

Table 1. Flower characteristics of 'Honeycrisp' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>y</sup>	Flower clusters spring 2015 (no/tree)		Bloom rating spring 2016 <sup>w</sup> (0-5)		Bloom rating spring 2017 (0-5)	
B.10	36.1	abc	2.8	a-d	3.7	abc
G.11	4.4	de	1.6	cd	2.1	bc
G.202	3.0	e	2.4	a-d	3.5	abc
G.214	58.7	a	3.5	abc	1.8	c
G.30	25.4	b-e	2.7	a-d	1.6	c
G.41	1.5	e	1.4	cd	3.7	abc
G.935	29.1	b-e	4.3	a	1.6	c
G.969	32.7	a-d	3.5	abc	2.3	abc
<b>M.26 EMLA<sup>x</sup></b>	<b>6.4</b>	<b>de</b>	<b>3.8</b>	<b>ab</b>	<b>1.8</b>	<b>c</b>
M.7	3.8	e	1.2	d	3.6	abc
<b>M.9 T337</b>	<b>19.2</b>	<b>b-e</b>	<b>2.7</b>	<b>a-d</b>	<b>3.6</b>	<b>abc</b>
MM.106	8.8	cde	1.8	bcd	3.5	abc
V.5	33.9	a-d	1.5	cd	4.4	a
V.6	39.3	ab	2.1	bcd	4.2	ab
V.7	44.3	ab	2.8	a-d	3.1	abc
Significance <sup>y</sup>	***		***		***	
P Value <sup>z</sup>	<0.0001		<0.0001		<0.0001	

<sup>y</sup> Rootstocks ranked in alphabetical order.

<sup>w</sup> Ratings were done at full bloom using a scale of 0 to 5 where: 0 = no flowering; 1=very few flowers; 2 = light flowering; 3=moderate flowing; 4= heaving flowering; 5 = very heavy flowering.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 2. Growth of 'Honeycrisp' trees, as indicated by trunk cross-sectional area, from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>v</sup>	Spring 2014 (cm <sup>2</sup> )	Fall 2014 (cm <sup>2</sup> )	Fall 2015 (cm <sup>2</sup> )	Fall 2016 (cm <sup>2</sup> )	Fall 2017 (cm <sup>2</sup> )	Fall 2018 (cm <sup>2</sup> )
V.5	2.2 a	2.7 a	5.9 a	8.8 a	12.6 a	18.6 a
V.7	2.1 a	2.6 ab	6.0 a	8.7 a	12.4 a	18.3 ab
V.6	2.1 a	2.6 ab	5.8 ab	8.3 ab	12.0 ab	18.3 ab
G.30	1.5 b	2.2 abc	5.4 ab	7.7 ab	11.6 ab	18.1 ab
B.10	2.1 a	2.2 a-d	4.6 bc	6.7 bc	9.6 bc	15.8 abc
MM.106	1.4 bc	2.0 cde	4.6 bc	6.7 bc	9.0 c	13.7 bcd
G.214	1.6 b	2.1 bcd	4.3 cd	6.0 cd	9.0 c	13.4 cd
M.7	1.5 b	1.8 cde	4.1 cde	5.7 cde	7.8 cde	12.7 cde
<b>M.26 EMLA<sup>x</sup></b>	<b>1.4 bc</b>	<b>1.8 cde</b>	<b>3.9 c-f</b>	<b>5.3 c-f</b>	<b>8.1 cd</b>	<b>12.6 cde</b>
G.969	1.4 bc	1.6 efg	3.8 c-f	5.2 c-f	7.4 cde	10.9 def
<b>M.9 T337</b>	<b>1.4 bc</b>	<b>1.6 efg</b>	<b>3.2 d-g</b>	<b>4.2 efg</b>	<b>6.1 def</b>	<b>9.1 efg</b>
G.41	1.1 cd	1.2 fg	2.8 fg	4.1 efg	6.0 def	9.0 efg
G.11	1.0 d	1.2 g	3.0 efg	3.9 fg	5.6 ef	8.2 fg
G.935	1.4 bc	1.7 def	3.5 c-g	4.3 d-g	5.4 ef	7.5 fg
G.202	0.8 d	1.2 g	2.5 g	3.2 g	4.3 f	6.2 g
Significance <sup>y</sup>	***	***	***	***	***	***
P Value <sup>z</sup>	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

<sup>v</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 3. Survival of 'Honeycrisp' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>w</sup>	Fall 2014 (%)	Fall 2015 (%)	Fall 2016 (%)	Fall 2017 (%)	Fall 2018 (%)
B.10	100	100	100	100	100
G.11	100	100	100	100	100
G.202	100	100	100	100	100
G.214	100	100	100	100	100
G.30	100	100	100	100	100
G.41	80	80	80	80	80
G.935	90	90	90	90	90
G.969	100	100	100	100	100
<b>M.26 EMLA<sup>x</sup></b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	100
M.7	100	100	100	100	100
<b>M.9 T337</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	100
MM.106	100	100	100	90	90
V.5	100	100	100	100	100
V.6	100	100	100	100	100
V.7	88	88	88	88	87.5
Significance <sup>y</sup>	ns	ns	ns	ns	ns
P Value <sup>z</sup>	0.1484	0.1484	0.1484	0.2740	0.2740

<sup>w</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to Tukey-Kramer's test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 4. Rootstock suckers from 'Honeycrisp' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>w</sup>	Fall 2015 (no)	Fall 2016 (no)	Fall 2017 (no)	Fall 2018 (no)	
B.10	0	0	b	0	0.0 b
G.11	0	0	b	0	0.0 b
G.202	0	0	b	0	0.0 b
G.214	0	0	b	1	1.4 b
G.30	0	0	b	0	0.1 b
G.41	0	0	b	0	0.1 b
G.935	0	0	b	0	0.0 b
G.969	0	0	b	0	0.0 b
<b>M.26 EMLA<sup>x</sup></b>	<b>0</b>	<b>0</b>	<b>b</b>	<b>0</b>	0.0 b
M.7	0	2	a	1	5.0 a
<b>M.9 T337</b>	<b>0</b>	<b>0</b>	<b>b</b>	<b>0</b>	0.1 b
MM.106	0	0	b	0	0.0 b
V.5	0	0	b	0	0.1 b
V.6	0	0	b	0	0.0 b
V.7	0	0	b	0	0.1 b
Significance <sup>y</sup>	ns	***	ns	***	
P Value <sup>z</sup>	.	<0.0001	0.1715	<0.0001	

<sup>w</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to Tukey-Kramer's test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 5.1. Fruiting characteristics of 'Honeycrisp' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>u</sup>	Total fruit yield 2015 (kg/tree) <sup>v</sup>	Total fruit yield 2016 (kg/tree)	Total fruit yield 2017 (kg/tree)	Total fruit yield 2018 (kg/tree)	Cumulative yield 2015-2018 (kg/tree)	Cumulative yield efficiency 2015-2018 (kg/tree/cm <sup>2</sup> TCSA <sup>w</sup> 2018)	Percent dropped fruit by weight 2017 (%)	Percent dropped fruit by weight 2018 (%)
G.935	nd	5.1 a	2.6 d	6.2 ab	13.9 abc	1.88 a	6.8 abc	60.2
G.11	nd	1.8 bcd	4.0 cd	5.7 abc	11.6 abcde	1.42 ab	4.4 abc	52.1
G.202	nd	1.5 d	3.7 cd	3.3 abcd	8.5 cde	1.38 ab	6.9 abc	63.5
G.969	nd	4.3 ab	4.3 cd	5.9 abc	14.4 ab	1.37 ab	3.7 bc	40.4
<b>M.9 T337</b>	<b>nd</b>	<b>3.1 a-d</b>	<b>4.9 bcd</b>	3.6 abcd	11.6 <b>abcde</b>	1.32 <b>bc</b>	<b>10.9 a</b>	69.0
G.214	nd	4.1 abc	4.2 cd	7.9 a	16.2 a	1.26 bc	3.0 c	37.1
G.41	nd	1.6 cd	5.7 a-d	3.3 abcd	10.6 abcde	1.17 bcd	6.8 abc	50.3
B.10	nd	2.0 bcd	8.5 ab	4.2 abcd	14.7 ab	1.00 bcde	5.8 abc	49.2
V.7	nd	3.7 a-d	6.5 a-d	5.2 abcd	15.3 ab	0.89 bcde	6.7 abc	50.3
V.5	nd	2.3 bcd	9.4 a	2.1 bcd	13.8 abc	0.81 cde	6.8 abc	42.3
<b>M.26 EMLA<sup>x</sup></b>	<b>nd</b>	<b>2.9 a-d</b>	<b>2.9 d</b>	3.8 abcd	9.5 <b>bcde</b>	0.80 <b>cde</b>	<b>4.3 abc</b>	52.7
V.6	nd	2.9 a-d	6.8 abc	3.4 abcd	13.1 abcd	0.72 cde	7.7 abc	49.0
G.30	nd	3.3 a-d	3.7 cd	4.5 abcd	11.5 abcde	0.66 bc	4.0 abc	38.1
MM.106	nd	1.6 cd	5.4 a-d	1.5 bcd	7.8 de	0.61 de	7.6 abc	49.9
M.7	nd	1.2 d	5.2 bcd	0.5 d	6.9 e	0.55 e	10.0 ab	54.9
Significance <sup>y</sup>	.	***	***	***	***	***	**	ns
P Value <sup>z</sup>	nd	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0039	0.3243

<sup>u</sup> Rootstocks ranked in alphabetical order.

<sup>v</sup> No data due to spring frost damage.

<sup>w</sup> Trunk cross-sectional area.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 5.2. Fruiting characteristics of 'Honeycrisp' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>u</sup>	Total number of fruit 2015 (no) <sup>v</sup>	Total number of fruit 2016 (no)	Total number of fruit 2017 (no)	Total number of fruit 2018 (no)	Average fruit weight 2016 (g)	Average fruit weight 2017 (g)	Average fruit weight 2018 (g)	Crop load at harvest 2016 (no/cm <sup>2</sup> TCSA <sup>w</sup> )	Crop load at harvest 2017 (no/cm <sup>2</sup> TCSA)	Crop load at harvest 2018 (no/cm <sup>2</sup> TCSA)						
B.10	nd	8.8	bc	43.0	ab	13.1	abcd	290	201	300.8	1.4	c	4.6	abc	0.9	
G.11	nd	6.8	c	22.2	bc	17.3	abc	330	180	324.2	1.8	bc	4.2	abc	2.1	ab
G.202	nd	7.0	c	23.0	bc	10.4	abcd	243	162	356.8	1.9	bc	6.4	a	1.5	bcde
G.214	nd	15.9	bc	20.0	c	24.5	a	264	211	421.8	2.9	bc	2.2	bc	2.0	abcd
G.30	nd	13.2	bc	17.9	c	13.2	abcd	280	210	349.8	1.6	bc	1.8	c	0.7	cdef
G.41	nd	5.8	c	29.1	abc	10.4	abcd	310	201	299.8	1.3	c	5.1	ab	1.1	bcdef
G.935	nd	28.9	a	13.4	c	23.2	a	185	200	271.8	6.6	a	2.6	bc	3.1	a
G.969	nd	19.7	ab	23.9	bc	21.1	ab	250	189	282.5	3.9	b	3.3	bc	2.1	abc
<b>M.26 EMLA<sup>x</sup></b>	<b>nd</b>	<b>12.7</b>	<b>bc</b>	<b>14.9</b>	<b>c</b>	11.7	abcd	<b>254</b>	<b>195</b>	315.9	<b>2.6</b>	<b>bc</b>	<b>1.7</b>	<b>c</b>	1.0	<b>bcdef</b>
M.7	nd	4.0	c	28.9	abc	2.0	d	330	183	212.5	0.6	c	3.8	abc	0.2	f
<b>M.9 T337</b>	<b>nd</b>	<b>11.4</b>	<b>bc</b>	<b>28.2</b>	<b>abc</b>	11.8	abcd	<b>354</b>	<b>176</b>	309.5	<b>2.7</b>	<b>bc</b>	<b>4.7</b>	<b>abc</b>	1.3	<b>bcdef</b>
MM.106	nd	6.5	c	32.0	abc	5.2	cd	285	169	292.8	1.0	c	3.7	abc	0.4	ef
V.5	nd	8.0	bc	47.8	a	7.4	bcd	303	200	276.2	1.0	c	3.9	abc	0.4	ef
V.6	nd	10.6	bc	34.9	abc	11.3	abcd	272	198	283.7	1.4	c	2.9	bc	0.6	def
V.7	nd	14.0	bc	34.0	abc	17.0	abcd	277	191	298.7	1.7	bc	2.9	bc	1.0	bcdef
Significance <sup>y</sup>	.	***	***	***		ns	ns	ns		***	***	***		***		***
P Value <sup>z</sup>	nd	<0.0001	<0.0001	<0.0001		0.2292	0.1533	0.2131		<0.0001	<0.0001	<0.0001		<0.0001		<0.0001

<sup>u</sup> Rootstocks ranked in alphabetical order.

<sup>v</sup> No data due to spring frost damage.

<sup>w</sup> Trunk cross-sectional area.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 6. Average SPAD and leaf area index (LAI) readings from 'Honeycrisp' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>v</sup>	Average SPAD reading 2017 <sup>u</sup>		Average LAI reading 2017 <sup>v</sup>		Average SPAD reading 2018 <sup>u</sup>	
B.10	47.0	abc	1.6	abc	46.7	a
G.11	48.8	a	1.2	c	47.6	a
G.202	44.3	bc	1.3	bc	44.7	b
G.214	46.5	abc	1.6	abc	47.7	a
G.30	47.1	abc	1.7	abc	46.8	a
G.41	47.0	abc	1.6	abc	47.2	a
G.935	45.8	abc	1.3	abc	47.3	a
G.969	47.5	ab	1.5	abc	48.1	a
<b>M.26 EMLA<sup>x</sup></b>	<b>46.4</b>	<b>abc</b>	<b>1.6</b>	<b>abc</b>	48.0	<b>a</b>
M.7	47.2	ab	1.3	abc	46.9	a
<b>M.9 T337</b>	<b>48.0</b>	<b>ab</b>	<b>1.4</b>	<b>abc</b>	46.2	<b>a</b>
MM.106	43.4	c	1.4	abc	45.9	a
V.5	47.1	abc	1.9	ab	47.0	a
V.6	45.5	abc	1.7	abc	46.5	a
V.7	45.8	abc	2.0	a	47.2	a
Significance <sup>y</sup>	***		**		*	
P Value <sup>z</sup>	0.0002		0.0024		0.0178	

<sup>u</sup> Assessment of the chlorophyll status of leaves.

<sup>v</sup> Measurement of light penetration into the canopy.

<sup>w</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P=0.10, P=0.05, and P=0.01 respectively.

Table 7. Flower characteristics of 'Aztec Fuji' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>v</sup>	Flower clusters spring 2015 (no)		Bloom rating spring 2016 <sup>w</sup> (0-5)		Bloom rating Spring 2017 (0-5)
B.10	35.8	abc	3.4	abc	2.9
G.11	4.9	c	2.4	cd	1.8
G.202	15.7	abc	3.6	abc	3.3
G.214	46.9	ab	4.4	ab	3.1
G.30	9.0	bc	3.1	abc	2.5
G.41	8.9	bc	2.7	bcd	2.8
G.935	11.9	bc	4.5	a	2.9
<b>M.26 EMLA<sup>x</sup></b>	<b>0.7</b>	<b>c</b>	<b>1.1</b>	<b>d</b>	<b>1.8</b>
<b>M.9 T337</b>	<b>1.5</b>	<b>c</b>	<b>3.4</b>	<b>abc</b>	<b>2.5</b>
V.5	52.6	a	3.8	abc	2.3
V.6	45.7	ab	3.0	abc	2.0
V.7	36.7	abc	3.4	abc	2.3
Significance <sup>y</sup>	***		***		ns
P Value <sup>z</sup>	<0.0001		<0.0001		0.3607

<sup>v</sup> Rootstocks ranked in alphabetical order.

<sup>w</sup> Ratings were done at full bloom using a scale of 0 to 5 where: 0 = no flowering; 1=very few flowers; 2 = light flowering; 3=moderate flowering; 4= heaving flowering; 5 = very heavy flowering.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.



Table 8. Growth of 'Aztec Fuji' trees, as indicated by trunk cross-sectional area, from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>w</sup>	Spring 2014		Fall 2014		Fall 2015		Fall 2016		Fall 2017		Fall 2018	
	(cm <sup>2</sup> )		(cm <sup>2</sup> )		(cm <sup>2</sup> )		(cm <sup>2</sup> )		(cm <sup>2</sup> )		(cm <sup>2</sup> )	
G.30	2.3	c	2.7	bcd	7.3	a	11.5	a	19.6	a	30.0	a
V.7	2.9	ab	3.2	ab	7.3	a	10.4	ab	16.7	ab	24.5	abc
<b>M.26 EMLA<sup>x</sup></b>	<b>1.3</b>	<b>de</b>	<b>1.6</b>	<b>f</b>	<b>4.3</b>	<b>de</b>	<b>7.4</b>	<b>c-f</b>	<b>14.7</b>	<b>bcd</b>	<b>23.9</b>	<b>abc</b>
B.10	2.3	c	2.4	cd	5.5	bcd	8.6	b-e	15.2	abc	23.4	abc
G.41	2.2	c	2.4	cd	6.1	abc	8.8	a-d	14.7	bcd	23.4	abc
V.6	2.4	bc	2.9	abc	6.4	ab	9.4	abc	15.2	abc	23.2	abc
V.5	3.1	a	3.3	a	6.6	ab	9.1	a-d	14.3	b-e	22.2	bcd
G.11	1.4	de	1.7	ef	4.7	cde	7.0	c-f	11.0	c-f	17.0	cde
<b>M.9 T337</b>	<b>1.6</b>	<b>d</b>	<b>1.8</b>	<b>ef</b>	<b>4.5</b>	<b>cde</b>	<b>6.5</b>	<b>def</b>	<b>10.4</b>	<b>def</b>	<b>15.5</b>	<b>de</b>
G.214	2.1	c	2.2	de	4.4	cde	5.9	ef	9.4	ef	15.5	de
G.935	2.1	c	2.2	de	4.5	cde	5.9	ef	8.6	f	13.1	e
G.202	1.0	e	1.2	f	3.1	e	4.4	f	6.4	f	10.9	e
Significance <sup>y</sup>	***		***		***		***		***		***	
P Value <sup>z</sup>	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	

<sup>w</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 9. Survival of 'Aztec Fuji' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>w</sup>	Fall 2014		Fall 2015		Fall 2016		Fall 2017		Fall 2018	
	(%)		(%)		(%)		(%)		(%)	
B.10	100	a	100	a	100	a	100	a	100	a
G.11	100	a	100	a	100	a	100	a	100	a
G.202	70	b	70	b	70	b	60	b	60	b
G.214	90	ab	90	ab	90	ab	90	a	90	a
G.30	100	a	100	a	100	a	100	a	100	a
G.41	100	a	100	a	100	a	100	a	100	a
G.935	100	a	100	a	100	a	100	a	100	a
<b>M.26 EMLA<sup>x</sup></b>	<b>100</b>	a	<b>100</b>	a	<b>100</b>	a	100	a	100	a
<b>M.9 T337</b>	<b>100</b>	a	<b>100</b>	a	<b>100</b>	a	100	a	100	a
V.5	100	a	100	a	100	a	100	a	100	a
V.6	100	a	100	a	100	a	100	a	100	a
V.7	100	a	100	a	100	a	100	a	100	a
Significance <sup>y</sup>	**		**		**		***		***	
P Value <sup>z</sup>	0.0027		0.0027		0.0027		<0.0001		<0.0001	

<sup>w</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 10. Rootstock suckers from 'Aztec Fuji' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>w</sup>	Fall 2015 (no)	Fall 2016 (no)	Fall 2017 (no)	Fall 2018 (no)	
B.10	0	0	0.2	0.4	b
G.11	0	0	0	0.0	b
G.202	0	0	0	0.0	b
G.214	0	0	0	0.6	b
G.30	0	0.3	0.6	1.5	ab
G.41	0	0.2	0.7	0.7	b
G.935	0	0	0	0.3	b
<b>M.26 EMLA<sup>x</sup></b>	<b>0</b>	<b>0</b>	<b>0</b>	0.0	<b>b</b>
<b>M.9 T337</b>	<b>0</b>	<b>0</b>	<b>0.2</b>	1.0	<b>b</b>
V.5	0	0.1	0	1.3	ab
V.6	0	0.2	0.2	3.9	a
V.7	0	0.2	0.4	2.1	ab
Significance <sup>y</sup>	ns	ns	ns	***	
P Value <sup>z</sup>	.	0.391	0.4514	0.0006	

<sup>w</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P=0.10, P=0.05, and P=0.01 respectively.

Table 11.1. Fruiting characteristics of 'Aztec Fuji' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>u</sup>	Total fruit yield 2015 (kg/tree) <sup>v</sup>	Total fruit yield 2016 (kg/tree)	Total fruit yield 2017 (kg/tree)	Total fruit yield 2018 (kg/tree)	Cumulative yield 2015-2018 (kg/tree)	Rank	Cumulative yield efficiency 2015-2018 (kg/tree/cm <sup>2</sup> TCSA <sup>w</sup> 2017)	Rank	Percent dropped fruit by weight 2018 (%)	
B.10	nd	3.9 ab	8.4 a	7.4 ab	19.7 ab	5	0.82	ab	11	0.7
G.11	nd	3.0 bcd	4.5 a	10.3 ab	17.8 ab	8	1.06	ab	5	0.7
G.202	nd	1.3 cd	4.8 a	5.3 ab	10.6 b	12	1.19	ab	2	1.6
G.214	nd	3.9 abc	5.1 a	6.1 ab	15.1 ab	9	1.01	ab	6	0.5
G.30	nd	5.4 a	9.3 a	9.9 ab	24.6 a	1	0.85	ab	9	1.8
G.41	nd	3.7 abc	10.0 a	10.4 ab	24.1 ab	2	1.06	ab	4	1.1
G.935	nd	5.1 ab	5.4 a	4.0 b	14.5 ab	10	1.11	ab	3	10.4
<b>M.26 EMLA<sup>x</sup></b>	<b>nd</b>	<b>0.9 d</b>	<b>3.8 a</b>	6.8 ab	11.5 b	11	0.51	b	12	0.4
<b>M.9 T337</b>	<b>nd</b>	<b>3.9 ab</b>	<b>4.9 a</b>	11.3 ab	20.1 ab	4	1.27	a	1	1.0
V.5	nd	4.2 ab	3.9 a	11.5 a	19.6 ab	6	0.88	ab	8	1.7
V.6	nd	3.8 abc	4.8 a	9.9 ab	18.5 ab	7	0.84	ab	10	0.2
V.7	nd	5.6 a	5.0 a	13.0 a	23.6 ab	3	1.00	ab	7	1.0
Significance <sup>y</sup>	.	***	**	**	**		*			ns
P Value <sup>z</sup>	nd	<0.0001	0.0054		0.002		0.015			0.0514

<sup>u</sup> Rootstocks ranked in alphabetical order.

<sup>v</sup> No data due to spring frost damage.

<sup>w</sup> Trunk cross-sectional area.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 11.2. Fruiting characteristics of 'Aztec Fuji' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>u</sup>	Total number of fruit 2015 (no) <sup>v</sup>	Total number of fruit 2016 (no)	Total number of fruit 2017 (no)	Total number of fruit 2018 (no)	Average fruit weight 2016 (g)	Average fruit weight 2017 (g)	Average fruit weight 2018 (g)	Crop load at harvest 2016 (no/cm <sup>2</sup> TCSA <sup>w</sup> )	Crop load at harvest 2017 (no/cm <sup>2</sup> TCSA)	Crop load at harvest 2018 (no/cm <sup>2</sup> TCSA)						
G.202	nd	8.9	de	41.9	30.7	ab	151	ab	111	178	a	2.2	cd	6.1	a	3.2
G.935	nd	43.1	a	33.3	21.0	b	118	b	140	198	a	7.6	a	3.8	ab	2.0
V.6	nd	23.0	bcd	29.7	48.2	ab	167	ab	157	211	a	2.6	bcd	2.0	b	2.2
V.7	nd	38.2	ab	30.3	61.2	a	149	ab	151	222	a	4.1	bc	1.7	b	2.6
V.5	nd	30.1	abc	25.2	51.1	ab	142	ab	182	225	a	3.5	bc	1.7	b	2.3
G.30	nd	33.7	abc	48.6	46.1	ab	162	ab	191	226	a	2.9	bcd	2.6	b	1.6
G.11	nd	18.7	cde	25.8	46.4	ab	174	a	159	231	a	2.7	bcd	2.4	b	2.8
<b>M.26 EMLA<sup>x</sup></b>	<b>nd</b>	<b>5.8</b>	<b>e</b>	<b>22.1</b>	28.9	ab	<b>191</b>	<b>a</b>	<b>153</b>	242	a	<b>0.8</b>	<b>d</b>	<b>1.5</b>	<b>b</b>	1.3
B.10	nd	24.7	bcd	46.7	34.0	ab	164	ab	178	247	a	3.1	bcd	3.0	ab	1.4
<b>M.9 T337</b>	<b>nd</b>	<b>25.7</b>	<b>bcd</b>	<b>27.5</b>	48.1	ab	<b>154</b>	<b>ab</b>	<b>169</b>	247	a	<b>3.9</b>	<b>bc</b>	<b>2.7</b>	<b>b</b>	3.0
G.41	nd	23.5	bcd	54.4	42.4	ab	156	ab	167	247	a	2.9	bcd	3.8	ab	1.9
G.214	nd	28.6	abc	32.6	25.3	b	133	ab	144	248	a	4.8	b	3.7	ab	1.8
Significance <sup>y</sup>	.	***	*	**	**	**	ns	*	*	***	***	***	***	***	*	*
P Value <sup>z</sup>	nd	<0.0001	0.0280	0.0041	0.0096	0.7464	0.0267	<0.0001	0.0001	0.0329						

<sup>u</sup> Rootstocks ranked in alphabetical order.

<sup>v</sup> No data due to spring frost damage.

<sup>w</sup> Trunk cross-sectional area.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*, indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.

Table 12. Average SPAD and leaf area index (LAI) readings from 'Aztec Fuji' trees from the NC-140 apple rootstock trial planted in 2014 at the University of Guelph Simcoe Research Station, Ontario. Trees trained to the tall spindle orchard system.

Rootstock <sup>w</sup>	Average SPAD reading 2017 <sup>u</sup>	Average LAI reading 2017 <sup>v</sup>	Average SPAD reading 2018 <sup>u</sup>	
B.10	47.9	ab	1.7	49.3
G.11	47.6	ab	1.6	48.4
G.202	40.7	c	1.4	47.9
G.214	45.7	abc	1.2	47.0
G.30	48.3	ab	1.7	47.9
G.41	48.9	a	1.6	50.4
G.935	41.1	c	1.8	48.2
<b>M.26 EMLA<sup>x</sup></b>	<b>49.2</b>	<b>a</b>	<b>1.9</b>	50.3
<b>M.9 T337</b>	<b>45.7</b>	<b>abc</b>	<b>1.3</b>	50.7
V.5	41.3	c	1.8	48.9
V.6	42.8	c	1.7	48.4
V.7	44.2	bc	1.9	49.3
Significance <sup>y</sup>	***	ns	*	
P Value <sup>z</sup>	<0.0001	0.0717	0.035	

<sup>u</sup> Assesment of the chlorophyll status of leaves.

<sup>v</sup> Measurement of light penetration into the canopy.

<sup>w</sup> Rootstocks ranked in alphabetical order.

<sup>x</sup> Standard rootstocks shown in bold.

<sup>y</sup> Mean values with the same letter within a given column are not significantly different according to the Tukey-Kramer test at P=0.05.

<sup>z</sup> ns, \*, \*\*, \*\*\*; indicates not significant, and significant differences at P= 0.10, P=0.05, and P=0.01 respectively.