

THE CURRENT STATUS OF AVOCADO PHASE II EVALUATIONS AT THE ITSC

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ABSTRACT

The aim of Phase II evaluations is to assess various rootstock/scion combinations in different production areas to select the best producing and quality combinations for a given area. The ITSC Phase II scion program involves planting the promising selections from the breeding and selection program, and imported cultivars at different sites on three different rootstocks, namely Duke 7, Thomas and Barr-Duke.

The rootstock evaluation program consists of grafting new rootstock cultivars and promising selections from the rootstock breeding program with Fuerte, Hass, Pinkerton and Ryan scions. This program is currently progressing smoothly with 92 different scion combinations and 20 different rootstock combinations planted at two different locations.

INTRODUCTION

What does Phase II mean and where does it fit into the breeding and selection program of the Institute for Tropical and Subtropical Crops (ITSC) as previously discussed by Du Plooy, Marais & Sippel (1992)? In the Phase I part of the program outstanding or improved scions/rootstocks are selected from the breeding program according to certain ideal characteristics. These selections must then undergo further field evaluations for horticultural performance, and this part of the program is known as Phase II. Thereafter follows semi-commercial trials (Phase III) before any selection can be released with confidence into the industry as a new cultivar.

The aim of Phase II evaluations is therefore to assess various rootstock/scion combinations in different production areas to select the best producing and quality combinations for a given area. Another aim is to find combinations that will extend the production season.

The motivation for a trial of this nature is that there are only five main scion cultivars, ie. Fuerte, Hass, Edranol, Ryan and Pinkerton in use, with mostly two major clonal rootstocks, namely Duke 7 and Martin Grande (MG). Lesser used rootstocks include G6, Edranol, and seedling trees.

A complex of problem areas in the industry necessitates an increase in the number of cultivars and rootstocks available. These problems are as follows:

Low production potential of the available scion /rootstock combinations, the occurrence of alternate bearing and small fruit sizes, susceptibility of rootstocks to root diseases

and of scions to sunblotch viroid, excessive growth vigour and characteristics which lower production per unit area, and poor storage ability of the fruit due to post harvest physiological problems (Knight & Winters, 1971; Terblanche, 1988).

Scion evaluations

Priorities of evaluation programs in other parts of the world are dependable productivity (ie. constant high yields), and disease resistance, while horticultural quality and the extension of the marketing season are further priorities (Knight & Winters, 1971). Cold tolerance also receives a high priority in some evaluation programs such as in Central Florida (Krezdorn, 1975).

Evaluation in California (Bergh, 1987) emphasizes self-pollination, inbreeding of some selected parents and hybridisation. This approach leads to accelerated cultivar selection, with a few new cultivars already in commercial testing. Currently the seedlings are predominantly derived from Gwen, Whitsell, Hass and Pinkerton hybrids, and the main aim is earlier maturity and greater hardiness.

The objective of the program in Israel is to find the most successful rootstock and scion combination for each set of climatic and soil conditions. The qualities sought include high yield, good fruit quality, dwarfing tree characteristics, and resistance to detrimental factors such as the quality of irrigation water and soils (Ben Ya'acov, 1971/72).

Rootstock evaluations

There is not much information available on rootstock programs around the world as the search for better scion cultivars receives a higher priority than rootstocks. However, the predominant desired characteristic sought in this regard is adequate resistance to *Phytophthora cinnamomi* (Pc) root rot.

One of the main avocado rootstock programs is the breeding and evaluation of rootstocks at the University of California, Riverside, where attempts are made to hybridize *Persea* species with different taxa to obtain resistance to the root rot fungus. Another aim of the California program is to find tolerance to salinity, and also dwarfing rootstocks (Du Plooy, 1991). The Israeli program has already been mentioned above (Ben Ya'acov, 1971/72).

Scion/rootstock interaction

It is known that the scion/rootstock interaction is an important factor involved in yield, fruit quality, tree development and resistance to adverse conditions under certain climatic situations. The Hass/Martin Grande's excessive growth and poor yield problem, which was an expensive but valuable lesson for the South African avocado industry, can be taken as an example.

To illustrate the problem of the Hass scion on the Martin Grande rootstock, figures obtained from a producer in the Schagen area are presented below. The planting consists of two and a half year old trees with alternate rows of Hass on Martin Grande and Hass on Duke 7. The first harvestable yield obtained from the orchard (1990) presented the following yield data:

Hass/Duke 7	10.99 Kg/tree (3.05 t/ha)
Hass/Martin Grande	4.61 Kg/tree (1.28 t/ha)

Thus, a remarkable yield difference is shown between the two rootstocks. The Hass on

Duke 7 trees realised R10 491 in income, whilst those on Martin Grande realised R4 654, a difference of R5 837 during the first year of production. Three years later (1993), the Hass/Duke 7 combination averaged 19 kg per tree whilst the Hass/MG averaged 16 kg per tree. On the positive side the Hass fruit from the MG rootstock were larger during 1990 (average count 18), compared with the count 20 from Hass fruit on Duke 7.

MATERIALS AND METHODS

Scion program

The ITSC Phase II scion program will involve planting the promising Phase I selections from the breeding and selection program, and imported cultivars, at different sites on three different rootstocks, namely Duke 7, Thomas and Barr-Duke. Duke 7 was chosen as the standard while the other two were included due to their promising performance in California against PC root rot.

Rootstock program

The rootstock evaluation program will consist of grafting new rootstock cultivars and promising Phase I selections from the rootstock breeding program (Bijzet, Sippel & Koekemoer, 1993) with Fuerte, Hass, Pinkerton and Ryan scions. These trees will also be established at different evaluation sites.

Evaluation criteria

As consumer preferences in fruit size, shape, colour and quality change, so will breeding objectives have to adapt. However, several general objectives will always be part of any avocado breeding and evaluation strategy. Some of the most advantageous characteristics which will be part of the avocado phase II evaluation criteria are listed below. This will be applied to the rootstock as well as the scion programmes.

Tree characteristics

- Consistent high yields
- Vigorous, but with semi-dwarf characteristics
- Horizontally spreading
- Tolerant to adverse conditions
- Graft compatibility

Fruit characteristics

- Medium size (250-300g)
- Spherical or ovate shape (Hass-like) medium thick dark skin, easy to peel and attractive
- Small seed
- Good pulp appearance and palatability
- Acceptable flavour and quality
- Short maturation period
- Long on-tree storage life
- Good post-harvest storage

RESULTS

Scion program

Scions planted out in the different orchards since the beginning of the program are

listed in Table 1. Initial plantings were established with two tree replicates. However, it was decided that the two tree replications are not sufficiently representative, and the program was altered to include five trees per scion per rootstock. This method was followed with the January 1994 planting and will also be implemented with new plantings.

TABLE 1. The planting program of the avocado Phase II scion evaluation trees

AVOCADO PHASE II EVALUATION PLANTING PROGRAM			
PLANTING DATA	SCIONS PLANTED	ROOTSTOCKS USED	PLANTING SITES
March 1993	Fuerte 1 Fuerte 2 Fuerte 3 Fuerte 4 Hass Pinkerton Ryan Gwen 87-7-1 87-17-1	Duke 7 Thomas Barr-Duke	Levubu Burgershall
October 1993	BL 149 BL 135 OA 184 Hayes Eksteen I 373 Edranol NA 37 NA 526 H 22 TX 531 Reed # 86	Duke 7 Thomas Barr-Duke	Levubu
November 1993	Steenkamp Nabal Ester Hilcoa 5	Duke 7 Thomas Barr-Duke	Burgershall
January 1994	Edranol BL 194 BL 135 NA 37 NA 526 OAI84 I 373 Hayes Reed Colin-V-33 Eksteen # 86 TX 531	Duke 7 Thomas Barr-Duke	Burgershall

Limited additions of other promising scions were also made in the Burgershall orchard. These are:

WB200 (2 x Duke 7; 2 x Barr-Duke)
 L 35 (2 x Duke 7; 2x Barr-Duke)
 T 205 (2x Duke 7; 2x Barr-Duke)
 Gordo (2 x Duke 7) and
 L 137 (2 x Duke 7)

Rootstock program

Rootstocks planted out in the different orchards since the beginning of the trial are listed in Table 2.

TABLE 2.
 The planting program of the avocado Phase II rootstock evaluation trees.

AVOCADO PHASE II EVALUATION PLANTING PROGRAM			
Planting Dates	Rootstocks Planted	Scions Used	Planting Sites
March 1993	Duke 7 G 6 Thomas Duke 9 Martin Grande	Fuerte 1 Hass Pinkerton Ryan	Levubu Burgershall

DISCUSSION

Future plantings will continue on this five-tree replicate system. It was decided to change the Barr-Duke root stock in these plantings to Seedling Duke 7. This will enable us to compare the clonal Duke 7 with the seedling, as many farmers tend to produce their own trees on seedlings.

Some of the scions in planning for inclusion for the 1995/6 planting will be:

BL122	RT5176
BL516	3-29-5
BL1058	Regal R
4E-17-15	4W-1-MID
5-552	Van Wyk
1-14-2	

At this early stage of the program, no evaluation data can be presented comparing the scions and the rootstocks with each other. The first assessments will only start one year after planting and these will consist mainly of tree characteristics and possibly early flowering and fruitset characteristics.

This program is currently progressing smoothly with 92 different scion combinations and 20 different rootstock combinations planted. We hope that the introduction of this program will be to the eventual benefit of each and every farmer and to the industry as a whole, and that in the end, costly mistakes, made by introducing cultivars and rootstocks which have not been tested extensively, can be avoided.

REFERENCES

- Ben Ya'Acov, A. 1971/72. Avocado rootstock-scion relationships: a long term large-scale field research project. *California Avocado Society Yearbook* 54/55, 158-161.
- BERGH, B.O., 1987. Avocado breeding in California. *South African Avocado Growers' Association Yearbook* 10, 22-26.
- BIJZET, Zelda., SIPPEL, A.D. & KOEKEMOER, P.J.J., 1993. Avocado breeding: a progress report. *South African Avocado Growers' Association Yearbook*, 16, 86-89.
- DU PLOOY, C.P., MARAIS, Zelda. & SIPPEL, A. 1992. Breeding and evaluation strategy on avocado. *South African Avocado Growers Association Yearbook*, 15, 75-77.
- KNIGHT, R.J. Jr., & WINTERS, H.F. 1971. Mango and avocado evaluation in Southeastern Florida. *Florida State Horticultural Society Yearbook*, 84, 314-317.
- KREZDORN, A.H. 1975. An expanded avocado variety improvement program. *Florida State Horticultural Society Yearbook*, 88, 460-462.
- TERBLANCHE, J.H. 1988. Noodsaaklikheid van 'n doeltreffende avokadoteelprogram. *South African Avocado Growers' Association Yearbook*, 11: 3-4.