AN INTEGRATED APPROACH TO AVOCADO ROOT HEALTH AND *PHYTOPHTHORA* CONTROL

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INTRODUCTION

The main avocado production areas in South Africa are concentrated in the north-east of the country, in the latitudes ranging from 22° to 30°S. This region is characterised by warm, wet summers and cool, dry winters. The high summer precipitation (>1000mm per annum in most areas) and warm temperatures contribute to a high incidence of root rot caused by *Phytophthora cinnamomi* (P.c.). Root rot is by far the most important avocado disease in South Africa. It causes a feeder root rot and its effects are rapid, resulting in death of the host tissue (Zentmyer, 1980). The infected tree declines, defoliation and branch dieback occur, and death may follow within a few years.

In the early 1980's a breakthrough in chemical control of avocado root rot was made at Westfalia Estate where the cost-effective injection of avocado trunks with phosphorous acid (H_3PO_3) was discovered (Darvas *et a*/., 1984). This method of restoring tree health and the development of P.c. tolerant clonal rootstocks (e.g. Duke 7) allowed the industry to grow rapidly. Currently, P.c. affects probably 90% of orchards in South Africa, but the disease is mostly well controlled by chemical and cultural methods.

INTEGRATED CONTROL PRINCIPLES

Integrated control practices for P.c. include four principles: sanitation, cultural and biological control, resistant rootstocks, and fungicides.

Sanitation

Measures have been developed to reduce the possibility of introducing the disease on infected nursery stock. The key factors are steam sterilization of the nursery mix, use of well-aerated, free-draining growing mixes, and hot water treatment (30 minutes at 48-52°C) of the seed used in propagation. Also, nurseries should be located on well-drained sites where the risk of flooding is minimal. Access to the nursery should be severely restricted by fencing. All footwear should be cleaned and treated in a footbath of dry copper sulphate before entry.

Fungicides such as metalaxyl and fosetyl-Al (Aliette) or H_3PO_3 suppress but do not eradicate P.c. and should never be used in the nursery. Introduction of P.c. into an avocado orchard should be avoided in all situations; even in an existing P.c. situation, trees should be introduced in a healthy condition.

P.c. still spreads from orchard to orchard on a regular basis, facilitated by the activities of orchard management and fruit-picking operations. Because much of the avocado land is hilly, runoff from irrigation and rainfall can also play a significant role in spreading P.c. The disease can be widespread in an orchard before symptoms appear on the aerial tree organs.

Cultural and biological control

Cultural methods for reducing the severity of P.c. start right at the beginning with the choice of the land, the soil preparation, and the planting technique. Other cultural practices, such as mulching with organic material and the growing of cover crops are highly advantageous. Extensive use of cellulose-rich mulches and occasionally the application of cattle manure proved to be very successful. By planting cover crops such as oats (which attract P.c. zoospores by their root exudates without being host plants), P.c. pressure on avocado can be reduced.

With regard to irrigation, the approach with P.c. is to recommend longer intervals between irrigations, which seems logical because *Phytophthora* is a "water-loving" pathogen. Therefore, micro-sprinklers are often used rather than drippers giving off low amounts of water over long periods. However, drippers are less wasteful (less evaporation) and where water is scarce or where salinity problems occur and leaching is needed, orchard soils may be wet for long times, potentially aggravating P.c. problems.

Resistant rootstocks

Since the early 1980's, clonally propagated P.c. tolerant rootstocks have been available commercially in South Africa. In the past 20 years, the Westfalia nursery sold over one million clonal rootstocks, most of which were the Duke 7 selection. Currently, approximately 200 000 clonal rootstocks are planted each year in South Africa. Although seedling rootstocks are still sold (less than 20% of nursery sales), their numbers are decreasing, and many of those are Duke 7 seedlings which have some resistance. The success with Duke 7 triggered the search for even better P.c. resistant rootstocks, which has led to superior selections being tested in South Africa, California and Israel.

Fungicides

There are only two fungicides with the potential to control P.c. available to avocado growers, namely metalaxyl and H_3PO_3, the breakdown product of fosetyl-Al. Fosetyl-Al is metabolized to phosphorous acid within 24 hours in plant tissues.

H_3PO_3 used as a trunk injection is an extremely inexpensive and effective product for P.c. control. As far as can be determined, H_3PO_3 is essentially nontoxic to both plants and animals and thus would appear to be ideal for P.c. control. Details on the application of H_3PO_3 in avocado orchards will be discussed.

CONCLUSION

Integrated control methods for P.c., including sanitation, cultural and biological measures, resistant rootstocks and fungicides, are applied successfully in South Africa. Tree condition and yields of root rot affected trees improve rapidly and may be maintained by using the integrated approach to P.c. control.

REFERENCES

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