

Split plot ANOVA design: Randomized block with 12 treatments



Measurements

The parameters and variables that will be assessed

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Preharvest			Post-harvest	Environmental
Growth	**Yield**	**Fertigation**	**Fruit Quality**	**Climatic**
Detailed Leaf nutrient analysis – 2nd Month	Tip counts – Every month	Detailed Fertigation Composition – Every month	Soluble solid content – When harvested	Wind
Leaf nutrient with Laquatwin - Every month	Bud counts – Every 2nd Week	Laquatwin Tank Composition – Every week	Acidity – When harvested	Daylength hours
Stem thickness – Every month	Flower count – Every Week	Laquatwin Drip and Drain Composition – Every week	Firmness – When harvested	Light intensity
Plant height – Every month	Fruit count – Every 2nd week	pH & Electrical conductivity	Fruit size – When harvested	Precipitation
	Fruit nutrient content – When harvested	NO3- content	Cell density (via weighing before and after drying fruit)	Temperature
		Ca2+ content	Shelf-life - When harvested	
		K+ content		
		Na+ content		

Production Management

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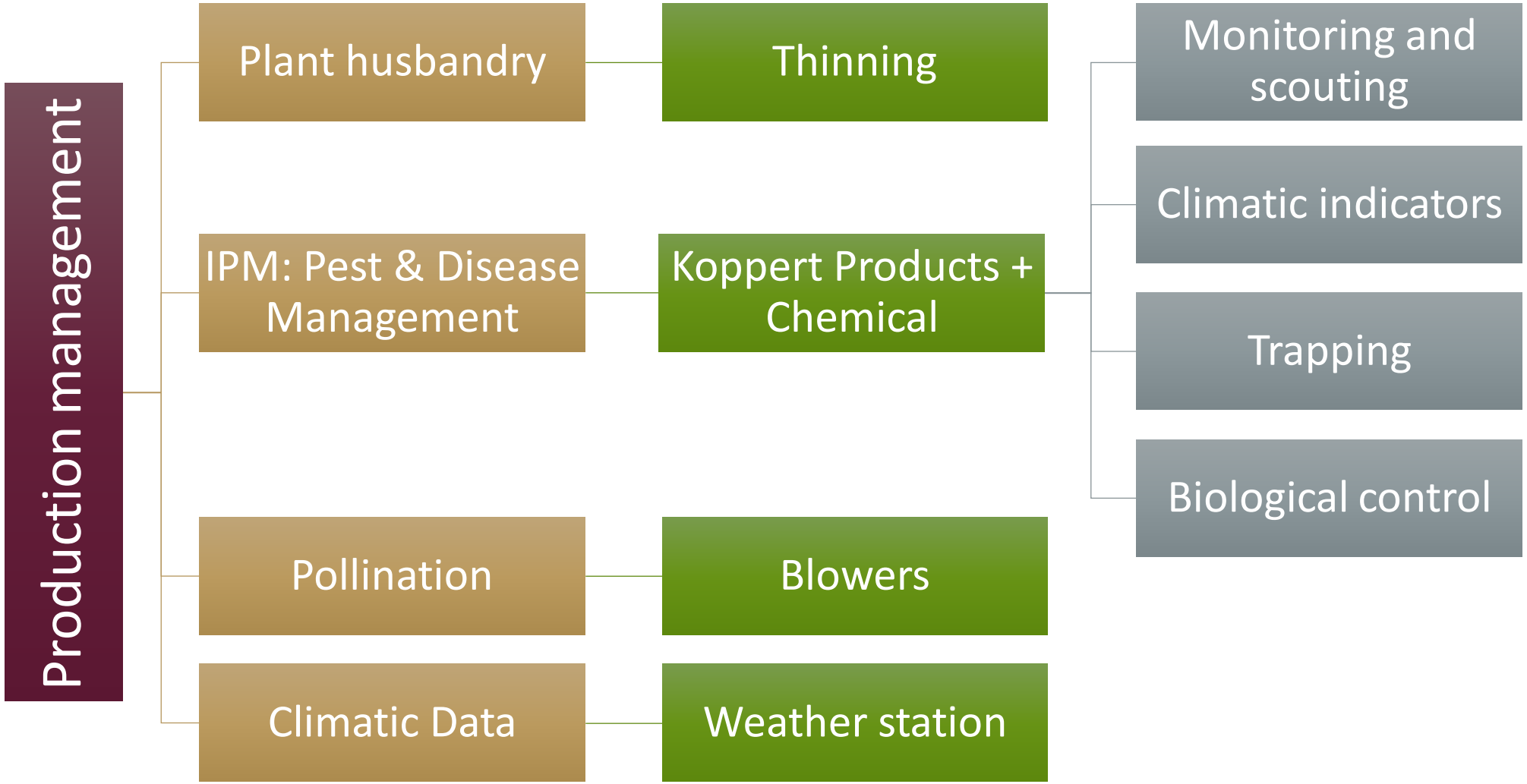
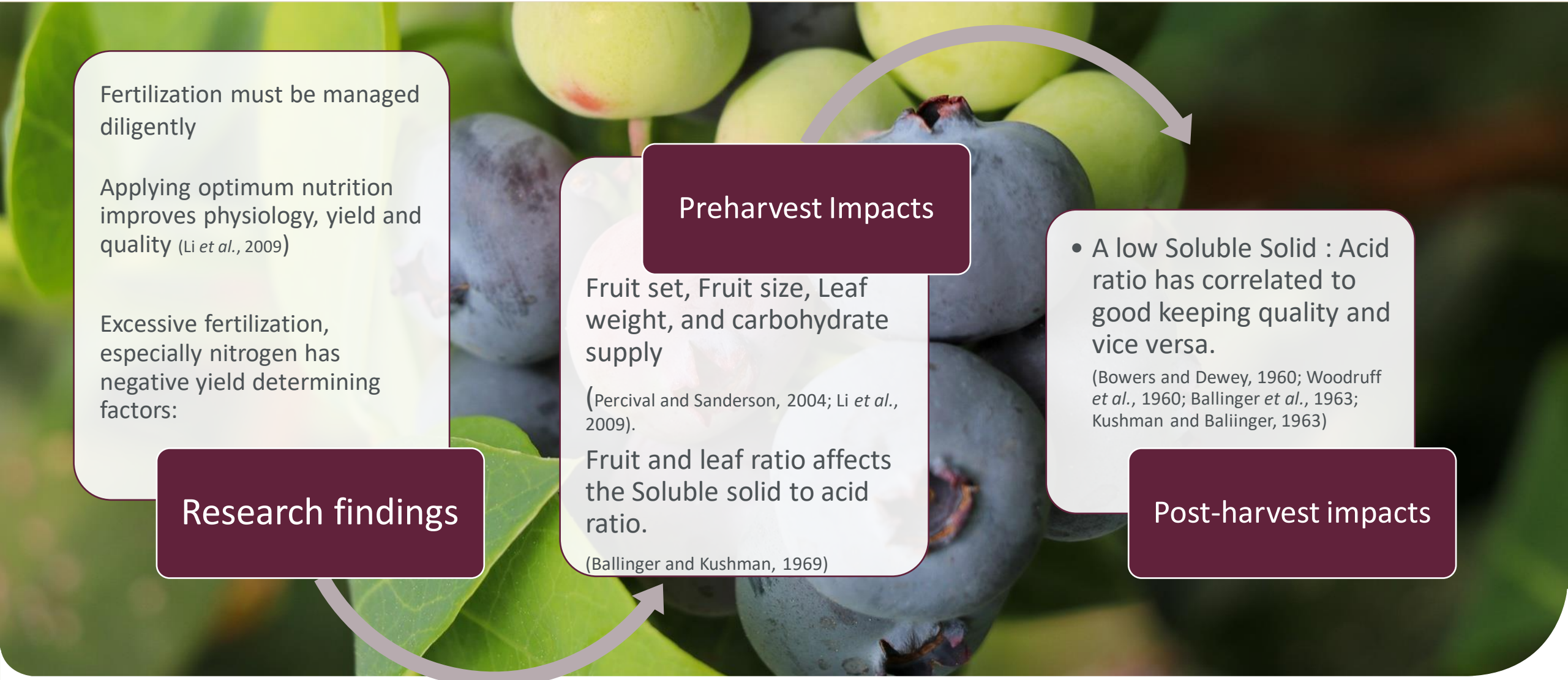
Production practices to be considered, monitored, and maintained



Research Findings

Interesting topics to understand based on the literature that can add value



Fertilization must be managed diligently

Applying optimum nutrition improves physiology, yield and quality (Li *et al.*, 2009)

Excessive fertilization, especially nitrogen has negative yield determining factors:

Research findings

Preharvest Impacts

Fruit set, Fruit size, Leaf weight, and carbohydrate supply

(Percival and Sanderson, 2004; Li *et al.*, 2009).

Fruit and leaf ratio affects the Soluble solid to acid ratio.

(Ballinger and Kushman, 1969)

- A low Soluble Solid : Acid ratio has correlated to good keeping quality and vice versa.

(Bowers and Dewey, 1960; Woodruff *et al.*, 1960; Ballinger *et al.*, 1963; Kushman and Baliinger, 1963)

Post-harvest impacts

Research Findings

Trial observations that has been found

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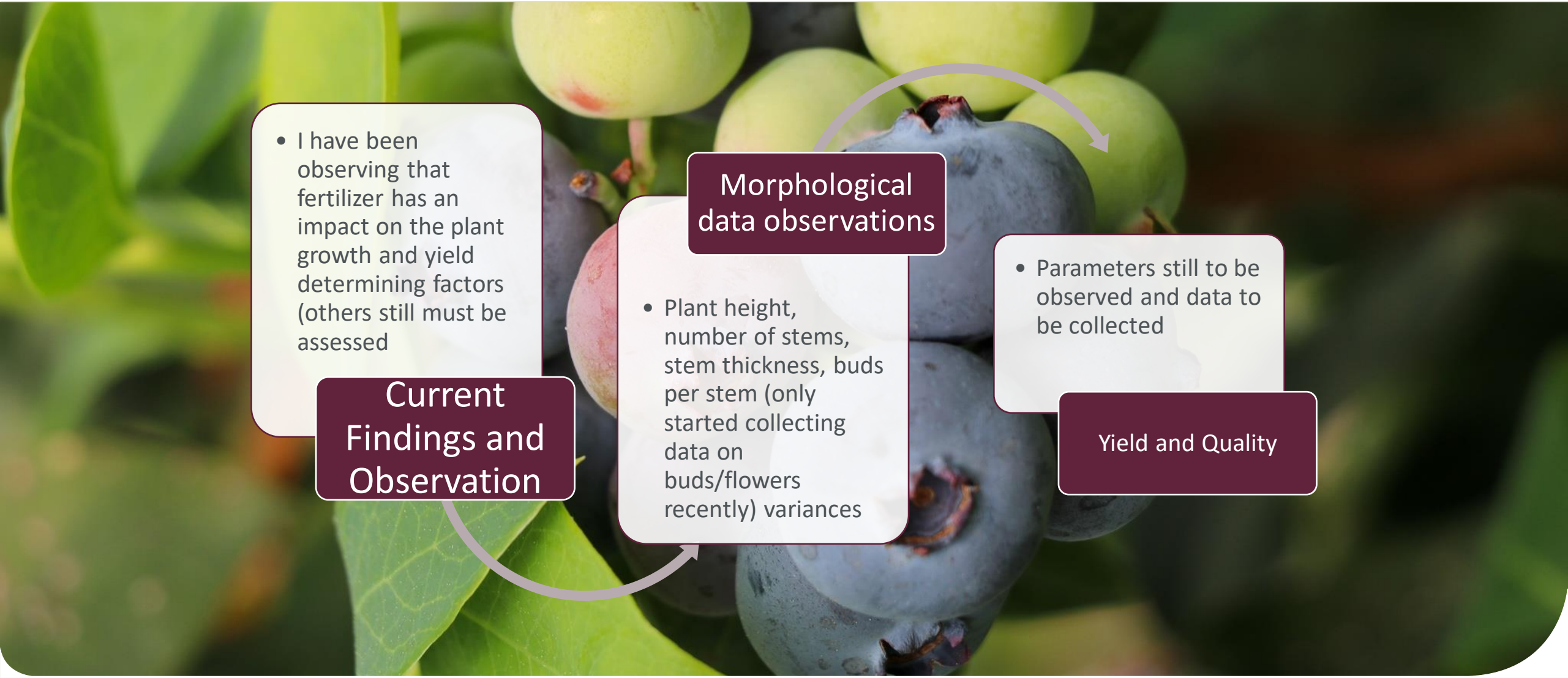

Potential impacts

This study will benefit the industry in the following ways

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Preharvest aspect

- Evaluate optimization areas for fertigation management to save on this input
- Impact of this on resource allocation, plant growth and yield
- Increase sustainability through
  - Conversion of fertilizer to fruit
  - Without compromising on quality
  - Benefits of Mycorrhizal and Endophytic fungi

Post-harvest aspect

- Establish an infield fruit morphological characteristic assessment
- Evaluate the impact of pre-harvest factors on fruit morphological characteristics and quality performance
- Improve proactive decision-making on the quality of products

Solutions

- Improving sustainable decision-making
- Understanding:
- Correlations between nutrition in preharvest and post-harvest aspects
- Expression of fruit morphological characteristics
- Environmental impacts on these parameters

Progress Photos

Site preparation - Before

Progress Photos

Site preparation – Tine and Scarifier Plow

Progress Photos

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Site preparation – Layout of materials and pump unit setup

Progress Photos

Site preparation – Planting 5 March

Progress Photos

Site preparation – Growth 9 May

Acknowledgement

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