Sweet Cherry Irrigation Strategy Literature Review

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Literature Review Summary: Irrigation Strategy for Sweet Cherries

The literature review found limited papers with a specific focus on the optimal irrigation strategy over the growing season for sweet cherries.

However, there are several papers that look at the impacts of various levels of deficit irrigation pre- and post-harvest. There are also papers that look at the impacts of excess and deficit irrigation on fruit quality (the incidence of cracking and other fruit quality indicators) alongside vegetative growth.

Blanco (2019) thesis provides a particularly useful overview of the current technical and scientific knowledge around soil and water management in sweet cherries grown in a mediterranean climate. In this he collates a table of suggested thresholds for both stem water potential and soil water content for critical and non-critical periods (pre- and post-harvest). The thresholds to be used for the trial are consistent with these. Blanco's thesis suggests maintaining soil moisture at 85% of field capacity and stem water potential above -7 to -8 Bar (-0.7 to -0.8 MPa) pre-harvest, and 55% - 60% of field capacity and above -15 Bar (-1.5 MPa) stem water potential post-harvest. The paper also summarises the impact of reduced deficit irrigation, noting that it can have a negative impact on yield during the critical period, and thus a 100% replacement of ETc is recommended.

Blanco et al (2016 & 2019) reduced deficit irrigation work (both summarised in the thesis above) also looked at the application of reduced deficit irrigation pre- and post-harvest. In this they find post-harvest reduced deficit irrigation was beneficial as it reduces vegetative growth and does not have an impact in the following season. However, where farmer treatments caused the stem water potential to drop below -18 Bar (-1.8 MPa) post-harvest this did have an impact the following season. They recommend a -16 Bar (-1.6 MPa) threshold for reduced deficit irrigation post-harvest.

The findings of Houghton & Nelson (2023) are suggestion with those of Blanco. They found one off post-harvest stem water potentials as low as -20 Bar (-2.0 MPa) have no lasting effect, however a threshold of -13 Bar (-1.3 MPa) is recommended. Carrasco-Benavides (2020) suggests a stem water potential threshold of -15 Bar (-1.5MPa) has no impact on fruit yield or quality in the following season. Blaya-Ros (2021) looked at the impact of drought stress on young sweet cherry trees and found a stem water potential of -20 Bar (-2.0 MPa) resulted in clear early defoliation.

Nieto (2017) found that a post-harvest irrigation strategy that only used 25% of ETc resulted in superior yields in the following year. However, no information was provided on the level of stress the trees were subject to.

Blanco (2020) reduced deficit irrigation work found that reduced deficit irrigation pre-harvest (85% of ETc), did not advance, enhance, or penalise flowering, fruit set or fruit growth. Also, it did not diminish carbohydrate concentration in roots or cause an increase in the number of double fruits. However, deficit irrigation did decrease vegetative growth and consequently the leaf to fruit area ratio, which, when it fell below 180 cm2 per fruit, affected cherry size.

Blanco et al (2022) more recently undertook work looking at the impact of irrigation and crop load on rain-induced cherry cracking. Coirrea (2018) provides an overview of the mechanisms for this including macroscopic and microscopic cracking through root water uptake, fruit water uptake and high rates of localised uptake. Blanco found that trees irrigated above the crop water requirements (110%) were three times more prone to cracking than those irrigated below (70%), and that lower crop loads were more prone to cracking than higher crop loads when over irrigated.

The above findings by Blanco are consistent with the Oregon State University Extension Service publication on Understanding and Preventing Sweet Cherry Fruit Cracking, (Kaiser 2019).

Other points of note from the literature review include:

- Blanco (2018) provides the full range of soil and plant indicators available to detect water stress in cherries. Stem water potential, soil potential and soil water content are all practical monitoring options for use in commercial orchards, but each has benefits and drawbacks. Soil potential and stem water potential are more responsive but do not provide a measure of the water available to the plant or water applied, and vice versa for soil water content.
- Marsal (2014) looks at the benefits of high frequency irrigation over low frequency irrigation on yield and found that high frequency irrigation (little and often) provided improved yield over low frequency.
- Black (2008) provides suggested crop coefficients for sweet cherries with a grass inter row over the growing season. Starting at 0.4, over 90-days increasing to 1.05, and then decreasing from day 150 to 0.4. It should be noted a deficit irrigation strategy post-harvest would impact these.
- Gebretsadikana (2023) looks at the benefits of mulches in semi-arid regions for improving soil water holding and fertility. This may have application, particularly for soil types of low water holding and limited organic matter content, in New Zealand.

Trial Irrigation Strategy

Stage 1: Budburst to Harvest

Irrigation will initially be based on 110% of ETc to increase soil moisture levels to the 80-90% of field capacity range. Once soil moisture is in the 80 - 90% of field capacity range, irrigation will be based on 100% of ETc through to harvest. Irrigation decision-making will also take account of forecast rainfall, i.e., be run at the lower end of the range when rainfall is forecast. Stem water potential will be maintained above -7 Bar. This approach should minimise the cracking risk from rainfall events noting the relationship between overwatering and cracking as highlighted in the literature review.

Stage 2: Post Harvest

Irrigation will be run at 50% of ETc and soil moisture levels allowed to drop to 60% of field capacity (or the relevant stress point for that soil noting the high sand content of many of the trial site soils). Once soil moisture is at 60% of field capacity (or the relevant stress point for the soil) this level will be maintained based on applications meeting 100% of ETc, while also accounting for rainfall. Stem water potential will be maintained above -16 Bar.

Literature Review

The following papers have been used to inform the sweet cherry irrigation trial. The below provides the paper reference, a link to the full paper, alongside relevant extracts from each.

Victor Blanco

Agronomic and physiological basis for automating regulated deficit irrigation in sweet cherry trees

PhD Thesis, 2019, Universidad Politécnica de Cartagena

https://repositorio.upct.es/handle/10317/8307

Table 2. Classification and threshold values of common use soil and plant water status indicators.

	Water status indicator	Crop	Threshold values: Critical period	Threshold values: Non critical period	References
Physiological indicators	Stem water potential	*P. avium L.* 'Summit'/'SL64'	-0.7 - -0.8 MPa	-1.5 MPa	Marsal et al., 2009
Physiological indicators	Stomatal conductance	*P. avium L.* 'Bing'/Mazzard 'Skeena'/'Gisela6'	150 - 200 mmol m^2 s^{-1}	100 mmol m^2 s^{-1}	Antunez-Barria, 2006; Neilsen et al., 2016
Physiological indicators	Net photosynthesis	*P. avium L.* 'Burlat'/'MaxMa14' 'Van'/'MaxMa14'	13 - 20 µmol m^2 s^{-1}	10 - 15 µmol m^2 s^{-1}	Gonçalves et al., 2005
Physiological indicators	MDS SI_{MDS}	*P. avium L.* *P. persicae Batsch.* 'Flanoba'/'GF677'	200 µm d^{-1} 1.1	350-450 µm d^{-1} 1.4	Biel et al., 2012; de la Rosa et al., 2015
Physiological indicators	BGR	*P. salicina Lindl.* Black Gold'/'Mariana'	25 - 30 µm d^{-1}	5 - 10 µm d^{-1}	Intrigliolo and Castel, 2006
Physiological indicators	TGR	*P. avium L.* 'Brooks'/'MaxMa14'	50 µm d^{-1}	5 µm d^{-1}	Livellara et al., 2011
Physiological indicators	Sap flow	*P. avium L.*	0.4 L m^{-2} leaf area d^{-1}	0.2 L m^{-2} leaf area d^{-1}	Abdelfatah et al., 2013
Physiological indicators	CWSI	*P. avium L.* 'Z900'/'Gisela5'	0.15	0.4 – 0.5	Köksal et al., 2010
Physical indicators	Soil water content related to field capacity	*P. avium L.* 'Cristalina'/'Gisela6' 'Skeena'/'Gisela6'	85 %	60 – 55 %	Neilsen et al., 2014
Physical indicators	Soil water potential	*P. dulcis (Mill.)D.A.Webb* 'Guara'/'GF677'	-30 kPa	-200 – -400 kPa	Puerto et al., 2013

Victor Blanco, Pedro J. Blaya-Ros, Roque Torres-Sánchez & Rafael Domingo

Irrigation and Crop Load Management Lessen Rain-Induced Cherry Cracking

Plants, 2022, 99 (23), 3249

https://www.mdpi.com/2223-7747/11/23/3249

Two irrigation treatments were imposed: (i) control treatment (CTL) irrigated above crop water requirements at 110% of crop evapotranspiration (ETC) and (ii) a deficit irrigation treatment (DI) irrigated at 70% ETC. Within each irrigation treatment, crop load was adjusted to three levels: 100% (natural crop load—high), 66% (medium crop load), and 33% (low crop load).

The results emphasised the different effects that rainfall before harvest has on mature cherries. Thus, cracked cherries at harvest represented 27.1% of the total yield of CTL trees while they were 8.3% of the total yield in DI trees. Cherries from CTL trees also showed a greater cracking index than those from DI trees.

Victor Blanco, Roque Torres-Sánchez, Pedro José Blaya-Ros, Alejandro Pérez-Pastor & Rafael Domingo

Vegetative and reproductive response of 'Prime Giant' sweet cherry trees to regulated deficit irrigation

Scientia Horticulturae, Volume 249, 2019, pages 478-489

https://www.sciencedirect.com/science/article/pii/S0304423819300925?via%3Dihub

Four drip irrigation treatments were imposed: (i) control treatment (CTL), irrigated without restrictions at 110% of seasonal crop evapotranspiration (ETc); (ii) sustained deficit irrigation (SDI) treatment irrigated at 85% ETc during pre-harvest and post-harvest periods and at 100% ETc during floral differentiation; (iii) regulated deficit irrigation (RDI) treatment irrigated at 100% ETc during pre-harvest and floral differentiation and at 55% ETc during post-harvest, and (iv) farmer treatment (FRM), irrigated according to the farmer's normal practice.

RDI reduced vegetative growth and did not cause significant lower yields or fruit quality. However, with SDI there was a trend towards smaller fruits and a slightly higher soluble solid content. Post-harvest deficit irrigation increased water productivity without penalizing fruit yield or the quality parameters studied, and allowed water savings of 39% compared to CTL at a time when other fruit tree species require more water. Moreover, RDI and SDI led to significantly less cracking incidence and a lower cracking index, which could extend fruit shelf life.

Victor Blanco, Pedro José Blaya-Ros, Roque Torres-Sánchez & Rafael Domingo

Influence of Regulated Deficit Irrigation and Environmental Conditions on Reproductive Response of Sweet Cherry Trees

Plants, 2020, Jan, 9(1), 94

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7020485/

Three irrigation treatments were assessed: (i) control treatment, irrigated without restrictions at 110% of seasonal crop evapotranspiration; (ii) sustained deficit irrigation treatment, irrigated at 85% ETc during pre-harvest and post-harvest periods, and at 100% ETc during floral differentiation, and (iii) regulated deficit irrigation treatment, irrigated at 100% ETc during pre-harvest and floral differentiation and at 55% ETc during post-harvest.

Deficit irrigation did not advance, enhance or penalize flowering, fruit set or fruit growth. Neither did it diminish carbohydrate concentration in roots or cause an increase in the number of double fruits, which was more linked to high temperatures after harvest. However, deficit irrigation decreased vegetative growth and consequently the leaf area/fruit ratio, which, when it fell below 180 cm^2 per fruit, affected cherry size.

Louise Nelson & Elizabeth Houghton

Postharvest Deficit Irrigation for Improved Resilience of Cherry to Climate Change

University of British Columbia, 2023

https://www.bcclimatechangeadaptation.ca/app/uploads/FI22-Project-Report-Postharvest-Deficit-Irrigation-for-Improved-Resilience-of-Sweet-Cherry-to-Climate-Change-2023.pdf

Climate change is altering the spatial boundaries of suitable growing regions for sweet cherry in the Okanagan Valley of British Columbia as a result of warmer temperatures and prolonged growing seasons. Sweet cherry orchards are now being established both further north and at higher elevations than ever before seen in the Okanagan Valley. As the sweet cherry industry expands into more extreme growing sites, there is increasing concern for the availability of a sufficient supply of water for irrigation and concern over risks for flower bud cold damage from fall and early spring frosts and winter cold snaps.

To address the first concern, the use of postharvest deficit irrigation (PDI) was investigated as a technique to conserve water and improve water use efficiency in commercial cherry orchards. Previous studies in this region have reported no change in plant physiology or tree growth with postharvest irrigation volume reductions of up to 25 %. We compared the effects of full irrigation (100 % of conventional grower practice through the growing season) with 27-33 % reductions in irrigation postharvest (~70 % of conventional grower practice) and 47-52 % reductions in irrigation postharvest (~50 % of conventional grower practice) over a three-year period (2019-2021) in five commercial sweet cherry orchards that ranged in elevation and latitude across the Okanagan Valley, BC, Canada. In the growing season following treatment application, PDI had no overall effect on stem water potential or photosynthesis; there were also no effects of PDI treatment on tree growth. Additionally, PDI did not significantly influence the timing of flower bud phenological stages in the spring, flower bud cold hardiness or moisture in the fall, winter, or spring period, or fruit yield and quality.

Findings from this study suggest that postharvest stem water potentials from -0.5 MPa to -1.3 MPa, and one-time stem water potentials as low as -2.0 MPa, have no lasting effects on future plant function or crop production. A cost-benefit analysis of adopting PDI in Okanagan cherry orchards was also completed and findings revealed the costs of implementing PDI are minimal but bring benefits for the grower and society in conserving water. This research demonstrates that commercial cherry growers in the Okanagan Valley can likely reduce the volume of water applied after harvest. These findings will contribute to improving sustainable irrigation practices to help conserve water in this region while improving the cherry industry's resilience to climate change through a better understanding of plant postharvest water requirements.

Elizabeth Houghton, K. Bevandick, D. Neilsen, K. Hannam & L.M. Nelson

Effects of postharvest deficit irrigation on sweet cherry (Prunus avium) in five Okanagan Valley, Canada, orchards: I. Tree water status, photosynthesis, and growth

Canadian Journal of Plant Science, 2023

https://cdnsciencepub.com/doi/full/10.1139/cjps-2022-0200

Postharvest deficit irrigation (PDI) is a strategy that can be used to reduce water demands in sweet cherry orchards; previous studies in this region have reported no change in plant physiology or tree growth with irrigation volume reductions of up to 25%, postharvest. However, the effects of more severe postharvest reductions in irrigation volume remain unknown. This study compared the effects of full irrigation (100% of conventional grower practice through the growing season) with 27%–33% reductions in irrigation postharvest (~70% of conventional grower practice) and 47%–52% reductions in irrigation postharvest (~50% of conventional grower practice) over a 3-year period (2019–2021) in five commercial sweet cherry orchards.

In the growing season following treatment application, PDI had no effect on stem water potential or photosynthesis in any year and at any site; there were also no effects of PDI treatment on tree growth. Findings from this study suggest that postharvest stem water potentials from −0.5 to −1.3 MPa, and one-time stem water potentials as low as −2.0 MPa, have no lasting effects on future plant water status, rates of photosynthesis, or plant growth.

Víctor Blanco, Rafael Domingo, Roque Torres, Alejandro Pérez Pastor, Manuel García, and Juan Antonio López

Development of deficit irrigation scheduling strategies for 'Prime Giant' sweet cherry

EGU General Assembly, 2016

https://ui.adsabs.harvard.edu/abs/2016EGUGA..1818538B/abstract

The objective of this work was to study the physiological and agronomic response of cherry trees to different irrigation treatments based on crop evapotranspiration (ETc). However, the final purpose was to establish threshold values of water stress indicators, which can be considered of practical applicability in automatic irrigation scheduling. The experiment was carried out in 2015 in a 0.5 ha commercial plot of 'Prime Giant' cherry [Prunus avium (L.)] in SE Spain.

Three treatments were studied i) T110, irrigated above the maximum crop water requirements (110% of ETc), ii) T85, sustained deficit irrigation, irrigated to satisfy 85% of ETc, throughout the growing season, and iii) T100-55, regulated deficit irrigation with different water deficit levels: 100% and 55% of ETc during pre- and postharvest, respectively. Each treatment was randomly distributed in blocks and run in triplicate. Soil and plant water status were assessed from the soil matric potential and volumetric water content (Ym and Ov), midday stem and fruit water potential (Ys and Yf), maximum daily trunk shrinkage (MDS), daily trunk growth rate (TGR), stomatal conductance (gs), photosynthesis (Pn) and transpiration rates (E). Vegetative growth, yield and the quality of the fruit were also evaluated. Ys and MDS signal intensity were used as the main indicators of water stress.

The water applied during the 2015 growing season was 7190, 5425 and 4225 m^3/ha for T110, T85 and T100-55, respectively. The mean values of Ys during pre- and postharvest were -0.51, -0.57, -0.54 and -0.65, -0.77 and -0.97 MPa in T110, T85 and T100-55, respectively, while Yf was -1.20, -1.36, -1.27 MPa, during the preharvest period, respectively.

The deficit irrigation strategies tested, T85 and T100-55, corresponded to equivalent signal intensities of Ys, 1.1 and 1.05, and of MDS 1.40 and 1.25, respectively, which would denote that the treatment irrigated to satisfy 100% of ETc during preharvest (T100-55) was slightly stressed.

Our results show that the water regime applied generated statistically significance differences between treatments both in plant (Ys, Yf, MDS, TGR, gs, Pn, E) and soil (Ym, Ov) water relations. There were no differences in vegetative growth, trunk cross-sectional area or summer pruning values. The irrigation strategies followed did not cause any difference in total production (16.1 t/ha).

Moreover, fruit quality at harvest did not differ between treatments, except for the solid soluble content and unitary cherry weight, when significant differences were obtained. The results confirm the usefulness of deficit irrigation scheduling in sweet cherry trees. However, these good results need to be followed up in subsequent growing seasons.

Marcos Carrasco-Benavides, Sergio Espinoza Meza, Jeissy Olguín-Cáceres, Diego Muñoz-Concha, Eduardo von Bennewitz, Carlos Ávila-Sánchez & Samuel Ortega-Farías

Effects of regulated post-harvest irrigation strategies on yield, fruit quality and water productivity in a drip-irrigated cherry orchard

NZ Journal of Crop and Horticultural Science, 2020

https://www.tandfonline.com/doi/full/10.1080/01140671.2020.1721544

The irrigation treatments were T0 = control (received 100% of the fruit grower irrigation); T1, T2, and T3 received 50%, 75% and 140% of T0. For both growing seasons, T0 and T3 averaged a midday stem water potential (Ψs) of −1.02 MPa, while that of T1 and T2 was at −1.13 MPa. Irrigation strategies applied affecting tree yield, fruit firmness (FF) at harvest, and WP. T3 and T2 had the highest and lowest yield. The best Water Productivity (WP) was found in T1. Growing season influenced fruit quality and quantity, and WP in the growing season 2014–2015. The irrigation treatment by growing season interaction was significant for FF. T2 and T3 exhibited the highest FF in the growing season 2013–2014. After cold storage, significant effects of the growing season were observed in fruit weight. Our results suggests that a moderate post-harvest water deficit (Ψs > −1.5 MPa), does not affect negatively, fruit quality and yield responses of cherry trees.

Víctor Blanco, Rafael Domingo, Alejandro Pérez-Pastor, Pedro José Blaya-Ros & Roque Torres-Sánchez

Soil and plant water indicators for deficit irrigation management of field-grown sweet cherry trees

Agricultural Water Management, Volume 208, 2018, pages 83-94

https://www.sciencedirect.com/science/article/pii/S0378377418306826

A two-year experiment with sweet cherry (P. avium L. cv Prime Giant) trees was carried out to ascertain which of the following commonly used soil and plant water indicators is most effective for deficit irrigation scheduling: Ψstem (midday stem water potential), MDS (maximum daily branch shrinkage), gs (stomatal conductance), Θv (soil volumetric water content), Ψm (soil matric potential). For this, soil and plant water relations, as well as the physiological and agricultural responses of trees to three different irrigation treatments, were evaluated. The irrigation treatments imposed were: i) a control treatment (CTL) irrigated at 110% of crop evapotranspiration (ETc) throughout the growing season, ii) a regulated deficit irrigation treatment (RDI), which met 100% ETc at preharvest and during floral differentiation and 55% ETc during the postharvest period and iii) a treatment based on normal farming practices (FRM).

MDS was the first indicator to detect water stress, while Ψm showed the highest sensitivity postharvest, when it was closely related with Ψstem. Consequently, a multiple linear regression equation based on average Ψm at a depth of 25 and 50 cm, and mean daily air vapor pressure deficit (VPD) was established to estimate Ψstem. The estimated Ψstem explained 84% of the variance in the measured Ψstem. Hence, the equation proposed can be used as a tool to estimate Ψstem and for irrigation scheduling. Based on the relation MDS vs. Ψstem and the observed agronomic response, a postharvest threshold value of −1.3 MPa is proposed for deficit irrigation management in ‘Prime Giant’ cherry trees.

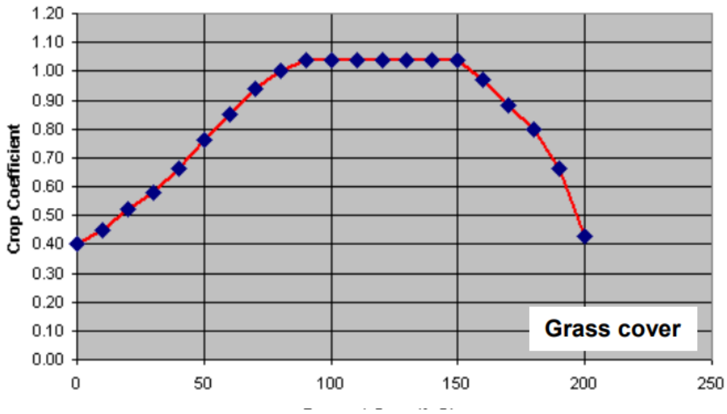
Brent Black, Robert Hill, and Grant Cardon

Orchard Irrigation: Cherry

Utah State University Cooperative Extension, 2008

https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1647&context=extension_curall

Sweet cherry kc where there is a grass cover inter row.



Jordi Marsal, G. Lopez, A. Arbones, M. Mata, X. Vallverdu & J. Girona

Influence of post-harvest deficit irrigation and pre-harvest fruit thinning on sweet cherry (cv. New Star) fruit firmness and quality

The Journal of Horticultural Science and Biotechnology Volume 84, 2009 - Issue 3

https://www.tandfonline.com/doi/abs/10.1080/14620316.2009.11512516

Four different treatments were applied: (i) fully irrigated (Control), in which irrigation was scheduled according to a water budget approach; (ii) RDI-80%, in which the crop received 0.8%. Control irrigation during post-harvest and was irrigated like the Control during pre-harvest; (iii) RDI-50% in which the crop received 0.5%. Control irrigation during post-harvest and was irrigated like the Control during pre-harvest; and (iv) RDI-80%-T in which irrigation management was the same as for RDI-80%, but fruits were only thinned 1 month prior to harvest in 2006. No significant effects on fruit load or yield were observed in 2006 as a consequence of the 2005 irrigation treatments. However, the RDI-50% treatment produced a noticeable advance in ripening, as evaluated from the percentage of fruit harvested at the first pick. Post-harvest water stress did not affect fruit quality at harvest, but slightly reduced fruit firmness (FF) and soluble solids content (SSC) after cold storage, with no significant variation in fruit flesh red colour (expressed as hue angle). Fruit-thinning reduced the fruit load by 38% compared to Control trees, and significantly increased fruit fresh weight (FW), FF, and SSC for cherries with similar flesh colour to the other treatments. Reducing irrigation by 50% during post-harvest advanced the harvest date (RDI-50% treatment), but did not provide any advantage in terms of fruit quality.

Pedro José Blaya-Ros, Víctor Blanco, Roque Torres-Sánchez & Rafael Domingo

Drought-Adaptive Mechanisms of Young Sweet Cherry Trees in Response to Withholding and Resuming Irrigation Cycles

Agronomy 2021, 11(9), 1812

https://www.mdpi.com/2073-4395/11/9/1812

The present work evaluates the main adaptive mechanisms developed by young sweet cherry trees (Prunus avium L.) to cope with drought. For this purpose, the young trees were subjected to two drought cycles with different water stress intensities followed by a recovery period. Three irrigation treatments were applied: control treatment (CTL) irrigated to ensure non-limiting soil water conditions; moderate water stress (MS) subjected to two drying cycles whose duration was dependent on the time elapsed until the trees reached values of midday stem water potential (Ψstem) of −1.3 and −1.7 MPa for the first and second cycle, respectively; and severe water stress (SS) similar to MS, but with reference values of −1.6 and −2.5 MPa. In-between drought cycles, MS and SS trees were irrigated daily as the CTL trees until reaching Ψstem values similar to those of CTL trees. The MS and SS trees showed an important stomatal regulation and lower vegetative growth. The decreasing leaf turgor potential (Ψturgor) during the drought periods accounted for 40–100% of the reduction in leaf water potential at midday (Ψmd). The minimum osmotic potential for mature leaves was about 0.35 MPa lower than in well-irrigated trees. The occasional osmotic adjustment observed in MS and SS trees was not sufficient to maintain Ψturgor values similar to the CTL trees or to increase the specific leaf weight (SLW). The leaf insertion angle increased as the water stress level increased. Severe water stress (Ψstem < −2.0 MPa) resulted in clear early defoliation as a further step in water conservation.

Tirhas Gebretsadikana, Paige Munro, Tom Forge, Melanie Jones & Louise Nelson

Mulching improved soil fertility, plant growth and productivity, and postharvest deficit irrigation reduced water use in sweet cherry orchards in a semi-arid region

Archives of Agronomy and Soil Science Volume 69, 2023 - Issue 8

https://www.tandfonline.com/doi/abs/10.1080/03650340.2022.2095621

Postharvest deficit irrigation (PDI) and organic mulches can reduce water use in orchards, but their interactive effects on soil fertility, water relations, and crop performance in new orchard environments are unknown. In a randomized block split-plot design, full irrigation (100%) or PDI (72–76% of full irrigation) was applied to the main plots, and mulches (compost, woodchips, bare) were subplots at three sites. Compost increased soil organic matter, nutrients, pH, and electrical conductivity over three seasons at all sites. Woodchips increased tree growth and foliar P and Mn, while compost increased some fruit quality attributes, and foliar P compared to bare soil. Relative to full, PDI saved 24–28% irrigation water after harvest per season at each site without affecting soil moisture and chemical properties, stem water potential, or crop performance, or interacting with mulch effects. These results suggest that in this semi-arid cherry growing region mulches are a promising strategy to maintain soil moisture and improve soil fertility and crop performance, and PDI can reduce water use after harvest without affecting commercial production.

John Golding

Review of international best practice for postharvest management of sweet cherries

Hort Innovation, 2018, Project code CY1700 https://www.cherrygrowers.org.au/assets/Review-of-international-best-practice-for-the-postharvest-management-of-sweet-cherries.pdf

Water availability is a major limiting factor in many Australian cherry growing regions. Yin et al. (2011) showed that drip irrigation applied to 'Lapins' cherry trees consumed only 21–29% of the irrigation water compared to microsprinkler irrigation but it enhanced marketable fruit by 7 to 12% and did not impact fruit yield or firmness, colour, and size (Yin et al., 2011). Low-frequency drip irrigation has also been shown to increase SSC in 'Cristalina' and 'Skeena' cherries (Neilsen et al., 2014). However, irrigation levels did not affect SSC, TA, and fruit weight of the cherries of the '900-Ziraat' cultivar (Demirtas et al., 2008). However, the effects of storage life from these preharvest treatments are limited. Velardo-Micharet et al. (2017) reported that supplementary irrigation did affect fruit size but had no effect on fruit quality (firmness, SSC, TA, stem colour, weight loss) during storage at 4°C. However, they did show higher rot incidence during postharvest storage in irrigated trees as compared to non-irrigated trees (Velardo-Micharet et al, 2017).

Gerry H. Neilsen, Denise Neilsen, Frank Kappel & Thomas Forge

Interaction of Irrigation and Soil Management on Sweet Cherry Productivity and Fruit Quality at Different Crop Loads that Simulate Those Occurring by Environmental Extremes

HortScience, 2014, 49(2), 215-220

Soil moisture content (0- to 20-cm depth) during the growing season was often higher in soils that received high-frequency irrigation (HFI) compared with low-frequency irrigation (LFI). HFI and LFI received the same amount of water, but water was applied four times daily in the HFI treatment but every other day in the LFI treatment. Consequently, higher yield were found on HFI compared with LFI trees.

E. Nieto, M.H. Prieto, R. Fortes, V. Gonzalez & C. Campillo

Response of a long-lived cherry cultivar to contrasting irrigation strategies in the Jerte Valley, Extremadura, Spain

VII International Cherry Symposium, 2017

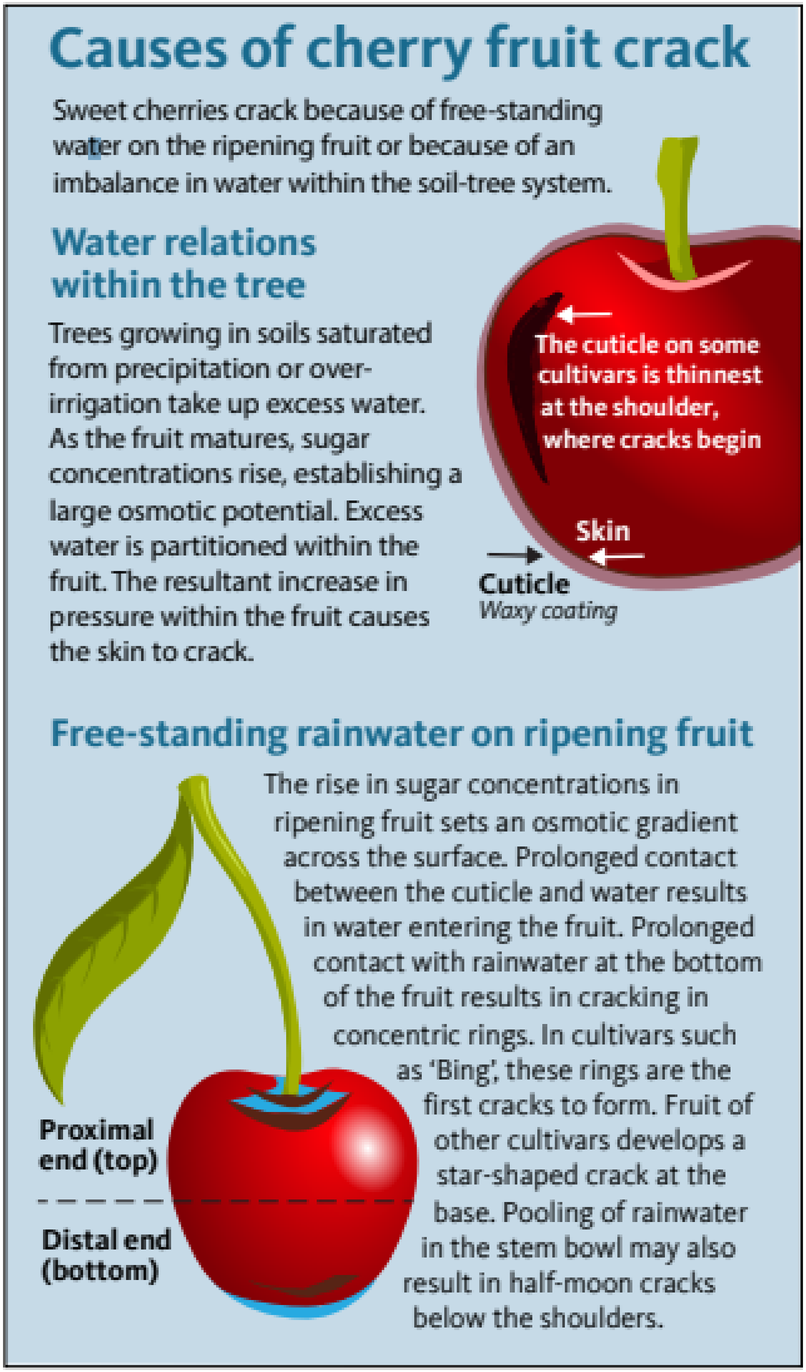
The present paper shows the results of field trials carried out in 2010 and 2011 in a cherry plantation (Prunus avium) with a long-lived cultivar, ('Lapins') in the Jerte Valley (Cáceres, Extremadura, Spain) to study the response contrasting irrigation programs. This work contributed to contrasting irrigation strategies, including pre- and postharvest irrigation. Preharvest irrigation programs included three irrigation treatments covering 100% of the ETc and another using traditional irrigation practices in the area, which include no irrigation during the preharvest interval. Postharvest irrigation programs consisted of four deficit irrigation treatments, three of which replaced 25, 50 and 100% of the ETc and one which delivered the average amount of water supplied during postharvest in the area. The experiment was a random block design with four replications. The study indicates that the deficit controlled treatment of replacing 25% of the ETc postharvest for two consecutive years resulted in superior yields than other treatments. Also, the regime using the average farmer's irrigation water and their habitual irrigation practices only postharvest maintained a good yield similar to that obtained by other regimes, which used preharvest irrigation, getting a reduction in the consumption of water up to 60%.

Clive Kaiser, Lynn Long, & Linda Brewer

Understanding and Preventing Sweet Cherry Fruit Cracking

Oregon State University Extension Service, 2019

https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9227.pdf



Sofia Correia, Rob Schouten, Ana Paula Silvaa & Berta Gonçalves

Sweet cherry fruit cracking mechanisms and prevention strategies: A review

Scientia Horticulture 240 (2018) 369-377