'SuperMac' Apple

Shahrokh Khanizadeh[1], Yvon Groleau[1], Audrey Levasseur[1],
Odile Carisse[1], Djamila Rekika[1], Jennifer DeEll [2], Jean-Pierre Privé[3], Intiaz Ali[4], Henk Kemp[5]

1 Agriculture and Agri-Food Canada, Horticulture Research Development Centre, 430 Gouin Blvd. St-Jean-sur-Richelieu, Quebec, Canada J3B 3E6. 2 Ontario Ministry of Agriculture and Food, Box 587, 1283 Blueline Rd & Hwy #3, Simcoe, Ontario, Canada N3Y 4N5.
3 Agriculture and Agri-Food Canada, Food and Horticulture Research Centre, Senator Hervé J. Michaud Research Farm, 1045 St. Joseph Rd. Bouctouche, NB, Canada. 4 Department of Food Science, Macdonald campus of McGill University, 4,111, Lakeshore rd. Ste Anne de Bellevue, Quebec.
5 Praktijkonderzoek Plant & Omgeving, sector Fruit, Lingewal 1, 6668 LA Randwijk, The Netherlands

Introduction

'SuperMac' (*Malus* x *domestica* Borkh) is being released as a replacement for 'Spartan', which is presently being grown in Eastern Canada for its excellent shelf life, but susceptible to apple scab, the most common apple disease.

Fig. 1 Fruits of 'SuperMac' at maturity

The new cultivar produces larger fruit than 'Spartan' and is resistant to apple scab (*Venturia inaequalis* (Cke) Wint.). It is very attractive (Fig. 1), has a pleasant taste, an excellent shelf-life and keeps very well and longer compare to the 'Spartan'.

'SuperMac' is a 'McIntosh' type apple. The tree is hardy to -30°C, and the fruit and leaves are resistant to the common races of apple scab due to the presence of the V_f gene derived from *Malus floribunda* 821.

Origin

'SuperMac', tested as FAR124-A56 and in replicated trials as SJC7123-2, originated from a cross made in 1971 between 'McIntosh' and PRI 674 (Fig 2), at Agriculture and Agri-Food Canada (AAFC), Horticulture Research and Development Centre (CRDH), Quebec. The pollen of PRI 674 was send to us by Dr. William (Purdue University, Department of Botany and Plant Pathology, Lilly Hall of Life Sciences, Lafayette, Indiana) in may 18th of 1971 and use as male parents to make the cross number 71-23. PRI 674 derived from a heterozygous scab resistant selection, F226829-2-2 originating from crosses involving a clone (821) of the small-fruited *Malus floribunda* made in early 19 century by Dr. C. S. Crandall at the University of Illinois.

Fig. 2 Pedigree of 'SuperMac' Apple

The seedling FAR124-A56 was selected for its resistance to scab and planted in 1974 at AAFC, CRDH, Quebec and evaluated since then for its hardiness, disease resistance, fruit quality, chemical composition (antioxidant) and shelf life at controlled atmosphere and also in ordinary cold room (4-5°C). It was selected after extensive testing in Frelighsburg substation of AAFC, CRDH, Quebec, based on its winter hardiness (similar to McIntosh), resistance to scab and fruit quality. It was then planted in replicated trials under the name SJC7123-2 and compared to two commercially grown cultivars 'Spartan' and 'Macspur'.

Compared to 'Spartan' and 'Macspur' this new cultivar has similar hardiness, it retains its fresh eating qualities in storage and it is resistant to the common races of apple scab, reducing the need for fungicide applications.

Inoculation of 'SuperMac' using naturally infected leaves showed zero percent of scab incidence on the vegetative and reproductive organs compared to 'Spartan' and 'Macspur' with no fungicide application.

Description

Tree characteristics. 'SuperMac' trees are vigorous and have an upright to slightly spreading habit when grafted on the M.26 rootstock. Fruits are borne on spurs and shoots, which are generally 1 to 3 years of age, and the fruiting zone tends to move away from the trunk to the outside of the tree (type III bearing habit according to Lespinasse, 1977). 'SuperMac' trees are hardy at Frelighsburg, Quebec (latitude 45°N, longitude 72°W), which has a sandy soil and an average winter minimum temperature of -25 °C. 'SuperMac' is also tested at L'Acadie (latitude 45.32 °N; longitude 73.35 °W), which has clay loam and an average winter minimum temperature of -35°C. There have been no signs of powdery mildew (*Podosphaera leucotricha* (Ell. & Ev.) Salm.) or fireblight (*Erwinia amylovora* (Burr.) Winslow *et al.*) infections during the evaluation period.

The leaves are medium to large in size, elliptic and the margins are mainly serrate but can sometimes be doubly serrate. The abaxial surface is hairy, the apex is acuminate and the base is obtuse. The average leaf length to width ratio is 1.7 and the petioles are hairy, 2.2 to 3.6 cm long with thin to medium stipules of varying length (mainly medium) when young. The surfaces of the leaves are dull and medium green.

Flower and fruit characteristics. Flowering starts at the same time as 'Macspur' and 'Spartan' (e.g. May 20) in Frelighsburg. Flower buds are reddish-purple (58A-B; Royal Horticultural Society Colour Chart (RHS), 1995) on a white base in full balloon stage and the flowers are single. When fully open, petals are oblong to slightly rounded, touching to slightly overlapping and are mainly white with a blush of medium to dark pink (61C-D) on both sides. The pedicels are mainly green but sometimes have a red stripe. The pollens are fertile but fruits get larger with a pollenizer like those recommended for 'McIntosh' and 'Spartan'.

'SuperMac' fruits ripen mid- to late October in Frelighsburg, about 3 to 4 weeks after 'McIntosh' and 2 weeks after 'Cortland' based on starch index. Fruits are large; they have a transverse diameter between 7.5-8.0 cm and an average weight of 192 g at harvest without thinning. Opposite to 'McIntosh' the fruit does not drop at maturity. Fruit shape is mainly globose. The sides of the fruit are slightly ribbed along the body and can be a bit lopsided. The skin is smooth, waxy, fairly thick and a bit tough at harvest but good after storage in CA. When harvested for CA storage, skin color is dark red flush (RHS185A) becoming washed, over a green background (RHS145A) and the flesh is white. Some dark red (RHS185A) stripes are noticeable on the washed colored areas. Surface bloom is scant. Low numbers of large lenticels near the stem but increasing to high numbers near the calyx; lenticels are conspicuous over the red areas. The length of the stem is short to medium, variable in diameter (small to medium), a little bit pubescent, and is green although it can be a bit red on one side. The cavity is mainly obtuse but it can be acute in some fruit, broad, shallow to medium depth and a very low amount of russeting. The basin is wavy to somewhat crowned, medium to somewhat deep with a medium to somewhat broad width and a little pubescent. The medium sized calyx is persistent with erect lobes, half-open to open, and the stamens are in median to slightly basal position. The large size core is open in the distant position with clasping core lines. The carpels are round, distal end truncate, a bit tufted inside and the cells are unsymmetrical and abaxile. The seeds are brown, plump with a normal to elongated end, a little bit tufted, and the tip is acute. At harvest the flesh is crisp, juicy, and firm (8.1 kg as measured by a EPT-1 pressure tester made by Lake City Technical Products Inc., Kelowna, B.C. Canada) with a very low to low discoloration depending on time after cutting. The flavor is pleasant, aromatic and slightly tart. The titratable acidity is 0.66% (malic acid) and the soluble solids are 11.5% (Brix).

Antioxidant composition. The content of 8 different phenolic compounds were determined using HPLC analysis (Rekika *et al.* 2005). On the basis of phenolic standards of protocatechuic acid, (+)-catechin, chlorogenic acid, caffeic acid, p-coumaric acid, vanillin acid and sinapinic acid, the phenolic compounds in the apples samples were identified by comparison of retention time of standards; the results expressed as % peak areas from HPLC chromatograms. On the 8 given phenolic compounds, there was significant difference in the % peak areas of (+)-Catechin, chlorogenic acid, p-coumaric acid and coniferal between 'SuperMac' and 'McIntosh' genotypes. The 'SuperMac', Scab resistant with excellent shelf life wascharacterized by higher chlorogenic acid and coniferal (8.10, 7.98 % peak area, respectively) and lower % peak area in both p-coumaric acid (0.06) and (+)-catechine (0.41). In contrast, McIntosh type, scab sensitive with low shelf life presents a different behavior for these same phenolic compounds: chlorogenic acid, coniferal, p-coumaric acid and (+)-catechine (10.23, 0.46, 5.21 and 10.2% peak area, respectively). Furthermore, it has been shown that oxidation product of chlorogenic acid was toxic to pathogens (Nicholson and Hammerschmidt, 1992). Clark *et al.* (1959) have reported that an addition product of chlorogenic acid with caffeic acid and six amino acids present in potato skin are highly toxic to race 1 of Helminthosporium carbonum. Scab resistance of our 'SuperMac' could be due to the higher chlorogenic acid content and worth further investigation. In our data 'SuperMac' scab resistant had much higher chlorogenic acid vs sensitive 'McIntosh'. Similar resistance were also noted for selected strawberry cultivar and other fruits in relation to antioxidant activities (Rekika *et al.* 2005, Tsao *et. al.* 2006).

Storage and other agronomic characteristics. After 6 months of storage air in CA (2.5% O_2, 4.5% CO_2, 2-3°C) the fruit is medium-firm (6.2 kg), the acidity was low (0.43%) and the soluble solids were medium (11.6%), its fresh eating qualities are excellent and taste and aroma are good. The fruit kept for at least 2 more months in regular cold room following CA storage and fruit quality was superior in texture and taste to that of 'Spartan' stored under similar conditions. 'SuperMac' is presently being evaluated at several research centers in Europe by Meiosis Inc. (Bradbourne House, Stable Block, East Malling, Kent ME19 6DZ, UK) and by other AAFC research centers including New Brunswick (Bouctouche), Manitoba (Morden), and also by the Ontario Ministry of Agriculture, Food and Rural Affairs, in comparison to the other known local cultivars.

Replicated four trees of each cultivar ('SuperMac', 'Spartan' and 'Macspur') were planted 2.0 m apart within the row and 4.5 m spacing between the rows in a randomized complete block design and evaluated since 2000 at L'Acadie experimental farm. 'SuperMac' (26.41 kg) had similar cumulative yield (includes fruit drop) compared (2001-2005) to 'Macspur' (25.00 kg) and 'Spartan' (19.00 kg) but larger fruit size (192 g) than 'Spartan' (170g) and 'Macspur' (175g). (Fig. 3.)

Fig. 3 Fruits of 'Macspur', 'Spartan' and 'SuperMac'

Availability

A Canadian Plant Breeder's Right has been issued [illegible]

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