agronomy

Review

Regulated Deficit Irrigation Perspectives for Water Efficiency in Apricot Cultivation: A Review

Lucía Andreu-Coll [1], Ángel A. Carbonell-Barrachina [2], Francisco Burló [2], Alejandro Galindo [3], Jesús García-Brunton [3], David B. López-Lluch [2], Rafael Martínez-Font [1], Luis Noguera-Artiaga [2], Esther Sendra [2], Pedro Hernández-Ariola [1], Francisca Hernández [1,*] and Antonio J. Signes-Pastor [4,5,6,*]

[1] Grupo de Investigación en Fruticultura y Técnicas de Producción, Instituto de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH), Universidad Miguel Hernández, Carretera de Beniel, km 3,2, Orihuela, 03312 Alicante, Spain; l.andreu@umh.es (L.A.-C.); rafa.font@umh.es (R.M.-F.); pedrohernandezariola@gmail.com (P.H.-A.)
[2] Grupo de Investigación en Calidad y Seguridad Alimentaria, Instituto de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH), Universidad Miguel Hernández, Carretera de Beniel, km 3,2, Orihuela, 03312 Alicante, Spain; angel.carbonell@umh.es (Á.A.C.-B.); francisco.burlo@umh.es (F.B.); david.lopez@umh.es (D.B.L.-L.); lnoguera@umh.es (L.N.-A.); esther.sendra@umh.es (E.S.)
[3] Grupo de Fruticultura, Departamento de Producción Vegetal y Agrotecnología, Instituto Murciano de Investigación y Desarrollo Agrario y Medioambiental (IMIDA), Calle Mayor, s/n, La Alberca, 30150 Murcia, Spain; alejandro.galindo@carm.es (A.G.); jesus.garcia2@carm.es (J.G.-B.)
[4] CIBER Epidemiología y Salud Pública (CIBERESP), Instituto de Salud Carlos III, 28034 Madrid, Spain
[5] Instituto de Investigación Sanitaria y Biomédica de Alicante, Universidad Miguel Hernández (ISABIAL-UMH), 03010 Alicante, Spain
[6] Unidad de Epidemiología de la Nutrición, Departamento de Salud Pública, Historia de la Ciencia y Ginecología, Universidad Miguel Hernández (UMH), 03550 Alicante, Spain
* Correspondence: francisca.hernandez@umh.es (F.H.); asignes@umh.es (A.J.S.-P.)

Citation: Andreu-Coll, L.; Carbonell-Barrachina, Á.A.; Burló, F.; Galindo, A.; García-Brunton, J.; López-Lluch, D.B.; Martínez-Font, R.; Noguera-Artiaga, L.; Sendra, E.; Hernández-Ariola, P.; et al. Regulated Deficit Irrigation Perspectives for Water Efficiency in Apricot Cultivation: A Review. *Agronomy* **2024**, *14*, 1219. https://doi.org/10.3390/agronomy14061219

Academic Editors: Belen Gallego-Elvira, Linlin Xu, Lili Zhangzhong and Wengang Zheng

Received: 16 May 2024
Revised: 26 May 2024
Accepted: 4 June 2024
Published: 5 June 2024

Abstract: Addressing agricultural water scarcity poses a current challenge of growing concern, exacerbated by climate change. This is particularly relevant for stone fruit trees, such as apricot, cultivated in semi-arid zones, where regulated deficit irrigation (RDI) strategies are gaining attention to tackle the challenge. The RDI method involves optimizing various factors based on how the plant responds physiologically to indicators of its water needs. Among these indicators, water potential is considered the most reliable and influential measure. For numerous apricot varieties and diverse geographic locations, research consistently shows that implementing water reduction strategies during non-critical developmental stages of floral bud development or fruit growth does not significantly impact crop yield. However, it does lead to reduced vegetative growth, which could offer additional benefits in crop management. Furthermore, the implementation of RDI strategies leads to advantageous improvements in fruit quality, particularly storage capacity and morphometric and chemical fruit characteristics, such as total soluble solids content. This scoping review study suggests that RDI is a feasible strategy to address water scarcity in apricot cultivation; however, further studies focused on continuous water monitoring alternatives are necessary to optimize RDI techniques. Future research should prioritize optimizing RDI for different growth stages, exploring advanced technologies for precise implementation, and assessing environmental impacts, while addressing research gaps including the influence of climate variability and the interaction with other agronomic practices, to refine RDI strategies and enhance apricot orchard sustainability and productivity.

Keywords: *Prunus armeniaca*; water saving; water potential; crop productivity; stone fruit

1. Introduction

Agriculture in semi-arid areas currently faces a significant challenge of water scarcity. Areas dedicated to growing vegetables and fruit trees along the Mediterranean are increasingly affected by severe droughts attributed to climate change [1,2]. In these regions with a long history of rainfed agriculture, it is common to find crops exhibiting drought resistance mechanisms. Examples include species of stone fruit from the genus Prunus, such as European plum (*Prunus domestica* L.), peach (*Prunus persica* L.), and apricot (*Prunus armeniaca* L.) [3].

Apricot, originating from the Orient, is primarily cultivated in Turkey, which accounted for 20.7% of global production in 2022, producing 803,000 tons [4]. In Spain, apricot cultivation covers 18,430 hectares and yielded 80,870 tons in 2022, representing 2.0% of global production [4]. This country has been a pioneer in apricot cultivation, focusing on production in the autonomous communities along the Mediterranean coast, particularly in the Region of Murcia, which contributes 50.4% (40,778 tons) of the national apricot production [5]. However, in Spain, there has been a decline in apricot production since 2018 due to a combination of climatic, economic, and market factors [4]. The "Huerta de Murcia" is considered one of the driest areas in the European continent [6], and this situation of water scarcity has been exacerbated by the increasing impact of climate change, rising industrial demand for water resources, and recent changes in water allocation regulations, particularly the Tajo-Segura transfer. Consequently, the cost of water for farmers has risen significantly due to the decreased volume of water available for irrigation, while fruit prices have become less affordable for consumers because of these water restrictions and the high costs of agricultural inputs [7].

Since the late 20th century, there has been a development and improvement in irrigation techniques capable of reducing water application without compromising production [8]. Partial root-zone drying, a technique which involves the alternation of the area of the tree receiving irrigation to hydrate only a specific root zone for a limited period, has been successfully applied in stone fruit trees [9]. Moreover, there are deficit irrigation strategies, based on irrigating a proportional part of the crop's evapotranspiration (ETc), thereby reducing water supply, with the most prominent being regulated deficit irrigation (RDI). RDI involves reducing the amount of irrigation water during non-critical periods of tree and fruit development, those in which water scarcity does not negatively affect fruit yield [2]. Growth curves in apricots, based on weight or fruit volume, have previously been described as a double sigmoid pattern [10,11]. This pattern, commonly observed in most stone fruits, typically comprises three stages. The initial stage (phase I) is characterized by cell division, followed by a lagging second stage (phase II) involving the physiological process of pit hardening. The third stage (phase III) is characterized by the peak intensity of fruit expansion, and it focuses on cell enlargement and the augmentation of intercellular space [12]. For apricot trees and other stone fruits, phase III of fruit growth (Figure 1) and early postharvest, which involves the induction and floral differentiation of buds that ensure the harvest for the following year [2], have been categorized as critical periods. Irrigation restrictions during these periods can lead to significant production losses. Therefore, the key aspect shared by RDI strategies in stone fruit trees is to ensure that the crop is under non-limiting irrigation conditions during these critical periods. This technique has shown promising results in various fruit trees, including olive trees [13], lemon trees [14], and peach trees [15].

The aim of this study is to review available information on RDI and evaluate its feasibility for application in apricot cultivation to address water scarcity in semi-arid zones. We focus on the following key aspects of apricot cultivation: (I) the water status of the crop, which serves as a representation of the physiological response to water scarcity; (II) crop productivity, focusing on the yield of apricot trees in terms of apricot production; and (III) fruit quality, analyzing the impact of RDI on the commercial value of the product.

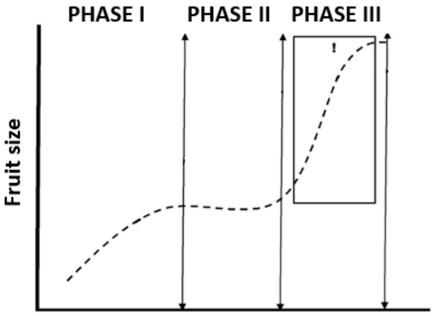

Figure 1. Characteristic growth pattern of a stone fruit, differentiating the three main phenological phases. The box indicates the critical period of rapid fruit growth where the crop is maintained under non-limiting irrigation conditions in RDI strategies (original image).

Section 2 outlines the literature review methodology. Section 3 presents the results and discussion, divided into three subsections: Section 3.1 addresses crop water status, covering volumetric water content (Section 3.1.1), stomatal conductance and net photosynthesis (Section 3.1.2), and water potential (Section 3.1.3); Section 3.2 focuses on crop productivity, discussing vegetative growth (Section 3.2.1), floral bud development (Section 3.2.2), and productive efficiency (Section 3.2.3); Section 3.3 examines fruit quality, detailing colorimetric parameters (Section 3.3.1), fruit weight and size (Section 3.3.2), fruit shelf life (Section 3.3.3), and chemical quality indexes (Section 3.3.4).

2. Methodology for the Literature Review

To conduct this review, the authors used a research paper format and employed a scoping review methodology based on the PRISMA Extension (PRISMA-ScR) approach [16]. A comprehensive literature search—Scopus—was performed in August 2023 and was limited to articles published in English since 1990. Text words and controlled vocabulary for several concepts (*Prunus armeniaca*, apricot, and deficit irrigation) within the titles, abstracts, and keywords were used. Focus has been given to studies published in journals included in the Journal Citation Reports. Each article entry was accessed to retrieve the full text and review its content, including the title, abstract, and description of irrigation treatments in the experimental design. This search yielded 35 studies, which were subjected to the first selection filter. The first selection filter was based on three criteria: full-text availability, categorization as scientific articles or reviews, and non-redundancy with other sources. This filter reduced the number of articles to 26, leaving 9 discarded articles. The 26 selected articles underwent another filter evaluation based on specific criteria: apricot tree experimentation, RDI application during critical and non-critical periods, and execution in local farm conditions. A total of 11 studies were selected after this filter as shown in Figure 2. The data extracted from these articles were incorporated into an Excel file for evaluation. The data from each selected study were manually recorded, including the type of RDI applied, along with metadata such as the title of the work, experimental period, variety, soil, weather conditions, and significance of the results.

In this work, 11 studies with data on RDI strategies in the apricot crop published before August 2023 were selected. The largest number of studies were from Spain ($n = 5$) followed by Turkey ($n = 3$). Of the three remaining studies, one was carried out in the North Island of New Zealand [17], another in Northern Egypt [18], and another in India [19]. The oldest studies were published in 2000 [2,17] and the rest of the articles were published between 2007 and 2022. The selected studies included data about the quality of apricot fruit ($n = 10$, [2,6,17–24]), apricot crop productivity ($n = 9$, [2,6,17–20,23–25]), and apricot crop water status ($n = 6$, [2,6,18,22–24]).

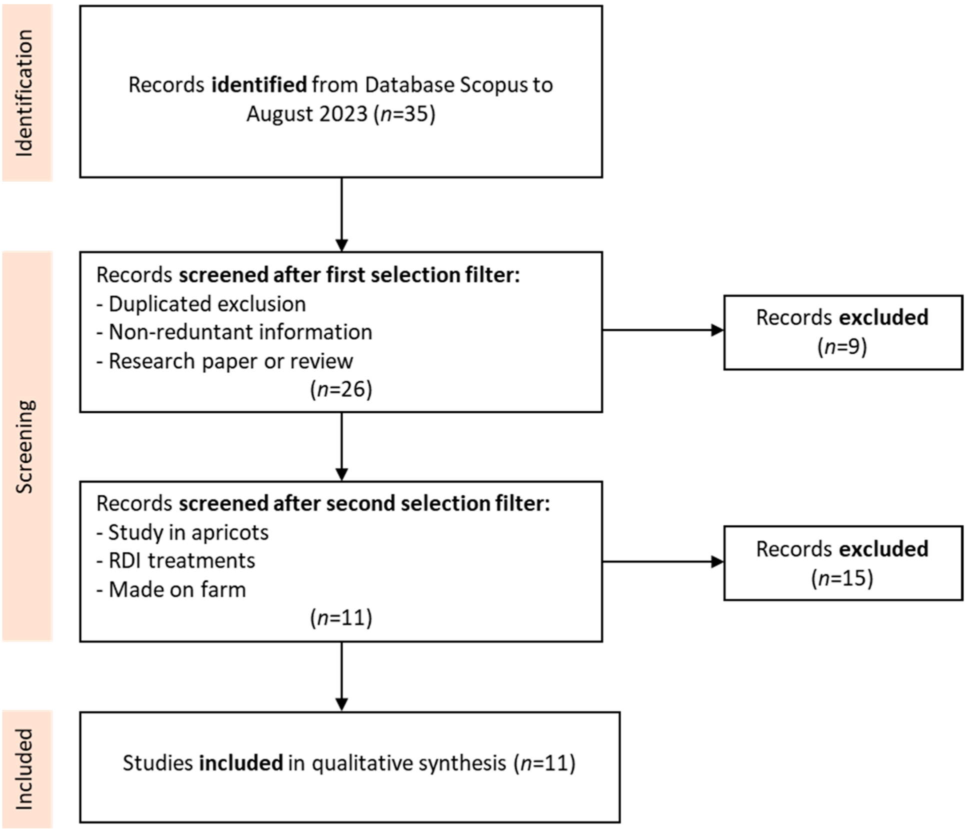

Figure 2. Flow diagram describing the study selection process of the scientific literature.

3. Results and Discussion

This section analyzes the results of the studies included in the qualitative synthesis (n = 11). These studies were selected following a literature search on Scopus in August 2023, focusing on articles in English published since 1990 with the terms *Prunus armeniaca*, apricot, and deficit irrigation in the titles, abstracts, and keywords. From the initial 35 studies found, a first filter based on full-text availability, categorization, and non-redundancy reduced the number to 26. A second filter focusing on apricot tree experimentation, RDI application, and local farm conditions further narrowed the selection to 11 studies. This section also includes a discussion of other articles that were not included in the qualitative synthesis because they did not meet the filter criteria.

3.1. Crop Water Status

Considering the crop as a comprehensive system comprising both the plant and the soil in which it thrives, the crop water status is understood as the plant's reaction to the available water in its environment. This status is determined by the balance between water inputs (from irrigation and precipitation) and outputs (from transpiration and drainage). Hence, water status parameters are crucial indicators of the plant's physiological state.

Six of the selected studies evaluated the crop water status in apricot with RDI strategies [2,6,18,22–24]. Three of them [2,23,24] studied the volumetric water content and stomatal conductance in the apricot crop during and after RDI treatments. Four studies determined leaf water potential at dawn [2,6,22,23] and three determined this parameter at noon [6,23,24]. Only one study determined stem water potential and the measurements were carried out at noon [24]. Net photosynthesis was determined in two studies [23,24]. The total soluble carbohydrates, indicator of leaf photosynthetic activity, and leaf proline content, which is related to water stress, were only determined by Ezzat et al. [18].

With advancements in understanding the impact of water on plant physiology, new methodologies have emerged for quantifying the water status of crops. Over the past four decades, water status indicators in the agricultural sector have been used to tailor irrigation strategies to the specific requirements of crops [26]. Some of these indicators primarily focus on the influence of water on tissues, while others consider the broader impact of abiotic stress on plants and, consequently, on water stress [27]. However, the emergence of new methodologies has also induced interest within the scientific community in assessing the extent of the information provided about how the crop accurately represents the physiological state of the plant and how useful it is for efficiently managing water use. Currently, the debate over the validity of available indicators has influenced the tendency of researchers to employ methodologies that better suit the species under study [28].

In the following subsections, we review the main hydration state indicators measured in apricot trees, exploring their associated physiological responses, and discuss their relevance in RDI strategies, as well as how the reduction in carbon assimilation affects vegetative and fruit growth.

3.1.1. Volumetric Water Content

The volumetric water content (θv) of soil is an indicator that quantifies the volume occupied by water in a soil sample. Depending on the methodology used (time-domain reflectometry sensors or gravimetric method), the volume of soil analyzed may vary [2,23,24]. Since the objective of the consulted articles is to describe the water status of the crop through this parameter, the soil samples analyzed coincide with the active root zone of the tree (close to the dripper and the tree, covering a depth of 1.4 m) [2,23]. This type of measurement is useful for understanding the water characteristics of the soil in which the trees are planted and for establishing thresholds of permanent wilting point, field capacity, and knowing the portion of water available to the plants, all to manage irrigation better.

The data on the sum of volumetric water content in different soil layers (up to 1.4 m depth) obtained by Torrecillas et al. [2] and Pérez-Pastor et al. [23] reveal the significant heterogeneity that an experimental plot can exhibit both spatially and temporally. Both studies on "Búlida" apricots were conducted on the same commercial farm in Mula, Spain (37°55′ N, 1°25′ W), during different time periods (distributed between 1994 and 2010), and the average values of volumetric water content for their control treatments (irrigation at 100% of ETc) were 450 and 290 mm, corresponding to soils categorized as clay loam and loam, respectively. When these authors applied RDI treatments in their respective experiments, a more drastic decrease in soil volumetric water content was observed as the irrigation reduction increased and the application period extended. These results explain that more pronounced reductions were caused in the irrigation suppression treatments (reduction of around 220 mm) [2] than in those where a reduction with respect to ETc was applied (reduction of around 90 mm) [23]. However, these were soils with different textures, and hydraulic conductivity may vary, so the magnitude of fluctuations in soil water content is not directly comparable. Another influential factor in the decrease in water reserves was evaporative demand, according to the data obtained by Torrecillas et al. [2], where suppression periods during the postharvest phase (June–July) caused greater water loss than those applied during fruit growth phase I (January) (Figure 1), where the decreases became statistically non-significant over the years. This trend was also observed by Pérez-Sarmiento et al. [24]. Root development is stimulated in drought situations, leading to an increase in the density of small roots (<1 mm in diameter), which affects the soil structure by developing a root system that promotes water retention, making it available for the crop, and reducing drainage and recharge times [6]. However, the fact that mild RDI treatments showed the stabilization of volumetric water content values close to those of controls could also be due to the influence of effective precipitation and/or irrigation based on ETc calculation using static crop coefficients from the literature [2,23,24]; both factors could influence the application of irrigations above the water needs of both the control and the experimental treatment, eliminating the possibility of evaluating the physiological effect of water scarcity. In terms of recharge times, it took between 4 and 9 days for the soil to return to values close to the control after the end of the RDI treatment, depending on the specific treatment and study [2,23].

The evidence suggests the intense dependence of soil volumetric water content on the characteristics of the soil, making it unreliable if intended for use in irrigation control on a soil different from the standardized one. Although this indicator allows us to obtain an idea of the water consumption of the plant and thereby its activity, it offers an indirect and not very representative relationship of the physiological state of the plant. Therefore, it would be more appropriate to apply direct measures to determine the water status of the plant.

3.1.2. Stomatal Conductance and Net Photosynthesis

Stomatal conductance (gs) refers to how much the stomata on a leaf are open, measured by the amount of gas flowing from inside the leaf to the outside [29]. The mechanism of stomatal occlusion and opening play a crucial role in regulating transpiration, which is the main route of water loss in the plant. This mechanism depends on the turgor pressure produced by the water within the guard cells that flange each stomatal pore. These specialized cells modulate stomatal pore size by means of expansion or contraction contingent upon water availability, which highlights its dependence on the water status of the plant and why it is used as an indicator. The movement of water in and out of the guard cells is influenced by the concentration of solutes such as sucrose or sorbitol, reserve metabolites produced by photosynthesis [30]. The strong connection between stomatal conductance and photosynthetic activity justifies using net photosynthesis as an additional indicator of the water status of the plant [31].

Under the environmental conditions of the Murcia Region, "Búlida" apricot trees exhibited an average stomatal conductance value of 130 mmol m^{-2} s^{-1} under non-limiting irrigation conditions (control treatments; 100% ETc) [2,23,24]. In RDI treatments, during periods of reduced water supply, the response of the plant was either significant or not depending on the severity of the irrigation reduction. Treatments involving complete irrigation suppression or a 25% reduction in ETc showed statistically significant differences compared to the control, with an approximate 75% reduction in stomatal conductance [2,24]. When Pérez-Sarmiento et al. [24] applied less severe reductions in ETc (>40%) during non-critical phenological periods (fruit growth phase III and early postharvest), the reduction in comparison to the control was negligible. Similarly, net photosynthesis, averaging 7.8 µmol m^{-2} s^{-1} in trees irrigated at 100% ETc, only showed statistically significant reductions compared to control (100% ETc) when irrigation was reduced to 25% of ETc (1 µmol m^{-2} s^{-1}) [24]. When irrigation control was resumed during the critical phenological periods in the RDI trees, the stomatal conductance took between 8 and 15 days to recover the values comparable to those of trees under non-limiting irrigation conditions, being an indicator of a longer response time than net photosynthesis [23].

The results indicated that water deficit reduced gas exchange between the leaf and the atmosphere [2,23,24]. Stomatal occlusion represents a drought resistance mechanism observed in apricot trees and other stone fruit species, aimed at minimizing water loss experienced by the plant when there is an imbalance between water absorbed by the root zone and that expelled through transpiration [32]. By closing the stomata, the water resistance of the plant increases, preventing the occurrence of cavitation phenomena in the vascular bundles [33]. As the leaf matures, a hardening of the guard cell walls and deterioration of the vascular bundles have been observed, hindering turgor variations responsible for opening and closing movements, thereby negatively affecting gas exchange capacity [33,34]. This effect, coupled with increased evaporative demand during postharvest periods (July–September in Spain, Mediterranean area), could explain the more pronounced reductions in stomatal conductance reported by Torrecillas et al. [2]. Additionally, the atmospheric CO_2 influx into the leaf also decreases [35], which would account for the similarities in the fluctuation of both indicators with irrigation reduction [24], since the scarcity of CO_2 in the electron transport chain of photosystem PSII leads to a decrease in its efficiency [31], resulting in lower net photosynthesis values.

However, the results were not significant unless the water stress was severe [24]. Losciale et al. [31] characterized drought resistance mechanisms in the "Portici" apricot variety by relating multiple indicators of water status and concluded that apricot trees exhibit an anisohydric trend to cope with water scarcity. This means that, despite experiencing stress, their stomata make osmotic adjustments to compensate for low turgor pressure and remain open [36], without hindering transpiration. However, this behavior is considered a "trend" because there is a limit to the water stress the plant can tolerate before closing its stomata. The interruption of transpiration leads to a reduced leaf cooling capacity under heat induced by solar radiation, a phenomenon for which mathematical models are being developed to calculate stomatal conductance and net photosynthesis based on the difference between leaf temperature and surrounding air temperature [31]. Another negative effect on the leaf associated with stomatal conductance closure is oxidative damage, manifested by the accumulation of high concentrations of proline and increased antioxidant enzyme activity [18,37]. The accumulation of reactive oxygen species is linked to the activation of secondary metabolic processes such as photorespiration, driven by the imbalance between excess energy produced by photosystems and the scarcity of electron acceptor molecules (CO_2) [31]. In addition to leaves, other plant organs are also affected by the connection of the plant to the atmosphere and its consequent decrease in biosynthesis. The results of the study by Ezzat et al. [18] revealed in "Canino" apricots decreases in the levels of non-structural soluble carbohydrates in the stem by 15% and 17% when 50% and 25% reductions in irrigation of ETc were applied, respectively.

Awareness of the negative effect of stomatal occlusion on crops has prompted the development of strategies to mitigate it. The use of shading nets (100% of the canopy volume was shaded by the net during the whole day and throughout the experiment) over the plantation allows for more uniform distribution of solar radiation, reducing turbulence and evaporative demand [33]. This allows the expansion of the range of drought that the plant can withstand before closing its stomata [38]. However, constant shading by the netting could affect the production of phytohormones responsible for vascular bundle development [30]. On the other hand, Ruiz-Sánchez et al. [36] proposed the application of controlled water stress pre-treatments to induce the activation of adaptive resistance mechanisms such as partial defoliation. The goal was to decrease transpiration (leaf water potential was measured at pre-dawn around -1.1 MPa) to conserve the limited water available to the plant, while avoiding the activation of evasive resistance mechanisms such as epinasty (leaf curvature to reduce radiation impact angle) or stomatal closure. Conversely, there are studies which advocated for the application of anti-transpirants on leaf surfaces to stimulate stomatal closure and prevent apricot trees from water stress [37].

The main disadvantage of stomatal conductance as an indicator of crop water status is its slow response time, which can be up to two weeks delayed. This is due to the inherent anisohydric tendency of apricot trees, which prioritize maintaining stable stomatal conductance levels even when stressed, making the effects of water deficit on stomatal conductance only noticeable when stress is very severe or prolonged over time. Since net photosynthesis is strongly influenced by CO_2 assimilation performance, which in turn depends on the stomatal opening degree, although it has been shown to have a slightly shorter response time, it presents the same main drawback when considered as an indicator of water status.

3.1.3. Water Potential

Water potential (Ψ) describes the energetic state of water and its tendency to move within its surrounding space [39]. In 1965, Scholander et al. [40] developed a methodology to measure the water potential of plant tissues by applying increasing pressure in a hermetic chamber. Soon, water potential became an essential indicator of the water status of the crop as it is based on the inherent behavior of water in plant tissues according to physical and thermodynamic principles, allowing for a faithful representation of the physiological state of the plant [41].

In most of the articles reviewed in this work, the selected methodology to understand the response to irrigation reduction was the measurement of leaf water potential, with a notable distinction made whether it was measured at dawn (before sunrise) or at midday. The values of leaf water potential at down ranges from 0.83 to 1.09 MPa during fruit growth phases I and II in a water deficit situation [2,6,23]. The average value of leaf water potential at dawn in "Búlida" apricot trees is around −0.6 MPa under non-limiting irrigation conditions in fruit growth phase III [2] (Figure 1). When subjected to RDI, during periods of irrigation reduction, the potential decreases to approximately −1.0 MPa, with absolute maximums observed during postharvest periods, reaching values up to −3.12 MPa [2,6,22–24]. As for leaf water potential at midday, it presented an average value in control trees lower than that measured at dawn (average value: −1.5 MPa), decreasing when irrigated below 100% of ETc (average value: −2.0 MPa), also showing more negative values both for the control and irrigation treatments during postharvest periods [6,23,24].

The data presented by these authors [2,6,22–24] demonstrate the influence of evaporative demand on leaf potential, as when there is active transpiration and the environment is drier, the more negative potentials represent the highest level of plant stress at midday compared to before sunrise [23]. However, leaf potential at midday was only significant compared to the control when severe reductions in water allocation were applied, being insensitive to minor changes in the amount of irrigation applied for which leaf water potential measured at dawn was significant [6,24]. Studies on the evolution of leaf potential over the course of hours indicate the existence of a plateau where the potential does not decrease further until the afternoon, and a possible explanation would be the transfer of water reserves from the trunk to the leaves [34], causing contraction in the trunk to be considered an indicator of the water status of the crop, measurable, standardizable, and useful in irrigation control [32]; broader contractions are related to a situation of greater water stress [33,42]. As for response time, control values were reached in crop rehydration with a lag of between 3 and 6 days [2].

To mitigate environmental influences on leaf water potential measurements, a new indicator based on this methodology emerged: stem water potential (Ψs). Its implementation requires prior coverage of leaves within aluminum bags to induce stomatal closure and thus prevent water loss through transpiration, causing the water potential of leaf tissues to equilibrate with that of the stem from which it emerges [43]. Results shown by Pérez-Sarmiento et al. [24] confirm that this is a more sensitive indicator than leaf water potential, even during periods of low evaporative demand. The average value in "Búlida" apricot trees with controlled irrigation was −0.8 MPa, with more negative absolute values during postharvest periods, where the greatest reductions were also observed (up to −1.4 MPa).

Water potential is a discrete and discontinuous measure, but in addition to allowing us to monitor the water status of the crop, it can provide more information about the physiological state of the plant. By calculating the water stress integral, the accumulated stress on the tree during the irrigation reduction period can be quantified, which can be related to the negative effects on the crop posed by the repeated use of these deficit irrigation treatments, even outside critical phenological phases [29]. For "Búlida" apricot trees, a threshold of −140 MPa (which would occur when irrigating below 20% of ETc for a couple of consecutive months) was established, below which vegetative growth (up to 25% reduction in pruning dry weight (kg tree^{-1}) and 2 cm in the trunk diameter) and yield (reduction of 32% in the first year of application of RDI) can be significantly affected [6].

Temnani et al. [44] investigated RDI in "Rojo Carlet" apricots, employing two treatments. Both treatments shared the application of 80% of crop evapotranspiration (ETc) during fruit growth phases I and II. However, they differed in the irrigation threshold during late postharvest: the first treatment (RDI1) maintained a threshold of approximately −1.5 MPa of Ψs, while the second treatment (RDI2) had a threshold of −2 MPa, representing moderate and severe water stress, respectively. Results indicated that Ψs varied with evaporative demand and irrigation reduction levels. During the water deficit period, Ψs averaged −1.3 and −1.5 MPa for RDI1 and −1.4 and −1.6 MPa for RDI2, in the first and second seasons, respectively. Both RDI treatments generally maintained values close to the predefined thresholds throughout the study period. Implementing a water stress integral (SΨ) of 30.2 MPa per day during postharvest led to a 20% water saving compared to well-irrigated trees, increasing to 33% with an SΨ of 41 MPa per day in the second season, even though there was a 35% reduction in vegetative growth. Deficit irrigation strategies involving maintaining Ψs thresholds between −1.5 and −2 MPa during late postharvest and a 20% reduction in irrigation during fruit growth stages I and II boosted crop water productivity by 13.2% and 25.6% for RDI1 and RDI2, respectively, without compromising yield. Late postharvest emerged as a critical period for water saving due to its higher evaporative demand and longer duration (mid-July to mid-October).

Regarding this indicator, there is a noticeable trend to replace the leaf water potential methodology with stem water potential based on the mentioned advantages [24]. Compared to other indicators discussed in this section, it is the most promising in terms of consistency, sensitivity, reproducibility, response time, and representativeness of the water status of the crop, as it is not known to be influenced by mechanisms of resistance to abiotic stress, since it does not measure plant activity but rather the energetic state of water in the plant.

3.2. Crop Productivity

The urgency to optimize irrigation management under the pretext of climate change and water resource scarcity, and its consequent impact on agriculture, is the origin of the concept of deficit irrigation (DI) strategies [45]. Therefore, the validity of RDI strategies is mainly measured in terms of yield in production, which is reflected in the fact that the results offered by the articles compiled in this work have mostly focused on the quantity of exploitable resources obtained from the crop under different irrigation regimes. This section will present and reflect on the impact of RDI treatments tested by various researchers on the management of apricot trees in semi-arid climates.

Nine of the selected studies evaluated the apricot crop productivity under RDI treatments [2,6,17–20,23–25]. The most calculated parameters by these authors in this area were total production [2,6,17,18,20,23,24], productive load [6,17,19,20,23], and fruit set [2,18,24]. The rest of the determinations were heterogeneous among different authors. Some authors determined productive load efficiency [6,17] and the correlation between productive load and fruit weight [23]. Ezzat et al. [18] focused their study on buds and flowers, determining number of buds (flower buds, open floral buds, vegetative buds, and total buds), starting of the anthesis, flower abscission, and heat requirements for bud flowering, in addition to determining days for end dormancy until fruit harvest, season vegetative growth, and fruit per tree. Pérez-Pastor et al. [6] determined parameters related to vegetative growth: trunk growth, trunk cross-sectional area, root density, leaf canopy area, stem length and diameter, pruning dry weight, and shaded area. Torrecillas et al. [2] also determined the shaded area, in addition to trunk circumference and fruit growth performance, and compared vegetive growth vs. fruit growth. Other authors [20,24] also determined trunk cross-sectional area (TSCA). Fruit and flower density of stems and proportion of fruit set were determined by Arzani et al. [17]. Kaya et al. [25] focused their study on the trunk and canopy, and they determined canopy and trunk diameter and canopy and trunk growth evolution, and these authors in another study [20] determined the canopy volume. Some authors also determined water use efficiency [23] and water productivity [24].

3.2.1. Vegetative Growth

The first evidence of the use of strategies declared as RDI in apricot trees indicates that they were applied as a means of controlling vegetative growth to properly increase plant density in the pursuit of better exploitation of apricot orchards, as there was limited accessibility to patterns that adapted to this planting design. At the same time, the possibility of saving on maintenance costs related to pruning was considered, as the tree would not produce as much wood with reduced irrigation [17].

While apricot orchards are more accessible in intensive systems nowadays, cost savings in tree pruning have remained a subject of study. The vegetative growth of the tree, expressed in terms of trunk cross-sectional area (TCSA), was affected by the RDI treatment applied by Pérez-Sarmiento et al. [24] resulting in a 14% reduction from the beginning to the end of the experimental period (Table 1). The expansion intensity of the canopy and the TCSA of the apricot tree ceases due to tissue aging, but the suppression of irrigation during non-critical fruit development periods in "Salak" apricot caused the TCSA growth to slow down compared to the control in young apricot trees [25]. This reduction was not statistically significant over a 3-year experimental period, but it did become significant when the number of observed years was extended, with Kaya et al. [20] obtaining a TCSA value for treated apricot trees 33% lower than that of apricot trees irrigated at 100% ETc after a 5-year experimental period. Pérez-Pastor et al. [6], a group that has thoroughly studied different deficit irrigation strategies in the apricot crop, showed a close relationship between the irrigation water saved in each season and the TCSA growth of "Búlida" apricot trees, where when the saved water accounted for less than 20%, there were no major changes in TCSA growth, but above this threshold, the irrigation cut begins to have a significant impact on vegetative growth. However, it is noteworthy that apricot trees irrigated well above their water needs (>100% ETc) did not show the greatest increase in TCSA; instead, the greatest vegetative growth was observed in treatments close to 100% ETc; this could be justified by poor root zone aeration caused by waterlogging from excessive irrigation [20,35]. On the other hand, canopy volume was influenced similarly to TCSA but to a lesser extent [25], and the shaded area and leaf area index of "Búlida" apricot trees did not decrease significantly over a 4-year period subjected to varying degrees of irrigation reductions [6] (Table 1).

Table 1. Effect of different RDI strategies on various parameters of vegetative growth and varieties in apricot crop ("↓", decreases compared to control; "=" does not vary significantly compared to control). Strategies are differentiated by application period and irrigation reduction (% ETc).

Parameter	Variety	RDI Timeframe	% ETc	Results	Reference
Trunk cross-sectional area (TCSA)	Salak	Postharvest	0%	↓	[20]
	Búlida	Fruit set + Fruit growth phases I, II + Late postharvest	25–60%	↓	[24]
Shaded area	Búlida	Fruit growth phases I, II + Late postharvest	0%	=	[2]
		Fruit growth phases I, II + Late postharvest	40–60%	=	[6]
Trunk size	Búlida	Fruit growth phases I, II + Late postharvest	0%	=	[2]
		Fruit growth phases I, II + Late postharvest	40–60%	=	[6]
	Salak	Postharvest	0%	=	[25]
Stem size	Búlida	Fruit growth phases I, II + Late postharvest	40–60%	↓	[6]
	Ninfa	Fruit growth phase I + Early postharvest	25–50%	=	[18]
	Canino	Fruit growth phase I + Early postharvest	25–50%	↓	[18]

Pérez-Pastor et al. [6] described how the application of moderate (irrigated at 100% of ETc during the critical periods (second rapid fruit growth period and 2 months after harvest), at 40% of ETc during the rest of the non-critical periods for the two first years, and 60% for the two last years) or severe (irrigated at 100% of ETc during the critical periods, at 25% of ETc during the rest of the non-critical periods for the first two years, and at 40% for the third and fourth) water deficit in "Búlida" apricot trees during non-critical fruit periods had significant effects on branch diameter and length, which were shortened by 50% and 20%, respectively (Table 1). This highlights the impact that reduced irrigation can have on vegetative growth depending on the intensity of the irrigation reduction. In turn, the application of moderate deficit irrigation showed that the reduction in stem size compared to the control was significant only during fruit growth phase II, while with severe RDI, despite being applied exclusively in the same periods as moderate RDI, it caused the branches to be significantly shorter at any time of the season. For "Búlida" apricot trees, two main stem growth periods were characterized: one in mid-March, coinciding with flowering and phenological phase I of fruit growth, and another in mid-June, coinciding with phenological phase II of fruit growth [6]. It is during the second period of vegetative growth that the stems complete 100% of the development of the season, which is not achieved when coinciding with a limitation of water resources [2]. The reduction in stem dimensions was accompanied by a reduction in fresh weight but not dry weight, suggesting that the decrease in vegetative growth is due to the loss of cell turgor due to water deficiency [6].

Regarding the trunk of the tree, there was no significant reduction in its circumference or diameter with RDI treatments of different intensities [2,25] (Table 1), except in the first year of the study conducted by Pérez-Pastor et al. [6], where trunk size was significantly reduced due to the drastic reduction in irrigation experienced by the crop during the first experimental year. In "Búlida" apricot trees, trunk growth mainly occurs between July and October, after harvest. On the other hand, the roots follow a different pattern from the vegetative growth of the aboveground part of the tree and like that of the fruit, which is related to the influence of auxins on root growth and their inhibitory role in stem growth [6,11]. Temnani et al. [44] determined a slight decrease in trunk growth observed between the fruit growth stage III and harvest when they applied an irrigation of 80% ETc during fruit growth phase I and II and a threshold of -1.5 MPa (RDI1) and -2 MPa (RDI2) of Ψs in "Rojo Carlet" apricots. Although trunk growth correlated with irrigation reduction, no distinctions between treatments were evident during the initial season (2015–2016). However, in the subsequent season, heightened water stress in RDI2 trees resulted in a 38.8% reduction in trunk growth compared to the control group.

These data confirm the existence of a temporal separation between the growth of different organs of the apricot tree; this separation is the key to the potential of RDI strategies, as it allows us to design water management strategies to make the most of the plantation according to our needs. Genotypic differences between apricot varieties influence the duration of the phenological growth phases, but the fruit growth curve is identical and characteristic of stone fruits [32] (Figure 1). For example, Ezzat et al. [18] observed how "Canino" and "Ninfa" varieties, when subjected to different intensities of irrigation reduction, did not influence stem vegetative growth to the same extent (Table 1). In addition to the non-overlapping periods of vegetative and fruit growth, another key factor for production is biomass partitioning in the plant [24]. Since the fruit acts as a strong sink for assimilates, it tends to accumulate more reserve substances than stems during phenological phase II even when water is limited [21,23], as evidenced by the low content of non-structural soluble carbohydrates in the stem compared to well-watered controls [18].

3.2.2. Evolution of Floral Buds

Over the years and across various experiments, while certain shifts in the onset of flowering or harvest were observed, they could not be directly attributed to the application of deficit irrigation treatments [18,23]. Instead, these shifts were more likely attributed to inherent characteristics of stone fruit species [12].

Floral induction occurs before the floral bud anthesis, a moment that coincides with early postharvest in apricot trees. This irreversible process of cell differentiation and organogenesis is complexly controlled by multiple genes and plant hormones [30]. The success of this process determines the number of fruits that the tree will ultimately bear at harvest, and since water availability can influence its development, it is a process that concerns the design of RDI strategies. Torrecillas et al. [2] demonstrated that irrigation suppression during early postharvest (June–July in Spain, Mediterranean area) resulted in a significant decrease in fruit set (around 9% of fruit set compared to 12–25% in other treatments which reduced irrigation in different periods) for the subsequent harvest, which was sufficient reason to define this period as critical in terms of irrigation. Stress during early postharvest atrophies the induction development and differentiation of the floral bud, leading to an increase in the number of flowers with dysfunctional organs [21]; for example, ungerminated pollen grains have been found in stressed apricot trees during this period [32]. Most organs finish differentiation outside this critical period, but vascular bundle formation has been shown to be affected by water scarcity even in late postharvest; the low or absent flow of nutrients through the xylem to young flowers eventually necrotizes the interior of the flower. This is because xylogenesis (the process of xylem formation) is a gradual process that depends entirely on cell turgor [30]. These facts could explain the results of Ezzat et al. [18], where two RDI strategies of different irrigation reduction intensities were applied during the same early postharvest period, and neither resulted in a significant decrease in the subsequent year in the number of floral buds (around 8% more than the control treatment) compared to the control for both apricot varieties ("Ninfa" and "Canino"), but a higher percentage of floral abscission (around 30% more than the control treatment) occurred. Indeed, in the most severe RDI treatment, there was a significant percentage of buds (around 7% more than the control treatment) that did not flower. This suggests that the flower had enough water for some time to develop part of its organs but not to complete organogenesis or xylogenesis. However, at the same time, an increase in the percentage of fruit set was observed. Pérez-Pastor et al. [6] did not observe significant variations in the proportion of fruit set in "Búlida" apricots when reducing irrigation during the critical early postharvest period by applying half the irrigation compared to the control. The percentage of fruit set apparently remained unchanged despite water stress during early postharvest due to a reduction in the number of viable flowers and an increase in the abscission of those that failed to complete their development, resulting in a decrease in the number of fruits per tree; there was a higher proportion of fruit set, not based on an increase in productive load, but on a decrease in the total number of flowers, mainly healthy ones [18]. On the other hand, fruit set not only remained stable but was significantly higher in "Sundrop" apricot trees subjected to a brief RDI period of irrigation suppression only during phenological phases I and II of fruit growth (around 28% of fruit set in RDI compared to around 18% in control treatment), being kept under non-limiting irrigation conditions after harvest; in this case, the increase in fruit set was accompanied by a higher density of apricots per stem [17].

To conclude, Ezzat et al. [18] investigated the influence of water on the dormancy period of floral buds in "Ninfa" and "Canino" varieties. Significant differences were found in terms of chilling requirements, but this depended entirely on the genotype of the variety studied. The "Canino" apricot required a greater number of chilling units (below 7.2 °C) to break dormancy when subjected to RDI treatment. "Ninfa" apricots, however, maintained chilling requirements like those of the well-watered control. Finally, the authors concluded that if RDI strategies are to be applied to commercial varieties with the aim of optimizing production, it is advisable to use varieties with low chilling requirements due to the risk that reduced irrigation may prolong bud dormancy.

3.2.3. Productive Efficiency

In this section, we will analyze the apricot harvest yields and the extent to which irrigation has influenced them, considering the conclusions reached in the previous Sections 3.3.1 and 3.3.2. Given the nature of RDI strategies, which are based on maximizing water use, results related to water investment in obtaining yields will be more important. Therefore, findings related to productive efficiency will take precedence over those related to absolute production values.

Regarding the impact of RDI on the harvest, the periods corresponding to the fruit growth phase III and postharvest are accepted as critical points in fruit development where plants should not accumulate water stress. Irrigations below 100% of ETc during the first critical period cause issues in the contemporary year harvest, and if this reduction occurs during early postharvest, it affects the harvest of the following year [2] (Figure 1).

In general terms, the total production of each harvest did not show statistically significant differences compared to the control, including in the "Búlida" apricots grown in Murcia, "Salak" (Turkey) or "Ninfa" (Egypt) apricots [2,6,18–20,23], and Indian apricots studied by Kumar et al. [19] (Table 2). These results are expected since the critical fruit growth periods had identical irrigation to the control. However, Arzani et al. [17] reported a more abundant harvest in absolute value despite the clear hindrance of vegetative growth influenced by RDI in "Sundrop" apricots (New Zealand), justifying these results by stating that lower canopy vigor allows for light to reach the inner parts of the tree, stimulating photosynthesis in internal canopy regions and increasing assimilation efficiency and biosynthesis [21]. Moreover, Bussi and Plenet [46] studied "Bergeron" apricots under severe irrigation restrictions applied before harvest and determined that fruit yields were not significantly limited by water restriction.

Table 2. Effect of different RDI strategies on productivity parameters and varieties in apricot crop ("↓" indicates decrease compared to control; "↑" indicates increase compared to control; "=" indicates no significant variation compared to control). Strategies are differentiated by the application period and the percentage reduction in irrigation (% ETc).

Parameter	Variety	RDI Timeframe	% ETc	Results	References
Percentage of fruit set	Sundrop	Fruit growth phases I, II	0%	↑	[17]
	Búlida	Fruit growth phases I, II + Late postharvest	0%	=	[2]
		Fruit set phase + Fruit growth phases I, II + Late postharvest	25–60%	=	[24]
	Ninfa	Fruit growth phase I + Early postharvest	25–50%	↑	[18]
	Canino	Fruit growth phase I + Early postharvest	50%	=	
		Fruit growth phase I + Early postharvest	25%	↓	
Productive load		Fruit growth phases I, II	0%	↑	[17]
	Sundrop	Fruit growth phases I, II + Late postharvest	25%	↓	[23]
	Búlida	Fruit growth phases I, II + Late postharvest	40%	=	
	Not available	Fruit growth phases I, II + Late postharvest	25%	↓	[6]
		Fruit growth phases I, II + Late postharvest	40–60%	=	[6]
		Fruit growth phases I, II + Late postharvest	60%	=	[19]
Total production	Sundrop	Fruit growth phases I, II	0%	↑	[17]
	Búlida	Fruit growth phases I, II + Late postharvest	0%	=	[2]
		Fruit growth phases I, II + Late postharvest	25%	↓	[23]
		Fruit growth phases I, II + Late postharvest	40%	=	
		Fruit growth phases I, II + Late postharvest	25%	↓	[6]
		Fruit growth phases I, II + Late postharvest	40–60%	=	
		Fruit set phase + Fruit growth phases I, II + Late postharvest	25–60%	=	[24]
	Salak	Postharvest	0%	=	[20]
	Ninfa	Fruit growth phase I + Early postharvest	50%	↑	[18]
		Fruit growth phase I + Early postharvest	25%	=	
	Canino	Fruit growth phase I + Early postharvest	25–50%	↓	
Water use efficiency (WUE)	Búlida	Fruit growth phases I, II + Late postharvest	25%	=	[23]
		Fruit growth phases I, II + Late postharvest	40%	↑	
		Fruit set phase + Fruit growth phases I, II + Late postharvest	25–60%	↑	[24]

On the other hand, productive efficiency (fruits cm^{-2}) proved to be higher in trees treated with RDI than in those irrigated at 100% of ETc throughout the year, mainly due to the reduction in TCSA growth [6,17,24]. However, this was not consistent in all cases, as Pérez-Pastor et al. [23] applied a very pronounced reduction in water supply during non-critical periods (25% of ETc; 100% of ETc during critical periods), and yet their results for load and productive efficiency decreased by 22% and 32%, respectively, compared to the control, with no significant water savings, reflected in the low water use efficiency (WUE) level (Table 2). They suggested that insufficient vegetative development due to high water stress likely caused these unfavorable results. Pérez-Pastor et al. [6] also attributed the low productivity in the first year to a very low TCSA growth rate in apricots (Table 2). Torrecillas et al. [2] applied complete suppression in two different treatments that occurred before the harvest, one during the phenological phase I (from February to March) and the other in phase II (from March to May), yet no decrease in production was observed. Pérez Pastor et al. [6] discussed that due to the extensive duration of application (from February to May in Spain, Mediterranean area) combined with severe irrigation reduction (25% of ETc), the water stress accumulated by the plant would have caused irreparable damage with rehydration during phase III. By adjusting the water supply of the RDI treatment (40% of ETc), satisfactory results were achieved at the end of the experimental period, with a load and productive efficiency 4% higher than the control and a 34% increase in WUE, corresponding to 22% water savings (Table 2). These findings support the idea that a lack of vegetative growth can compromise production [21], especially in young apricot trees [35]. Kaya et al. [20] concluded that the sustained reduction irrigation treatment throughout the season at 50% of ETc (even during critical periods) had better productive efficiency than other treatments, including RDI. Initially, this result contradicts what other researchers observed, but since the applied RDI treatment is based on the complete suppression of irrigation for a long period (from the end of harvest in June to September), the accumulated stress in the trees was intense enough to prevent minimal vegetative growth. On the other hand, Pérez Sarmiento et al. [24] managed to maintain productive efficiency and increase WUE by an average of 2.32 kg m^{-3} (a 49% increase compared to control, 100% ETc irrigation), corresponding to a 30% water saving, by applying an RDI whose irrigation reduction was adapted to the ability of the crop to combat water stress and with the caution of ensuring non-limiting irrigation conditions during critical periods. Nicolás et al. [33] reported that the use of shade nets could help increase WUE.

However, there are multiple external factors that can favor or ruin the harvest (such as excessive heat, which can affect apricot fruit set, or extreme drought) [6], causing irregularities frequently. Another drawback of data extracted from experimentation with specific varieties is their low reproducibility in other varieties, also represented in the total production results obtained for the "Ninfa" and "Canino" varieties when subjected to the same irrigation reduction [18]. Nevertheless, in apricot cultivation, the current trend in Spain is towards the cultivation of extra-early varieties due to the advantages they offer to farmers (greater resistance to viruses and greater competitiveness in the market) [47], and the characteristics of "Búlida" apricots align with those of the most popular varieties, making the results obtained by researchers on this apricot tree beneficial for managing commercial varieties.

The different analyzed articles warn of a delicate balance regarding the reduction in vegetative growth in increasing water use efficiency, as if natural tree growth is hindered too much, it can lead to significant decreases in harvest that do not compensate for water savings. Moreover, it is crucial to conduct a thorough characterization of the treated variety to avoid exceeding induced water stress by RDI treatments.

3.3. Fruit Quality

While RDI is initially designed as a strategy for vegetative control and maximizing production in relation to applied water, understanding the physiological changes observed in woody species to combat water stress raises the possibility that fruit may alter its physicochemical properties. The profitability of any crop is not solely influenced by productive efficiency, as product demand determines its market value. The reduction in irrigation in stone fruit management cannot be validated until it is known whether it leads to degradation in fruit quality, in which case it could not be proposed as a viable strategy for the farmer. Therefore, this section compiles results related to the quality of apricots that were treated with RDI strategies.

Ten of the selected studies included data about quality parameters of apricot fruit [2,6,17–24]. Most of them evaluated morphometric parameters related to quality, mainly fruit weight (*n* = 8; [2,6,17–19,21–23]), fruit diameter (*n* = 7, [2,6,19,21–24]), and firmness (*n* = 5 [2,20,22–24]). Only one study described the influence of RDI in fruit height and stone weight [21]. Four studies evaluated the influence of RDI in fruit color, all of them determined external color [2,22–24], and three also evaluated internal color [22–24]. The main chemical quality indices, total soluble solids, and titratable acidity were determined in five studies [19,20,22–24]. Only one study [22] described the influence of RDI in fruit shelf life, including physiopathies, fungal infections, and ethylene and CO_2 production.

3.3.1. Colorimetric Parameters

The initial judgment that consumers make when deciding whether to purchase a particular fruit comes from its appearance [48]. The values of the parameters a* and b* represent the coordinates within the CIELAB color space of the red/green axis and yellow/blue axis, respectively. It has been observed that these values shift towards those associated with a more reddish color on the external and internal parts of the fruit in treated "Búlida" apricot trees [23], which may be related to increased ethylene release promoted by water stress [22]. The parameter L* showed higher values with the application of RDI, indicating a brighter color on the skin [24]. Torrecillas et al. [2] observed an increase in the C* of fruits whose irrigation was suppressed during the rapid growth phase (phenological phase III). This parameter is calculated from the previously described parameters and indicates the chroma or color intensity [49], and the results differed when irrigated at 100% of ETc during phase III, as no significant differences were found [23]. Neither were observed by Pérez-Sarmiento et al. [24] except for the harvest of the last experimental year, where it increased significantly. Regarding the parameter h° (hue angle), an increase is shown both in the skin and pulp, which, depending on the season, was statistically significant or not compared to the control treatment (100% ETC irrigation) [23]. The h° describes color saturation, and its increase in apricot trees is associated with greater exposure to solar radiation, as it causes a higher proportion of oxidized carotenoids; however, over the days in apricots stored at 13 °C, this value decreased until it equilibrated with the control [22]. As with C*, Pérez-Sarmiento et al. [24] observed arbitrary variations of h° over the harvests. These results are inconclusive as they do not strongly support a direct relationship between RDI and color change in apricots, although reduced vegetative growth allows for a greater incidence of sunlight on fruits inside the canopy and thus influences their coloration, with the latter hypothesis being more plausible [17,22].

3.3.2. Fruit Weight and Size

The most influential factor regarding the final size of the fruit is the full availability of water during its rapid growth phase (phase III) [2,21] (Table 3). Analyzing the graphs of fruit diameter evolution in the study by Pérez-Sarmiento et al. [24] in "Búlida" apricots, a certain reduction compared to the control is observed during the months corresponding to fruit growth phases I and II. Although the fruit has considerably less water than the control, it continues to act as a powerful sink for assimilates and, therefore, accumulates reserve substances, which is manifested in the fact that the dry weight of the fruit continued to grow while the fresh weight barely did. The beginning of the rapid growth phase is accompanied by crop rehydration (application of control irrigation), and thanks to the reserve substances, the fruit expansion is greatly accelerated, eventually showing the same size as the control fruits. This dynamic is also replicated with the increase in fruit weight, but the progression of each growth phase is less distinguishable; however, analyzing the progression of the fresh weight/dry weight ratio, the beginning of phase III is highlighted by a sharp change in slope [6].

Table 3. Effect of different RDI strategies on various fruit quality parameters and varieties in apricot crop ("↓" decreases with respect to the control; "↑" increases with respect to the control; "=" does not vary significantly with respect to the control). The strategies are differentiated in the application period and irrigation reduction (% ETc).

Parameter	Variety	RDI Timeframe	% ETc	Results	References
Fruit size	Búlida	Fruit growth phases I y II + Late postharvest	0%	=	[2]
		Fruit growth phases I y II + Late postharvest	25%	=	[22]
		Fruit growth phases I y II + Late postharvest	25%	=	[23]
		Fruit growth phases I y II + Late postharvest	25%	↓	[6]
		Fruit growth phases I y II + Late postharvest	40–60%	=	
		Fruit set phase + Fruit growth phases I y II + Late postharvest	25–60%	=	[24]
	Salak	Postharvest	0%	=	[21]
	Not available	Fruit growth phases I y II + Late postharvest	60%	=	[19]
Fresh weight	Sundrop	Fruit growth phases I y II	0%	=	[18]
	Búlida	Fruit growth phases I y II + Late postharvest	0%	=	[2]
		Fruit growth phases I y II + Late postharvest	25%	=	[22]
		Fruit growth phases I y II + Late postharvest	25%	=	[23]
		Fruit growth phases I y II + Late postharvest	40%	=	[6]
		Fruit growth phases I y II + Late postharvest	60%	=	
	Ninfa	Fruit growth phases I y II + Early postharvest	25–50%	=	[18]
	Canino	Fruit growth phases I y II + Early postharvest	25–50%	=	
	Salak	Postharvest	0%	=	[21]
	Not available	Fruit growth phases I y II + Late postharvest	60%	=	[19]
Firmness	Búlida	Fruit growth phases I y II + Late postharvest	0%	=	[2]
		Fruit growth phases I y II + Late postharvest	25%	=	[22]
		Fruit growth phases I y II + Late postharvest	25%	=	[23]
		Fruit set phase + Fruit growth phases I y II + Late postharvest	25–60%	=	[24]
	Salak	Postharvest	0%	=	[20]
Titratable acidity (TA)	Búlida	Fruit growth phases I y II + Late postharvest	25%	=	[22]
		Fruit growth phases I y II + Late postharvest	25%	↑	[23]
		Fruit set phase + Fruit growth phases I y II + Late postharvest	25–60%	=	[24]
	Salak	Postharvest	0%	=	[20]
	Not available	Fruit growth phases I y II + Late postharvest	60%	=	[19]
Total soluble solids (TSSs)	Búlida	Fruit growth phases I y II + Late postharvest	0%	=	[2]
		Fruit growth phases I y II + Late postharvest	25%	↑	[22]
		Fruit growth phases I y II + Late postharvest	25%	↑	[22]
		Fruit set phase + Fruit growth phases I y II + Late postharvest	25–60%	↑	[24]
	Salak	Postharvest	0%	=	[20]
	Not available	Fruit growth phases I y II + Late postharvest	60%	=	[19]

Regardless of the severity of the irrigation reduction (from 60% of ETc to irrigation suppression) and the variety under study, RDI treatments did not significantly reduce fruit diameter or weight compared to the control group [6,17,18,21–24] (Table 3). Fluctuations in fruit size from one harvest to another depended on the number of fruits produced, with fruit size being inversely proportional to the fruit load [23]. In fact, in "Búlida" apricots, the recovery of size under RDI was so effective that it resulted in a harvest of apricot trees with a larger than usual caliber [23,24]. Temnani et al. [44] detected a reduction in fruit size and weight in the 2015/16 season during the fruit growth stage II when they applied an

RDI treatment of 80% ETc during fruit growth phase I and II and an irrigation threshold of −2 MPa during late postharvest but not in the subsequent evaluations.

When apricot trees were not irrigated during the fruit growth phase III, significant reductions in fruit size and volume were observed [2]; in the first harvest of the study by Pérez-Pastor et al. [6], significant reductions in diameter and fruit fresh weight (which can reach 4.5 cm and more than 50 g in this variety, respectively) were observed, which could be justified by a possible deviation in the rehydration timing, leading to the maintenance of water stress during part of phase III (Table 3). With the 50% ETc sustained irrigation treatment throughout the year, similar reductions in final fruit size were observed in all harvests, evidencing the negative impact of irrigation limitation during the defined critical periods for apricot trees. In Kaya et al. [21], fruit caliber was similar to that of the 100% ETc treatment, unlike with the sustained irrigation reduction treatments. Nevertheless, Ben Mimoun and Marchand [50] demonstrated that the reduction in size of "Ouverdi" apricots can be mitigated by applying certain concentrations of potassium in irrigation water.

3.3.3. Fruit Shelf Life

The ability to maintain fruit quality from harvest to consumption is another influential factor in its market value. Fruit firmness, defined as the resistance to compression forces [51], was not affected by the RDI treatment regardless of its severity or the variety [20,22,46]. Only softer fruits were harvested when the decrease in irrigation coincided with the fruit growth phase III [2]. Pérez-Sarmiento et al. [24] obtained fruits that were 30% less firm in the first harvest of the experimental period, but this was not repeated in subsequent years; they indicate that this could have occurred due to a high accumulated water stress during the first year as other quality aspects were also affected. When apricots are stored, firmness gradually decreases over time; however, the decrease in irrigation due to RDI stimulated the formation of tougher cuticles that maintained their integrity better than those of control apricot trees, resulting in a lower incidence of micro-cracking. This led to a considerable reduction in weight loss during storage at 13 °C (a reduction of 5.9% in RDI compared to 19.3% in control) by hindering water loss and increasing resistance to the appearance of physiopathologies or infection by fungi such as Botrytis cinerea [22]. Additionally, Torrecillas et al. [32] mentioned that water stress caused an increase in the concentration of volatile compounds for defense against pathogens and in calcium, which helps maintain the integrity of intracellular membranes, preventing phenol oxidation and the consequent characteristic browning.

3.3.4. Chemical Quality Indices

The pH of apricot juice was not altered by RDI in any case [2,24]. Titratable acidity (TA) showed values around 1.1 g of malic acid mL^{-1}, and there were no statistically significant differences [2,24] (Table 3). In "Búlida" apricots, total soluble solids (TSSs) showed higher values when an RDI treatment was applied, which is explained by the solute-concentrating effect resulting from decreased available water [23], although this was a slight increase and sometimes not statistically significant [24] (Table 3). These results agreed with Bussi and Plenet [46], who applied severe water restrictions in "Bergeron" apricots before harvest. Furthermore, during cold storage after harvest, the values of the control and treatment tended to equalize [22]. On the other hand, the maturity index ("Maturity Index", MI), which expresses the ratio between TSSs and TA, showed that the sugar content of apricot juice treated with RDI relative to total acidity was significantly higher, indicating that these fruits were sweeter, which could lead to increased consumer demand [24]. However, Temnani et al. [44] did not detect significant differences between RDI treatments and the control (irrigation 100% ETc) in fruit quality in TSSs, TA, and MI when they applied irrigation of 80% of ETC during fruit growth phase I and II and an irrigation threshold of −1.5 MPa (RDI1) and −2 MPa (RDI2) during late postharvest in "Rojo Carlet" apricots. Moreover, Kumar et al. [19] also did not detect significant differences in TSS and TA values between RDI treatment (irrigation 60% ETc during fruit growth phase I and II and early postharvest) and control (irrigation 100% ETc). The application of potassium in irrigation water caused a significant increase in the MI of "Ouverdi" apricots [50].

Soluble sugars and organic acids together with volatile compounds (aroma) and juiciness strongly determine the organoleptic properties of apricot. A good balance between TSSs and TA is a key factor for apricot acceptance. Most relevant sensory quality attributes in apricot are blush and a flesh color, juiciness, sweetness, apricot flavor, fruity flavor, and floral flavor [52]. As far as RDI may affect color, TSSs, TA, and plant metabolism (including potential modification of volatile compounds), it is expected to affect apricot sensory properties. Future studies on the RDI of apricots need to pay special attention to sensory evaluation.

4. Future Prospectus

Research on regulated deficit irrigation in apricot trees has shown that these techniques can improve water use efficiency without significantly compromising productivity. Studies indicate that RDI can enhance certain aspects of fruit quality, such as total soluble solids content, although results vary depending on the duration and timing of water deficits. Additionally, RDI has been found to reduce excessive vegetative growth, facilitating orchard management and harvest efficiency. Periods critical to the crop cycle have been identified where RDI application can be most beneficial, while other periods should be avoided to prevent yield loss.

Future research should focus on optimizing RDI for various growth stages of apricot trees, such as flowering and fruiting. Further exploration of advanced technologies and automated systems for precise RDI implementation, including soil moisture sensors and smart irrigation systems, is needed. Assessing the environmental impact of RDI is crucial, particularly in terms of water use efficiency, soil biodiversity, and reduction in water footprint. It is also important to study how RDI affects apricot trees' resilience to water stress and other environmental stresses.

Despite these advances, several research gaps need to be addressed. There is a lack of studies considering the impact of climate variability on the effectiveness of RDI across different regions and conditions. Most research focuses on short- to medium-term effects, with limited information on long-term impacts on tree health and soil quality. Current studies often concentrate on a few apricot varieties, neglecting potential variations in RDI response among different varieties. Additionally, more studies are needed to explore the interaction between RDI and other agronomic practices, such as fertilization, pruning, and pest management. Addressing these gaps will help optimize RDI strategies for apricot trees and enhance the sustainability and productivity of apricot orchards.

5. Conclusions

Regulated deficit irrigation or RDI may increase water use efficiency during production, which provides economic and environmental advantages, if the irrigation reduction is applied during non-critical periods of fruit development. The first critical factor in the success of RDI strategies is the characterization of the phenological phases of fruit development of the studied variety, and for apricot trees, these periods correspond to phase III of (i) fruit growth and (ii) floral induction during postharvest; although the first period (fruit growth) is respected by most researchers, there is some discrepancy regarding the timing of irrigation reduction during postharvest, which varies mainly depending on the variety being studied. The predetermination of the floral buds mainly occurs during early postharvest during their differentiation, but vascularization can be affected by water scarcity in later stages, potentially reducing the harvest of the subsequent year, highlighting the need for further research on the effect of water availability during postharvest. Furthermore, water savings during non-critical fruit development phases must be combined with accurate characterization of the water status of the crop, which is the second crucial factor for the success of this technique, and it should be determined by direct measures. Productive efficiency at harvest increases due to reduced tree vegetative growth, but severe and prolonged water stress can stunt production. Crop water status control can be based on multiple indicators, not all of which are suitable for monitoring the water needs of the plant, primarily due to their long response times. Discrete and discontinuous measurement of midday stem water potential has proven to be the most robust and representative of crop water status. Moreover, RDI treatments did not negatively influence fruit weight and size when they were carried out appropriately in non-critical phases of fruit development. Some RDI treatments even increased fruit shelf life and TSS concentration, improving these quality parameters. However, it is necessary to continue exploring new continuous monitoring alternatives for plant water needs to fully exploit the potential of RDI techniques, in addition to delving into the effects of RDI on the functional quality of fruits and potential acceptance of these products by consumers.

Author Contributions: Conceptualization, F.H., A.J.S.-P. and L.A.-C.; methodology, A.J.S.-P., L.A.-C. and P.H.-A.; investigation, L.A.-C. and P.H.-A.; resources, L.A.-C.; validation, F.H. and A.J.S.-P.; writing—original draft preparation, L.A.-C.; writing—review and editing, F.H., A.J.S.-P., D.B.L.-L., Á.A.C.-B., F.B., R.M.-F., L.N.-A., E.S., J.G.-B. and A.G. All authors have read and agreed to the published version of the manuscript.

Funding: L. Andreu-Coll is funded by AGROALNEXT program and was supported by MCIN with funding from European Union NextGenerationEU (PRTR-C17.I1) and by Generalitat Valenciana, and A.J. Signes-Pastor is funded by CIDEGENT/2020/050. (22119/JLI/22) is funded by Fundación Séneca—Agencia de Ciencia y Tecnología de la Región de Murcia (Seneca Foundation—Agency for Science and Technology in the Region of Murcia) under the program "Jóvenes Líderes en Investigación". CC Huella Hídrica is funded by the European Regional Development FundAgro. Huella Hídrica is funded by Agroalnext Región of Murcia.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Berbel, J.; Esteban, E. Droughts as a catalyst for water policy change. Analysis of Spain, Australia (MDB), and California. *Glob. Environ. Chang.* **2019**, *58*, 101969. [CrossRef]
2. Torrecillas, A.; Domingo, R.; Galego, R.; Ruiz-Sánchez, M.C. Apricot tree response to withholding irrigation at different phenological periods. *Sci. Hortic.* **2000**, *85*, 201–215. [CrossRef]
3. Torrecillas, A.; Galego, R.; Pérez-Pastor, A.; Ruiz-Sánchez, M.C. Gas exchange and water relations of young apricot plants under drought conditions. *J. Agric. Sci.* **1999**, *132*, 445–452. [CrossRef]
4. FAO, Food and Agriculture Organization of the United Nations. Data from Apricot Producing Nations. 2023. Available online: http://www.fao.org/faostat/en/#data/ (accessed on 20 March 2024).
5. MAPA, Ministerio de Agricultura, Pesca y Alimentación. Anuario de Estadística 2023. Análisis Provincial de Superficie, Árboles Diseminados, Rendimiento y Producción. 2022. Available online: https://www.mapa.gob.es/es/estadistica/temas/publicaciones/anuario-de-estadistica/ (accessed on 20 March 2024).
6. Pérez-Pastor, A.; Ruiz-Sánchez, M.C.; Domingo, R. Effects of timing and intensity of deficit irrigation on vegetative and fruit growth of apricot trees. *Agric. Water Manag.* **2014**, *134*, 110–118. [CrossRef]
7. Morote Seguido, Á.F.; Rico Amorós, A.M. Perspectivas de funcionamiento del Trasvase Tajo-Segura (España): Efectos de las nuevas reglas de explotación e impulso de la desalinización como recurso sustitutivo. *Boletín Asoc. Geógrafos Españoles* **2018**, 2754. [CrossRef]
8. Chalmers, D.J.; Mitchell, P.D.; Van Heek, L. Control of Peach Tree Growth and Productivity by Regulated Water Supply, Tree Density, and Summer Pruning. *JASHS* **1981**, *106*, 307–312. [CrossRef]
9. Sepaskhah, A.R.; Ahmadi, S.H. A review on partial root-zone drying irrigation. *Int. J. Plant Prod.* **2012**, *4*, 241–258. [CrossRef]
10. Baldicchi, A.; Farinelli, D.; Micheli, M.; Di Vaio, C.; Moscatello, S.; Battistelli, A.; Walker, R.P.; Famiani, F. Analysis of seed growth, fruit growth and composition and phospoenolpyruvate carboxykinase (PEPCK) occurrence in apricot (*Prunus armeniaca* L.). *Sci. Hortic.* **2015**, *186*, 38–46. [CrossRef]
11. Pérez-Pastor, A.; Ruiz-Sánchez, M.C.; Domingo, R.; Torrecillas, A. Growth and phenological stages of Búlida apricot trees in south-east Spain. *Agronomie* **2004**, *24*, 93–100. [CrossRef]
12. Westwood, M.N. *Temperate-Zone Pomology*; Timber Press: Portland, ME, USA, 1993.
13. Moriana, A.; Girón, I.F.; Martín-Palomo, M.J.; Conejero, W.; Ortuño, M.F.; Torrecillas, A.; Moreno, F. New approach for olive trees irrigation scheduling using trunk diameter sensors. *Agric. Water Manag.* **2010**, *97*, 1822–1828. [CrossRef]

14. Domingo, R.; Ruiz-Sánchez, M.C.; Sánchez-Blanco, M.J.; Torrecillas, A. Water relations, growth and yield of Fino lemon trees under regulated deficit irrigation. *Irrig. Sci.* **1996**, *16*, 115–123. [CrossRef]
15. Boland, A.-M.; Mitchell, P.D.; Jerie, P.H.; Goodwin, I. The effect of regulated deficit irrigation on tree water use and growth of peach. *J. Hortic. Sci.* **1993**, *68*, 261–274. [CrossRef]
16. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ* **2021**, *372*, n71. [CrossRef] [PubMed]
17. Arzani, K.; Wood, D.; Stephen Lawes, G. Influence of first season application of paclobutrazol, root-pruning and regulated deficit irrigation on second season flowering and fruiting of mature "sundrop" apricot trees. *Acta Hortic.* **2000**, *516*, 75–82. [CrossRef]
18. Ezzat, A.; Salama, A.-M.; Szabó, S.; Yaseen, A.A.; Molnár, B.; Holb, I.J. Deficit irrigation strategies on tree physiological and chemical properties: Treatment effects, prediction based model analyses and inter-correlations. *Agronomy* **2021**, *11*, 1361. [CrossRef]
19. Kumar, P.; Thakur, J.; Agrawal, G. Evaluation of regulated deficit drip irrigation strategies in apricot. *J. Plant Nutr.* **2022**, *45*, 3109–3117. [CrossRef]
20. Kaya, S.; Evren, S.; Dasci, E.; Adiguzel, M.C.; Yilmaz, H. Effects of different irrigation regimes on vegetative growth, fruit yield and quality of drip-irrigated apricot trees. *Afr. J. Biotechnol.* **2010**, *9*, 5902–5907.
21. Kaya, S.; Evren, S.; Dasci, E.; Cemal Adiguzel, M. Fruit physical characteristics responses of young apricot trees to different irrigation regimes and yield, quality, vegetative growth, and evapotranspiration relations. *Int. J. Phys. Sci.* **2011**, *6*, 3134–3142.
22. Pérez-Pastor, A.; Ruiz-Sánchez, M.C.; Martínez, J.A.; Nortes, P.A.; Artés, F.; Domingo, R. Effect of deficit irrigation on apricot fruit quality at harvest and during storage. *J. Sci. Food Agric.* **2007**, *87*, 2409–2415. [CrossRef]
23. Pérez-Pastor, A.; Domingo, R.; Torrecillas, A.; Ruiz-Sánchez, M.C. Response of apricot trees to deficit irrigation strategies. *Irrig. Sci.* **2009**, *27*, 231–242. [CrossRef]
24. Pérez-Sarmiento, F.; Mirás-Avalos, J.M.; Alcobendas, R.; Alarcón, J.J.; Mounzer, O.; Nicolás, E. Effects of regulated deficit irrigation on physiology, yield and fruit quality in apricot trees under Mediterranean conditions. Span. *J. Agric. Res.* **2016**, *14*, e1205. [CrossRef]
25. Kaya, S.; Evren, S.; Dasci, E.; Cemal Adiguzel, M.; Yilmaz, H. Evapotranspiration, irrigation water applied, and vegetative growth relations of young apricot trees under different irrigation regimes. *Sci. Res. Essays* **2011**, *6*, 738–747.
26. Pereira, L.S. Higher performance through combined improvements in irrigation methods and scheduling: A discussion. *Agric. Water Manag.* **1999**, *40*, 153–169. [CrossRef]
27. Jones, H.G. Irrigation scheduling: Advantages and pitfalls of plant-based methods. *J. Exp. Bot.* **2004**, *55*, 2427–2436. [CrossRef] [PubMed]
28. Parkash, V.; Singh, S. A review on potential plant-based water stress indicators for vegetable crops. *Sustainability* **2020**, *12*, 3945. [CrossRef]
29. Pask, A. (Ed.) *Physiological Breeding. II, A Field Guide to Wheat Phenotyping*; CIMMYT: Mexico City, Mexico, 2012.
30. Bartolini, S.; Lo Piccolo, E.; Remorini, D. Different summer and autumn water deficit affect the floral differentiation and flower bud growth in apricot (*Prunus armeniaca* L.). *Agronomy* **2020**, *10*, 914. [CrossRef]
31. Losciale, P.; Gaeta, L.; Corsi, M.; Galeone, C.; Tarricone, L.; Leogrande, R.; Stellacci, A.M. Physiological responses of apricot and peach cultivars under progressive water shortage: Different crop signals for anisohydric and isohydric behaviours. *Agric. Water Manag.* **2023**, *286*, 108384. [CrossRef]
32. Torrecillas, A.; Corell, M.; Galindo, A.; Pérez-López, D.; Memmi, H.; Rodríguez, P.; Cruz, Z.N.; Centeno, A.; Intrigliolo, D.S.; Moriana, A. Agronomical effects of deficit irrigation in apricot, peach, and plum trees. In *Water Scarcity and Sustainable Agriculture in Semiarid Environment: Tools, Strategies, and Challenges for Woody Crops*; García, I.F., Durán, V.H., Eds.; Academic Press: Cambridge, MA, USA, 2018; pp. 87–109. [CrossRef]
33. Nicolás, E.; Torrecillas, A.; Amico, J.D.; Alarcón, J.J. Sap flow, gas exchange, and hydraulic conductance of young apricot trees growing under a shading net and different water supplies. *J. Plant Physiol.* **2005**, *162*, 439–447. [CrossRef] [PubMed]
34. Ruiz-Sánchez, M.C.; Domingo, R.; Pérez-Pastor, A. Daily variations in water relations of apricot trees under different irrigation regimes. *Biol. Plant.* **2007**, *51*, 735–740. [CrossRef]
35. Bozkurt, S.; Ödemiş, B.; Durgaç, C. Effects of deficit irrigation treatments on yield and plant growth of young apricot trees. *N. Z. J. Crop Hortic. Sci.* **2015**, *43*, 73–84. [CrossRef]
36. Ruiz-Sánchez, M.C.; Domingo, R.; Torrecillas, A.; Pérez-Pastor, A. Water stress preconditioning to improve drought resistance in young apricot plants. *Plant Sci.* **2000**, *156*, 245–251. [CrossRef]
37. Joody, A.T. Reducing water stress on apricot saplings cv. Zanjelly. *Plant Arch.* **2020**, *20*, 105–108.
38. Barradas, V.L.; Nicolás, E.; Torrecillas, A.; Alarcón, J.J. Transpiration and canopy conductance in young apricot (*Prunus armenica* L.) trees subjected to different PAR levels and water stress. *Agric. Water Manag.* **2005**, *77*, 323–333. [CrossRef]
39. Robbins, N.E.; Dinneny, J.R. The divining root: Moisture-driven responses of roots at the micro- and macro-scale. *J. Exp. Bot.* **2015**, *66*, 2145–2154. [CrossRef]
40. Scholander, P.F.; Hammel, H.T.; Bradstreet, E.D.; Hemmingsen, E.A. Sap pressure in vascular plants. *Science* **1965**, *148*, 339–346. [CrossRef]
41. Jones, H.G. Physiological Aspects of the Control of Water Status in Horticultural Crops. *HortScience* **1990**, *25*, 19–25. [CrossRef]

42. De Swaef, T.; Steppe, K.; Lemeur, R. Determining reference values for stem water potential and maximum daily trunk shrinkage in young apple trees based on plant responses to water deficit. *Agric. Water Manag.* **2009**, *96*, 541–550. [CrossRef]
43. Choné, X.; Van Leeuwen, C.; Dubourdieu, D.; Gaudillère, J.P. Stem water potential is a sensitive indicator of grapevine water status. *Ann. Bot.* **2001**, *87*, 477–483. [CrossRef]
44. Temnani, A.; Berríos, P.; Zapata-García, S.; Espinosa, P.J.; Pérez-Pastor, A. Threshold values of plant water status for scheduling deficit irrigation in early apricot trees. *Agronomy* **2023**, *13*, 2344. [CrossRef]
45. Mitchell, P.D.; Chalmers, D.J. The Effect of Reduced Water Supply on Peach Tree Growth and Yields. *JASHS* **1982**, *107*, 853–856. [CrossRef]
46. Bussi, C.; Plenet, D. Effect of three different irrigation regimes on young apricot (*Prunus armeniaca* L. Batsch) trees. *J. Hortic. Sci. Biotechnol.* **2013**, *88*, 519–524. [CrossRef]
47. Melgarejo, P.; Calín-Sánchez, A.; Carbonell-Barrachina, A.A.; Martínez-Nicolás, J.J.; Legua, P.; Martínez, R.; Hernández, F. Antioxidant activity, volatile composition and sensory profile of four new very-early apricots (*Prunus armeniaca* L.). *J. Sci. Food Agric.* **2014**, *94*, 85–94. [CrossRef]
48. Shih, H.-H.; Wu, C.-F.; Wang, S.-B.; Lin, K.-C. The influences of lighting design on fruit images. In Proceedings of the 2018 IEEE International Conference on Applied System Invention (ICASI), Chiba, Japan, 13–17 April 2018; pp. 506–509. [CrossRef]
49. Gómez, R.; Costa, J.; Amo, M.; Alvarruiz, A.; Picazo, M.; Pardo, J.E. Physicochemical and colorimetric evaluation of local varieties of tomato grown in SE Spain: Quality of tomato varieties. *J. Sci. Food Agric.* **2001**, *81*, 1101–1105. [CrossRef]
50. Ben Mimoun, M.; Marchand, M. Combined effect of restricted irrigation and potassium on yield and quality of apricot (*Prunus armeniaca* L.). *Acta Hortic.* **2016**, *1130*, 519–523. [CrossRef]
51. Jackman, R.L.; Marangoni, A.G.; Stanley, D.W. Measurement of Tomato Fruit Firmness. *HortScience* **1990**, *25*, 781–783. [CrossRef]
52. Ayour, J.; Benichou, M.; Alahyane, A.; Harrak, H. Relationships between Biochemical Criteria, Volatile Compounds, and Sensory Profiles of Ten Apricot Clones at Commercial and Consumption Ripening Stages. *J. Food Qual.* **2020**, *2020*, 8873835. [CrossRef]