

Project Title	Evaluation of a Range of Plum Rootstocks
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The results and conclusions in this report are based on a series of experiments conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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Grower Summary

Headlines

- The rootstock Plumina can produce a greater yield of Jubileem and Marjorie's Seedling than either St Julian A or Pixie rootstocks.
- Tree training and pruning can influence fruit number.

Background and expected deliverables

The standard plum rootstock, St Julian A, has a number of shortcomings including:

- the need for expensive tree management and/or growth regulators to achieve adequate tree control
- lack of precocity
- moderate fruit size

The new rootstock introductions, Ishitara and Plumina, offer improvements in some or all of these areas and on the continent have been shown to have better crown volume to yield ratios than St Julian A. Pixie has seen limited use on established varieties but may have benefits for new variety introductions. Current information on the performance of these rootstocks is only available from work in other countries and does not evaluate UK preferred varieties. This trial was designed to assess these rootstocks in relation to the UK climate and preferred varieties.

The intended deliverables of this project are assessments of the rootstocks, varieties and pruning methods that will:

- provide practical recommendations on best rootstock/variety combinations
- provide practical recommendations on best pruning and tree training methods
- provide an idea of expected yields in the initial years of an orchard with varieties grown on these rootstocks

Summary of the project and main conclusions

The various variety and rootstock combinations were trialled in five orchards on two farms in East Kent:

Variety	Rootstocks
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Jubileem	Pixie	Plumina	St Julian A
Marjorie's Seedling	Pixie	Plumina	St Julian A
Opal	Ishtara		
Opal		Plumina	St Julian A
Victoria	Plumina	St Julian A	

Results from 2007 show that in all cases fruit number was greater for the rootstock Plumina than the rootstocks St Julian A and Pixie. The rootstock Ishtara supports a large extensive tree and in the case of Opal yielded more fruit. The results for all varieties support data from the continent where the rootstock Plumina has been shown to produce greater yields than St Julian A and where St Julian A produced greater yields than Pixie.

The data from 2007 showed a variable influence of rootstock on fruit size with Plumina tending to produce smaller fruit than St Julian A, Pixie and Ishtara. However the reduction in fruit size can be partially explained by the increase in fruit number on Plumina.

The results of average fruit weight in 2007 show that for Jubileem and Marjorie's Seedling, the rootstock Plumina produces heavier fruit than St Julian A or Pixie, similar to the results for fruit size measurements. In the case of Opal there was no difference in average fruit weight from either St Julian A or Plumina. For Victoria, St Julian A produced heavier fruit than Plumina.

In all but one case, tree training had a beneficial effect on average fruit number for trees grown on St Julian A. However in the case of Plumina training resulted in an increase in fruit number for Opal and Victoria but a decrease in fruit number for Jubileem and Marjorie's Seedling. Training Jubileem on Pixy resulted in an increase in fruit number but training Marjorie's Seedling on Pixy resulted in a decrease in fruit number.

The results for Jubileem in 2007 show that fruit number can be increased by training for St Julian A and Pixie but that training has a detrimental effect on fruit number for the rootstock Plumina. A similar trend was observed for Marjorie's Seedling grown on St Julian A and Plumina, but here snaking the leader then tying down or cracking increased fruit number compared to control or snaking the leader alone. In the cases of Opal and Victoria training generally increased fruit number for both St Julian A and Plumina rootstocks.

When the combination of average fruit number per tree (control), average weight of fruit per tree (control) and planting density are taken into account, the 2007 yield per variety/rootstock combination can be calculated. From the yield results it can be seen that for the varieties

Jubileem and Marjorie's Seedling, the use of the rootstock Plumina resulted in a marked increase in yield compared to Pixie and the industry standard St Julian A in 2007. However yields for Opal and Victoria were greater in 2007 for the rootstock St Julian A than for the rootstock Plumina.

Financial benefits

Earlier yields equate to a quicker return. The potential higher yields in initial years for Jubileem and Marjorie's Seedling on Plumina than on other rootstocks could result in a faster payback and increased profitability.

Action points for growers

- Consider using the rootstock Plumina when planting Jubileem and Marjorie's Seedling .
- When planting Opal and Victoria, the rootstock Plumina or St Julian A could be considered, however future results from this trial will determine which of these two rootstocks will be preferred.
- As training trees on the rootstock Plumina can have a detrimental effect on fruit number limit tree management to.....?

Science Section

Introduction

The plum rootstock St Julian A has now been used as the industry standard for many years. It is very vigorous and needs stringent vigour control to maintain regular cropping, especially for the more vigorous varieties. This gives rise to a number of shortcomings for this rootstock, including lack of precocity, moderate fruit size and the need for expensive tree management and/or growth regulators to achieve adequate tree control,.

The new rootstock introductions, Ishitara and Plumina, offer improvements in some or all of these areas and on the continent have been shown to have better crown volume to yield ratios than St Julian A. Pixie has seen limited use on established varieties but may have benefits for new variety introductions. Current information on the performance of these rootstocks is only available from work in other countries and does not evaluate UK preferred varieties. This trial was designed to assess these rootstocks in relation to the UK climate and preferred varieties.

The commercial objectives of this project are to:

- provide practical recommendations on best rootstock/variety combinations
- provide practical recommendations on best pruning and tree training methods
- provide an idea of expected yields in the initial years of an orchard with varieties grown on these rootstocks

Materials and Methods

This trial was conducted at Gaskains Ltd., Norham Farm, Selling, Faversham, Kent by kind permission of Charles Gaskain and at E.S. & L.E. Dawes, Mount Ephraim, Hernhill, Faversham, Kent by kind permission of Sandys Dawes. The location of the trial trees was within 5 orchards on the above farms. The orchards having soil of the following types and tree combinations:

Cage,

Soil type: silty clay loam

Rootstocks: Pixie, Plumina, St Julian A

Variety: Marjorie's Seedling

Green Lane,

Soil type: silty clay loam
Rootstocks: Pixie, Plumina, St Julian A
Variety: Jubileem

Orchards,
Soil type: sandy loam
Rootstocks: Ishtara
Variety: Opal

Rhode Court,
Soil type: silty clay loam
Rootstock: Plumina, St Julian A
Variety: Victoria

Shottenden,
Soil type: clay loam
Rootstock: Plumina, St Julian A
Variety: Opal

Pruning and training treatments were superimposed over the variety/rootstock combinations. These treatments included control, pruning, pruning plus cracking and pruning plus tieing. The combinations and layout of the rootstock/variety/training treatments is shown in Appendix I.

The following measurements were recorded for each assessed tree:

- fruit number
- average fruit size (diameter, mm)
- average fruit weight (g)

Results and Discussion

Effects of rootstock on fruit number

Fruit number was recorded on 23rd July 2007 for Jubileem, 24th July 2007 for Marjorie's Seedling, 17th July 2007 for Opal and 24th July 2007 for Victoria.

Table 1. The effects of rootstock on mean fruit number per tree in Jubileem, Marjorie's Seedling, Opal and Victoria for the control treatment in 2007.

	St Julian A	Pixie	Plumina	Ishtara
Jubileem	40.0	37.0	162.0	
Marjorie's Seedling	53.0	50.0	123.0	
Opal	13.8		39.6	65.0
Victoria	60.8		162.8	

The results show that in all cases fruit number was greater for the rootstock Plumina than the rootstocks St Julian A and Pixie. The rootstock Ishtara supports a large extensive tree and in the case of Opal yielded more fruit than on St Julian A and Plumina. However, as the Opal on Ishtara was not grown in the same location and soil type as the Opal on St Julian A and Plumina this result may not be particularly informative.

The results for all varieties supports data from the continent where the rootstock Plumina was shown to produce higher yields than St Julian A and that St Julian A produced higher yields than Pixie.

Effects of rootstock on fruit size

Fruit size was recorded on 23rd July 2007 for Jubileem, 17th August 2007 for Marjorie's Seedling, 17th July 2007 for Opal and 24th July 2007 for Victoria.

Table 2. The effects of rootstock on average fruit diameter (mm) in Jubileem, Marjorie's Seedling, Opal and Victoria for the control treatment in 2007.

	St Julian A	Pixie	Plumina	Ishtara
Jubileem	45.3	45.5	41.8	
Marjorie's Seedling	44.4	45.8	45.3	
Opal	54.2		51.6	57.9
Victoria	35.8		35.0	

Table 2 shows that there is a variable influence of rootstock on size with Plumina tending to produce marginally smaller fruit than St Julian A, Pixie and Ishtara in 2007, despite the generally much higher fruit number on Plumina.

Effects of rootstock on fruit weight

Fruit weight was recorded on 23rd July 2007 for Jubileem, 17th August 2007 for Marjorie's Seedling, 17th July 2007 for Opal and 24th July 2007 for Victoria.

Table 3. The effects of rootstock on average fruit weight (g) in Jubileem, Marjorie's Seedling, Opal and Victoria for the control treatment in 2007.

	St Julian A	Pixie	Plumina
Jubileem	51.7	49.8	56.7
Marjorie's Seedling	55.2	59.0	60.3
Opal	38.1		38.1
Victoria	30.7		29.7

The results of average fruit weight (Table 3) show that for Jubileem and Marjorie's Seedling, the rootstock Plumina produces heavier fruit than St Julian A or Pixie which is also shown in the fruit size measurements. In the case of Opal there was no difference in average fruit weight from either St Julian A or Plumina. For Victoria, St Julian A produced heavier fruit than Plumina.

Effects of training on average fruit number

Tables 4-7 show the effect of training treatment on fruit number for Jubileem, Marjorie's Seedling, Opal and Victoria when grown on St Julian A, Pixie and Plumina.

In all but one case tree training has a beneficial effect on average fruit number for trees grown on St Julian A, however in the case of Plumina training resulted in an increase in fruit number for Opal and Victoria but a decrease in fruit number for Jubileem and Marjorie's Seedling. Training Jubileem on Pixy results in an increase in fruit number but training Marjorie's Seedling on Pixy results in a decrease in fruit number.

Table 4. The effects of training on average fruit number for Jubileem in 2007.

	St Julian A	Pixie	Plumina
Control	40	37	162
Snaked leader, pruned	162		136
Snaked leader, pruned & cracked	120	84	104
Snaked leader, pruned & tied	142	115	121
Cut leader, pruned & cracked			81
Cut leader, tied			93

Table 5. The effects of training on average fruit number for Marjorie's Seedling in 2007.

	St Julian A	Pixie	Plumina
Control	53	50	123
Snaked leader, pruned	57	28	64
Snaked leader, pruned & cracked	97	41	57
Snaked leader, tied	89	31	48

Table 6. The effects of training on average fruit number for Opal in 2007.

	St Julian A	Plumina
Control	40	14
Snaked leader, pruned		172
Snaked leader, pruned & cracked	79	
Snaked leader, tied	72	179
Snaked leader, cracked & twisted		136
Cut leader, tied		116
Cut leader, cracked & twisted		199

Table 7. The effects of training on average fruit number for Victoria in 2007.

	St Julian A	Plumina
Control	141	133
Cut leader, pruned	154	206
Snaked leader, pruned & cracked	61	163
Snaked leader, tied & cracked	225	156

The results for Jubileem in 2007 show that fruit number can be increased by training for St Julian A and Pixie but that training has a detrimental effect on fruit number for the rootstock Plumina. A similar trend was observed for Marjorie's Seedling grown on St Julian A and Plumina, but here snaking the leader than tying down or cracking increased fruit number compared to control or snaking the leader alone. In the case of Opal and Victoria training generally increased fruit number for both St Julian A and Plumina rootstocks.

Effect of rootstock on total yield

When the combination of average fruit number per tree (control), average weight of fruit per tree (control) and planting density are taken into account, the 2007 yield per variety/rootstock combination can be calculated.

Table 8. Yield in Tonnes per hectare for variety/rootstock combinations in 2007.

	St Julian A	Pixie	Plumina
Jubileem	3.93	3.51	17.47
Marjorie's Seedling	4.14	4.17	10.50
Opal	2.65		0.92
Victoria	8.22		7.55

From the yield results (Table 8) it can be seen that for the varieties Jubileem and Marjorie's Seedling, the use of the rootstock Plumina results in a marked increase in yield compared to Pixie and the industry standard St Julian A in 2007. However yields for Opal and Victoria were greater for the rootstock St Julian A than for the rootstock Plumina.

Conclusions

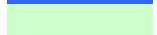
This years results from the project have shown that rootstock choice has exerted an influence on fruit number and size and hence total yield. The trial has also shown that for the same time period, training of the tree had a large influence on mean fruit number.

For the precocious variety Victoria and the variety Opal the rootstock St Julian A has produced the greatest yields per acre in 2007. For the other two varieties trialled Jubileem and Marjorie's Seedling the rootstock Plumina is far superior with yields far in excess of St Julian A or Pixie.

Appendix I

Jubileem at Green Lane

ROW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
32	JUBILEEM	PC	PC	PC	PC	PC	PT	PT	PT	PT	P	P	P	XX	P	C	C	C	→						
28	JUBILEEM																								
27	JUBILEEM																								
26	VICTORIA																								
25	VICTORIA																								
24	JUBILEEM																								
23	JUBILEEM																								
22	VICTORIA																								
21	VICTORIA																								
20	JUBILEEM																								
19	JUBILEEM	PC	PC	PC	PC	XX	PT	PT	PT	PT	P	P	P	CC	CC	CC	CC	CT							
18	VICTORIA																								
17	VICTORIA																								
16	JUBILEEM	PC	PC	PC	PC	PC	PT	PT	PT	PT	C	C	C	→											
15	JUBILEEM																								
14	VICTORIA																								
13	VICTORIA																								
12	JUBILEEM																								
11	JUBILEEM																								

 = ST JULIAN A
 = PIXIE
 = PLUMINA

C = CONTROL
 P = PRUNED
 T = TIED
 P.T = PRUNED/TIED

PC = PRUNED / CRACKED
 CC = CUT LEADER CRACKED / PRUNED
 CT = CUT LEADER TIED

Marjorie's Seedling at Cage

	VARIETY	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	Marjorie's Seedling																																					
2	Marjorie's Seedling																																					
3	Marjorie's Seedling	PC	PC	PC	PC	PC	PC	T	T	T	T	T	P	P	P	PC	PC	PC	PC	PC	PC	T	T	T	T	T	P	P	P	P	PC	PC	PC	PC				
4	Marjorie's Seedling																																					
5	Marjorie's Seedling																																					
6	Marjorie's Seedling																																					
7	Marjorie's Seedling																																					
8	Marjorie's Seedling																																					
	Marjorie's Seedling																																					

PIXIE
PLUMINA
ST.JULIAN A

C = CONTROL
P = PRUNED
T = TIED
PT = PRUNED & TIED
PC = PRUNED & CRACKED

Opal at Shottenden

 = OPAL ON PLUMINA
= VICTORIA ON ST JULIAN A
= OPAL ON ST JULIAN A

SCT = SNAKED LEADER CRACKED & TWISTED
ST = SNAKED LEADER TIED
CCT = CUT LEADER CRACKED & TWISTED

CT = CUT LEADER TIED
SP = SNAKED LEADER PRUNED
SPC = SNAKED LEADER PRUNED & CRACKED
C = CONTROL

Opal at Orchards

ROW	VARIETY	ROOTSTOCK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7	Victoria	ST.JULIAN A																
6	Opal	ISHTARA	Control	P T	P T	P T	P T Cu6	P T Cu4	P T Cu2	P	P	P	P	P	P	P	Control	
5	Opal	ISHTARA	Control	P T	P T	P	P Cu2	P T Cu4	P Cu6	Cu2	Cu4	Cu6	Cu8	P Cu2	P Cu4	P Cu6	P Cu8	Control
4	Victoria	ST.JULIAN A																
3	Victoria	ST.JULIAN A																
2	Victoria	ST.JULIAN A																
1	Victoria	ST.JULIAN A																

ST.JULIAN A
ISHTARA

C = CONTROL
P = PRUNED

T = TIED
Cu = Cultar ml/tree Cultar applied to soil in 500ml water

Victoria at Rhode Court

Row	Variety	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	VICTORIA																								
2	VICTORIA	PC	PC	PC	PC	PC	P	P	P	P	TC	TC	TC	TC	C	C	C								
3	VICTORIA	PC	PC	PC	PC	PC	P	P	P	P	TC	TC	TC	TC	C	C	C								
rest																									

■ = PLUMINA
■ = ST.JULIAN A

C = CONTROL
P = PRUNED (CUT TREES)
T = TIED

PT = PRUNED & TIED
PC = PRUNED & CRACKED (SNAKED TREES)
TC = TIED & CRACKED (SNAKED TREES)

