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Performance of Rootstock Cultivars in the Avocado Phase II Evaluation Programme: 1997

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ABSTRACT

The purpose of a rootstock evaluation trial is to collect information on the performance of important avocado cultivars in combination with various rootstock cultivars. The first ARC-ITSC trials were established with five rootstock cultivars, namely Duke 7, Thomas, G6 combination with the commercial scions Fuerte, Hass, Pinkerton and Ryan. These trials were planted at Levubu and Bürgerst however, lost during 1996 as a result of the excessive rains of that season.

With Fuerte the best yield per tree came from scions grafted on the Thomas rootstock, at 40.6 kg fruit per tree. This rootstock was also the best performer based on tree size. Hass also had the best per tree yield also on Thomas, but based on tree size, performed better on Duke 7. Pinkerton produced an average of 64.5 kg fruit/tree on Duke 7, with this rootstock also being the best on a tree volume basis. Ryan production was very poor with G6 being the better rootstock at 16.2 kg fruit/tree. However, based on tree volume the best combination (Ryan on Thomas) outperformed the best Fuerte combination.

Data from only the first three years of production are presented. It is suggested that data from two years more should be added before any specific recommendations can be made from this trial.

UITTREKSEL

Die doel van 'n onderstam evaluasie projek is om inligting te versamel aangaande die prestasie van belangrike avokado bostamme in kombinasie met verskeie onderstam kultivars. Die eerste LNR-ITSG proewe is geplant met vyf onderstam kultivars, naamlik Duke 7, Thomas, G6, Duke 9 en G755, in kombinasie met die komrnersieele bostamme Fuerte, Hass, Pinkerton en Ryan. Hierdie proewe is geplant by beide Levubu en Burgershall. Laasgenoemde perseel se proef moes egter gestaak word aangesien die borne doodgegaan net as gevolg van die oormatige reens gedurende die 1995/96 seisoen.

Met Fuerte as bostam en Thomas as onderstam is die beste opbrengs per boom, naamlik 40.6 kg vrugte, verkry. Hierdie onderstam was ook die beste presteerder gebaseer op boom grootte, of te wel, kilogram vrugte per volume eenheid. Waar Hass die bostam was, was die beste opbrengs op 'n per-boom-basis ook verkry met Thomas as onderstam, maar gebaseer op volume het die Duke 7 onderstam beter presteer. Pinkerton het gerniddeld 64.5 kg vrugte per boom geproduseer op Duke 7, terwyl die betrokke onderstam ook die beste resultate gelewer het op 'n volume basis. Ryan se produksie was oor die algemeen swak, met die G6 onderstam die beste teen 16.2 kg vrugte per boom. Gebaseer op boomvolume het Ryan op Thomas egter beter presteer, selfs beter as die beste Fuerte kombinasie.

Siegs data vir die eerste drie jaar se produksie is aangebied. Dit is nog nie voldoende om genoegsame afleidings mee te kan maak nie en daar word voorgestel dat nog twee jaar se data ingesamel word.

INTRODUCTION

The primary objective of the avocado phase II rootstock evaluation programme is to gather information on the performance of scion cultivars in current use within the industry on different rootstock cultivars.

MATERIALS AND METHODS

Details of the different plantings were presented during the 1997 SAAGA research symposium and are fully described in the latest yearbook (Sippel *et al*, 1997).

RESULTS

The A3 orchard at Levubu was established in March 1993 and the first crop was produced in 1995. In this report three years yield data of the four major cultivars on five different rootstocks will be reported on in tables 1 to 6. Data obtained from the A2 cultivar evaluation trial at Levubu will also be reported on as three different rootstocks were used in this trial (table 7).

Levubu A3: Yield

The performance of Fuerte on the five different rootstocks is given in table 1. During the past season a marked increase in production took place, with the average going up from 9,1 to 28,8 kg fruit per tree for the trial block. The best yield (40,6 kg fruit per tree) was achieved on the Thomas rootstock, with scions on Duke 7 yielding 31,7 kg per tree. Taking the tree size (volume) into consideration, i.e. kg fruit produced per cubic metre canopy, the Fuerte scions on Thomas were once again the best at 0,44 kg fruit/m³. The other rootstocks had very similar yields based on this method of comparison.

The data of Hass on the various rootstocks are presented in table 2. On a per tree basis the best yield (1997) came from Hass on Thomas, followed by Hass on Duke 7. Based on the yield per cubic metre canopy volume, the G755 rootstock produced 0,78kg fruit/m³. The best producer was Hass on Duke 7 at 0,82kg fruit/m³.

		FUERTE Kg fruit per cubic metre 1995 1996 1997 1995 1996 1997 0 4.6 31.7 0 0.15 0.36 0 12.4 40.6 0 0.32 0.44 0 19.9 26.8 0 0.67 0.35					
Rootstock	K	g fruit per	tree	Kg fruit per cubic metre			
	1995	1996	1997	1995	1996	1997	
Duke 7	0	4.6	31.7	0	0.15	0.36	
Thomas	0	12.4	40.6	0	0.32	0.44	
G6	0	19.9	26.8	0	0.67	0.35	
Duke 9	0	2.5	20.9	0	0.10	0.37	
G 755	0	6.0	23.9	0	0.20	0.38	
Average	0	9.1	28.8	0	0.29	0.38	

Table 1. Performance of the different rootstocks in the avocado phase II evaluation programme at Levubu (A3) with Fuerte as scion. Planting date: 03/93.

Table 2. Performance of Hass grafted on different rootstocks in the phase II evaluation programme at Levubu (A3). Planting date: 03/93.

		H	LASS				
Root-stock	K	g fruit per	tree	Kg fruit	per cubi	c metre	1.11.1
	1995	1996	1997	1995	1996	1997	
Duke 7	5.2	10.6	48.2	0.43	0.36	0.82	
Thomas	2.6	11.1	62.2	0.21	0.35	0.79	
G6	9.0	16.6	42.7	0.57	0.45	0.59	
Duke 9	7.1	19.8	44.1	0.58	0.75	0.77	
G 755	8.2	9.8	45.9	0.67	0.35	0.78	
Average	6.4	13.6	48.6	0.49	0.45	0.75	

Table 3 displays the yields achieved with Pinkerton on the different rootstocks. The best yield (fruit mass/tree) came from the Pinkerton on Duke 7 rootstocks with an average production of 64,5 kg fruit per tree. Pinkerton on Thomas produced 59,2 kg fruit per tree. The same performance trend was observed on a yield per cubic metre canopy volume basis.

Table 3. Production of Pinkerton grafted on differen' rootstocks in the phase II evaluation programme at Levubu (A3). Planting date: 03/93.

		PII	NKERTO	N	A state		
Rootstocks	Kg	fruit per ti	ee	Kg fruit	per cubic	e metre	
	1995	1996	1997	1995	1996	1997	
Duke 7	9.2	28.9	64.5	0.80	1.24	1.32	
Thomas	11.1	19.5	59.2	0.89	0.80	1.11	
G6	7.4	21.6	52.1	0.71	0.94	1.00	
Duke 9	0.7	16.8	49.8	0.08	0.86	1.00	
G 755	8.0	14.8	38.8	0.72	0.73	1.05	
Average	7.3	20.3	52.9	0.64	0.91	1.10	

From the results of Ryan on the various rootstocks (table 4), it is evident that this cultivar does not perform well at this trial site. The best performance the past season, based on kilogram fruit per tree, came from Ryan scions on G6, at only 16,2 kg fruit per tree. This is well below the average of 28,8 kg per tree for Fuerte. However, based on tree size and thus production per cubic metre canopy volume, the production of Ryan on Thomas was better than that of Fuerte, mainly because of the smaller tree size of the Ryan cultivar.

Table 4. Frui II evalua	t yield by ation prog	Ryan gra ramme at	fted on d Levubu (ifferent roc (A3). Planti	tstocks ir ng date:	the phase 03/93.	
			RYAN				
Rootstocks	K	g fruit per	tree	Kg fruit per cubic metre			
	1995	1996	1997	1995	1996	1997	
Duke 7	13.4	8.1	10.2	1.74	0.50	0.39	
Thomas	12.6	13.3	14.6	1.77	0.86	0.45	
G6	9.7	4.5	16.2	1.11	0.24	0.40	
Duke 9	8.7	5.3	9.8	1.51	0.39	0.35	
G 755	2.5	2.0	1.9*	0.38	0.14	0.07*	
Average	9.4	6.6	10.5	1.30	0.43	0.33	

* Data from one tree only.

Levubu A3: Tree size

Table 5 presents tree sizes, based on cubic metres canopy volume, of the different cultivars due to rootstock effects. Within the Fuerte group the scions grafted on Thomas were by far the largest trees in the block, followed by those on Duke 7. The smallest Fuerte trees were the ones grafted on Duke 9 rootstocks. With Hass the largest trees

were again those grafted on Thomas, with those on G6 being second largest. The Hass scions on the three other rootstocks were very equal in size. The smallest Pinkerton trees were those on G 755 rootstock, whilst the largest were on Thomas rootstock. Ryan scions produced in general small trees, with the smallest being those grafted on Duke 7.

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	TR	EE SIZE	Cubic metr	res)		
Rootstock	Fuerte	Hass	Pinkerton	Ryan	Average	
Duke 7	88.0	58.9	48.9	26.5	55.6	
Thomas	92.3	78.5	53.2	32.5	64.1	
G6	75.7	72.6	51.9	40.1	60.1	
Duke 9	57.2	57.6	49.6	28.1	48.1	
G 755	62.7	59.1	37.1	28.5	46.8	
Average	75.6	65.3	48.1	31.1	55.0	

Table 5. Tree sizes (February 1998) of the different cultivars grafted on different rootstocks in the phase II evaluation programme at Levubu (A3). Planting date: 03/93.

Levubu A3: Fruit size

Average fruit mass of the different commercial cultivars grafted on different rootstocks are presented in table 6. Fruit size of Hass is a constraint in the marketing of this cultivar and the search for a rootstock which produces larger fruit with this cultivar is a priority. At Levubu the G 755 produced the largest Hass fruit at an average of 202.8g per fruit. This is marginally larger than fruit on Duke 7, being 185.3g on average. However, this trend could be the result of less fruit being produced by this rootstock with the other rootstocks it was found that the G 755 rootstock performed similarly to Duke 7, with marginally less fruit being produced on a tree volume basis than Duke 7.

AVERAGE FRUIT MASS (g)						
Rootstocks	Fuerte	Hass	Pinkerton	Ryan	Average	
Duke 7	279.7	185.3	295.8	358.9	279.9	
Thomas	213.8	179.1	319.0	342.6	263.6	
G6	18.4	175.5	312.8	362.9	292.4	
Duke 9	290.1	181.6	301.6	377.7	287.7	
G 755	321.2	202.8	303.0	320.0	286.7	
Average	284.6	184.9	306.4	352.4	282.1	

Table 6. Average fruit mass of the different cultivars grafted on different rootstocks in the phase II rootstock evaluation programme at Levubu (A3). Planting date: 03/93.

Levubu A2: Yield

In the cultivar trial three different rootstocks were compared to each other, namely Duke 7, Thomas and Barr Duke (table 7). With Fuerte the best production came from scions grafted onto Duke 7 (20,1 kg/tree) followed by those on Barr Duke at 16,3 kg fruit per tree. Based on tree volume, Fuerte on Duke 7 produced 0.2 kg fruit per cubic metre more than on the other two rootstocks.

CULTIVAR	ROOTSTOCK	Kg F per tr	Kg FRUIT per tree		Kg FRUIT per Cubic metre	
		1996	1997	1996	1997	
FUERTE*	Duke 7	3.8	20,1	0.25	0.65	
	Thomas	3.7	15,5	0.25	0.45	
	Barr Duke	3.4	16,3	0.19	0.40	
	Average	3.6	17,3	0.23	0.50	
HASS ¹	Duke 7	19.7	50,9	1.14	1.68	
	Thomas	13.2	36,8	0.92	1.52	
	Barr Duke	10.6	47,1	0.73	1.90	
	Average	14.5	44.9	0.93	1.70	
PINKERTON	Duke 7	16.4	48,4	1.64	1.57	
	Thomas	12.9	50,1	1.08	1.67	
	Barr Duke	14.6	50,8	1.09	1.45	
	Average	14.6	49.8	1.27	1.56	
RYAN ¹	Duke 7	2.3	8,0	0.31	0.73	
	Thomas	17.3	14,3	1.75	0.81	
	Barr Duke	8.7	5,8	1.15	0.33	
	Average	9.4	9.4	1.07	0.62	

Table 7. Yield comparisons of cultivars on different rootstocks in the avocado phase II cultivar evaluation trial at Levubu orchard A2.

* Average of 8 trees per rootstock

¹ Average of 2 trees per rootstock

Hass also had the same trend with scions on Duke 7 rootstocks doing better than on Barr Duke when comparing yield on a per tree basis. Hass on Thomas did not do well at only 36,8 kg fruit per tree, compared to the production of 62,2 kg per tree in the A3 rootstock trial. Taking tree size into consideration the Hass on Barr Duke did best with 1.9 kg fruit per cubic metre, compared to 1.68 fruit per cubic metre on Duke 7 rootstock, both figures being better than those found in the A3 trial. This is due to the smaller tree sizes of the trees in the A2 block.

No real difference was noticed between the rootstocks used with Pinkerton as scion as they all produced equally well at around 50 kg fruit per tree. This figure is also comparable with the results found in the A3 rootstock trial. Based on tree size Pinkerton

on Thomas did best with a yield of 1.67 fruit per cubic metre.

Ryan on Thomas at 14,3 kg per tree produced almost double than this scion on the other two rootstocks. In both trials Ryan on Thomas performed better than Ryan on Duke 7. Both blocks had equally disappointing yields on a per tree basis compared to the other cultivars. However, yield of this cultivar on a tree volume basis was on average better than that of Fuerte.

SUMMARY & CONCLUSIONS

From the results presented it is evident that no specific rootstock can be recommended for both Fuerte and Hass, as no trend has as yet emerged from three years data.

With Pinkerton, performance based on kilogram fruit per tree matched performance on a per cubic metre tree canopy basis. Pinkerton on Duke 7 rootstock performed best in the trials but any of the other rootstocks can be used with equally good prospects.

Ryan did not perform well at this site with the effect that no real recommendation can be made. It was found that based on tree size the Ryan cultivar performed better than Fuerte. It also seems as if Ryan on the Thomas rootstock produced marginally better than on the other rootstocks. This combination could thus be considered in future plantings.

Data from only the first three years of production were presented. In order to be able to draw proper conclusions from this trial, it is suggested that two more years' data should be accumulated. It is also recommended that the rootstock trials be extended to farmers' orchards to gain maximum benefit from a range of climates and soils under which rootstocks can be tested. This will also ensure that results are more applicable to the areas of production. This option will be investigated as to its feasibility.

REFERENCE

SIPPEL, A.D., SNIJDER, B., WERKSMAN, J. & BIJZET, Z.1997. Performance of rootstock cultivars in the avocado phase-II evaluation programme: 1996. *South African Avocado Growers' Association Yearbook* 20: 28 - 29.