BERRISYS

Postharvest protection of blueberries

Elton Williams

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INTRODUCTION

Postharvest Pathogens

Product Development

Sulphur dioxide and Products

Internal and External efficacy trials

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FACTORS PROMOTING POSTHARVEST DISEASES

- Postharvest diseases are a major contributing factor for the decline in blueberry quality during storage and transport.
- The challenge to arrive with quality products is even greater for South African growers, since main consumer markets are distant.
- **Promoting factors: Temperature, availability of moisture, and the microbial load.**

FACTORS PROMOTING POSTHARVEST DISEASES

- It is impossible to remove every fungal spore or bacterial cell. However, reducing the number that is present reduces the chance that infection will occur.
- Most organisms causing postharvest disease are weak pathogens.
- Broken cells/wound sites provide water and nutrients creating ideal environments for spores to germinate.
- Few fungi (*Colletotrichum*) can directly invade healthy skin.

FACTORS PROMOTING POSTHARVEST DISEASES

- *Alternaria* and *Botrytis* can infect flower petals and develop as the fruit mature to cause problems during storage.

- Fungal spores are also present in the air, on equipment, on containers and on the hands of harvest workers and packers

POSTHARVEST DISEASES

Gray mould (*Botrytis cinerea*)
Infected berries are covered with white fluffy growth that turns grey.

Alternaria fruit rot (*Alternaria* spp.)
Infected berries become softer, and a greenish-black mold will develop on the berry surface.

Anthracnose (*Colletotrichum* spp.)
Orange-coloured spore masses form during storage and transport.

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PRODUCT DESIGN AND DEVELOPMENT

1. Idea generation – Collective brainstorming
2. .Market analysis + TPP (Target Product Profile)
3. Validation of prototyping (*In vitro* and *In vivo* screening)
4. Independent verification trials (Trials conducted by 3rd party)
5. Internal transfer from Research and Development to Sales and Marketing.
6. Semi and commercial trials, and because market requirements are ever changing, continuous product refinement is also a part of the process.

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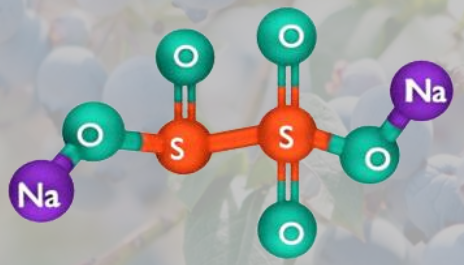
SULPHUR DIOXIDE

- Effectiveness of Sulfur Dioxide (SO_2) have been proven for years when applied during fumigation or as in-packaging pads on grapes.

- Uvasys (Grapes), Berrisys (Berries), Tomasys (Tomatoes) and Florasys (Cut Roses) contains Sodium Metabisulphite ($Na_2S_2O_5$).



- Products are designed for a specific crop and differ with regards to concentrations, particle size and material specifications.

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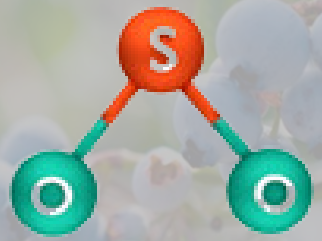
SULPHUR DIOXIDE

- Moisture (H_2O) travels though different layers of the pads and reacts with the SMBS ($Na_2S_2O_5$) encapsulated in the wax or resin/hardener matrix to produce Sulphur Dioxide (SO_2).



$$Na_2S_2O_5 + H_2O \rightarrow Na_2SO_3 + SO_2 + H_2O$$

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SULPHUR DIOXIDE

- The gas acts as the fumigator and the relative humidity should be higher than 70% to start the reaction.

Conc. (ppm)	Time (h)
200	1
100	2
50	4
+/- 3	Continual

How much SO_2 is needed?

Efficacy is dependent on exposure time of pathogen to a specific concentration.

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SULPHUR DIOXIDE

How does SO_2 reduce postharvest decay?

- SO_2 + water forms sulphurous acid.
- Sulphurous acid (H_2SO_3) reacts with cell membrane and block enzymes by reducing essential disulphide linkage.

- Inhibit the multiplication of microorganisms.
- Therefore prevent spreading to healthy neighbouring berries and resulting in nest rots.

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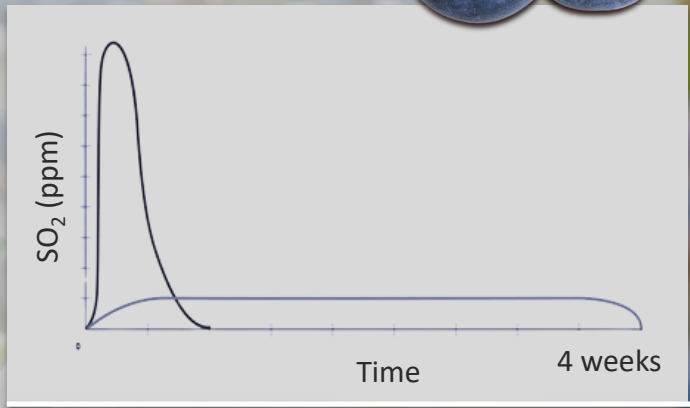
PRODUCTS

BERRISYS DR B

BERRISYS DR

Berrisys/Berrisys Recyclable (No liner packaging)

- Berrisys consist out of a fast and slow-release stage.
- Fast Release disinfect blueberry surfaces by eliminating any actively growing *Botrytis* fungal spores present on arrival.



- The Slow-Release layer emits a low, continual dose of gas to inhibit any latent infections during storage and transport.
- Must be applied on each layer with proper ventilated punnets.

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PRODUCTS

Berrisys LITE/Berrisys LITE Recyclable (Liner packaging)

- Lower fast release stage compared to Berrisys products.

- Recommended for loose bulk or open top punnets enclosed with plastic liners/pallet wrapping/shrouds or MAP bags – 0% ventilation area to 0.3%.

EFFICACY TRIALS (IN VITRO)

Factors that might also influence efficacy

- Punnet design – Carton punnets absorb SO_2
- Temperature breaks.
- Poor quality fruit: Effective pre-harvest spray programs essential.

Coverage of > 80% essential.

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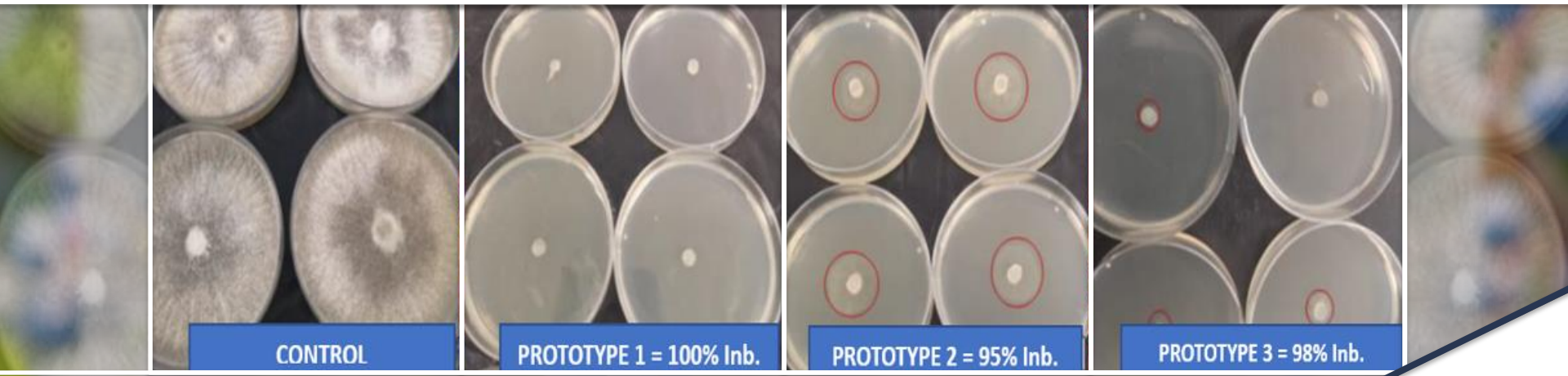
EFFICACY TRIALS (IN VITRO)

- With the development of Berrisys LITE the mycelium plugs of the fungus (*Botrytis*) was placed on growth media and exposed to the gas release of different prototypes.
- These plates was stored for 28 days @ 0.5 °C
- Plates were moved to 10 °C and evaluated after 7 days.



- Prototype 1 (100% inhibition) reflected the best results and therefore was selected to continue with trials on actual blueberries.

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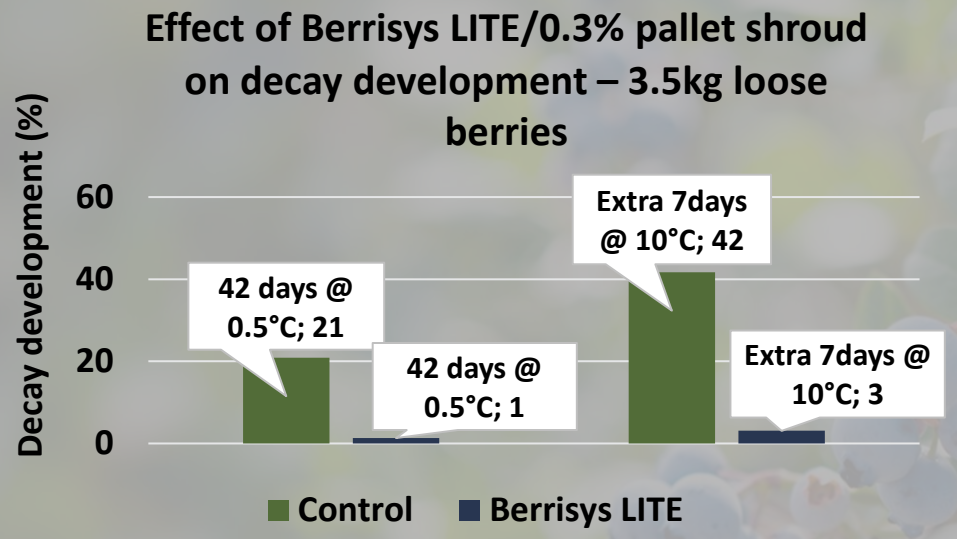
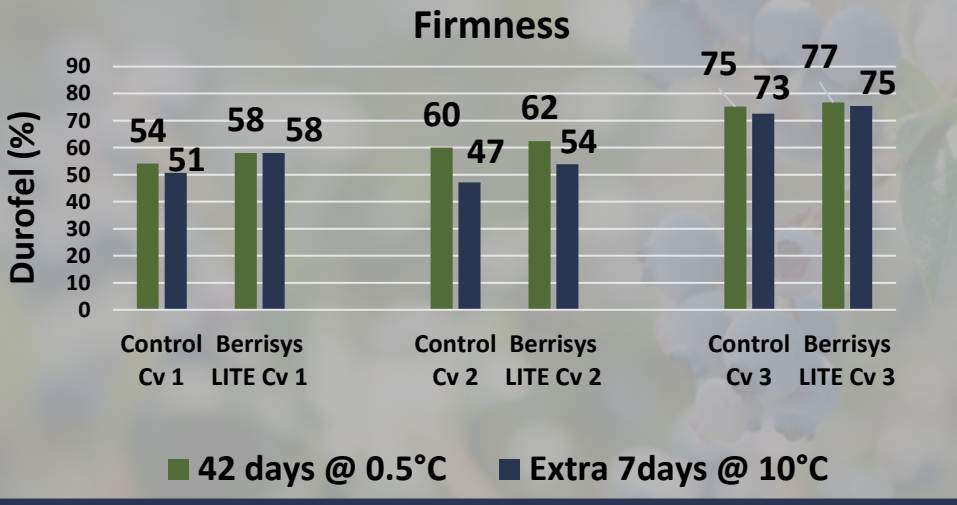
EFFICACY TRIALS (*IN VIVO*)





- 21% decay development during cold storage of 42 days and during shelf-life of 7 days a further 42% for control.
- Decay for Berrisys Lite was only 1% during cold storage and 3% during the higher shelf-life temperature.
- For controls a total waste of 63% compared to 4% was recorded.
- Durofel firmness readings reflects no real difference between treated and control although Berrisys Lite treated berries was slightly higher for was respective cultivar.

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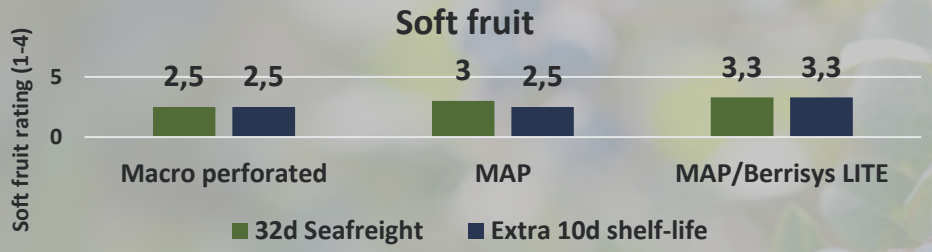
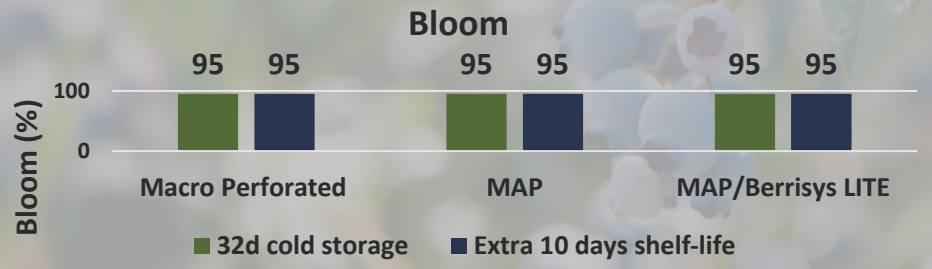
EXPORT TRIAL SA – UK (INDEPENDENT QC)



1 -severe, 2 -moderate, 3 -slight, 4 –none



- Export trial from SA to UK via sea freight conducted to compare Berrisys LITE in MAP to MAP and macro perforated liners on their own.
- Evaluations after 32d on arrival and an extra 10d simulating shelf-life reflects that Berrisys LITE/MAP had the least amount of soft fruit.
- Taste and bloom was also not affected.

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EXPORT TRIAL SA – UK (INDEPENDENT QC)

1-inedible, 2-unsaleable, 3-saleable, 4-excellent

- Berrisys LITE/MAP less waste on arrival. Only (1.2%) compared to MAP (5.1%) and Perforated liner (9.4%).
- After shelf-life waste in liners (100%) and (8.8%) for MAP compared to 1.2% for MAP / Berrisys Lite.
- Overall quality on arrival and after shelf-life was deemed good to excellent for the combination compared to rest.

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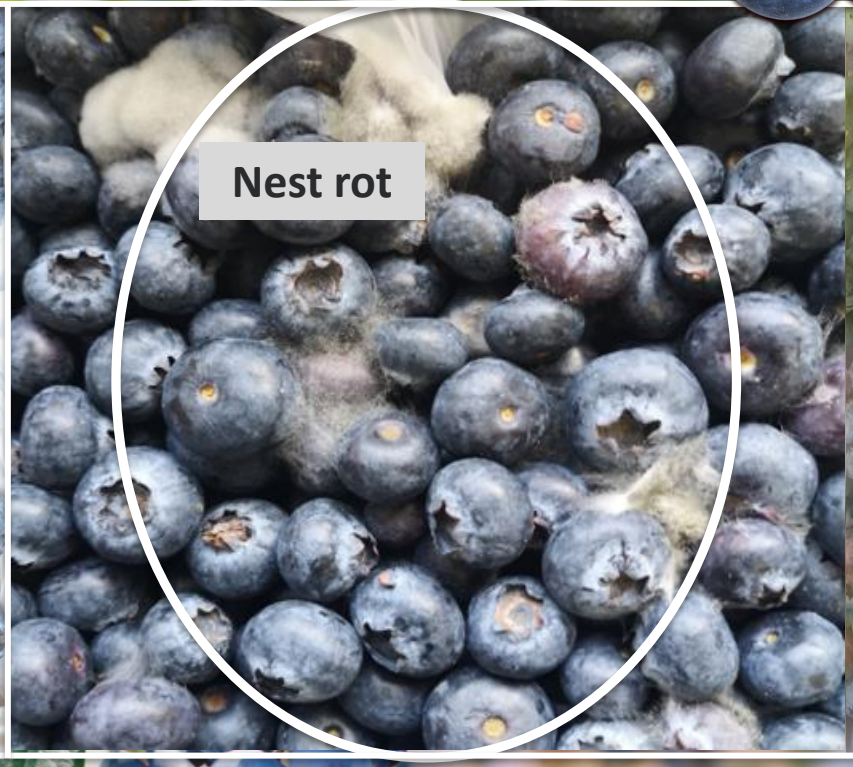
EFFECT OF SO_2 DURING EXPORT TRIAL



Berrisys LITE preventing spreading from infected berries to healthy berries.

Untreated berries – infection spreading to neighboring berries.

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CONCLUSION

- Postharvest diseases results in significant losses during storage and transport.
- Trials indicate that the use of Berrisys products significantly reduce the development of fungal diseases up to 42 days.
- Berrisys products does not affect other blueberry quality parameters and are within the Maximum Residue limits of < 10ppm.
- Berrisys products currently registered in US and Australia after successful independent registration trials. Peru trials completed, waiting on registration.

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ACKNOWLEDGEMENT

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TRIBUTE

Thank you

GERHARD SLABBERT

THANK YOU