An Evaluation of Selected Cultivars, Rootstocks and Hardy Interstocks

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Since most of Ohio's apple crop is sold for fresh consumption, the performance of new cultivars on various rootstocks must be continually evaluated to insure the greatest possible cropping efficiency. A study was established in 1964 at the Mahoning County Branch of the Ohio Agricultural Research and Development Center to evaluate the response of various cultivars on selected clonal rootstocks with and without hardy intermediate stocks. Several cultivars were propagated on 'M.2' and 'M.7' (Tables 1-4). Some were also top-worked on interstems of 'Hibernal', 'Kulon Kitaika' and 'Columbia' propagated on 'M.7'. The top-working was accomplished over a 2-3 year period with 3-5 scaffold limbs per tree budded to the cultivar. The trees were spaced 22.5' x 25' and the cultivar/rootstock combinations planted at random. The orchard received standard cultural practices and the trees were trained to a central leader without the use of limb spreaders.

Tree growth characteristics of height and spread were measured in 1974. Data indicated that the hardy intermediate stem trees on 'M.7' were very similar to those of the cultivar propagated directly on 'M-7' (Table 1). Trees on 'M.2' averaged 11% taller and 9% wider than those on 'M.7'. 'Chelan Red', a standard habit 'Delicious', and 'Melrose' produced the largest trees; 'Golden Delicious' and 'Starkrimson', the spur habit "Delicious', produced the smallest trees.

Trees of all cultivars on 'M.2' (Idared was not propagated on this stock) tended to produce more fruit than those on 'M.7' for the first 5 years after planting as well as the succeeding 5 years (Table 2). Cultivars on 'M.7' were similar in yield to trees with the hardy intermediate stocks on 'M.7'. Compared with 'Kulon Kitaika' or 'Columbia', the combination of 'Hibernal' on 'M.7' appeared to produce more fruit of the cultivars 'Golden Delicious', 'Idared' and 'Melrose'. But 'Hibernal' had no advantage with the 'Delicious' strains. 'Golden Delicious'

Table 1. Average height and spread (feet) of five apple cultivars on two rootstocks and three hardy intermediate stocks planted in 1964 at the Mahoning County Branch, OARDC and measured in 1974.

	M.2		M.7		Hibernal/M.7		Kulon Kitaika/M.7		Columbia/M.7	
Cultivar	Height	Spread	Height	Spread	Height	Spread	Height	Spread	Height	Spread
Chelan Red	13.5	15.4	13.0	15.5	11.1	13.1	12.0	13.0	12.8	14.6
Golden Delicious	12.7	13.5	9.6	9.8	10.8	13.6	8.6	10.3	10.3	12.1
Idared	—	—	12.0	12.8	11.2	12.6	11.6	11.5	11.2	12.8
Melrose	13.1	15.9	12.3	14.9	10.7	13.7	13.0	16.3	13.3	14.7
Starkrimson	12.2	10.4	10.8	10.1	9.8	9.8	10.2	9.7	10.7	9.6
Averages	12.8	13.8	11.5	12.6	10.7	12.6	11.1	12.2	11.7	12.8

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Table 2. Average accumulative yield (pounds/tree) of five apple cultivars on two rootstocks and three hardy intermediate stocks planted in 1964 at the Mahoning County Branch, OARDC*.

	M.2		M.7		Hibernal/M.7		Kulon Kitaika/M.7		Columbia/M.7		Averages	
Cultivar	64-69	70-74	64-69	70-74	64-69	70-74	64-69	70-74	64-69	70-74	64-69	70-74
Chelan Red	19	425	7	267	4	189	10	203	1	189	8	254
Golden Delicious	75	519	30	228	22	443	13	363	14	304	30	371
Idared	—	—	17	532	11	439	3	271	24	333	13	393
Melrose	15	672	22	505	13	548	4	491	3	417	11	443
Starkrimson	23	314	16	265	10	222	4	170	3	236	11	241
Averages	33	482	18	359	12	368	7	299	9	295		

*Set 22.5′ x 25′, interstems top-worked 1965-1968.

was the most productive cultivar in the five-year period following planting and 'Melrose' had the highest production per tree in the 1970-1974 period regardless of rootstock. When accumulated yield per acre was projected based on an in-row planting distance of actual tree spread at 10 years of age and a between-row distance of spread plus 8 feet, the smaller tree size of 'Golden Delicious' made it a more efficient producer than 'Melrose' (Table 3). The large tree size and relatively low yields of 'Chelan Red' made it an inefficient cultivar compared to the spur type 'Starkrimson Delicious' and the other cultivars in this test. On a per acre basis, 'M.2' appeared to be the most efficient rootstock and the hardy interstocks on 'M.7' the least efficient. The 2-3 years required for complete top-working slightly delayed fruiting and would partially explain the lower yields of the hardy interstock trees.

When the accumulated yield per tree of 16 cultivars on 'M.7' are compared, 'Mutsu' (644 lbs.), Idared (549 lbs.) and 'Melrose' (528 lbs.) were the highest yielding (Table 4). 'Holiday' (240 lbs.), 'Wellspur Delicious' (248 lbs.) and 'Millerspur Delicious' (258 lbs.) had the lowest yields per tree. However, when total accumulated yield per acre was calculated using actual tree size as described above, 'Starkspur Golden Delicious' (1998 bu.), 'Sundale Golden Delicious' (1812 bu.), and 'Idared' (1812 bu.) were the most efficient. The cultivars with the

Table 3. Projected accumulated yield* (bushels/acre), using a planting distance based on tree spread of five apple cultivars on two rootstocks and three hardy intermediate stocks planted in 1964, at the Mahoning County Branch, OARDC.

Cultivar	M.2	M.7	Hibernal/M.7	Kulon Kitaika/M.7	Columbia/M.7
Chelan Red	1171	644	636	699	491
Golden Delicious	1748	1306	1367	1887	1194
Idared	—	1812	1462	1031	1176
Melrose	1615	1373	1649	1163	1096
Starkrimson	1694	1403	1161	871	1210
Averages	1557	1307	1255	1130	1033

*1964-1974 bushels (48 lb.) per acre calculated using in-row spacing of tree spread at 10 years of age and between row spacing of spread plus 8 feet.

Table 4. Average height, spread, accumulative yield and projected yield of selected cultivars on M.7 and M.2 rootstocks at the Mahoning County Branch, OARDC, 1964-1974.**

Cultivar	Number of Observations	Tree Hgt. (Ft.)	Tree Sprd. (Ft.)	Accum. Yield/Tree (Lbs.) 64-69	70-74	Total Proj. Accum. Yield bu/a
			M.7 Rootstocks			
Franklin	5	13.3	16.2	26	437	1090
Golden Delicious*	7	9.6	9.8	30	228	1306
Hi-Early*	4	12.9	13.4	21	357	1105
Holiday*	13	12.1	13.4	14	226	795
Houser	5	12.5	15.0	13	420	1137
Idared	6	12.0	12.8	17	532	1812
Jonathan*	6	11.2	14.7	25	381	1060
Melrose*	5	12.3	14.9	23	505	1373
Millerspur	5	10.9	10.3	16	242	1299
Mutsu	6	12.4	16.5	20	624	1369
Myrtle	5	13.4	14.5	9	373	1000
Starkrimson*	12	10.8	10.0	16	265	1418
Starkspur	5	10.8	9.3	41	299	1998
Sundale	5	9.8	8.6	39	271	1812
Wayne	5	14.0	15.4	30	279	809
Wellspur	10	11.2	9.3	16	232	1433
			M.2 Rootstocks			
Gallia Beauty	3	8.1	9.0	10	203	1249
Golden Delicious*	4	12.7	13.5	35	519	1748
Hi-Early*	6	12.0	15.2	25	498	1360
Holiday*	6	12.9	15.3	32	427	1209
Jonathan*	3	11.2	12.2	26	337	1366
Melrose*	6	13.1	15.9	16	672	1615
Red King	6	13.0	16.1	13	453	1096
Red Rome	3	12.5	12.5	19	598	2031
Red Spur	8	12.7	9.7	26	349	1887
Royal Red	7	12.7	14.7	19	461	1260
Ruby	4	12.6	12.2	39	597	2391
Starkrimson*	7	12.2	10.4	24	314	1694
Sungold	5	9.5	11.0	15	320	1439

*Cultivars common to both M.7 and M.2 rootstocks.
**1964-1974 bushels (48 lb.) per acre calculated using in-row spacing of tree spread at 10 years of age and between row spacing of spread plus 8 feet.

poorest efficiency were 'Holiday' (795 bu.), 'Wayne' (809 bu.) and 'Myrtle Delicious' (1000 bu.). The 3 highest yielding spur and standard strains shown in Table 4 were selected from the complete comparison of 13 standard 'Red Delicious' strains and 4 spur type strains from this orchard (1). The data indicate that per tree yields at 10 years of age were lower for spur types, but production efficiency as measured by calculated yields per acre based on actual tree size was greater. This trend was also shown when 'Golden Delicious' (1306 bu.) was compared to the spur forms, 'Starkspur' (1998 bu.) and 'Sundale' (1812 bu.). The spur forms of both cultivars have required less pruning in recent years than the standard forms, and the smaller tree size allows more of the harvesting to be accomplished from the ground. For these reasons spur type trees of 'Red Delicious' and 'Golden Delicious' appear to be much more efficient for overall orchard management than the standard forms.

'Melrose' (688 lbs.), 'Ruby' (636 lbs.) and 'Red Rome Beauty' (617 lbs.) had the highest yields per tree when 13 cultivars on 'M.2' were compared (Table 4). 'Gallia Beauty' (213 lbs.), 'Starkrimson Delicious' (338 lbs.) and 'Sungold' (335 lbs.) were the lowest yielding on 'M.2'. When production efficiency was compared by projecting accumulated yield per acre based on actual tree size, 'Ruby' (2391 bu.), 'Red Rome Beauty' (2031 bu.) and 'Red Spur Delicious' (1887 bu.) had the highest efficiency and 'Red King Delicious' (1096 bu.), 'Holiday' (1209 bu.) and 'Gallia Beauty' (1240 bu.) had the lowest efficiency.

'Holiday', in addition to having low yields, frequently had severe cracking at the calyx end. 'Mutsu' fruits were larger, firmer and less russeted than 'Golden Delicious', and did not have the bacterial spot that has been a problem in other plantings of this cultivar. The distinctive taste of this cultivar offers promise as a fresh market apple. Both 'Starkspur' and 'Sundale' produced slightly more russet than standard 'Golden Delicious' in this planting. Although 'Sungold' had an attractive pink cheek the fruit quality and taste were much inferior to 'Golden Delicious'. The low yield and rather low quality of 'Wayne' would preclude the recommendation of this cultivar for fresh market sales.

Although 'M.7' was not as efficient in fruit production as 'M.2' in this study, its availability and greater adaptability to various soil types would recommend continued use of 'M.7' in Ohio. The hardy interstocks on 'M.7' trees were nearly the same size as the trees with the cultivar worked directly on 'M.7'. Since yields of these comparisons were also similar, the use of hardy interstocks would appear to offer little advantage in Ohio. During the course of this study temperatures low enough to cause trunk injury did not occur (lowest temperature was −15° F), and thus an evaluation of the degree of hardiness imparted cannot be made. Although the upright growth habit of the spur forms will require additional training time with limb spreaders to produce a satisfactory central leader tree, their management and production efficiency offer many advantages for future plantings. The combination of productive cultivars with size reducing and precocious rootstocks offers great potential for improving the efficiency of fruit production.

Literature Cited

1. Ferree, D. C., C. A. Morrison and L. C. Shew. 1975 Evaluation of Delicious Strains. *Ohio Report*, April issue, Vol. 6 (2):19-22.