

Early Results from the Phase-II Avocado Rootstock Selections

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ABSTRACT

Since 1992 the ARC-ITSC has been carrying out Phase-II avocado rootstock evaluations at Burgershall and Levubu. The first orchard planted for this purpose in 1993 is now in production and was evaluated for tree growth and production. Although the trees are only in their third year since planting, certain trends are being noticed. At Burgershall the C6 rootstock is currently the best, followed by Duke 9, and at Levubu the Duke 9 is the best, followed by Duke 7. However, the trees are still too young to draw conclusions from these early results.

INTRODUCTION

The ARC-ITSC has been conducting phase-II avocado evaluations since 1992, and in 1993 the first orchards were planted for this purpose. Last year, initial tree differences were reported and the first small yields were obtained from the two-year-old trees. These orchards are now in their third year, and bearing their first good yields. However, at the time of writing, harvesting had not started, and yield can therefore be reported only on a fruit number basis, and not on actual mass obtained.

MATERIALS AND METHODS

Orchards established in March 1993, November 1993 and January 1994 at the Burgershall and the Levubu experimental stations were evaluated. Measurements taken were tree height stem circumference, tree radius at the four compass points, and number of fruits on the tree. At Burgershall this data was obtained during November, one week after a severe hailstorm hit the trees. At these orchards fruit knocked off the trees by hail was also counted to determine the effect of the hailstorm. At Levubu data was gathered during February so as to minimize the effect of fruit fall on the number of fruits counted.

Tree height and average radius was used to calculate tree volume using the formula: $\text{Volume} = \pi r^2 (h - 0,33r)$. Tree volume was then used to express tree productivity as fruits per cubic meter. In order to compare various selections with one another, a performance ranking system was devised. Trees were ranked firstly on their volumes (smallest being best), secondly on number of fruits (most being best), and lastly on fruits per cubic meter (highest being best). Where two selections scored equally, the better ranking was assigned to the selection with the better productivity.

RESULTS

Burgershall — Orchard B4

Volume

At this site, scions on Duke 7 rootstock had the smallest volume overall, followed by scions on Duke 9 and Thomas (table 1). The largest volume was recorded on Martin Grande (G 755) rootstock. Thomas and Duke 9 rootstocks produced a smaller Pinkerton than Duke 7.

Fruits per tree

Due to hail damage only the potential number of fruits per tree in this orchard can be taken into consideration, in other words, fruits on the tree as well as fruits knocked off during the hailstorm were counted. On this basis the G6 rootstock would have produced the best, followed by Duke 9 and Martin Grande (table 2). Duke 7 gave the worst results. Fuerte produced very well on G6, and Hass did best on Duke 9. Pinkerton on Martin Grande did well, followed by Pinkerton on Duke 7 at half the number of fruits. Ryan did best on Duke 9.

Table 1
Average tree volume and ranking of the phase-II avocado rootstock trial
at Burgershall (B4; 24/01/1996)

<i>Scion</i>	<i>Rootstocks</i>					<i>Average</i>
	Duke 7	Thomas	G6	Duke 9	G 755	
Fuerte	3,79	5,04	5,19	6,49	6,24	5,35
Hass	3,93	5,95	2,67	5,05	5,60	4,64
Pinkerton	2,13	1,85	dead	1,29	4,19	2,36
Ryan	1,13	2,46	dead	1,62	3,51	2,18
Average	2,75	3,83	3,93	3,61	4,89	
Ranking	1	3	4	2	5	

Table 2
Average potential number of fruits per tree and ranking of the phase-II
avocado rootstock trial at Burgershall (B4; 24/01/1996)

<i>Scion</i>	<i>Rootstocks</i>					<i>Average</i>
	Duke 7	Thomas	G6	Duke 9	G 755	
Fuerte	1,5	0	58,5	25,0	19,5	20,9
Hass	2,5	23,0	29,0	57,0	7,0	23,7
Pinkerton	22,0	11,0	—	16,5	44,5	23,5
Ryan	0,5	1,0	—	3,5	0	1,25
Average	6,63	8,75	43,75	25,5	17,75	
Ranking	5	4	1	2	3	

Fruits per volume

Fuerte again did best on G6 (table 3); Hass did equally well on both Duke 9 and G6; whilst Pinkerton produced best on Duke 9, closely followed by Martin Grande and Duke 7; and Ryan did best on Duke 9.

Levubu — Orchard A3

Volume

At Levubu the trees grew exceptionally well and were about 4,8 times larger than those at Burgershall (table 4). Average tree growth for this orchard was 43,3 %. The lowest growth recorded was for scions on Duke 9 (36 %), followed by those on G6 (37,2 %), Thomas (40,8 %) and Duke 7 (46,1 %). Martin Grande showed the largest increase in tree height (56,5 %), the Fuerte scions showed the smallest increase in height, possibly due to their spreading habit. Ryan scions had the largest increase in height.

Scions on Duke 9 had the smallest volume, followed by those on Duke 7 and Martin Grande (table 5). Scions on Thomas rootstock became the largest.

Table 3

Average number of fruits per cubic meter per tree and ranking of the phase-II avocado rootstock trial at Burgershall (B4; 24/01/1996)

Scion	Rootstocks					Average
	Duke 7	Thomas	G6	Duke 9	G 755	
Fuerte	0,40	0	11,27	3,85	3,13	3,73
Hass	0,64	3,87	10,86	11,29	1,25	5,58
Pinkerton	10,33	5,95	—	12,79	10,62	9,92
Ryan	0,44	0,41	—	2,16	0	0,75
Average	2,95	2,56	11,07	7,52	3,75	
Ranking	4	5	1	2	3	

Table 4

Average percentage tree growth and ranking of the phase-II avocado rootstock trial at Levubu (A3; 05/02/1996)

Scion	Rootstocks					Average
	Duke 7	Thomas	G6	Duke 9	G 755	
Fuerte	50,3	32,2	24,4	28,2	41,0	35,2
Hass	43,6	39,0	32,2	39,4	64,1	43,7
Pinkerton	41,4	36,4	36,4	35,5	56,4	41,2
Ryan	49,3	55,6	55,8	41,0	64,3	53,2
Average	46,1	40,8	37,2	36,0	56,5	43,3
Ranking	4	3	2	1	5	

Table 5
Average tree volume and ranking of the phase-II avocado rootstock trial at Levubu (A3; 05/02/1996)

<i>Scion</i>	<i>Rootstocks</i>					Average
	Duke 7	Thomas	G6	Duke 9	G 755	
Fuerte	20,53	27,74	20,75	19,51	22,22	22,15
Hass	19,51	19,65	25,32	20,29	19,71	20,90
Pinkerton	18,04	19,80	16,7	14,58	17,37	17,30
Ryan	12,03	11,34	14,41	9,26	11,15	11,64
Average	17,52	19,63	19,29	15,91	17,61	
Ranking	2	5	4	1	3	

Table 6
Average potential number of fruits per tree and ranking of the phase-II avocado rootstock trial at Levubu (A3; 05/02/1996)

<i>Scion</i>	<i>Rootstocks</i>					Average
	Duke 7	Thomas	G6	Duke 9	G 755	
Fuerte	23,5	34,5	56,0	14,0	13,0	28,2
Hass	56,5	46,5	80,0	92,0	47,0	64,4
Pinkerton	146,0	95,5	98,5	83,0	69,0	98,4
Ryan	9,5	12,5	13,5	17,5	14,0	13,4
Average	58,87	47,25	62,0	51,62	35,75	
Ranking	2	4	1	3	5	

Fruits per tree

Table 6 shows that G6 was the best rootstock, followed by Duke 7 and Duke 9. Martin Grande yielded the least.

Fruits per volume

Table 7 shows that scions on Duke 7 tended to be the best, followed by Duke 9 and then G6. Again production was poorest on Martin Grande rootstock.

Table 7
Average number of fruits per cubic meter per tree and ranking of the phase-II avocado rootstock trial at Levubu (A3; 05/02/1996)

<i>Scion</i>	<i>Rootstocks</i>					Average
	Duke 7	Thomas	G6	Duke 9	G 755	
Fuerte	1,14	1,24	2,70	0,72	0,58	1,28
Hass	2,90	2,37	3,16	4,53	2,38	3,07
Pinkerton	8,09	4,82	5,90	5,69	3,97	5,69
Ryan	0,79	1,10	0,94	1,89	1,26	1,20
Average	3,23	2,38	3,17	3,21	2,05	
Ranking	1	4	3	2	5	

DISCUSSION

Burgershall — Orchard B4

The trees at Burgershall had to cope with more adverse conditions (drought, hail and scorching temperatures) than those at Levubu, which explains the large difference in tree size between these two sites, even though the orchards were established at the same time. Also, general climatic conditions for tree growth seem to be more favourable at Levubu than at Burgershall. Currently the trees at Burgershall are under stress, and may even die due to flooding of the orchard after the recent heavy rains in the area.

The G6 rootstock seems to be doing very well at Burgershall, even though it did not survive the conditions there with Pinkerton and Ryan as scions. This performance is followed by Duke 9 and then by the standard Duke 7. Interestingly, Martin Grande performed better than Thomas, even though Martin Grande had more vegetative growth.

Also interesting is the production of Pinkerton, both on Martin Grande and on Duke 7. On Martin Grande the Pinkerton had twice as many fruits per tree as on Duke 7, but it produced a similar number of fruits per cubic meter on both rootstocks. This trend could be an important consideration regarding spacing requirements, because Martin Grande trees become much larger than Duke 7 trees.

At Burgershall, on the ranking system (table 8), Go was the best rootstock overall, followed by Duke 9, Duke 7, Martin Grande and Thomas in that order.

Table 8
Overall performance (ranking) of the various rootstocks in the phase-II avocado rootstock trials at Burgershall and Levubu

<i>Site</i>	<i>Rootstocks</i>				
	Duke 7	Thomas	G6	Duke 9	G 755
Burgershall	3	5	1	2	4
Levubu	2	4	3	1	5

Levubu — Orchard A3

At this site Duke 9 and G6 rootstock grew the least in height over the past year. However, on the basis of tree volume, the Duke 7 moves into second place after Duke 9, closely followed by Martin Grande. So, even though Martin Grande had put on a lot of growth during the past season, it is still not larger than Thomas and G6 in volume.

G6 outperformed the other rootstocks on number of fruits per tree, but Duke 7 actually had the best performance, because of its smaller tree volume. The expected low yields of Hass on Martin Grande compared to Duke 7 did not realize, but its yield per cubic meter on Duke 9 was about twice as much as on Martin Grande. Pinkerton on Duke 7 outperformed the rest of the combinations with 8,09 fruits per cubic meter.

Overall, at Levubu, on the ranking system (table 8) Duke 7 performed best, followed by Duke 9, G6, Thomas and, lastly, Martin Grande.

CONCLUSION

These trees are only in their third year after planting. As yet, no specific recommendations can be made as to the best scion rootstock combination. However, the data does offer possible answers for future spacing requirements as well as possible new combinations to consider in order to extend our range of rootstocks away from the current Duke 7 domination.