

California Cling Peach Advisory Board
2019 Annual Report

Project Titles:	Regional Testing of New Cling Peach Selections
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Summary Page

Breeding objectives for 2019 included:

- A. Release *Ultra-Early#1* as the unpatented UCD variety *Ogawa* to encourage grower/processor assessments/options.
- B. Continue the evaluation of UCD Experimentals currently in regional trials, particularly *Early#6* and *Early#7* in the *Dixon-Andross* period. Establish a more formal UCD protocols for facilitating rapid and large-scale grower testing of new UCD processing peach experimentals.
- C. Identify candidates for the next round of regional testing in UCD test-plots and through fruit-sample processing at the UCD Pilot Plant. Establish virus-free foundation nursery stock for new items and verify trueness-to-type of advanced selections already in Foundation Plant Services (FPS). Work with processors and growers in defining and testing fruit and tree characteristics required for effective once-over, including mechanical, harvesting.

Because of recent changes in the FPS propagation protocols, certified sources of *Ogawa* have yet to be established at FPS, delaying its informal release. In discussing this with shareholders, it was agreed to hold off on the release until we have a better understanding of industry priorities for this season. Meanwhile, dramatic increases in labor costs continues to challenge both the continuity of commercial processing peach production as well as the continued efforts of the UCD Breeding and Evaluation Program. The UCD program is also in the transition to a fuller deployment and recombination of new germplasm developed over the past decades while shifting objectives in anticipation of continuing industry and program needs for labor reduction. Selections facilitating mechanization at all aspects of orchard management including pruning, flower-thinning and harvest are being pursued. Increased labor and field charges for UCD breeding plots are also requiring the program to dramatically reduce field plantings from the current level of approximately 22,000 trees. A central part of this shift is the comprehensive evaluation of promising traditional and advanced generation breeding materials in order to identify the best breeding lines and parents for further progress and to rogue out populations and breeding lines of less value. The 44 breeding selections summarized in this report represent the more promising material within currently targeted Extra-Early and Early harvest seasons with a 3-year goal of eliminating 30 to 40% of unnecessary field plantings.

Introduction

The UCD processing peach variety *Kader* has been released as a replacement variety for the Extra-Early ‘Dixon-gap’ (USPP26871), with *Vilmos* released as an alternative to the Early season Andross variety (USPP29623P3). The Ultra-Early selection *Ogawa* is being prepared for release as an unpatented UCD variety, and UCD selection Early#6 is in the final stages of regional trials prior to formal release procedures. These releases demonstrate two main services provided by UCD and other public breeding programs: a long-term investment in discovering, incorporating and commercializing new germplasm for solving current and future industry problems, and long-term regional testing to ensure that released varieties are free of major flaws that would cause growers and industry significant hardships if released prematurely. Both services, new germplasm development and long-term regional testing, require an investment of 10 to 20 years, a commitment that makes them unappealing to private breeding ventures. The Dixon gap (the harvest season between Carson and Bowen) resulted from the loss of the *Dixon* variety over 40 years ago because of problems with red-stained and split pits. Efforts to develop replacement varieties utilizing the traditional California germplasm were unsuccessful because all traditional material was closely related so highly vulnerable to pit quality problems at this critical ripening-time. The breeding of the *Kader* variety resulted from the incorporation of novel Plant-Introduction (PI) germplasm allowing good processing quality for the Dixon-time while further introducing an early version of the ‘*stay-ripe*’ trait that allows tree-ripe fruit to retain ‘on-tree’ processing quality for a week or more, allowing growers and processors more flexibility in harvest. *Stay-ripe*, improved brown rot resistance and reduced fruit-bruising susceptibility have also been incorporated into the *Vilmos* and (yet to be released) *Early#6* varieties and these separate sources of resistance are now being further concentrated for even greater performance in the next generation UCD processing peach selections. (See related discussions in the Annual Variety Development Report). While processing peach varieties inherently need to demonstrate longer orchard productivity and production efficiency compared to the higher-priced and shorter orchard-life-expectancies of fresh-market varieties, the incorporation of new, untested germplasm accentuates the need for such long-term, regional testing to rogue out undesirable wild-type characteristics. New canning varieties thus need to be appropriately tested in the different production regions and under the range of environment/cultural conditions anticipated for commercial production. This is necessary to identify the most promising selections for release to growers/processors as well as to detect any deficiencies prior to large-scale commercial plantings.

The UCD processing peach breeding program is presently in the transition to a fuller deployment and recombination of new germplasm developed over the past decades. It is also shifting objectives in anticipation of future industry needs for labor reduction. Consequently, selections facilitating mechanization at all aspects of orchard management including pruning, flower-thinning and harvest are being pursued. Increased labor and field charges for UCD breeding plots are also requiring the program to dramatically reduce field plantings. A central part of this shift is the comprehensive evaluation of promising traditional and advanced generation breeding materials in order to identify the best breeding lines and parents for further progress and to rogue out populations and breeding lines of less value. The 44 breeding selections presented below represent the most promising material within currently targeted Extra-Early and Early harvest seasons which have been subject to a more comprehensive selection process with a goal of eliminating 30 to 40% of current field plantings.

Ogawa release.

Because of recent changes in the Foundation Plant Services (FPS) propagation protocols, certified sources of *Ogawa* (Ultra-Early-1) have yet to be established at FPS, delaying its informal release. In discussing this with shareholders, it was agreed to hold off on the release until we have a better understanding of industry priorities for this season extension.

Accelerating regional testing.

Selections were evaluated in regional evaluation blocks located in Sutter, Yuba, Yolo, Solano and Stanislaus counties. Evaluations were primarily through sample and data collection during the fruit-ripening season. An additional 28 selections were selected from the main breeding block for further evaluation either as candidate selections or as parents for further, directed crossing. We are in the final stages of converting all Davis and Winters breeding and evaluation blocks to annual mechanical hedging and mechanical flower-thinning. This is both a response to rapidly escalating UCD field charges as well as an effort to more aggressively pursue future selections and varieties compatible with mechanize field operations. Special UCD Test Agreements are also being developed that allow for the large-scale commercial propagation of 10,000 trees or more of UCD advanced selections to accelerate regional grower testing. In addition, we are negotiating with UCD Patent Office to allow cooperating nurseries to recover some of their propagation/marketing cost through a redistribution of UCD patent royalties as a further incentive to maintain/market processing peach varieties.

Promising selections.

With the transition to the next generation of advanced UCD processing peach breeding selections as well as the lull in new commercial plantings, we were initiated a comprehensive evaluation/review of both 2nd and 3rd generation breeding selections to identify the best candidates for the next round of regional grower testing. Selections are evaluated in order of the anticipated harvest season, though the final mature grafted-tree harvest date may vary by several days because of the seedling and so somewhat juvenile nature of current selections.

Ultra-Early

Ogawa.

Currently being tested as *Ultra-Early#1*, this selection is derived from a combination of Brazilian (*Conserva485*) with probable Eastern European (*NJC5102893*) peach germplasm from the Rutgers University breeding program of Dr. Fred Hough which was terminated in the 1980s. The initial New Jersey parent expressed unusual sections of stem necrosis which we determined to be possibly epigenetic rather than disease in origin. A series of clonal-source selections since the 1990's (based on the Noninfectious-Bud-Failure elimination strategies developed for almond) has eliminated all trace of this condition in all subsequent UCD and regional grower



trees. *Ultra-Early#1* combines very good size and cropping potential for its very early maturity of approximately 8-12 d before *Loadel*. Despite its early maturity, this selection demonstrates exceptional compensatory-sizing capacity (i.e. the ability to aggressively size fruit when more resources become available, as would occur when the crop is over-thinned or due to early fruit loss from weather, disease, etc.). The aggressive fruit sizing compensates by making remaining fruit and so final yield larger. *Ultra-Early#1* has also shown resistance to fruit brown-rot and has been an important parent for both early maturity, good fruit size and firmness, as well as fruit brown-rot resistance. (More disease data is presented in 2012 to 2018 annual Variety Development reports). The exceptional size and yield potential for such an early season combined with its high level of brown-rot resistance have made this a particularly attractive variety for grower trials for organic production of processed product because it allows the product to be processed in the cannery before contamination by non-organic fruit. The high orange-gold flesh color of this selection would also result in a more desirable processed product without the undesirable risk of mixing with lighter colored fruit (which would result in an inconsistent canned product color). Depending and spring temperatures, this selection can produce a large number of irregularly shaped fruit. While this would discourage its use for processing peach-halves, most very early processing peach fruit is diced with some slicing, neither of which seem to present a problem for this time-period based on processor discussions. The potential for good fruit production and quality as well as good fruit brown-rot resistance in a very early processing peach variety offers the opportunity for both season-extension and expansion of organic production. Because both of these options are inherently risky, it has been decided to release this selection under the name *Ogawa* but without patenting to make it more accessible to the industry for grower/processor experimentation. Clean foundation stock has now been sent to FPS and we are now awaiting final certification for trueness-to-type and freedom from viruses.



04,2-148. Ripening between *Ogawa* and *Ceres Carson*. Fruit are medium in size with no tendency for developing red coloring of the pit. Resulting from a cross between the more traditional parents, including 96,3-153, this selection combines early season with relatively good fruit. Firmness holds well for a week to 10 days but in some years can soften rather rapidly after that. Fruit are consistently at the higher end of sugar concentration.. Fruit size and final productivity, however, need to be more carefully evaluated.



Extra-Early

Carson harvest season.

2011,23-61. Fruit have a desirable golden-yellow flesh color and good fruit size and uniformity for the season. Ripening in the *Carson* harvest season, this advanced selection is a selfed progeny of 90,11-3 which has plant introduction PI292557 in its lineage. Ripe fruit are firm and have a moderate red blush covering approximately 60% the surface. Fruit quality and firmness are maintained to 2 weeks following tree ripe. Despite harvesting at 2 weeks following tree-ripe, fruit process well, producing a good quality product (2 sequential years imaged). This selection shows good field resistance to fruit brown-rot though testing using controlled inoculations in laboratory conditions have not yet been made. In 2018, this selection showed good performance despite being in an evaluation block that suffered from frost damage..



05,4-237. Resulting from a cross to the South African *stay-ripe* source, this selection combines moderately good firmness with good size and color. Firmness is maintained for up to 2 weeks or more. This item is a 2nd generation selection and while not exceptional in any single category, it has been consistently good producer of quality fruit over the last half-dozen years and so continues to have promised particularly towards this desirable harvest season. Bruising and flesh browning may become issues and there has been observations of red pigmentation of overripe pits.



1,12-54. Also product of the older 2nd generation of selections, this item is also the result of crosses within traditional germplasm. This selection shows very good size, firmness and productivity but may soften rather rapidly a week to 10 days after tree ripe. It had also consistently been on the higher end of fruit sugar concentration. Trees appear to have exceptional potential for productivity in this Extra-Early-season as well as producing fruit with good size and color. It's tendency of becoming soft may make it unacceptable for mechanical harvesting.



11,12-122. Representing a newer, third-generation selection, this processing peach combines traditional with the South African *stay-ripe* sources, producing firm fruit of good quality. Tree is vigorous and productive, producing abundant fruit yellow to golden-yellow flesh color. Fruit firmness is very good at harvest and is maintained for up to 2 weeks after initial tree-ripe phase. Pit cavity is relatively small but can show some slight red-pigmentation following warmer spring temperatures. Similarly, there is some tendency for the inner flesh at the pit to retain some greenish color even when the remainder of the fruit is full-ripe, though this tends to cook-out with processing.



Dixon harvest season.

Early#6. This item continues to look very promising but requires additional field production data as part of standard Plant Science Department variety release protocol. Bred as 9,12-155, Early-6 represents 3rd-generation germplasm, being an advanced breeding selection developed from Californian and South African germplasm (*Wolvamade*) combining the distinct *stay-ripe* potentials of *Wolvamade* and UCD-Late#4 with a more traditional golden-yellow flesh color and a ripening time within the crucial Dixon-Andross gap. This selection has consistently shown superior fruit color as well as harvest- and post- harvest firmness and cropping potential over a multi-year test period. Fruit maintain integrity and quality 14 days or more after tree-ripe (*stay-ripe* trait) allowing delayed or once-over harvest. Good levels of fruit brown-rot resistance have also been achieved both in the lab and field, as well as moderate levels of resistance to *Monilinia* flower blight. Fruit is medium large, uniformly round and firm, even when overripe. Fruit remain free of red blush on the skin with no red staining of the fruit pit-cavity even up to two weeks beyond the full-ripe date. (This genotype appears to be a carrier for a gene that is thought to shut down the expression of any red pigmentation in the flesh. This trait is similar to the ‘highlighter’ gene in fresh market peaches except that, unlike ‘highlighter’ the fruit flesh can continue to develop a rich golden-yellow color. (We are currently evaluating RosBreed-2 data to try to confirm this origin and possibly develop molecular markers for red-pigmentation. Current data supports distinct origin and activity for this valuable trait). Pit-cavity is medium and somewhat ragged. Fruit weight following heavy thinning was moderately large (238g) being similar to *Ross* though somewhat smaller than *Kader*. Because *Early-6* harvest between *Kader* and *Vilmos*, it may complement these varieties as the fruit, while medium in size, tend to be uniform and above the minimum size. Because of its good color, freedom from red pit and pit fragments, and ability to maintain good fruit integrity a week or more after the tree ripe-stage, this breeding line is being extensively studied in the RosBreed-2 molecular marker project which began in 2015 and completed 2019 (though an extensive resultant database remains to be analyzed). *Early#6* has also shown good tolerance to low-chill winter conditions of both 2013/14 and 2014/15 as it consistently produces high densities of concentrated (i.e. at similarly uniform development stage) bloom with resulting in more uniform crop development and harvest [see earlier annual reports]. Good productivity and disease resistance was observed in all UCD and grower plots 2018 and 2019 despite significant brown rot damage on adjacent plantings. A moderate final fruit size and tendency to size up relatively late, remain the major concerns for this item.

2011,23-65. With a lineage containing both the new germplasm PI292557 as well as the traditional variety *Dixon*, this second-generation breeding selection ripens in the *Dixon* harvest season while maintaining good processed fruit size, color and firmness up to 16 days after tree-ripe (image). Fresh fruit have a red to pink blush on approximately 70% of the surface. A slight pink coloration can occasionally be observed at the pit -cavity in some delayed-harvested fruit, though this is usually lost in processing (see image from 2018). A smaller pit cavity also contributes to higher case yields. The tree continues to be productive, producing fruit of uniform size and shape. In some years fruit have had a tendency to be irregular in shape, and this remains a concern for future evaluations.



2011,23-81. Representing a 3rd generation breeding selection, this genotype resulted from Dr. Davis and a hybridization between PI292557 progeny and advanced selection *UltraEarly-1*, which itself is derived from germplasm from Brazil. The tree is productive and produces fruit of good size and firmness. Fruit quality and firmness are maintained for 2 weeks or more after tree-ripe. Fruit show good field resistance to fruit brown-rot which has been verified in laboratory studies in the Bostock lab. Image is of fruit following 2015/16 inoculation showing little to no disease development. [Both the *Dr. Davis* seed parent and *UltraEarly-1* have been identified as dependable sources of brown-rot disease resistance with putative molecular markers for this trait identified (see 2016 & 2018 Variety Development Report). Irregular fruit sizing has been observed in some years such as 2016 and 2019.



10,8-456. Also representing a third generation breeding selection derived from a cross with *Dr. Davis* and advanced selection *UltraEarly-1* as grandparents, this Dixon-period selection shows good size for the season. Good field resistance is also observed though, following Bostock lab inoculation, resistance is slightly less than 2011, 23-81. In addition to good size and flesh color, fruit demonstrate good firmness and freedom from pit staining and fragmentation. Good processing fruit quality is maintained on-tree for over 2 weeks post-ripe though the fruit may soften to below 5 pounds pressure by this time. The seedling tree shows good productivity but continued to show only moderate vigor in 2018 in our very high density selection orchards. In 2019 it was propagated to a more standard planting density.



11,23-110. Resulting from a cross between more traditional parents, this selection combines firmness with good fruit color at this critical harvest period. Fruit is medium in size with a uniform yellow-gold color. Fruit is more susceptible to bruising than other selections in this category and fruit brown rot has been observed in the field but this item has yet to be tested in controlled laboratory conditions. Pits are clean of any red pigmentation even in overripe fruit or after prolonged heat. Fruit sizing remains a concern.



11,2-84. This selection resulted from a cross between the very firm but small selection 2000,9-79 with *Ultra-Early-1* resulting in improved firmness and size. Fruit color is a desirable golden-yellow and fruit tend to be large with moderate small pit. Fruit have good firmness at tree-ripe and in many years will maintain this firmness for a week or more. Fruit also show a low tendency to bruise and show low fruit brown rot disease in the field. In some years, such as 2016 and 2019, over-ripe fruit tend to soften in the outer flesh resulting in pit or-cup bruising during processing. Split pits were concern in 2019, though the fruit remained relatively free in previous years.



05,10-223. Resulting from a cross between Dr. Davis and almond derived breeding lines, this selection produces fruit of good firmness and size. Interestingly, molecular data showed that the almond parent contributed an important gene for fruit size that was present in early peach accessions but was lost during subsequent domestication and breeding. Fruit sizing tendency is such that over-thinned fruit can continue to size up to harvest resulting in larger fruit that compensate for the smaller crop load. While fruit tend to have good firmness that is maintained for a week or more after tree-ripe, large fruit that sized-up late achieve this by significant water uptake making those fruit susceptible to rapid softening after tree-ripe. Fruit have a good golden-yellow flesh color with clean pit though some slight staining will be apparent in some years in overripe fruit. Fruit are moderately resistant to flesh-bruising but becoming less so in overripe fruit.



11,10-70. Resulting from lineages combining traditional and almond breeding material, this selection produces fruit of good shape and quality. Fruit show good firmness but fruit sizing can be irregular depending on the year. The tree may also be more susceptible to split pits following light crop years. Firmness is good for the season and holds for a week or more after tree-ripe. Fruit flesh can sometimes fragment during the pitting process suggesting the nature of the texture firmness may be less compatible with current pitting techniques (or it may be that the pitter at the UCD plant is not correctly adjusted for that size fruit).



11,17-150. This selection has breeding line 00,16-92 as a grandparent. 00,16-92 is unique in that the epidermis is somewhere between peach-fuzz and the nectarine-glabrous. Pubescence or fuzz on this and other selections derived from 00,16-92 appears denser and more compact with a less 'woolly' mouth-feel yet better resistance to fruit brown rot. Fruit are firm with a golden-yellow to gold flesh and skin color. Red pigmentation is absent from both the skin as well as pit. Fruit maintain good firmness for up to a week after tree-ripe but can soften quickly thereafter. This is one of the few sources of the *stay-ripe* trait which can be transferred to freestone peaches, though the effect is not as pronounced as in clingstone.



Bowen harvest time.

2010,21-450. Despite being a progeny from Late season selection *Wolvamade* (South Africa) and *Extra-Late-2* as grandparents, this selection ripens with *Bowen*. (It is not unusual for more exotic germplasm to shift ripening time beyond that of either parent. This was essentially how the Dixon gap was targeted: *Vilmos* with its Dixon harvest time, has a similar lineage. This transgressive harvest shifting has been one of our core strategies for targeting the otherwise challenging Carson-Andross



maturity time). As with *Vilmos*, the fruit show a desirable golden yellow flesh and skin color without blush. Also similar to *Vilmos*, fruit have very good firmness at tree ripe that is maintained to over 2 weeks post-ripe. Fruit are uniform in size though not as large as previously described selections in this group. Some fruit bruising is observed on fruit harvested longer than 2 weeks post-ripe, though a 2 week delay represents a rather strong selection pressure since commercial delays would not be expected to be this long. This selection also demonstrates good bloom consistency with variable winter chill as well as a delayed flowering by almost a week which allowed it to escape frost damage in some of our 2018 plots. Flesh color in fruit held on the tree for 2 weeks or more will develop a yellow-gold to more pronounced gold color. Fruit show good resistance to flesh bruising and fruit brown rot (image from controlled inoculations).

10,13-80. Ripening in the Bowen harvest season, this advanced selection is a next-generation hybrid with *Early-5* and so represents a further refinement/introgression of the PI292557 s lineage. As in the related selections, fruit quality is very good in terms of color, flavor and firmness, and with good but not exceptional fruit size. The tree is productive and vigorous. Fruit quality and firmness are maintained on the tree for 2 weeks following the full ripe. Fruit show good resistance to brown-rot both in the field in 2018 and in earlier Bostock lab inoculation (image). Fruit also appear free from pit staining and associated fragmentation and appears to contain a *hi-lighter* type gene which suppresses anthocyanin production and so eliminates the risk of red pit-staining in this and genetically related selections. Moderate fruit sizes, without any trace of pit staining were again observed in 2018 in 2019.



10,21-186. Resulting from a cross between traditional and introgressed breeding selections, having 04,4-155 as a great grandparent. Breeding line 04,4-155 is one of the few traditional peach genotypes showing potential for prolonged processing quality after the tree-ripe stage (*stay-ripe*). Fruit show good productivity though fruit size can be variable, particularly in young trees. Fruit have approximately 70% red blush with some red imprinting observed in fruit pits, though this cooked out with processing. Fruit also show good resistance to bruising with fruit brown rot occasionally observed in the field.



11,14-120. Related to 11,17-150, and also having 00,16-92 as a grandparent. This and other selections derived from 00,16-92 have a denser and more compact pubescence with a less 'woolly' mouth-feel yet better resistance to fruit brown rot. Fruit show moderate size and moderately good firmness with improved peeling ability possibly due to the modified epidermis. This selection has also consistently been on the higher end of sugar concentration. As with 11, 17-150 both skin and pit are free of any red pigmentation even in overripe fruit.



11,23-147. A sister line to 11,17-150 and also having 00,16-92 as a grandparent. Pubescence or fuzz on this and other selections derived from 00,16-92 appears denser and more compact with better resistance to fruit brown rot as well as improved lye-peeling ability. Fruit show moderate size and good firmness but greater susceptibility to flesh bruising. As with other 00,16-92 breeding selections, epidermis and fruit pit are free from any red pigmentation, even in overripe fruit.



11,9-143. Fruit show good firmness and size as well as color. This selection is derived from the same source as the 'compact' trait which when fully expressed, reduces tree size by 2/3 to 1/2. While this selection has a normal size tree, it has inherited the *stay-ripe* trait from this *compact* source. Fruit retain good processing ability for 10 days or more after the initial tree-ripe stage. Color of both flesh and epidermis is yellow to yellow-gold. Fruit epidermis as well as the pit cavity are largely free from any red pigmentation even when overripe. Fruit size is medium to large but fruit sizing can be inconsistent in different years.



Early.

Andross harvest time.

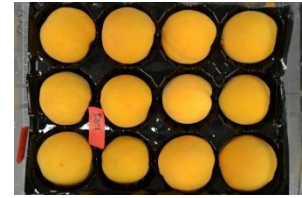
2011,11-233. A progeny from one of our most advanced almond introgression line, this selection has consistently shown good tree productivity and fruit size, quality and firmness. Fruit quality has been maintained for up to 2 weeks following tree-ripe though the fruit tend to be a bit softer than other advanced selections in this harvest time. Fruit are free from red staining of the pit and associated pit fragmentation. Pit are medium to small in size. The uniform yellow-gold skin and flesh color are also maintained at 2 weeks following tree ripe contributing to a good-quality processed product (images) as well as enhance consumer nutrition (i.e. higher levels of antioxidants). Fruit show low levels of fruit brown rot in natural field inoculations but have not yet been tested under laboratory conditions. Fruit also show reduced levels of flesh bruising.



2011,11-232. A sibling of 2011,11-233, this seedling tree is also derived from the same advanced almond introgression line. Fruit are typically medium to large and free from pit staining and associated fragmentation. Fruit has been maintained on the tree for up to 2 weeks following tree-ripe without appreciable loss in quality. Fruit tend to be firmer than 2011,11-233, and this firmness is better maintained in overripe fruit. Fruit is moderately susceptible to fruit brown-rot in both field and laboratory observations. (The image shows 2011,11-232 fruit following standard Bostock lab inoculation and screening. This level of disease is typical of that seen in the more resistant traditional varieties such as *Carson*). Tree is vigorous and upright with good bearing structure.



2010,18-528. This selection is derived from 00,16-92 as a grandparent. Pubescence or fuzz on this and other selections derived from 00,16-92 appears denser and more compact with better resistance to fruit brown rot as well as improved lye-peeling ability. Fruit show moderate size and good firmness but greater susceptibility to flesh bruising. As with other 00,16-92 breeding selections, epidermis and fruit pit are free from any red pigmentation, even in overripe fruit. Breeding line 00,16-92 is from a 2nd and independent almond germplasm source, which appears associated with greater fruit structural integrity and so firmness, particularly for the inner flesh near the pit cavity. It is one of the firmest selections in this maturity season and the flesh firmness holds well to 2 weeks or more after tree ripe. The seed parent, 2000,16-92, also possesses exceptional firmness but had a tendency to soften rapidly at about 10 days after tree ripe. By selfing (seed were derived from self-pollinations of the parent), we appear to be successful in roguing-out some of the softening factors while maintaining good fruit quality but have also lost a little in fruit size. Good brown-rot resistance is observed following Bostock lab inoculation (image) as well as in field evaluations in 2018 and 2019. Fruit is generally free from red skin blush or pit staining except in very overripe fruit (image). Despite being the product of 2 consecutive generations of self-pollinations, the tree remains vigorous and productive. [This is probably an additional benefit of new gene introgression, since traditional material tends to lose some vigor with each generation of self-pollination].



12,6-294. The result of hybridization between advanced selection Extra Late-2 and almond-derived breeding selection 2008-57-35 producing fruit with good size and quality as well as the ability to hold on the tree for a week or more. Skin has approximately 34% blush though the fruit pit remain largely free of any red pigmentation. Some slight red tinting is apparent in very overripe fruit but even this cooked out with processing. Pit are relatively small resulting in greater case yields. Fruit are also generally uniform in size shape and color. Flesh is more susceptible to bruising though response to fruit brown rot has not been observed in the field or under laboratory conditions.



11,6-41 Resulting from a cross having Carson and 98,13-17, an almond derived breeding line as grandparents, this selection produces fruit of good quality and size and moderate to good firmness. Flesh firmness is maintained for a week or more following tree-ripe. Skin is largely free from any red blush though pits may occasionally show red tinting which cooked out with processing. Fruit show good resistance to flesh bruising but have not yet been tested against fruit brown rot. Tree is vigorous and productive.



03,1-329. Resulting from a cross between traditional peach germplasm and the wild peach *P.mira*, this selection produces fruit with good size and color. Fruit firmness is also maintained for 10 days or more after tree-ripe. *P. mira* thus appears to be another, independent source for the *stay-ripe* trait expression but is not as strong as in almond derived sources. This selection has been an important parent in crosses to combine *stay-ripe* from different genetic sources to improve both total firmness as well as environmental resilience. Fruit can show 85% or more blush with some slight red imprint in common in pits even at tree-ripe and becoming darker with overripe fruit. Some split pits are observed but at relatively low frequencies given the vigor of tree. Trees are very vigorous and productive. While the red in pit and flesh softening after 10 to 15 days make this item less desirable, it has consistently made a strong showing at processing and later cutouts over the last 6 years and thus merits further evaluation.



Klampt harvest time.

2011,22-233. This selection, which ripens with *Klampt* is derived from the F8,5-166 almond source. This germplasm has been a good source for brown-rot resistance (see image following Bostock lab controlled inoculation) and has also been a promising source for mildew resistance. The skin may show a slight blush covering about 40% of the fruit. Fruit flesh remains generally free of any red pit staining and associated pit fragmentation. Fruit maintained good firmness and a bright yellow-gold color 2 weeks or more after tree ripe. The tree is vigorous and productive producing large fruit of uniform size and shape. No leaf curl and a reduced mildew was observed in 2018 and 2019 field evaluations.



2011,23-71. A selection harvesting at *Klampt* time resulting from a cross of *Loadel* by breeding line 96,3-153 which, in turn, was derived from more exotic germplasm probably originating in East Europe. [The UCD breeding program was fortunate to acquire promising clingstone peach germplasm from Drs. Hough and Shawn Mehlenbacher's very productive New Jersey breeding program prior to its termination, and this selection as well as *UltraEarly-1* (and its breeding progeny) are some of the end products]. Fruit show a very slight blush with a yellow-gold flesh color. Flesh and pit remain largely free from red staining and pit-fragmentation even in overripe fruit. Fruit firmness and quality have been maintained for 2 weeks or more following tree ripe. The maintenance of good fruit integrity was particularly apparent in 2016 samples which were overcooked during processing (see image). Trees are moderately susceptible to fruit brown-rot both in the field and following Bostock lab inoculation (right-image). Good fruit size and quality with only a small amount of brown rot damage was observed in 2018 and 2019.



2011,9-104. Derived from the almond by peach F8,5-166 germplasm, from a cross between *ExtraLate-1* with *ExtraLate-6*, this selection harvests with *Klampt* despite the very late maturation of its grandparents. [As previously discussed, this transgressive harvest shift has been a useful strategy to target the Dixon maturity gap]. Fruit are large with uniform size and shape and free from red blush as well as red pit staining and associated pit fragmentation. Good resistance to fruit brown-rot has been observed in the field and following Bostock lab inoculation (image) and good fruit firmness and quality is maintained up to 2 weeks following tree ripe. Tree is moderately vigorous and productive.



2010,17-120. A sibling of the previously described advanced selection 2010,18-528, this selection is derived from the almond-derived germplasm. Selection 2010,17-120 demonstrates many of the same characteristics as 2010,18-528, but ripening with *Klampt*. Fruit show good size and uniformity of shape and, similar to the sib, show good firmness for 2 weeks or more after tree ripe. Fruit is largely free of any red blush as well as any red pit staining and associated pit fragmentation. Flesh color is golden-yellow. Fruit have shown greater susceptibility to fruit brown-rot both in the field and following Bostock lab inoculation (image). As with the siblings, the fruit show good integrity and firmness of the fruit which is retained even when overcooked, as occurred in 2016 (image). The tree is moderately vigorous and productive.



2010,17-567. Also a sibling of previously described advanced selections 2010,18-528 and 2010,17-120, and so derived from almond germplasm. Fruit have consistently shown good size and shape. Skin is free of blush and flesh is free of red staining of flesh and pit and associated pit fragments. Flesh color is golden-yellow throughout. A smaller pit cavity contributes to higher case yields. As with its siblings, fruit maintain good flesh firmness to 2 weeks or more after tree-ripe. Some fruit brown-rot disease has been observed in field plantings including 2018, but this item has not yet been evaluated under controlled conditions in the Bostock lab. Tree is moderately vigorous, semi-upright and productive.



2011,6-80. This selection is also derived from almond germplasm but through a different lineage than the previously described selections. Fruit share many of the same characteristics, being of good size, shape and color. Fruit skin is generally free of red blush and flesh is free of red staining and associated pit fragments. A relatively small pit also contributes to improved case yields. Fruit flesh maintains good firmness and integrity for up to 2 weeks following tree-ripe, though rapid softening can occur in excessively overripe fruit. Some fruit brown-rot disease has been observed in the field, including 2018, but this item has not yet been tested under controlled conditions of the Bostock lab. Tree is moderately vigorous and productive.



11,6-95. A sister line to 11, 6-41 with a similar lineage and fruit quality but ripening about a week later. Resulting from a cross having Carson and 98,13-17, an almond derived breeding line as grandparents, this selection produces fruit of good quality and size and moderate to good firmness. Flesh firmness is maintained for a week or more following tree-ripe. Skin can show 80% or greater red blush and pits and occasionally flesh may occasionally show red tinting which cooked out with processing. Fruit show good resistance to flesh bruising but have not yet been tested against fruit brown rot. Tree is moderately vigorous and productive. Some split pits have been observed following over thinning.



11,8-155. Primarily utilizing traditional germplasm, fruit show good size and productivity and moderately good firmness. Skin as well as pit cavities show no red blush. Flesh is a bright gold-yellow. Fruit are only medium in size, even with over thinning. Pit size, while medium, is still relatively large relative to the medium size fruit. Flesh is moderately resistant to flesh bruising and while brown rot has not been observed in the field it has not been tested yet under laboratory conditions. Tree is moderately vigorous and productive.



11,8-83. Resulting from a more traditional cross targeting brown rot resistance, fruit is medium in size with only approximately 25% red blush on the skin. Pit cavities show a slight red staining which cooked out with processing. Split pits have been observed in 2019. The tree is vigorous and very productive. Fruit flesh is only moderately resistant to flesh-bruising and this selection has not yet been laboratory tested for fruit brown rot.



14,6-174. Resulting from a cross between more traditional germplasm and the Brazilian derived germplasm *UltraEarly-1*, producing fruit of good quality and size. Fruit as well as pit cavities are generally free from any red staining. Fruit show good firmness that is maintained for 10 days or more after tree ripe, though overripe fruit tends to soften at the outer fruit layers resulting in the danger of pit-cup pressure damage during processing. Trees are moderately resistant to flesh bruising.



14,6-28. An example of a 3rd generation breeding selection. 14, 6-28 results from lineages having almond as a great-grandparent, fruit show good size and firmness. Skin has approximately 30% light red blush while the flesh and pit remain free of red staining. Fruit sizing has been consistently good for the pit tends to be a bit larger and can be a bit ragged. Fruit hold on the tree for 10 days or more following tree-ripe stage though overripe fruit can develop a water-soaked appearance though this has cooked out with processing.



15,5-106. Also an example of an advanced generation selection. Fruit are of good size with an unusually high firmness. Color is uniform and bright with no red staining of flesh or the pit cavity even in overripe fruit. Skin is a golden yellow with no evidence of red blush. Good processing quality is retained up to 14 days after the tree-ripe stage. Low fruit brown rot has been observed in the field but this item has not been tested under laboratory conditions. Fruit are more susceptible to bruising from both physical damage as well as cold injury.



16,7-300. An advance breeding generation selection combining firmness and cold storage ability of Rizzi with the stay-ripe trait from *Prunus argentea*, a wild relative of almond. 16, 7-300 produces fruit of good size and exceptional firmness as well as good tree holding ability (stay-ripe trait). Fruit is a bright golden-yellow with approximately 80% red blush on the skin. Pit cavities remained free of red staining though occasionally the flesh can develop either a red tint or a water-soaked appearance when overripe. Fruit appear moderately resistant to bruising.



17,3-185. More recent selection resulting from a cross between traditional and introduced germplasm. It has produced good quality fruit with good firmness and holding ability, though additional seasons of observation are needed. Fruit skin, flesh and pit are uniform golden-yellow with no evidence of red staining even in overripe fruit. Fruit holds well on the tree for 10 days or more after the tree-ripe stage. Low brown rot has been observed in the field but this item has not yet been tested under laboratory conditions. Fruit also show good resistance to bruising in initial evaluations.



17,4-154. Similar to 17,3-185 but incorporating the *stay-ripe* trait from South African germplasm. Fruit show good processing quality, and exceptional firmness and color though additional seasons of evaluations are required. As with the previous selection, skin and flesh are uniform golden-yellow color though pits can show evidence of slight red imprinting when overripe. Fruit holds well on the tree for 10 days or more after the tree-ripe stage. Even overripe fruit appeared to have good resistance to bruising.



9,8-202. From a cross between traditional material and *Compact-3*, targeting the compact tree size and good fruit and tree-holding capabilities of *Compact-3* but with ripening date 2 weeks earlier. Fruit skin, flesh and pit very uniform yellow-gold but can become darker when overripe. Some slight red staining of pits are also sometimes seen on overripe fruit but have cooked out with processing. Split pits have also been observed on over thinned trees. Fruit are medium sized and somewhat asymmetrical with somewhat large and ragged pit cavities. Tree is compact and vigorous.



2011,9-90. The last item ripening in the Klampt time, this selection also has the most exotic lineage. The germplasm is derived from the wild almond *Prunus argentea*, which shows promising levels of resistance to a number of diseases and environmental stresses but generally produces small poor quality fruits on a plant that is more shrub than tree. The result of a series of backcrosses to cultivated peach, culminating in self-pollinations to sort out desirable from undesirable genes, this selection continues to show promise as a parent for future crossing and as a possible candidate for regional grower testing. Fruit are large and uniform with a moderate to slightly more pronounced red blush, depending on season. Flesh is yellow to yellow-gold with some red pit staining in very over-ripe fruit but no serious pit fragmentation. Pit size is medium to small. Fruit have shown good resistance to fruit brown-rot disease in both 2016 Bostock lab evaluations (image) and field, including 2018 and 2019 evaluations. Fruit show good firmness, which is maintained to 2 weeks after full-ripe. Fruit integrity is maintained even with overcooking during processing as occurred in 2016 (image-right). The tree is vigorous upright-spreading and productive.



Recent Relevant Publications

2019 Gradziel, T. and S. Marchand. 2019. 'Kader' Peach: a Processing Clingstone Peach with Improved Harvest Quality and Disease Resistance, Ripening in the 'Dixon' Maturity Season. *HORTSCIENCE* 54(4):754–757. 2019. <https://doi.org/10.21273/HORTSCI13708-18>

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2019 Gradziel, T. M., and B. Lampinen. 2019. 'Kester' Almond: A Pollenizer for the Late 'Nonpareil' Bloom with High Yield and Kernel Quality. *HORTSCIENCE* 54(n):1–2. 2019. <https://doi.org/10.21273/HORTSCI14398-19>