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**PERFORMANCE OF THE APPLE CULTIVAR
JONATHAN ON CLONAL ROOTSTOCKS IN
SOUTHERN QUEENSLAND**

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SUMMARY

Final results are reported on a 20-year-old apple rootstock trial at Applethorpe, Queensland. This featured Jonathan as the scion variety on a range of Malling-Merton rootstock (MM107, MM108, MM109, MM110, MM111, MM113, MM114 and MM115), Malling 411, Malling 279, Malling 25 and Northern Spy under infertile, unirrigated conditions at a 6 m by 6 m spacing.

MM109 produced the largest girth, the heaviest scion weight and the heaviest crops. Girth, scion weight and yield of trees on Northern Spy compared unfavourably with most of the other rootstocks. However, Northern Spy and MM110 induced the greatest fruitfulness. On Northern Spy, fruit was of good size, but MM110 produced the smallest fruit in the trial.

Because of fruitfulness and fruit quality when this rootstock is used, Northern Spy rates consideration under more fertile conditions and for irrigated close-planting regimes. The latter are under test at Applethorpe.

I. INTRODUCTION

In 1950, Thomas planted at the Granite Belt Horticultural Research Station, Applethorpe, a Jonathan Rootstock Trial made up of a selection of Malling-Merton rootstocks (MM107, MM108, MM109, MM110, MM111, MM113, MM114 and MM115), Malling 411, Malling 279, Malling 25 and Northern Spy. Northern Spy had been the standard apple rootstock in the district because of its resistance to woolly aphis (*Eriosoma lanigerum* Hausm) and its reputation for fruitfulness and good fruit quality. But, on infertile soils, it failed to produce trees large enough to give satisfactory yields. Rootstocks selected for the trial comparison had a wide vigour range and were claimed to have woolly aphid resistance.

An interim report on this trial has been published (Thomas 1966). Data collected and analysed were girth measurements (cm), accumulated crop (kg per tree) for 1958-61 and 1958-65 and mean weight per 100 or 200 fruit. His main conclusions were—

1. Trees on rootstock MM109 had the largest girth, carried the heaviest crop and exhibited precocity in bearing.
2. MM113 and MM115 produced larger trees and heavier crops than Northern Spy.
3. Mean fruit weight was commercially acceptable for MM109, MM114, Malling 411 and Northern Spy. MM110 produced the smallest fruits.

II. MATERIALS AND METHODS

The trial was established on a sandy podsol of granitic origin, representative of the poorer district soils. Spacing was 6 m by 6 m on the square under dryland conditions. These were the standard district management practices in 1950. Layout was a randomized block with 20 replicates of the 12 rootstock treatments as single tree plots.

Granny Smith trees were interplanted between blocks for cross pollination purposes. Trees were pruned to the vase system. At each winter pruning, two-thirds of the leader growth were removed. Sub-leaders were developed during the first 5 years to fill in spaces between the leaders.

Fertilizing practices consisted of an annual spring dressing of a mixture containing 10N:4P:6K applied at the rate of 2.7 kg per tree. The minor elements, copper, zinc and boron were applied at locally recommended rates and an intensive pest and disease control programme was carried out. Summer weed growth was controlled by inter-row cultivating equipment while rye or lupins were grown as winter green manure crops.

After the 1970 harvest, the trial was concluded. After taking final girth measurements, trees were cut down and scion weights taken. Collection of data and general trial management had continued as in the interim report with one exception. From 1967 onwards, the trial was reduced to 12 replicates for management reasons.

III. RESULTS

Table 1 expresses data as means of 12 replicates and refers to girth, scion weight, accumulated yield and fruitfulness.

TABLE 1
GROWTH, YIELD AND FRUITFULNESS

Rootstock	Mean Girth 1970 (cm)	Mean Scion Weight (kg)	Mean Accumulated Yield (kg per tree)			Fruitfulness*		
			1958-65	1966-70	1958-70	a	b	
MM109	50.4	78.6	686.5	668.8	1 355.3	18.11	1.16	
MM113	46.7	66.3	589.5	648.2	1 238.4	19.31	1.24	
MM114	46.5	71.4	563.9	606.9	1 170.8	18.59	1.19	
MM115	45.5	59.4	620.8	551.3	1 172.0	21.92	1.23	
Malling 411	43.2	60.8	618.5	604.6	1 223.1	20.94	1.39	
Malling 279	42.9	55.2	568.4	534.7	1 103.1	20.75	1.31	
Malling 25	42.9	54.3	493.0	488.7	981.7	19.15	1.15	
Northern Spy	37.2	42.2	471.3	449.2	920.5	23.69	1.38	
MM107	37.1	35.2	358.5	299.1	657.6	20.07	0.96	
MM111	34.9	34.7	400.2	345.4	745.5	21.69	1.30	
MM108	34.7	32.6	357.4	351.0	708.4	22.92	1.19	
MM110	33.3	33.9	398.4	354.7	753.1	23.78	1.48	
Necessary differences for significance	5% 1%	4.6 6.0	16.6 21.9	112.0 148.1	130.9 173.0	226.2 299.1	3.43 4.54	0.16 0.21

* Fruitfulness is expressed by—(a) $\frac{\text{Accumulated Crop 1958-70}}{\text{Scion Weight (kg)}}$

(b) $\frac{\text{Accumulated Crop 1958-70}}{(\text{Girth 1970})^2}$

Girths measured in 1970 follow the same trends as in the interim report. From the results, the rootstocks can be divided broadly into three girth size categories, MM109 alone, MM113, MM114, MM115, Malling 411, Malling 279 and Malling 25 collectively and finally those of the smallest size namely, Northern Spy, MM107, MM108, MM110 and MM111. Northern Spy and associated rootstocks produced trees significantly smaller in girth than did all rootstocks in the first two categories. MM109 gave significantly greater girth than all rootstocks except MM113 and MM114.

Scion weights follow almost the same pattern as girth measurements. With Northern Spy and associated rootstocks, they are significantly less or almost significantly less than with all rootstocks in the first two categories. Scion weight on MM109 is significantly greater than on all other rootstocks except MM113 and MM114.

Accumulated yield figures (1958-65) are as shown in the interim report with yields on MM109, MM115, MM113 and Malling 411 being significantly greater, and on MM107 and MM108 significantly less, than on Northern Spy. MM109 has significantly greater yields than all the other rootstocks except MM115, MM113 and Malling 411.

Accumulated yield figures (1966-70) show MM109, MM113, MM114 and Malling 411 significantly more productive and MM107 significantly less productive than Northern Spy. Again, MM109 is significantly more productive than most of the other rootstocks.

Total crop figures (1958-70) show similar differences to those of the 1966-70 yields.

Fruitfulness is expressed in two ways—

$$\frac{\text{Accumulated Yield 1958-70}}{\text{Scion Weight}} \quad \text{or} \quad \frac{\text{Accumulated Yield 1958-70}}{(\text{Girth 1970})^2}$$

Scion weight is regarded as the best parameter but, because of the destructive nature of this measurement, it can be taken only at the completion of the trial. However, strong correlations have been obtained previously for fruitfulness using both scion weight and girth measurements (Preston 1958; Thomas 1968).

With scion weight as the parameter, Northern Spy and MM110 exhibit the greatest fruitfulness. They are significantly more fruitful than MM109, MM113, MM114, MM107 and Malling 25.

With girth as the parameter, MM110, Northern Spy and Malling 411 exhibit the greatest fruitfulness. They are significantly more fruitful than MM109, MM107, Malling 25, MM114, MM108 and (except for Northern Spy) MM115. This follows in the main the same level of significances shown by scion weight.

Table 2 expresses mean fruit weight. This has been taken from the interim report and concerns three seasons each receiving widely different rainfalls. Northern Spy produced significantly greater fruit size than several other rootstocks in 1964 and 1965, but did not perform as well in 1966. MM110 produced the smallest fruit. MM109 has good fruit size for a high yielding rootstock.

TABLE 2
MEAN WEIGHT PER 100 OR 200 FRUIT

Rootstock	1964	1965	1966
	100 Fruit Weight (kg)	200 Fruit Weight (kg)	100 Fruit Weight (kg)
MM111	13.74	16.04	9.50
Northern Spy	14.95	15.62	10.12
MM107	14.02	15.30	9.79
MM109	14.54	14.94	10.40
M411	14.52	14.77	10.39
MM114	14.58	14.74	10.31
M279	13.96	14.26	10.01
MM108	14.25	13.98	10.42
MM113	13.46	13.58	9.90
M25	13.99	13.32	10.15
MM115	14.19	13.29	9.49
MM110	12.99	12.39	9.49
Necessary differences for significance	5%	1.89	0.71
	1%	2.49	0.93

Rainfall from 1 November to 5 February 1963-64—385 mm
1964-65—144 mm
1965-66—293 mm

IV. DISCUSSION

Under the conditions of this trial, MM109 has produced the largest trees and the greatest yield. It has also performed well in other areas such as England (Preston 1966), New Zealand (McKenzie 1964) and Tasmania (Richardson 1970). It was reported to have a poor root system (Preston 1966; van Heck 1957) but did not show this characteristic in this trial.

By comparison, the standard rootstock Northern Spy was one of the smallest rootstocks with a low yield. MM113 and MM115 have produced larger trees and heavier crops than Northern Spy. So also have Malling 411 and MM114.

However, Northern Spy and MM110 were the most fruitful stocks. MM110 has the smallest girth, yielded considerably less than Northern Spy and produced the smallest trial fruit. Small fruit size in Jonathan can be a limiting factor in market acceptability.

Under infertile conditions, Northern Spy rootstock produced small trees but given better nutrient and moisture supply, trees large enough to give satisfactory yields can be grown.

Because of Northern Spy's high degree of fruitfulness, its good fruit size and general high quality, it should not be dismissed as an unsuitable rootstock. As horticultural thought changes from dryland wide-spacing to irrigated close-planting, and large tree size becomes less important, Northern Spy may still merit serious consideration. Recently established close-planting trials at the Granite Belt Horticultural Research Station are comparing Northern Spy with more vigorous rootstocks.

All rootstocks tested showed a good degree of woolly aphid resistance. However, modern insecticides have reduced the importance of this pest.

This final report substantiates the findings of Thomas's interim report.

V. ACKNOWLEDGEMENTS

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