A Comparison of the Growth and Fruiting of McIntosh and MacSpur Apple Trees

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McIntosh is the leading apple cultivar grown in the northeastern United States. Recently spur-type strains of this cultivar have been discovered in British Columbia and propagated. It has been reported that the spur-type McIntosh are smaller than non-spur trees, although these comparisons were quite limited (2, 4). Growers are currently showing considerable interest in spur-type McIntosh and are planting a large number of these trees (3).

Preliminary observations of spur-type McIntosh in New York and New England suggest that spur-types of this cultivar may be quite vigorous. This study was conducted to compare the growth and vigor of spur and non-spur McIntosh trees under controlled conditions and in the field. At the same time, comparisons of spur and non-spur Delicious trees were also made, since most of the previous studies of spur-type morphology have been conducted on this cultivar.

Growth Chamber Studies. Imperial McIntosh (non-spur), MacSpur, Imperial Delicious (non-spur), and Miller Spur Delicious trees on M 106 were purchased from Hilltop Nurseries, Hartford, MI. Trees were planted in 19 liter pots in a 1 sand: 1 soil: 3 perlite: 4 peat mixture, and headed to .6 m. Trees were grown in 14 hr light (22°C), 10 hr dark (20°C) cycles in a walk-in growth chamber. Twelve trees (3 of each cultivar) were grown in each chamber study. The chamber studies were replicated 3 times.

When shoot growth on the trees had reached about .5 m, the study was terminated. Shoot growth of the leader, and the number and length of scaffold limbs was measured. Trees were then held in the chamber for 2 weeks under short days (8 hr at 8°C), and defoliated. Defoliated trees were held at 3°C for 8 weeks and transferred to the greenhouse to assess their development after chilling. After 4 weeks in the greenhouse, the number of spurs on the leader was counted, and the number of spurs per unit length of wood calculated.

Miller Spur Delicious made the expected spur-type growth habit under these conditions. Trees were shorter, and made less scaffold growth than those of Imperial Delicious (Table 1). In contrast, no difference in shoot growth was detected between trees of Imperial McIntosh and MacSpur. Following chilling, both spur-type cultivars showed more spurs per unit length of wood than the non-spur cultivars.

Field Studies. Measurements of the height, diameter and trunk cross-sectional area of spur and non-spur McIntosh trees were made at the Cornell University orchard in Ludlowville, New York. Trees were planted in 1973, and size was measured in 1979 after 2 or 3 years of cropping. Ten trees of each strain on the following rootstocks were measured: seedling, M9 interstock on seedling root, and M9 interstock on M106 root. Trees were planted in solid blocks of 10 to 40 trees each. Consequently the experiment was not thoroughly randomized. However, little difference among soil conditions occurred within the planting. At the end of the 7th growing season, the expected differences in tree vigor among rootstocks were observed (Table 2). These differences were statistically significant ($p = .001$). No significant differences between

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Table 1. Comparison of the development of spur and non-spur apple trees grown under controlled conditions.

Cultivar and strain	Shoot length (cm) Leader	Shoot length (cm) Scaffolds	Spurs on leader following chilling (no/cm)
Imperial McIntosh	48.4 ab[1]	171.8 b	.13 a
MacSpur	50.9 ab	161.4 b	.30 b
Imperial Red Delicious	55.2 b	239.8 c	.09 a
Miller Spur Delicious	46.6 a	116.1 a	.34 b

[1]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. Effects of strain and rootstock on McIntosh apple tree growth.

Strain	Rootstock	Trunk cross-sectional area (cm^2)	Spread (m)	Height (m)
Imperial McIntosh	M9/106	42.2	3.4	2.8
MacSpur	M9/106	37.7	3.2	2.8
Imperial McIntosh	M9/Seedling	53.4	3.6	2.9
MacSpur	M9/seedling	48.6	3.6	2.9
Imperial McIntosh	seedling	112.2	4.2	4.7
MacSpur	seedling	111.5	4.3	4.3
Analysis of variance[1] Source		**F-value**		
MacSpur vs. McIntosh		NS	NS	NS
Among rootstocks		***	***	***

[1]Significance at 0.1% level (***) or non-significant at 5% level (NS) by analysis of variance and F test.

Table 3. Comparison of the fruitfulness of spur and non-spur McIntosh and Delicious apple trees on seedling roots.

Cultivar and strain	Yield/tree (kg) 1978 (6th leaf)	Yield/tree (kg) 1979 (7th leaf)	Cumulative (1978-1979)
Imperial McIntosh	17.4	53.2	70.6 c[1]
MacSpur	23.2	65.0	88.2 d
Vance Delicious	15.8	11.7	27.5 a
Bisbee Delicious	21.8	14.6	36.4 b

[1]Mean separation by Duncan's multiple range test, 5% level.

Imperial McIntosh and MacSpur were detected in any of the variables measured.

In 1978 and again in 1979, yield data were taken on the trees on seedling roots. Yield data were also collected on 10 Bisbee Delicious (spur) and Vance Delicious (non-spur) trees of the same age and rootstock in the same orchard. In both years, spur-type trees yielded more fruit than non-spur trees in these cultivars (Table 3). Records of spur age and fruitfulness were taken during harvest. In MacSpur and Bisbee Delicious, a larger percentage of fruit was borne on spurs which were on 4-year and older wood. This suggests that continued annual productivity of older spurs on spur type trees may be a major factor contributing to their efficiency.

Conclusions. In comparisons of spur and non-spur strains of McIntosh, no differences in shoot growth or tree size were noted, while large differences were noted in comparisons of spur and non-spur Delicious trees. The results presented here on Delicious agree with previous reports on this cultivar (1, 5, 6). However, the lack of difference in tree size between McIntosh and MacSpur differs from the previous brief reports (2, 4). The spur-type morphology may arise differently in these two cultivars. In McIntosh, the differences between spur and non-spur type trees occurred in the development of spurs at the beginning of the second growing season (Table 1), productivity (Table 3), and continued fruiting of older spurs. No inherent dwarfing appeared to be present in young, vigorous MacSpur trees when compared to non-spur McIntosh. It is conceivable that with continued cropping, MacSpur trees may eventually become smaller than those of non-spur McIntosh. However, it is suggested that fruit growers plant MacSpur at a similar spacing to that used for non-spur McIntosh to avoid crowding in the orchard.

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