Food and Agriculture Organization of the United Nations

Brief No. 4

BUILDING RESPONSIBLE GLOBAL VALUE CHAINS **FOR SUSTAINABLE TROPICAL FRUITS**

TECHNICAL BRIEF

Ripe for change: adapting avocado production to a changing climate

Main findings from the publication "Adapting to climate change in the tropical fruit industry – a technical guide for avocado and pineapple producers and exporters."

Why is understanding climate change important for avocado producers?

Globally, climate change has become an observed reality, with countries around the world experiencing increases in the frequency and intensity of extreme weather events. Droughts, high temperatures, hailstorms, rainfall variability, strong winds and heavy rainfall are affecting global avocado production and trade, impacting crop growth, productivity and fruit quality. In some regions, changing weather patterns have made production unviable and, in some cases, producers have been forced to relocate production areas or abandon avocado production completely. Increased outbreaks of pests and diseases due to changing climatic conditions are also threatening production in many countries.

To better understand current and future climate risks and their impact on avocado production and trade, as well as how to prepare for, and deal with these risks, the **Responsible Fruits Project**, working in partnership with key players in the avocado sector, produced a technical guide on climate change adaptation.[1] The guide was designed for producers and exporters of avocado and pineapple who are interested in learning more about climate change in the context of their own production systems. This brief summarizes the main findings from the guide related to climate risks and adaptation options for the avocado industry. For more detailed information on adaptation practices, please refer to the guide.

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[1] **FAO.** Forthcoming. *Adapting to climate change in the tropical fruit industry – a technical guide for avocado and pineapple producers and exporters – Technical Guide No.2.* Rome.

How will climate change impact the main avocado producing regions in the future?

Avocado production is highly sensitive to changes in temperature and precipitation. All major avocado producing countries are projected to experience higher temperatures in the coming decades, whereas rainfall patterns are expected to vary from country to country. Colombia, Kenya, and Peru will likely see an increase in rainfall by 2100, while Mexico, Chile, and South Africa are expected to see decreases in rainfall by the end of the century.

Warmer temperatures and changes in precipitation will lead to different climate risks and impacts on avocado production. Current climate trends have already exacerbated many of these risks in producing countries, with key climate risk factors and their impacts on production discussed below.

Water scarcity leads to plant stress, soil erosion, decreased productivity, and smaller-sized fruits with changes in internal quality. Insufficient water can also create social tensions among producers of different size, and between producers and communities as they compete for the resource (e.g., production vs household use).

Flooding and intense rainfall negatively impact avocado trees, given their shallow root system, poor capacity for water uptake and sensitivity to low soil oxygen concentrations. As a result of soil flooding, trees can become highly sensitive to the invasion of fungal pathogens such as Phytophthora cinnamomi.

Strong winds and hailstorms damage production by minimizing fruit setting and altering the quality of fruits. Wind and hailstorms can be devastating to avocado trees, leading to the fall of branches, flowers and fruits, which could ruin a full-season's production or destroy trees.

High temperatures and heat stress inhibit pollination, fruit setting and alter the shape and size of avocado fruits. Temperatures over 30 °C cause irregular ripening and darkening of avocado flesh. Over-ripening results with temperatures above 40 °C. Increased solar radiation can lead to sunburn on fruits and damage to branches.

Reduction of pollinators results in lower fruit set, lower yield, and weaker market potential for the industry. Pollinator populations are affected by climate change and extreme weather events. Warmer temperatures can cause early blooming of flowers, reducing food available for some pollinators, while longer dry seasons and droughts result in reduced nectar production, affecting the health of pollinators. Extreme rainfall will limit the gathering of nectar and pollen by pollinators, including honeybees, the main pollinators of avocados.

Soil erosion is exacerbated by strong winds, heavy rainfall, and temperature changes. Combined with inadequate soil and land management practices, soil degradation, including pollution, fertility decline, and salinization may occur. This affects the ability of the soil to drain and retain water, with detrimental effects on yield and product quality. Warmer weather may also result in higher soil temperatures, affecting soil moisture retention and structure.

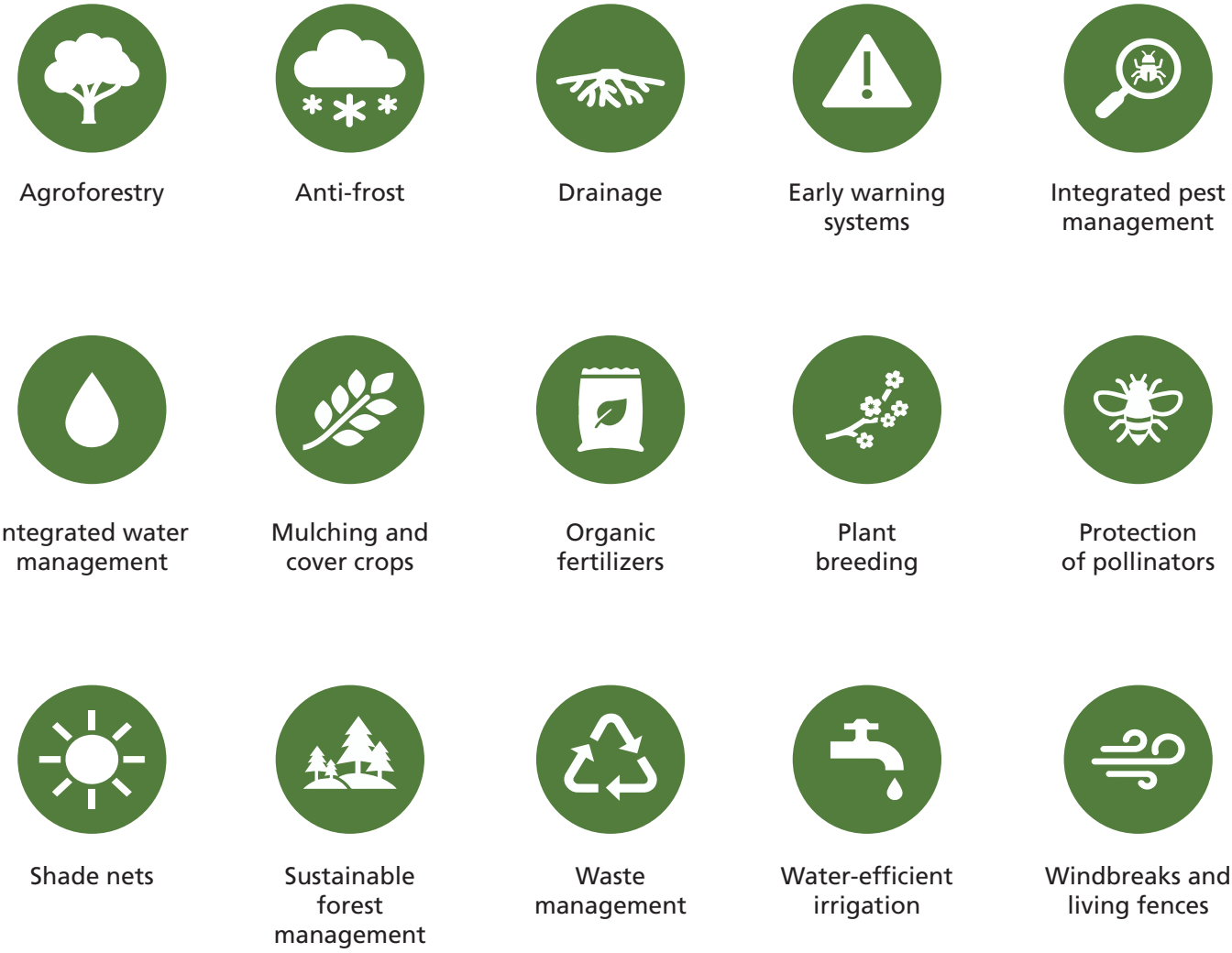
Spread of pests and disease. Climate change is expected to exacerbate the frequency and resistance of pests and diseases. Changes in temperature and humidity can lead to shorter pest cycles, increasing damage to orchards. In some regions, the incidence of diseases may increase due to increased precipitation and higher humidity levels in orchards.

How can avocado producers adapt to climate change?

Numerous practices exist to help avocado producers to adapt, mitigate and prepare for the changing trends in climate and the occurrence of extreme weather events. Figure 1 identifies 15 adaptation practices highlighted in the guide with the potential to address multiple risks simultaneously. Although many more practices exist, the ones selected here were identified by the project and its industry participants as most relevant for the industry. These practices rely on the principles of conservation agriculture, agroecology and climate-smart agriculture to promote a sustainable approach for climate adaptation and build climate resilience.

All 15 practices are presented in detail in Chapter 4 of the technical guide. A brief description of five key practices is given below.

Figure 1. Selected climate adaptation practices for the avocado sector



Integrated management of agricultural water resources

This practice entails a coordinated approach to the management of water, land and related resources to maximize efficiency in water consumption and protect ecosystems. These include **rainwater harvesting, soil and water conservation, deficit and supplementary irrigation, on-farm water management, minimum tillage and keyline ploughing**, among others. The practice helps to address climate risks such as drought, intense rains, changes in rainfall patterns, soil erosion and preservation of water.

Sustainable Forest Management

Sustainable forest management (SFM) is a way to promote the development of productive activities and support local communities while preserving forests and biodiversity. SFM can enable continued avocado production, while actively seeking to eliminate the risk of deforestation, restoring forest cover and enhancing carbon sequestration. SFM helps to maintain the capability of forests to produce forest products and services through **reduced logging, promotion of natural forest regeneration, conservation areas, fire protection**, and other practices. Producers, local communities, and policymakers should work together to implement SFM in forest regions where avocado production takes place.

Protection of pollinators and beekeeping

The protection of pollinators is crucial to the avocado industry, as production is highly dependent on pollinating activity. Pollinators are negatively affected by extreme temperatures, environmental degradation, loss of biodiversity and excessive use of agrochemicals. They can be protected using a holistic approach by **implementing beehives** in avocado plantations; **protecting or restoring natural habitats** surrounding orchards that support native pollinator communities (e.g. honey wasp, honeybees); **growing other flora** that is attractive to pollinators and **reducing the use of synthetic pesticides**.

Mulching and cover crops

The introduction of **mulching and cover crops** into avocado orchards has demonstrated potential to prevent soil erosion from intense rainfall and wind, low humidity, and competition with weeds for nutrient uptake. Permanent soil cover can also protect seedlings and roots from frost, drought, changes in rainfall patterns and sudden temperature changes. Other beneficial impacts include improving soil structure and fertility and reducing pest incidence by interrupting the pest cycles. This can also reduce the need for agricultural inputs such as fertilizers and pesticides, while protecting pollinators. Good nutrient management using cover crops and mulching can also help producers to prevent the incidence of alternate bearing cycles and reduce greenhouse gas emissions.

Integrated pest management

Integrated pest management (IPM) consists of combining several agricultural practices – **crop rotation and association, mechanical and biological control** – to manage pests and diseases. The practice helps to address new and/or more persistent pests and diseases that result from increased temperatures and humidity. Pathogens that can be managed through IPM include fungi (e.g. *Phytophthora*), bacteria, insects, mites, vertebrates and weeds that damage avocado orchards and fruits at pre- and post-harvest stages. IPM also helps to replace or minimize the use of synthetic pesticides and herbicides and the associated negative risks to human health and environment.

What do producers need to keep in mind when implementing adaptation practices?

- Climate adaptation is a **continuous process** that takes time and requires investment, information and data. Regular data and information on production factors and climate trends are needed for adaptation practices to stay relevant. Practices may need to be trialled over multiple seasons in order to see results.
- Adaptation practices should aim to **address multiple climate risks** and associated impacts **simultaneously**. Discrete adaptation strategies that deal with only one risk factor at a time are less likely to achieve the desired impact in the way that combining many practices will.
- Producers, companies and associations should aim to foresee and **prevent the creation of new risks** when adopting adaptation practices. For instance, extracting water for supplementary irrigation to address water scarcity needs close monitoring to avoid depletion and contamination of groundwater resources that will have negative impacts on ecosystems and communities.
- **Adaptation requires collaboration between governments and other actors.** Practices such as plant breeding for climate resilience, pest management or establishment of early warning systems need participation from governments, research institutions, producers and other parties to be successful. Stronger engagement among different actors will also promote ownership and the long-term sustainability of the strategies adopted.
- **Climate adaptation and mitigation go hand in hand.** Practices to promote adaptation to climate change can also contribute to the reduction of carbon emissions and/or on carbon removal and storage. Examples of these are sustainable forest management, use of windbreaks and living fences, sustainable soil management, integrated pest management and agroforestry.

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