

Optimising postharvest packaging to prolong storage and maintain quality of table grapes

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Rationale



- In general, SO_2 released from in-package SO_2 generators is successful in limiting decay during controlled shipment and storage conditions
- Table grape quality maintenance complication factors:



- Type of cultivar (difference in susceptibility)
- Pre-harvest and at-harvest quality of table grapes
- Postharvest conditions (packaging, cooling and logistics)
- Efficacy of SO_2 treatments



This study aims to determine the efficacy of different SO_2 packaging options to limit decay and maintain quality of table grapes.

Objectives

Obj 1

Identify industry packaging combinations and prolonged storage periods

Obj 2

Establish SO₂ release patterns and efficacy of different SO₂ sheets to confine decay

Obj 3

Efficacy of different inner packaging combinations to confine decay

Obj 4

Efficacy of the best packaging combinations to confine decay under different pre-pack and postharvest storage extremes

Obj 5

Efficacy of the best packaging combination to confine decay on different grape cultivars subjected to long term storage

Establish SO₂ release patterns - (SO₂ Generator Selection)

– SO₂ Sheets:

1. Untreated Control
2. Dual release SO₂ generating sheet
3. Dual release SO₂ generating sheet
4. Dual release SO₂ generating sheet
5. SO₂ extruded bag



SO₂ release patterns: 0-8 Hours

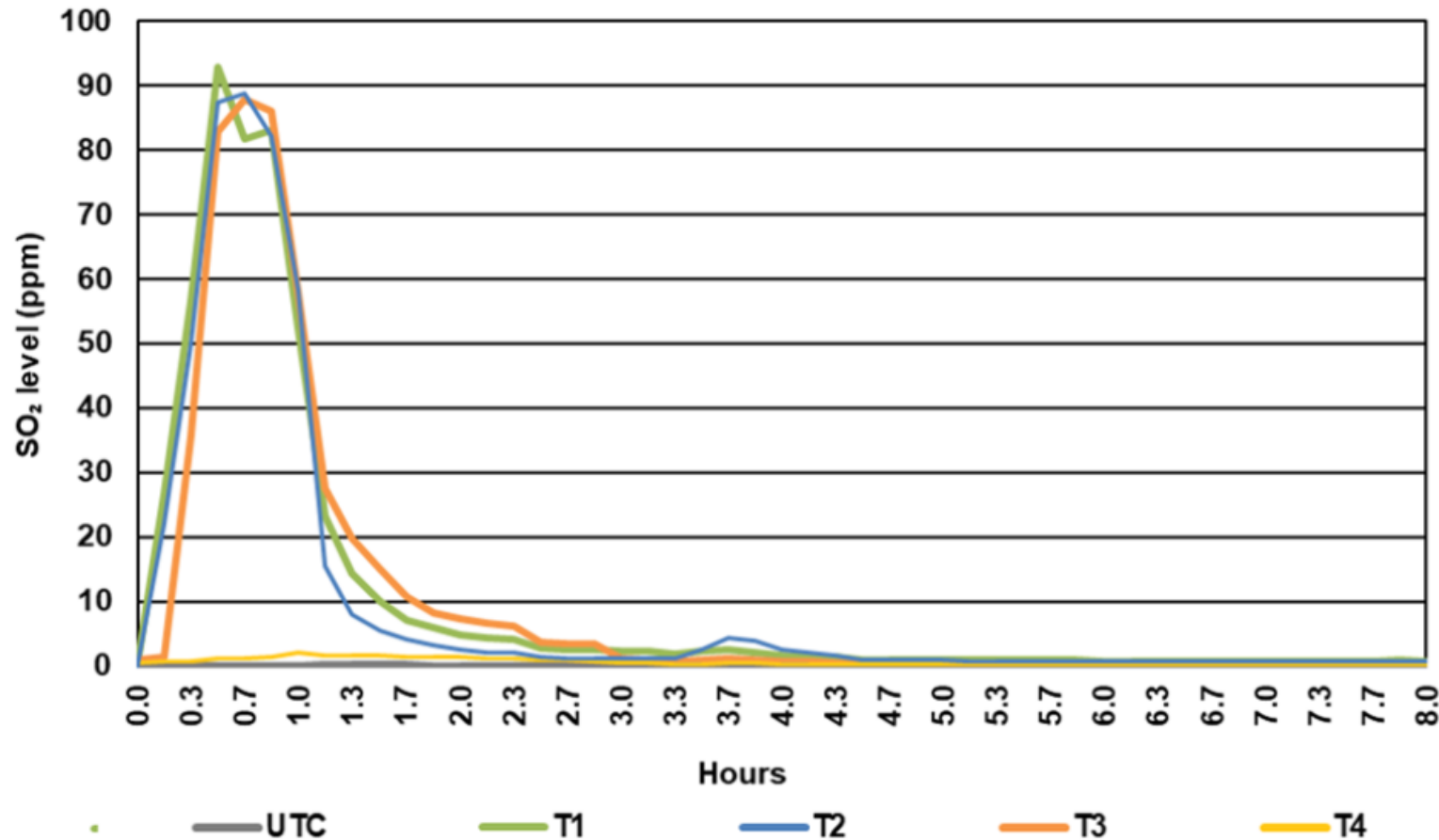


Fig 1. SO₂ emission from different in-box SO₂ treatments over an eight-hour period during forced-air cooling (FAC) at -0.5 °C. FAC commenced approx. one hour after bag closure

SO₂ release patterns: 8-24 Hours

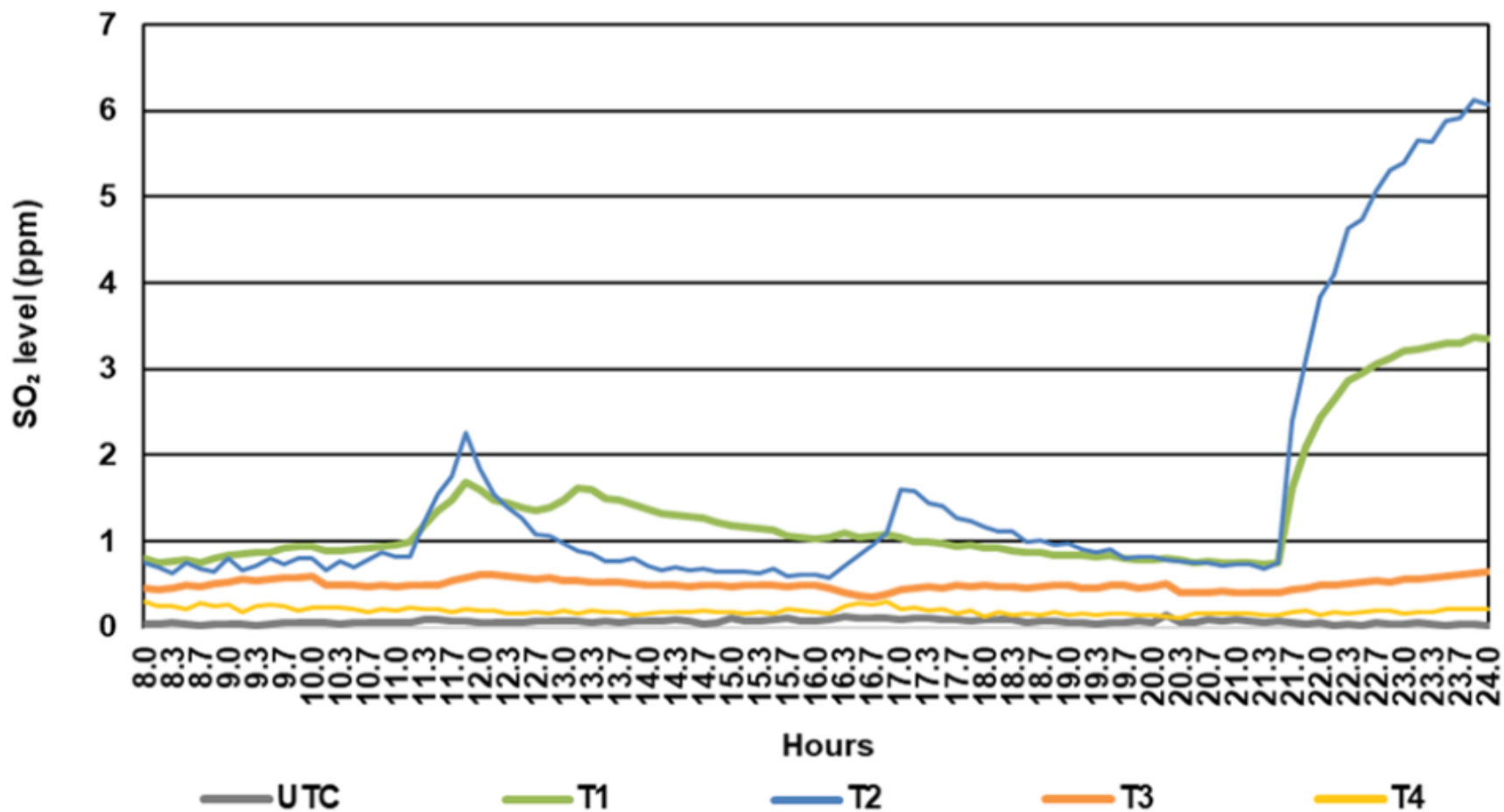


Fig 2. SO₂ emission from different in-box SO₂ treatments over 8 - 24 hours during passive cooling at -0.5 °C. Forced-air cooling started approx. one hour after bag closure and stopped after ±21 hours.

SO₂ release patterns: 1-4 Days

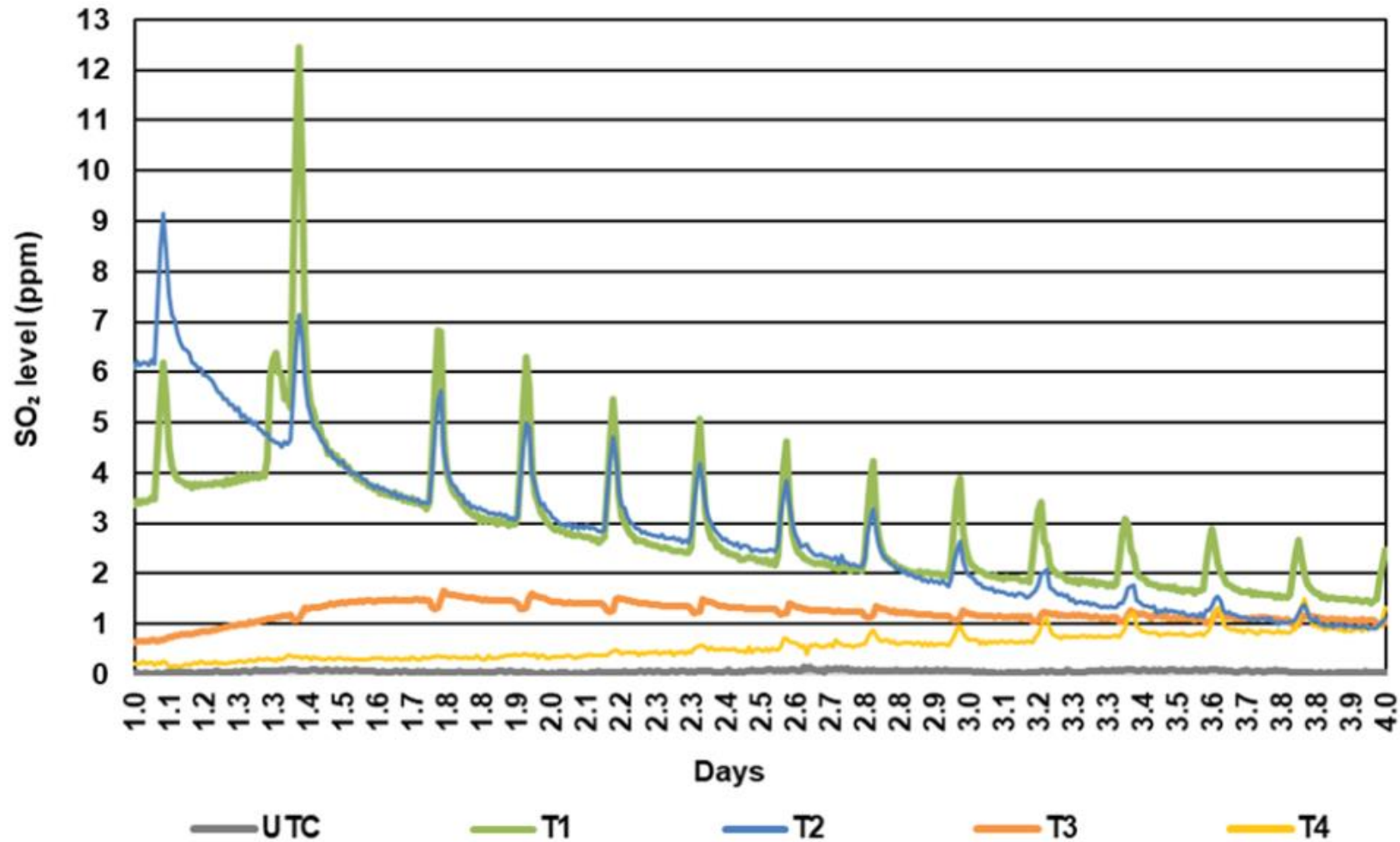


Fig 3. SO₂ emission from different in-box SO₂ treatments over 1 - 4 days passive cooling at -0.5 °C

SO₂ release patterns: 4-21 Days

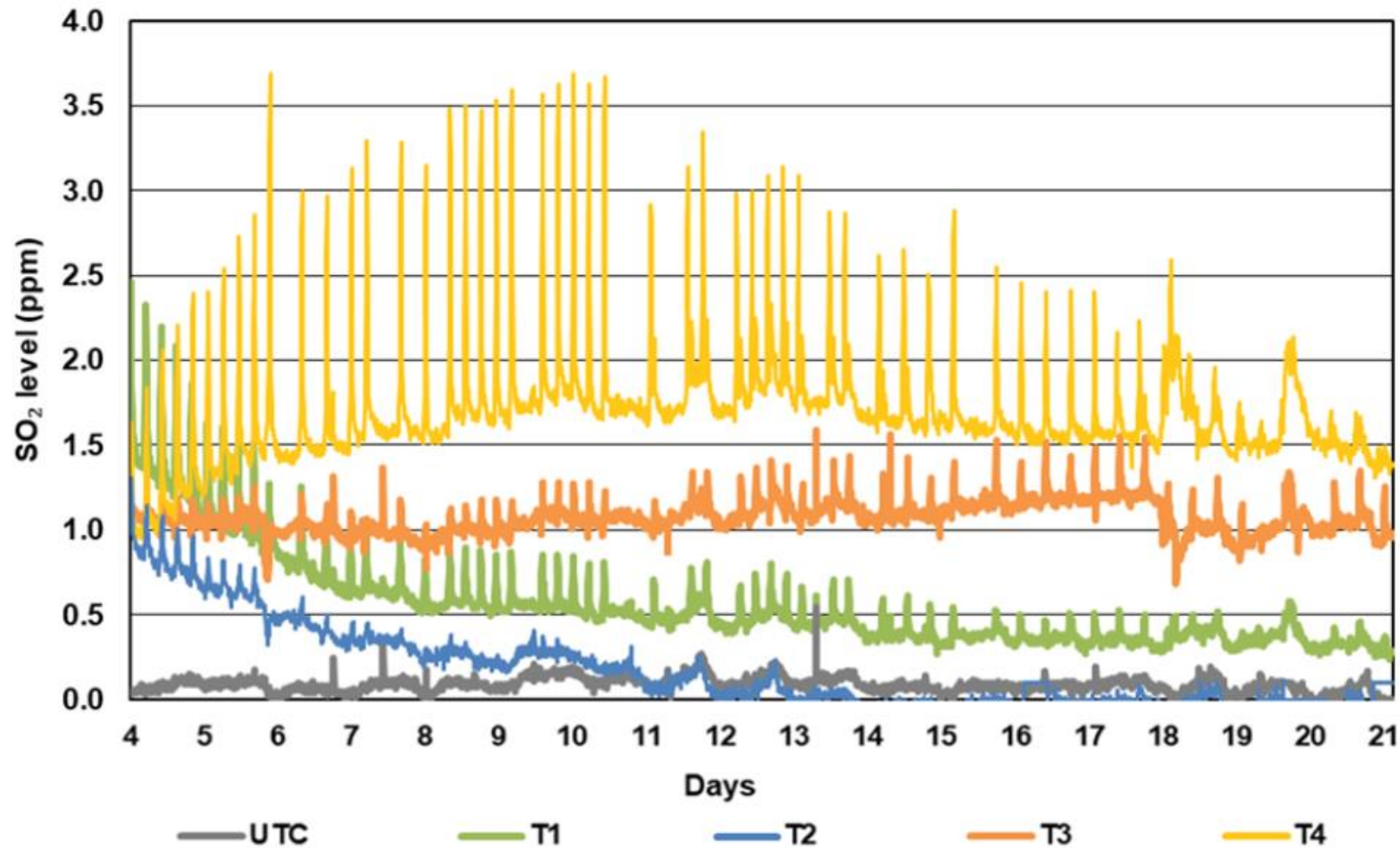


Fig 4. SO₂ emission from different in-box SO₂ treatments over 4 - 21 days passive cooling at -0.5 °C

SO₂ release patterns: 21-46 Days

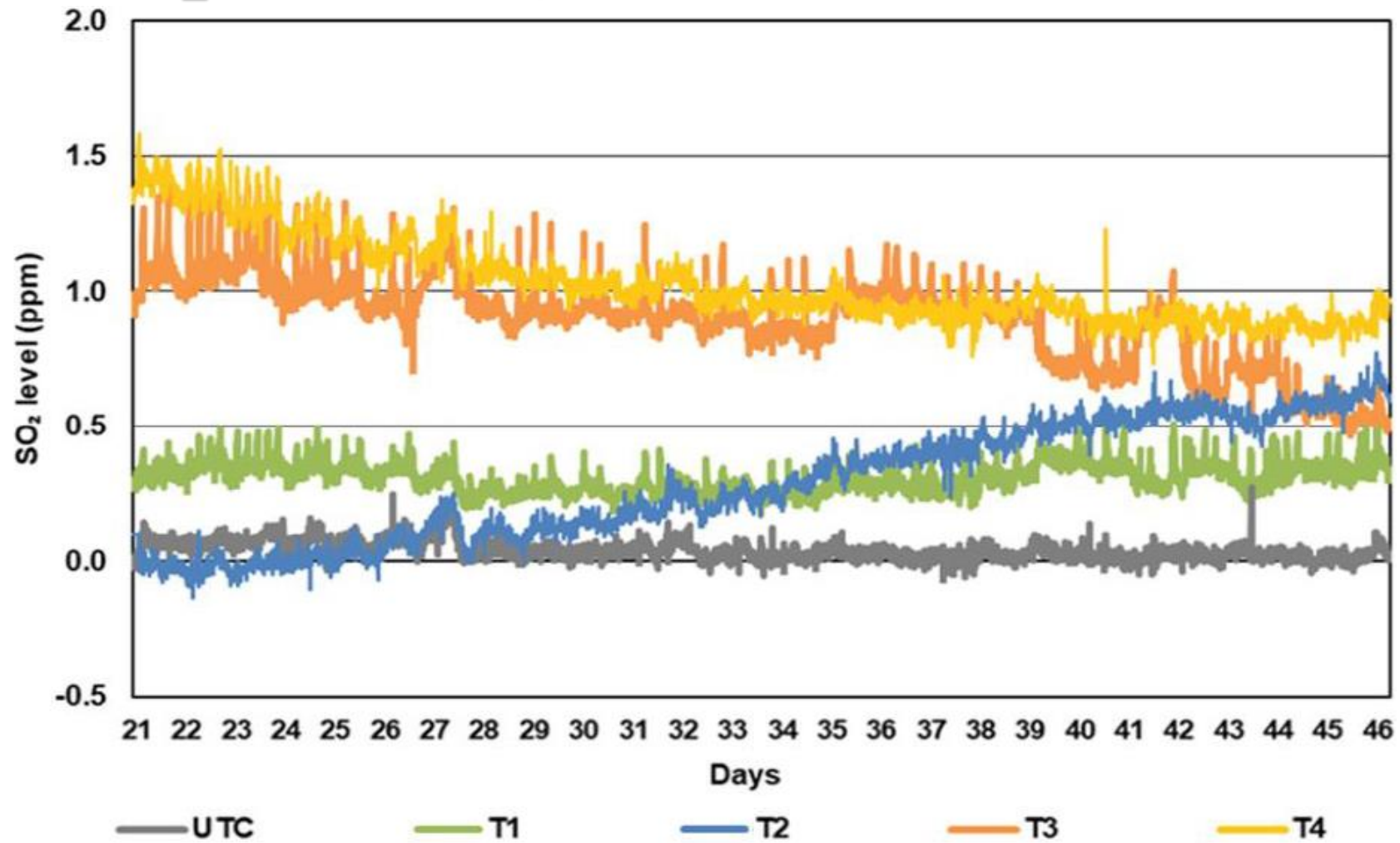


Fig 5. SO₂ emission from different in-box SO₂ treatments over 21 - 46 days passive cooling at -0.5 °C

End of Shelf-life Evaluation - Decay

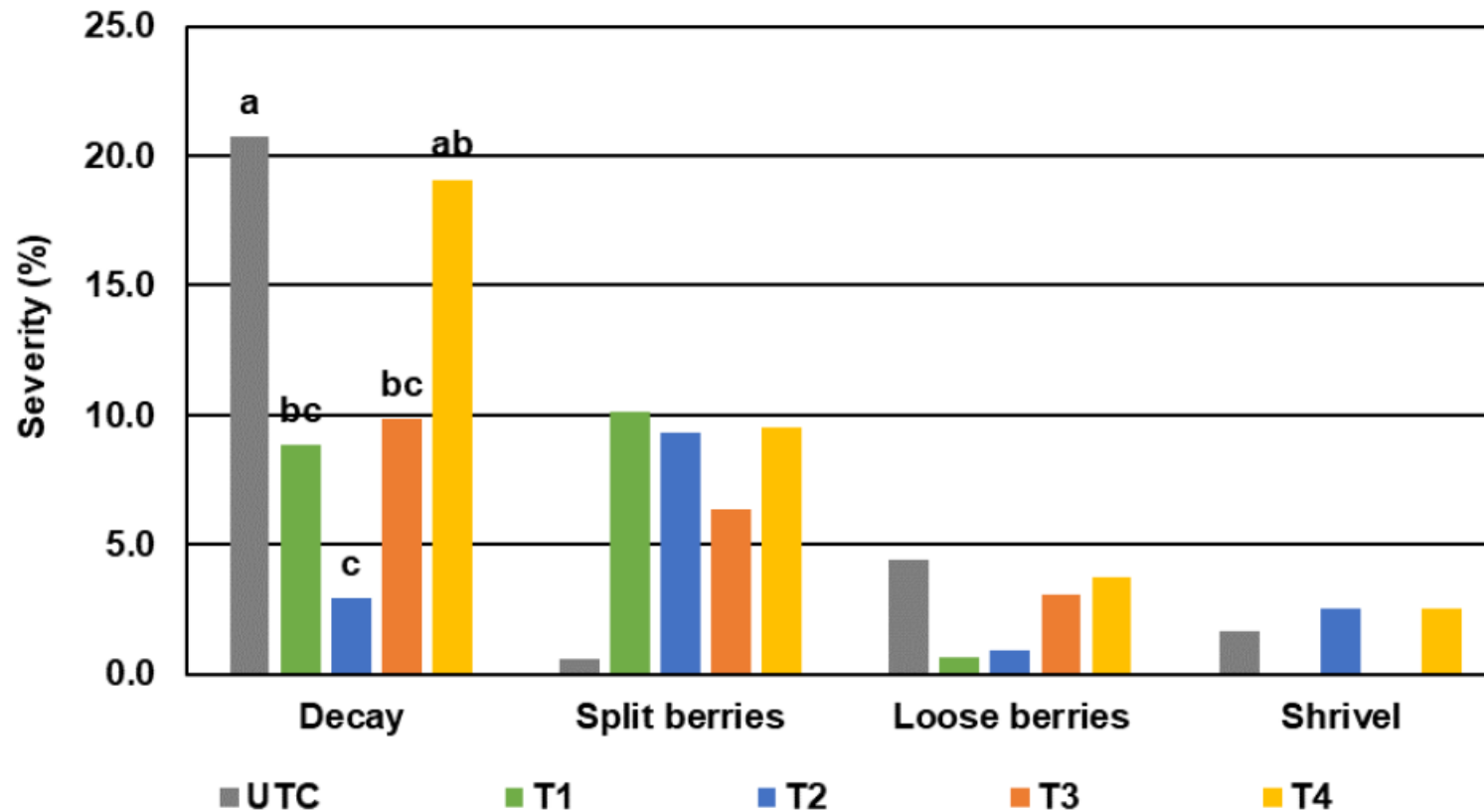


Fig 6. Percentage decay, split, loose and shrivel berries of Autumn Crisp table grapes packed with different SO₂ treatments (T1 - T4) and an untreated control (UTC) after eight weeks cold (-0.5 °C) and three days shelf-life (7.5 °C) storage.

End of Shelf-life Evaluation - SO₂ related damage

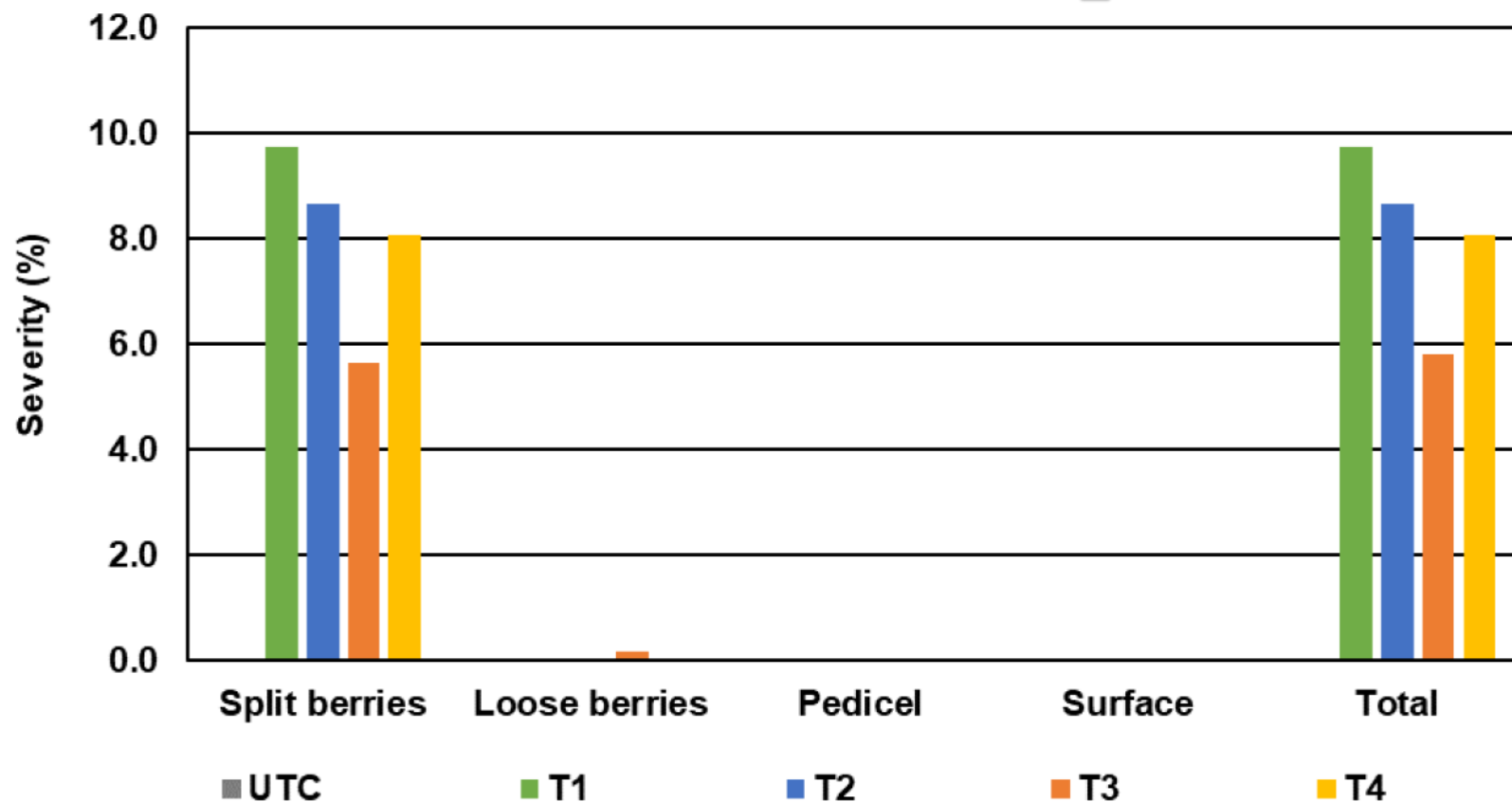


Fig 7. Percentage SO₂ related damage of Autumn Crisp table grapes packed with different SO₂ treatments (T1 - T4) and an untreated control (UTC) after eight weeks cold (-0.5 °C) and three days shelf-life (7.5 °C) storage.

End of Shelf-life Evaluation - Rachis & Pedicel

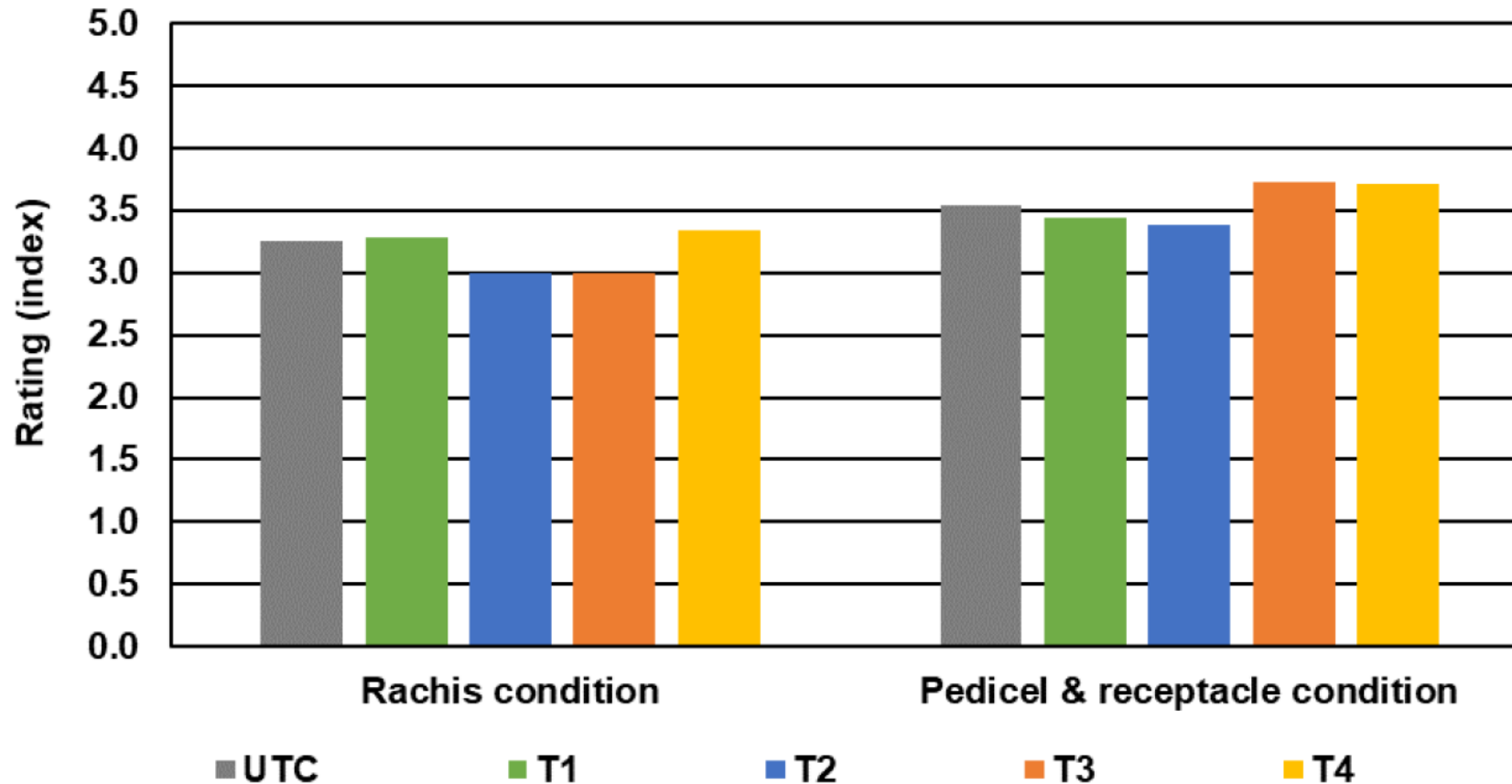


Fig 8. Rachis, pedicel and receptacle condition of Autumn Crisp table grapes packed with different SO₂ treatments (T1 - T4) and an untreated control (UTC) after eight weeks cold (-0.5 °C) and three days shelf-life (7.5 °C) storage. Index: 1 - 5; 1, green & turgid; 5, dark brown and desiccated.

End of Shelf-life Evaluation - Inoculation Trial

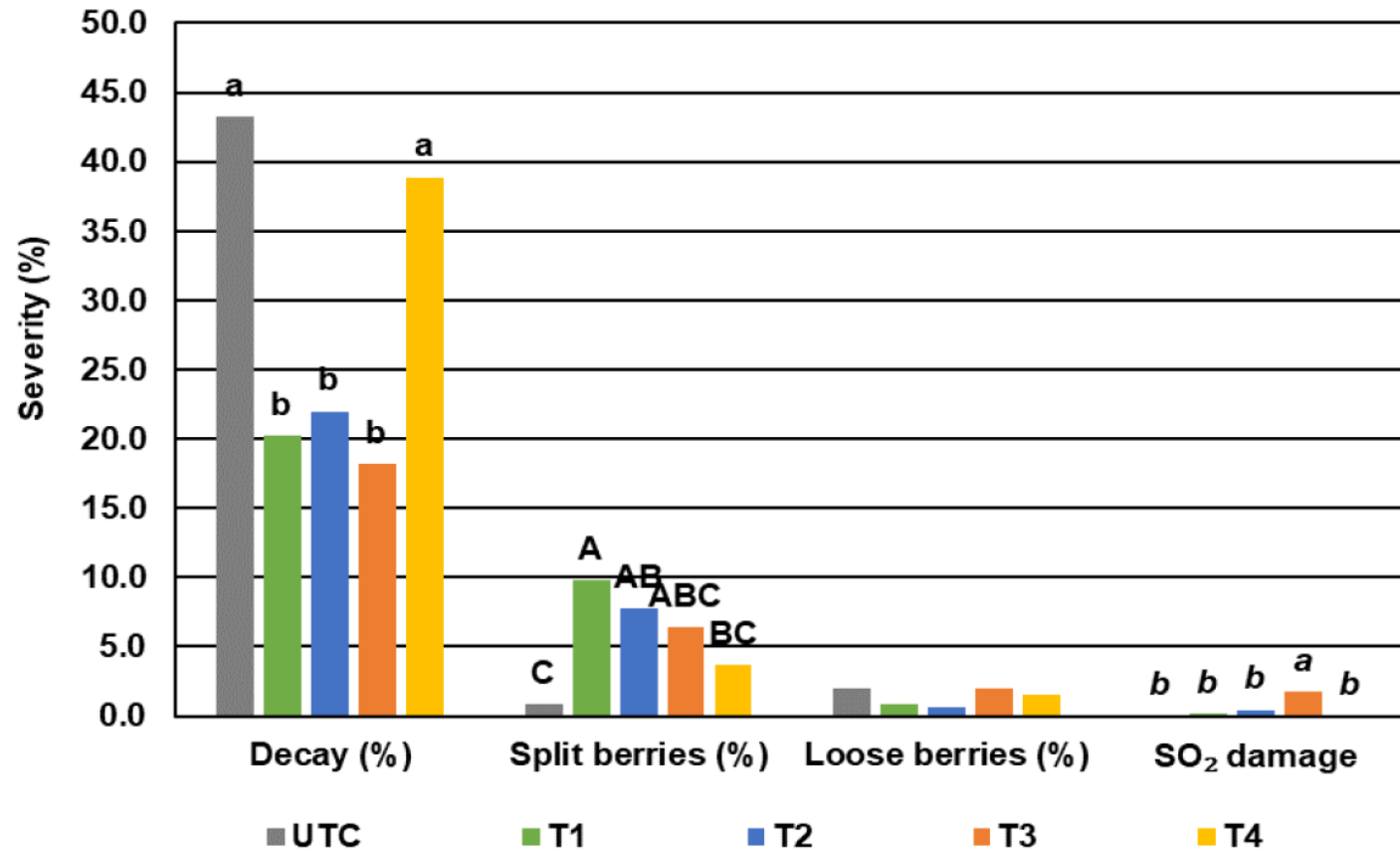


Fig 9. Average decay, split, loose and SO₂ damaged berries of Autumn Crisp table grapes inoculated with *B. cinerea*, *A. alternaria* & *P. expansum* packed with different SO₂ treatments (T1 - T4) and an untreated control (UTC), and subjected to eight weeks cold (-0.5 °C) and three days shelf-life (7.5 °C) storage.

End of Shelf-life Evaluation - Inoculation Trial

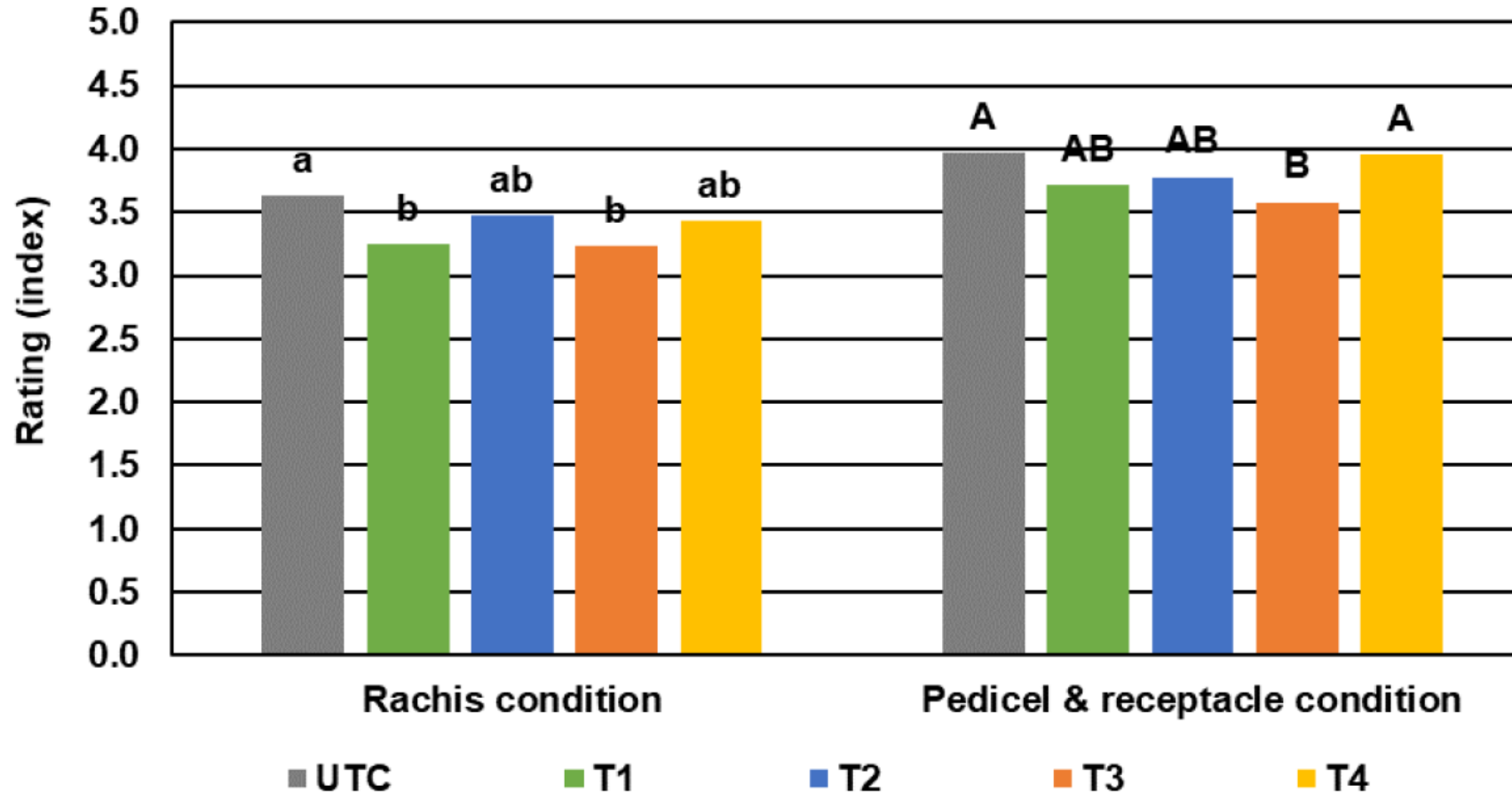


Fig 10. Average rachis, pedicel and receptacle condition of Autumn Crisp table grapes inoculated with *B. cinerea*, *A. alternaria* & *P. expansum* packed with different SO₂ treatments (T1 - T4) and an untreated control (UTC), and subjected to eight weeks cold (-0.5 °C) and three days shelf-life (7.5 °C) storage.

End of Shelf-life Evaluation - Wound Trial

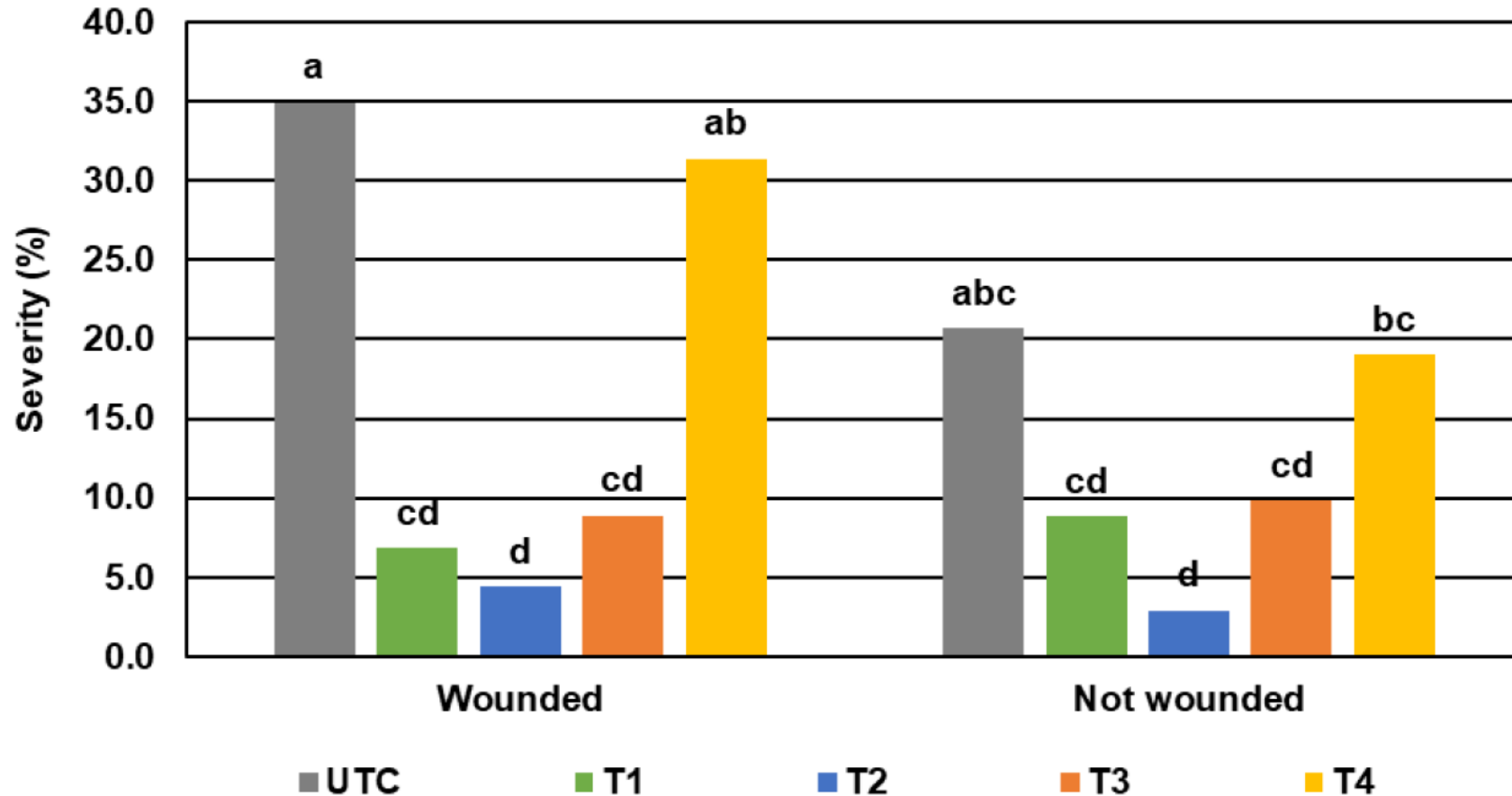


Fig 11. Percentage decay of **wounded** and **not wounded** Autumn Crisp table grapes treated with different SO₂ treatments (T1 - T4) and an untreated control (UTC) after eight weeks cold (-0.5 °C) and three days shelf-life (7.5 °C) storage.

End of Shelf-life Evaluation - Wound Trial

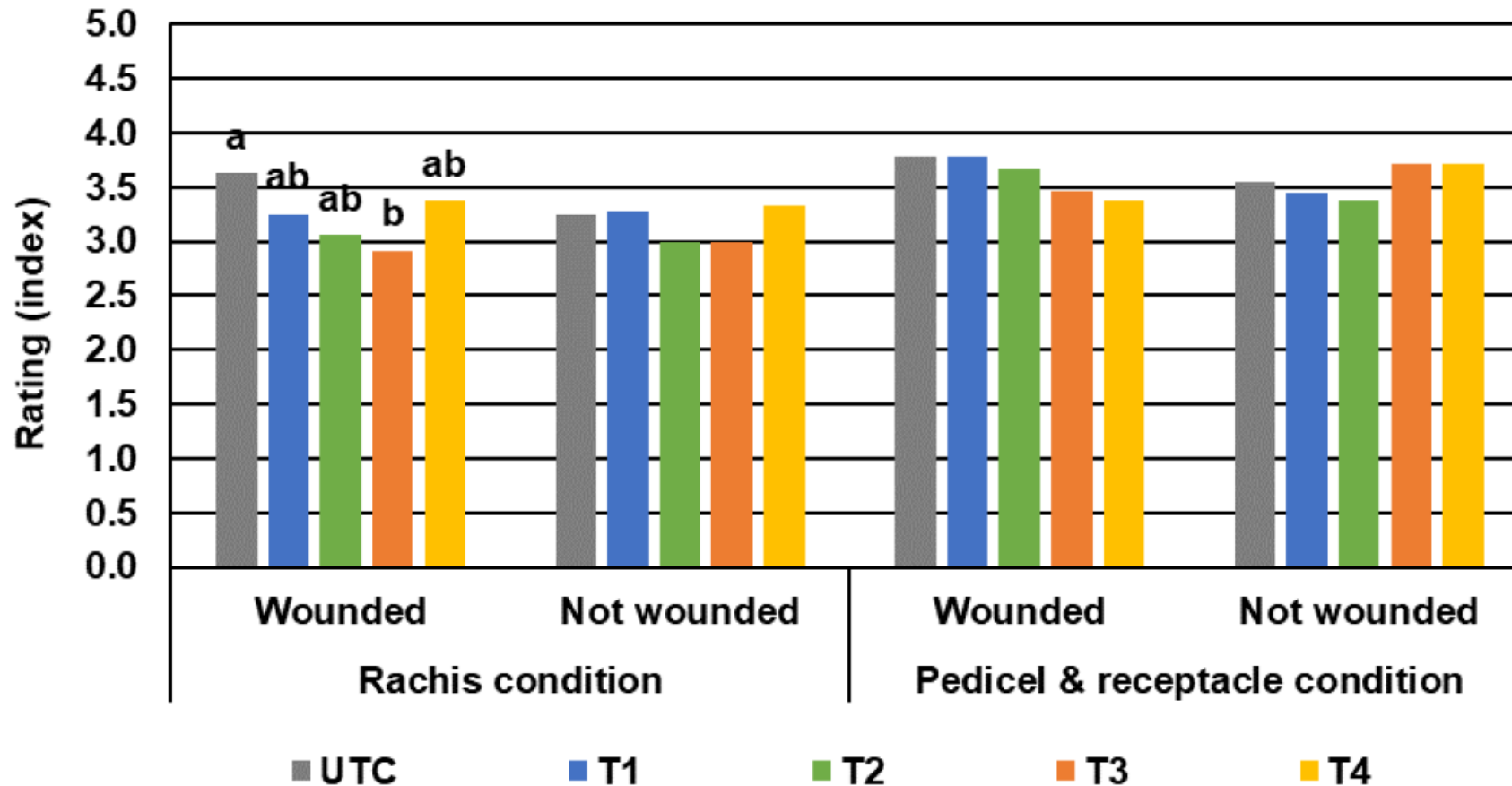


Fig 12. Rachis, pedicel and receptacle condition of **wounded and not wounded** Autumn Crisp table grapes treated with different SO₂ treatments (T1 - T4) and an untreated control (UTC) after eight weeks cold (-0.5 °C) and three days shelf-life (7.5 °C) storage.

Efficacy of different inner packaging combinations to confine decay

– SO₂ Sheets:

- Dual release SO₂ generating sheet
- Dual release SO₂ generating sheet
- Dual release SO₂ generating sheet

– Plastic Liner Bags:

- 96 x 5 mm Perforations
- 112 x 4 mm Perforations
- “Needle Scarred” Microperforation

– Punnets:

- Clamshell
- Open top

– Inoculation with:

- *Botrytis cinerea*
- *Penicillium expansum*

End of Shelf-life - Plastic Liner Bags - *Botrytis* Inoculation Trial

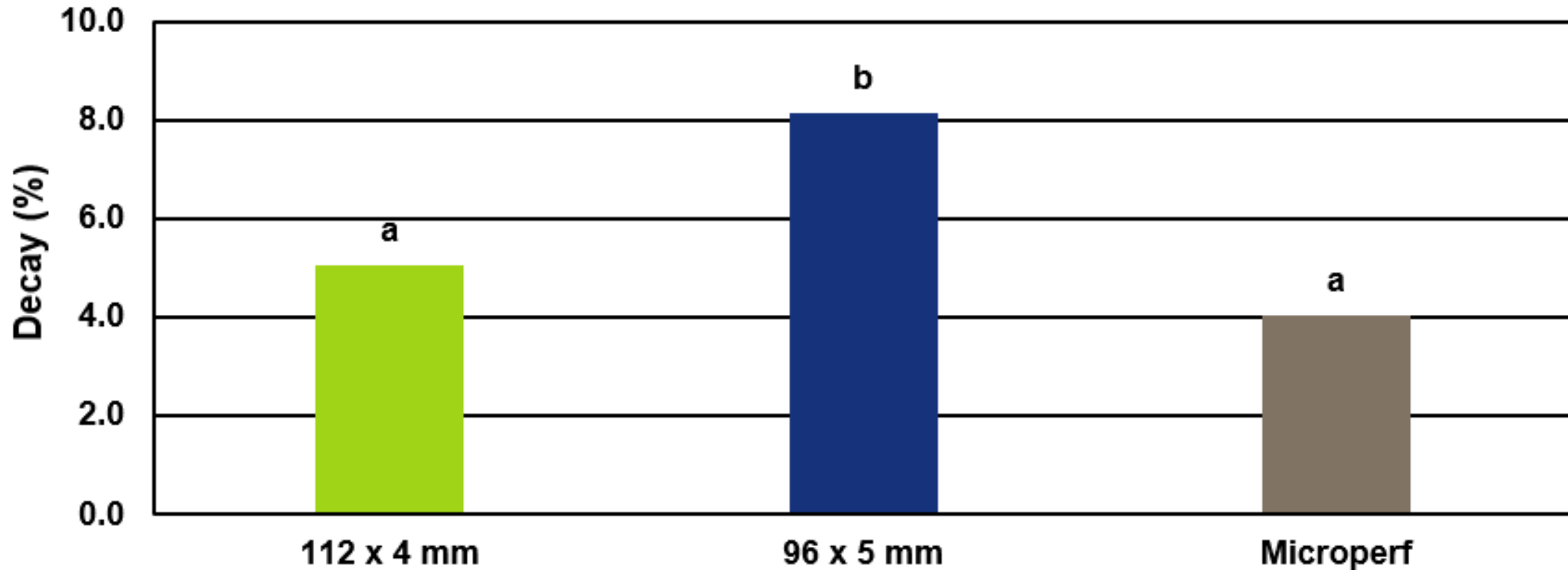


Fig 13. Average percentage decay of Sweet Globe table grapes packed with three different SO₂ sheets, three different liner bags (96 x 5 mm, 112 x 4 mm and Microperf) and two different punnets (Clamshell and Open Top punnets), inoculated with *B. cinerea* and submitted to six weeks cold storage (-0.5 °C) and five days shelf-life (7.5 °C).

End of Shelf-life - Punnets - *Botrytis* Inoculation Trial

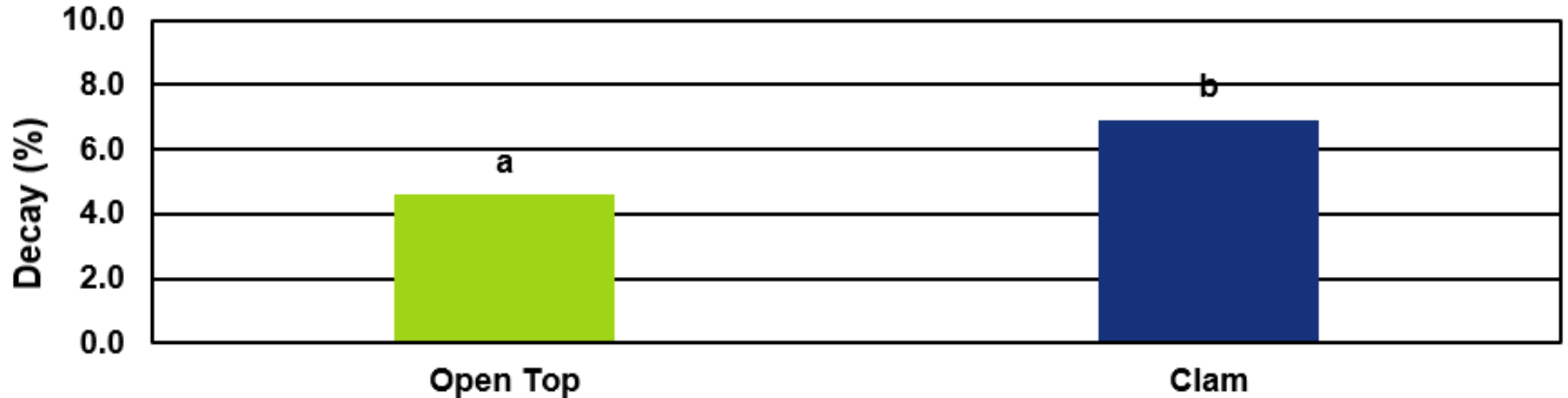


Fig 14. Average percentage decay of Sweet Globe table grapes packed with three different SO₂ sheets and in three different liner bags (96 x 5 mm, 112 x 4 mm and Microperf) and two different punnets (Clamshell and Open Top punnets), inoculated with *B. cinerea* and submitted to six weeks cold storage (-0.5 °C) and five days shelf-life (7.5 °C).

End of Shelf-life - SO₂ Sheets - *Botrytis* Inoculation Trial

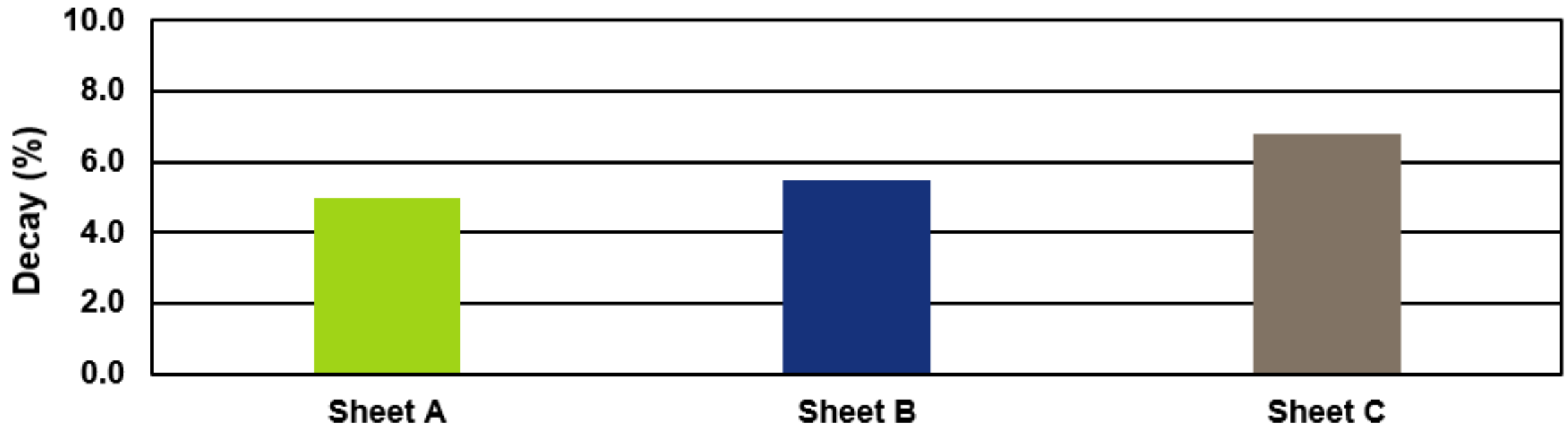


Fig 15. Average percentage decay of Sweet Globe table grapes packed with three different SO₂ sheets, three different liner bags (96 x 5 mm, 112 x 4 mm and Microperf) and two different punnets (Clamshell and Open Top punnets), inoculated with *B. cinerea* and submitted to six weeks cold storage (-0.5 °C) and five days shelf-life (7.5 °C).

End of Shelf-life - SO₂ Sheets x Plastic Liner Bag - *Botrytis* Inoculation Trial

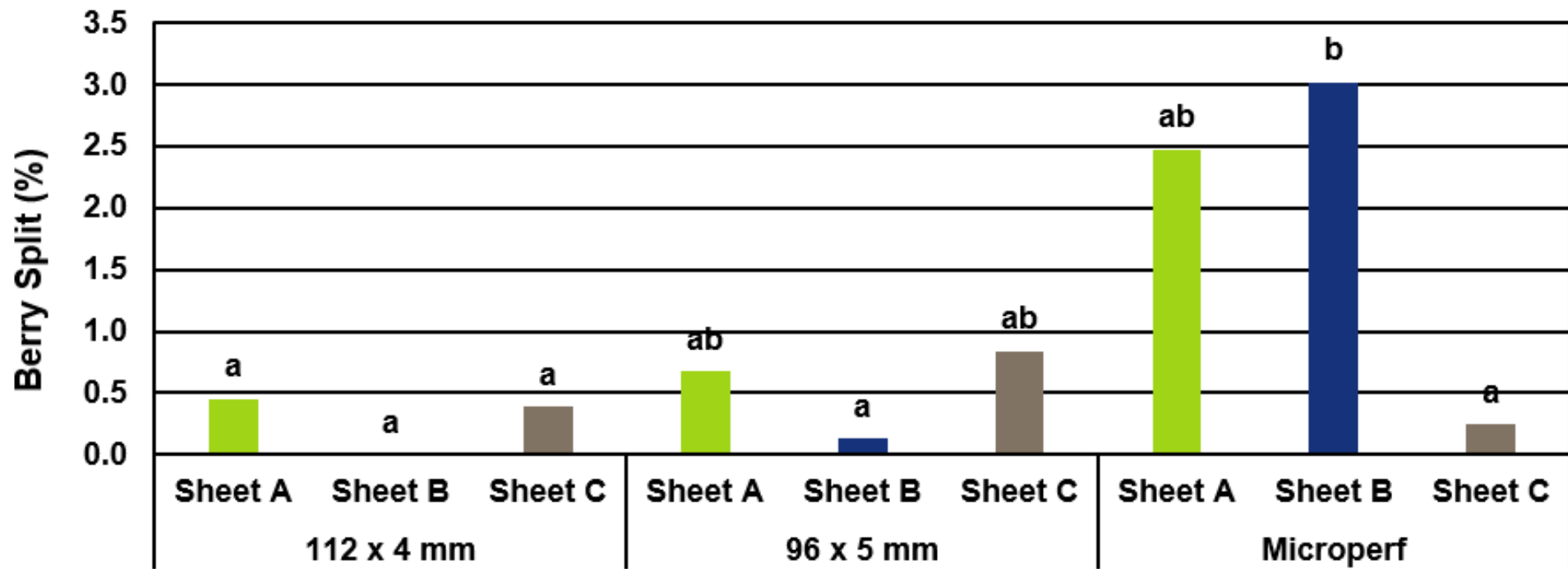


Fig 16. Average percentage berry split of Sweet Globe table grapes packed with three different SO₂ sheets, three different liner bags (96 x 5 mm, 112 x 4 mm and Microperf) and two different punnets (Clamshell and Open Top punnets), inoculated with *B. cinerea* and submitted to six weeks cold storage (-0.5 °C) and five days shelf-life (7.5 °C).

Summary

- Need a balance between SO_2 concentration and ventilation % of the plastic liner bag, to limit decay and other defects
- The results confirms previous findings done on older cultivars
- End of shelf-life table grape quality data correlates and confirms the SO_2 profiles during storage
- Sanitation and maintenance phases of SO_2 generators is important



Take Home Message

- Know table grape quality at time of packing, the storage duration and limitations of a specific cultivar
- The plastic liner bag configuration and the SO_2 availability plays an important role during the sanitation and maintenance phases (decay & berry splits)
- During storage - temperature control is crucial for SO_2 release and availability
 - Could determine table grape quality (especially SO_2 damage)

