Fruit Varieties Journal 47(4):226-229 1993

Performance of 'Starkspur Supreme Delicious' Grown on Twenty-five Rootstocks in Quebec

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Abstract

The performance of 'Starkspur Supreme Delicious' apple was evaluated on 25 rootstocks having a wide range of vigor. Trees on M.26 EMLA, M.9 EMLA, O.3, M.9, B.9, MAC.39, C6, MAC.9, P.2, P.16 and P.22 were best for yield efficiency and all were compact enough to manage from round level. All appear to be winter hardy and do not present any problem in orchard management.

Introduction

'Delicious' trees suffered extensive losses during the winter of 1980 in Quebec when temperatures as low as -36C persisted for a week at the end of December. Losses among the major cultivars were 40% for 'Delicious,' 23% for 'Cortland,' 19% for 'McIntosh' and 6% for 'Lobo' (3). The predominant rootstocks for 'Delicious' were M.7 EMLA, M.26 EMLA and seedling. Tree losses were higher on seedling than on dwarfing rootstocks. The conditions in Quebec require rootstocks which are not only cold-hardy and yield-efficient, but which also promote good productivity. Because of the particular requirements imposed by the Quebec environment which are, at best, marginal for 'Delicious' apples, the 1980-81 and 1984 cooperative trials of the NC-140 were initiated in that province to evaluate the performance of 'Starkspur Supreme Delicious' on 25 rootstocks. Such studies were crucial to the Quebec apple industry because very little work had been reported on the local evaluation of dwarfing rootstocks (4). This paper reports on the results obtained in the NC-140 cooperative plantings at Frelighsburg, Quebec, for the period 1980-89 (inclusive).

Materials and Methods

The 25 rootstocks compared in these trials originated from breeding or evaluation programs in England (M. = Malling, EMLA = East Malling/Long Ashton and MM. = Malling Merton series), Michigan (MAC. = Michigan Apple Clone Series), Missouri (C = Clark series), New York (CG, = Cornell/ Geneva series), Oregon (OAR = Oregon Apple Rootstock series), Poland (P. = Polish series), Russia (B. = Budagovsky series) and Canada (O. = Ottawa and A. = Antonovka series). The scion was 'Starkspur Supreme Delicious.'

In the 1980 & 1981 plantings the rootstocks were O.3, M.7 EMLA, M.9 EMLA, M.26 EMLA, M.27 EMLA, M.9, MAC.9, MAC.24 and OAR 1. The field lay-out consisted of five single-tree replicates of each rootstock/scion combination planted in a randomized complete block design. The protocol for the planting was that described in NC-140 (4).

In the 1984 planting the rootstocks were A.313, B.490, B.491, B.9, C6, CG.24, M.7 EMLA, M.26 EMLA, M.4, MAC.1, MAC.39, P.1, P.16, P.18, P.2, P.22, MM.111 and seedling. A randomized complete block design (n = 10)

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was used in the field lay-out. The protocol for this planting was that of NC-140 (6).

All trees were planted at 3.5 m x 5.5 m and were initially free standing. Normal orchard management practices were followed each year (1). Alleyways were mown but clean cultivation with herbicides was utilized within the tree row. Trunk circumference (used to calculate trunk cross-sectional area (TCSA)), tree height, tree spread, number of rootsuckers and total yield were recorded annually for each tree. Records of trees that succumbed to winter injury were deleted from the trials. Data were subjected to an analysis of variance by the GLM procedure in SAS (Statistical Analysis Services, Carey, N.C.).

Results and Discussion

The 1989 results for the 1980 and 1981 planting are reported in Table 1. Trunk cross-sectional area (TCSA) in the 1980 planting was of the order MAC. 24 > M.7 EMLA > OAR 1 > all others but in the 1981 planting, it was MAC.24 > all others and OAR 1, M.7 EMLA > most others. Cumulative yield was not different among rootstocks except for M.27 EMLA for which yield was lower than all other rootstocks in the 1980 planting and lower than most rootstocks in the 1981 plots. Yield efficiency was usually higher on the dwarfing rootstocks (M.26 EMLA, MAC.9, M.9 EMLA, O.3 and M.9) than on the more vigorous rootstocks (MAC.4, OAR 1 and M.7 EMLA). Yield efficiency for M.27 EMLA was better in the 1981 than in the 1980 planting. Fruit size was not affected by rootstock (data not shown). All trees except those on MAC.24, M.7 EMLA and OAR 1 could be managed from ground level. Rootsuckers were much more evident with MAC.24 than with any other rootstocks. Tree loss was appreciable in the 1981 planting

Table 1. 1989 Performance of 'Starkspur Supreme Delicious' scion on nine rootstocks planted in 1980 and eight rootstocks planted in 1981.

Rootstock	Final TCSA[1] (cm^2)	Cumulative Yield (kg)	Yield Efficiency (kg/cm^2)	Final Tree height (m)	Final Tree spread (m)	No. of root-sucker	No. of dead trees	% of trees staked
1980 Planting								
MAC.24	101 a[2]	52 ab	0.5 d	3.50 a	3.80 a	184 a	1	40
M.7 EMLA[3]	78 b	66 a	0.8 d	3.19 ab	3.17 b	16 b	1	40
OAR 1	53 c	41 ab	0.8 d	2.98 b	2.32 c	14 b	1	20
M.26 EMLA[3]	34 d	56 ab	1.6 c	2.40 c	2.50 c	31 b	0	60
MAC.9	25 de	47 ab	1.9 bc	2.02 cd	1.94 c	13 b	0	70
M.9 EMLA	23 def	57 ab	2.5 a	1.95 cd	2.13 c	8 b	0	100
O.3	20 def	38 b	2.0 abc	1.62 de	2.07 c	21 b	1	80
M.9	19 ef	47 ab	2.4 ab	2.04 cd	2.37 c	23 b	1	90
M.27 EMLA	7 f	7 c	0.9 d	1.31 e	0.74 d	15 b	1	80
1981 Planting								
MAC.24	67 a	26 ab	0.4 c	3.37 a	3.15 a	98 a	3	40
OAR 1	46 b	26 ab	0.5 c	3.07 a	2.50 b	10 b	2	20
M.7 EMLA[3]	46 b	42 a	1.0 bc	3.14 a	2.67 b	26 b	1	40
M.26 EMLA[3]	41 bc	50 a	1.4 abc	2.93 ab	2.60 b	13 b	0	60
M.9 EMLA	26 cd	46 a	1.9 ab	2.45 bc	2.70 b	1 b	3	100
MAC.9	23 cde	51 a	2.2 a	2.29 cd	2.09 c	13 b	0	70
M.9	18 de	41 ab	2.2 a	2.29 cd	2.08 c	3 b	0	90
M.27 EMLA	8 e	15 b	1.8 ab	1.85 d	1.17 d	3 b	1	80

[1]Trunk cross-sectional area, measured in fall 1989.
[2]Mean separation within columns and year of planting by Duncan's multiple range test at 5% level.
[3]Same rootstocks as in the 1984 trial (see Table 2 for comparison).

Table 2. 1989 Performance of 'Starkspur Supreme Delicious' scion on eighteen rootstocks planted in 1984.

Rootstock	Final TCSA[1] (cm^2)	Cumulative Yield (kg)	Yield Efficiency (kg/cm^2)	Final Tree height (m)	Final Tree spread (m)	No. of root-sucker	No. of dead trees	% of trees staked
A.313	64	12	0.2	3.49	2.65	10	0	0
P.18	63	30	0.5	3.53	3.09	4	0	30
MM.111	63	11	0.2	3.48	2.70	15	0	0
Seedling	62	21	0.3	3.50	2.79	11	0	0
B.491	61	23	0.4	3.64	2.98	33	0	40
M.4	55	25	0.5	3.45	3.03	21	0	30
CG.24	55	16	0.3	3.73	2.54	24	0	40
B.490	54	24	0.4	3.46	2.68	0	0	10
MAC.1	53	22	0.6	3.17	2.45	6	0	40
P.1	51	34	0.7	3.29	2.90	2	1	60
M.7 EMLA[3]	44	31	0.7	3.11	2.59	4	0	40
M.26 EMLA[3]	32	40	1.2	2.72	2.43	2	0	60
MAC.39	28	20	0.9	2.48	2.33	3	0	70
B.9	21	29	1.4	2.32	2.25	0	1	90
C6	20	20	1.1	1.99	1.66	1	1	100
P.2	15	22	1.7	1.99	1.82	1	2	100
P.22	14	10	1.0	2.07	1.54	3	1	90
P.16	12	15	1.7	2.26	1.69	3	3	90
LSD[2]	9.8	8.9	0.27	0.43	0.37	9.7		

[1]Trunk cross-sectional area, measured in fall 1989.
[2]Least significant difference at 5% level.
[3]Same rootstocks as in the 1980-81 trial (see Table 1 for comparison).

and losses of 40, 60, 60 and 100% were experienced for OAR 1, MAC.24, M.9 EMLA and O.3, respectively.

In the 1984 planting, trees on the P-series of rootstocks (except P.18) had smaller TCSA values than on most of the other rootstocks. Yield efficiency was best for the smaller trees, i.e. M.26 EMLA, MAC.39, B.9, C6, P.2, P.22 and P.16. Tree height and spread were lower on C6, P.2, P.16 and P.22 than on most of the other rootstocks. Rootstocks CG.10 and B.491 tended to have a higher incidence of root-suckers than other rootstocks.

Trees on dwarfing rootstocks were for the most part, unable to remain erect and had to be staked (Tables 1 and 2). Vigorous rootstocks produced well-anchored free-standing trees.

Appreciable tree loss was experienced by others with the 1981 plantings (5). Granger (2) has also observed severe winter damage to apple trees in Quebec in 1981-82. In both 1980 and 1981 plantings a total tree loss of 4, 3, 3, 2, 1 and 1 was observed respectively for MAC24, OAR1, M.9 EMLA, M.7 EMLA, O.3 and M.9 due to winter injury (Table 1). Poorly rooted and weak trees of O.3 were obtained from the nursery for the 1980 planting and were more vulnerable to the low winter temperature. This rootstock was not available for the 1981 planting. In the 1984 planting tree losses were observed on P.16, P.2, P.22, C.6, B.9 and P.1 from 1984 to 1989 when no severe winter was experienced (Table 2). Results from the 1980, 1981 and 1984 plantings (Tables 1 and 2) clearly demonstrate the superiority of dwarfing rootstocks for increasing yield efficiency. Similar results were noted by other cooperators in the joint study (5, 6). M.27 EMLA did not perform well at any location.

From the results in this study, it is apparent that M.26 EMLA, MAC.9, M.9 EMLA, O.3, M.9, B.9, MAC.39,

C6, P.2, P.16 and P.22 are good rootstocks for 'Delicious' production in Quebec. Trees on these rootstocks are sufficiently small to manage from ground level. However, with 'Starkspur Supreme Delicious' as the scion cultivar, only M.26 EMLA, MAC.9 and MAC.39 have been cold hardy. These combinations are quite yield efficient, prime requirements for any apple grower.

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Fruit Varieties Journal 47(4):229-233 1993

Seed Germination of Ribes Hybrids[1]

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Abstract

Germination of the seed of two Ribes x nidigrolaria Bauer & Bauer cvs. Jostaberry and ORUS-6 varied with pregermination treatment and genotype. Cleaned seed and seed remaining in the berry were prechilled and germinated. Prechilled cleaned seeds gave the most complete and rapid germination. The median response time of seeds in this treatment was 12.3 days. About 42% of cleaned seed of both genotypes germinated after prechilling at 5°C for 12 weeks. Seeds from the decomposing berry treatments had significantly less germination (16% or lower) with or without a prechilling treatment. This study verifies that prechilling from four to twelve weeks improves germination of cleaned Ribes seed and suggests that sowing decomposing berries is not an efficient technique for laboratory germination.

Introduction

Poor germination in seeds of temperate fruits may be caused by inhibitory or impermeable properties of the seed coat, embryo immaturity or combinations of both (5, 14, 15). Germination tests of Ribes have given widely varied results suggesting that the methods tested have not fully broken dormancy (2, 9). Several reports recommend allowing seeds to remain in fermenting fruit pulp (12, 13). Seeds in these berries would be released to germinate after the berry had decomposed and the bacteria and fungi involved in the decomposition process had degraded the seed coat. Quick (19), working with North American Ribes species, reported that the best germination was obtained after three or more months of prechilling. Others also reported better germination in Ribes after prechilling (1, 16, 17, 18, 20). Prechilling could allow a rudimentary embryo to mature or inhibitory substances in the seedcoat to be metabolized (6). Despite the horticultural importance of Ribes crops (black and red currants, gooseberries) in Europe, neither the International Seed Testing Association nor the Association of Official Seed

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