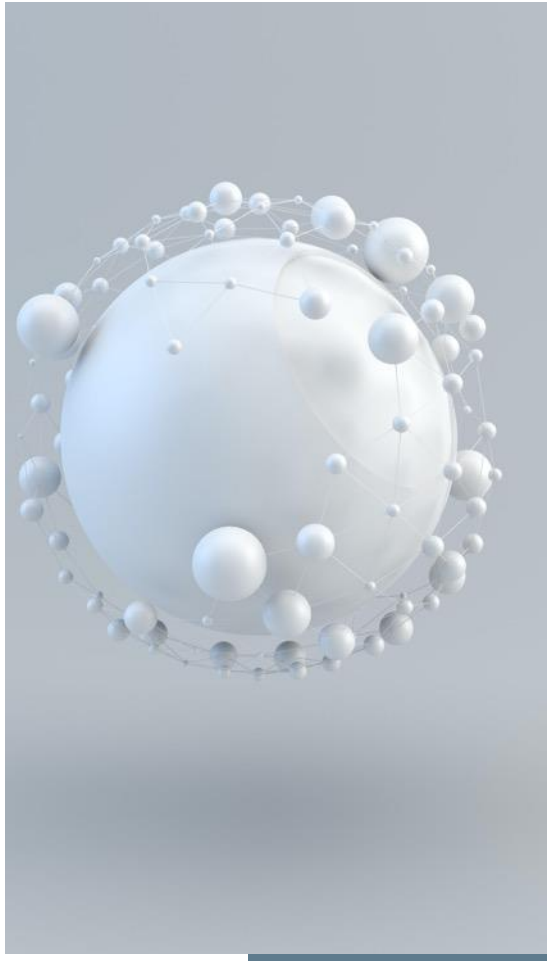
Impact of UV-C irradiation on induced defense mechanisms for the control of grey mould in blueberries



Carl Schulenburg

Supervisor: Prof Lise Korsten

May 2024

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YUNIBESITHI YA PRETORIA

BERRIES ZA
SUPPORTING SOUTH AFRICAN GROWERS

INTRODUCTION

Why shortwave ultraviolet (UVC) irradiation?

Extend shelf life

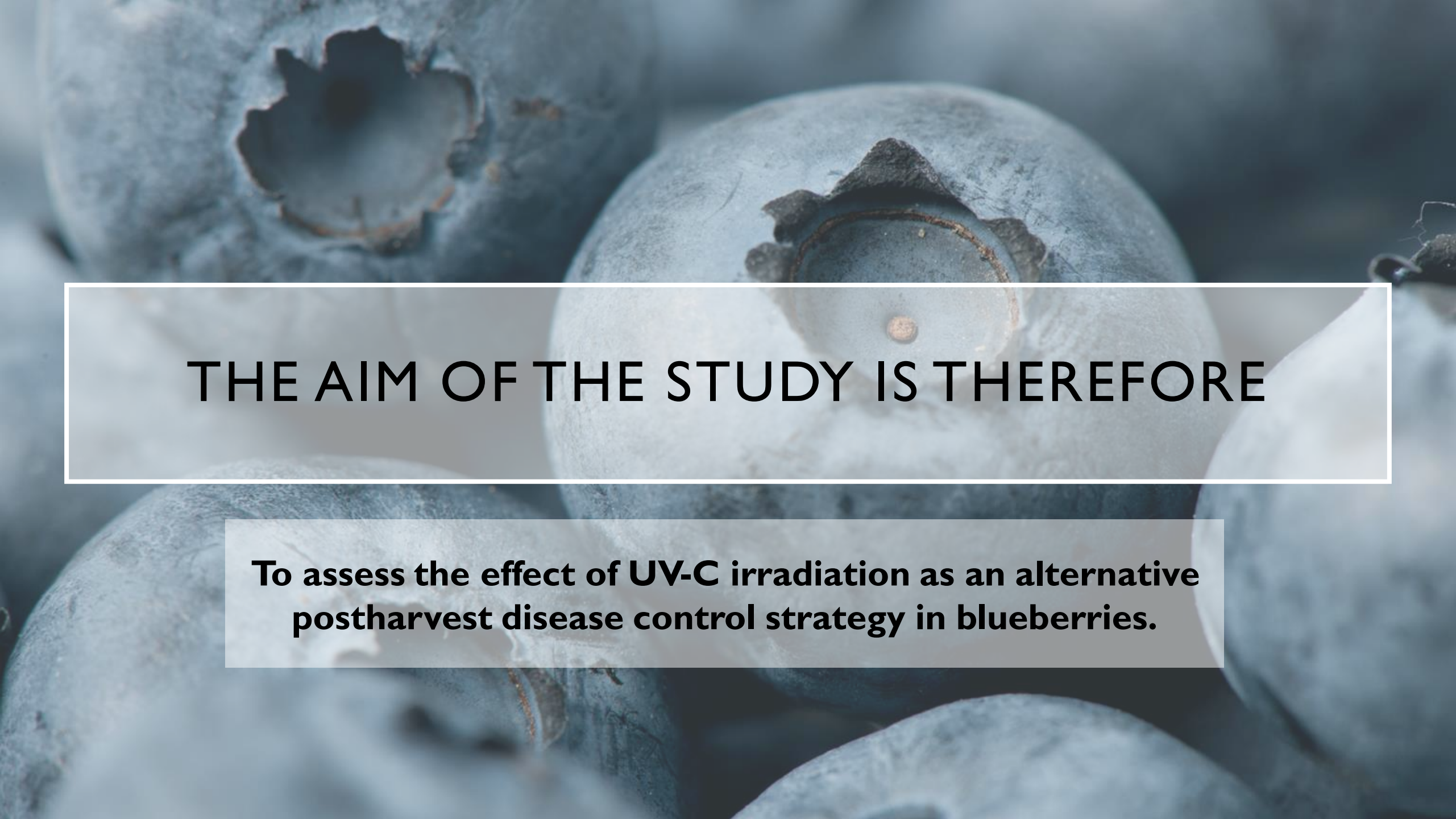
Stimulate antioxidants

Reduce rots

Induce defense genes

No chemical residue

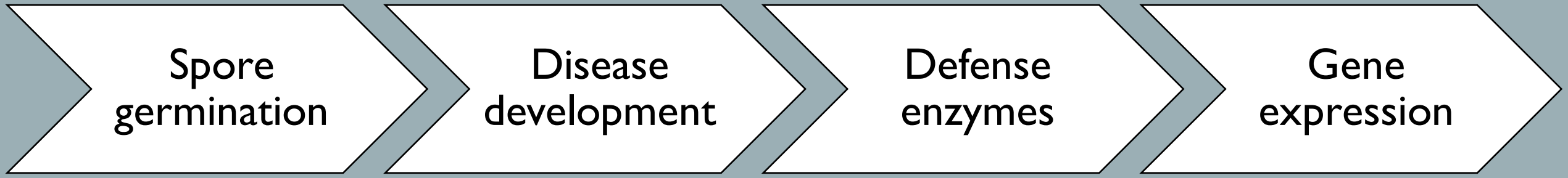
(Kowalski, 2009)



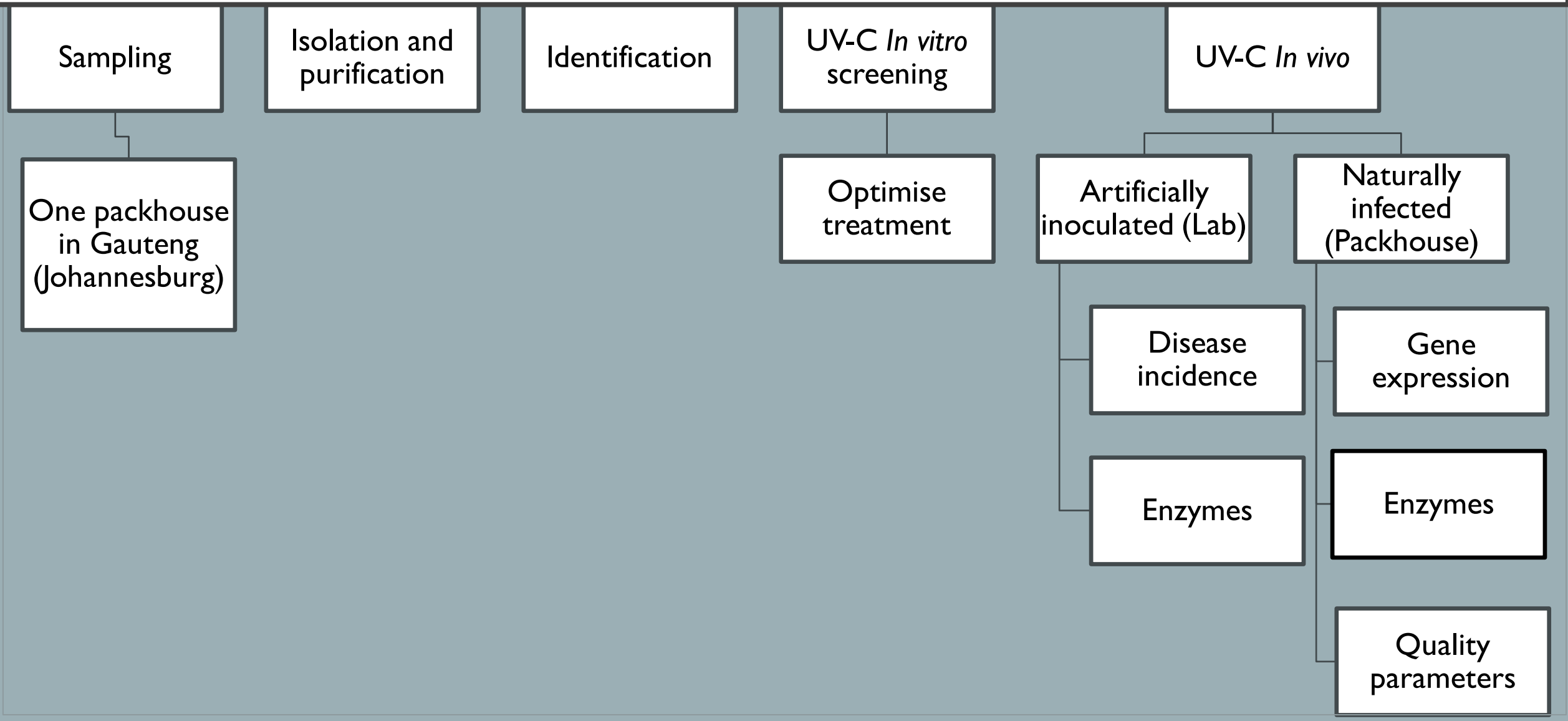
THE AIM OF THE STUDY IS THEREFORE

To assess the effect of UV-C irradiation as an alternative postharvest disease control strategy in blueberries.

OBJECTIVES


Spore germination
Disease development
Defense enzymes
Gene expression

MATERIALS AND METHODS OVERVIEW



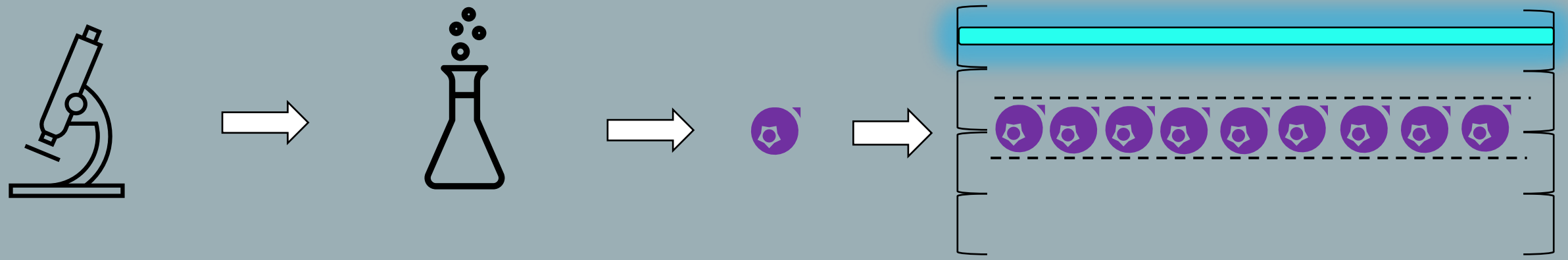
UV-C IN VITRO

- Spore suspension: 1 x 10^6 spores/ml
- Treatments: UV-C treatments + untreated control

(Steinberg, 2007)

UV-C IN VIVO

ARTIFICIAL INOCULATION



- Spore suspension: 1 x 10^5 spores/ml
- Artificial inoculation: **Fruit** 2 cultivars
- Treatments: UV-C treatments(**best performing** based on preliminary experiments) + untreated control + commercial SO2 treatment

IMPACT OF UV-C ON DEFENSE ENZYME AND ANTIOXIDANT SYSTEMS

ARTIFICIAL INOCULATION

Enzymes

Phenylalanine ammonia-lyase (**PAL**)

Peroxidase (**POD**)

Chitinase (**CHI**)

B-1,3-glucanase (**Bglu)**

Antioxidants

Total phenolic content **(TPC)**

Total flavonoid content **(TFC)**

Antioxidant capacity **(AC)**

EFFECT OF UV-C ON EXPRESSION LEVELS OF KEY DEFENSE GENES IN LATENT INFECTIONS

NATURALLY INFECTED

Defense-related genes

Pathogenesis related protein 3

chalcone synthase

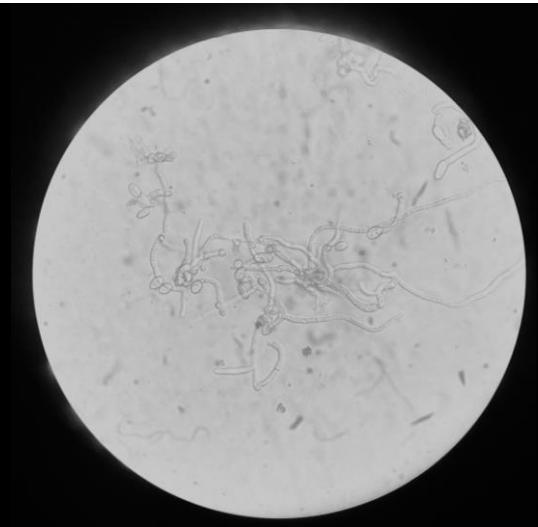
Pathogenesis related protein 4

chalcone isomerase

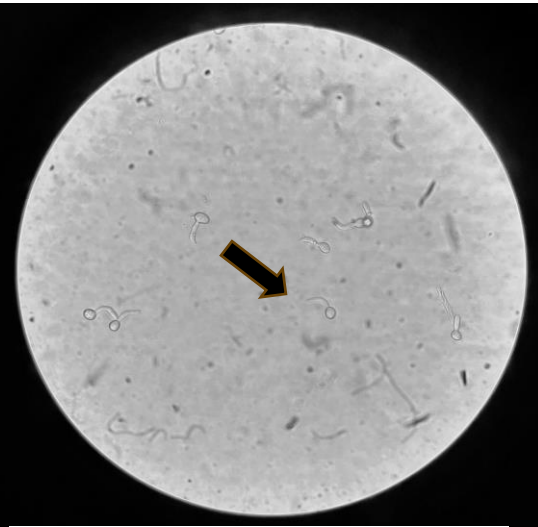
flavonol synthase

anthocyanidin reductase

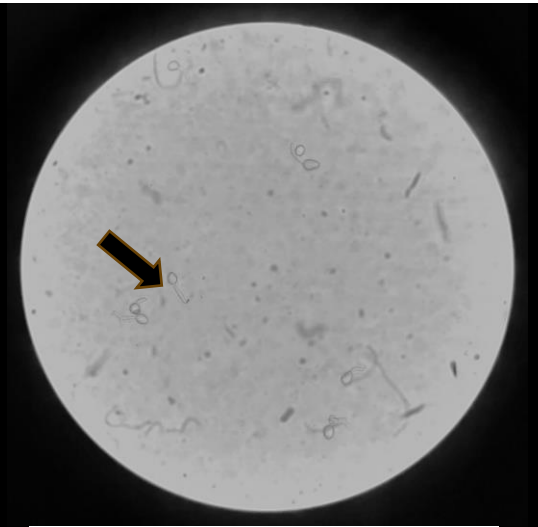
IMPACT OF UV-C ON SPORE GERMINATION



UNTREATED



T1



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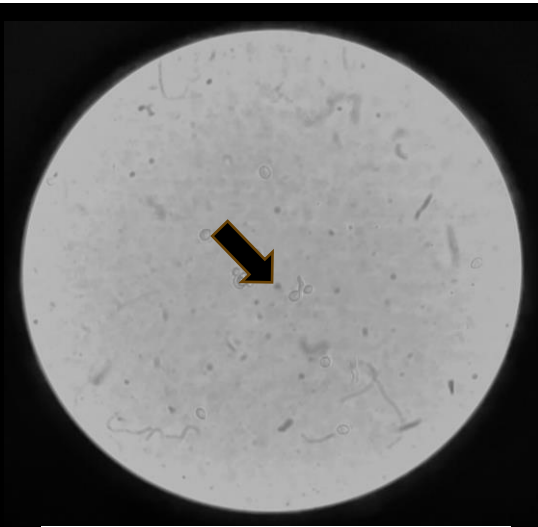
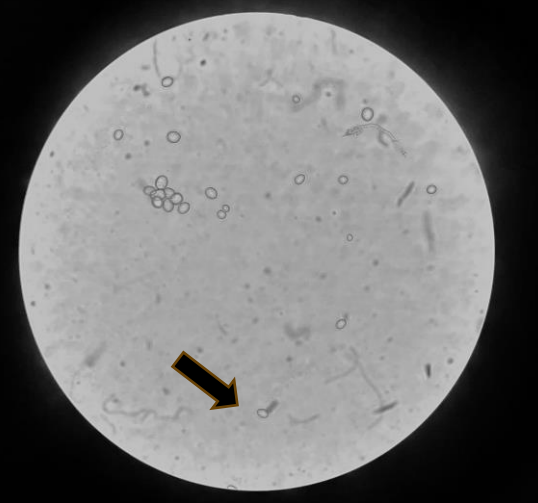


T3

T4



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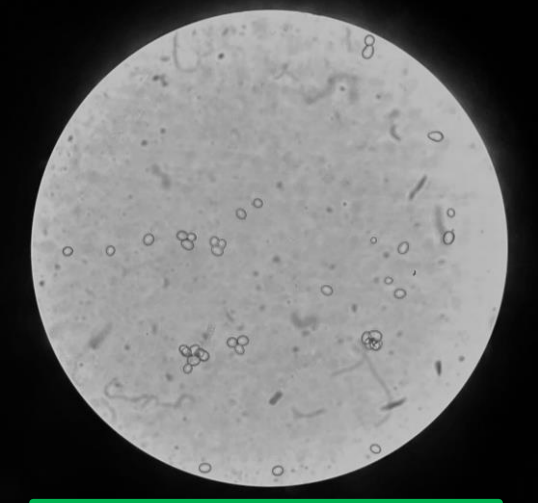

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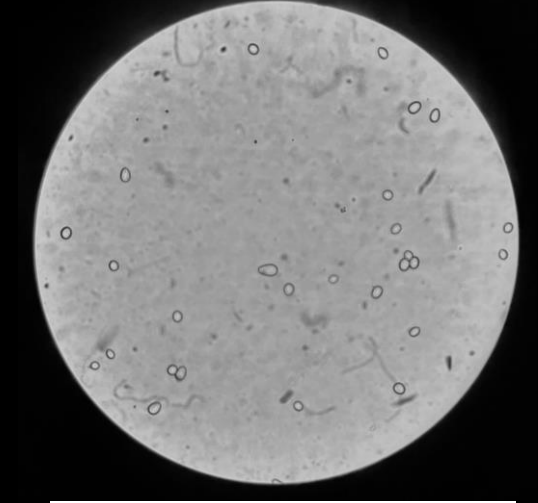
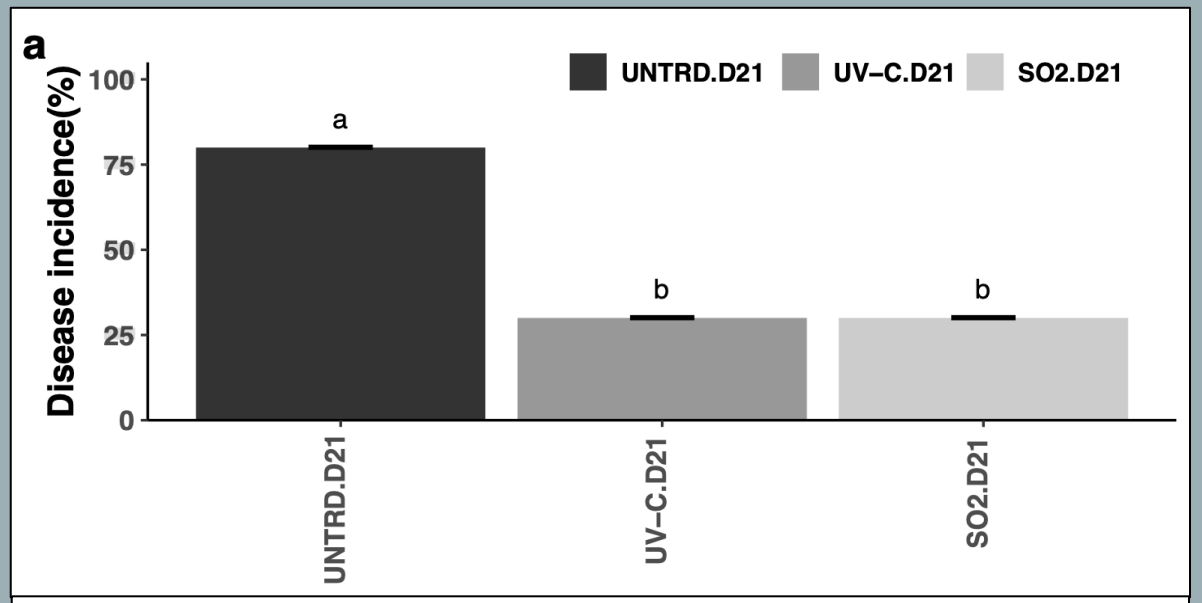
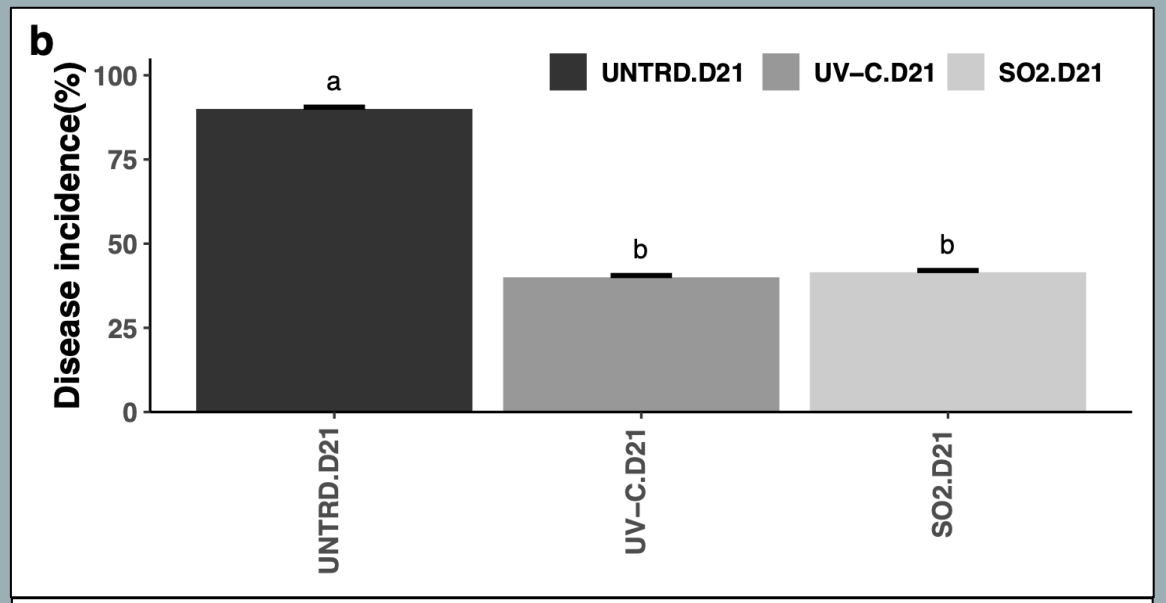


T7

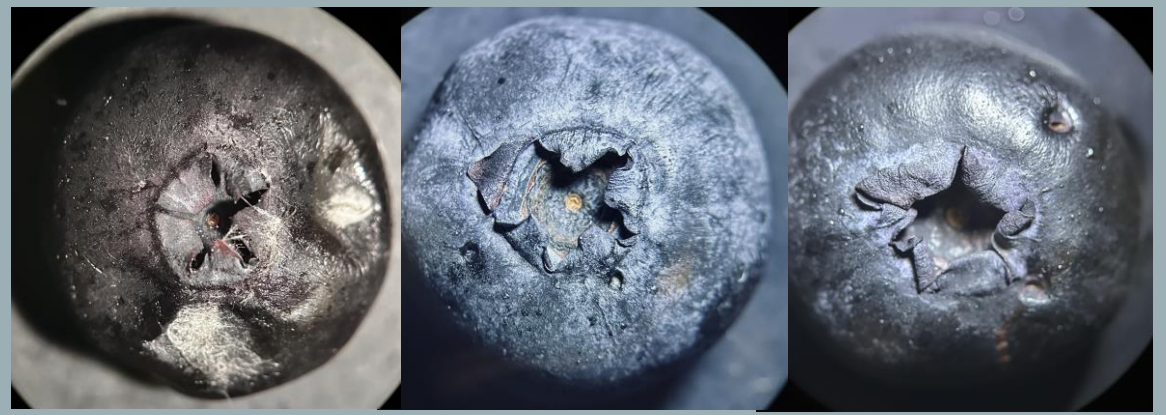
PRELIMINARY RESULTS FROM UV-C TRIALS



Impact of UV-C on disease incidence after 21 days of cold storage for cultivar 1



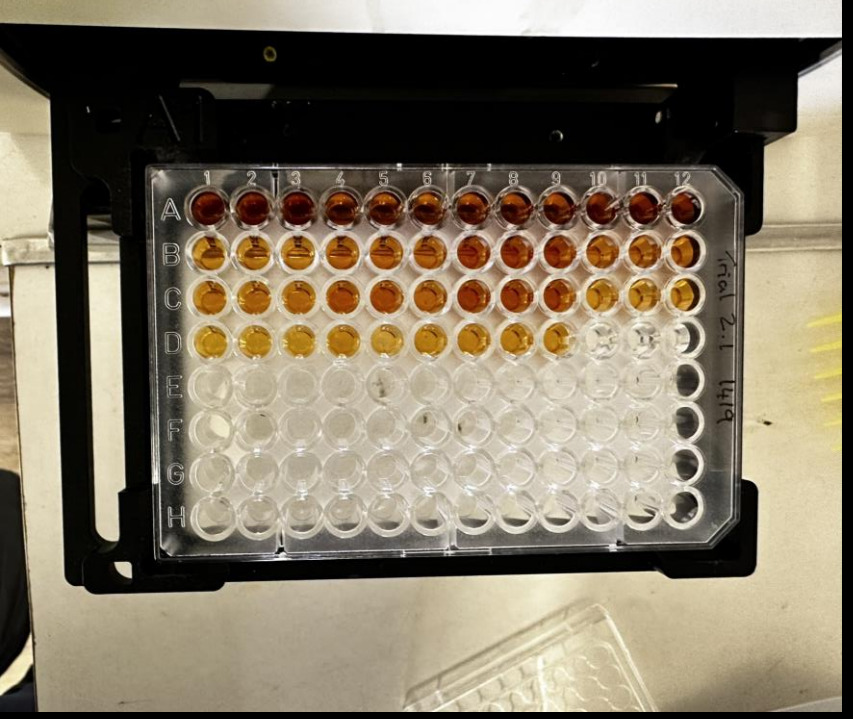
Impact of UV-C on disease incidence after 21 days of cold storage for cultivar 2

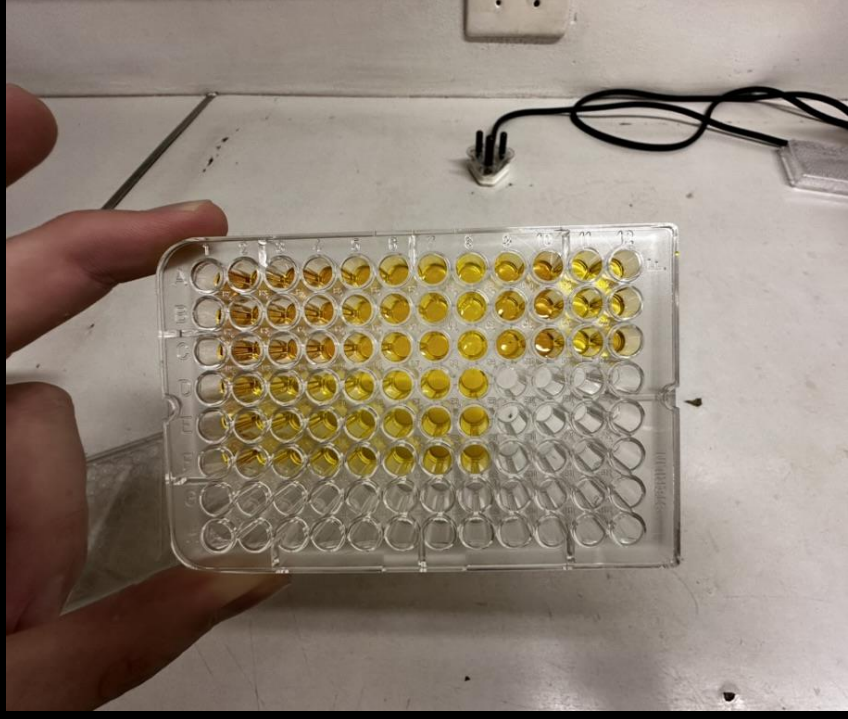


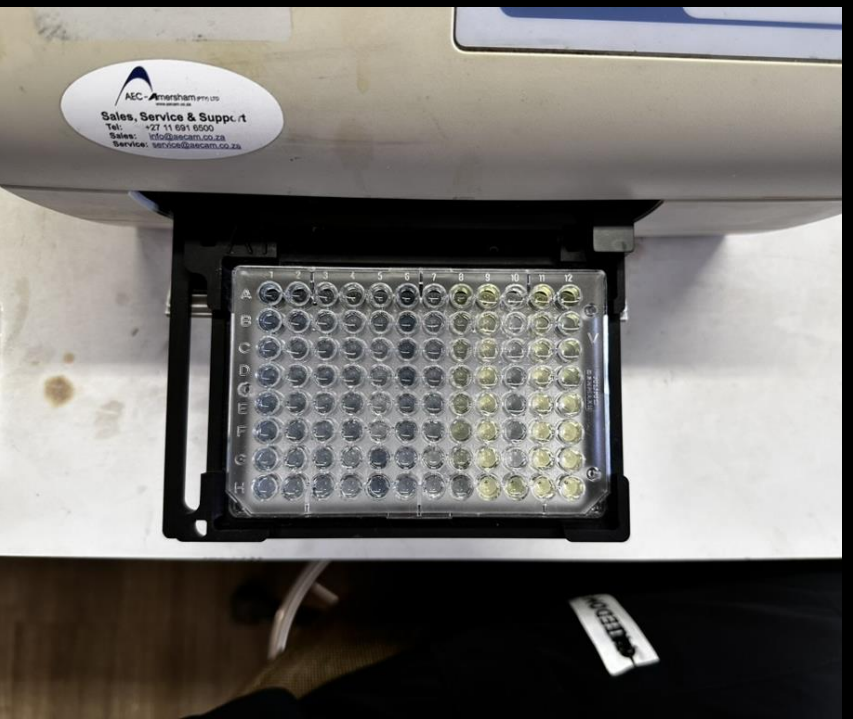
PRELIMINARY RESULTS FROM UV-C TRIALS

ENZYME AND ANTIOXIDANT SYSTEMS

DAY 0	DAY 7	DAY 14	DAY 21
Phenolics	Phenolics	★ Phenolics	★ Phenolics
Flavonoids	Flavonoids	★ Flavonoids	★ Flavonoids
Peroxidase	★ Peroxidase	Peroxidase	Peroxidase
b-1,3-glucanse	b-1,3-glucanse	★ b-1,3-glucanse	b-1,3-glucanse
Chitinase	★ Chitinase	Chitinase	Chitinase
Phenylalanine	Phenylalanine	★ Phenylalanine	★ Phenylalanine
ammonia-lyse	ammonia-lyse	ammonia-lyse	ammonia-lyse


1 2 3 4 5 6 7 8 9 10 11 12
A
B
C
D
E
F
G
H

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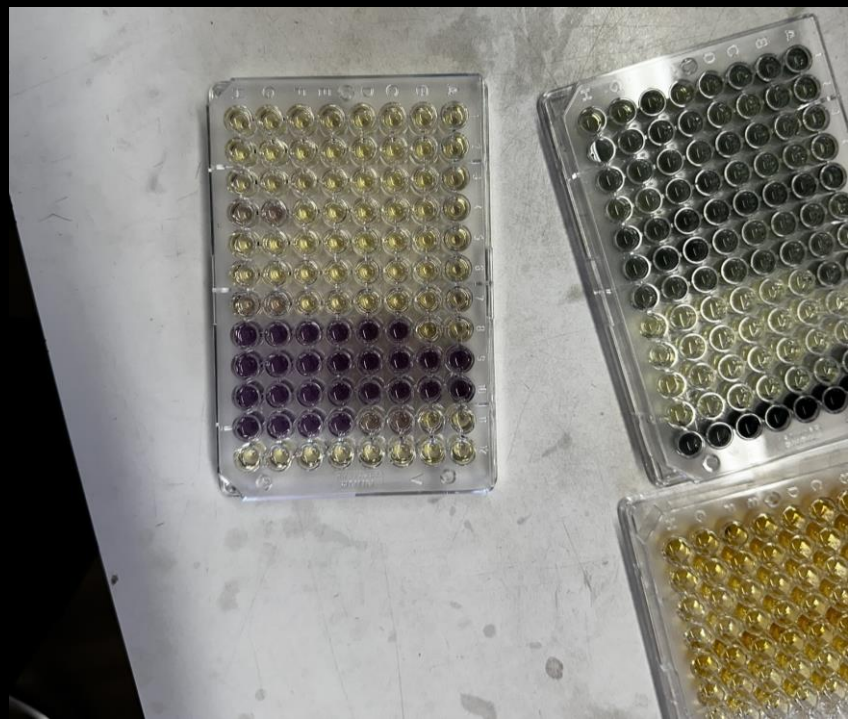
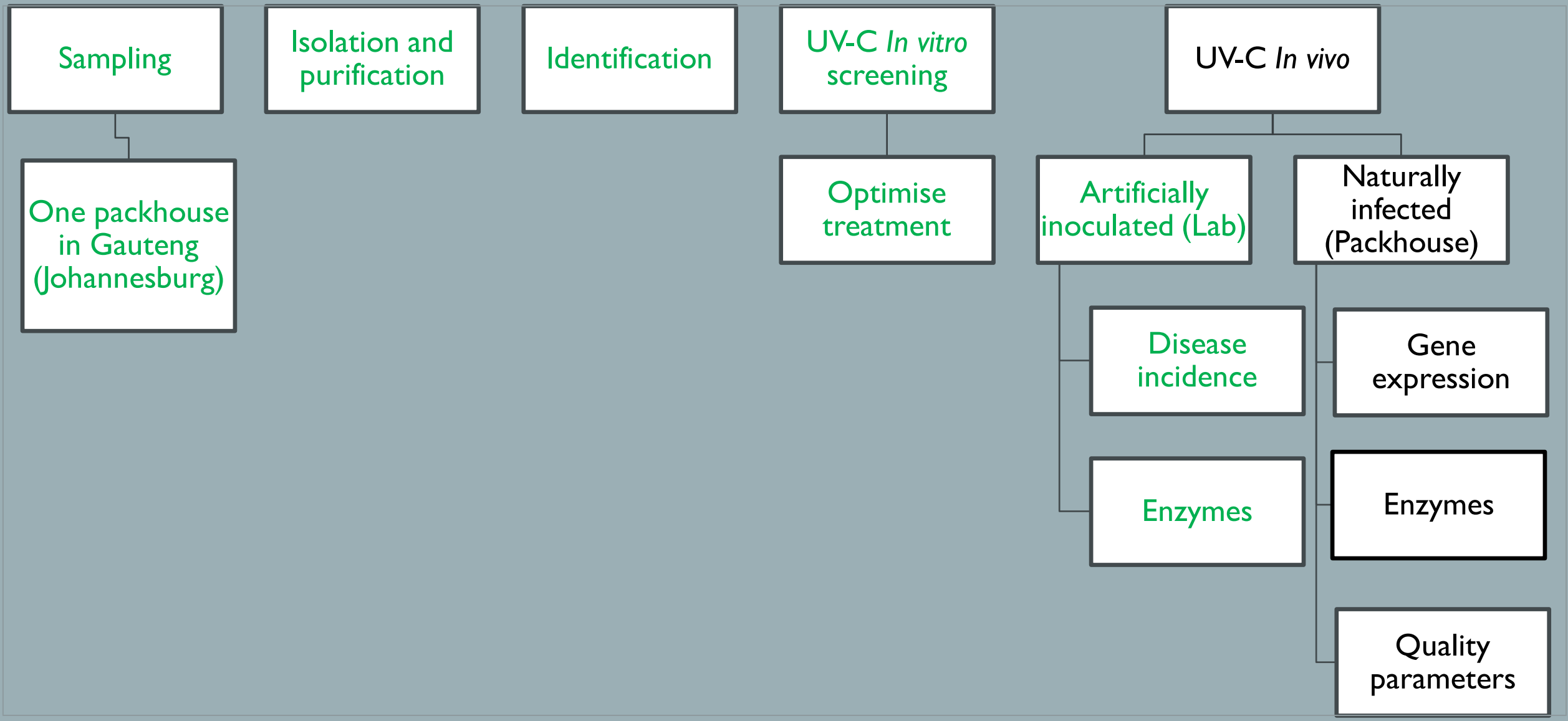
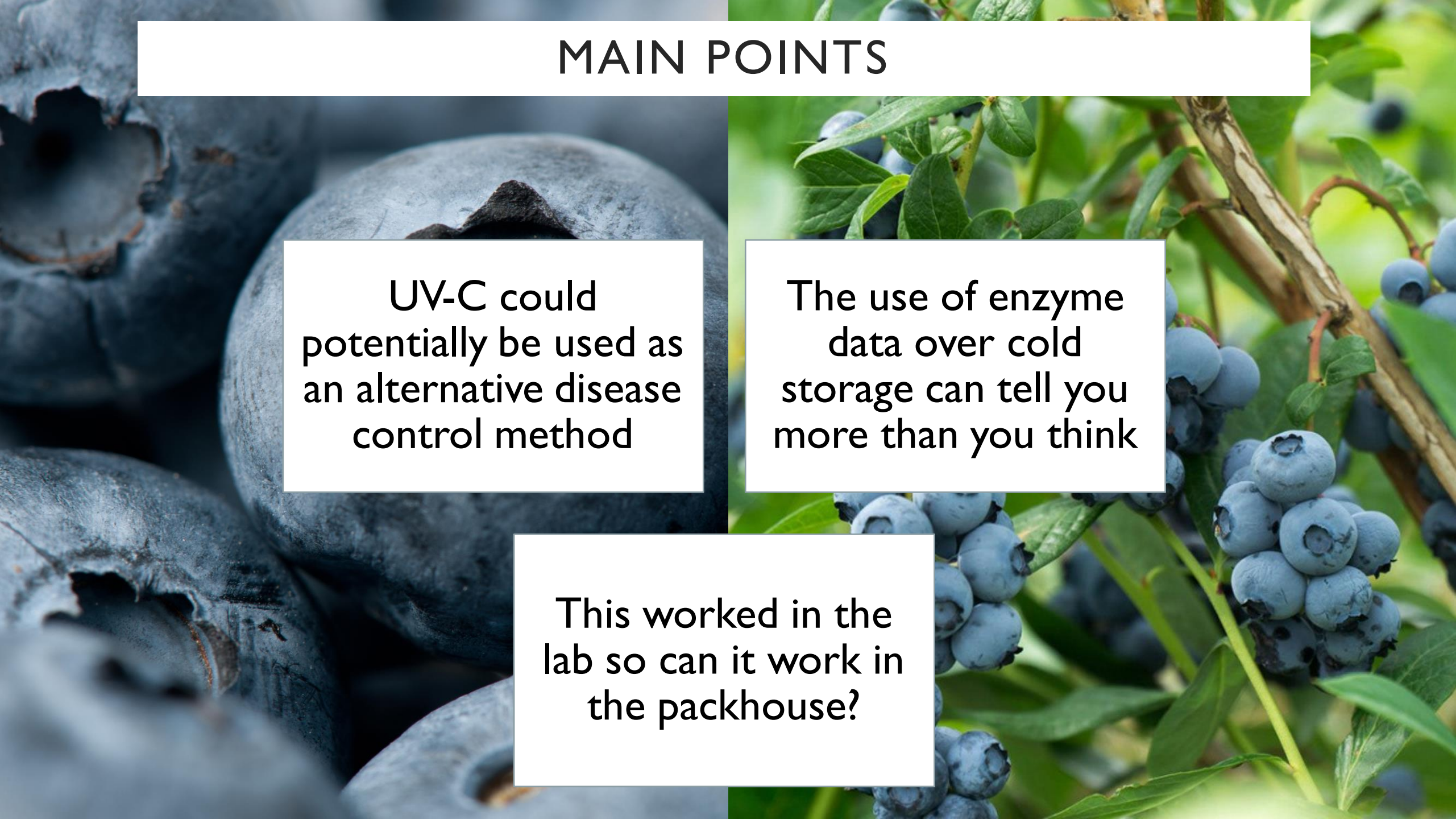


PROGRESS


Sampling
Isolation and purification
Identification
UV-C *In vitro* screening
UV-C *In vivo*
One packhouse in Gauteng (Johannesburg)
Optimise treatment
Artificially inoculated (Lab)
Naturally infected (Packhouse)
Disease incidence
Enzymes
Gene expression
Enzymes
Quality parameters

MAIN POINTS

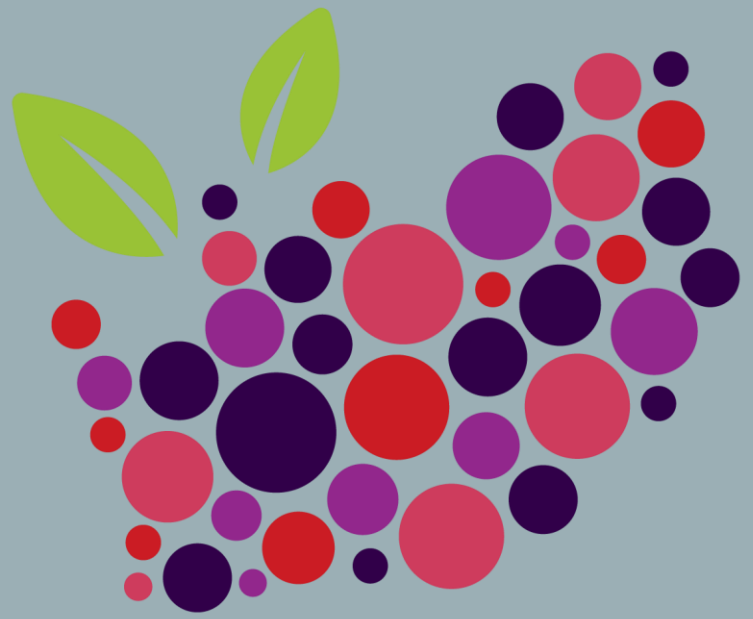


UV-C could potentially be used as an alternative disease control method

The use of enzyme data over cold storage can tell you more than you think

This worked in the lab so can it work in the packhouse?

ACKNOWLEDGEMENTS



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THANK YOU