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Phenological Development, Yield Performance, and Fruit Quality of Fourteen Peach Cultivars Across Four Growing Seasons

Esmaeil Fallahi[1*], Bahar Fallahi[2], and Michael J. Kiester[3]

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Abstract

Demographic diversity and the broadening range of consumer preferences have intensified demand for peach cultivars that differ in skin color, flesh color, flavor profile, and seasonal availability. To address these needs, the performance of 14 peach cultivars was evaluated over four years with respect to Julian day number, bloom and harvest phenology, yield, and fruit quality attributes. Across seasons, 'Snow Giant', 'PF 35 007', and 'O'Henry' were identified as early-, mid-, and late-blooming cultivars, respectively; however, all three matured late in the season. Early-maturing cultivars included 'PF 5D Big', 'PF8 Ball', and 'Rich Lady'; mid-season cultivars included 'PF9A 007', 'PF11 Peach', 'Sierra Rich', 'Klondike', and 'PF 28 007'; and late-maturing cultivars included 'PF 24C', 'Giant Elberta', 'Snow Giant', 'PF 35 007', and 'O'Henry'. Trees of 'PF9A 007', 'PF 24C', and 'PF 35 007' were precocious. Trees of 'PF9A 007', 'PF 35 007', and 'PF 24C' consistently produced high yields, whereas 'Giant Elberta', 'PF 5D Big', 'PF8 Ball', and 'Rich Lady' were among the lowest yielding cultivars in most years and in four year averages. Early-maturing cultivars ('PF 5D Big', 'PF8 Ball', 'Rich Lady') produced the smallest fruit (191.5–221.8 g), while late-maturing cultivars ('Giant Elberta', 'Snow Giant', 'PF 35 007', 'O'Henry') produced the largest fruit (329–354 g). Fruit size varied widely among Paul Friday ("PF") cultivars when averaged across four years. 'PF 35 007' produced the largest fruit, 'PF11 Peach' produced medium-sized fruit, and 'PF8 Ball' produced the smallest. Soluble solids concentration (SSC) also varied among cultivars, with 'O'Henry' consistently exhibiting the highest SSC in three of four years, whereas 'PF8 Ball' had the lowest. These findings highlight the importance of aligning cultivar selection with harvest timing, market demand, and labor availability to optimize production efficiency and fruit quality in commercial peach orchards.

Introduction

Peach is a widely cultivated deciduous fruit species capable of thriving across diverse climates, elevations, chilling requirements, and growing degree day accumulations from January 1 through bloom and harvest. Advances in both traditional breeding methods and modern molecular breeding technologies have facilitated the development and release of numerous improved peach cultivars in recent years (Abbott et al. 2008; Monet and Bassi 2008; Okie et al. 2008; Shane and Iezzoni 2007).

Establishing a productive peach orchard requires careful consideration of multiple site and cultivar specific factors, including chilling requirements, elevation, orchard site selection, cultivar and rootstock choice, irrigation management, and nutrient supply (Bassi and Monet 2008; Johnson 2008; Magar et al. 2020; Monet and Bassi 2008; Reighard

[1]Em. Professor and Director of Pomology and Viticulture Program, University of Idaho, College of Agricultural and Life Sciences, Plant Science Department, Parma Research and Extension Center, 29603 U of I Lane, Parma, Idaho 83607, USA.
[2]Senior Scientific Aide, Pomology and Viticulture Program
[3]Research Associate, Pomology and Viticulture Program
[*]Corresponding author email: esmaeilfallahi51@gmail.com.
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and Loreti 2008). Marini et al. (2025) reported that cultivars requiring fewer than 800 chilling hours tend to bloom earlier and are therefore more vulnerable to injury from early spring frosts. Their work also indicated that peaches grown at lower elevations may ripen 3 to 20 days earlier than those grown at approximately 670 m above sea level.

In Arkansas, Braxton et al. (2026) recommended the use of cultivars such as ‘Scarletprince’, ‘Red Globe’, ‘Loring’, ‘White River’, ‘Contender’, ‘Julyprince’, ‘Whiterock’, ‘Crest Haven’, ‘White Diamond’, ‘Flameprince’, and ‘Carolina Gold’, which collectively require between 750 and nearly 1000 chilling hours. They further advised planting cultivars that require more than 1000 chilling hours in central and northern Arkansas to ensure more consistent cropping, while discouraging the use of cultivars that require fewer than 750 chilling hours due to the elevated risk of frost damage during bloom.

The influence of temperature on floral bud cold hardiness, as well as the relationship between chilling accumulation and freeze susceptibility, has been characterized for peach producing regions in Colorado (Sterle et al. 2023) and Illinois (Hentschel 2016; 2019), providing additional regional context for cultivar selection and frost risk management.

Rouse and Sherman (1989) reported that several low chill peach cultivars grown in the Lower Rio Grande Valley of Texas exhibited greater skin blush intensity than those grown in Gainesville, Florida, attributing this difference to the warmer prevailing temperatures in Texas. Similarly, in a multi-location study across Florida, Wert et al. (2009) evaluated four cultivars (‘Flordaprince’, ‘Flordaglo’, ‘UFGold’, and ‘TropicBeauty’) and found that fruit produced in the warmer southwestern region developed higher skin color and soluble solids concentration (SSC), but had a shorter fruit development period (FDP) than fruit from the cooler north central region. These differences were attributed to elevated temperatures during early stages of cell division and enlargement in the warmer region. Earlier work also demonstrated that temperatures during the initial phases of fruit development strongly influence FDP (Batjer and Martin 1965). Topp and Sherman (1989a) quantified this relationship, reporting that a 1 °C reduction in mean temperature across the FDP extended development by approximately 5 days. Boonprakob et al. (1992) further showed that average daily temperatures 30–45 days after full bloom were strong predictors of FDP length, with a 1 °C increase in mean temperature shortening FDP by 2–6 days depending on cultivar. The NC-140 researchers in several states in the US found a closed association between temperatures during FDP and fruit size in peaches (Marini et al. 2018). In contrast to these findings, Topp and Sherman (1989b) observed no association between temperature and red blush development across 13 peach producing regions in Australia.

Several pre- and postharvest factors influence storage life and fruit quality in peaches and nectarines, including cultivar, storage duration, fruit size, crop load (Campos-Vargas et al. 2006; Lurie and Crisosto 2005), and storage temperature. Temperature fluctuations within the range of 2.2–7.6 °C are particularly conducive to the development of chilling injury, a major physiological disorder in stone fruit (Farcuh and Hopfer 2023).

Given the strong influence of environmental conditions on phenology and fruit quality, extensive pilot evaluations of cultivar adaptability, phenological characteristics, and quality performance should be conducted in each production region prior to large scale commercial planting (Fallahi et al. 2009a; 2009b; 2014; İkinci and Bolat 2018; Souza et al. 2019). As consumer demographics diversify, demand for peaches and nectarines with varied skin color, flesh color, and flavor profiles continues to increase (Bruhn et al. 2009). This has prompted comparative evaluations of white and yellow-fleshed cultivars. Frecon et al. (2002), assessing New Jersey developed peaches and nectarines alongside white fleshed cultivars from other regions, identified ‘Carolina Belle’, ‘Blushing Star’, ‘Sugar Giant’, ‘Snow Giant’, and ‘Arctic Jay’ as promising selections for New Jersey. In California’s San Joaquin Valley, Crisosto et al. (2001) documented substantial variability among white fleshed cultivars in titratable acidity (TA), SSC, bruising susceptibility, flesh browning, and market life. They also reported that SSC and TA remained stable after harvest, resulting in an unchanged SSC/TA ratio. Iglesias and Echeverria (2009), examining six peach and nectarine cultivars, found that sub-acid cultivars consistently developed more intense red skin coloration and did so earlier in the season than acid cultivars. Acid cultivars exhibited a more rapid decline in firmness, particularly among early season types such as 'Alice'. In that report, consumer preference was consistently higher for non-acid cultivars across maturity stages.

Fallahi et al. (2009a), in a comprehensive evaluation of 34 yellow and white-fleshed peaches, categorized 'Snow Giant', 'Jupiter', 'Yukan King', 'Burpeach Six', 'Fairtime', 'Coral Star', 'July Sun', and 'Zee Lady' as early-blooming cultivars, whereas 'Sierra Gem', 'Fancy Lady', and 'Red Star' were classified as late blooming. In a related study of yellow and white-fleshed nectarines, Fallahi et al. (2009b) reported that 'Arctic Jay', 'Fantasia', 'Honey Kist', and 'Arctic Pride' bloomed earlier, while 'Arctic Mist', A28.082, and 'Summer Fire' bloomed later than other cultivars. Under high desert conditions in southwest Idaho, Fallahi et al. (2014) found that 'Diamond June' and 'Honey Kist' were the earliest yellow-fleshed nectarines to mature, requiring 110 and 114 days from full bloom to harvest, respectively, whereas 'Sparkling Red' and A28.082 were harvested in late September.

Peach production has been established in southwest Idaho since at least 1870 (Yost and d'Easum 1980). As in other fruit producing states (Frecon et al. 2002), prime orchard sites have increasingly been lost to urban development. Nevertheless, peaches accounted for 18% of Idaho's total tree fruit production in 2022, and the number of peach orchards increased by 10% between 2017 and 2022, reaching 132 operations (USDA Census of Agriculture 2024). This growth is attributable in part to the introduction of new cultivars adapted to the region (Fallahi et al. 2009a; 2009b; 2014) and to the region's favorable climate, characterized by warm, dry days and cool nights, which promotes the development of high-quality peaches and nectarines.

Given the increasing commercial importance of stone fruit and declining production in California, the objective of this study was to evaluate bloom and harvest phenology, yield, and fruit quality attributes of 14 yellow and white-fleshed peach cultivars.

Materials and Methods

Experimental orchard, cultural practices, and phenology. The study was conducted at the University of Idaho Pomology and Viticulture Program, located at the Parma Research and Extension Center in Parma, Idaho, USA (43°48′00″N, 116°56′00″W; elevation 703 m). The site is representative of fruit-producing orchards in the Intermountain West and is characterized by an average annual precipitation of 274 mm, mean January minimum temperatures of −5 to −8 °C, and mean July maximum temperatures of 33 to 34.3 °C.

Uniform peach trees on 'Lovell' rootstock, with an average of 1.27 cm diameter, were obtained from different nurseries as follows: 'PF 5D Big', 'PF8 Ball', 'PF9A-007', 'PF Lucky 13', 'PF11 Peach', 'PF 28-007', 'PF 24C', and 'PF 35-007', and 'O'Henry' from C & O Nursery, Washington, USA; 'Rich Lady', 'Sierra Rich', 'Klondike', and 'Snow Giant' from Dave Wilson Nursery, California, USA; and 'Giant Elberta' from Burchell Nursery, California, USA.

Trees were planted in a north-south orientation at a spacing of 2.44 × 4.88 m on 4 April 2007 and trained to a four leader upright vase system. Supplemental summer pruning was conducted annually to enhance light penetration throughout the canopy. The soil at the site was a sandy loam, and had the following properties within the 0–61 cm depth: pH 7.1–7.3, nitrate-nitrogen (NO_3-N) 2.74–3.14 $\mu g \cdot g^{-1}$, ammonium nitrogen (NH_4-N) 1.09–1.45 $\mu g \cdot g^{-1}$, phosphorus (P) 8.0–12.4 $\mu g \cdot g^{-1}$, potassium (K) 306–319 $\mu g \cdot g^{-1}$, cation exchange capacity (CEC) 0.166–0.183 $meq \cdot g^{-1}$, and organic matter 0.48–1.03%.

A 1-mm subsurface drip irrigation line (Rain Bird Corporation, Azusa, CA, USA) was installed in a 10-cm-deep trench, positioned 40.6 cm from the tree row and parallel to it on both the east and west sides. The system was regulated to maintain a constant operating pressure of 3.52 kg·cm^{-2}. Pressure-compensating emitters were spaced 45.7 cm apart, each delivering 3.48 L·h^{-1}. Irrigation was applied twice weekly at 100% of crop evapotranspiration (ETc), calculated using Agrimet weather station data from the University of Idaho Parma site and standard crop coefficient procedures described by Allen et al. (1998) and Fallahi et al. (2013).

Annual fertigation was applied in May using urea nitrogen [$CO(NH_2)_2$] combined with potassium chloride (KCl) and phosphorus fertilizers to supply 123, 56, and 67 kg·ha^{-1} of N, P, and K, respectively. Micronutrients, particularly iron (Fe) and zinc (Zn), were applied twice in spring and once in early summer. Crested wheatgrass [*Agropyron cristatum* (L.) Gaertn.], a drought tolerant species, was grown as the orchard floor cover in all treatments. For the general cultural practices, standard protocols for the commercial orchard management in the region were followed (Washington State University 2026).

Full bloom and harvest calendar dates, along with the corresponding Julian day numbers (JDNs) from January 1 to full bloom and harvest, were determined for each cultivar annually and across years using meteorological data obtained from the Agrimet Weather Station in Parma, Idaho, USA.

Fruit thinning was performed manually each year when the fruit diameter reached approximately 2–2.5 cm. At this stage, crop load was adjusted by removing excess fruit to maintain an approximate spacing of 20 cm between adjacent fruits along each fruiting branch.

Tree growth, yield per tree, and fruit quality assessment. Tree growth, yield, and fruit quality attributes were quantified using standardized horticultural procedures. Tree trunk diameter (TD) was measured each year in late fall using a flexible measuring tape, with readings taken in two perpendicular orientations at 30 cm above the bud union. Trunk cross sectional area (TCSA) was calculated as $(TD/2)^2 \times 3.14$. Yield efficiency for each season was computed as the ratio of yield per tree (kg) to TCSA (cm^2), and the four-year mean yield efficiency is reported.

Harvest timing for each cultivar was determined based on the following maturity indicators:

1. External color development: Fruit reached full size and exhibited complete loss of green background color, transitioning to creamy yellow or bright red depending on cultivar.
2. Firmness suitable for handling: Flesh remained sufficiently firm for harvest and postharvest handling but yielded slightly under firm thumb pressure.
3. Edible but not fully ripe stage: The fruit was palatable but not yet at peak eating quality, consistent with commercial harvest standards.

At each harvest, eight fruits per tree (replication) were randomly collected, placed into perforated plastic trays (8-fruit capacity), and packed into 11.3-kg cardboard boxes. Samples were transported to the University of Idaho Pomology and Viticulture Program laboratory and immediately precooled at 0 °C. Eight fruits per tree were evaluated for quality attributes at harvest.

Fruit weight was recorded at harvest. Soluble solids concentration (SSC) was measured using a temperature compensated handheld refractometer (N1; Atago, Tokyo, Japan). Skin and flesh color were visually assessed, and flavor characteristics were described by trained evaluators for each cultivar.

Experimental design and statistical analysis. The experiment followed a completely randomized design with 14 peach cultivars and six single-tree replications. Data were analyzed using the General Linear Model (GLM) procedure, and treatment means were separated using Fisher's protected least significant difference (LSD) test at $\alpha = 0.05$. Statistical analyses were performed using SAS software (version 9.2; SAS Institute, Cary, NC, USA).

Results and Discussion

Phenology and Julian dates. Across the four study years, bloom and harvest timing exhibited substantial interannual variability; however, the range of harvest dates among cultivars was consistently wider than the variation in bloom dates (Tables 1 and 2). The range of full-bloom dates in 2010, 2012, and 2013 was between April 9 and April 19 (JDN 99–109), whereas harvest dates spanned late July to late September across years. This pattern indicates that harvest phenology is a more effective tool for refining cultivar behavior than bloom timing.

Bloom phenology is primarily determined by chilling accumulation and subsequent spring temperature conditions (Fallahi et al. 2009; Fallahi et al. 2014). Based on the senior author's long term experience, insufficient chilling has never been a limiting factor in this region, as winters consistently provide adequate chilling hours. Instead, temperatures between March 15 and May 15 constitute the most influential period governing bloom timing. Across all cultivars, full bloom occurred later in 2011 and earlier in 2012 and 2013 (Table 1). These differences correspond to contrasting thermal conditions during this critical window: cooler temperatures in 2011 delayed the onset of bloom, whereas warmer temperatures in 2012 advanced bloom progression (data not shown).

Average bloom dates showed relatively narrow differences among cultivars. 'Sierra Rich', 'Snow Giant', and 'Klondike' were the earliest to bloom (mean JDN 108), while 'O'Henry' bloomed latest (mean JDN 113). Despite these differences, all cultivars bloomed within the regional frost risk window, suggesting that selecting later blooming cultivars would not substantially reduce frost exposure.

Although 'Snow Giant', 'PF 35 007', and 'O'Henry' represented early- , mid- , and late -blooming groups, respectively, all three were late-maturing cultivars, demonstrating that bloom timing was not predictive of maturity class. Cultivars were clearly grouped into early-, mid-, and late-maturing categories, each with an approximate two-week harvest window. Early cultivars included 'PF 5D Big', 'PF8 Ball', and 'Rich Lady'; mid season cultivars included PF9A 007, Lucky 13, PF11 Peach, Sierra Rich, Klondike, and PF 28 007; and late cultivars included 'PF 24C', 'Giant Elberta', 'Snow Giant', 'PF 35 007', and 'O'Henry'.

Yield performance. All cultivars produced full crops during 2010–2013 (Table 3), consistent with the absence of major winter or bloom time freeze events during these seasons. Yield in most commercial peach cultivars can be reduced when winter temperatures reach approximately –12 °C (Hentschel 2019; Sterle 2023). However, in this study, no such reductions were observed except for potential impacts in 2013. In 2013, temperatures reached –22 °C on January 21 for a short period and –3.0 °C on April 14, the latter occurring near bloom time. Although these events might have been expected to cause some bud injury, yields in 2013 were numerically higher than in other years, making it difficult to quantify any true impact from these freezes. Because the same fruit thinning strategy was applied each year, the absence of yield reduction can be attributed to two factors: the January 21 freeze occurred during deep endodormancy, when trees exhibit maximum cold hardiness; and the subfreezing temperature on April 14 lasted only 15 minutes or less (data not shown), a duration insufficient to cause meaningful injury to open flowers. Thus, the relatively high yield in 2013 compared with prior years likely reflects that trees were six years old and fully mature, and that no major or prolonged freeze events occurred during the critical stages of reproductive development.

Cultivars differed markedly in precocity. 'PF9A 007', 'PF 24C', and 'PF 35 007' produced 19.1–25.6 kg·tree^{-1} at the third leaf, making them strong candidates for growers prioritizing early returns. When averaged across four years, 'PF9A 007', 'PF 35 007', and 'PF 24C' were consistently high yielding, whereas 'Giant Elberta', 'PF 5D Big', 'PF8 Ball', and 'Rich Lady' were among the lower yielding cultivars.

Tree size strongly influenced yield efficiency. 'Klondike' exhibited the largest trunk cross sectional area (TCSA), while 'PF 24C' had the smallest, resulting in the highest yield efficiency for 'PF 24C'. Trees of 'Klondike' had about 2.47 times larger TCSA than those of 'PF 24C', supporting the suitability of 'PF 24C' for a high-density orchard system. Under the tree spacing of this study

(2.44 × 4.88 m; 841 trees·ha^{-1}), 'PF 24C' produced a cumulative yield 150 kg·tree^{-1} over four years, equivalent to 126.15 MT·ha^{-1}. If planted at a density of 1278 trees·ha^{-1}, achievable with 1.829 × 4.268 m spacing, yield could theoretically reach 191.7 MT·ha^{-1}, assuming constant per tree productivity. This demonstrates the substantial potential to intensify high-efficiency cultivars such as 'PF 24C'. Nevertheless, it is important to emphasize that the establishment of any high density orchard system, including the configuration proposed for 'PF 24C', should be preceded by targeted preliminary evaluations before large scale commercial adoption.

Fruit weight and soluble solids. Fruit weight was positively correlated with harvest JDN across cultivars and years. Early maturing cultivars ('PF 5D Big', 'PF8 Ball', 'Rich Lady') produced the smallest fruit (191.5–221.8 g), whereas late maturing cultivars ('Giant Elberta', 'Snow Giant', 'PF 35 007', 'O'Henry') produced the largest fruit (329–354 g; Table 4). Within the PF series, fruit size varied widely. The fruit of 'PF3007' with 335.7 g·fruit^{-1} was the largest, and that of 'PF8 Ball' had the smallest fruit among all the PF series.

Soluble solids concentration (SSC) did not differ consistently between white and yellow-fleshed cultivars. For example, SSC in yellow-fleshed 'O'Henry' was often similar to that of white fleshed 'Snow Giant'. 'O'Henry' had the highest SSC in three of four years, while 'PF8 Ball' had the lowest (Table 5).

Integrated phenology, yield, and quality attributes. We did not observe any cultivar-by-year interactions for any of the measured parameters in this study. Cultivar selection should be aligned with market timing, labor availability, and compatibility with other crops in the production system. Furthermore, as described by Olmstead et al. (2015), the preference of consumers for an "ideal" peach may widely vary depending on the consumer's age and market location. In our study, early cultivars ('PF 5D Big', 'PF8 Ball', 'Rich Lady') matured between July 25 and August 10, aligning well with operations that also grow 'Gala' apples, which begin harvest in mid-August. 'Rich Lady' fruit had red-pink skin and white flesh with red pigments, with an attractive appearance, pleasant taste, and texture. Harvest times of mid-season cultivars ('PF9A 007', 'PF Lucky 13', 'PF11 Peach', 'Sierra Rich', 'Klondike', 'PF 28 007') and late cultivars ('PF 24C', 'Giant Elberta', 'Snow Giant', 'PF 35 007', 'O'Henry') overlap with harvest periods for 'Golden Delicious', 'Delicious', early 'Fuji', and 'Braeburn' apples. Given increasing labor constraints, growers should plan carefully when combining late peaches with these apple cultivars.

The "PF" series provided a wide range of maturity dates, fruit sizes, and soluble solids concentrations, offering flexibility for diverse market targets. 'PF9A 007' performed strongly as an early -season cultivar, while 'PF 24C' and 'PF 35 007' were well-suited for early and late September markets, respectively. Based on our observations, 'PF 24C' was particularly well adapted to Intermountain West conditions. In addition to high yield efficiency and suitability for high density systems, 'PF 24C' demonstrated notable cold tolerance and maintained adequate yields even in seasons with subfreezing temperatures (data not shown). Consumer response to the "bleeding" phenotype, the penetration of red pigments into the flesh, commonly observed in several PF cultivars, varies widely among markets. This trait should therefore be considered carefully when selecting cultivars for specific consumer groups. The fruit of 'PF 5D Big' exhibited non-uniform maturity, which can be a preferred trait for small-scale growers and farmers' markets.

Although early maturing cultivars often show higher split pit incidence (Yu et al. 2025), this relationship did not apply to late maturing 'Snow Giant' and 'O'Henry', which exhibited no split pits despite large fruit size. 'O'Henry' combined high yield, large fruit size, attractive red skin, yellow flesh, and strong aroma, making it one of the most desirable, yellow-fleshed cultivars for regions similar to the study site. 'Snow Giant' demonstrated exceptional quality attributes and has become a leading, white-fleshed cultivar for export markets, particularly Taiwan. This long-term evaluation provides robust evidence of cultivar-specific dif-

Table 1. Julian days to full bloom and harvest time in different peach cultivars over four years in 2010-2013.

	Julian Day Number to Full Bloom[z]					Julian Day Number to Harvest[z]				
Cultivar	2010	2011	2012	2013	Avg. 2010-2013	2010	2011	2012	2013	Avg. 2010-2013
PF 5D Big	109 a[y]	121 e	105 e	102 b	109 d	209 l	219 j	197 h	200 j	206 m
PF8 Ball	108 b	123 c	106 d	101 c	110 c	219 k	224 i	208 g	208 i	215 l
Rich Lady	109 a	124 b	108 b	102 b	111 b	228 j	236 h	221 f	222 h	222 k
PF9A-007	108 b	120 f	105 e	100 d	109 d	232 1	236 h	225 e	224 g	229 j
PF Lucky 13	109 a	122 d	105 e	100 d	109 d	238 g	236 h	226 e	224 g	231 i
PF11 Peach	108 b	121 e	107 c	100 d	109 d	236 h	236 h	226 e	227 f	231 i
Sierra Rich	107 c	123 c	102 h	100 d	108 e	242 f	242 g	226 e	231 e	235 h
Klondike	106 d	121 e	103 g	99 e	108 e	242 f	245 f	233 d	238 d	240 g
PF 28-007	108 b	122 d	105 e	101 c	109 d	250 e	249 e	240 c	238 d	244 f
PF 24C	109 1	122 d	107 c	102 b	110 c	256 d	256 d	251 b	245 c	252 e
Giant Elberta	108 b	122 d	104 f	102 b	109 d	263 c	264 c	251 b	253 b	258 d
Snow Giant	108 b	122 d	104 f	100 d	108 e	270 b	276 a	269 a	265 a	270 b
PF 35-007	108 b	122 d	105 e	100 d	109 d	269 b	269 b	269 a	265 a	268 c
O'Henry	109 a	126 a	109 a	109 a	113 a	273 a	276 a	269 a	266 a	271 a

[z]Abbreviations: Julian Day to Full Bloom = Julian day number (JDN) from January 1 to full bloom; Julian day number (JDN) to harvest.
[y]Mean separations within columns by Fisher's protected Least Significant Difference (LSD) test at 5% level. Cultivars followed by different letters within each column are significantly different.

Table 2. Calendar day of full bloom and harvest time in different peach cultivars over four years in 2010-2013.

	Calendar Day of Full Bloom					Calendar Day of Harvest				
Cultivar	2010	2011	2012	2013	Avg. 2010-13	2010	2011	2012	2013	Avg. 2010-13
PF 5D Big	April 19	May 1	April 15	April 12	April 19	Jul 28	Aug 7	Jul 16	Jul 19	Jul 25
PF8 Ball	April 18	May 3	April 16	April 11	April 20	Aug 7	Aug 12	Jul 27	Jul 27	Aug 3
Rich Lady	April 19	May 4	April 18	April 12	April 21	Aug 16	Aug 24	Aug 10	Aug 10	Aug 10
PF9A-007	April 18	April 30	April 15	April 10	April 19	Aug 20	Aug 24	Aug 13	Aug 12	Aug 17
PF Lucky 13	April 19	May 2	April 15	April 10	April 19	Aug 26	Aug 24	Aug 14	Aug 12	Aug 19
PF11 Peach	April 18	May 1	April 17	April 10	April 19	Aug 24	Aug 24	Aug 14	Aug 15	Aug 19
Sierra Rich	April 17	May 3	April 12	April 10	April 18	Aug 30	Aug 30	Aug 14	Aug 19	Aug 23
Klondike	April 16	May 1	April 13	April 9	April 18	Aug 30	Sep 2	Aug 21	Aug 26	Aug 28
PF 28-007	April 18	May 2	April 15	April 11	April 19	Sep 7	Sep 6	Aug 28	Aug 26	Sep 1
PF 24C	April 19	May 2	April 17	April 12	April 20	Sep 13	Sep 13	Sep 8	Sep 2	Sep 9
Giant Elberta	April 18	May 2	April 14	April 12	April 19	Sep 20	Sep 20	Sep 8	Sep10	Sep 15
Snow Giant	April 18	May 2	April 14	April 10	April 18	Sep 27	Oct 3	Sep 26	Sep 22	Sep 27
PF 35-007	April 18	May 2	April 15	April 10	April 19	Sep 26	Sep 26	Sep 26	Sep 22	Sep 25
O'Henry	April 19	May 6	April 19	April 19	April 23	Sep 30	Oct 3	Sep 26	Sep 23	Sep 28

Table 3. Yield per tree, tree trunk cross sectional area, and average yield efficiency over four years in 2010-2013.

Cultivar	Yield·tree^{-1} (kg) 2010	2011	2012	2013	Cum. 2010-13	TCSA 2013 (cm^2)^z	Avg. YldEff^z 2010-13 (kg·cm^{-2})
PF 5D Big	11.0 def^z	29.9 bcde	22.7 ef	23.7 g	87.2 fgh	121.1 c	0.2345 fg
PF8 Ball	14.8 bcd	25.5 de	28.6 cde	30.9 fg	99.8 efgh	90.2 d	0.349 cd
Rich Lady	7.8 ef	25.2 e	15.6 fg	31.0 fg	79.6 gh	145.6 bc	0.177 g
PF9A-007	20.3 ab	51.0 a	44.9 a	57.4 ab	173.6 a	129.7 bc	0.429 b
PF Lucky 13	15.1 bcd	35.6 bc	36.4 abcd	54.1 abc	141.3 bc	127.1 bc	0.356 cd
PF11 Peach	11.7 def	38.3 b	27.7 de	44.3 cde	122.0 cde	144.8 bc	0.263 ef
Sierra Rich	11.1 def	25.6 de	28.1 cde	39.8 ef	104.6 defg	146.1 bc	0.228fg
Klondike	8.7 ef	23.5 e	28.8 cde	48.0 bcde	109.0 def	201.9 a	0.177 g
PF 28-007	13.2 cde	22.5 e	34.8 bcd	43.7 cde	114.2 de	139.3 bc	0.260 ef
PF 24C	19.1 bc	27.2 cde	42.7 ab	61.0 a	150.0 ab	81.9 d	0.557 a
Giant Elberta	6.9 f	23.1 e	8.7 g	36.9 ef	75.7 h	136.6 bc	0.178 g
Snow Giant	9.8 def	29.1 bcde	24.1 ef	64.6 a	127.6 bcd	148.8 b	0.272 ef
PF 35-007	25.6 a	34.5 bcd	37.1 abc	53.7 abcd	150.8 ab	131.6 bc	0.413 bc
O'Henry	17.8 bc	23.8 e	30.2 cde	41.4 def	113.2 def	122.1 c	0.315 de

[z] Abbreviations: Cum. = Cumulative; TCSA = Tree Trunk Cross Sectional Area; Avg. YldEff = Average Yield Efficiency across 4 years of 2010-2013; Yield efficiency for each year = yield per tree in kg·TCSA^{-1} in cm^2.

[y] Mean separations within columns by Fisher's protected Least Significant Difference (LSD) test at 5% level. Cultivars followed by different letters within each column are significantly different.

Table 4. Fruit weight, skin and flesh color over four years in 2010-2013.

	Fruit weight (g)						
Cultivar	2010	2011	2012	2013	Avg. 2010-2013	Fruit skin Color	Fruit flesh color
PF 5D Big	185.7 h[z]	196.9 f	180.7 g	202.9 fg	191.5 h	Med red on orange background	Yellow
PF8 Ball	169.9 f	215.9 def	187.9 g	173.5 g	186.6 h	Med to dark red on yellow-orange background	Yellow, bleeding skin toward the pit
Rich Lady	209.4 gh	207.5 ef	246.1 e	224.4 ef	221.8 g	Med red maroon on orange background	Golden yellow, bleeding pit to skin
PF9A-007	244.9 de	276.5 b	266.6 def	241.5 def	257.4 e	Dark red on orange background	Yellow, bleeding pit to skin
PF Lucky 13	225.3 efg	238.9 cd	255.7 ef	247.4 de	241.8 efg	Yellow/ red background	Deep yellow
PF11 Peach	233.0 defg	240.1 cd	264.5 def	254.9 cde	248.1 ef	Med red orange background, mottling	Yellow, bleeding pit to skin
Sierra Rich	218.5 fg	223.5cde	265.3 def	239.0 def	236.6 fg	Maroon, red, almost black	Yellow, bleeding bit to skin
Klondike	254.4 cd	280.1 b	279.9 d	298.6 bc	278.2 d	Light to dark red/pink	Creamy, bleeding pit to skin
PF 28-007	281.5 b	325.9 a	348.7 b	303.6 b	314.3 c	Light red on yellow background	Yellow, bleeding pit to skin
PF 24C	235.3 def	241.8 c	276.0 de	272.8 bcd	256.5 ef	Light to dark red on yellow with mottling	Yellow, sever bleeding pit to skin
Giant Elberta	317.5 a	330.6 a	395.2 a	372.0 a	354.1 a	Light red on yellow with mottling	Yellow, bleeding pit to skin and skin to pit
Snow Giant	274.0 bc	350.5 a	409.8 a	380.5 a	353.7 a	Light to dark pink on creamy background	White, some bleeding from pit to skin
PF 35-007	287.1 b	342.5 a	324.6 c	388.4 a	335.7 ab	Red to almost black	Yellow, bleeding from pit to skin
O'Henry	281.9 b	331.2 a	338.0 bc	365.1 a	329.1 bc	Dark red on dark yellow	Bright shiny yellow, bleeding pit to skin

[z] Mean separations within columns by Fisher's protected Least Significant Difference (LSD) test at 5% level. Cultivars followed by different letters within each column are significantly different.

Figure 1. Pictures of fruit skin and flesh colors, patterns of pigmentations, and dates of photography during the growing season in peach cultivars.

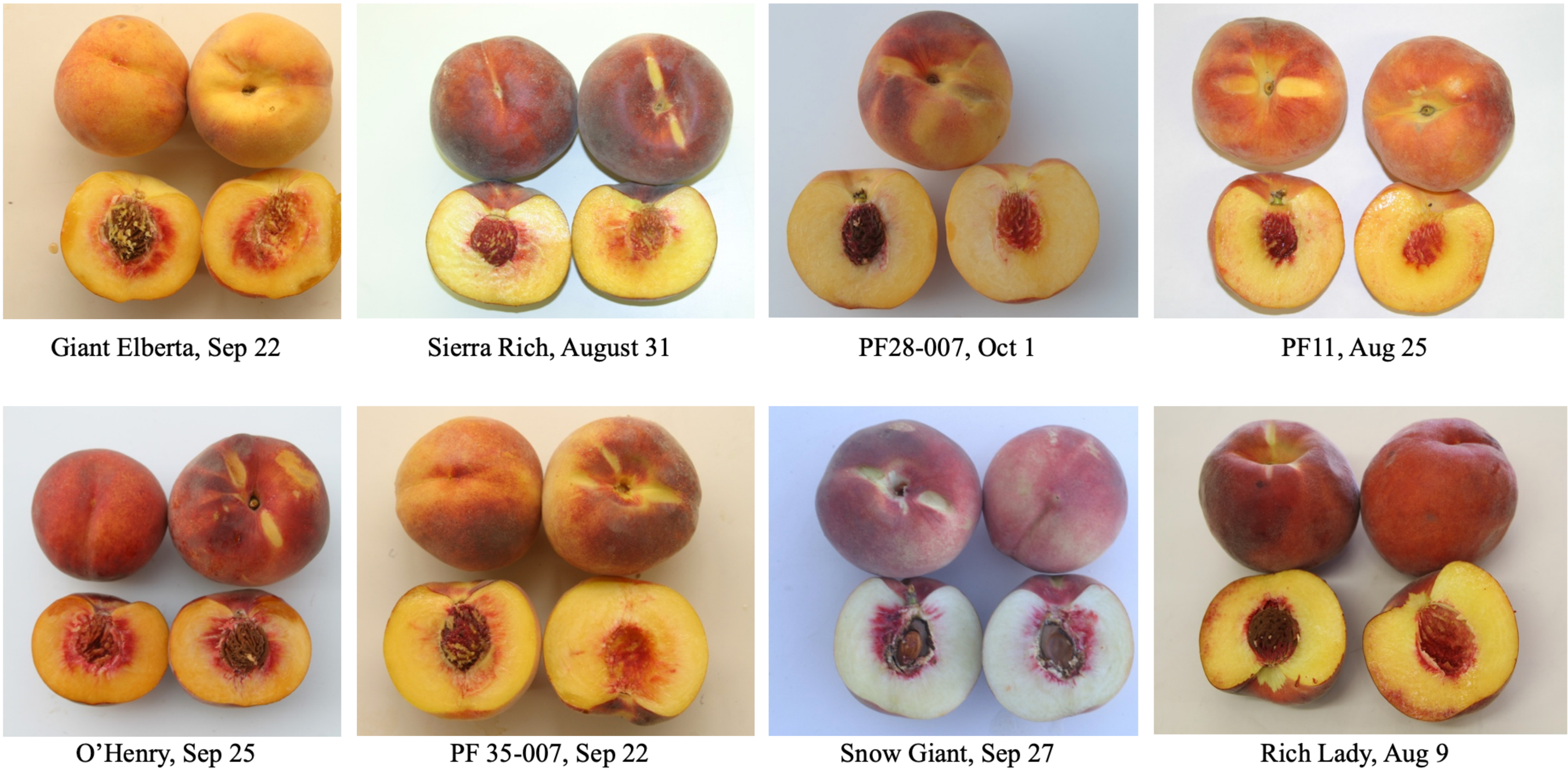

Figure 1 (continued). Pictures of fruit skin and flesh colors, patterns of pigmentations, and dates of photography during the growing season in peach cultivars.

PF Lucky 13, Aug 17

PF 9A-007, Aug 12

Klondike, Aug 18

PF8 Ball, Aug 3

PF 24C, Sep 13

PF 5D Big, July 25

Spectrum of flesh color

Spectrum of skin color

ferences in phenology, yield potential, fruit quality, and orchard system suitability. The findings are broadly applicable to regions with similar climatic and edaphic conditions. Continued long-term evaluation of emerging peach and nectarine cultivars, and particularly their preference among diverse age groups and markets, as suggested by Olmstead et al. (2015), is warranted to support informed commercial adoption prior to large-scale planting.

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