

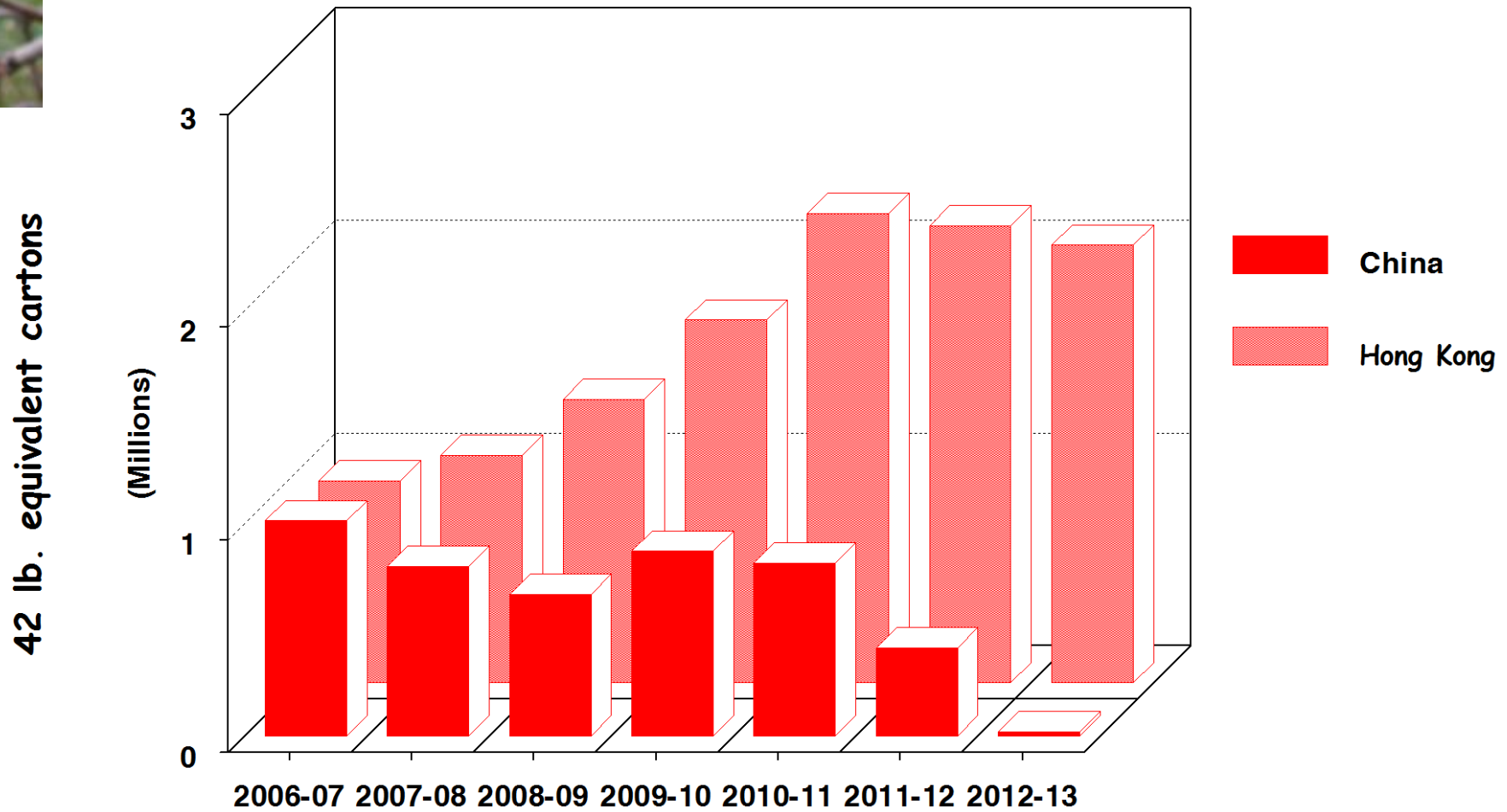
Crabapple Diseases Cause Postharvest Rots and International Trade Issues

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Horticultural Council; and Tom Auvil, Washington Tree
Fruit Research Commission**





Apple Exports to China and Hong Kong 2006 to 2013





Crabapple Issues and Exports

- In August 2012, China closed its market to U.S. Red and Golden Delicious apples following years of detections of bull's eye rot and the two crabapple canker-based diseases.
- In a letter received by USDA on January 15, 2013, China provided a detailed proposal for additional management steps required to re-open the market.
- Among these steps was a proposal for an industry-developed orchard sanitation component aimed at removing infected crabapple wood and fruit and primarily focused on *Sphaeropsis* and *Phacidiopycnis* (speck rot).
- Re-opening the Chinese market for Washington apples is a high priority of the industry and impacts future access for all varieties, not only Red's and Golden.

Bull's-Eye Rot of Apple



- *N. malicorticis* and *N. alba* have been reported to occur in China since the 1940's. Documentation of "official control" status in China has not been provided by MOA
- *Neofabraea* spp. are slow growing. Conidia disperse in splashing water. No records of fruit-born conidia infecting apple trees.
- *N. malicorticis* does not occur in Australia, but Australia does not require mitigation measures for Chinese apples.
- *N. malicorticis* and *N. perennans* are very closely related species.
- Australia has also notified the United States that *N. malicorticis* and *N. perennans* will not require any mitigation measures for U.S. apples moving to that country based on a unrestricted risk rating of "very low."

Neofabraea malicorticis and *Neofabraea alba* reported from China in:

- Biosecurity Australia. 2010. Final import risk analysis report for fresh apple fruit from the People's Republic of China. Biosecurity Australia, Canberra.
- Fang, Z. D., ed. 1994. Crop Diseases in China. Beijing, China Agriculture Press.
- Lu, P.K., Pang, Z. et al. eds. 1993. Atlas of Insect Pests and Diseases of Fruit Plants in China.
- Lu, P.K., Pang, Z. et al. eds. 2013. Atlas of Insect Pests and Diseases of Fruit Plants in China.
- Ma, C.S. 2006. Pests, diseases and weeds of apples published by Key Laboratory of Agriculture Department, China . http://www.ecolsafety.org.cn/db/Fruit/login_pg.asp, Accessed: 19 June 2006. (Cited by BA)
- Tai, F.L. 1979. Sylloge Fungorum Sinicorum. Sci. Press, Acad. Sin., Peking, 1527 pp.
 - Yu, T.F. 1940. A List of Important Crop Diseases Occurring in Kiangsu Province (1934-1937). Lingnan Sci. J. 19:67-78 (*Neofabraea malicorticis*)
 - Ling, L. 1948. Host Index of the Parasitic Fungi of Szechwan, China. Pl. Disease Rep. (U.S. Dept. Agr.) Suppl. 173:1-38 (*Neofabraea alba* syn. *Gloeosporium album*)
- Zhuang, W.Y. 2005. Fungi of Northwestern China. Mycotaxon, Ltd. Ithaca, New York 430 pages (*Neofabraea alba* syn. *Gloeosporium album*)

Sphaeropsis Rot of Apple

(*Sphaeropsis pyriputrescens*)



Based on research at Washington State University since 2003:

- It causes stem-end rot and calyx-end rot.
- In regular atmosphere storage at 0°C, symptoms develop 2-3 months after harvest.
- No airborne spread; inoculum spread by splashing water

Speck Rot of Apple

(Phacidiopycnis washingtonensis)



Based on research at Washington State University since 2003

- Causes stem-end rot and calyx-end rot.
- In regular atmosphere storage at 0°C, symptoms start to develop 2-3 months after harvest.
- No airborne spread; inoculum spread by splashing water



Why Do We Need To Manage Cankers and Twig Dieback of Crabapple Trees?

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Sphaeropsis rot – a postharvest disease of apples

Sphaeropsis rot, caused by the fungus *Sphaeropsis pyriputrescens*, is a newly reported postharvest fruit rot disease on apple and pear (Fig. 1). Surveys of postharvest diseases conducted in 2003 and 2004 indicated that Sphaeropsis rot is an important component of storage rots of apple. Instances of severe Sphaeropsis rot (11 to 24% losses) during storage have been observed on Red Delicious and Fuji apples. The disease also occurs on other apple varieties, including Golden Delicious, Granny Smith and Gala.



Fig. 1. Sphaeropsis rot caused by *Sphaeropsis pyriputrescens* on Red Delicious (left, decay originating from infection of stem) and Fuji (right, decay originating from infection of calyx)

What are the sources of inoculum in the orchard?

Research conducted in my lab indicated that infection of apple fruit by the Sphaeropsis fungus occurs in the orchard, and symptoms develop during storage. One of the key questions regarding control of Sphaeropsis rot is what are the sources of inoculum of the fungus in the orchard.



Fig. 2. A crabapple twig with dieback symptom associated with *Sphaeropsis pyriputrescens*. Abundant pycnidia (fruiting bodies, arrow indicated) of the fungus are present on diseased tissues of the twig.

Crabapple can be an important source of inoculum

Crabapple has been commonly used as a source of pollen in apple production and may account for 5-10% of the trees in modern apple orchards. We have found that *Sphaeropsis pyriputrescens* is associated with a dieback and canker disease of crabapple trees (Figs. 2-4). The Sphaeropsis fungus has been commonly isolated from the margin between diseased and healthy tissues of crabapple twigs with dieback and canker symptoms. Fruiting bodies of the fungus are commonly present on diseased twigs or cankers and can be an important source of inoculum for infection of both fruit and trees of apple in the orchard.



Fig. 3. A canker on the main branch of a crabapple tree caused by *Sphaeropsis pyriputrescens*. Abundant pycnidia (fruiting bodies) of the fungus are present on the diseased tissues.



Fig. 4. Dead twigs of crabapple with abundant pycnidia of the *Sphaeropsis* fungus can be an important source of inoculum for infection of fruit as well as apple trees in a Fuji apple orchard.

Apple trees can be infected by *S. pyriputrescens*

The Sphaeropsis fungus can also cause canker and twig dieback on Fuji apple trees (Figs 5 and 6).



Fig. 5. A canker on a Fuji tree caused by *Sphaeropsis pyriputrescens*. Pycnidia (fruiting bodies) of the fungus are present on the diseased tissues.



Fig. 6. *Sphaeropsis pyriputrescens* is associated with dead fruit pedicle and spurs. Fruiting bodies of the fungus are present on the diseased tissues.

What can we possibly do?

It appears that 'Manchurian' crabapple trees are very susceptible to twig dieback and canker caused by the Sphaeropsis fungus. Fruiting bodies of the fungus are often present on diseased tissues. Thus, removal of diseased twigs and cankers during pruning would help reduce inoculum in the orchard.

Research is underway to evaluate pre- and postharvest fungicides for control of Sphaeropsis rot.

Support from the Washington Tree Fruit Research Commission is greatly appreciated.

Effect of crabapple pruning on Sphaeropsis and speck rot incidence

Objectives

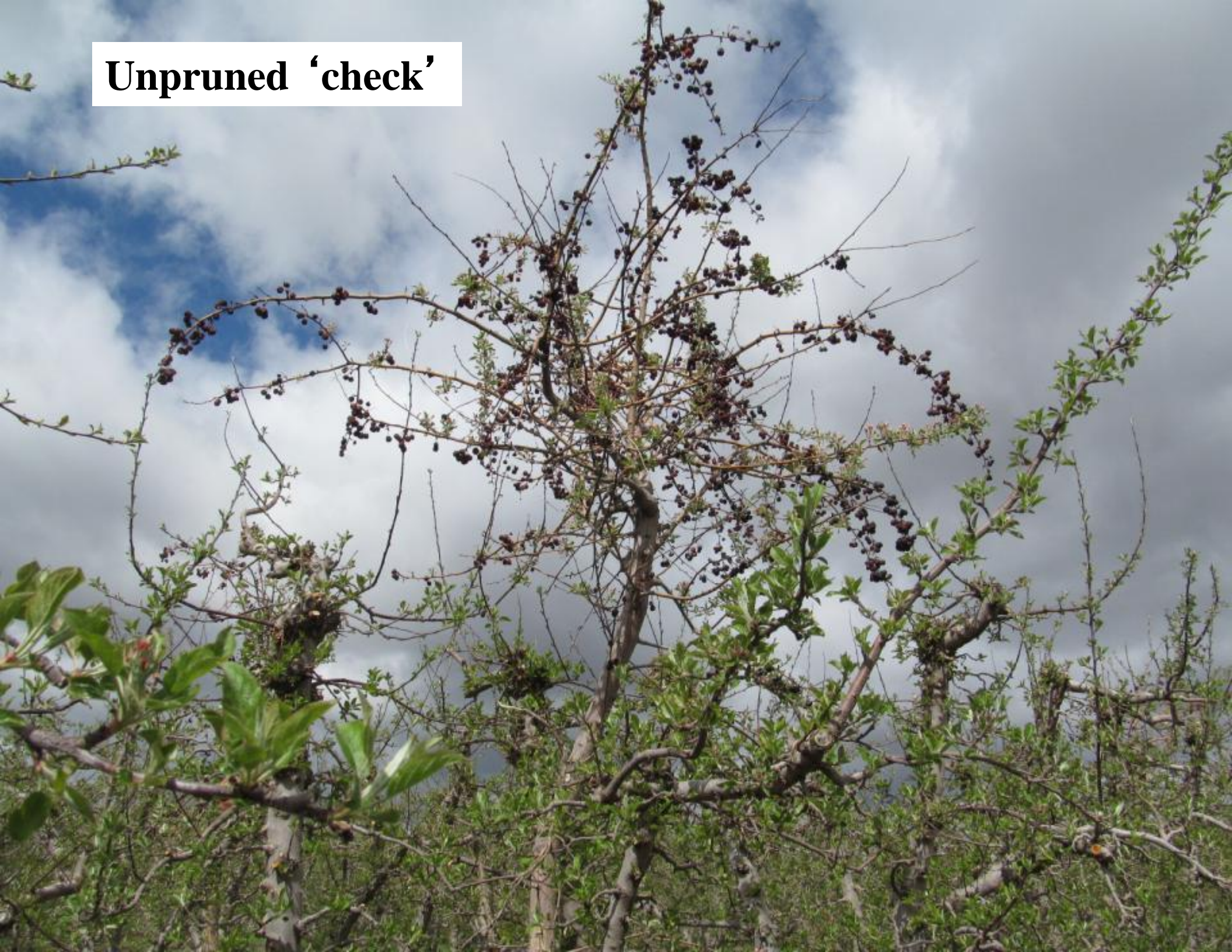
- 🍏 To generate practical information regarding the impact of crabapple pruning in apple orchards as part of a postharvest decay IPM program.
- 🍏 To understand in-season fruit infection by *S. pyriputrescens* and/or *P. washingtonensis* after pruning crabapple trees.
- 🍏 To evaluate the impact of crabapple pruning on the incidence of Sphaeropsis rot and/or speck rot in storage.

Experimental Design

- 🍏 Three 'Red Delicious' orchards with a history of Sphaeropsis rot or speck rot incidence.
- 🍏 Treatments: no pruning, chainsaw pruning, and detailed pruning. Pruning was completed before bloom.
- 🍏 Four replications/treatment, 3 crabapple trees/replicate.
- 🍏 Monitoring fruit infections on apples adjacent to crabapple trees during the fruit-growing season.
- 🍏 Monthly decay evaluations in stored apples for up to 9 months after harvest.



Unpruned 'check'



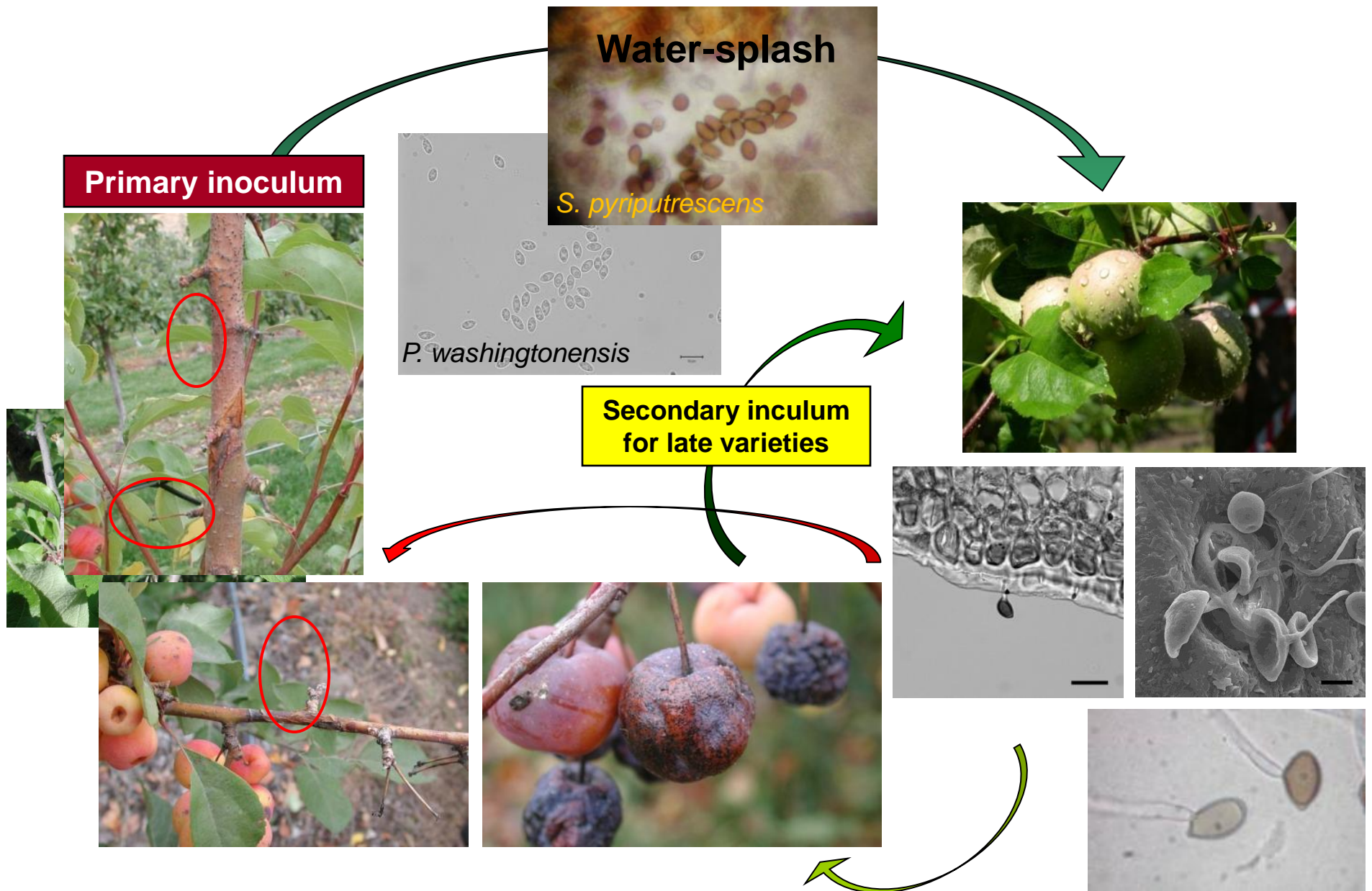
Both *Sphaeropsis* and *Phacidiopycnis* produce similar disease symptoms on crabapple





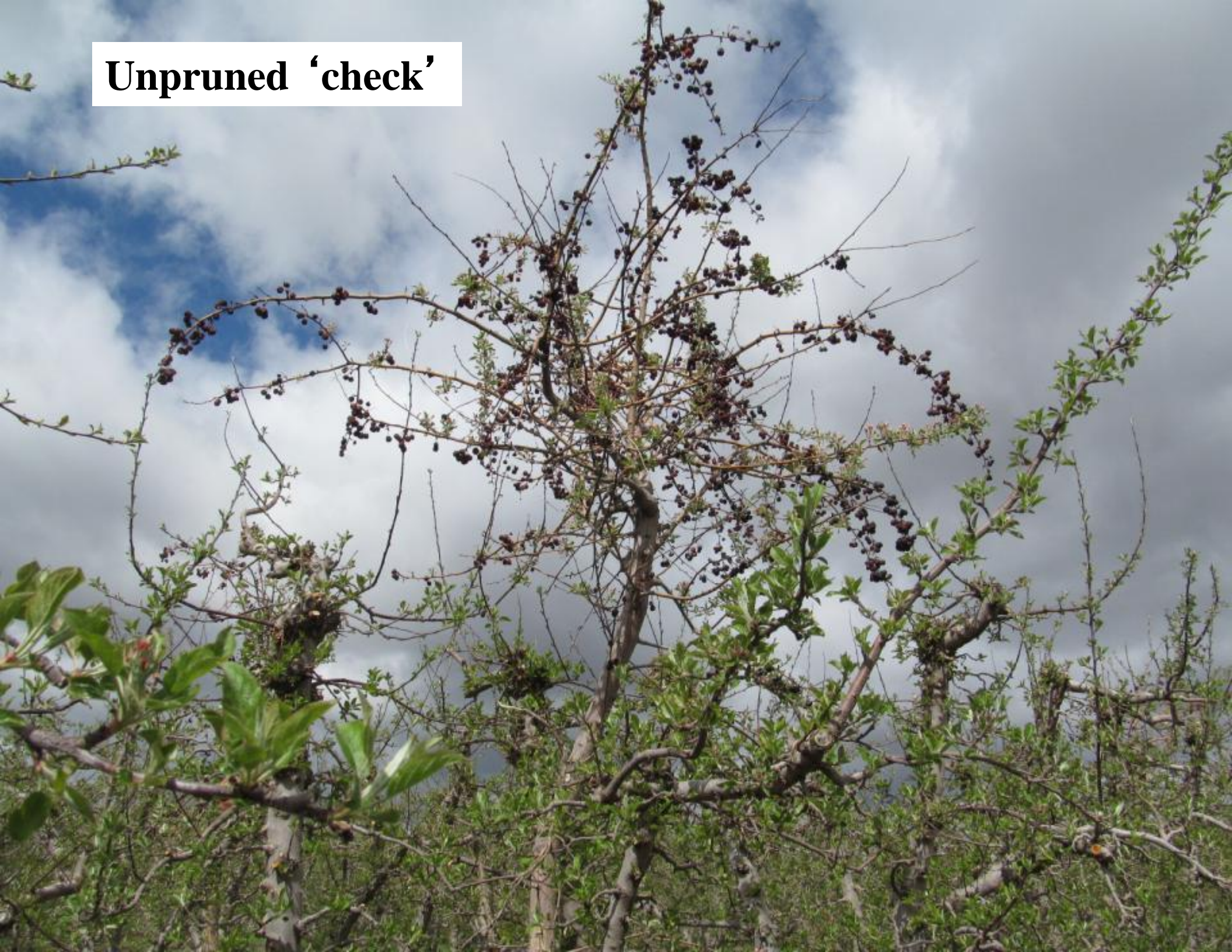
Fruiting bodies of the Sphaeropsis fungus

Disease Cycle





Unpruned 'check'

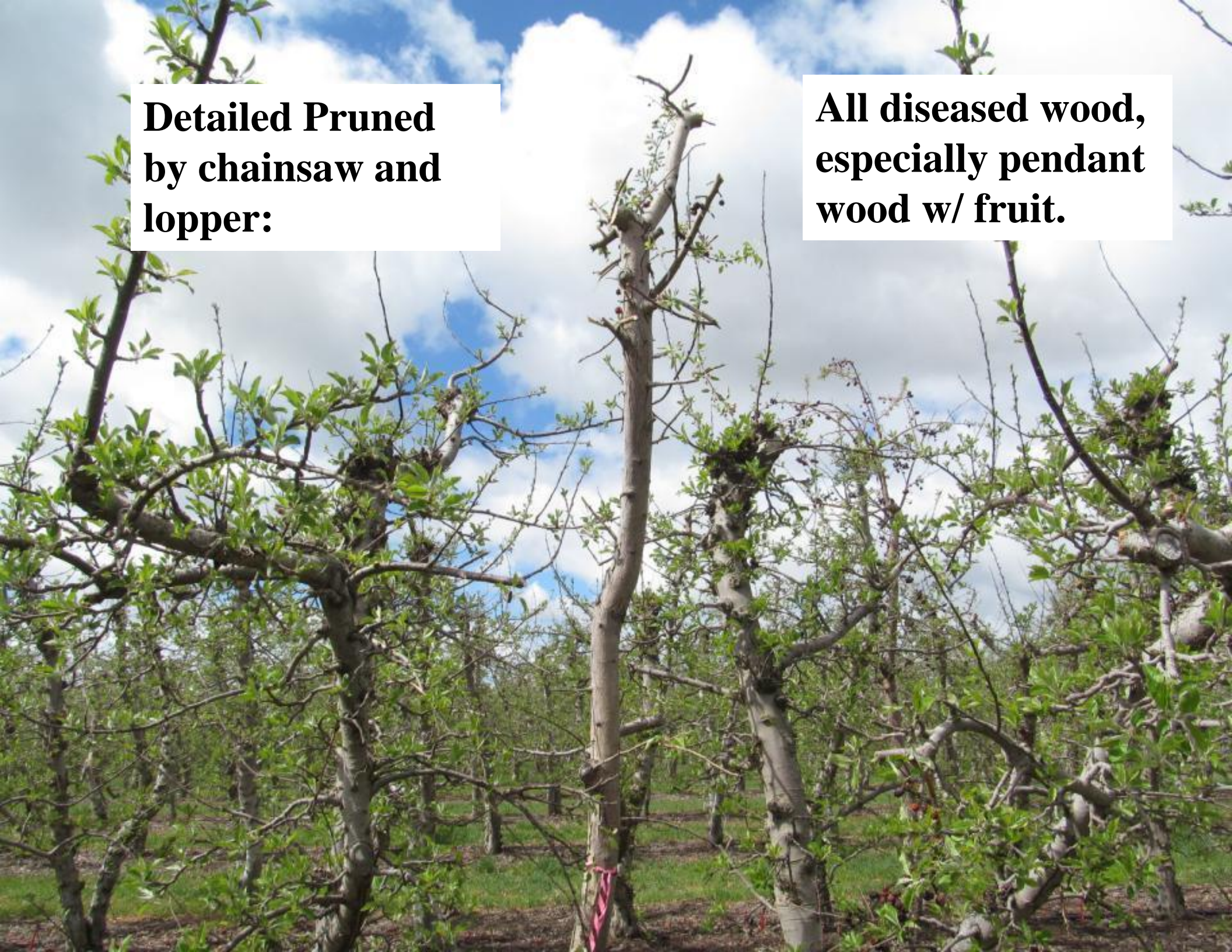


**Pruned by
chainsaw:**

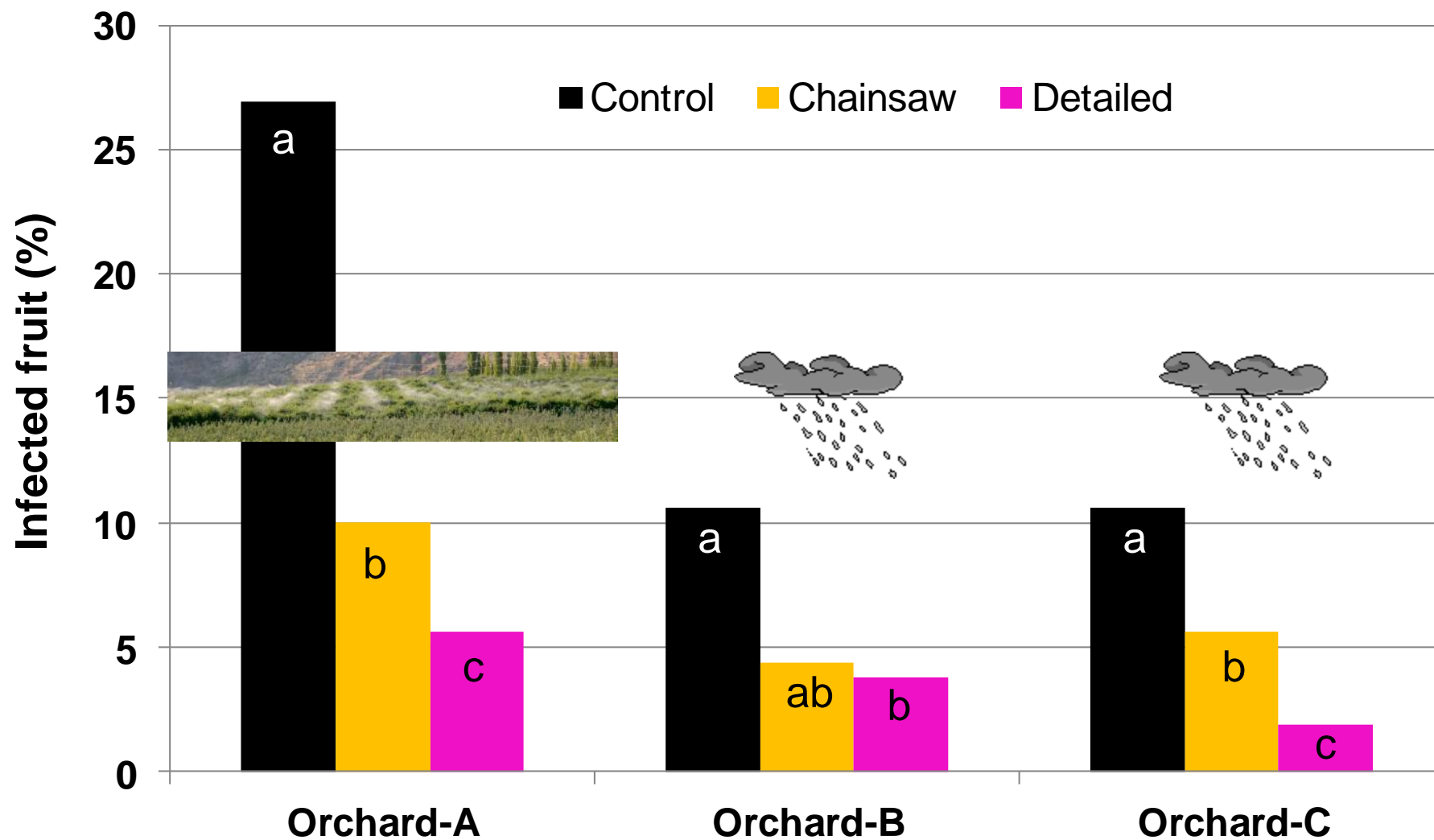


**Detailed Pruned
by chainsaw and
lopper:**

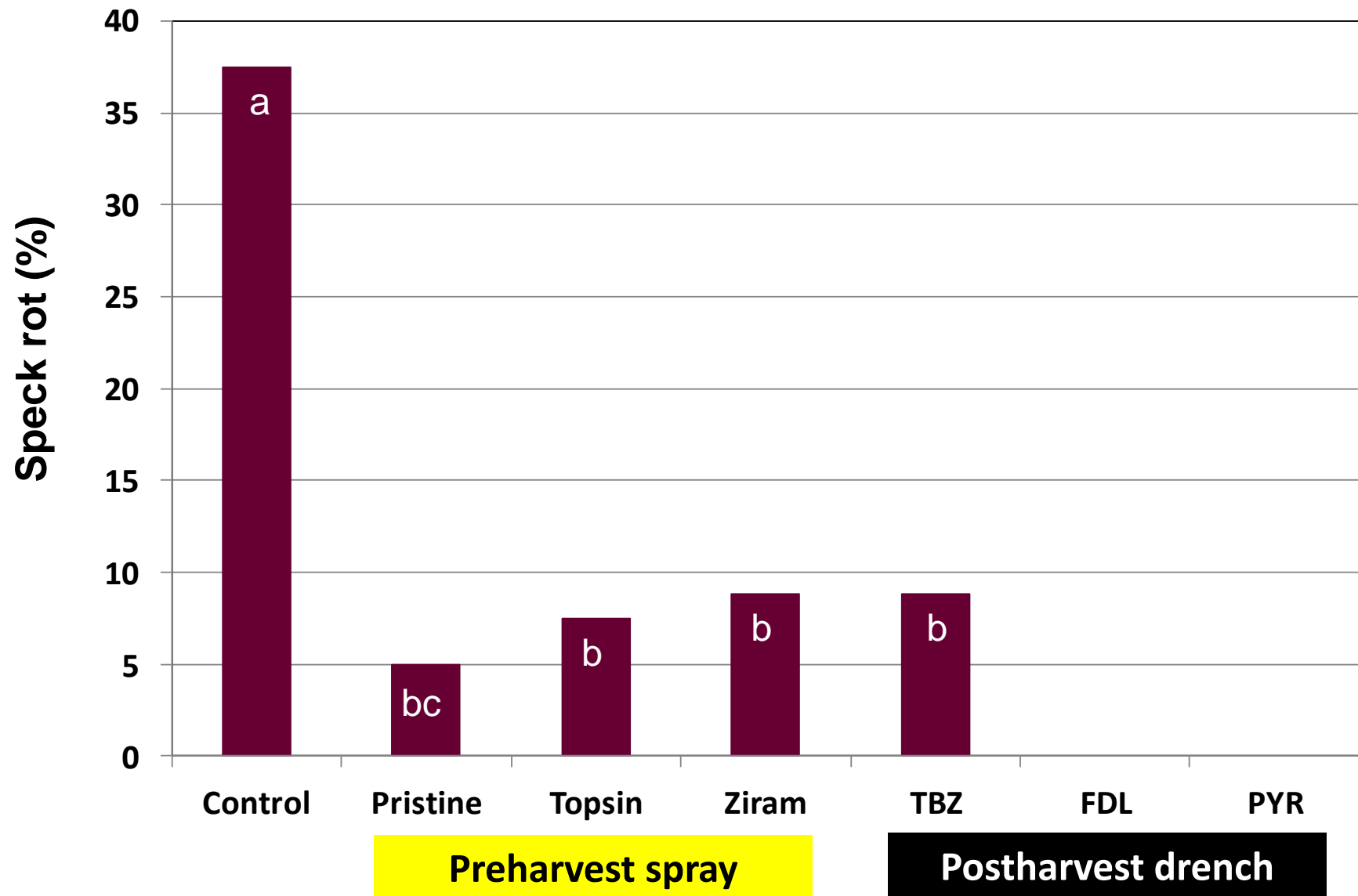
**All diseased wood,
especially pendant
wood w/ fruit.**



Apples Infected by *P. washingtonensis*

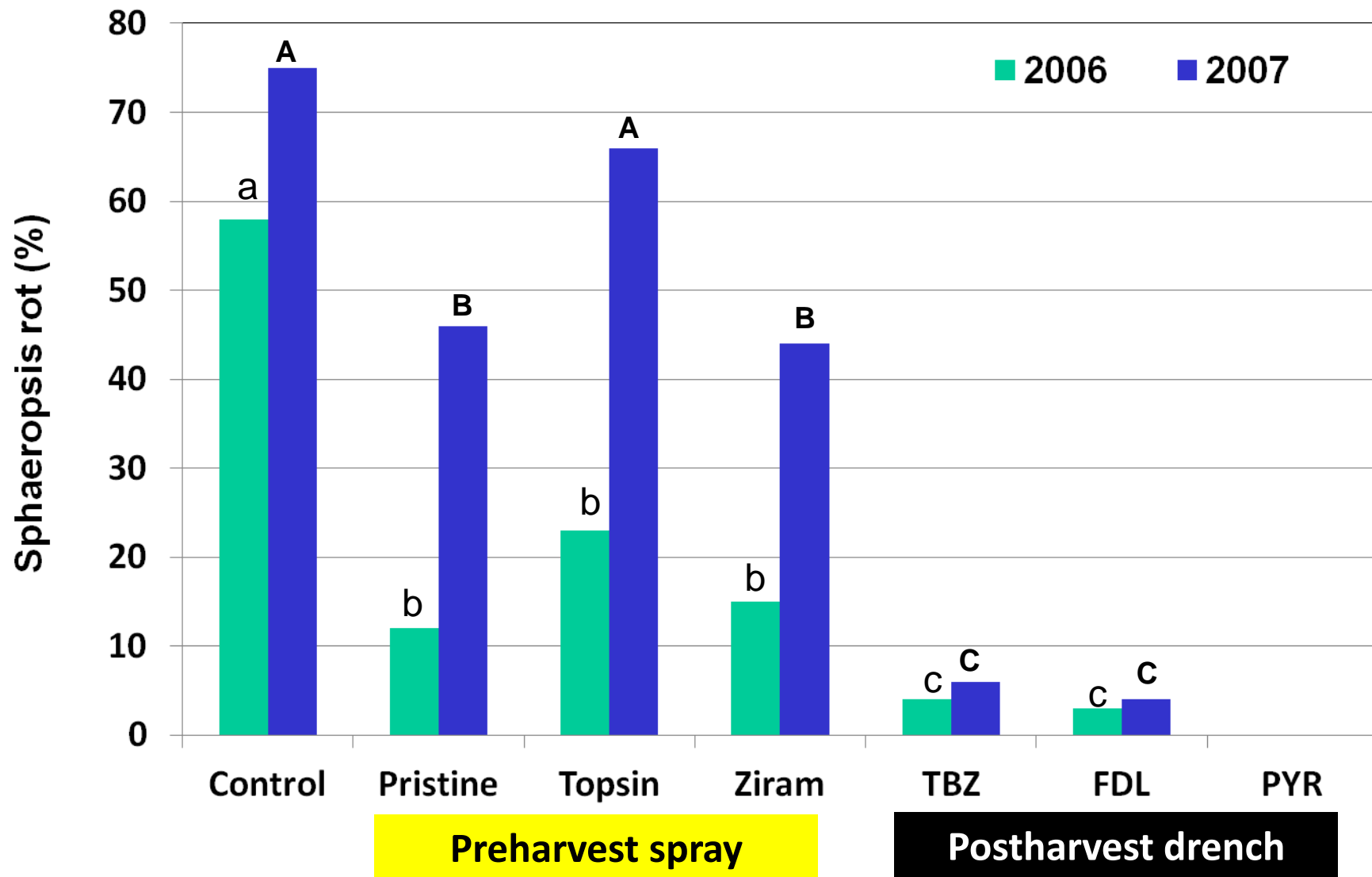


Control Speck Rot on Red Delicious



(Xiao et al., unpublished)

Control Sphaeropsis Rot of Apple



(Xiao et al., 2011)



Northwest Horticultural Council

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