Variety Trials

Bloom and Harvest Dates, Fruit Quality Attributes, and Yield of Modern Peach Cultivars in the Intermountain Western United States

Esmacil Fallahi^{1,4,8}, Bahar Fallahi^{1,5}, Bahman Shafii^{2,6},
and Mohammad E. Amiri^{3,7}

ADDITIONAL INDEX WORDS. adaptability, growing degree-days, *Prunus persica*, variety evaluation

SUMMARY. Production of peaches (*Prunus persica*) in southwestern Idaho and other states in the intermountain western United States has increased during recent years, requiring information on the performance of modern cultivars in the region. Thus, a long-term project was conducted to investigate bloom date, harvest date, cumulative growing degree-days, fruit quality, and yield of various yellow- and white-fleshed peaches under conditions of southwestern Idaho during 2003 to 2007. The analysis of average response over these years indicated that ‘Snow Giant’, ‘Jupiter’, ‘Yuko King’, ‘Burpeach Six’, ‘Fairtime’, ‘Coral Star’, ‘July Sun’, and ‘Zee Lady’ bloomed earlier (5–7 Apr.), while ‘Sierra Gem’, ‘Fancy Lady’, and ‘Red Star’ bloomed later (11–12 Apr.) than other cultivars. ‘Crimson Lady’, ‘May Sun’, and ‘Sierra Gem’ were the earliest cultivars, had smaller fruit, and on average were harvested on 11, 13, and 24 July and needed 94, 96, and 103 days from full bloom to harvest, respectively. ‘Opal Moncav’, ‘August Flame’, ‘August Lady’, ‘Ryan Sun’, ‘September Snow’, ‘Yukon King’, and ‘Fairtime’ were harvested during the second half of September. The periods between bloom and harvest for these cultivars on average were 160, 163, 163, 168, 171, 173, and 177 days, respectively, and these cultivars often had greater soluble solids concentrations than other cultivars. ‘PF12B’ and ‘PF15A’ were “mid-season,” but ‘PF 20–007’ and ‘PF 24–007’ were “late-season” cultivars. ‘PF12B’, ‘PF15A’, ‘PF 20–007’, ‘Star Fire’, ‘Burapeach Six’, ‘Coral Star’, ‘All Star’, and ‘Zee Lady’ had higher yield than many of the other cultivars. While the “early-season” cultivars can be planted for regional and local market, the “mid-season” and “late-season” peaches are excellent choices for marketing during September and early October when production of the similar cultivars are already completed in warmer regions. Overall, ‘Sweet Dream’, ‘August Lady’, ‘Zee Lady’, ‘August Flame’, ‘Snow Giant’, ‘Saturn’, ‘Jupiter’, and ‘PF24–007’ showed satisfactory to great performance in this long-term evaluation.

Commercial peach production in Idaho is dated back to 1870. Cultivars Early Red Haven, Late Redhaven, Redglobe, Early Hale, J.H. Hale, and Improved Elberta are among the popular cultivars of peaches that are still in production after many decades of their initial planting in

Idaho (Yost and d'Easum, 1980; Idaho Tree Fruit Census, 2007). Peaches and nectarines (*Prunus persica* var. *nectarina*) constituted of 18% of the total fruit production in Idaho in 2006, and production of white-flesh peaches has increased in this state during recent years (Idaho Tree Fruit

Census, 2007). Similar to the situation in other peach-producing states (Freccon et al., 2002), the best orchard sites are taken for development and urbanization in Idaho. However, new peach orchards are often planted in old apple (*Malus × domestica* cv. Delicious) orchard sites. This increase is due to the national and international market demands for high-quality peaches produced under high desert conditions of intermountain western United States, including southwestern Idaho and central Washington. Warm and dry days and cool nights during the growing season create suitable conditions for growing high-quality peaches and nectarines in this region. The pressure for urbanization and the competitive nature of the world market mandate production of new cultivars with high quality that mature over several weeks for a wide market window. The California Tree Fruit Agreement (CTFA, 2003) and Huang et al. (2008) classified peaches into five categories, according to their period between full bloom and harvest: 1) “very early cultivars,” which have less than 65 d from full bloom to harvest, 2) “early cultivars,” which have 66 to 90 d from full bloom to harvest, 3) “mid-season cultivars,” which have 91 to 120 d from full bloom to harvest, 4) “late-season cultivars,” which have 121 to 150 d from full bloom to harvest, and 5) “very late cultivars,” which have more than 151 d from full bloom to harvest. Cultivars in each group have their advantages and disadvantages, and they are planted according to the marketing outlet and strategy of each grower. Okie et al. (2008) have described the history, quality attributes, marketing status, and breeding strategies of various peach cultivars in different regions to fulfill the needs of today’s peach market. According to that report, most breeding for fresh market peaches follows similar protocols. Advanced selections and cultivars from in-house as well as other breeding programs are evaluated to find superior parents. Parents with superior characteristics are crossed by hand to produce seedlings that combine the desirable qualities of the parents.

Consumer preference for white-fleshed nectarines and peaches may vary according to individual consumer preference and ethnic background, while yellow-fleshed peaches and nectarines are generally accepted by most

consumers. In general, white-fleshed peaches and nectarines are popular among consumers of Asian ethnic backgrounds, but these cultivars are not well known by other American consumers (Bruhn et al., 1991). Many white-fleshed peaches are highly susceptible to bruising and have a low acid content (Brooks and Olmo, 1972 and 1997; Crisosto et al., 2001; Okie, 1998; Whealy and Demuth, 1993). Crisosto et al. (2001) reported that a large variability in titratable acidity (TA), soluble solids concentrations (SSC), bruising and flesh browning susceptibility, and market life was found for several white-fleshed peach and nectarine cultivars under conditions in the San Joaquin Valley of California. During ripening off the tree, SSC did not increase nor did TA decrease; thus, the SSC/TA remained the same in these stone fruit (Crisosto et al., 2001). Because of these characteristics, it was suggested that white-fleshed peaches and nectarines can be eaten when still firm if hard texture is not a concern. Frecon et al. (2002) compared the peach and nectarines developed in New Jersey with some white-fleshed cultivars from other locations and found that 'Carolina Belle', 'Klondike', 'Blushing Star', 'Sugar Giant', 'Snow Giant', and 'Arctic Jay' showed promise for planting on the basis of fruit quality.

In spite of the increasing commercial importance of and the increasing trend in peach production, there is no comprehensive information on the bloom and harvest dates, yield, or quality of these fruit in the southwestern Idaho of the intermountain western region of the United States. The goal of this long-term project was to investigate bloom date, maturity and harvest date, yield, and fruit quality of various yellow- and white-fleshed peaches under conditions of southwestern Idaho.

Materials and methods

The experimental orchard was located at the University of Idaho Parma Research and Extension Center near Parma, ID. This orchard was located in southwestern Idaho, which was a representative area of fruit-producing orchards in the intermountain western United States region (lat. 43°48'00"N, long. 116°56'00"W) with an annual precipitation of about 10.8 inches, an average minimum daily temperature of -17.6 °F in January and an average maximum daily temperature of 93.2 °F in July, and an elevation of 2305 ft.

Uniform peach trees on 'Nemaguard' rootstock, with an average of 0.5-inch diameter, were obtained from various nurseries in California and Washington. Thirty-eight peach cultivars or selections were planted at 8 × 16.5-ft spacing in Apr. 2000. The list of cultivars is presented in Tables 1 through 4. 'Burapeach Six', 'August Flame', and 'Summer Flame' were named B4.098, B2.034 ('Burapeach Four'), and C12.001, respectively, when they were at experimental stages.

Trees were trained into a four-leader vase-shaped system. Trees were also pruned during the summer to facilitate light penetration through the canopy.

The soil was sandy loam and at the depth of 0 to 24 inches, and the soil characteristics were as follows: pH 7.1 to 7.3, nitrate nitrogen (NO₃-N) 2.74 to 3.14 µg·g⁻¹, ammonium nitrogen (NH₄-N) 1.45 to 1.09 µg·g⁻¹, phosphorous (P) 8.0 to 12.4 µg·g⁻¹, potassium (K) 306 to 319 µg·g⁻¹, cation exchange capacity (CEC) 0.166 to 0.183 meq/g, and organic matter 0.48% to 1.03%.

Urea nitrogen [CO(NH₂)₂] mixed with potassium chloride (KCl) and P were applied during the month of May annually to provide N, P, and K at rates of 110, 50, and 60

lb/acre, respectively. This mixed fertilizer was broadcasted in an ≈3-ft band on either side of tree rows. Trees were irrigated weekly with under-tree sprinklers to match the evapotranspiration requirement for peach crop (ETc). We used information from the Agrimet Weather Station at the University of Idaho, Parma, ID, to calculate ETc. Annual pruning, spray, and other cultural practices in this experiment were similar to those of commercial orchards in the region.

Dates of full bloom (about 80% blooms open) and commercial harvest (when most of the fruit were ready to be harvested) for each tree were recorded every year in 2003 to 2007. In addition to the actual dates, the number of "days from 1 Jan. (DJ)" to full bloom was also computed. Daily growing degree-days (DGDD) from 1 Jan. to full bloom and harvest dates were calculated as: [(daily maximum plus minimum temperatures °F)/2 - (40 °F)]. Cumulative degree-days (GDD) were calculated as the sum DGDD to the full bloom or harvest dates for each cultivar in each year. We chose to use 40 °F as the base temperature in the DGDD calculations because even at this temperature, bloom will develop although the rate of development is slower (E. Fallahi, personal observation and unpublished data).

Fruit color was described visually and total yield per tree was measured at harvest time every year in 2003 to 2006. At commercial harvest time, 10 fruit were randomly sampled from each tree and average fruit weight was measured in 2003 to 2005 and SSC was measured in 2004 and 2005 with a hand-held temperature-compensated refractometer (N1; Atago, Tokyo). Fruit skin and flesh color were inspected visually and described. Fruit of each cultivar was evaluated by several people at harvest and the flavor was described objectively.

¹Department of Plant, Soil, and Entomological Sciences, Parma Research and Extension Center, University of Idaho, Parma, ID 83660

²Statistical Programs, College of Agricultural and Life Sciences, University of Idaho, Moscow, ID 83844

³Department of Horticulture, University of Zanjan, Zanjan, Iran.

⁴Professor and Director of Pomology.

⁵Research Associate of Pomology.

⁶Professor and Director of Statistical Programs.

⁷Associate Professor of Horticulture.

⁸Corresponding author. E-mail: efallahi@uidaho.edu.

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.3048	ft	m	3.2808
25.4	inch(es)	mm	0.0394
0.4536	lb	kg	2.2046
1.1209	lb/acre	kg·ha ⁻¹	0.8922
1	meq/g	mol·kg ⁻¹	1
28.3495	oz	g	0.0353
1	ppm	µg·g ⁻¹	1
(°F - 32) ÷ 1.8	°F	°C	(1.8 × °C) + 32

EXPERIMENTAL DESIGN. The experimental orchard was arranged as a completely randomized design with six replications per cultivar. Data were analyzed using general linear model (GLM) procedures. Fisher's protected LSD ($\alpha = 0.05$) was used to separate treatment means. Statistical analyses were carried out using SAS (version 9.2; SAS Institute, Cary, NC).

Results and discussion

BLOOM DATES AND GDD FOR BLOOM. In Table 1, peach cultivars

are listed according to their long-term average full bloom dates and the number of days from 1 Jan. to full bloom (DJ). Considering all cultivars over the period of 2003 to 2007, dates of full bloom ranged from 30 March to 25 Apr. (a total of 26 d). Averaging values for actual full bloom dates or days from 1 Jan. from 2003 to 2007 revealed a 7-d or 89 °F GDD difference between the earliest-blooming and latest-blooming cultivars. These average values showed that 'Snow Giant', 'Jupiter', 'Yuko

King', 'Burpeach Six', 'Fairtime', 'Coral Star', 'July Sun', and 'Zee Lady' bloomed earlier (5–7 Apr.), while 'Sierra Gem', 'Fancy Lady', and 'Red Star' bloomed later (11–12 Apr.) than other cultivars (Table 1). In this experiment, the variation for full bloom time was greater between years than among cultivars within a given year. Trees within each cultivar and each year had very small variation in their full-bloom dates due to the tree and soil uniformity (data not shown). There was no significant

Table 1. Full bloom date (FB), cumulative growing degree-days (GDD), and number of days from 1 Jan. to full bloom (DJ) for various cultivars of peaches grown under southwestern Idaho conditions.

Cultivar	Full bloom date					Avg FB 2003–07	Avg GDD to FB 2003–07 (°F) ^z	DJ for FB 2003–07 (d)
	2003	2004	2005	2006	2007			
Snow Giant	30 Mar.	3 Apr.	5 Apr.	18 Apr.	31 Mar.	5 Apr.	381	95
Jupiter	1 Apr.	4 Apr.	9 Apr.	17 Apr.	4 Apr.	7 Apr.	409	97
Yukon King	1 Apr.	4 Apr.	8 Apr.	17 Apr.	4 Apr.	7 Apr.	409	97
Burpeach Six	1 Apr.	4 Apr.	9 Apr.	18 Apr.	5 Apr.	7 Apr.	409	97
Fairtime	1 Apr.	5 Apr.	10 Apr.	18 Apr.	3 Apr.	7 Apr.	409	97
Coral Star	1 Apr.	4 Apr.	9 Apr.	18 Apr.	4 Apr.	7 Apr.	409	97
July Sun	31 Mar.	5 Apr.	7 Apr.	18 Apr.	4 Apr.	7 Apr.	409	97
Zee Lady	31 Mar.	4 Apr.	7 Apr.	20 Apr.	3 Apr.	7 Apr.	409	97
May Sun	4 Apr.	5 Apr.	10 Apr.	16 Apr.	5 Apr.	8 Apr.	423	98
Crimson Lady	4 Apr.	4 Apr.	10 Apr.	17 Apr.	5 Apr.	8 Apr.	423	98
PF24–007	3 Apr.	5 Apr.	9 Apr.	18 Apr.	4 Apr.	8 Apr.	423	98
Summer Flame	2 Apr.	5 Apr.	10 Apr.	18 Apr.	5 Apr.	8 Apr.	423	98
Elegant Lady	2 Apr.	4 Apr.	9 Apr.	18 Apr.	5 Apr.	8 Apr.	423	98
Sugar Giant	1 Apr.	4 Apr.	10 Apr.	18 Apr.	5 Apr.	8 Apr.	423	98
July Flame	1 Apr.	3 Apr.	10 Apr.	19 Apr.	5 Apr.	8 Apr.	423	98
Sweet Dream	1 Apr.	5 Apr.	9 Apr.	19 Apr.	4 Apr.	8 Apr.	423	98
August Flame	1 Apr.	4 Apr.	10 Apr.	19 Apr.	4 Apr.	8 Apr.	423	98
September Snow	1 Apr.	5 Apr.	9 Apr.	19 Apr.	4 Apr.	8 Apr.	423	98
Snow King	1 Apr.	5 Apr.	9 Apr.	19 Apr.	5 Apr.	8 Apr.	423	98
Star Fire	2 Apr.	5 Apr.	10 Apr.	20 Apr.	5 Apr.	8 Apr.	423	98
Saturn	1 Apr.	5 Apr.	10 Apr.	20 Apr.	4 Apr.	8 Apr.	423	98
August Lady	5 Apr.	5 Apr.	11 Apr.	20 Apr.	6 Apr.	9 Apr.	434	99
Ryan Sun	4 Apr.	5 Apr.	11 Apr.	20 Apr.	5 Apr.	9 Apr.	434	99
Brenda Sun	2 Apr.	5 Apr.	12 Apr.	19 Apr.	6 Apr.	9 Apr.	434	99
All Star	2 Apr.	4 Apr.	15 Apr.	19 Apr.	5 Apr.	9 Apr.	434	99
Autumn Red	4 Apr.	5 Apr.	11 Apr.	20 Apr.	5 Apr.	9 Apr.	434	99
O' Henry	5 Apr.	5 Apr.	10 Apr.	19 Apr.	5 Apr.	9 Apr.	434	99
Opal Moncav	4 Apr.	5 Apr.	10 Apr.	20 Apr.	5 Apr.	9 Apr.	434	99
PF15A	2 Apr.	4 Apr.	14 Apr.	20 Apr.	4 Apr.	9 Apr.	434	99
PF20–007	5 Apr.	5 Apr.	12 Apr.	20 Apr.	5 Apr.	9 Apr.	434	99
Rich Lady	2 Apr.	5 Apr.	10 Apr.	20 Apr.	6 Apr.	9 Apr.	434	99
Vista	6 Apr.	5 Apr.	10 Apr.	20 Apr.	5 Apr.	9 Apr.	434	99
Glow Star	5 Apr.	5 Apr.	10 Apr.	21 Apr.	6 Apr.	9 Apr.	434	99
Summer Lady	6 Apr.	5 Apr.	12 Apr.	20 Apr.	6 Apr.	10 Apr.	445	100
PF12B	6 Apr.	5 Apr.	9 Apr.	23 Apr.	5 Apr.	10 Apr.	445	100
Red Star	9 Apr.	5 Apr.	13 Apr.	23 Apr.	6 Apr.	11 Apr.	457	101
Fancy Lady	6 Apr.	5 Apr.	15 Apr.	25 Apr.	7 Apr.	12 Apr.	470	102
Sierra Gem	8 Apr.	5 Apr.	13 Apr.	25 Apr.	7 Apr.	12 Apr.	470	102
LSD ^y						1	10	1

^z(°F – 32) ÷ 1.8 = °C.

^yMean separation within columns, using least significant difference (LSD) at $P \leq 0.05$.

interaction between years and cultivars for any of the bloom date measurements. It is difficult to pre-plan for some cultural practices such as blossom thinning in the cultivars that exhibit wide tree-to-tree or year-to-year variations in bloom, based on historical data.

During warmer seasons, differences still existed between cultivars but the differences were less than those in cooler seasons. For example, GDD for the period between 30 Mar. and 25 Apr. was 291.2 °F in 2005 and 399.2 °F in 2004 (data not shown). However, the difference between the earliest- and the latest-blooming cultivars was 10 d in 2005 and 2 d in 2004 (Table 1). Historically, starting 1 May, the chance of spring frost diminishes significantly in southwestern Idaho. Therefore, the late-blooming cultivars such as 'Fancy Lady', 'Red Star', and 'Sierra Gem' may have a lower risk of frost damage.

COMMERCIAL HARVEST DATE. Cultivars in Tables 2 through 4 are arranged in ascending order of their 2003 to 2007 average harvest dates. Significant differences existed in commercial harvest dates among cultivars (Table 2). Harvest date for each cultivar varied from year to year, but the order of harvest among cultivars mostly stayed the same in each season, and no significant interaction existed between cultivars and years. The differences among cultivars were greater for harvest dates than for bloom dates. For example, the difference between the earliest and latest cultivars for full bloom dates was only 7 d, while for harvest dates, it was 83 d (the difference between 11 July and 1 Oct.). The earliest cultivar in our evaluation was 'Crimson Lady', which needed 94 d between full bloom, and on average, was harvested on 11 July. Thus, the earliest cultivar in our evaluation fits in the "mid-season" category of Huang et al. (2008). 'May Sun' and 'Sierra Gem' were also early, and, on average, harvested on 13 July and 24 July and needed 96 and 103 d from full bloom to harvest, respectively (Table 2). 'Opal Moncav', 'August Flame', 'August Lady', 'Ryan Sun', 'September Snow', 'Yukon King', and 'Fairtime' were harvested during the second half of September, and the periods between bloom and harvest for these cultivars were 160, 163, 163,

168, 171, 173, and 177 d, respectively. Thus, these peaches are considered "very late" cultivars according to the CTFA (2003) and Huang et al. (2008) categorization.

PF series cultivars had different harvest dates. 'PF12B' and 'PF15A' were "mid-season" cultivars and were harvested on 8 Aug. (120 and 121 d from full bloom), respectively. However, 'PF 20-007' and 'PF 24-007' were "late-season" cultivars and were harvested on 17 Aug. (130 d from full bloom) and 24 Aug. (138 d from full bloom), respectively.

In the highly competitive peach market, in addition to climatic conditions, time of harvest (early, mid, or late season), quality attributes, and yield should be considered before planting a cultivar. According to the CTFA (2003), of the total number peach trees sold in California during 1999 to 2002, 43.1% were in a combination of "very early season" and "early-season" categories, while 39% and 17.9% were in "mid-season" and "late-season" categories, respectively. A comparison of results of selected cultivars used in the CTFA report (2003) and our experiment revealed that peaches matured several weeks later in southwestern Idaho than in California. It is noteworthy that the maturity differences between California and Idaho were greater for early-maturing cultivars than late-maturing ones (Table 2). For example, these differences were 46, 52, and 49 d for the earlier-maturing cultivars of 'Crimson Lady', 'Rich Lady', and 'Vista', respectively, while they were, 34, 28, and 26 d for the late-maturing cultivars of 'Ryan Sun', 'September Snow', and 'Fairtime', respectively. In New Jersey, 'Saturn', 'Sugar Giant', and 'Snow King' were harvested on 21 July, 12 Aug., and 20 Aug., respectively (Frecon et al., 2002). However, in Idaho, these three cultivars were harvested between 2 to 3 weeks later (Table 2). Comparison of these harvest dates underscores the importance of producing peaches with different harvest times in southwestern Idaho. Our "early-season" peaches mature at a time that many "mid-season" peaches from California are in the market. Thus, our early cultivars would be more appropriate for local and farmers' markets. However, "medium-" and "late-season" peaches (Table 2) are harvested at the time that

California marketing for those cultivars has slowed down or finished, and thus provide an excellent market window for growers in southwestern Idaho and other similar regions in the intermountain western region of the United States. Results in Tables 2 to 4 provide options to peach growers to select cultivars with different flesh color and flavor best suited to their operations. However, because many peach growers in Idaho and the intermountain western region of the United States also grow apples, the harvest time of late peaches may overlap with the apple harvest, and this should be considered before planting.

Fruit quality attributes and yield

FRUIT COLOR. Descriptions for fruit skin and flesh color are presented in Table 3, and other quality attributes and yield are shown in Table 4. Fruit color can be affected by extent of light penetration through the tree canopy, but all cultivars were trained, pruned, and thinned similarly, and thus, descriptions in Table 3 reflect their relative colors. Although fruit flesh colors are generally categorized as yellow or white, a range of skin color such as red, blushed, and yellow was observed in these cultivars. 'Sweet Dream', 'Zee Lady', 'PF24-007', 'Jupiter', 'August Flame', 'Yukon King', 'Sugar Giant', 'September Snow', 'Opal Moncav', and 'Jupiter' had distinctively attractive skin and flesh color. For example, 'Sweet Dream' had red to dark maroon color. 'Yukon King' had an extremely attractive creamy white with pink to dark red skin color. 'Fairtime' had distinctively yellow skin and bright yellow flesh.

FRUIT SIZE (WEIGHT). Early-ripening cultivars such as 'Crimson Lady', 'May Sun', 'Sierra Gem', 'Saturn', and 'Vista' had smaller fruit and their long-term average fruit weights were less than 200 g (Table 4). 'Yukon King', 'PF24-007', 'Coral Star', 'Sugar Giant', 'August Flame', 'Snow Giant', 'Fairtime', and 'August Lady' had consistently larger fruit than many other cultivars, and their average fruit weights exceeded 260 g over 2003 to 2005 (Table 4). 'PF24-007' had numerically the largest average fruit weight among all cultivars (280.3 g), but the fruit weight of this cultivar was not significantly

Table 2. Harvest date (HD), cumulative growing degree-days (GDD), and days from bloom to harvest for various peach cultivars under conditions of southwest Idaho, listed in ascending order of their average harvest dates.^z

Cultivar	Commercial harvest date										Time bloom to harvest (d)
	2003	2004	2005	2006	2007	Range for HD 2003–07		Avg HD 2003–07	CA HD 1999–2002 ^z	GDD for harvest 2003–07 (°F) ^y	
Crimson Lady	15 July	2 July	13 July	14 July	9 July	2–15 July	9 July	11 July	25 May	2550	94
May Sun	5 July	4 July	22 July	24 July	9 July	9–24 July	9 July	13 July	—	2625	96
Sierra Gem	22 July	20 July	28 July	28 July	23 July	20–28 July	23 July	24 July	—	3063	103
Rich Lady	30 July	23 July	5 Aug.	7 Aug.	8 Aug.	23 July–8 Aug.	8 Aug.	2 Aug.	10 June	3405	115
Vista	30 July	29 July	5 Aug.	11 Aug.	9 Aug.	29 July–Aug. 11	9 Aug.	4 Aug.	15 June	3475	117
Saturn	4 Aug.	28 July	1 Aug.	11 Aug.	6 Aug.	28 July–11 Aug.	6 Aug.	4 Aug.	—	3475	118
Red Star	5 Aug.	3 Aug.	5 Aug.	14 Aug.	5 Aug.	3–14 Aug.	5 Aug.	6 Aug.	—	3547	117
Fancy Lady	5 Aug.	3 Aug.	8 Aug.	9 Aug.	8 Aug.	3–9 Aug.	8 Aug.	7 Aug.	—	3582	117
PF12B	12 Aug.	31 July	8 Aug.	11 Aug.	8 Aug.	31 July–12 Aug.	8 Aug.	8 Aug.	—	3617	120
PF15A	10 Aug.	31 July	8 Aug.	15 Aug.	8 Aug.	31 July–15 Aug.	8 Aug.	8 Aug.	—	3617	121
Star Fire	4 Aug.	3 Aug.	12 Aug.	11 Aug.	8 Aug.	3–12 Aug.	8 Aug.	8 Aug.	—	3617	122
Burpeach Six	4 Aug.	5 Aug.	10 Aug.	15 Aug.	14 Aug.	4–15 Aug.	14 Aug.	10 Aug.	—	3688	125
July Flame	12 Aug.	8 Aug.	12 Aug.	15 Aug.	14 Aug.	8–15 Aug.	14 Aug.	12 Aug.	—	3754	126
PF20–007	17 Aug.	14 Aug.	20 Aug.	20 Aug.	16 Aug.	14–20 Aug.	16 Aug.	17 Aug.	—	3926	130
Coral Star	19 Aug.	20 Aug.	20 Aug.	22 Aug.	14 Aug.	14–22 Aug.	14 Aug.	19 Aug.	—	3989	134
All Star	21 Aug.	18 Aug.	20 Aug.	22 Aug.	20 Aug.	18–22 Aug.	20 Aug.	20 Aug.	—	4022	133
Elegant Lady	1 Sept.	18 Aug.	18 Aug.	24 Aug.	24 Aug.	18 Aug.–1 Sept.	24 Aug.	23 Aug.	19 July	4118	137
Jupiter	29 Aug.	15 Aug.	30 Aug.	24 Aug.	24 Aug.	15–30 Aug.	24 Aug.	24 Aug.	—	4146	139
PF24–007	21 Aug.	24 Aug.	28 Aug.	28 Aug.	20 Aug.	20–28 Aug.	20 Aug.	24 Aug.	—	4146	138
Glow Star	29 Aug.	25 Aug.	30 Aug.	29 Aug.	24 Aug.	24–30 Aug.	24 Aug.	27 Aug.	—	4234	140
July Sun	30 Aug.	24 Aug.	25 Aug.	8 Sept.	28 Aug.	24 Aug.–8 Sept.	28 Aug.	29 Aug.	—	4297	144
Sweet Dream	4 Sept.	30 Aug.	30 Aug.	24 Aug.	31 Aug.	24 Aug.–4 Sept.	31 Aug.	30 Aug.	20 July	4325	144
Sugar Giant	30 Aug.	26 Aug.	30 Aug.	3 Sept.	31 Aug.	26 Aug.–3 Sept.	31 Aug.	30 Aug.	—	4325	144
Zee Lady	31 Aug.	29 Aug.	31 Aug.	31 Aug.	31 Aug.	29–31 Aug.	31 Aug.	31 Aug.	31 July	4354	146
Summer Flame	8 Sept.	30 Aug.	2 Sept.	4 Sept.	1 Sept.	30 Aug.–8 Sept.	1 Sept.	3 Sept.	—	4443	148
Summer Lady	14 Sept.	30 Aug.	9 Sept.	6 Sept.	4 Sept.	30 Aug.–14 Sept.	4 Sept.	6 Sept.	—	4533	149
Brenda Sun	8 Sept.	2 Sept.	2 Sept.	13 Sept.	4 Sept.	2–13 Sept.	4 Sept.	6 Sept.	—	4533	151
O' Henry	11 Sept.	9 Sept.	13 Sept.	14 Sept.	14 Sept.	9–14 Sept.	14 Sept.	12 Sept.	5 Aug.	4681	156
Snow Giant	13 Sept.	11 Sept.	13 Sept.	13 Sept.	11 Sept.	11–13 Sept.	11 Sept.	12 Sept.	—	4681	160
Snow King	15 Sept.	9 Sept.	16 Sept.	10 Sept.	10 Sept.	9–16 Sept.	10 Sept.	12 Sept.	—	4681	157
Autumn Red	11 Sept.	7 Sept.	12 Sept.	20 Sept.	18 Sept.	7–20 Sept.	18 Sept.	14 Sept.	—	4725	158
Opal Moncav	11 Sept.	13 Sept.	19 Sept.	19 Sept.	18 Sept.	11–19 Sept.	18 Sept.	16 Sept.	—	4766	160
August Flame	11 Sept.	17 Sept.	20 Sept.	23 Sept.	18 Sept.	11–23 Sept.	18 Sept.	18 Sept.	—	4800	163
August Lady	18 Sept.	19 Sept.	20 Sept.	20 Sept.	20 Sept.	18–20 Sept.	20 Sept.	19 Sept.	—	4817	163
Ryan Sun	30 Sept.	21 Sept.	23 Sept.	26 Sept.	18 Sept.	18–30 Sept.	18 Sept.	24 Sept.	20 Aug.	4911	168
September Snow	24 Sept.	24 Sept.	23 Sept.	29 Sept.	28 Sept.	23–29 Sept.	28 Sept.	26 Sept.	28 Aug.	4951	171
Yukon King	24 Sept.	28 Sept.	29 Sept.	28 Sept.	26 Sept.	24–29 Sept.	26 Sept.	27 Sept.	—	4976	173
Fairtime	5 Oct.	24 Sept.	1 Oct.	1 Oct.	31 Sept.	24 Sept.–5 Oct.	31 Sept.	1 Oct.	5 Sept.	5061	177
LSD ^x										169	10

^aData of this column is taken from California (CTFA, 2003) for comparison.

^y(°F – 32) ÷ 1.8 = °C.

^zMean separation within columns, using least significant difference (LSD) at $P \leq 0.05$.

Table 3. Description of skin and flesh color of different peach cultivars under conditions of southwest Idaho, listed in ascending order of their harvest dates.

Cultivar	Fruit skin	Flesh color	Comment
Crimson Lady	Orange to maroon	Yellow	Early
May Sun	Orange to maroon	Yellow with bleeding red	Early
Sierra Gem	Dark orange to dark maroon	Yellow with red spot in the middle	Early
Rich Lady	Red to dark maroon	Yellow with a little red near the pit	—
Vista	Light to dark maroon with blotches	Yellow	—
Saturn	Cream to dark red	White	Novelty market
Red Star	Dark red to maroon with some blotches	Yellow with red stain	—
Fancy Lady	Orange to dark maroon	Yellow with bleeding near the pit	Excellent
PF12B	Yellow/orange to dark red	Yellow with red stain in the middle	—
PF15A	Yellow orange to dark maroon	Yellow with red spot	—
Star Fire	Light to very dark red	Yellow with red Stain	—
Burpeach Six	Orange to dark maroon	Yellow with red stain near skin	—
July Flame	Red to dark maroon with some blotches	Yellow with red stain	Good flavor
PF20-007	Orange to dark maroon	Yellow with a little red	—
Coral Star	Light Orange to dark red	Yellow	Large
All Star	Yellow to dark red	Yellow with light red stain	—
Elegant Lady	light red to very dark maroon almost black	Yellow with red blush	—
Jupiter	Light red to deep maroon	White	Novelty market
PF24-007	Light to medium red	Yellow with red stripe in the middle	Large, cold hardy
Glow Star	Yellowish red to dark red	Yellow	—
July Sun	Light to dark red/yellow background	Yellow with red stain in the middle	—
Sweet Dream	Red to dark maroon	Yellow with red blush	Beautiful peach
Sugar Giant	Light red to maroon, uniform	White	Excellent flavor
Zee Lady	Dark and attractive maroon	Deep yellow	Excellent shipping
Summer Flame	Medium to very dark red	Yellow	—
Summer Lady	Light orange to dark maroon	Yellow with red spot	Good commercial
Brenda Sun	Red to very dark red almost black	Yellow with pink stain near the pit	—
O'Henry	Medium to dark red	Yellow	Excellent flavor
Snow Giant	White/green /yellow background and red lush	White	Excellent flavor
Snow King	Light red to dark maroon	White	Great color
Autumn Red	Yellow orange to red	Yellow	—
Opal Moncav	Light to medium red with cream stain	White	Late white flesh
August Flame	Medium to very dark red	Yellow with red stain	Outstanding
August Lady	Medium to dark red	Yellow with pink line in middle	Outstanding
Ryan Sun	Dark orange to maroon	Yellow with red stain near the pit	—
September Snow	Light pink to dark red	White	Great late white
Yukon King	Creamy white with pink to dark red	White with thick pink line near the pit	Excellent late white
Fairtime	Straw yellow	Bright yellow	Distinct yellow

different from that of ‘Coral Star’. It is noteworthy that these cultivars represent “mid-season” and “late-season” peaches according to the CTFA (2003). The larger fruit size in some of these cultivars was inversely correlated to their lighter yield.

SSC. Generally, SSC increased with ripening season (Table 4). With the exception of ‘Ryan Sun’ and ‘Fairtime’, fruit of the late-ripening cultivars that on average were harvested after 14 Sept. (Table 2) had greater than 13% SSC (Table 4). “Flat” peaches had high SSC values. ‘Jupiter’ had significantly higher SSC (overall average of 15.0%) than all other cultivars. ‘Saturn’ (another flat peach) had higher SSC values than all other

cultivars except ‘Jupiter’ and ‘Yukon King’. Frecon et al. (2002) also reported that ‘Saturn’ was among cultivars with high SSC in New Jersey. Among all cultivars, ‘PF15A’, ‘Coral Star’, and ‘All Star’ consistently had less than 10% SSC in 2 years (Table 4). The taste survey showed that ‘All Star’ and ‘Coral Star’ had relatively “flat” taste (data not shown) that could have been as a result of their low SSC. These cultivars had larger fruit weight (Table 4) and perhaps higher fruit water content than many other cultivars, leading to a lower SSC value due to a dilution effect. However, ‘PF24-007’ peach had large size and low SSC but had good flavor. Also, cultivars such as ‘August Flame’

and ‘August Lady’ had greater than 13% SSC in spite of their large fruit size. Most of the white-fleshed peaches had higher SSC values than yellow-fleshed peaches, which is in agreement with results reported by Robertson et al. (1990).

YIELD. All cultivars had lower yields in 2003 compared with other years because the trees were young. ‘Crimson Lady’, which was the earliest cultivar to harvest, had the lowest yield, perhaps due to its small fruit size (Table 4). However, ‘Sierra Gem’ (also an early-maturing cultivar) was among the high-yielding cultivars every year. ‘PF12B’, ‘PF15A’, ‘Star Fire’, ‘Burpeach Six’, ‘PF20-007’, ‘Coral Star’, and ‘All Star’

Table 4. Peach cultivar quality attributes (fruit size and soluble solids concentration) and yield under the conditions of southwest Idaho, listed in ascending order of their average harvest dates.^z

Cultivar	Avg fruit wt (g) ^y				Soluble solids concn (%)			Yield/tree (kg) ^y				
	2003	2004	2005	Avg 2003–05	2004	2005	Avg 2004–05	2003	2004	2005	2006	Avg 2003–06
Crimson Lady		143.3	182.4	162.9	10.7	11.3	11.0	3.6	11.5	7.6	11.0	8.4
May Sun	106.7	155.4	172.5	144.9	11.8	11.7	11.8	6.4	18.4	12.0	14.0	12.7
Sierra Gem	167.1	198.6	207.5	191.1	11.1	10.5	10.8	15.0	23.4	22.6	29.8	22.7
Rich Lady	166.9	169.8	224.5	187.1	11.1	12.1	11.6	9.2	16.4	10.4	12.6	12.16
Vista	166.2	189.6	224.5	193.4	12	12.4	12.2	7.8	15.4	8.1	11.2	10.6
Saturn	90.8	92.3	89.3	90.8	13.1	14	13.6	12.6	22.8	15.2	36.9	21.9
Red Star	190.8	191	196	192.6	12.6	12.3	12.5	17.0	17.4	10.2	29.9	18.6
Fancy Lady	179.7	206.7	220.5	202.3	11.8	11.3	11.6	14.6	18.4	13.0	27.6	18.4
PF12B	185.3	198.9	241.9	208.7	11.8	12.5	12.2	13.1	25.4	23.8	33.28	23.9
PF15A	150.5	224.2	241	205.2	9.8	9.7	9.8	24.6	36.1	13.4	30.1	26.0
Star Fire	203.1	225.5	252.7	227.1	10.7	11.6	11.2	18.0	25.9	17.9	41.8	25.9
Burpeach Six	191.1	231.6	269.1	230.6	9.8	10.4	10.1	23.3	31.9	18.0	38.9	28.0
July Flame	186.9		236.7	211.8		11.2	11.2	15.0	18.9	21	31.3	21.6
PF20–007	207.8	241.2	294.9	248.0	10.8	11.2	11.0	15.5	26.1	15.7	41.1	24.6
Coral Star	239.5	261	308.3	269.6	9.5	9.4	9.5	13.4	37.2	19.0	36.6	26.6
All Star	220.4	257.8	282.1	253.4	9.6	9.3	9.5	17.3	40.0	20.6	29.8	26.9
Elegant Lady	212.5	219.9	219.4	217.3	11.2	11.5	11.4	6.0	14.9	14.1	20.6	13.9
Jupiter		122.2	126.7	124.5	14.2	15.7	15.0		11.9	17.5	28.4	19.4
PF24–007	235.9	299.6	305.4	280.3	9.1	9.7	9.4	10.9	22.8	10.1	19.6	15.9
Glow Star	212.0	246.7	274.8	244.5	11.3	10.9	11.1	13.6	12.5	21.1	21.7	17.2
July Sun	237.2	227.3	265.3	243.3	12	12.1	12.1	4.0	14	10.5	18.7	11.8
Sweet Dream	231.0	259.1	275.5	255.2	12.4	12.4	12.4	7.2	12.5	22.4	23.6	16.4
Sugar Giant	267.6	291.6	258.6	272.6	11.3	10.2	10.8	5.7	16.4	15.1	18.4	13.9
Zee Lady	190.2	180.1	189.1	186.5	10.8	11.2	11.0	15.0	40.0	17.4	23.0	23.9
Summer Flame	231.3	249.2	258.7	246.4	10.5	11.8	11.2	1.3	12.9	7.6	17.8	9.9
Summer Lady	229.5	230.5	261.9	240.6	11	13.4	12.2	10.9	13.4	5.8	15.7	11.5
Brenda Sun	227.5	232.4	222.7	227.5	12.2	12.1	12.2	0.9	11.9	12.6	22.7	12.0
O’Henry	245.4	240	256.8	247.4	12.2	13.2	12.7	5.8	19.4	16.5	26.5	17.1
Snow Giant	275.4	289.0	218.9	261.1	12.4	12.2	12.3	14.0	23.8	19.0	25.0	20.5
Snow King	242.5	251.3	254.5	249.4	11.6	11.6	11.6	17.0	18.1	18.6	28.2	20.5
Autumn Red	242.0	251	282.6	258.5	11.6	10.7	11.15	2.2	16.4	10.8	18.5	12.0
Opal Moncav	201.4	256.1	258.1	238.5	13.3	13.3	13.3	4.4	17.4	18.3	19.5	14.9
August Flame	246.1	283.7	254.8	261.5	13.5	12.6	13.1	4.6	23.8	16.1	18.5	15.8
August Lady	262.7	291.9	280.0	278.2	13.1	12.8	13.0	8.5	21.2	12.1	17.6	14.9
Ryan Sun	180.9	298.0	286.5	255.1	12.4	11.5	12.0	9.9	14.9	14.6	17.6	14.2
September Snow	190.9	247.3	224.2	220.8	13.4	13.0	13.2	9.1	16.4	14.6	16.7	14.2
Yukon King	245.0	280.8	279	268.3	13.4	13.9	13.7	6.6	22.4	19.4	21.9	17.6
Fairtime	243.9	267.0	274.1	261.7	12.0	12.2	12.1	12.0	14.7	18.1	23.1	17.0
LSD	15.1	16.2	17.1	12.4	1.0	1.5	1.0	2	5.1	5.5	5.0	4.0

^zMean separation within columns by LSD at $P \leq 0.05$.

^y1 g = 0.0353oz; 1 kg = 2.2046 lb.

consistently had higher yield than most other cultivars. Fruit size is often negatively associated with fruit number (E. Fallahi, personal observation and unpublished data). However, among these high-yielding cultivars, ‘Coral Star’ and ‘All Star’ also had larger fruit size despite their high yields, which makes them suitable as commercial cultivars, although the flavors of these cultivars were not distinctively superior to those of other cultivars.

OVERALL PERFORMANCE. Considering all the factors evaluated

under conditions of this project, we believe that ‘Sierra Gem’ is suitable as an early cultivar. Although fruit of early-ripening cultivars are usually of a smaller size, fruit of ‘Sierra Gem’ were medium size (average 191.1 g) with a good flavor, and the trees were highly productive (Table 2). This cultivar can be planted on a limited scale for early market.

Based on our findings and conditions of this experiment, ‘Saturn’ and ‘Jupiter’ cultivars can be planted if “flat” peaches are in demand by the novelty market. ‘Saturn’ was a

relatively early cultivar and was harvested between 28 July and 11 Aug. (average harvest date of 4 Aug.). This cultivar needed about 118 d to mature (between full bloom and harvest), while ‘Jupiter’ was harvested on 24 Aug. and needed 139 d to mature. Thus, planting both of these cultivars can provide “flat” peaches for farmers markets and local or regional consumption for several weeks. ‘Saturn’ and ‘Jupiter’ had a great appeal among consumers when fruit was harvested at ripening. However, these fruit can easily get damaged at harvest time.

PF series cultivars had different harvest dates. While 'PF12B' and 'PF15A' were harvested on 8 Aug. (120 and 121 d from full bloom), respectively, 'PF24-007' was harvested on 24 Aug. (138 d after bloom). Planting these cultivars also provides a range of harvest opportunities. PF series cultivars tested in this experiment had satisfactory overall performance. Some of these cultivars had lower SSC, but they had good flavor. We noticed that 'PF24-007' had slightly reduced bud injury under mild frost conditions.

'Sweet Dream' had good overall performance. Fruit of this cultivar have an attractive color, relatively large size (average 255.2 g) with over 12% SSC, and the trees have moderately high yields. Therefore, 'Sweet Dream' can be a good choice as a late-August cultivar.

'August Flame' and 'O'Henry' had outstanding flavor and were two of the favorite yellow-fleshed peaches, as judged by many in the taste evaluations. 'August Flame' is a "newly released" cultivar by Burchell Nursery in California. In our evaluation, 'August Flame' seems to have a great potential for a wide-scale planting as a late-ripening cultivar due its outstanding quality and distinctively pleasant flavor. We also found 'Zee Lady' to be an excellent choice for the late-August to early-September commercial production. Fruit of this cultivar have medium size, deep dark maroon skin, and deep yellow flesh,

high firmness, good storage life, and excellent flavor, while the trees had relatively high yields. 'Yukon King' and 'September Snow' had very attractive fruit with high SSC. These two cultivars, particularly 'Yukon King', were the most attractive white-fleshed peaches in our evaluation. Both of these cultivars had outstanding flavor, particularly when fruit were harvested close to the peak of ripening, as judged by the taste survey. We found through our taste survey that some people do not like white-fleshed peaches due to their low acid content. Also, many American consumers do not like white-fleshed peaches if they are firm. However, many of the same people would enjoy these peaches if they are consumed as ripe fruit.

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