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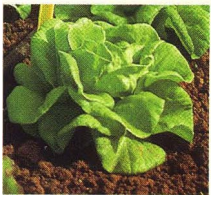
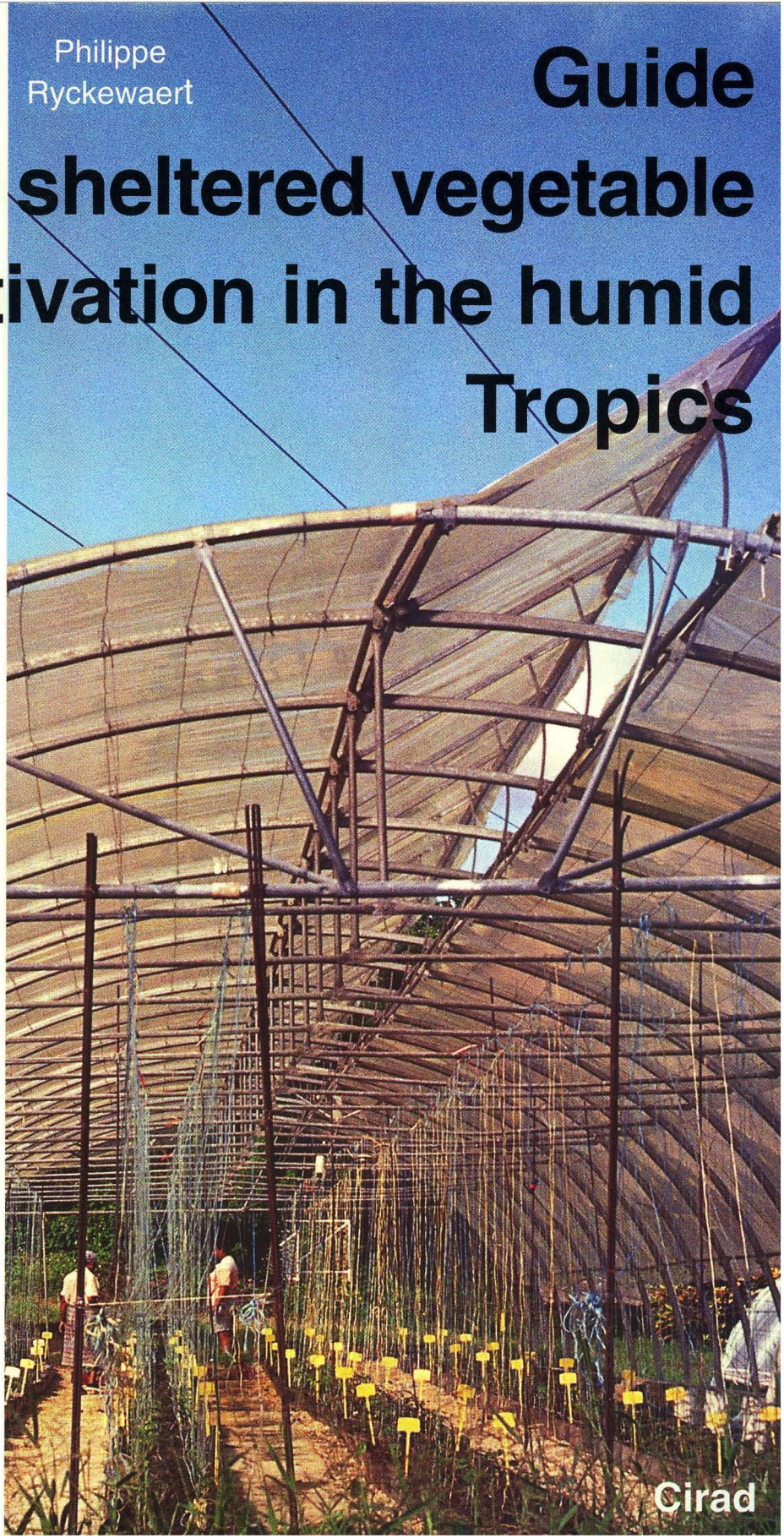
Guide to sheltered vegetable cultivation in the humid Tropics





Cirad

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Guide to sheltered vegetable cultivation in the humid Tropics

CIRAD

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FOREWORD

This guide is based on knowledge acquired under CIRAD research programmes in Martinique, supported by the *conseil général* in Martinique, the *région* and the European Community. The results obtained were modulated and supplemented by observations made during study missions in various countries in the humid Tropics.

The guide is primarily intended for agricultural technicians who will have to adjust the various recommendations made to fit the prevailing socio-economic conditions in their respective countries.

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Contents

Part I. Specificities of sheltered cultivation

Part II. Individual data sheets on vegetable species

SPECIFICITIES OF SHELTERED CULTIVATION

SHELTERS IN THE HUMID TROPICS

Presentation of sheltered cultivation

Definitions

Cultivation "in the open" is the traditional method, with no form of protection from the elements.

"Sheltered" cultivation involves protecting the plants under some form of shelter; it calls for permanent irrigation. With "sheltered cultivation in soil", the soil is kept, while with "sheltered soilless (hydroponic) cultivation", the plants are grown either on an inert substrate or without a substrate *(Nutrient Film Technology* or *NFT,* aeroponics, aquaponics, etc.). This type of method calls for permanent fertilizer-enriched irrigation (nutrient solution).

Pros and cons of sheltered cultivation

During the rainy season characteristic of humid tropical climates, the waterlogged soils cannot be cultivated and the heavy rains destroy plants and fruits while facilitating the development of certain diseases, notably those caused by fungi. Vegetable production in such climates is thus limited, yet the high population densities seen in both island and peri-urban areas result in strong demand for vegetables.

To increase vegetable production in these regions, it is therefore essential to overcome the constraints linked to the high rainfall levels in the humid Tropics. Sheltered cultivation is an interesting alternative: it protects plants from the rain, enabling all-year-round production. Moreover, it also enables soilless or hydroponic cultivation which overcomes certain constraints linked to soil type: mineral deficiencies, unsuitable physical structure, existence of pathogens, etc. Lastly, through better control of diseases and water and mineral supplies, sheltered cultivation ensures better yields than cultivation in the open, and more attractive fruits that therefore sell better. In short, it enables increased production on smaller areas.

However, although sheltered cultivation solves the specific problems related to heavy rainfall, it entails other constraints linked to the climate, parasites or nutrition.

Climatic factors

For plants grown under shelter, the resulting greenhouse effect tends to increase the already high temperatures seen in the Tropics. At the same time, the material used for the shelters (generally plastic film) filters the sunlight. In tropical zones, from May to September, there is already less solar radiation than in southern France, while temperatures are at their peak. There is therefore an imbalance between increased respiration due to high temperatures and reduced photosynthesis as a result of moderate radiation levels, which adversely affects crop metabolism.

Again as a result of the humid tropical climate, there is a high hurricane risk in these areas, which needs to be taken into account when designing shelters.

Parasite factors

While the lack of rain under the shelters alleviates the impact of many fungal and bacterial diseases on vegetable crops, the environment created favours insect and mite development. For sheltered cultivation to be economically feasible, it is important to control such pests effectively.

Nutritional factors

For individual farmers in the Tropics, the investment required to build a shelter is relatively high. To make it cost-effective, farmers need to cultivate the sheltered area intensively, which means maintaining high soil chemical, physical and biological fertility.

Species suitable for sheltered cultivation

The main vegetable crops suitable for all-year-round sheltered cultivation are tomatoes, lettuces, peppers, courgettes, French beans and herbs, including spring onions.

Others such as carrots and bulb onions also perform well, but the stiff competition from cheap imports means that sheltered cultivation is not necessarily cost-effective.

"Charentais cantaloup" type melons can be grown under shelter during the rainy season—i.e., out of season—in zones with high sunshine levels, for instance southern Martinique.

Chayotes can also be grown under shelter in cool areas, since the technique prevents the fungus *Mycosphaerella* sp., which causes blight, from multiplying.

Some species such as aubergines, cabbages, water melons or pimentos easily withstand the rain, and sheltered cultivation would not be worthwhile

Shelter structure

Framework

There is a high hurricane risk throughout the Caribbean. Martinique is hit by a major hurricane every nine years on average, but there are storms with winds of over 100 km/h almost every year.

On the islands of Martinique and Guadeloupe, the structures used for sheltered cultivation were chosen in line with the risks: farmers use tunnels