

HORTICULTURE RESEARCH INTERNATIONAL

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CONTRACT REPORT
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**Susceptibility of 42 apple varieties
to pests and diseases, 1999**

Undertaken for APRC

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Susceptibility of 42 apple varieties to pests and diseases, 1999

Summary

A replicated field experiment to evaluate the susceptibility of 42 apple varieties to pests and diseases was planted at Poultry Farm, Marden, in February 1998 and is in progress currently. There are four replicates and each plot consists of two adjacent trees. The varieties (M9 rootstock) are:

1. A567/19	15. Egremont Russet	29. Prima
2. A931/15	16. Falstaff	30. Princess
3. A93/16	17. Fiesta	31. Priscilla
4. Antonoulka	18. Florina	32. Red Charles Ross
5. Belle de Boscoop	19. Freedom	33. Red Ellison's Orange
6. Ceeval	20. Goldrush	34. Red Fortune
7. Delorina	21. Greensleeves	35. Redfree
8. Discovery	22. Herrings Pippin	36. Regent
9. Double Red Wealthy	23. Judeline	37. Saturn
10. E11/20	24. King of the Pippins	38. Sir Prize
11. E83/4	25. Liberty	39. Vanda
12. E210/198	26. Lord Lambourne	40. Wealthy
13. Early Victoria	27. Mother	41. Winston Red Sport
14. Edward VII	28. Northern Greening	42. Wyken Pippin

Foliar sprays were not applied in 1998 or 1999.

Infestations of pests and diseases were assessed in the second year of growth after planting to determine the relative susceptibility of the varieties. Assessments of the full range of pests and diseases were made on 22 June – 7 July and 27-28 September 1999. A special assessment for leaf bronzing by rust mite was done on 16 July 1999.

Despite favourable weather for the disease, scab levels were generally low, even on the variety Fiesta which is known to be very susceptible. Traces of scab were found on many varieties. Commercially significant levels of fruit scab at harvest were found on Fiesta, Northern Greening and Regent. The low incidence of scab, even on known susceptible varieties, indicate that the susceptibility or otherwise of the varieties to this disease has not been tested adequately in the experiment to date.

The level of susceptibility of the varieties to mildew was severely tested in 1999. Discovery, E11/20, Edward VII, Greensleeves, Lord Lambourne, Prima and Red Ellison were clearly of comparatively low susceptibility to mildew and, thus, could be grown with minimal sulphur fungicide sprays in organic production. Many of the other varieties were severely affected by mildew, to the extent that they were prematurely defoliated. A567/19, Delorina, Freedom, Goldrush, Princess, Priscilla, and Sir Prize were the worst

affected. These varieties are unsuitable to organic production because of their high susceptibility to mildew.

Varieties varied in susceptibility to fungal leaf spots. Antonoulka, Belle de Boscoop, Freedom, Mother, Northern Greening and Winston Red Sport were the most susceptible. The fruits of some varieties were infected with sooty blotch and flyspeck. The infections were most easily visible on varieties with green or yellow skin. The diseases were most severe on Falstaff, Sir Prize and Goldrush.

Pest infestations were generally low and sporadic. Rust mite infestations developed on the foliage of most trees. Varieties which developed more severe bronzing symptoms on the undersides of leaves (mean score ≥ 2.0) were Belle de Boscoop, Egremont Russet, Florina, King of the Pippins, Priscilla, Saturn, Vanda and Wealthy.

The varieties Falstaff and Judeline cropped particularly heavily with a mean of over 30 fruits per dwarf tree in June-July.

Methods and materials

The experiment was planted on 16 February 1998 with two-year-old nursery trees supplied by the Brogdale Horticultural Trust. It consists of 8 rows of 42 trees. The rows are spaced 10 feet (= 3.05 m) apart with a spacing of 5 feet (= 1.52 m) between trees in the row. The design of the experiment is a randomised block with four replicates. Each plot consists of two adjacent trees in a row. Hence each row contains 21 plots. No foliar sprays of plant protection products or nutrients have been applied to the trees.

The incidence of pests and diseases and the damage caused by them on each tree were assessed on 22 June – 7 July 1999 and at the second assessment on 27-28 September 1999 and on 27-28 September 1999. The methods of assessment were tailored to the range and incidence of pests and diseases present. The assessment methods used are shown in Table 1.

Table 1. Assessment methods for pests and diseases

Pest/disease	Assessment method per tree
<i>First assessment (22 June – 7 July 1999)</i>	
Primary mildew	Nos. of mildewed shoots and blossoms
Mildew	Nos. of leaves out of 5 youngest infected in one shoot
Mildew	Severity score:- 0 = none, 1 = trace, 2 = slight, 3 = moderate, 4 = severe, 5 = very severe
Leaf scab	Presence/absence
Fruit scab	Presence/absence

Other diseases Presence/absence on tree

Rust mite bronzing assessment(16 July 1999)

Mite bronzing Leaf bronzing damage scored on terminal, middle and basal leaves on each of two shoots per tree:- 0 = none, 1 = trace, 2 = slight, 3 = moderate, 4 = severe

Second assessment (27-28 September 1999)

Leaf scab	Presence/absence
Fruit scab	Severity score:- 0 = none, 1 = trace, 2 = slight, 3 = moderate, 4 = severe, 5 = very severe
Sooty blotch and fly speck on fruit	Severity score:- 0 = none, 1 = trace, 2 = slight, 3 = moderate, 4 = severe, 5 = very severe
Leaf mildew	Severity score:- 0 = none, 1 = trace, 2 = slight, 3 = moderate, 4 = severe, 5 = very severe
Fruit mildew	Russet severity score:- 0 = none, 1 = trace, 2 = slight, 3 = moderate, 4 = severe, 5 = very severe
Leaf spot	Severity score:- 0 = none, 1 = trace, 2 = slight, 3 = moderate, 4 = severe, 5 = very severe
Canker	Presence/absence
Pests	Presence/absence of pests or their damage (e.g. rosy apple aphid damage) noted on each tree.

Results and Discussion

Scab: Although the wet weather in 1999 were favourable to scab, the incidence of the disease was low, even on the variety Fiesta which is known to be very susceptible. Traces of scab were found on the leaves or fruits of the varieties A567/19, Belle de Boscoop, Delorina, Double Red Wealthy, E210/198, Early Victoria, Edward VII, Egremont Russet, Falstaff, Fiesta, Goldrush, Herrings Pippin, Lord Lambourne, Mother, Northern Greening, Princess, Regent, Sir Prize and Winston Red Sport (Table 2). Significant levels of fruit scab at harvest were found only on Fiesta, Northern Greening and Regent.

The low incidence of scab, even on known susceptible varieties, indicates that the susceptibility or otherwise of the varieties to the disease has not been adequately tested.

Mildew: A high incidence (≥ 5 infected shoots/tree) of primary mildew infection occurred on A567/19, Delorina, Freedom, Goldrush, Princess, Priscilla, and Sir Prize (Table 3). The incidence was very low (≤ 0.1 /tree) on Discovery, Edward VII, Lord Lambourne, Red Charles Ross, Red Ellison, Regent and Wealthy. Severe secondary mildew infection developed on the shoot leaves of most varieties. Those with notably low levels of infection in June-July(score ≤ 1.5) were Discovery, E11/20, Edward VII, Greensleeves, Red Ellison and Lord Lambourne and, in late September, Discovery, Lord Lambourne,

Prima and Red Ellison (E11/20 nearly so). The fruit of A567/19, Freedom and Sir Prize were russeted by mildew, severely in the case of A567/19.

The susceptibility to mildew of the varieties was severely tested in 1999. Discovery, E11/20, Edward VII, Greensleeves, Lord Lambourne, Prima and Red Ellison were clearly of comparatively low susceptibility to mildew and, thus, could be grown with minimal sulphur sprays in organic production. Many of the other varieties were severely affected by mildew, to the extent that they were prematurely defoliated. A567/19, Delorina, Freedom, Goldrush, Princess, Priscilla, and Sir Prize were the worst affected.

Canker: Canker infections were present on Ceeval, E83/4, Falstaff, Freedom, Goldrush Northern Greening, Princess, Regent, Vanda and Winston Red Sport (Table 3).

Leaf spots: Some varieties were notably affected by fungal leaf spots. Those with a mean score ≥ 2.0 were Antonoulka, Belle de Boscoop, Freedom, Mother, Northern Greening and Winston Red Sport (Table 3). The cause of the leaf spot has not yet been identified.

Sooty blotch: The fruits of some varieties were infected with sooty blotch and fly speck. The symptoms were most easily visible on varieties with green or yellow skin. The highest levels (score ≥ 2.0) were on Falstaff, Sir Prize and Goldrush (Table 3).

Rust mite: Rust mite infestations developed on the foliage of most trees. Varieties which developed more severe bronzing symptoms on the undersides of leaves (mean score ≥ 2.0) were Belle de Boscoop, Egremont Russet, Florina, King of the Pippins, Priscilla, Saturn, Vanda and Wealthy (Table 5).

Other pests: Leaf midge and leafhoppers were present on all trees. Occasional trees of several varieties were infested with rosy apple aphid.

Crop load: There were large differences between varieties in crop load. The varieties Falstaff and Judeline cropped particularly with a mean of over 30 fruits per tree in June-July (Table 4).

Acknowledgements

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Table 2. Mean scores for the severity of scab infection of leaves and fruits at the first assessment on 22 June – 7 July 1999 and at the second assessment on 27-28 September 1999.

Variety	Leaf scab present in June-July	Fruitlet scab score in June-July	Leaf scab score in September	Fruit scab score in September
A567/19	+	0.3		0.0
A931/15		0.0		0.0
A93/16		0.0		0.0
Antonoulka		0.0		0.0
Boscoop	+	0.0		0.0
Ceeval		0.0		0.0
Delorina	+	0.3		0.0
Discovery		0.0		*
Double Red Wealthy		0.1		0.0
E11/20		0.0		0.0
E83/4		0.0		0.0
E210/198	+	0.0		0.0
Early Victoria		0.0	+	*
Edward VII	+	0.0	+	0.0
Egremont Russet	+	0.0	+	0.0
Falstaff		0.1	+	0.0
Fiesta	+	0.6	+	1.3
Florina		0.0		0.0
Freedom		0.0		0.0
Goldrush		0.0	+	0.0
Greensleeves		0.0		*
Herrings Pippin	+	0.0		*
Judeline		0.0		0.0
King of Pippins		0.0		0.0
Liberty		0.0		0.0
Lord Lambourne		0.1		0.0
Mother	+	0.0		0.0
Northern Greening	+	0.5		1.2
Prima		0.0		0.0
Princess		0.0	+	0.0
Priscilla		0.0		0.0
Red Charles Ross		0.0		0.0
Red Ellison		0.0		0.0
Red Fortune		0.0		*
Redfree		0.0		*
Regent	+	0.9		0.8
Saturn		0.0		0.0
Sir Prize		0.0	+	0.0
Vanda		0.0		0.0
Wealthy		0.0	+	0.0
Winston Red Sport		0.1	+	0.3
Wyken Pippin		0.0	+	0.0

Table 3. Mean numbers of primary mildew infections per tree, numbers of shoot terminal leaves out of 5 infected with secondary mildew and mean mildew score in late June – early July 1999 and mean mildew fruit russet score and mean leaf secondary mildew score in late September 1999.

Variety	26 June – 7 July 1999			27-28 September 1999	
	No. 1 ^o infections /tree	No. shoot leaves/5 with 2 nd infection	2 nd mildew score	Fruit mildew russet score	2 nd mildew score
A567/19	10.4	5.0	5.0	4.0	4.6
A931/15	0.3	4.3	3.1	0	2.1
A93/16	2.4	4.1	4.1	0.3	2.7
Antonoulka	0.9	4.8	4.4	0	3.4
Belle de Boscoop	2.3	4.7	3.6	0.4	3.3
Ceeval	2.4	3.3	3.1	0	2.1
Delorina	9.5	5.0	5.0	0.8	4.3
Discovery	0.0	0.4	0.4	*	0.9
Double Red Wealthy	0.4	4.3	3.1	0	1.9
E11/20	0.8	0.9	1.3	0	1.6
E83/4	2.4	4.1	3.6	1.0	3.3
E210/198	2.1	4.4	3.3	0	3.1
Early Victoria	0.4	2.1	2.0	*	2.7
Edward VII	0.0	0.6	0.8	0.3	1.1
Egremont russet	4.0	3.6	3.5	0	2.6
Falstaff	1.9	3.6	2.9	0	2.4
Fiesta	0.9	4.8	3.9	0.2	2.9
Florina	0.3	3.8	2.1	0.5	1.6
Freedom	8.8	5.0	5.0	2.5	4.0
Goldrush	7.9	5.0	5.0	0	4.4
Greensleeves	1.1	0.8	1.0	*	2.6
Herrings Pippin	0.3	2.9	1.9	*	1.6
Judeline	0.9	4.6	2.9	0.4	2.0
King of Pippins	2.6	3.9	3.8	0	3.8
Liberty	2.4	5.0	4.5	0.8	2.9
Lord Lambourne	0.0	0.9	0.8	0	1.0
Mother	0.5	3.5	3.1	0	3.1
Northern Greening	1.1	4.8	4.4	0.2	3.8
Prima	0.5	2.8	1.6	2	1.4
Princess	7.1	5.0	4.6	0	4.3
Priscilla	6.8	5.0	4.9	0.1	3.8
Red Charles Ross	0.0	4.1	3.4	1.0	1.9
Red Ellison	0.0	1.5	1.4	0	0.6
Red Fortune	0.4	4.3	3.3	*	1.8
Redfree	0.4	2.6	2.4	*	1.7
Regent	0.1	4.6	3.1	0	3.1
Saturn	0.8	3.0	1.9	0.8	1.9
Sir Prize	5.0	5.0	5.0	1.6	3.6
Vanda	4.6	4.9	4.7	0	3.0
Wealthy	0.0	4.6	2.9	0	1.8
Winston Red Sport	1.1	3.3	2.9	1.1	3.1
Wyken Pippin	2.5	4.8	4.0	0	3.3

Table 4. Mean number of fruits per tree on 22 June – 7 July and the mean scores for severity of infection of fruits by sooty blotch, of leaves by leaf spot and of branches and shoots by canker on 27-28 September 1999.

Variety	Mean no. fruits per tree in June-July	Sooty blotch score in September	Leaf spot score in September	Canker present in September (+)
A567/19	9.1	1.1	1.3	
A931/15	2.8	0.7	1.3	
A93/16	21.6	0.7	1.1	
Antonoulka	8.0	0.0	2.4	
Boscoop	4.1	0.0	2.6	
Ceeval	7.8	0.0	0.6	+
Delorina	2.4	1.5	0.9	
Discovery	11.5	*	1.0	
Double Red Wealthy	13.6	1.3	0.9	
E11/20	22.6	0.0	0.9	
E83/4	3.8	0.0	0.9	+
E210/198	4.5	0.5	1.0	
Early Victoria	9.1	*	1.1	
Edward VII	5.5	0.1	0.8	
Egremont Russet	11.3	0.0	1.3	
Falstaff	35.9	2.3	1.6	+
Fiesta	19.9	0.1	1.3	
Florina	10.8	0.4	0.8	
Freedom	10.6	0.8	2.1	+
Goldrush	14.4	3.3	1.3	+
Greensleeves	19.6	*	0.4	
Herrings Pippin	3.5	*	0.3	
Judeline	48.1	1.4	0.9	
King of Pippins	8.0	0.0	1.0	
Liberty	19.1	0.6	1.0	
Lord Lambourne	18.4	0.1	0.8	
Mother	0.9	0.0	3.1	
Northern Greening	7.8	1.7	2.1	+
Prima	7.5	0.0	0.4	
Princess	22.3	0.0	1.5	+
Priscilla	17.9	0.6	0.8	
Red Charles Ross	4.1	0.0	1.0	
Red Ellison	16.3	0.0	0.6	
Red Fortune	11.1	*	1.5	
Redfree	15.0	*	1.4	
Regent	9.3	0.8	0.9	+
Saturn	21.0	1.0	1.9	
Sir Prize	11.3	2.0	1.9	
Vanda	8.1	0.6	1.1	+
Wealthy	9.3	0.5	1.4	
Winston Red Sport	10.8	0.6	3.4	+
Wyken Pippin	9.2	0.3	1.5	

Table 5. Mean score for severity of rust mite bronzing on undersides of leaves on 16 July 1999

Variety	Bronzing score	Variety	Bronzing score
A567/19	1.0	Herrings Pippin	1.9
A931/15	1.5	Judeline	0.4
A93/16	1.4	King of Pippins	2.3
Antonoulka	1.6	Liberty	1.7
Boscoop	2.4	Lord Lambourne	1.7
Ceeval	1.3	Mother	1.7
Delorina	1.6	Northern Greening	0.9
Discovery	2.0	Prima	1.8
Double Red Wealthy	1.5	Princess	1.3
E11/20	0.9	Priscilla	2.2
E83/4	1.7	Red Charles Ross	1.4
E210/198	1.7	Red Ellison	1.2
Early Victoria	1.0	Red Fortune	1.4
Edward VII	0.5	Redfree	1.3
Egremont Russet	2.0	Regent	2.3
Falstaff	1.3	Saturn	2.1
Fiesta	1.5	Sir Prize	1.6
Florina	2.1	Vanda	2.5
Freedom	1.8	Wealthy	2.6
Greensleeves	1.4	Winston Red Sport	0.8
Goldrush	1.0	Wyken Pippin	0.8