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Performance of Scab Resistant Apple Cultivars at the Smithfield Experimental Farm

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Abstract

Scab resistant apple cultivars developed from the breeding program initiated in 1949 at the Central Experimental Farm, Ottawa, Ontario, include 'Macfree,' 'Moira,' 'Trent,' 'Britegold,' 'Murray,' 'Richelieu,' and 'Rouville.' Three additional scab resistant selections 'O-637,' 'O-654' and 'O-662' show promise as fresh market and processing apples. 'Murray' was the highest yielding cultivar but 'Moira' had the highest cumulative yield efficiency on all rootstocks. 'Britegold' and 'Richelieu' had low yields. Fruit size of 'Macfree,' 'Moira,' 'Murray,' 'Richelieu' and 'O-662,' was smaller than 'McIntosh' while fruit size of 'Rouville' was larger. 'Trent' had the best storage life, retaining firmness for at least 6 months at 2°C. The fruit of 'Macfree,' 'O-637,' 'O-654' and 'O-662' was resistant to cedar apple rust although the leaves were susceptible and the fruit of all cultivars was susceptible to quince rust. 'Britegold,' 'Macfree' and 'O-637' showed good resistance to fire blight. These cultivars offer a range in harvest dates from late August with 'Murray' to late October with 'Trent.'

The breeding and evaluation program to develop apple cultivars resistant to apple scab (*Venturia inaequalis* (Cke.)Wint.) began in 1949 at the Canada Department of Agriculture, Ottawa, Ontario and the Smithfield Experimental Farm (S.E.F.), Trenton, Ontario (5). Apple cultivar introductions resistant to apple scab include 'Macfree' (1974), 'Moira' (1978), 'Trent' (1979) and 'Britegold' and 'Murray' (1980) (2, 6). In addition, 'Richelieu' and 'Rouville' introduced in 1983 by the Agriculture Canada Research Station, Saint-Jean-sur-Richelieu, Quebec (4) were selected and tested at the S.E.F. as 'Ottawa 635 ('O-635) and 'O-627,' respectively. This report summarizes the performance of these cultivars at the S.E.F. and describes the scab resistant selections 'O-637,' 'O-654' and 'O-662' which are available for additional testing.

Materials and Methods

A planting was established starting in the spring of 1978 and consisted of three trees (not randomized) of each cultivar on each of M.26 and Ottawa 3 (Ott.3) rootstocks and two trees of each on MM.106 and *Malus robusta* 5 (Rob.5) rootstocks. Some cultivars and selections were added to the planting in later years. Trees on M.26 and Ott.3 rootstocks were spaced at 2.5 x 4 m and on MM.106 and Rob.5 at 4 x 7 m. 'McIntosh' and 'Delicious' trees were planted as guard rows around the outside of the orchard to provide a source of inoculum for *V.inaequalis*. All trees were trained to a central leader system. Trees were defruited by hand for the first three years. After that, fruit on the central leader was removed by hand and additional hand thinning was done only where necessary to prevent limb breakage on the M.26 and Ott.3 rootstocks. No fungicides were applied in this orchard. A seasonal insecticide spray program was applied consisting of four or five sprays annually of azinphos-methyl or phosmet and acaracides for mite control were applied as necessary. Trunk girth was measured annually 35 cm above ground level. All fruit including drops was harvested annually and weighed to determine total yield (Table 1). Yields in 1986 were low due to spring frosts which damaged flower buds. Picked fruit was passed over a Bartlett size grader and graded into 0.6 cm size categories. Data for two size

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classes is presented in Table 2. Fruit was stored at 2°C and evaluated periodically during the winter to assess appearance, storage life, flesh, and eating qualities. Fruit was examined for the presence of apple scab. Mohr et al. (3) evaluated the processing qualities of cultivars as slices for pie, sauce, and juice. Field susceptibility of cultivars to cedar apple rust (*Gymnosporangium juniperi-virginianae* Schw.) and quince rust (*G. clavipes* Cke. and Pk.) was assessed in 1985 (7) and 1986 (unpublished). Cultivar susceptibility to fire blight was assessed from 1983 to 1985 following field inoculations of shoots with five strains of *Erwinia amylovora* (Burrill) (1).

Fruit from each original seedling tree of 'Rouville,' 'O-637,' 'O-654' and 'O-662' was also evaluated. Yield records from the seedling trees were not collected and only limited yield information is available for 'O-637,' 'O-654' and 'O-662.'

Results and Discussion

'Britegold' ('O-652')—'Sandel' ('Delicious' x 'Sandow') x 'O-522' ('Red Melba Platts' x R6T68 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.))). 'Britegold' produces an attractive, yellow skinned sweet apple suitable only for home garden use with medium to large sized fruit. It matures in late September, just after 'McIntosh.' Fruit had a tendency to mature unevenly and was subject to drop. Storage life was short and was 1 to 2 months at 2°C. Flesh was cream to yellow in colour, slightly coarse, tender, juicy, low acid and only medium in quality. Fruit bruised easily and showed bruises. The tree was moderate to low in vigour, spreading and small branches were thin, weak and had a tendency to droop. Foliage colour was pale with small leaves. Yields were low averaging less than 10 kg per tree from the fifth to the tenth leaf on the dwarfing M.26 and Ott.3 rootstocks (Table 1). 'Britegold' bloomed approximately one day after 'McIntosh.' It was very susceptible to cedar-apple rust and quince rust, and moderately susceptible to bitter pit, especially on larger fruit. The tree was less susceptible to fire blight than was 'McIntosh.' Processed fruit was rated good for sliced products and fair for sauce.

'Macfree' ('O-532')—'McIntosh' x R18T40 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.)). 'Macfree' is a 'McIntosh' type suitable for fall use. Fruit was smaller than 'McIntosh,' had a shorter storage life and not quite as good quality as 'McIntosh.' Fruit matured in early October, a few days before 'Delicious.' Adequate fruit thinning may be required to obtain good fruit size. On the dwarfing Ott.3 and M.26 rootstocks approximately 6% of the fruit was over 7.6 cm in diameter averaged over the 6 years between 1982 and 1987 while none of the fruit was over 7.6 cm in diameter from the MM.106 and Rob.5 rootstocks (Table 2). Storage life was 2-3 months at 2°C. Flesh was juicy, white, slightly tinged with green, with moderate acidity. The tree was hardy, moderately vigorous and spreading. Yields on Ott.3 and M.26 rootstocks averaged approximately one bushel per tree from the fifth to the tenth leaf (Table 1). There was a tendency to biennial bear, particularly on MM.106 and Rob.5 rootstocks. 'Macfree' bloomed 1-2 days after 'McIntosh' and was resistant to fire blight. Foliage was susceptible to cedar-apple rust and fruit was very susceptible to quince rust. Processed fruit was rated fair to good for juice, and poor to fair for sauce and sliced products.

'Moira' ('O-548)—'McIntosh' x Dg 22-81 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.)). 'Moira' is a 'McIntosh' type suitable for fall use. Fruit had medium to good quality. Fruit size was smaller than 'McIntosh' and may require thinning to obtain adequate fruit size. Less than 2% of the fruit was over 7.6 cm in diameter

Table 1. Yield and trunk area of scab resistant apple cultivars, 1981 to 1987[y].

Rootstock and cultivar	No. trees	Yield (kg/tree) 1981	1982	1983	1984	1985	1986	1987	Cumm.	Trunk area 1987 (cm^2)	Cumm. yield effic. (kg/cm^2)
Ott.3 rootstock											
Macfree	3	2.7	22.3	5.4	33.3	8.6	20.7	21.8	114.8± 4.7[z]	49.8± 3.7	2.3±0.1
Moira	3	2.5	23.7	10.5	37.5	24.6	6.6	43.3	148.8±11.7	36.5± 3.6	4.1±0.3
Trent	3	1.8	10.4	4.9	29.6	16.4	6.8	31.9	103.0± 5.5	52.8± 6.2	2.0±0.1
Britegold	3	0.7	6.5	1.9	15.8	5.7	4.7	17.5	52.8± 7.0	20.4± 2.2	2.6±0.4
Richelieu	3	0.8	4.5	2.3	17.6	9.5	0	21.1	55.7± 5.3	28.0± 2.7	2.0±0.01
M.26 rootstock											
Macfree	3	0.6	10.1	7.4	21.6	13.9	11.1	23.1	87.7±20.9	39.4±17.0	2.2±0.4
Moira	2	2.1	15.5	11.5	20.9	12.9	12.8	32.9	108.5±33.1	31.3± 7.8	3.5±0.2
Trent	2	1.6	10.0	2.6	30.0	14.5	8.2	34.4	102.8± 2.9	62.1± 2.8	1.7±0.1
Britegold	2	0	3.5	2.5	13.6	6.9	6.5	18.6	51.6±23.4	23.4±12.1	2.2±0.1
Murray	3	2.9	12.0	13.7	25.0	26.5	1.4	45.0	126.5± 5.8	49.2± 9.6	2.6±0.5
Richelieu	3	0.8	4.3	1.5	9.4	7.7	0	17.7	41.2±21.5	27.2±11.6	1.5±0.4
0-637	2	0.6	4.0	0.6	8.7	5.9	4.9	9.5	34.2± 4.2	16.1± 0.8	2.1±0.2
MM.106 rootstock											
Macfree	1	0	5.1	15.1	0	43.3	1.1	44.2	109.3	59.3	1.8
Moira	2	0	5.4	10.4	15.4	18.6	9.1	39.3	98.1± 4.3	32.4± 8.1	3.0±0.7
Trent	2	0.5	0.9	8.4	26.8	21.4	8.8	41.5	108.2±10.9	65.3± 9.3	1.7±0.1
Britegold	2	0	2.1	3.1	19.3	5.2	3.0	36.1	68.7±26.5	43.0±13.8	1.6±0.1
Murray	2	0.8	5.4	14.3	17.0	43.8	0	61.1	142.4±90.7	53.7±37.4	2.7±0.1
Richelieu	2	0.5	2.3	7.3	26.9	20.5	0	34.0	91.6± 6.8	48.7± 0.8	1.9±0.2
Robusta 5 rootstock											
Macfree	2	0	5.0	24.9	0.8	57.8	0	69.3	158.9± 0.6	84.7± 4.8	1.9±0.1
Moira	2	0	32.1	48.0	90.0	52.6	4.8	96.5	324.9±38.0	104.5± 4.5	3.1±0.5
Trent	2	0	3.2	17.7	40.0	47.2	2.6	91.5	202.4±27.9	159.9±22.7	1.3±0.01
Britegold	2	0.8	8.3	2.1	35.4	24.1	4.7	39.6	115.7± 1.8	73.0±12.9	1.6±0.3
Murray	2	0.9	5.9	24.0	54.2	85.0	2.3	95.2	267.5± 4.1	137.2± 4.2	1.9±0.1
Richelieu	2	0.3	8.9	14.1	47.5	42.0	0	21.3	134.1±17.5	74.7± 9.3	1.8±0.01
0-637	2	0	2.1	15.8	91.0	56.1	12.5	80.8	258.9±51.3	127.8±19.8	2.0±0.1

[y]Trees were planted in 1978.
[z]± Standard deviation.

averaged over the 6 years between 1982 and 1987 (Table 2). Fruit matured in the second week of October, with 'Delicious.' Storage life was 2-3 months at 2°C, shorter than for 'McIntosh'. Flesh was creamy white, slightly tinged with green, with moderate acidity. The tree was moderately vigorous and spreading. 'Moira' out yielded 'Macfree' and the yield efficiency on all rootstocks was higher for 'Moira' than for the other scab resistant cultivars (Table 1). Bloom date was 2-3 days after 'McIntosh.' The tree was susceptible to fire blight, susceptible to cedar-apple rust and the fruit was very susceptible to quince rust. Processed fruit was rated fair for juice and poor for sauce and sliced products.

'Murray' ('O-628)—'McIntosh' x 52-05-26 ('Red Melba Platts' x R16T19 ('Wolf River' x *M. atrosanguinea* 804)). 'Murray' is a medium to good quality red apple suitable for the late August to early September market. Fruit matured 7-10 days ahead of 'McIntosh.' Storage life was short and less than one month at 2°C. Fruit size was medium with less than 50% of the fruit over 6.35 cm in diameter averaged over the 5

Table 2. Fruit size of scab resistant apple cultivars, 1982 to 1987.

Rootstock and cultivar	% fruit over 6.35 cm diameter						% fruit over 7.6 cm diameter					
	1982	1983	1984	1985	1986	1987	1982	1983	1984	1985	1986	1987
Ott.3 rootstock												
Macfree	64.0	—	52.1	64.2	72.9	60.2	1.8	—	0	5.3	1.9	2.2
Moira	58.0	90.3	41.4	55.4	75.9	79.4	1.0	0.8	0.5	0	9.0	0
Trent	87.1	95.2	81.3	86.8	77.0	94.5	22.4	52.7	10.9	14.7	12.9	39.7
Britegold	—	—	74.9	40.0	82.0	99.0	—	—	13.4	—	36.0	17.7
Richelieu	—	—	86.0	63.6	—	92.6	—	—	7.0	3.0	—	1.0
M.26 rootstock												
Macfree	82.0	92.5	47.1	78.8	65.1	84.3	4.2	22.6	0	11.7	1.3	9.7
Moira	83.4	94.5	56.3	81.3	78.7	93.6	1.5	6.8	0	0	1.2	0
Trent	97.1	98.1	91.7	88.5	81.4	97.3	48.7	42.7	15.2	19.6	22.9	42.2
Britegold	—	—	85.7	85.5	67.8	96.6	—	—	5.7	8.1	20.3	40.2
Murray	—	84.2	48.5	37.7	—	47.1	—	0.7	1.1	0	—	0
Richelieu	—	—	90.1	77.9	—	95.5	—	—	8.6	9.4	—	3.2
MM.106 rootstock												
Macfree	—	53.7	—	46.0	—	36.3	—	0	—	0	—	0
Moira	—	50.0	50.8	56.2	62.4	83.0	—	0	0.5	0	0	0
Trent	—	82.7	96.3	81.0	76.8	95.6	—	12.3	19.5	8.4	30.4	27.3
Britegold	—	—	86.5	—	—	97.9	—	—	2.7	—	—	27.1
Murray	—	50.7	71.0	23.1	—	42.0	—	0.7	0	0	—	0
Richelieu	—	87.7	91.1	66.3	—	93.8	—	7.2	14.9	0.6	—	3.3
Robusta 5 rootstock												
Macfree	—	—	—	25.5	—	37.5	—	—	—	0	—	0
Moira	86.2	60.8	66.0	65.2	85.1	88.6	0.9	0	9.1	0.2	4.1	0.7
Trent	—	73.4	84.9	80.3	66.9	96.0	—	0	11.5	8.5	3.3	17.7
Britegold	—	—	90.8	93.0	—	97.9	—	—	3.9	19.7	—	29.5
Murray	—	50.3	30.5	20.7	—	—	—	0	0	0	—	—
Richelieu	—	74.0	78.8	46.2	—	68.7	—	0.9	4.4	0	—	1.0

— Indicates fruit not graded for size.

year period between 1983 and 1987 (Table 2). Thinning may improve fruit size. Flesh was juicy, white, fine in texture, with moderate acidity. Eating quality was good. The tree was moderately vigorous and spreading. 'Murray' had greater yields than 'Moira' on M.26 and MM.106 rootstocks but because of a larger tree size, yield efficiency was lower for 'Murray' than for 'Moira' (Table 1). 'Murray' bloomed with 'McIntosh' It was susceptible to cedar-apple rust and the fruit was very susceptible to quince rust but the tree was similar to 'McIntosh' in susceptibility to fire blight. A few scab spots have occassionally been observed on the fruit, however, field resistance to *Venturia inaequalis* still exists. 'Murray' is probably susceptible to race 5 of *V. inaequalis*. Processed fruit was rated poor for juice, sauce or sliced products.

'Richelieu' ('O-635)—'O-521' ('Red Melba Platts' x R6T68 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.))) x 'O-541' ('McIntosh' x Dg 22-81 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.))). 'Richelieu' was introduced by the Agriculture Canada Station, St. Jean, Quebec as a juice processing apple. It is also a medium to good quality fresh market 'McIntosh' type suitable for the fall season. Fruit matured in mid-September with 'McIntosh' and had a storage life of two to

three months at 2°C, shorter than for 'McIntosh.' Fruit was medium in size but larger than for 'Macfree', 'Moira' or 'Murray' (Table 2). Flesh was white, tender, juicy, fine texture, and low to moderate in acidity. The tree was as hardy as 'McIntosh,' moderately vigorous and semi-spreading. 'Richelieu' was a low yielding cultivar averaging less than 10 kg of fruit per year from the fifth to the tenth leaf on the Ott.3 and M.26 rootstocks (Table 1). It was very susceptible to cedar-apple rust and the fruit was susceptible to quince rust. At Smithfield, processed fruit was rated only fair for juice.

'Rouville' ('O-627)—52-05-312 ('Red Melba Platts' x ('Wolf River' x *M. atrosanguinea* 804)) x 'McIntosh.' 'Rouville' was introduced by the Agriculture Canada Research Station, St. Jean, Quebec as a juice processing apple. 'Rouville' has not fruited in the second test orchard at the S.E.F. Fruit from the original seedling tree at Smithfield was only medium quality as a fresh market 'McIntosh' type. Fruit matured during the first week of September, just ahead of 'McIntosh.' Storage life was short, approximately two months at 2°C. Fruit size was large. Flesh was white, tender, slightly coarse, and low in acidity. 'Rouville' was rated only fair for juice at the S.E.F.

'Trent' ('O-531) — 'McIntosh' x R18T40 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.)). 'Trent' is a medium quality, late harvested red apple suitable for long term storage. It required a long growing season to properly mature the fruit and was harvested in late October with 'Northern Spy.' Storage life was six months at 2°C. Fruit size was medium to large, similar to 'McIntosh' in size. Flesh was moderately juicy, firm, cream coloured with a greenish tinge, slightly coarse, with moderate acidity. The tree was vigorous and semi-spreading. 'Trent' yielded as well as 'Macfree' but due to tree size, cumulative yield efficiency was lower for 'Trent' than for 'Macfree' (Table 1). Bloom date

Table 3. Fruit characteristics, disease resistance and processed rating of scab resistant cultivars at the Smithfield Experimental Farm.

	Fruit[x]				Disease resistance[y]					Processed rating[z]		
						Cedar-apple rust						
Cultivar	Skin colour	Size	Harvest season	Storage life (months)	Apple scab	Fr	Le	Quince rust	Fire blight	Sauce	Slices	Juice
Britegold	Yellow	M-L	Late Sept.	1-2	R	VS	VS	VS	R	F	G	—
Macfree	Red	M	Early Oct.	2-3	R	R	S	VS	R	P-F	P-F	F-G
Moira	Red	M	Early Oct.	2-3	R	S	S	VS	S	P	P	F
Murray	Red	M	Late Aug.	1	R	S	S	VS	I	P	P	P
Richelieu	Red	M	Mid-Sept.	2-3	R	VS	VS	S	—	—	—	F
Rouville	Red	L	Early Sept.	2	R	—	—	—	—	—	—	F
Trent	Red	M-L	Late Oct.	6	R	S	S	VS	I	G	G	F
0-637	Red	M-L	Late Sept.	3-4	R	R	S	S	R	P	G	G
0-654	Yellow	M-L	Late Sept.	4	R	R	S	VS	—	G	F-G	F-G
0-662	Red	M	Early Oct.	4-5	R	R	S	VS	—	—	—	—
McIntosh	Red	M-L	Mid-Sept.	3-4	S	R	S	S	I	F	P	G

[x]Fruit size: M = medium, L = large.
[y]Disease resistance: Fr = fruit, Le = leaves, R = resistant, I = intermediate in susceptibility, S = susceptible, VS = very susceptible.
[z]Processed rating: p = poor, F = fair, G = good.
— indicates not evaluated.

was 2-3 days after 'McIntosh.' 'Trent' was susceptible to cedar-apple rust and very susceptible to quince rust. Fruit was susceptible to bitter pit. The tree was moderately susceptible to fire blight with a reaction similar to 'McIntosh.' Processed fruit was rated good for sauce and sliced products and fair for juice.

'O-637'—'McIntosh' x 'O-525 ('Red Melba Platts' x R6T68 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.))). A 'McIntosh' type selected in 1974 which shows promise as a fall and early winter fresh market apple. Fruit matured in late September to early October, just after 'McIntosh.' Storage life was similar to 'McIntosh' and was 3-4 months at 2°C. Fruit size was medium to large, similar to 'McIntosh' in size. Fruit shape was globose-conical. Fruit colour was washed and lightly striped of a medium red with a light green ground colour with good appearance. Flesh was cream with a slight green tinge, firm, crisp, juicy, and moderate to high in acidity. Eating quality was medium to good. The tree was moderately vigorous and spreading. Yields and tree size were smaller on M.26 than on Rob.5 rootstock when compared to other cultivars (Table 1). The tree was less susceptible to fire blight than 'McIntosh.' Fruit was susceptible to quince rust and foliage was susceptible to cedar-apple rust. Processed fruit was rated good for juice and sliced products but poor for sauce.

'O-654'—'O-522 ('Red Melba Platts' x R6T68 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.))) x 'Sandel' ('Delicious' x 'Sandow'). Selected in 1980, 'O-654 was a medium quality, yellow skinned apple which may have potential as a fresh market or processing type. Quality was better than for 'Britegold' when harvested in late September, just after 'McIntosh.' The storage life was four months at 2°C. Fruit size was medium to large and fruit shape was oblong-conical. Fruit colour was yellow with an orangish blush having medium to good appearance. Flesh was light yellow, tender, slightly coarse, juicy, and low in acidity. The tree was vigorous, spreading and had a semi-spur type growth habit. Fruit was very susceptible to quince rust and foliage was susceptible to cedar-apple rust. Processed fruit was rated good for sauce and fair to good for sliced products and juice.

'O-662'—'O-521' ('Red Melba Platts' x R6T68 ('Jonathan' x ('Rome Beauty' x *M. floribunda* 821 sib.))) x 'Delicious.' Selected in 1977, 'O-662' had attractive, red fruit, similar in shape to 'Delicious' but with better quality and flavour. It is promising as a fall and winter fresh market apple. Harvested in early October, just ahead of 'Delicious', storage life was 4-5 months at 2°C. Fruit was medium sized, with an oblong-conical shape. Fruit colour was washed of a medium to dark red with very little ground colour of a light greenish yellow with excellent appearance. Flesh was light yellow, tender, slightly coarse, firm, juicy, and low in acidity. The tree was moderately vigorous and spreading. Fruit was very susceptible to quince rust and the foliage was susceptible to cedar-apple rust.

The scab resistant cultivars and selections, except 'Murray,' remained free of infection from apple scab in the field without the application of fungicides. In the Trenton area, the cultivars described in this report were infected with cedar-apple rust and/or quince rust. The cultivars rated very susceptible (Table 3) would require fungicide sprays to control the rust diseases some years. 'Britegold,' 'Macfree,' and 'O-637' showed good resistance to fire blight. The processing evaluation indicated that some of the scab resistant cultivars particularly 'Trent,' 'O-637,' and 'O-654' have potential for juice, sauce or sliced apple products.

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Strawberry Cultivars and Worldwide Patterns of Strawberry Production

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Abstract

California produces between 20-25 percent of the world's strawberries and as a result 'Douglas,' 'Chandler,' 'Tufts,' 'Aiko,' and 'Selva' are the dominant cultivars. Other cultivars showing broad geographic acceptance are 'Bounty,' 'Earliglow,' 'Gorella,' 'Guardian,' 'Honeoye,' 'Kent,' 'Redchief,' 'Redcoat' and 'Senga Sengana.'

Introduction

The most important commercial strawberry in the world is *Fragaria* x *ananassa* Duch. It is grown in most temperate regions of the earth with world production approaching 2,000,000 metric tons (1). Strawberry cultivars have high turn-over rates, but little recent data has been published on the distribution of cultivars across the world. This contribution is a preliminary attempt to fill this void.

Materials and Methods

Strawberry researchers from most regions of the world were identified in 1986 by the authors and asked by letter, telephone call or personal visit to answer the following questions: 1) What are the most important cultivars grown in your region? 2) What are the most promising new cultivars? 3) How many acres of strawberries are planted? 4) How many tons are produced? We took this information and summarized it by region.

The individuals responding to the survey were: *Western United States*— R. Bringhurst, Univ. California-Davis; F. Lawrence, U.S.D.A.-ARS, Corvallis, Oregon; V. Voth, Univ. California-Davis; *Mid-southern United States*— C. Odell, Virginia Polytechnic Inst., Blacksburg; E. Poling, North Carolina State Univ., Raleigh; J. Spiers, U.S.D.A.-ARS, Poplarville, Mississippi; *North and Mid-central United States*— J. Courter, Univ. Illinois, Simpson; M. Dana, Univ. Wisconsin, Madison; R. Funt, Ohio State Univ., Columbus; J. Luby. Univ. Minnesota, St. Paul; J. Moore, Univ. Arkansas, Fayetteville;

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