California Cling Peach Advisory Board
2021 Annual Report

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

Higher levels of orchard stress, particularly at University test plots in Davis and Winters, California, emphasized vulnerabilities in previous breeding selections being considered for advancement to regional testing. Irrigation scheduling problems, combined with low winter rainfall and unusually warm early summer temperatures represented the main source of stress, though this was compounded by inconsistent orchard management. The effects of stress were viewed primarily as smaller fruit sizes, an earlier fruit softening and increased levels of red staining of the pit and flesh and associated pit-splits/fragmentation were also observed. Consequently, it was decided that only selections showing good performance for at least 5 years of differing environmental conditions such as winter chill, winter rainfall, high spring and/or summer temperatures, etc., would be considered before advancement to regional testing. Under this more demanding assessment process, 6 new selections have been advanced to regional testing, including 4 in the Extra-Early, 3 Early, and 2 Extra-Late harvest seasons. New regional plots have been established in San Joaquin, Merced and Fresno Counties, though because of reduced grower plantings, several plots involve topworked trees from UCD provided graftwood.

Selections currently in regional testing, including the recently released varieties Kester and Vilmos, and selections Early #6 and Ultra-Early#1, currently in the release process as Schuler and Ogawa, respectively, continued to show good production and quality, though somewhat reduced size in Winters, California test plots owing to reduced irrigation. The stability of these selections under these more intense environmental pressures reaffirms the value of the 10+ year regional vetting process employed by this program but also identifies important challenges for reducing this regional testing period to significantly shorter time periods.

Progress report.

Evaluations in 2021-22 of advanced breeding selections proved particularly valuable for identifying selections more vulnerable to aspects of climate change. This was especially true in University plantings at Davis (Yolo County) and Winters (Solano County) where COVID-related management setbacks resulted in increased tree stress from reduced irrigation and fertilization that was further exasperated by low winter chill conditions and low rainfall and so already depleted early-season soil moisture. As shown in the graph above, the stresses were further exacerbated by unusually warm summer temperatures. Consequently, several previously promising breeding selections being considered for advancement to regional testing showed an undesirably prolonged/extended bloom, increase pit-staining and associated splitting and/or reduced fruit-sizing under these conditions. With the expectation that both climate and water accessibility will continue to present production problems into the future, it was concluded that advancement of promising breeding selections to the next stage of regional testing should not occur until at least 5 years of production/processing data representing such diverse climates was available for analysis. Selections currently in regional testing, including the recently released varieties Kester and Vilmos, and selections Early #6 and Ultra-Early#1, currently in the release process as Schuler and Ogawa, respectively, continued to show good production and quality, though somewhat reduced size owing to reduced irrigation. The varieties Kester and Vilmos, when harvested a week after tree-ripe stage, also continued to show good firmness but develop a slight pinking in the pit and occasional flesh that, however, cooked out during processing. The stability of these selections under these more intense environmental stresses reaffirms the value of the 10+ year regional vetting process employed by this program but also identifies important challenges for reducing this regional testing period to significantly shorter time periods.

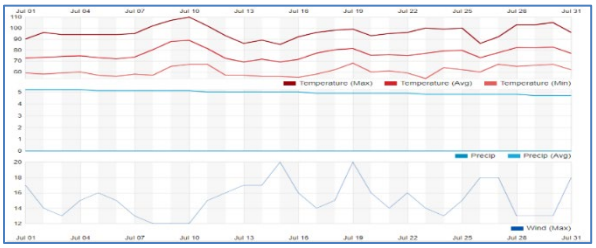

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Table 1. Summary of 2021 evaluations of advanced breeding selections in regional testing as well as selections recently advanced to consideration for regional testing. (Data for new regional testing candidates is preliminary and so subject to change as additional information on regional performance becomes available. Exotic origin indicates next-generation progeny combining desired traits from multiple distinct origins).

Item	Seed Parent	Pollen Parent	Origin	Firm. (lbs.)	Ripe (Esti.)	Red in Pit	Splits & Frag.
Ogawa	*D62-193*	mutation	*Brazil*	6.5	1-Jul	+	+
Extra-Early#4	Andross	Kakamas	South Africa	6.1	10-Jul	+	+
Extra-Early#5	DrDavis	D,62-193	Exotic	6.3	16-Jul	+	-
Extra-Early#6	03,5-209	clone	*Standard*	6.2	7-Jul	+	-
Extra-Early#7	91,9-161	96,3-153	*Brazil*	5.8	18-Jul	-	-
Early#7	DrDavis	D,62-193	Exotic	7.3	21-Jul	+	+
Early#8	05,27-232	Self	*Vilmos*	6.2	18-Jul	-	+
Early#9	99,12-155	self	*S. Africa*	7.7	27-Jul	-	+
Kader	Ross	R1-1	*PI.292557*	6.2	16-Jul	+	-
Schuler	Woltemade	91,17-195	*S. Africa*	5.6	18-Jul	-	+
Andross	Fortuna	Dix,5A-1	*Standard*	5.4	2-Aug	+++++	+++
Vilmos	Loadel	F10E,6-27	*Standard*	6.1	3-Aug	+	-
Extra-Late#2	18,6-33	87,13-13	*Standard*	7.1	30-Aug	-	+
Compact#4	18,8-11	mutation	*mutation*	6.2	28-Aug	-	+

Recently Released Selections

Kader

Kader harvests between Carson and Andross (the harvest gap left by the loss of the Dixon variety). Fruit samples of Kader collected in 2021 as in 2020 regional trials continue to show good-quality fruit including the ability of the fruit to hold on the tree for one week or more after developing to the full-ripe stage. Late-harvested fruit from Yuba County harvests showed a slight pink staining of the pit in 2021with a few instances of pink staining extending into the flesh. All staining cooked out with processing, however.

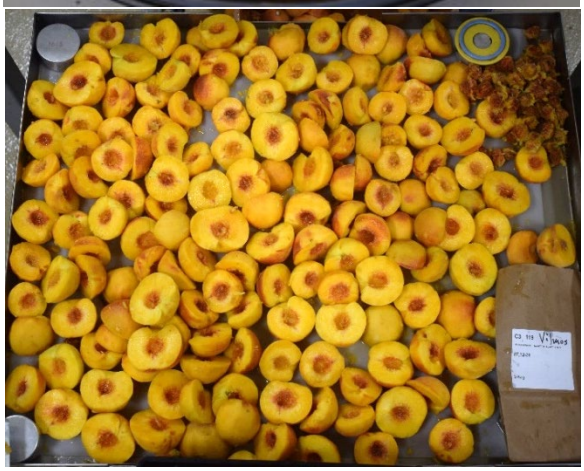
Kader's improved resistance to Monilinia fruit brown-rot and resistance to flesh browning/bruising also contribute to good harvest and post-harvest quality, even when fruit left on the tree for a week or more after the tree-ripe stage. A processing failure at the UCD Mondavi Pilot Plant in 2021 resulted in a batch of fruit showing flesh darkening, resulting in a more orange-color hue rather than the more typical golden-yellow. Kader, while showing the condition, was less affected by this flesh darkening, presumably owing to its lower phenolic content and so bruising susceptibility. Kader continues to show fruit-sizing capacity with good fruit eating quality and a stay-ripe firmness allowing delayed harvest so that interior and otherwise slower-growing fruit can continue to size, further contributing to a high yield potential.

Fruit weight under conditions of heavy flower thinning is among the largest of the Extra- Early and Early selections tested. This indicates an aggressive compensatory-sizing (similar to Andross) which should facilitate consistently high grower yields even when over thinned. Fruit Brix (averaging 12.9) is also amongst the highest for this maturity seasons) and Brix/TA ratio is above the desired level of 20. Fruit are generally symmetrical; though occasionally show some

cheek asymmetry similar to Goodwin with which it shares some lineage, though Kader does not show a similar tendency for split-pits even under the very higher July temperatures of 2021. Flesh color is golden-yellow, also similar to Goodwin. Fruit drop also increased in heat stressed sites, similar to 2020.

Vilmos

Vilmos ripens with or just after Andross and possesses fruit and tree characteristics similar to the variety Ross. Fruit are similar to Ross in size though slightly more oblate in shape and with less red-blush. As previously mentioned, the 2021 season once again saw unusually high June/July temperatures in regional test plots. Vilmos fruit, like those previously described for Kader, showed slight pinking in many pits as well as some flesh adjacent to highly blushed skin areas. We previously observed that in hotter regions such as the southern San Joaquin, some Vilmos fruit flesh may develop a reddish stain particularly when 5+ days overripe. As with Kader, Vilmos flesh continues to show low bruising/browning potential and fruit readily hold on the tree for 10 days or more after initial tree-ripe even under these higher temperatures allowing greater flexibility in grower and processor harvest. Vilmos fruit were also included in the 2021 Mondavi plant processing failures which led to flesh darkening of resultant processed fruit. Vilmos fruit samples were among the least affected, however, showing better color than even Kader fruit, despite having similar bruising resistance. [The cause of the processing failure leading to the higher levels of flesh discoloration remain unknown, partly because it was only discovered during the cutout evaluations which occur many months after processing. Several aspects of the processing procedures were modified this processing batch, however, including use of a cane sugar-based syrup rather than the usual



pear concentrate, as well as a longer cooking time]. Vilmos fruit sized well in 2021, as in previous seasons, requiring less thinning than other varieties such as Loadel, though over-thinned fruit will develop only to a medium to medium-large size rather than the distinctly larger fruit observed in varieties such as *Kader* and *Dr. Davis* when over-thinned. Trees are hardy with yields comparable to Andross. Some fruit drop has been observed, particularly if developing fruit are left in clumps and ripening is delayed for a week or more after initial tree ripe. Fruit process well, and the relatively small pit, combined with lower incidence of pit-staining and pit fragments can result in higher case yields than *Andross*. Some pit fragments and split-pits have been observed (~5%) as in previous samplings, but consistently less than *Andross* and other accessions ripening at this very vulnerable time period.

Selections currently being processed for release

Early#6

Early#6 continues to perform well, with good yields of uniform fruit size shape and quality and pit/flesh color even under the unusually high June/July temperatures of 2020 and 2021. This is partly because Early#6 has a gene for suppressing all red anthocyanin production in the fruit. Interestingly, fruit samples that were included in the problematic processing batch at Mondavi were comparable to Kader in their degree of flesh darkening, with Vilmos showing the least darkening, despite possessing the distinct red blush compared to the lack of blush in Early#6 . We are continuing with the patenting and release process which has been frustrated by COVID as well as new descriptor requirements such as aspects of bloom which have to be remeasured in spring, 2021. 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. So far, this selection has consistently shown superior fruit color as well as harvest- and post-harvest firmness along with good cropping potential over a multi-year test period. Fruit can 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 as demonstrated in both lab and field evaluations, and it also demonstrates improved levels of resistance to Monilinia flower blight. Bloom time also remains relatively concentrated even in years of low winter chill such as occurred in 2021 resulting in more uniform fruit ripening times. This combination of traits makes it a promising varietal-type for addressing anticipated climate changes over the next decades. 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. 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. As mentioned in previous reports, however, fruit can be slow to size, and this was true in 2021. Trees tend to be upright and have been consistently productive under a range of summer temperatures.

Ogawa.

Currently being tested in both the Sacramento and San Joaquin valleys 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 that we determined to be possibly epigenetic rather than disease in origin. A series of clonal-source selections during the 1990's (based on the Noninfectious-Bud-Failure elimination strategies developed for almond) has eliminated all trace of this condition in 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 as 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 conferring fruit brown-rot resistance as well as early maturity, good fruit size and firmness. 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 in the cannery before contamination by non-organic fruit. Early processing of this high orange-gold selection would also result in a more desirable processed product without the undesirable risk of mixing with later maturing lighter colored fruit varieties (which would result in an inconsistent canned product color). High temperatures during fruit development (as occurred in 2020 and to a greater extent in 2021) result in irregularly shaped fruit. While this would discourage its use for processing peach-halves, much of the 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 been provided to FPS and we expect certification for trueness-to-type and freedom from viruses in early 2022.

Breeding Program Selections Advanced to Regional Testing

Extra-Early Season

Extra-Early#4.

This has been one of our most productive selections in the Extra-Early ripening period. While it has good fruit firmness at the initial tree-ripe stage, it softens rather quickly with time making it unsuitable for mechanical or otherwise delayed harvest. Nonetheless, the higher yield potential and good fruit quality and desirable harvest time between Carson and Bowen suggest that it may have commercial potential. Fruit have good size and symmetry and show low incidence of split-pits and fragmentation in the limited trials done to date. Some slight pink staining was observed in the unusually hot conditions of June/July 2021, though these were limited to a few fruits and primarily the inner flesh. The similarly slight staining of the pit cavity has been observed during previous growing seasons having an unusually warm spring/summer temperatures but have consistently cooked-out with processing. Pits are medium in size though with a somewhat larger pit tip which could present problems for processing. Processed fruit show good sugar levels as well as sugar/acid ratios. A medium red blush covers approximately 60% of the fruit skin. Regional trials are being established in Fresno, Merced and Yuba counties.

Extra-Early#5.

Resulting from a cross between Dr. Davis and almond derived breeding lines, this selection produces fruit of good firmness and size ripening about Bowen time. Interestingly, molecular data showed that the almond parent contributed a gene for fruit size that was present in ancient peaches but was lost during subsequent domestication and

breeding. Fruit have a desirable golden-yellow flesh color with clean pits though some slight staining has been observed in overripe fruit following heat spells of 2020 and 2021. Fruits are medium to large in size with a relatively small pit cavity, resulting in potentially improved case yields. Blush is pink to light red covering approximately 40% of the skin. Fruit are moderately resistant to flesh-bruising but becoming less so in overripe fruit. 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 more susceptible to rapid softening after tree-ripe.

Extra-Early#6.

Ripening about with Carson, fruit have been slightly smaller than Carson in early evaluations but with better firmness and ability to hold on the tree for a week or more after the tree-ripe stage**.** Fruit have a desirable golden-yellow flesh color and good fruit size and uniformity for the season. Ripe fruit are firm and have a moderate red blush covering approximately 60-80% the surface. Overripe fruit, such as those shown at right from the 2021 harvest, can develop a pink staining of the pit and inner flesh, though this cooks out with processing. Despite harvesting after tree-ripe, fruit process well, producing a good quality product. This selection shows good field resistance to fruit brown-rot though testing using controlled inoculations in laboratory conditions have not yet been done.

Extra-Early#7.

Ripening between Carson and Bowen, fruit are medium in size with no tendency for developing red coloring of the pit observed over the past several harvest seasons, even those with higher-than-normal temperatures. Resulting from a cross between the more traditional parents, including Vilmos, this selection combines early season with relatively good fruit color and firmness. Firmness holds well for a week to 10 days but in some years can soften rather rapidly after that. Softening can sometimes occur between the skin and the outer flesh resulting in potential pitting problems. Fruit have been consistently at the higher end of sugar concentration in processing studies.

Early Season

Early#7 Representing a 3rd generation breeding selection, this selection resulted from Dr. Davis crossed with a hybrid between PI292557 progeny and advanced selection *UltraEarly*-1. The tree is productive and produces fruit of good size and firmness. Fruit quality and firmness are maintained one week 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 [Both the *Dr. Davis* seed parent and *UltraEarly-1* have been identified as dependable sources of brown-rot disease resistance with molecular markers currently being developed for these sources]. Irregular fruit sizing has been observed in some years. A slight but distinctive pink staining of the fruit pit cavities was seen in the higher temperatures of 2020 and 2021 as well as some observed but limited split-pits.

Early#8. Ripening in the Bowen harvest season, this advanced selection is a third-generation hybrid with *Vilmos* parentage, representing 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 up to one week following the tree-ripe stage. Fruit show good resistance to brown-rot both in the field in 2018 and 2020 and in earlier Bostock lab inoculation (see attached image). Fruit also appears generally 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 2019 tru 2021 though some split-pits were observed in 2019 and 2021.

Early#9 Despite being a progeny from Late season selection *Wolvamade* (South Africa) and *Extra-Late-2* as grandparents, this selection ripens with to just after *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: *Early-6* 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 *Early-6*, the fruit show a desirable golden yellow flesh and skin color without blush. Also similar to *Early-6*, fruit have very good firmness at tree ripe that is maintained for 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 from a yellow-gold to more pronounced gold color. Fruit show good resistance to flesh bruising and fruit brown rot both in the field and after controlled lab inoculations. As with *Early-6*, fruit achieve only a moderate final size with much of that growth in the final weeks/days of ripening, yet like Early-6 yields are good and fruit quality is consistently very good, with uniform size shape and color and low defects.

Extra-Late Season

Extra-Late#2. Ripening about Sullivan#4 time, this selection has proven to be productive with good processing quality. Fruit are medium to large with good firmness even up to a week or more after the tree-ripe stage. Fruit pits and flesh have so far remained generally free from any red staining associated with higher summer temperatures though some split pits have been observed in 2019 and 2021. As shown in the 2021 image below, trees are upright to upright spreading with the potential for well distributed crop. This selection has shown moderate to good resistance to fruit brown rot in both field and lab evaluations.

Compact#4. This is the latest ripening in a series of compact selections where a shorter distance between leaf internodes results in a final tree size that is ½ to 2/3 of normal as shown in the 2021 image below. This would complement previously developed compact selections ripening in the Extra-Early and Late seasons. In addition to a more compact tree size, all selections show a suppression of watersprout growth (shown in the

image below (useful for operations utilizing mechanical hedging) as well as the development of fruit with the *stay-ripe* trait allowing harvest for a week or more after the normal tree-ripe stage. As with Extra-Late#2, fruit tend to darken from a yellow-gold to a more orange-gold color with increasing time between ripening and harvest.

The image at right shows tree size comparison for Extra-Late#2 and Compact#4 in August, 2021. Also note the suppression of watersprout growth in Compact#4 despite heavy pruning the previous spring for both selections.

Recent or Relevant Publications

1. 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
2. Gradziel, T., and S. Marchand. 2019. 'Vilmos' Peach: A Processing Clingstone Peach Expressing a Novel 'Stay-Ripe' Trait With Improved Harvest Quality, Ripening In The 'Andross' Maturity Season. HORTSCIENCE 54: 2078-2080. 2019. https://doi.org/10.21273/HORTSCI14291-19
3. Gradziel, T. M. (2022) Exotic genes for solving emerging peach production challenges. Scientia Horticulturae Volume 295, https://doi.org/10.1016/j.scienta.2021.110801
4. Martinez Garcia, P.J.; Dan E. Parfitt; Richard M. Bostock; Jonathan Fresnedo- Ramirez; Alejandra Vazquez-Lobo; Ebenezer Ogundiwin; Thomas M. Gradziel; Carlos H. Crisosto.. Application of Genomic and Quantitative (2013) Genetic Tools to Identify Candidate Resistance Genes for Brown Rot Resistance in Peach. PLoS ONE 8(11): e78634.
5. Gradziel, T.M. 2020. Redomesticating Almond to Meet Emerging Food Safety Needs. Frontiers in Plant Science, Volume 11, 12 June 2020. 89/fpls.2020.00778. https://doi.org/10.33
6. Johnson, E.P., Preece, J.E., Aradhya, M., Gradziel, T. 2019. Rooting response of Prunus wild relative semi-hardwood cuttings to indole-3-butyric acid potassium salt (KIBA). Scientia Horticulturae, Volume 263, 15 https://doi.org/10.1016/j.scienta.2019.109144.
7. Felipe Pérez de los Cobos, Pedro J Martínez-García , Agustí Romero , Xavier Miarnau, Iban Eduardo, Werner Howad, Mourad Mnejja, Federico Dicenta, Rafel Socias i Company, Maria J Rubio-Cabetas, Thomas M Gradziel, et al. (2021). Pedigree analysis of 220 almond genotypes reveals two world mainstream breeding lines based on only three different cultivars. Hortic. Res. (2021) 8:11. https://doi.org/10.1038/s41438-020-00444-4.
8. Moral, J. , M. Teresa Garcia-Lopez1, A.a Gordon, A. Ortega-Beltran, R. Puckett1, K. Tomari, T. M. Gradziel, and T. J. Michailides. 2021., Resistance of almond cultivars grown in California to Aspergillus flavus and A. parasiticus. Plant Disease. manuscript ID is PDIS-05-21-0892.
9. D'Amico-Willman, K.M.; Anderson, E.S.; Gradziel, T.M.; Fresnedo-Ramírez, J. Relative Telomere Length and Telomerase Reverse Transcriptase (TERT) Expression Are Associated with Age in Almond (Prunus dulcis [Mill.] D.A.Webb). Plants 2021, 10, 189. https://doi.org/10.3390/plants10020189
10. Gradziel, T.M.; Shackel, K.A. Propagation of an Epigenetic Age-Related Disorder in Almond Is Governed by Vegetative Bud Ontogeny Rather Than Chimera-Type Cell Lineage. Horticulturae 2021, 7, 190. https://doi.org/10.3390/horticulturae7070190
11. Vahdati, K.; Sarikhani, S.; Arab, M.M.; Leslie, C.A.; Dandekar, A.M.; Aletà, N.; Bielsa, B.; Gradziel, T.M.; (et al.). Advances in Rootstock Breeding of Nut Trees: Objectives and Strategies. Plants 2021, 10, 2234. https://doi.org/10.3390/plants10112234
12. D'Amico-Willman, K.M.; Anderson, E.S.; Gradziel, T.M.; Fresnedo-Ramírez, J. et al. Identification of putative markers of noninfectious bud failure in almond (Prunus dulcis [Mill] D.A. Webb) through genome wide DNA methylation profiling and gene expression analysis in an almond peach hybrid population. Frontiers Front. Plant Sci. 13:804145. doi: 10.3389/fpls.2022.804145.
13. Angela S. Prudencio, Raquel Sánchez-Pérez, TM Gradziel, Pedro J. Martínez-García, Federico. (2020) Genomic Designing for New Climate-Resilient Almond Varieties . In: Chittaranjan Kole (Ed.) Genomic Designing of Climate-Smart Fruit Crops pp. 1-21. . ISHS Jhlpd68505c015976.
14. Gradziel TM. (2022) utilizing wild species for rootstock development. In: C. Kole, (ed.) Genomic Designing for Biotic Stress Resistant Fruit Crops. Springer DOI : 10.1007/978-3-030-91802.