Food and Agriculture Organization of the United Nations

Brief No. 5

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

TECHNICAL BRIEF

Ripe for change: adapting pineapple 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 pineapple 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. Rising temperatures, variability in precipitation, tropical storms and heavy rainfall are affecting global pineapple production and trade. In recent years, changes in climate and the occurrence of extreme weather events have led to serious losses in production and revenue for the industry as a whole. Increased outbreaks of pests and diseases due to changing climatic conditions are also threatening pineapple production and export in many countries.

To better understand current and future climate risks and their impact on pineapple 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 pineapple sector, produced a technical guide on climate change adaptation.[1] The guide was designed for producers and exporters of pineapple and avocado 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 pineapple industry. For more detailed information on adaptation practices, please refer to the guide.

[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 pineapple producing regions in the future?

Pineapple production is highly sensitive to fluctuations in temperature and humidity. Over the coming decades, significant increases in temperature are projected in all major pineapple producing countries, while rainfall patterns are expected to differ between countries. Costa Rica is expected to experience a decrease in average annual rainfall, whereas other major pineapple producing and exporting nations including the Philippines, Ecuador, Thailand and Ghana will likely observe an upsurge in average rainfall by the end of the century.

Warmer temperatures and **changes in precipitation** will lead to different climate risks and impacts on pineapple production. Current climate trends have already exacerbated many of these risks in producing countries, and will continue to impact pineapple development, yield, and quality. Key climate risk factors identified by producers and their impacts on production are discussed below.

High temperatures (above 32 °C) can cause unevenly shaped fruits or plant mortality. Together with higher humidity, warmer weather enables the conditions needed for the proliferation of pineapple pathogens. Warmer night temperatures can accelerate flowering and distort production and harvesting schedules (see below).

Intense solar radiation poses significant risks to fruit quality, including sunburn and severely misshapen fruits. Direct exposure of pineapple plants to sunrays during flowering causes an increase in fruit damaged by corky roots, reducing the overall quality and appearance of the fruit, diminishing its market value. Additionally, the well-being and productivity of field workers are compromised by risks such as dehydration, skin-related ailments and heat-stress symptoms.

Excess rainfall has a direct impact on fruit quality and development, as well as on the prevalence of pests and diseases. Soil saturation reduces the development of roots and vegetative growth, which can cause colour loss, lower sugar content and yield. Without a good drainage system, waterlogging can cause developmental disorders, and when combined with high temperatures, may increase the incidence of fungal diseases such as Fusarium E. carotovora.

Precocious flowering affects crop management, harvesting and fruit sales. Early natural flowering occurs with warmer night temperatures or a sudden fall in temperature. This phenomenon desynchronizes production and harvest times, leading to increasing costs, unreliable supply and increased losses. This is an important economic risk for producers.

Strong winds can severely damage all parts of the plant or uproot it, resulting in costs from re-planting. Strong winds can also contribute to soil erosion, especially on bare soils.

Soil erosion is exacerbated by 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.

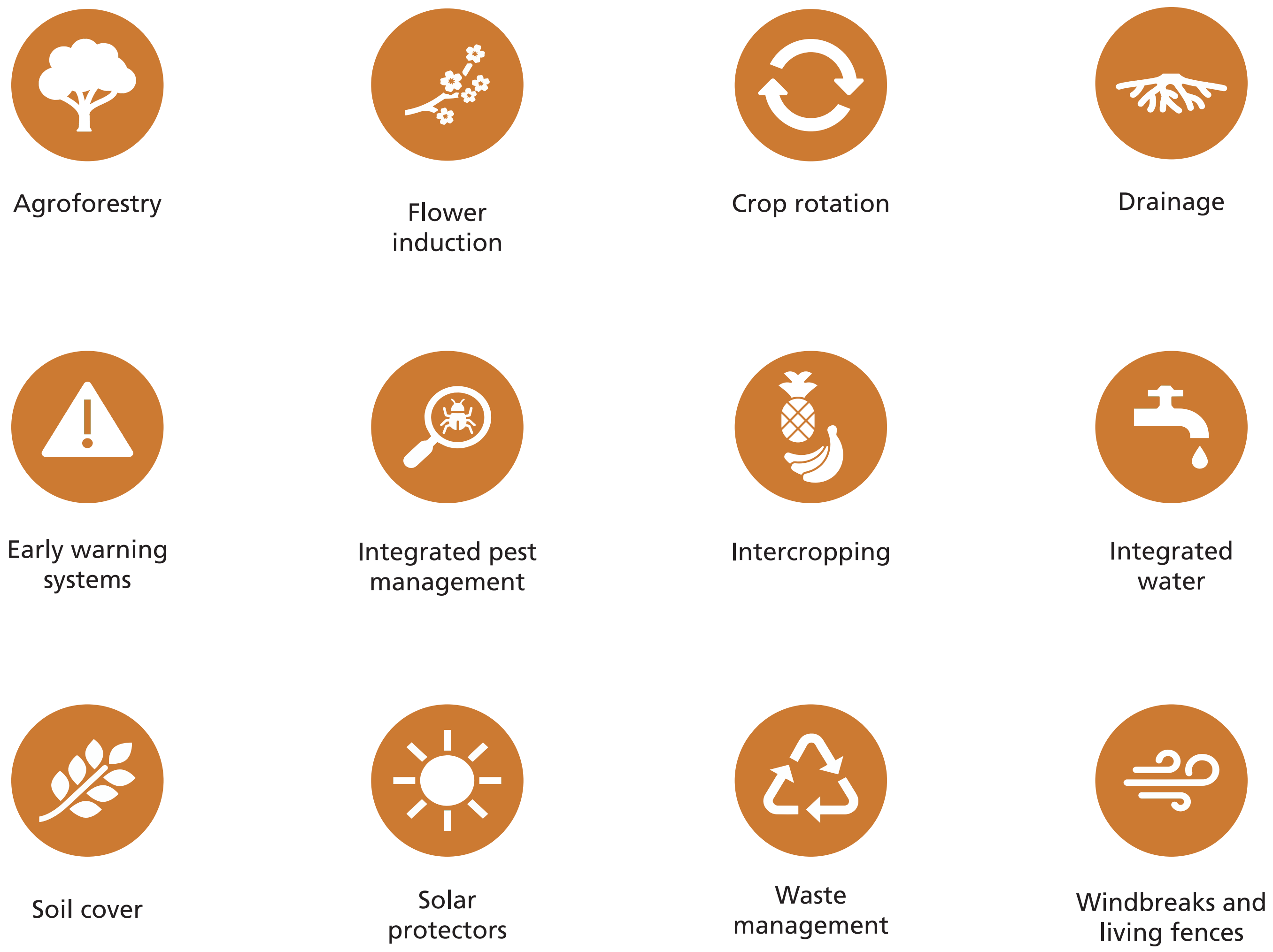
Spread of pests and disease. Warmer temperatures and changes in humidity levels are bringing about shifts in the geographical distribution of pests, the timings of outbreaks, and population dynamics (e.g. survival rates). The projected increase in pests, compounded by more stringent phytosanitary requirements and regulations on agrochemical use from importing markets, poses a sustainability and resilience challenge to the pineapple sector.

How can pineapple producers adapt to climate change?

Numerous practices exist to help pineapple producers to adapt, mitigate and prepare for the changing trends in climate and the occurrence of extreme weather events. Figure 1 highlights 12 adaptation practices that have 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 are based on the principles of conservation agriculture, agroecology, and climate-smart agriculture, to promote a sustainable approach for climate adaptation and build climate resilience.

All 12 practices are presented in detail in Chapter 6 of the technical guide. A brief description of five key practices is given below.

Figure 1. Selected climate adaptation practices for the pineapple sector



Drainage

Pineapple is intolerant to excessive soil moisture and humidity, making it crucial to design drainage systems that prevent water accumulation in the growing area. Effective drainage systems help to prevent climate risks associated with intense rainfall and soil erosion caused by runoff. The slope of the production area will determine the type of drainage system(s) used as well as the number and distribution of these in the production area. **Surface drainage** systems are recommended to remove excess water that may saturate the topsoil due to flooding or waterlogging. These systems eliminate excess "shallow" water and divert it to a natural water stream. **Sub-surface drainage** systems are used to remove excess water in the cultivation area where the groundwater table is close to the surface, causing the saturation of the soil profile and very high moisture content in the root development zone.

Soil cover (mulching and cover crops)

Soil degradation and loss of biodiversity pose a major threat to the resilience of the pineapple industry in the face of climate change. Permanent soil cover can protect suckers and roots from frost, drought, changes in rainfall patterns and sudden temperature changes. Soil cover can be achieved by using **cover crops and mulches**. The cover aims to improve soil structure and fertility, reduce water consumption, and in some cases, reduce pathogen incidence by interrupting the pest cycle. Cover crops reduce soil erosion and improve soil structure by increasing soil organic matter and fertility levels. Mulches composed of organic or inorganic material help to improve the soil structure, stimulating carbon storage, and offer protection against increasing temperatures and radiation. They also prevent nutrient leaching following heavy rainfalls or irrigation. The use of pineapple waste in organic mulching also has the potential to reduce agricultural residues and minimize carbon emissions.

Solar protectors

Pineapples are susceptible to heat stress and sun damage, which can significantly reduce yield and fruit quality. However, several **chemical measures** (e.g. kaolin, silicon and wax-based products) or **physical methods** (e.g. use of shades, plastic bags, Saran or paper) can offer protection against high temperatures and increasing solar radiation. The use of Saran (made of black polyvinyl chloride [PVC]) placed around the entire plant and fruit was identified as providing strong protection to MD2 pineapples. Vegetable oils sprayed directly onto the fruit can act as sunscreen and repel fungal pathogens and some insects. Reusable plastic covers or plastic mulches on top of the pineapple can also offer protection from sun scorching. A similar practice is fruit bagging, but internal fruit temperatures must be carefully monitored. The use of mulch composed of organic material (e.g. dry grass or residues), tying the pineapple leaves on top of the young pineapple fruits or using the natural shade from surrounding forests are other practices that can offer sun protection to pineapple plantations and reduce costs associated with the use and safe disposal of plastic-based material.

Integrated Pest Management (IPM)

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 the effects of increased temperature and humidity in some regions, bringing in new and/or more persistent pests and diseases. Pathogens that can be managed through IPM include fungi, insects and weeds that damage pineapple plants and fruits. Monitoring is a key component of IPM for the early identification of pests and for understanding pathogen cycles. More stringent regulations on agrochemical use by some importing markets has also pushed pineapple producers to look for more sustainable alternatives for the management of pests and diseases. IPM and biological control methods in particular, are showing promising results in some countries in controlling pests and building resilience by reducing reliance on agrochemicals.

Windbreaks and living fences

Windbreaks and living fences consist of **planting rows of high-density native and local trees and shrubs** of different heights (short, medium and tall) to protect the crops from strong wind and to reduce water velocity. These practices contribute to limiting wind and water erosion and can also help to improve fruit quality due to the lower incidence of wind scarring and associated damage by pathogens.

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 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 example, the use of inorganic plastic mulches has proven effective in reducing evaporation and nutrient leaching, but consideration should be given to the lack of biodegradability and difficulties in collecting and disposing of plastic after use. Poor disposal practices may have potentially negative impacts on ecosystems related to plastic waste and pollution.
- **Some level of fruit loss may be unavoidable in adaptation.** For instance, when implementing IPM, producers may need to tolerate low pest numbers on plantations that may damage a small percentage of fruit in view of reducing overall agrochemical applications. Where zero tolerance of pathogens is needed to meet phytosanitary requirements, this practice may not be suitable and will need to be adjusted.
- **Adaptation requires collaboration between governments and other actors.** Practices such as plant breeding, 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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Federal Ministry
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CC7097EN/1/07.23