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Western Iowa 1992 Apple Cultivar × Rootstock Trial

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Abstract
Proper tree spacing is a key to maximizing the production potential of an apple orchard. Along with cultivar, rootstock, and management system, soil conditions affect tree size and thus tree spacing making it necessary to evaluate rootstock performance under a variety of different soil conditions. The loess soils of western Iowa are unique, and little is known about their influence on apple tree growth, particularly on dwarfing rootstocks. This study was established to evaluate the performance of apple cultivars on rootstocks ranging from full dwarfing to standard-size to better ascertain optimum spacing for apple trees planted on loess soils.

Keywords
Horticulture

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Introduction

Proper tree spacing is a key to maximizing the production potential of an apple orchard. Along with cultivar, rootstock, and management system, soil conditions affect tree size and thus tree spacing making it necessary to evaluate rootstock performance under a variety of different soil conditions. The loess soils of western Iowa are unique, and little is known about their influence on apple tree growth, particularly on dwarfing rootstocks. This study was established to evaluate the performance of apple cultivars on rootstocks ranging from full dwarfing to standard-size to better ascertain optimum spacing for apple trees planted on loess soils.

Materials and Methods

The study was established in 1992 to evaluate the performance of three apple cultivars (Smoothee Golden Delicious, Empire, and Nured Jonathan) on seven commercially available rootstocks (seedling, MM.111, MM.106, M.7 EMLA, M.26 EMLA, M.9 EMLA, and Mark) trained to a central leader system. Each cultivar/rootstock combination was replicated 10 times in a split-plot arrangement of randomized complete block design, with cultivar whole-plots and rootstock sub-plots. Cultivar and rootstock performance has been reported in the 1994 through 2000 Annual Fruit and Vegetable Progress Reports (FG-601). This report summarizes the tree growth and yield characteristics for the 2001–growing season by cultivar and rootstock main effects.

Results and Discussion

After 10 growing seasons, differences in tree size remain evident (Table 1). By cultivar, Golden Delicious trees were largest while Jonathan trees were the smallest, based on trunk diameter and tree volume. A similar trend existed for tree height and tree spread. By rootstock, trees on seedling were generally the largest, followed in order by MM.106, MM.111, M.7 EMLA, M.26 EMLA, M.9 EMLA, and Mark. Because no attempts were made to control tree spread, it is probable that trees on the more dwarfing rootstocks could be planted up to 2 feet closer together in a central leader training system. Differences in suckering were evident, with Empire trees producing more suckers than Jonathan trees. By rootstock, trees on M.7 EMLA and seedling produced the most suckers.

Yields were low in 2000, and all cultivars and rootstocks combinations had a heavy to very heavy bloom in 2001(Table 2). By cultivar, Golden Delicious trees produced the largest crop, with no difference existing between Empire and Jonathan. However, based on fruit density and average fruit weight, it was evident that the Golden Delicious trees were over-cropped. By rootstock, trees on M.9 EMLA and MM.106 were the most yield efficient, while trees on seedling were the least yield efficient. Based on fruit density, trees on M.9 EMLA, MM.106, M.26 EMLA, and Mark were probably over-cropped. This is reflected in average fruit weight, particularly for trees on M.9 EMLA and Mark. On a cumulative basis, Golden Delicious trees remained the most productive. By rootstock, trees on M.9 EMLA had the highest yield efficiency after 10 years. The next most efficient rootstocks were Mark, MM.106, and M.26 EMLA. The least yield

efficient rootstock was seedling, followed in order by MM.111, and M.7 EMLA. With M.7 EMLA and MM.111 being the only rootstocks that can be safely recommended for Iowa, it is evident that much improvement can be made with better-adapted rootstocks.

Table 1. Growth characteristics of three cultivars on seven rootstocks in the 1992 Western Iowa apple rootstock trial for 2001.

Treatment:	Trunk Dia. (in.)	Tree Height (ft)	Tree Spread (ft)	Tree Volume (cu ft)	Number of Suckers
Cultivar:					
Golden Delicious	5.2	14.5	15.2	1,301	4.6
Empire	4.9	12.5	14.7	1,056	7.4
Jonathan	4.5	12.3	14.2	942	2.4
LSD .05	.14	.5	.5	113	2.8
Rootstock:					
Seedling	6.4	16.2	16.9	1,698	12.0
MM.106	5.7	15.4	17.5	1,703	.6
MM.111	5.6	15.3	16.1	1,426	1.5
M.7 EMLA	5.1	13.8	15.1	1,121	16.1
M.26 EMLA	4.3	11.3	13.9	752	.5
M.9 EMLA	3.6	10.6	12.4	579	3.4
Mark	3.4	9.2	10.6	361	2.0
LSD .05	.19	.6	.6	126	4.6

Table 2. Fruit yield characteristics of three cultivars on seven rootstocks in the 1992 Western Iowa apple rootstock trial for 2001.

	2001					Cumulative	
Treatment:	Bloom Rating[z]	Yield lb/tree	Yield Eff.[y]	Fruit Density[x]	Fruit wt. (oz)	Yield lb/tree	Yield Eff.[y]
Cultivar:							
Golden Delicious	4.9	287.1	.89	10.3	3.1	565.0	1.87
Empire	5.0	129.6	.50	5.0	3.8	316.3	1.32
Jonathan	4.8	115.0	.53	5.6	3.7	275.7	1.27
LSD .05	.17	42.2	.14	1.7	.3	54.0	.18
Rootstock:							
Seedling	4.8	172.1	.36	3.4	4.0	336.6	.72
MM.106	5.0	309.3	.84	8.4	3.7	629.5	1.73
MM.111	4.9	201.3	.55	5.5	3.7	398.9	1.10
M.7 EMLA	5.0	171.4	.52	5.1	4.0	399.4	1.28
M.26 EMLA	4.9	157.4	.75	8.1	3.6	354.9	1.71
M.9 EMLA	4.8	137.8	.88	10.6	3.1	317.4	2.09
Mark	4.7	81.0	.56	7.6	2.8	247.0	1.81
LSD .05	.15	31.2	.09	1.2	.32	47.1	.14

[z] Bloom rating: 0= failed to bloom; 1=very light; 3=normal; 5=very heavy.

[y] Yield efficiency reported in kilograms of fruit per cm^2 of the trunk cross-sectional area. Higher values indicate more productive trees.

[x] Number of fruit per cm^2 trunk cross sectional area.