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A MORPHOLOGICAL AND PHYSIOLOGICAL STUDY ON THE ROOTING POSSIBILITY OF THREE AVOCADO CULTIVAR CUTTINGS

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INTRODUCTION

Avocado root rot, caused by the fungus *Phytophthora cinnamomi,* is one of the greatest problems of the avocado industry. By the initiative of Zentmyer from the University of California at Riverside, rootstocks known to have some resistance against the diseases, such as Duke 6, Duke 7 and G22, were selected (Brokaw, 1975).

Usually only a 20% resistance in the progeny of seed propagated avocados can be found and it is therefore necessary to propagate these rootstocks vegetatively. By means of this vegetative propagated technique resistance is assured in the progeny (Brokaw, 1975).

Over the years several research workers have tried to root avocado cuttings with limited success. It was established however, that juvenility, leafiness, degree of ripeness, auxin treatment, etiolation of cuttings, type of rooting medium, addition of mineral nutrients and fungicides to some degree, exercised an influence on the rooting of avocado cuttings (Frolich, 1951; Kadman & Ben Ya'acov, 1965 ; Bourdeaut, 1970).

With these factors in mind, two promising methods have been developed to propagate avocado rootstock material vegetatively, viz.: Firstly, the Ted Frolich etiolation technique which is commercially used by the Oliver Atkins nursery and the Brokaw nursery in California. This technique is based on the grafting of a Duke 7 scion onto a seedling at a very early stage. The scion is allowed to grow in the dark (etiolate) and is then grafted with a commercial cultivar such as Fuerte. As soon as the Fuerte scion grows well the Duke 7 rootstock is severed form the original seedling and transferred to a full humidity chamber. After rooting and hardening a commercial Fuerte cultivar on a Duke 7 rootstock it can be transferred to the field. The disadvantages of this method are that it is very cumbersome and expensive (Brokaw, 1975). Secondly, there is the technique developed by Ruveni of the Volcani Institute in Israel. This technique is based on the use of juvenile wood, cut as near as possible to the roots. With the etiolation of this material even better results can be obtained. The leafy cuttings are dipped into a 1% índole -3-butyric acid, 1% Benlate and 98% talc mixture and are then transferred to a medium consisting of equal parts peat, perlite and vermiculite, in a mist-bed with a bottom temperature of 30°C. This technique is less cumbersome and cheaper than the former, but has the disadvantage that cuttings can take up to ten months to root, with a relatively low rooting percentage. Contrary to the above-mentioned it has a further disadvantage that the rooted cuttings still have to be grafted when used as rootstock

material.

The purpose of this project is therefore to examine morphological and physiological factors involved in the rooting of avocado cuttings in an attempt to obtain successful rooting. With the anatomical and physiological study there will be concentrated on possible differences that may exist between the easy to root juvenile seedling cuttings and the difficult to root adult cuttings of the three avocado cultivars Duke, Edranol and Fuerte.

2. PROCEDURE

2.1 *Morphological survey*

2.1.1 Rooting experiment of cuttings

This experiment was laid out in a fiberglass structure, with thermostatically controlled electronic heating cables to provide the cuttings with bottom heat, to hasten root formation. Each mist bed was divided into 12 plots. There were four treatments, four replicated and four control treatments. Each of the above-mentioned plots contained a specific medium. Shade cloth was installed above the mist beds to reduce natural sunlight intensity by 50%.

A mist control system consisting of an outlay of water pipes with a stopcock, strainer, fine filter, bypass valve, pressure gauge, solonoid valve and several nozzles were successfully installed in the unit. For this system to be effective, a thin film of water must be maintained on the leaves for at least during daylight hours. To avoid over irrigation, which may cause damping-off, an intermittent mist control system was installed in the unit (Allan, 1973). Use was made of an electronic time clock in co-operation with the solonoid valve.

A thermohigrograph was installed immediately above the nozzles for the duration of the experiment. Use was also made of a thermograph with 12 thermocouples to record the actual bottom temperature as well as the average leaf temperature of each plot.

The statistical lay-out of the experiment to root cuttings was a splitplot design and started on the 31st May 1977 and implied the rooting of Duke, Edranol and Fuerte cuttings with the following treatments:

2.1.1.1 At four different temperatures, namely 20°C, 25°C, 30°C and a control temperature.

2.1.1.2 In four different media (plots), namely equal parts peat, vermiculite and perlite; one part peat and three parts sand (Bourdeaut, 1970); equal parts vermiculite and sand and finally vermiculite only. (Kadman & Ben Ya'acov, 1965)

2.1.1.3 With three treatments per medium, namely the dipping of cuttings in a 1% índole -3-butyric acid, 1% Benlate and 98 talc mixture; a root grafting (Haas, 1937); and the control treatment were used. The experiment existed of two replicates per treatment.

The whole experiment was carried out under intermittent mist with a four to five seconds per minute cycle, during day-light hours only.

Semi-hardwood, leafy cuttings of which the leaf surfaces were reduced by half, were used in this experiment. Before planting, the bases of the cuttings were pruned edgewise and then dipped into a 0,5 gram per litre Benlate solution. The dipping into Benlate was repeated with each taking of results.

2.1.2 Etiolation experiment of cuttings

This experiment commenced on the 2nd October 1977. The etiolated material will be rooted in the mist propagation unit as soon as the above-mentioned experiment (2.1.1) is completed. One of the objects of this experiment is to compare the rooting on etiolated and non-etiolated cuttings. The cuttings will be dipped in 1% índole -3-butyric acid dissolved in 50% ethyl alcohol, in 50% acetone, in talc and in tap water.

2.1.3 Anatomical survey

A large variety of avocado stems were cut anatomically, with a rotary microtome, in an attempt to compare etiolated and non-etiolated seedling as well as adult wood of the three avocado cultivars, namely Duke, Edranol and Fuerte.

2.2 *Physiological survey*

Juvenile and adult material will be compared at different stages of development, chromatographically to find a connection between the physiological condition of a plant and its ability to produce roots.

3. RESULTS

3.1 *Morphological survey*

3.1.1 Rooting experiment of cuttings

The results of this experiment were taken monthly (with 30 day intervals) during which the following were studied:

3.1.1.1 The appearance of roots

3.1.1.2 The appearance of callus

3.1.1.3 The defoliation of the cuttings

3.1.1.4 The die-back of the cuttings

3.1.1.5 The appearance of dead cuttings

Interesting preliminary results so far are the intense callus development of the cuttings, especially in the vermiculite medium, after the first month in the mist-bed.

Distinct rooting differences between seedling and adult cuttings were also noticed. Seedling cuttings showed a rooting percentage of 100 within two months.

Contrary to the eary rooting of juvenile cuttings, the first adult cutting only rooted after four months, with a relatively poor root quality. Rooting of a large amount of these adult cuttings did not occur at all and consequently they died back soon.

3.1.2 Etiolation experiment of cuttings

Since this experiment has just been started no results are available yet.

3.1.3 Anatomical survey

Cross-and longitudinal sections were made of the following stem material of the three avocado cultivars, namely Duke, Edranol and Fuerte:

3.1.3.1 Red and green coloured juvenile seedling wood

3.1.3.2 Etiolated juvenile as well as adult wood

3.1.3.3 Adult soft and semi-hard wood

3.1.3.4 Different stages of root development of juvenile as well as adult stem wood. Only the juvenile material has been cut so far.

As all the material has not yet been cut and microscopically studied, these results can not be fully interpreted.

3.2 *Physiological survey*

The physiological work will soon be started in co-operation with the Plant Physiology Department, University of Pretoria.

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