APPLE (*Malus* x *domestica*)
Apple scab; *Venturia inaequalis*
Cedar apple rust; *Gymnosporangium juniperi-virginianae*
Flyspeck; *Zygophiala jamaicensis*
Fruit rots; *Botryosphaeria* sp.

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Disease susceptibility of 11 hard-cider apple cultivars in southeastern New York, 2006-2007.

Eleven European cider apple cultivars were planted in spring of 2003. All trees were propagated on M.9 rootstock (Nic.29 strain), and trees were trained as a slender spindle using conduit posts supported by a wire that connected the posts 6 ft above ground. Trees were planted 7 ft apart within rows in a randomized block design with six single-tree replications for each cultivar. Trees were evaluated for susceptibility to diseases in 2006 and 2007. In 2006, trees were maintained with standard insecticide and herbicide applications, but no fungicides were applied at any time during the year. Incidence of apple scab and cedar apple rust on leaves was evaluated during summer. All fruit (regardless of maturity) was harvested on 6 Sep 06, moved to cold storage, and then evaluated for fruit decays in mid-November. In 2007, trees were again maintained with standard insecticides and herbicides, but they also received the following fungicide sprays (expressed as rates/A): 21 Apr – Dithane 75DF 3 lb; 1 May – Penncozeb 75DF 3 lb plus Nova 40WSB 5 oz; 10 May – Dithane 75DF 3 lb plus Nova 40WSB 5 oz; 17 May (full bloom) – Dithane 75DF 3 lb plus Topsin M 70WSB 6 oz; 26 May (petal fall) — Dithane 75DF 3 lb plus Flint 50WDG 2 oz; 5 Jun – Dithane 75DF 3 lb plus Topsin M 70WDG 12 oz; 21 Jun – Flint 50WDG 2 oz; 7 Jul – Topsin M 70WDG 15 oz plus Captan 80WDG 36 oz; 21 Jul – Topsin M 70WDG 12 oz plus Captan 80WDG 36 oz; 11 Aug – Topsin M 70WDG 8 oz plus Captan 80WDG 24 oz. (All of these cider apple cultivars begin growth later in spring than conventional apple cultivars and bloom 10 to 15 days after other cultivars.) All of the sprays were applied with a Rears three-point-hitch airblast sprayer calibrated to apply 100 gal of spray solution per acre. The fungicide sprays provided excellent control of foliar diseases in 2007, and therefore we did not evaluate disease incidence on leaves. However, fruit were harvested for evaluation in 2007 at the time that the first mature fruit were noted on the ground. Harvest dates are shown in Table 2.

All of the apple cultivars were relatively resistant to apple scab infections on both leaves and fruit (Table 1). Unsprayed Jerseymac apples in a nearby plot had 40 percent of shoot leaves and 70 percent of fruitlets showing scab lesions on 13 Jun 06 (Rosenberger *et al.* 2007. Report 1:PF020. DOI:10.1094/PDMR01) whereas only one of the cider apple cultivars in this trial had more than 10 percent scab on fruit or leaves. Most cultivars were also relatively resistant to cedar apple rust infections on leaves. However, all of the cultivars except Binet Rouge had leaf spots on more than 14 percent of leaves. Leaf spotting was caused by both *Botryosphaeria obtusa* (frogeye leaf spot) and by rust infections that failed to develop because of host incompatibility reactions. We did not attempt to distinguish between the two. All of the cultivars were very susceptible to summer fruit decays caused by *Botryosphaeria* species (*B. obtusa* and *B. dothidea*). The cultivar Major was so susceptible to *Botryosphaeria* fruit decays that most fruit had already dropped from the tree by 7 Sep 06 and were not available for rating (Table 1). Several other cultivars also had only low numbers of fruit in 2006, but lack of fruit on those cultivars was caused by over-thinning rather than by fruit decays. Although 10 fungicide sprays were applied to these trees in 2007, we still failed to control *Botryosphaeria* fruit decays on the cultivar Major (Table 2). On Major, many decayed fruit again dropped from trees prior to harvest. Five other cultivars also had more than 15% of fruit with decay at harvest. An inch of rainfall between 16 and 21 Aug 07 probably removed much of the fungicide residue from the 11 Aug spray, but the high incidence of fruit decays following 10 fungicide applications was still unexpected. Fruit blemishes caused by scab and flyspeck are of little consequence for fruit that are used to make hard ciders. However, fruit decays caused by *Botryosphaeria* species can significantly depress yield on highly susceptible cultivars because severely affected fruit will drop from the tree prematurely. The high susceptibility to *Botryosphaeria* shown by some of these apple cultivars could limit their usefulness in regions where hot humid summers favor development of black rot and white rot fruit decays.

Table 1. Disease incidence in 2006 when no fungicides were applied to trees.

Cultivar	Mean no. fruit per trees	Apple scab (%) Terminal leaves[y]	Apple scab (%) Fruit	Cedar apple rust on leaves Severity [x] (scale of 0-3)	Cedar apple rust on leaves Incidence on leaves(%)	Leaves with leaf spot (%)	Fruit decays (%) Blk/white rot	Fruit decays (%) bitter rot
Binet Rouge	46	3.0 ab[w]	0.0 a[w]	<0.01 a[w]	0.4 a[w]	14 a[w]	25 ab[w]	2.3
Brown Snout	11	7.4 cd	6.5 b	0.09 bc	9.2 cd	35 d	14 a	0.0
Chisel Jersey	82	0.9 ab	1.1 ab	0.18 de	16.3 de	31 d	29 ab	0.8
Dabinette	70	1.3 ab	0.3 ab	0.17 de	14.0 cde	28 cd	34 ab	7.7
Ellis Bitter	38	11.8 d	19.3 c	0.11 cd	11.1 cd	26 bcd	51 bc	0.0
Harry Masters	40	8.6 cd	6.0 b	0.01 a	1.4 ab	18 ab	27ab	2.8
Madaille d'Or	61	1.2 ab	0.0 a	0.09 bc	8.4 c	21 abc	35 ab	0.0
Major	13	1.9 ab	0.0 a	0.01 a	0.5 a	35 d	77 bc	15.4
Michelin	62	0.6 a	2.4 ab	0.21 e	19.2 e	29 cd	41 ab	1.4
Sommerset Red Streak	28	5.2 bc	0.7 ab	0.03 ab	3.3 b	26 bcd	78 c	0.0
Tremlats Bitter	0	2.2 ab	n.d.	0.02 ab	2.2 ab	30 d	n.d.	n.d
P values		<0.001	<0.001	<0.001	<0.001	<0.001	0.049	0.825

[z] All available fruit were harvested from trees on 6 Sep 06 (Reps I - IV) and 7 Sep 06 (Reps V – VI) and moved to storage where fruit were held at 37° F until they could be rated 13 – 16 Nov 06.

[y] All leaves on 5 terminals per tree from 5 replicates were evaluated for the presence of each disease on 13 Jul 06. Total leaves ranged from 49 to 123 with a mean of 88 leaves per tree.

[x] All leaves were rated separately for both rust and leaf spot severity on a scale of 0 to 3 where 0 = no disease; 1= 1-5 lesions; 2 = 6 – 20 lesions and 3 = > 20 lesions per leaf.

[w] Numbers within columns followed by the same small letter do not differ significantly, Fisher's Protected LSD (P = 0.05). The angular transformation was used for statistical analysis of percentage data and the arithmetic means are reported.

Table 2. Disease incidence in 2007 when trees were protected with fungicides.

Cultivar	Harvest date	Mean no. fruit rated per tree [z]	Fruit with apple scab (%)	Fruit with flyspeck (%)	Fruit decays (%) Total rots	Fruit decays (%) Rots > 5 mm	Fruit decays (%) Rots 1-5 mm	Fruit decays (%) Rots <1 mm
Binet Rouge	13 Sep	50.0	0.0	13.8 de[y]	14.6 bc	3.0 bc	5.8 bcde	5.8 bcd
Brown Snout	7 Sep	50.0	1.0	9.0 cd	11.3 abc	9.0 d	2.0 abc	0.3 a
Chisel Jersey	27 Sep	50.0	0.0	18.3 e	34.0 d	5.7 cd	10.3 de	18.0 ef
Dabinette	13 Sep	58.3	0.0	16.7 de	49.8 e	26.5 e	14.2 e	9.1 de
Ellis Bitter	24 Aug	33.5	0.0	0.0 a	5.8 a	1.0 ab	2.0 ab	2.8 abc
Harry Masters	7 Sep	47.7	0.0	6.8 bc	20.1 c	12.1 d	6.0 cde	2.0 ab
Madaille d'Or	7 Sep	50.0	0.8	1.2 ab	10.8 abc	2.4 abc	2.4 abc	6.0 cd
Major	24 Aug	10.5	0.0	0.0 a	100.0 f	57.1 f	15.0 e	27.9 f
Michelin	13 Sep	44.0	0.0	21.4 e	18.3 bc	2.4 abc	5.4 bcd	10.6 d
Sommerset Red Streak	28 Aug	49.8	0.0	4.8 bc	15.8 bc	13.1 d	2.3 abc	0.4 a
Tremlats Bitter	24 Aug	48.7	0.0	1.7 ab	8.3 ab	0.0 a	0.3 a	7.9 d
P values			0.156	<0.001	<0.001	<0.001	<0.001	<0.001

[z] All fruit from each tree were rated (up to a maximum of 50 fruit per tree) for presence of disease. Rots were catagorized by size, the largest rot taking presidence for the category.

[y] Numbers within columns followed by the same small letter do not differ significantly, Fisher's Protected LSD (P = 0.05). The angular transformation was used for statistical analysis of percentage data and the arithmetic means are reported.