South African Avocado Growers' Association Yearbook 1993. 16:75-76

THE INFLUENCE OF ORGANIC AMENDMENTS AND DISCONTINUATION OF CHEMICAL ROOT ROT CONTROL ON TREE CONDITION AND YIELD OF AVOCADO

J.A. DUVENHAGE[1] , J.S. KÖHNE[1] AND B. KIRKMAN[2]
Merensky Technological Services, P.O. Box 14, Duiwelskloof 0835, RSA[1]
Westfalia Estate, P.O. Box 14, Duiwelskloof 0835, RSA[2]

ABSTRACT

Avocado trees which had recovered from root rot (caused by Phytophthora cinnamomi [*Pc]) received different types of organic amendments, while chemical treatment was discontinued. Condition of trees from all treatments declined significantly during the third and forth year of the study, possibly as a result of drought stress. The yield of trees receiving no treatment at all, or only cattle manure, declined significantly after three or four years. However, legume cover crop* (Dolichos lablab) *or lucerne straw mulch (on its own or combined with cattle manure) seemed to inhibit yield decline. However, results must be seen in the light of the drought and may differ in years of normal rainfall.*

UITTREKSEL

Avokadobome wat herstel net van wortelvrot (veroorsaak deur Phytophthora cinnamomi *[Pc]) het verskillende soorte organiese materiaal ontvang, terwyl chemiese beheer gestaak is. Die toestand van borne uit alle behandelings het betekenisvol verswak gedurende die derde en vierde jaar van die Studie en kan moontlik toegeskryf word aan droogtespanning. Opbrengs van borne wat geen behandeling, ofalleenlikbeesmis ontvang het, het betekenisvol afgeneem na drie of vier jaar. 'n Peuldekgewas* (Dolichos lablab,) *of lusernstrooi (alleen of gekombineerdmetbeesmis) het opbrengsverlagings kynbaar geïnhibeer. Resultate moet egter gesien word in die lig van die droogte en mag verskil in normale reënvaljare.*

INTRODUCTION

Avocado yield is influenced by root rot, and subsequent tree decline can cause serious losses if the disease is not managed correctly (Darvas, 1978). Measures for the control of root rot rely heavily on chemical treatments in the form of Fosetyl Al and H_3PO_3 injection of affected trees. However, application of fertilisers (Kotzé *et al.,* 1987), cover cropping (Wolstenholme, 1979), good irrigation management and soil drainage, and root rot tolerant rootstocks, eg. Duke 7, are also used. Continuous chemical treatment of trees that have recovered from root rot is expensive, and development of resistance of *Pc* against the chemical is a possibility. On the other hand, discontinuation of chemical treatment holds the danger of possible rapid decline in tree health and yield.

However, avocado orchards have been found in Australia in which root rot (caused by *Phytophthora cinnamomi [Pc])* did not occur, even though *Pc* was present and the climate favoured disease development (Broadbent, Baker & Waterworth, 1971). These soils were termed "suppressive soils". Pegg (1977) demonstrated that organic mulches and fowl manure can be used to restore the lost suppressiveness of soils, and that non-suppressive soils could be rendered suppressive by intensive cover cropping and the use of dolomite and fowl manure.

Consequently, the purpose of this study was to evaluate the effect of different organic amendments on yield and tree condition of trees when chemical treatment is discontinued.

MATERIALS AND METHODS

A Fuerte orchard, on Duke seedling rootstocks planted in 1977, which recovered from root rot due to a programme of Fosetyl-Al injections, was used for this study. The trees were grown on a 'Hutton' soil with dragline irrigation scheduled by using tensiometers. However, due to drought, the trees received little or no irrigation water during 1991 and 1992.

The following treatments were applied annually from July 1988 to July 1992, after which the trial was terminated:

1. Fosetyl-Al trunk injection (0.4g/m^2 of canopy area) in February, July and November (standard commercial treatment).
2. Untreated control. Trunk injections discontinued from 1988.
3. Trunk injections discontinued from 1988. A legume cover crop (*Dolichos lablab,* 40 kg seed/ha) was planted annually (in spring) between trees.
4. Trunk injections discontinued from 1988. Cattle manure (100 kg/tree) was applied annually in November.
5. Trunk injections discontinued from 1988. Lucerne straw (2 bales/tree) was applied annually in November.
6. Trunk injections discontinued from 1988. Treatments 4 and 5 were combined.
7. Ten single tree replicates were used for each treatment. Individual tree yield (in kg) and tree condition was recorded annually. Tree condition was rated during July according to a disease index of 0 (healthy) to 10 (dead), as described by Darvas *et al.,* (1984).

RESULTS AND DISCUSSION

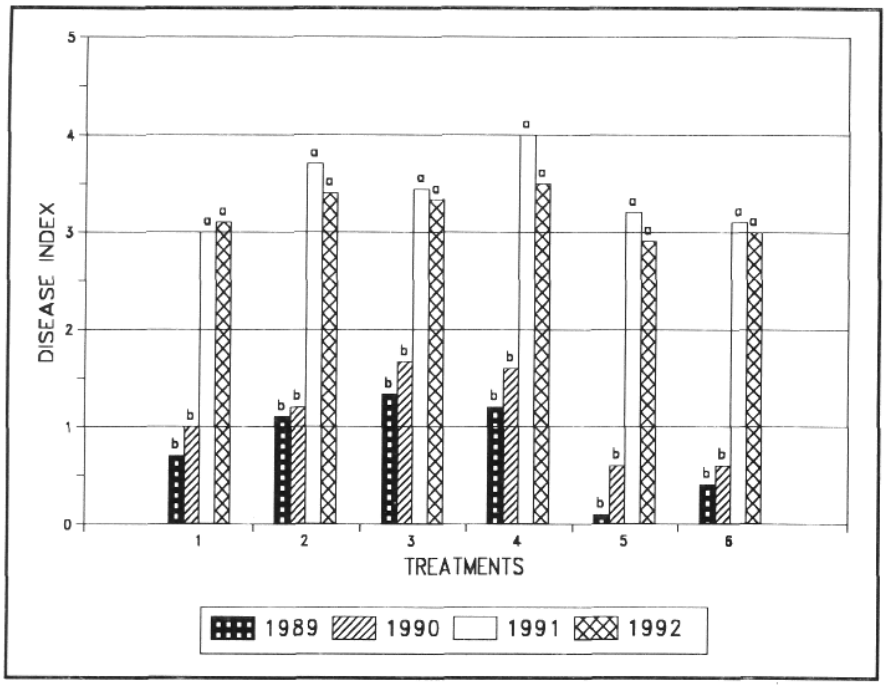
Tree condition during the first and second year did not differ significantly for any one treatment (Fig. 1), as reported previously (Köhne & Kirkman, 1991). However, for all treatments, tree condition was significantly poorer during the third and forth year than during the first and second year (Fig. 1). This may be ascribed to the fact that trees were not irrigated during the third and forth year of the study (due to unavailibility of

irrigation water) while rainfall was subnormal.

During the period of the trial there was no significant difference between yield in different years of the study for the injection treatment, or treatments receiving legume cover crop, mulch, or mulch and manure (Fig. 2). However, yield of the control treatment was significantly lower in the third and forth year of the trial when compared to the first year (Fig. 2). Also, yield of the treatment receiving manure was significantly reduced in the second, third and forth year when compared to the first year (Fig. 2).

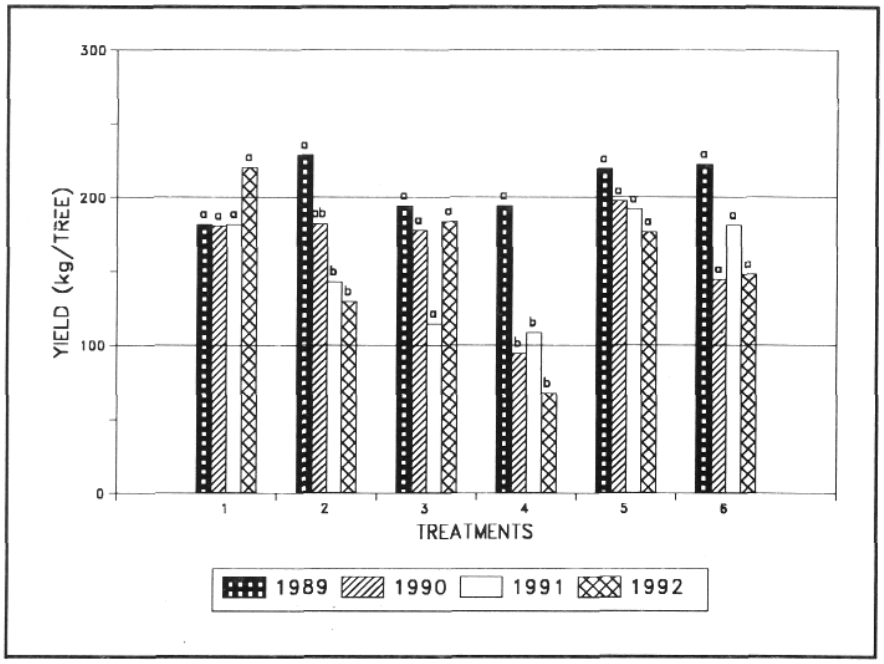
These results (Fig. 2) show that stopping injection of trees causes a decline in yield after four years. Organic matter amendments seem to inhibit this decline (especially the legume cover crop used), except when manure (which is nitrogen rich and may result in excessive fruit drop) is used (Fig. 2). This is in agreement with results obtained in Australia (Pegg, 1977), (where root rot could be controlled and soils made suppressive by organic amendments) but may differ in years of normal rainfall.

Because root rot is still the most important disease of avocado, the positive results obtained by some organic amendments used in this study, warrants further research regarding less frequent injection of trees in conjunction with application of organic amendments.



Values within treatments not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0,05).

FIG. 1 The influence of different treatments on tree condition (as indicated by the disease index).



Values within treatments not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0,05).

FIG. 2 The influence of different treatments on annual yield of trees.

REFERENCES

BROADBENT, P., BAKER, K.F. & WATERWORTH, Y. 1971. Bacteria and actinomycetes antagonistic to fungal root pathogens in Australian soils. *Australian Journal of Biological Science* 24: 925 - 944.

DARVAS, J.M., 1978. Common root pathogens from avocados. *South African Avocado Growers' Association Yearbook* 2: 3 - 4.

DARVAS, J.M., TOERIEN, J.C. & MILNE, D.L. 1984. Control of avocado root rot by trunk injection with phosethyl-Al. *Plant Disease* 68: 691 - 693.

KÖHNE, J.S. & KIRKMAN, B. 1991. Observations in an avocado orchard where chemical control of *Phytophthora cinnamomi* was discontinued for two years. *South African Avocado Growers' Association Yearbook* 14: 12.

KOTZÉ, J.M., MOLL, J.N. & DARVAS, J.M. 1987. Root rot control in South Africa. *South African Avocado Growers' Association Yearbook* 10: 89 - 91.

PEGG, K.G. 1977. Biological controls of Phytophthora cinnamomi root rot of avocado and pineapple in Queensland. Pages 7 - 12 in: Seminar papers, *Annual Conference of Australian Nurserymen's Association Limited,* Hobart. 38 pages.

WOLSTENHOLME, B.N. 1979. Prospects for integrated and biological control of avocado root rot - some overseas impressions. *South African Avocado Growers' Association Yearbooks:* 17 - 20.