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Vegetative Growth and Mixed-Bud Development of 'Fuji' Apple Trees as Influenced by Rootstocks and Microsprinkler Fertigation

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Abstract

The influence of five rootstocks, B.9, M.9 NAKBT337, O.3, M.26 EMLA, and M.7 EMLA, and five nutrition treatments applied through a microsprinkler system, on growth characteristics of 'BC-2 Fuji' apple trees (*Malus domestica* Borkh.) was evaluated for two years. Nutrition treatments consisted of 22.4 kg nitrogen (N)/ha (low N), 89.7 kg N/ha (medium N), 156.9 kg N/ha (high N), 89.7 kg N/ha in combination with 78.5 kg potassium (K)/ha, and 156.9 kg N/ha in combination with 78.5 kg K/ha. Trees on M.7 EMLA had larger trunk cross-sectional areas (TCA) and longer limbs and terminal shoots than those on other rootstocks. Trees on B.9 had the smallest TCA and the shortest limbs and terminal shoot. The density of non-flowering spurs in the scion trees increased with the vigor of rootstocks. Trees on B.9 had significantly higher density of fruit spur without bourse shoot than those on other rootstocks in 1998. Bud break in the mixed-buds of trees on of M.7 EMLA was slower than those on B.9 and O.3 in both years. Over all, trees on B.9, M.9 and O.3 were less vigorous than those on M.7 EMLA and can be used for high-density orchards. Trees receiving high N had significantly longer terminal shoot than those with low N treatment in both years. Nutrition treatments showed little effect on other growth characteristics of scion trees.

Introduction

Growth and development of fruit trees is affected by the genotype of scion and rootstock, environmental factors, and cultural practices. Numerous studies have shown that rootstock affects tree growth (15, 22, 32), spur and flower development (3, 14, 18), mineral uptake (20), fruit productivity (27, 28), and fruit quality (12) in various apple (*Malus domestica* Borkh.) cultivars.

Many apple cultivars have unique bud and vegetative growth characteristics (11, 13). 'Fuji' trees ('Ralls Janet' x 'Delicious') are vigorous (13, 23) and have a strong biennial bearing habit (23). They exhibit a new cycle of growth after bud formation in late August (10). 'Fuji' has become one of the most popular apple cultivars in the world (16, 26, 29, 30). However, a comprehensive report on the vegetative growth and spur development of 'Fuji' is absent from the literature.

The objective of this study was to evaluate the vegetative growth and mixed-bud development of 'Fuji' apple trees as influenced by five rootstocks and five fertigation treatments with N and K.

Materials and Methods

In 1995, 'BC-2 Fuji' trees on B.9, M.9 NAKBT337, O.3, M.26 EMLA, and M.7 EMLA rootstocks were planted at a spacing of 2.43 x 4.87 m at the University of Idaho Parma Research and Extension Center, Parma, Idaho. The soil was sandy loam and at the depth of 0-58.8 cm, the soil characteristics were as follow: pH 7.1 to 7.3, NO_3-N 2.74 to 3.14 $\mu g \cdot g^{-1}$, NH_4-N 1.45 to 1.09 $\mu g \cdot g^{-1}$, P 8.0 to 12.4 $\mu g \cdot g^{-1}$, K 306 to 319 $\mu g \cdot g^{-1}$, CEC 16.6 to 18.3, and organic matter 0.48 to 1.03%.

Uniform size trees with 1.27 cm circumference were obtained from Willow Drive Nursery, Inc., Ephrata, Washington

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for this experiment. The trees were trained to a central leader with the top of the leader bent in a zig-zag pattern to control growth (2). 'Snowdrift' crabapple was planted in each row as a pollinizer.

Methods

Five nutrient treatments were delivered through a microsprinkler irrigation system (fertigation). Urea-ammonium nitrate (UAN-32) nitrogen (N) and liquid K (0-0-13) were used as sources of N and K. The total nutrient applied each year were as follows: 22.4 kg N/ha (low N), 89.7 kg N/ha (medium N), 156.9 kg N/ha (high N), 89.7 kg N/ha in combination with 78.5 kg K/ha, and 156.9 kg N/ha in combination with 78.5 kg K/ha. Nutrient treatment was applied in four equal quantities on 31 May, 8 June, 15 June, and 23 June in 1998, and on 20 May, 27 May, 4 June, and 10 June in 1999. These dates correspond to the period of rapid fruit growth. These fertigation treatments were applied to each rootstock in an experimental plot arranged as a split plot design with fertigation treatments as the main plots and rootstocks as sub-plots (eight observations/rootstock/fertigation treatment). Four blocks and two replications of trees within each sub-plot were used in this study. Analyses of variance were conducted by GLM procedure, using SAS (SAS Institute, Cary, N.C., USA). Fisher's protected LSD ($\partial \leq 0.05$) was used to separate treatment means.

Trunk circumference was measured at 30 cm above the bud union at the end of growing seasons in 1998 and 1999 and trunk cross-sectional area (TCA) was computed. One major limb (scaffold) on the east side and west side of each tree was selected for measurement of growth components. Total lengths of limb with and without terminal shoots were measured, and the number of branches and side shoots on each limb (Fig. 1 A) were counted after terminal buds were formed in mid-August of each year. In August of both seasons, 30 mid-shoot leaves were sampled, and analyzed for N concentration using a LECO Protein/Nitrogen Analyzer (FP-528, LECO Corp., St. Joseph, MI).

'BC-2 Fuji' apple trees showed three types of spur structures (Fig. 1 B, C, and D) as described below. 1) Fruit spur with bourse shoot had fruit and a bourse shoot (a lateral shoot in a spur structure); 2) fruit spur without bourse shoot had bourse bud instead of bourse shoot in the spur structure; and 3) non-flowering spur that commonly would produce fruit during the next season. The numbers of each spur type, located on the main limbs, were counted after bud formation during mid-August of each year, and spur diameter was measured using a digital caliper (Digimatic Caliper, Mitutoyo Corp., Kawasaki, Japan). Densities of each spur type, located on the main limb, were calculated as numbers of spur type per meter of limb. For this calculation, only the length of the main limb was used, excluding terminal shoot.

To determine the development of mixed-buds, the diameter of 12 mixed-buds around the periphery of each tree was measured on 27 Mar. 1999 and 24 Mar. 2000 using a digital caliber. The stage of bud development was determined using a bud development chart in the Crop Protection Guide for Tree Fruits in Washington (9).

Results and Discussion

The assumption of normality was checked by computing univaritate analyses for all tree responses, and all responses had normal distributions. Performing Fisher's protected LSD ($\partial \leq 0.05$) revealed no significant interaction between rootstocks and nutrition treatments in any part of this study. Therefore, only the effects of main plots and sub-plots are discussed below.

Rootstock Effects

Tree and limb growth: Rootstock strongly influenced shoot growth of 'BC-2 Fuji'. Trunk cross-sectional area (TCA) of trees grown on M.7 EMLA was larger when compared to other rootstocks, followed by those on M.26 EMLA, O.3, M.9, and B.9 in both years (Table 1). Limb and terminal shoot lengths ranked in the approximate same order as their TCA, so that trees on M.7 EMLA had the longest limbs and terminal shoots, whereas those on B.9

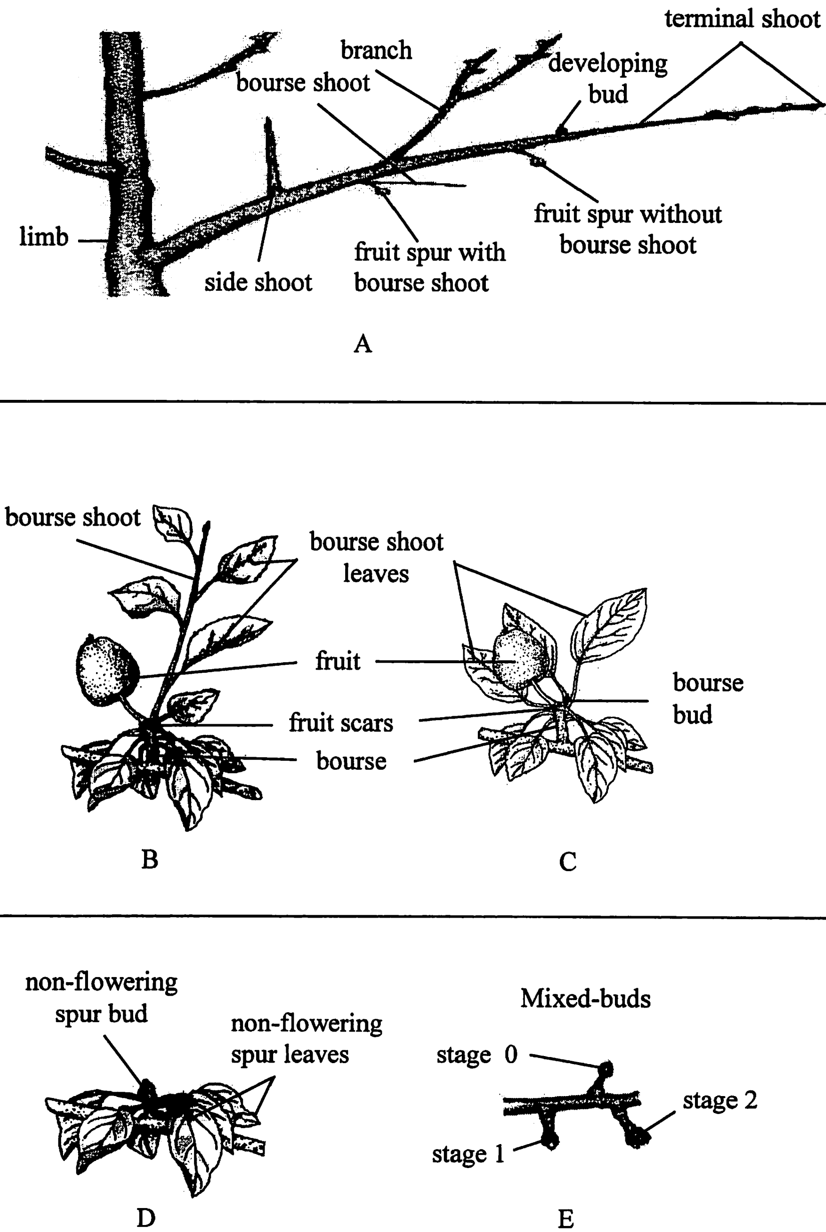

Fig. 1. Trunk, limb, and spur structure of 'Fuji' apple tree and their associated parts. A: Trunk and limb structure without leaves, B: Fruit spur with bourse shoot (FSWS), C: Fruit spur with no bourse shoot, D: Non=flowering spur, E: Structure of mixed buds at different developmental stages (Stage 0,1, and 2; stages mixed-buds were determined based on bud development chart (Reference 9).

Table 1. Trunk cross-sectional area (TCA), limb length, number of branches per limb, number of side shoots per limb, terminal shoot length, and leaf nitrogen concentration of 'BC-2 Fuji' apple trees in 1998 and 1999 as influenced by rootstock.

Rootstock	TCA (cm^2)	Limb length (m)	No. branch	No. side shoot	Terminal shoot length (cm)	LeafN (%·dwt)
1998						
B.9	14.2 e[z]	2.01 c	2.7 c	3.3 d	32.6 c	2.34 b
M.9 NAKBT337	19.2 d	2.18 bc	3.3 bc	6.2 c	39.0 b	2.38 ab
O.3	21.6 c	2.34 bc	3.5 b	6.7 c	41.0 b	2.36 ab
M.26 EMLA	31.6 b	2.44 ab	3.6 b	12.4 b	48.7 a	2.35 ab
M.7 EMLA	41.4 a	2.72 a	4.4 a	15.0 a	51.3 a	2.42 a
1999						
B.9	18.4 e	1.70 e	4.3 c	5.0 c	18.6 e	2.21 b
M.9 NAKBT337	26.7 d	2.08 c	5.3 b	6.5 b	30.9 c	2.28 a
O.3	29.8 c	1.76 d	5.2 bc	6.2 b	27.3 d	2.21 b
M.26 EMLA	42.7 b	2.33 b	5.6 b	7.2 b	37.4 b	2.28 a
M.7 EMLA	58.3 a	2.52 a	7.0 a	10.2 a	41.7 a	2.17 b

[z]Mean separation within columns of each year by LSD at $\partial \leq 0.05$ (n = 40).

had the shortest. Numbers of branches and side shoot of trees on M.7 EMLA were significantly greater than those on all other rootstocks. Trees on B.9 had significantly fewer side shoots than those on all other rootstocks in both years. Trees on B.9 also

Table 2. Spur characteristics of 'BC-2 Fuji' apple trees in 1998 and 1999 as influenced by rootstock.

Rootstock	Fruit Spur with bourse shoot: Density (No./m)	Fruit Spur with bourse shoot: Diameter (mm)	Fruit Spur with bourse shoot: Bourse Shoot length (cm)	Fruit Spur without bourse shoot: Density (No./m)	Fruit Spur without bourse shoot: Diameter (mm)	Non-flowering spur: Density (No./m)	Non-flowering spur: Diameter (mm)
1998							
B.9	7.0 b[z]	7.2 c	13.4 b	6.9 a	6.4 a	4.3 c	3.3 b
M.9 NAKBT337	9.0 a	7.5 ab	14.5 b	3.4 b	6.5 a	7.5 b	3.5 a
O.3	9.3 a	7.3 bc	15.2 b	3.1 b	6.4 a	7.0 b	3.4 ab
M.26 EMLA	4.7 c	7.6 a	14.3 b	1.3 c	6.6 a	12.6 a	3.6 a
M.7 EMLA	5.3 c	7.6 a	18.5 a	1.3 c	6.4 a	13.0 a	3.5 a
1999							
B.9	2.0 ab	7.0 b	10.5 c	1.7 a	6.5 a	11.0 b	3.9 ab
M.9 NAKBT337	1.8 ab	7.8 a	15.1 ab	0.9 b	6.6 a	11.9 ab	3.9 ab
O.3	2.4 a	7.7 a	13.3 b	1.7 ab	6.7 a	11.9 ab	4.0 a
M.26 EMLA	2.0 ab	7.6 a	14.2 b	1.5 ab	6.5 a	12.8 a	4.0 a
M.7 EMLA	1.3 b	8.1 a	17.6 a	1.0 b	7.0 a	13.1 a	3.8 b

[z]Mean separation within columns by LSD at $\partial \leq 0.05$ (n = 40).

Table 3. Mixed-bud development of 'BC-2 Fuji' apple trees on March 27, 1999 and on March 24, 2000 as influenced by rootstock.

Rootstock	Stage 0[z] (%)	Stage 0 Diameter (mm)	Stage 1 (%)	Stage 1 Diameter (mm)	Stage 2 (%)	Stage 2 Diameter (mm)	PAMB[x] (%)
1999							
B.9	18.5 b[y]	3.24 a	67.3 a	4.21 c	14.2 a	3.55 ab	81.5 a
M.9 NAKBT337	23.8 b	3.44 a	64.1 a	4.36 bc	12.1 ab	4.14 a	76.2 ab
O.3	26.5 b	3.27 a	63.1 a	4.45 ab	10.4 abc	3.22 ab	73.5 b
M.26 EMLA	23.3 b	3.37 a	69.8 a	4.54 a	6.9 bc	2.39 b	76.7 ab
M.7 EMLA	46.3 a	3.42 a	48.8 b	4.30 bc	5.0 c	3.28 ab	53.8 c
2000							
B.9	11.0 b	4.24 a	76.9 ab	5.17 ab	12.1 a	5.69 a	89.0 a
M.9 NAKTB337	14.6 ab	4.26 a	77.9 ab	5.23 a	7.5 b	4.52 ab	85.4 ab
Ottawa 3	11.5 b	4.16 a	79.4 a	5.16 ab	9.1 ab	4.59 ab	88.5 a
M.26 EMLA	18.3 a	4.25 a	73.8 bc	5.04 b	7.9 b	4.21 b	81.7 b
M.7 EMLA	16.7 a	4.24 a	71.6 c	5.15 ab	11.7 a	5.56 ab	83.3 b

[z]Stage of mixed-buds were determined based on bud development chart (Reference 9): 0=dormant; 7=full bloom.
[y]Mean separation within columns by LSD at $\partial \leq 0.05$ (n = 40).
[x]PAMB: percentage of advanced mixed-buds (total percentage of mixed-buds in stage 1 plus stage 2).

had significantly fewer branches than those on M.26 EMLA and M.7 EMLA in both years.

The effects of rootstock on TCA and tree growth in 'BC-2 Fuji' apple were in general agreement with those in most other apple cultivars (1, 4, 24). Autio and Southwick (1) reported that 'McIntosh' apple trees on M.7 were larger than those grown on M.26 and M.9. Barritt et al. (4) reported similar results for 'Golden Delicious', 'Granny Smith', and 'Delicious'. The 1996 NC-140 (24) indicated that 'Starkspur Supreme Delicious' apple trees on M.7 EMLA had relatively larger TCA than M.26 EMLA and B.9. Trees on B.9

Table 4. Trunk cross-sectional area (TCA), number of branch per limb, terminal shoot length, and leaf nitrogen concentration of 'BC-2 Fuji' apple trees in 1998 and 1999 as influenced by fertigation.

Fertigation[z]	TCA (cm²)	No. Branch	Terminal shoot length (cm)	Leaf N (%·dwt)
1998				
Low N	24.6 bc[y]	3.4 b	41.3 c	2.2 b
Medium N	27.2 a	3.5 ab	41.6 bc	2.3 ab
High N	27.0 ab	3.4 b	43.1 ab	2.5 a
Medium N + K	25.3 abc	4.1 a	41.4 bc	2.4 a
High N + K	24.3 c	3.3 b	44.2 a	2.5 a
1999				
Low N	33.7 b	5.8 a	27.2 c	1.9 c
Medium N	35.9 ab	5.1 a	32.2 ab	2.2 b
Hign N	37.3 a	5.5 a	34.3 a	2.4 a
Medium N + K	34.8 ab	5.3 a	30.0 bc	2.2 b
High N + K	34.7 ab	5.7 a	32.2 ab	2.4 a

[z]Fertigation treatment: Low N, 22.4 kg N/ha; Medium N, 89.7 kg N/ha; High N, 156.9 kg N/ha; Medium N + K, 89.7 kg N/ha plus 78.5 kg K/ha; High N + K. 156.7 kg N/ha plus 78.5 kg K/ha.
[y]Mean separation within columns by LSD at $\partial \leq 0.05$ ºn = 40º.

Table 5. Spur characteristics of 'BC-2 Fuji' apple trees in 1998 and 1999 as influenced by fertigation.

	Fruit Spur with bourse shoot			Fruit Spur without bourse shoot		Non-flowering spur	
Fertigation[z]	Density (No./m)	Diameter (mm)	Bourse shoot length (cm)	Density (No./m)	Diameter (mm)	Density (No./m)	Diameter (mm)
1998							
Low N	7.3 a[y]	7.2b	13.6 a	3.1 a	6.5 a	9.1 a	3.4 a
Medium N	7.5 a	7.4 ab	15.9 a	3.4 a	6.4 a	9.4 a	3.5 a
High N	6.2 a	7.4 ab	14.1 a	2.7 a	6.4 a	9.0 a	3.5 a
Medium N+K	7.6 a	7.4 ab	14.7 a	3.7 a	6.3 a	8.8 a	3.4 a
High N+K	6.7 a	7.5 a	16.1 a	2.9 a	6.6 a	8.1 a	3.4 a
1999							
Low N	0.7 b	6.9 b	10.5 b	0.6 b	6.5 a	14.4 a	3.9 a
Medium N	2.5 a	7.7 a	14.4 ab	1.8 a	6.6 a	11.8 bc	3.9 a
High N	2.3 a	7.6 a	15.1 a	1.3 ab	6.5 a	11.2 c	4.0 a
Medium N+K	2.6 a	7.8 a	14.9 ab	1.2 ab	6.6 a	12.4 b	3.8 a
High N+K	1.6 ab	7.7 a	13.0 ab	1.3 ab	6.9 a	11.0 c	4.1 a

[z]Fertigation treatments: See Table 4.
[y]Mean separation within columns by LSD at $a \leq 0.05$ (n = 40).

had the smallest TCA across 30 sites in North America (24).

Barritt et al. (4) found that the size-controlling ability of O.3 rootstock with 'Delicious' and 'Golden Delicious' scions was between M.9 and M.26 EMLA rootstocks. Also, Hampson et al. (17) reported that TCA of 'Macspur McIntosh' on O.3 rootstock was smaller than the TCA of trees on M.26 EMLA and M.7 EMLA. However, 'Jonagold' and 'Rome' apple trees on O.3 rootstock were similar in tree height and TCA to trees on M.9 EMLA (25). In our experiment, 'BC-2 Fuji' trees on O.3 had significantly smaller TCA than those on M.7 EMLA and M.26 EMLA but had significantly greater TCA than those on M.9 rootstocks. Therefore, TCA of 'BC-2 Fuji' on O.3 in relation to those on M.26 EMLA and M.9 is similar to those of 'Delicious' and 'Golden Delicious' as reported by Barritt et al. (4). However, in our experiment, the number of branches and side shoots and lengths of terminal shoots and limbs of trees on O.3 were often statistically similar to those on M.9 rootstock (Table 1), which is consistent with the tree height results for 'Jonagold' and 'Rome' (25).

Spur development: Spur density, spur diameter, and length of bourse shoots of 'BC-2 Fuji' apple trees were affected by rootstock (Table 2). Trees on O.3 and M.9 had significantly higher density of fruit spurs with bourse shoot than did those on other rootstocks in 1998. Trees on M.7 EMLA rootstock had significantly lower density of fruit spurs with bourse shoot than those on O.3 in both years. Diameter of fruit spur with bourse shoot on B.9 rootstock was significantly smaller than those on all rootstock in 1999 and than those on M.9, M.26 EMLA, and M.7 EMLA in 1998. Length of bourse shoot of trees on B.9 rootstock was significantly shorter than those on M.7 EMLA in 1998 and than those all rootstocks in 1999. Trees on M.7 EMLA had significantly larger fruit spur with bourse shoot diameter and longer bourse shoots than those on B.9 in 1998 and 1999. Trees on B.9 had significantly higher density of fruit spurs without bourse shoot than those on all rootstocks in 1998 and than those on M.9 or M.7 EMLA in 1999. In general, the presence of a more fruit spurs (with or without bourse shoots) in the trees on dwarfing rootstocks is because these trees are more precocious than those on M.7 EMLA (7).

Hirst and Ferree (18) reported that trees on rootstocks with longer shoots generally had lower spur density in 'Starkspur Supreme Delicious', although spur density of trees on M.26 EMLA was slightly higher than those of trees on B.9 or M.7 EMLA

Table 6. Mixed-bud development of 'BC-2 Fuji' apple trees on March 27, 1999 and on March 24, 2000 as influenced by fertigation.

	Stage 0[z]		Stage 1		Stage 2		PAMB[w]
Fertigation[y]	(%)	Diameter (mm)	(%)	Diameter (mm)	(%)	Diameter (mm)	(%)
1999							
Low N	34.8 a[x]	3.31 a	57.5 c	4.28 a	7.7 a	2.78 a	65.2 b
Medium N	26.0 ab	3.21 a	66.5 ab	4.43 a	7.5 a	2.96 a	74.0 ab
High N	25.5 ab	3.48 a	58.0 bc	4.49 a	13.5 a	3.98 a	71.5 ab
Medium N + K	20.6 b	3.28 a	69.8 a	4.27 a	9.6 a	3.24 a	79.4 a
High N + K	28.3 ab	3.35 a	61.5 abc	4.39 a	10.2 a	3.61 a	71.7 ab
2000							
Low N	12.7 a	4.21 a	81.5 a	5.01 b	5.8 b	5.00 b	87.3 a
Medium N	18.1 a	4.21 a	73.7 ab	5.18 ab	8.2 ab	5.18 ab	81.9 a
High N	16.0 a	4.29 a	72.3 b	5.20 a	11.7 a	5.21 a	84.0 a
Medium N + K	13.3 a	4.22 a	74.4 ab	5.18 ab	12.3 a	5.18 ab	86.7 a
High N + K	12.9 a	4.25 a	77.7 ab	5.19 ab	10.4 ab	5.19 ab	88.1 a

[z]Stage of mixed-buds: see Table 3.
[y]Fertigation treatment: see Table 4.
[x]Mean separation within columns by LSD at $\partial \leq 0.05$ (n = 40).
[w]PAMB: see Table 3.

over six years in Wooster, Ohio. Their results generally agree with densities of the fruit spurs with or without bourse shoot in our study. However, trees on dwarfing rootstocks had lower density of non-flowering spurs than those on vigorous rootstocks (Table 2).

Mixed-bud development: Rootstock affected the time of scion mixed-bud break (Table 3). The percentage of advanced mixed-buds (mixed-buds that were more advanced than stage 0) in the trees on M.7 EMLA was less than those in trees on B.9 and O.3 in both years (Table 3), indicating that these trees break mixed-buds later. The diameter of mixed-buds that were dormant (stage 0) was unaffected by rootstock. The diameters of mixed-buds that were at stages 1 or 2 were inconsistently affected by rootstock. Root temperature (5) and over all hormonal balances, particularly cytokinin (6, 19), gibberellins (21), and ABA (Lee and Fallahi, unpublished data) contribute to chilling requirements and, consequently, to the time of bud break in apples (8), pears (31), and peaches (33). The factors involved in the time of bud break, particularly in the size-controlling rootstocks, deserve further investigation.

Fertigation Effects

Tree and limb growth: Nutrient treatments affected tree and terminal shoot growth of 'BC-2 Fuji' (Table 4). TCA of trees receiving low N tended to be smaller than those with medium or high N treatments. Terminal growth of 'BC-2 Fuji' apple trees tended to increase as the amount of N applied increased. In most cases, the addition of K to medium or high N treatments did not affect any of the measured vegetative growth components in either year (Table 4). Lack of a response by addition of K is due to the fact that K was not absorbed by any tissue (7). Lack of K absorption could have been due to NH_4^+ - K^+ ions competition at the site of absorption.

Spur development: Microsprinkler fertigation of N with or without K did not affect densities of fruit spurs with or without bourse shoot or non-flowering spurs in 1998 (Table 5). In 1999, trees receiving low N treatment had lower densities of fruit spurs with and without bourse shoot, but a higher density of non-flowering spurs than trees with medium N. Diameter of fruit spur with bourse shoot of the trees receiving medium N or high N treatment was significantly higher than low N treatment in 1999. Non-flowering spur diameter was not affected by fertigation treatments.

Mixed-bud development: The effects of fertigation on mixed-bud development were inconsistent in both years (Table 6). Rates of N did not affect percentage of advanced mix-buds in either year (Table 6).

Over all, trees receiving low N had lower yield (7), but better fruit color than trees with medium N (data not shown). On the other hand, fertigation with high N or added K did not increase yield but reduced fruit red color and other quality attributes. Therefore, under the conditions of this study, the application of a rate of N between 22.4 kg·ha^{-1} and 89.7 kg·ha^{-1} seems to be sufficient for optimum yield and fruit color, including tree growth components in 'BC-2 Fuji'.

Conclusions

Rootstock strongly influenced vegetative growth and mixed-bud development of 'BC-2 Fuji' apple trees. Among the rootstocks tested, Trees on M.7 EMLA had the largest TCA and longest limbs and terminal shoots, and trees on B.9 had the smallest TCA and the shortest limbs and terminal shoots than those on other rootstocks. Vigorous rootstocks generally had higher non-flowering spur density than dwarfing rootstocks. Fertigation of 22.4 kg N/ha resulted in reduced length of current terminal growth probably due to lower leaf N concentrations. Under the conditions of this study, application of between 22.4 and 89.7 kg N/ha should provide optimum tree growth, as these rates of N fertigation resulted in optimum yield and fruit quality (data not shown). Added K did not affect tree growth.

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Call for Wilder Medal Nominations

The Wilder Medal Committee of the American Pomological Society (APS) invites nominations for the 2002 Wilder Silver Medal Award. The Wilder Medal was established in 1873 in honor of Marshall P. Wilder, the founder and first President of the Society.

The Wilder Medal is conferred on individuals or organizations which have rendered outstanding service to horticulture in the area of pomology. Special consideration is given to work relating to the origination and introduction of meritorious fruit cultivars. Individuals associated with either commercial concerns or professional organizations will be considered if their introductions are truly superior and have been widely planted.

Significant contributions to the science and practice of pomology other than through fruit breeding will also be considered. Such contributions may relate to any important area of fruit production such as rootstock development and evaluation, anatomical and morphological studies, or noteworthy publications in any of the above subjects.

To obtain nomination guidelines, contact committee chairperson, Desmond R. Layne, Dept. of Horticulture, Box 340375, Clemson University, Clemson, SC 29634-0375; phone: 864-656-4960; fax: 864-656-4960; e-mail: dlayne@clemson.edu. Nominations must be submitted by **1 May 2002.**