

Avocado Rootstock Breeding — New Developments and Intricacies

Z. Bijzet H.J. Breedts P.J.J. Koekemoer B. Cilliers

ARC-Institute for Tropical and Subtropical Crops, Private Bag X11208, Nelspruit 1200

ABSTRACT

Development and selection of *Phytophthora*-tolerant avocado rootstocks is the major objective of ARC-ITSC's avocado rootstock breeding programme. This paper reports on new approaches that will improve efficiency of the rootstock breeding programme. These include the establishment of a polycross nursery and the use of large bins for the transplantation of selected seedlings to facilitate multiplication.

INTRODUCTION

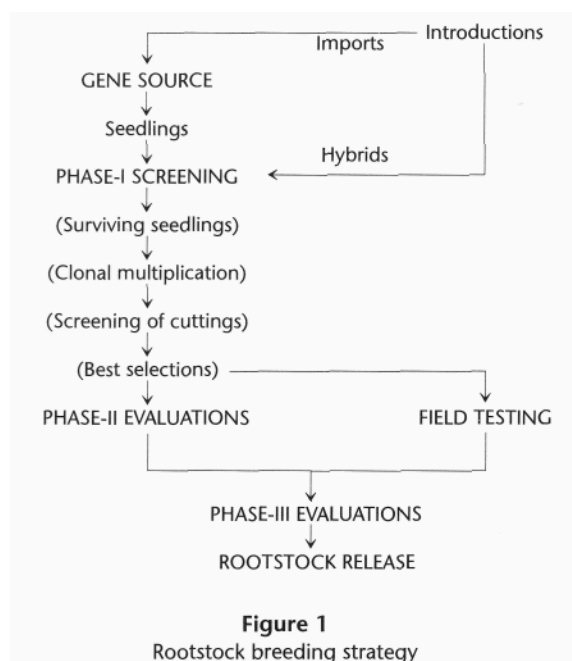
Avocado root rot caused by *Phytophthora cinnamomi* has a large financial impact on the South African avocado industry. Development and selection of *Phytophthora*-tolerant avocado rootstocks is therefore one of the major research objectives of the ARCITSC's avocado research programmes.

The ITSC's avocado rootstock programme was started in 1992 and fine-tuned for four seasons. Progress was reported by Bijzet, Sippel & Koekemoer (1993); Koekemoer, Breedts, Manicom & Bijzet (1994); and Breedts, Koekemoer & Bijzet (1995).

This paper reports on new innovations that will enhance the rootstock breeding programme these include the establishment of a polycross nursery and the use of large bins for transplanting of selected seedlings to facilitate their multiplication thereof.

MATERIAL AND METHODS

Various stages in the rootstock breeding programme were described by Bijzet *et al.*, (1993). these were subsequently altered to achieve greater efficiency (figure 1).



Rootstock breeding

Since 1992, open-pollinated seeds from avocado rootstocks and from other cultivars in the close proximity of the avocado rootstock material were germinated for screening. Detailed accounts of the results were given by Bijzet *et al.* (1993), Koekemoer *et al.* (1994) and Breedts *et al.* (1995). Due to the recent drought, only 2 437 seeds (table 1) could be secured for screening in the 1995 season.

Pollen derived from non-resistant sources detracts from the efficiency of the current procedure of producing seedlings. An isolated orchard consisting only of rootstock material is needed. An orchard of this kind will be very costly to maintain because it would have to be very far from other avocado orchards. This problem was solved by renovating and old-shade cloth structure of approximately 1 000 m². The structure consists of six terraces, each 3 m wide, 50 m long and with 15 well-drained plant pots 1,25 m in diameter and spaced 3 m apart, giving 90 pots in total. This area is covered with shade cloth supported by treated wooden poles.

Table 1
Screening of open-pollinated seedlings

<i>Year</i>	<i>Seeds</i>	<i>Selections</i>	<i>Survival</i>
1992	5 717	12 (0,21 %)	1
1993	2 799	15 (0,54 %)	3
1994	16 381	26 (0,16 %)	20
1995	2 437	4 (0,16 %)	4

Phase-I screening

The protocol for screening phase-I seedlings has been finalized. It entails planting seed directly into bins filled with *Phytophthora cinnamomi* soil. The seeds are left to germinate and subsequently to die of *Phytophthora* root rot. Indicator plants show whether the disease pressure is correct and, if not, a mycelium suspension is applied approximately 120 days after germination. Surviving seedlings are selected. If the percentage of survivors is too high, further elimination is done after an inspection of the root systems. The surviving seedlings are then treated as described by Koekemoer *et al.* (1994) and transplanted in sterilized soil.

In the past the plants were transplanted to 5 t plastic bags. Instead of the plastic bags, 50 l PVC dustbins are now used, because these allow proper root expansion and subsequent top growth, which is required for further multiplication of the selection. Twenty to thirty cuttings of each selection and of Duke 7 are made. These are then planted in bins filled with sterilized soil to which a known concentration of *Phytophthora* mycelium is added. Valid comparisons can be made, and selections better than Duke 7 are included in field trials and in a phase-II programme. The field trial will be carried out at Burgershall in an orchard known to have a high incidence of *Phytophthora*.

RESULTS AND DISCUSSION

Rootstock breeding

The polycross nursery was established with 80 % of the mother trees already planted. It is expected that this facility will produce seed within two years.

Phase-I screening of seedlings

From 1992 to 1994 a total of 24 897 seedlings were screened for resistance/tolerance to *Phytophthora*, and 53 selections were made. During the subsequent multiplication period 29 of then weaker selections died. During 1995 all but 54 of the 2 437 screened seedlings died. Four of these surviving seedlings showed strong root development (figure 2). These are now included in the clonal multiplication programme for the second screening.

CONCLUSION

The implementation of the polycross nursery introduces new depth to the breeding programme. A further 2 437 seeds germinated and were screened for resistance. Four seedlings were selected. Clonal multiplication of the previous 32 selections (1992-1994) is progressing slowly. Rapid multiplication will, however, be achieved as soon as a tissue culture technique for multiplication is finalized. Until then the introduction of 50 t bins for transplantation will help to accelerate the process. Exciting results are expected from the statistical screening of cuttings.

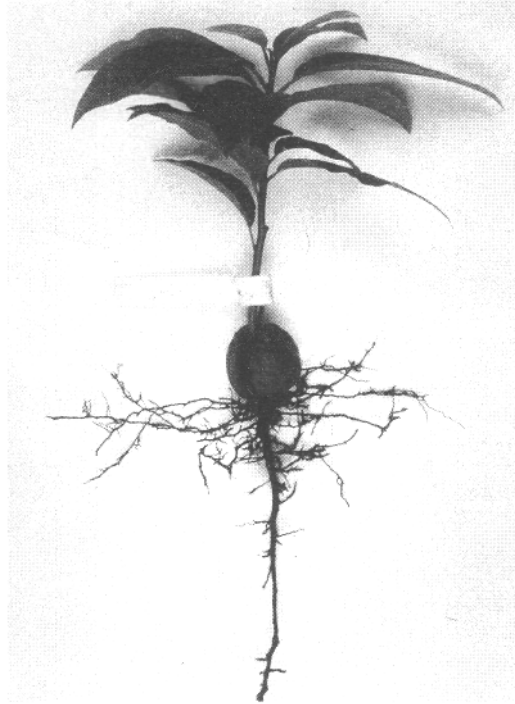


Figure 2

One of the four *Phytophthora*-resistant rootstocks selected in 1995

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