



WORLDWIDE  *fruit*

Water Stewardship Case Studies

Spanish Case Study 2:

TROPS

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1. Context

Worldwide Fruit Limited (WFL) are investing in Water Stewardship across their supply base. As part of their commitment, they are presenting a series of Water Stewardship case studies from supplying farms. The aim of these case studies is to raise awareness of the challenges that WFL's growers deal with on a daily basis. Water management challenges and the solutions implemented to overcome them are explored, but we will also see how growers are driving ongoing good management of water resources. Apart from water, case studies will also look at current sustainability strategies implemented and plans for improving sustainability into the future.

This case study presents TROPS, a producers organisation bringing together more than 3 000 associated farmers from Spain and Portugal. TROPS is a strategic partner and avocado supplier for WFL.

2. Summary

TROPS, a prominent producers organisation specialising in the cultivation of avocados and mangoes, exports its fruits to 25 countries, uniting more than 3 000 associated farmers. Their primary production regions include the Axarquía region of the province of Málaga, the tropical coast of Granada, Valencia, Cádiz, and Huelva, as well as the Portuguese Algarve region. TROPS' state-of-the-art classification and packaging plant in Vélez-Málaga also ensures optimal fruit processing using cutting-edge technologies.

TROPS goes the extra mile in offering support to farmers, especially around water-related challenges faced in drought-affected regions. One approach is the implementation of smart irrigations systems on farms. TROPS also actively participates as a promoter in the 'Agua+S' Project to tackle water scarcity in the province of Málaga. This project proposes a desalination plant near the coast, a network of pumping stations along a river, and a floating photovoltaic plant on a reservoir. TROPS also make use of reclaimed water to ensure a sustainable water supply for agriculture, and they are working towards improving water conductivity to enhance irrigation efficiency and optimise water usage. TROPS was the first company in Europe to have the avocado water footprint of their farmers verified by SGS.

In addition to water-related initiatives, TROPS engages in other environmental efforts such as agronomic research, carbon footprint reduction, biodiversity conservation, and the generation of bio-fertilisers from waste. These initiatives contribute to their overall commitment to sustainable practices and environmental stewardship. They also have a strong focus on social initiatives which includes support for their farmers and promoting employee well-being.

3. About TROPS

TROPS, founded in 1979 in Vélez-Málaga, is a producers organisation that specialises in the cultivation and marketing of avocados and mangoes. With a strong presence in the global market, their fruits are exported to 25 countries worldwide. Bringing together over 3 000 associated farmers, their main production regions is concentrated in the Axarquía region of the province of Málaga, the tropical coast of Granada, Valencia, Cádiz, and Huelva, as well as the Portuguese Algarve region. Their classification and packaging plant in Vélez-Málaga, located at TROPS' main headquarters, was inaugurated in 2012 and incorporates the latest technologies in fruit processing.

TROPS prides themselves on supporting their farmers in all facets of the productive-economic cycle. TROPS has a qualified team of agronomists that assist farmers with crop planning. Additionally, TROPS provides financial support, commercial advice, and continuous training to their farmers. They strive to ensure the highest quality in their productions and TROPS' main objective is to guarantee fair marketing for their farmers and provide the best avocados and mangoes to their customers.



TROPS is a producers organisation that specialises in the cultivation and marketing of avocados and mangoes. Photo supplied by TROPS

4. WWF Water Risk Filter: water risks for Spain & Portugal

The below images show the WWF Water Risk Filter results for Spain and Portugal. Also indicated are TROPS' growing regions ranging from the eastern part of the Iberian Peninsula, the provinces of Alicante and Valencia, the Granada and Málaga area (known as the Andalusian subtropical coast), Cádiz, Huelva, and the Portuguese Algarve region.

The physical risk layer represents both natural and human-induced conditions of river basins. It is based on region specific data and comprises four risk categories covering different aspects of physical risks: water scarcity, flooding, water quality, and ecosystem services status. Therefore, physical risks consider if water is too little, too much, unfit for use, as well as the ecological health of surrounding ecosystems and associated ecosystem services.



Left: Physical risk results map of Spain and Portugal. Major river basins are indicated with blue lines. TROPS' growing regions are indicated with black dots.



Below: Water scarcity results map of Spain and Portugal. Major river basins are indicated with blue lines. TROPS' growing regions are indicated with black dots.

Water scarcity refers to the physical abundance or lack of freshwater resources, which significantly impact business such as production/supply chain disruption, higher operating costs, and growth constraints. Water scarcity is human-driven, and can be aggravated by natural conditions (e.g., aridity, drought periods, extreme temperatures), and it is generally calculated as a function of the volume of water use/demand relative to the volume of water available in a given area.



5. Regions impacted by drought and the implications for farmers

The Granada and Málaga regions serve as Spain's primary production centre for avocados and mangoes. Approximately 40-50% of TROPS avocados are grown in the Málaga region and ~10% in the Granada region, while ~93% of TROPS mangoes are grown in Málaga and ~6% in Granada. The Axarquía region, situated in the eastern part of Málaga/Granada, is the most severely affected growing area for TROPS due to inadequate rainfall. The region is characterised by a subtropical-like climate with minimal precipitation and dry summers. Normally, it receives an average of 375 mm of rainfall per hydrological year, but in recent years, particularly since 2021, precipitation has been below average, leading to water scarcity.

This water shortage has adversely impacted agriculture, resulting in reduced water allocations for most crops. Avocado and mango farmers, in particular, have faced challenges due to limited water availability for irrigation and above-average temperatures. TROPS has observed different effects on their orchards, including:

- Decreased production - the approximate reduction in yield due to water scarcity is around 30%. However, it's important to note that this figure can vary depending on factors such as location and the availability of water reservoirs or alternative water sources.
- For avocados specifically, the shortage of water has led to a decrease in soil-borne fungal symptoms, such as phytophthora. However, it has also resulted in an increased incidence of aerial fungi from the *Brotryosphaeria* family due to the stress imposed on the trees, particularly the younger plants. These observations are based on the expertise of TROPS' agronomic engineers.



Tensiometers are used to monitor soil moisture and are incorporated into irrigation systems. Photos supplied by TROPS

At the individual farmer level, TROPS has been actively assisting growers in mitigating the situation by promoting the efficient use of available resources. One approach is the implementation of localised irrigation systems that minimise water losses through evaporation. TROPS is currently introducing smart irrigation systems that enable farmers to reduce water consumption by applying water only when necessary, without compromising production.

To minimise water losses, TROPS is also helping farmers install digital sensors in their orchards. These sensors, strategically placed throughout the fields, provide real-time data on soil moisture levels, temperature, humidity, and other crucial environmental factors. This information empowers farmers to make informed decisions regarding irrigation, fertilisation, and pest control, leading to maximised yields and sustainable farming practices.



Dendrometers aid in irrigation scheduling. Photo supplied by TROPS

6. Water Stewardship initiatives

Growing concerns have emerged in the media regarding the ecological consequences of utilising groundwater for avocado irrigation, especially in southern Spain, pushing the region closer to a water crisis. Since 2021, the region has been severely impacted by drought.

In response to this limited water availability, particularly in the Málaga/Granada region, TROPS has initiated the development of essential infrastructure to harness alternative water sources. The following are some of TROPS' initiatives as part of their long-term strategy to ensure water accessibility for their farmers and the company.

6.1 Desalination plant

TROPS actively participates as a promoter in the 'Agua+S' Project to tackle water scarcity in the province of Málaga. The project led by TROPS, the Institute of Domotics and Energy Efficiency of the University of Malaga (UMA) and Tedagua (a Cobra Group company specialising in water treatment) is planned for the mouth of the Vélez river. This circular economy initiative proposes a desalination plant near the coast, a network of pumping stations along a river, and a floating photovoltaic plant on a reservoir. The desalination plant will be capable of producing 40 cubic hectometre (hm³) of desalinated water per year which will be pumped to the Viñuela reservoir. The photovoltaic plant is expected to generate 250 megawatt (MW) of energy, of which the project will only require ~50 MW for

the desalination process and pumping. The surplus energy (~200 MW) will be made available to the grid. The project aims to benefit the local community by establishing a publicly accessible resource that provides sustainable and economically viable access to water for the entire region. This project will ensure water at a minimum cost of ~€0.25/m³.



Left: The La Viñuela reservoir which in May 2023 was at less than 10% capacity. Photo: www.surinenglish.com. Right: A generated image of the proposed floating photovoltaic plant on the La Viñuela reservoir, as part of the 'Agua+S' Desalination Project. Photo: www.surinenglish.com

6.2 Reclaimed water

Research is currently being done for various projects on the utilisation of reclaimed water and nutrient recovery. Through these projects TROPS is exploring innovative approaches to safely reuse water, both on farms and within the company. This includes the separation of “waste” from water so that it can be put back into the production chain. See more on this project under the environmental initiatives: generating bio-fertilisers from waste.

6.3 Improving water conductivity

Currently, the primary source of irrigation water for most of TROPS' farmers is groundwater. However, with the planned implementation of the aforementioned projects involving diverse water sources such as desalinated water, reclaimed water, and groundwater, TROPS recognises the need to enhance water conductivity in the Axarquía region. Water conductivity is a measure of the ability of water to conduct an electric current and it is measured in terms of the total salt concentration of the water in microSiemens per centimetre ($\mu\text{S}/\text{cm}$).

For avocado farmers, it is important to monitor water conductivity because avocado trees are highly sensitive to salt. Preferably, irrigation water for avocados should have an electrical conductivity (EC) of less than 500 $\mu\text{S}/\text{cm}$, ideally less than 300 $\mu\text{S}/\text{cm}$. Lower quality water of up to and above 700 $\mu\text{S}/\text{cm}$ can be used, but management practices must be employed to reduce the impact on tree health and therefore fruit yield and quality. TROPS is therefore actively investigating and implementing systems aimed at improving the conductivity parameters of water, which will enable them to ensure the quality characteristics of the water so that they can confidently utilise it on their farms.

6.4 Avocado water footprint

Avocados are known to have higher water requirements compared to some other fruit types. To ensure that they do not use more water than other fruit types, TROPS wanted to verify their water footprint for avocados. The water footprint were calculated according to the methodology of the [Water Footprint Network](#) and [verified](#) by [SGS](#), an international testing, inspection and certification company. TROPS was the first company in Europe to have the avocado water footprint of their farmers verified by SGS.

The TROPS total product water footprint (including green, blue and grey water) was found to be 775,52 litres of water per kg of avocado produced (l/kg) during the period October 2020 – September 2021 in Málaga (table below). This water consumption is lower than the global average avocado water footprint, as well as lower than the water footprint for avocados produced in the Guadalquivir River Basin in southern Spain. It is also similar to that of other fruit and vegetable products (table below).

Table: The product water footprint of several fruit and vegetable products. All water footprint values are global averages, except for avocado specifically from the Spanish Guadalquivir River Basin and avocados produced by TROPS. For comparison, avocado water footprints are in bold. All values were obtained from the [Water Footprint Network](#).

Commodity	Average Product Water Footprint (l/kg or m ³ /ton)			
	Green	Blue	Grey	Total
Mango/Guava	1 314	360	126	1 800
Avocado (Spanish Guadalquivir River Basin)	368	359	193	920
Peach/Nectarine	582	191	137	910
Avocado (Global Average)	575	238	8	821
Banana	664	95	32	790
Avocado (TROPS)	319	315	142	776
Orange	403	112	45	560
Cucumber/Pumpkin	205	42	106	353
Potato	189	34	63	287
Cabbage/Lettuce	133	28	76	237
Tomato	107	64	43	214

The water footprint of a product is the total volume of freshwater (blue, green, and grey) directly and indirectly consumed in the production of a product across its entire supply chain. Blue water footprint refers to the amount of surface water and groundwater required (evaporated or used directly) to produce an item. Green water footprint refers to the amount of rainwater required (evaporated or used directly) to make an item. Grey water footprint refers to the amount of fresh water required to dilute pollutants and make water pure enough to meet water quality standards.



TROPS' headquarters in Vélez-Málaga. Photo supplied by TROPS

7. Other environmental initiatives

7.1 Agronomic research

In TROPS' efforts to reduce their environmental impact, they conduct extensive research on their experimental farm, the TROPS Innovation Centre, where they test various projects before implementing it with their farmers. Their agronomic team collaborates closely with their farmers, guiding them in adopting these new practices and implementing the identified improvements on the farms. The progress of implementing these practices across all 3 000 farms depends on the specific technologies involved and the needs of each individual farm. Once they find effective solutions to major sector challenges, it becomes relatively easy to implement them since farmers are eager to adopt solutions that benefit their operations and the environment.

TROPS recently joined the international avocado platform [Green Motion](#). One of the goals of the platform is to continue expanding varieties and rootstocks available to growers around the world, helping to create a more diversified and sustainable market and facilitating access to the University of California Riverside's elite collection of avocado germplasm. Through Green Motion, trials are underway on varieties that have shown great potential in California, a region with climatic conditions similar to the Spanish Mediterranean climate. TROPS is actively contributing expertise to the project, evaluating advanced selections of four Hass avocado varieties and five rootstocks. The objective is to extend the traditional marketing window of Hass avocados, offering enhanced disease tolerance, drought resistance, heat resilience, and tolerance to soil salinity.

7.2 Carbon footprint

Since 2018, TROPS has been diligently calculating their carbon footprint. The TROPS carbon footprint includes all stages of their avocado and mango production, including cultivation, transportation, processing, packaging, storage, and distribution to European countries. TROPS' carbon footprint data have been [certified and verified](#) by OCA Global and SGS respectively, in accordance with the ISO 14064-1 standard.

In 2018, TROPS' emissions were measured at 14 107 tons of CO₂ equivalent (t CO₂e), while their carbon removals amounted to 67 406 t CO₂e. This positive difference of 53 299 t CO₂e is attributed to the contribution of TROPS' farmers who have collectively planted over 1.5 million trees, effectively sequestering carbon dioxide from the atmosphere.

Since 2018, TROPS has implemented a number of initiatives to further reduce their carbon footprint, such as the installation of photovoltaic panels at their headquarters in Vélez-Málaga, and successfully reducing plastic packaging usage by more than 70%. Additionally, TROPS ensures that all inorganic waste is recycled or reused internally, while organic waste is repurposed for avocado oil, compost, or animal feed. With more than 30 ongoing R+D+i projects, TROPS remains committed to finding innovative solutions that can further reduce their carbon footprint and promote environmental sustainability.



Left: Solar panels at TROPS headquarters in Vélez-Málaga, Spain. Right: Building bird boxes as part of TROPS' focus on biodiversity conservation. Photos from www.trops.es.

7.3 Conserving biodiversity

In their ongoing commitment to the environment, TROPS recently collaborated with the Association for the Environment and Quality of Life for Axarquía (AMACVA) to organise a reforestation day. This event took place in the municipality of Benamocarra and involved tree planting activities to reforest and restore the area's greenery.

In addition, TROPS organised an educational biodiversity conservation activity in collaboration with AMACVA, which involved a workshop where participants learned to

construct nesting houses for birds. Bird boxes aid in promoting ecosystem balance. By offering artificial nesting structures that protect birds from predators, these boxes help increase bird populations and maintain a healthy avian presence in areas with limited natural resources. This, in turn, help with pest control and can enhance crop yields on agricultural lands.

7.4 Generating bio-fertilisers from waste

TROPS is part of the European Union funded project [P2Green](#) which aims to close the gap between fork and farm for circular nutrient flows. The project will implement innovative nitrogen and phosphorous recovery solutions based on human sanitary waste from urban settlements and its conversion into safe bio-based fertilisers for agricultural production. The project will test the solutions in three pilot regions. TROPS is part of the Spanish pilot project in the Axarquía region (Málaga).

8. Social initiatives

8.1 Employees

TROPS prioritises their employees' wellbeing through a range of social initiatives. They have developed an application for sharing new tips, conducting surveys, and encouraging suggestions. The company offers opportunities for young talent and promotes gender equality and workforce diversity. Healthy habits are actively promoted, and environmental activities and training courses are provided.

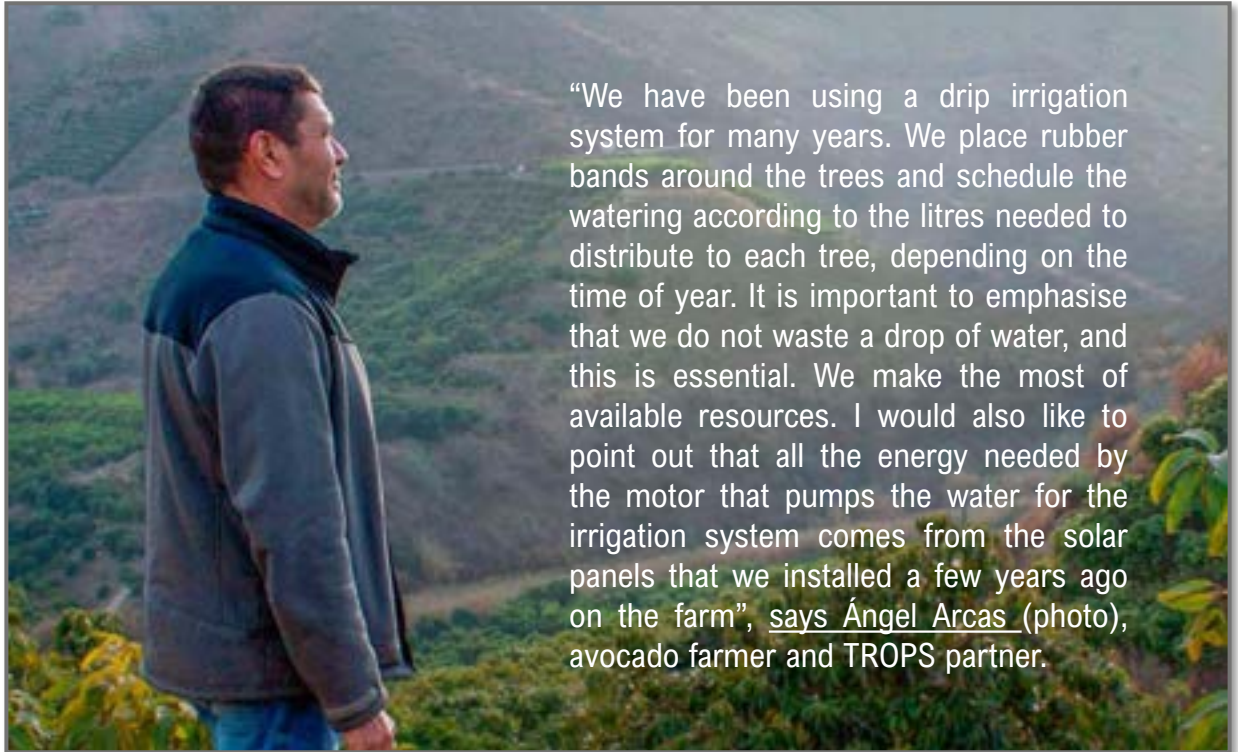
As part of their commitment to reducing their environmental impact, TROPS offers employees sustainable mobility options. This includes carpooling, convenient bicycle paths and bicycle parking, a nearby bus stop, and telework arrangements. By promoting these sustainable transportation methods, TROPS aims to minimise carbon emissions and contribute to a greener and more sustainable work environment.

8.2 Farmers

TROPS is a cooperative of more than 3 000 farmers and one of their key priorities is creating and maintaining opportunities to support their farmers in continual growth. TROPS offers a range of valuable initiatives. They organise technical seminars focused on improving crop cultivation techniques and provide ongoing guidance and testing in agronomic innovation through their dedicated agronomic team. To foster effective communication and collaboration, TROPS has developed [an application](#) exclusively for their farmers which facilitates interaction and information exchange. TROPS also assists farmers in managing subsidies for digital transformation, enabling them to embrace modern technologies and practices.



TROPS offers various training days for farmers, including technical seminars, focused on improving crop cultivation techniques. Photos from www.facebook.com/frutasTrops/



“We have been using a drip irrigation system for many years. We place rubber bands around the trees and schedule the watering according to the litres needed to distribute to each tree, depending on the time of year. It is important to emphasise that we do not waste a drop of water, and this is essential. We make the most of available resources. I would also like to point out that all the energy needed by the motor that pumps the water for the irrigation system comes from the solar panels that we installed a few years ago on the farm”, [says Ángel Arcas](#) (photo), avocado farmer and TROPS partner.



“We care for the land and trees by scrupulously following the instructions and advice we receive from the TROPS Technical Department. Among other things, they are in charge of analysing the soil and the leaves of the trees. With this data, they prepare a specific fertilisation plan for our crop, which we then have to apply between the months of April and August”, [says Luis Saborido](#) (photo above), mango farmer and TROPS partner.