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West Virginia Peach and Nectarine Fruit and Vegetative Bud Injury and Crop Rating Resulting from -28°C January Temperature[1]

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Abstract

Seventy-one peach cultivars, twelve nectarine cultivars and one apricot cultivar growing in the W. Va. Univ. Experiment Farm cultivar test plantings were evaluated for vegetative and flower bud injury, blossoming, and crop production following a low temperature of -28°C occurring the morning of 22 January 1984. Cultivar ratings for vegetative bud injury ranged from the complete tree kill to a few terminals with dieback as a result of cold temperature. Cultivar bloom ratings ranged from zero to full crop potential. Crop ratings ranged from no crop to those approaching a need for thinning.

Introduction

Peach trees growing in the West Virginia Eastern Panhandle fruit area are not usually seriously injured by cold temperatures occurring during the winter months of December, January and February. When temperatures approach -24°C, serious bud and or wood injury may occur. It is well documented that cold injury to dormant peach wood and buds depends upon such factors as tree growth the previous season, tree vigor, preconditioning temperatures, rapidity of temperature drop, duration of the low temperature, stage of tree development, and rootstock (1, 2, 3, 4, 5, 6, 7). Conditions do vary. Factors that influence susceptibility vary from location to location. A low temperature of -23.3°C may cause less injury in Michigan and New York than a -17.8°C in Georgia and South Carolina.

Materials and Methods

The cold injury data presented was taken from two West Virginia University Experiment Farm's cultivar plantings consisting of one apricot, 12 nectarine and 71 peach cultivars. One cultivar planting was established in 1968 with 67 cultivars and a second, adjacent to the first, was established in 1973 with 47 cultivars. Five cultivars ('Blake,' 'Coronet,' 'Loring,' 'Sunhigh,' and 'Redhaven') were present in both plantings. Four trees for each cultivar were planted. Winter cold temperatures during 1967-1968, 1978-1979 and 1981-1982 caused some wood injury, as observed during pruning, and bark splitting of the trunk. At the time of the 1983-1984 cold temperature injury evaluations being reported, not all of the original cultivars were present and not all of the remaining cultivars had four trees present. Following each of the severe cold temperature periods of December 1983, and January, February and March of 1984, buds of 'Biscoe,' 'Blake,' 'Candor,' 'Glohaven,' 'Loring,' 'Sunhigh,' 'Redhaven' and 'Redskin,' were examined for injury and cut branches were placed in a growth chamber for several days for further evaluation of potential injury.

The fenced enclosure for recording the National Oceanic and Atmospheric Administration (NOAA) official climatological observations at the West Virginia University Experiment Farm, Kearneysville, W. Va. is located 335 meters (1100 feet) from the variety plantings. The climatological instruments are approximately 0.6 m (2 ft) lower in elevation of the highest location in the variety plantings and has good air movement toward lower land.

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Table 1. High, low and mean daily temperatures (degrees centigrade) for the lowest temperature cold durations for the months of December 1983 and January, February, March and April of 1984.

Date	High	Low	Mean	Monthly mean (departure)
22 December 1983	0.0°C	-7.2°C	-3.6°C	December -0.89° (-1.9)
23	3.9	-7.2	-1.6	
24	-2.2	-10.0	-6.1	
25	-10.0	-20.0	-15.0	
26	13.3	-18.3	15.8	
18 January 1984	1.1	-6.7	-2.8	January -3.51 (-3.5)
19	-2.2	-8.9	-5.5	
20	-4.4	-18.9	-11.7	
21	-6.1	-20.5	-13.3	
22	-8.9	-27.8	-18.3	
23	-3.9	-18.9	-11.4	
30	2.8	-5.6	-1.4	
31	2.8	-3.3	-0.3	
1 February 1984	0.0	-7.8	-3.9	February 3.5 (+2.4)
2	1.1	-9.4	-4.2	
3	6.1	-7.2	-0.6	
8 March 1984	5.0	-5.6	-0.3	March 2.2 (-3.4)
9	0.0	-9.4	-4.7	
10	-3.3	-13.3	-8.3	
11	1.7	-10.0	-4.2	
1 April 1984	9.4	-3.3	3.1	April 9.6 (-2.2)
10	12.8	-2.8	5.0	
11	14.4	-2.2	6.1	
12	15.5	-0.6	7.9	

Minimum thermometers placed in trees of the cultivar plantings have through the years averaged 1 to 3 degrees above the NOAA shelter temperatures. The climatological observations for each day are made at 8:00 am for the preceeding 24-hour period. During the years December 1963 to March 1983 temperatures of -17.8°C and below with the date of occurrence in parentheses for the months of December, January and February are as follows: -21.6°C (31 Dec. 1963), -18.8°C (15 Jan. 1964), -18.3°C (23 Feb. 1964), -18.3°C (15 Jan. 1965), -18.9°C (29 Jan. 1966), -23.9°C (8 & 9 Feb. 1967), -27.2°C (2 Jan. 1968), -26.6°C and -26.1°C (12 & 13 Jan. 1968), -17.8°C (10 Jan. 1970), -21.6°C (21 Jan. 1975), -17.8°C (19 Jan. 1976), -23.0°C (13 Jan. 1977), -19.4°C (23 Jan. 1978), -20.5°C (20 Feb. 1978), -23.3°C (18 Feb. 1979), -17.8°C (18 Dec. 1980), -20.0°C (13 Jan. 1981), -18.3°C (21 Dec. 1981), -23.9°C (17 Jan. 1982), and -21.6°C (13 Feb. 1983).

Several low temperatures periods occurred during December 1983, and January, February, March and April of 1984 (Table 1). Low temperatures of -18.9°C on the mornings of January 20 and 23, 1984 and a -27.8°C on the morning of January 22, 1984 gave the opportunity to evaluate vegetative and fruit bud injury. Since the few cultivars present in both plantings responded to the cold temperature similarly, the tree age difference did not appear to have an influence on the resulting injury and is thus not considered a factor in the data presented. The average mean daily temperature from January 1 to 19 was -2.8°C (range of high's was -5.5 to +7.7°C and for low's

was 0.0 to -16.6°C) and from January 20 to 21 was -7.2°C. The duration of the low temperatures of -27 to -27.8°C was seven hours occurring from midnight to 7:00 am on January 22.

Data on the abundance of blossoms present was collected at the estimated full bloom period (April 23, 1984). Open blossoms were not examined to determine if any floral parts were injured or lacking. Bloom ratings, based upon the abundance of blossoms present as relevant to the corolla or petals were rated as: heavy, moderate, light, and few scattered blossoms; thus, indicating a possible full crop, medium crop, light crop, and very light crop potential, respectively.

The vegetative bud injury data was collected during the first week of July from Observations made on the quantity of foliage on stems or branches in the tree canopy. A rating scale of 0 to 100 was developed where 0 = full complement of foliage and 100 = complete defoliation. Crop load estimate for 1984 was made the first week of July, following the normal June-Drop period. A rating scale of 0 to 100 was established where 0 was no crop and 100 required thinning for production of normal fruit size.

Results

From 1968 to until 1984, the vegetative shoot growth for many cultivars was excessive and exhibited no cold injury symptoms during the growing seasons even though three winter periods (1967-1968, 1978-1979 and 1980-1981) had temperatures cold enough to cause slight wood injury as observed during pruning and bark splitting injury of the trunk. Following the low temperatures of December 25 and 26, 1983, branches from several cultivars held at room temperature for examination showed little injury to vegetative or flower buds. On the other hand, branches of the same cultivars held at room temperature following the January 20-23, 1984 low temperatures did not respond in the same manner and showed brown colored wood and considerable numbers of dead flower and vegetative buds.

Cold injury to flower and vegetative buds caused a serious reduction in crop for a high percentage of the cultivars (Table 2). All cultivars had some vegetative bud injury. The vegetative bud injury ratings ranged from 5 (few branches with no foliage present) to 100 (all branches completely devoid of foliage and tree dead). The apricot 'Sungiant' had a very heavy bloom but by the time of the vegetative bud injury evaluation the trees were completely dead. As the vegetative bud injury rating approached 50 a few flower buds were observed and for the cultivar 'Poza Peach' a 40% crop developed. Even though bloom ratings ranged from few bloom for 'Cresthaven' and 'Winblo,' to light bloom for 'Whynot' and 'Glohaven' to moderate bloom for 'Redglobe' and 'Madison,' and to heavy bloom for 'Emery' and 'Troy' all of these cultivars had commercially acceptable crops of 74 to 90% of a full crop. Cultivars which developed a 25 to 50% of full crop were 'Allred' from a moderate bloom, 'Candor' from a heavy bloom, 'Earlired' from few bloom, 'Earliblaze (nectarine) from heavy bloom, 'Lexington' (nectarine) from heavy bloom, 'Poza Peach' from few bloom, 'Redbud' (nectarine) from heavy bloom, and VPI 60 from few bloom. Cultivars which produced a crop under 20% of a full crop included: 'Harbrite,' 'Harrow 593,' 'Jerseyqueen,' 'Norman,' 'Redskin,' 'Regina,' 'Biscoe,' 'Late Sunhaven,' 'Loring,' 'Pekin,' 'Redchief,' 'Rio-Oso-Gem,' 'Rubired,' 'Sentinel,' 'Suncrest,' 'Sunhigh,' ' Sunglo,' 'Surecrop,' 'Washington,' B-611505, B-62739, B-6371, B-63130, B-69162, VPI-61 all developing from a few to a moderate amount of bloom.

Since minimum thermometers in the cultivar platings tended to be one to three degrees higher, it is questionable

Table 2. Evaluations for vegetative bud injury (0 to 100 where 0 = no injury), bloom and crop production (0 to 100 where 0 = no crop and 100 = thinning required) made for cultivars of peach, nectarine and apricot following a temperature of -28°C on 22 January 1984.

Vegetative Bud Injury and Cultivar	Bloom Rating	Crop Production
75 to 100 injury rating		
'Cherokee'[a]	few	0.0
'Coronet'	few	0.0
'Earliglo'[a]	few	0.0
'Harbelle'	0.0	0.0
'Springold'	0.0	0.0
B-6409	0.0	0.0
'Sungiant' apricot	heavy[b]	0.0
50 to 74 injury rating		
'Blake'	few	0.0
'Canadian Harmony'	0.0	0.0
'Elberta'	0.0	0.0
Harrow 2219	0.0	0.0
'Marsun'	0.0	0.0
'McNeely'	0.0	0.0
'Pocohontas'[a]	0.0	0.0
'Poza Peach'	few	40.0
'Sunhaven'	0.0	0.0
B-591750	0.0	0.0
B-64361	0.0	0.0
B-611505	few	10.0
25 to 49 injury rating		
'Earlired'	few	50.0
'Emery'	heavy	90.0
'Harbrite	few	10.0
Harrow 593	few	20.0
'Havis'	few	0.0
'Honey Dew Hale'	0.0	0.0
'Jerseyqueen'	few	20.0
'Lafayette'[a]	0.0	0.0
'Norman'	few-light	10.0
'Redbud'[a]	heavy	40.0
'Redgold'[a]	moderate	0.0
'Redskin'	few	5.0
'Regina'	few	20.0
'Velvet'	few	0.0
B-64371	moderate	50.0
B-6419	0.0	0.0
B-62290	0.0	0.0
5 to 24 injury rating		
'Allred'	moderate	25.0
'Biscoe'	few	10.0
'Cando'	heavy	50.0
'Cavalier'[a]	0.0	0.0
'Charles'	0.0	0.0
'Cresthaven'	few	90.0
'Cullinan'	0.0	0.0
'Dunlop'	0.0	0.0
'Earliblaze'[a]	heavy	40.0
'Glohaven'	light	75.0
'Hale Harrison Brilliant'	few	0.0
'Harbinger'	0.0	0.0
'Harvester'	0.0	0.0
Harrow 2043	0.0	0.0
Harrow 2091	0.0	0.0
'Jefferson'	0.0	0.0
'Late Sunhaven'	few	20.0
'Lexington'[a]	heavy	40.0
'Loring'	few	5.0
'Madison'	moderate	75.0
'Pekin'	few	10.0
'Redchief'[a]	few	20.0
'Redglobe'	moderate	95.0
'Redhaven'	light	25.0
'Rio-Oso-Gem'	few	20.0
'Rubired'	few	20.0
'Sentinel'	few	20.0
'Suncrest'	few	20.0
'Sunhigh'	few	10.0
'Sunglo'[a]	few	20.0
'Surecrop'	moderate	10.0
'Swanee'	0.0	0.0
'Troy'	heavy	90.0
'Washington'	few	30.0
'Whynot'	light	90.0
'Winblo'	few	90.0
B-62739	few	20.0
B-6371	few	20.0
B-63130	few	10.0
B-64302	0.0	0.0
B-69162	few	10.0
VPI-60	few	40.0
VPI-61[a]	light	20.0

[a]Nectarine.
[b]All trees died following bloom.

whether the -2.2 to -3.3°C shelter temperatures during the first part of April were low enough to cause cold injury to the blossom. Since vegetative bud injury occurred with all cultivars, the wood may have had sufficient cold injury for some cultivars to cause a weakening of the flower buds which in turn to caused the erratic responses between the amount of bloom and the crop load for those cultivars having fruit.

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Book Review

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