

Innovations in Solar Drying of the Fine or Flavour Cocoa Bean

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**“Cocoa Sector Technical Forum”
Kingston & St. Mary, Jamaica
8 – 10th July 2009**



Outline of presentation

Linking post harvest processing to cocoa quality

Cocoa drying - general theory and objectives

Innovations in solar drying of cocoa beans

Solar dryers in various countries

Solar dryer concepts to consider

What is right for Jamaica?

Recommendations



All activities in cocoa production, management and processing ultimately affect flavour development

Cocoa flavour development is influenced by the genetic composition of the bean (genetic flavour potential)

Post harvest processing (fermentation and drying)

During manufacturing (roasting, milling and conching etc.).



The responsibilities of cocoa producers and cocoa fermentary operators

Main aim:

To provide fermented and dried cocoa beans of the highest quality for sale/export

Main task:

To provide conditions during post harvest processing (fermentation and drying) that facilitate the necessary biochemical changes inside the cocoa beans to develop the characteristic aroma and flavour



Regional Producers of Fine or Flavour Cocoa





CHOCOLATOLO Puroamente
Bitter Chocolate
Extra 30%
9 AMEDEI
TOSTATO

TRINITARIO
80% Kakao

80% Kakao

JAMAICA
AMDEI

VAUGHNA
2005
Cremoso Sabor de Domingo
GRAN COUNA
PLANTATION GRAN COUNA
ORIGINE TRINIDAD

GRENADA
AMDEI

LOBAGO
75% Kakao

Les Tropiques du Chocolat
Papouasie
75% C.A.F.E
Pralus
CHOCOLATIER
75%

Les Tropiques du Chocolat
Trinidad
Pralus
CHOCOLATIER
75%

Pralus
CHOCOLATIER
75%
Les Tropiques du Chocolat
São Tomé
ST. DOMINGO
FORASTERO

THE GRENADA CHOCOLATE COMPANY
ORGANIC DARK CHOCOLATE 60% COCOA

Pralus
CHOCOLATIER
75%
Les Tropiques du Chocolat
Madagascar
CRIOLLO

Drying theory applied to cocoa

Drying is governed by two factors:

Transfer of heat into the cocoa bean to provide energy for evaporation of moisture

The movement of vaporised moisture from within the bean to the drying air

Drying rate is determined by whichever of these two factors is slower

Drying can take place via:

Convection

Radiation

Conduction

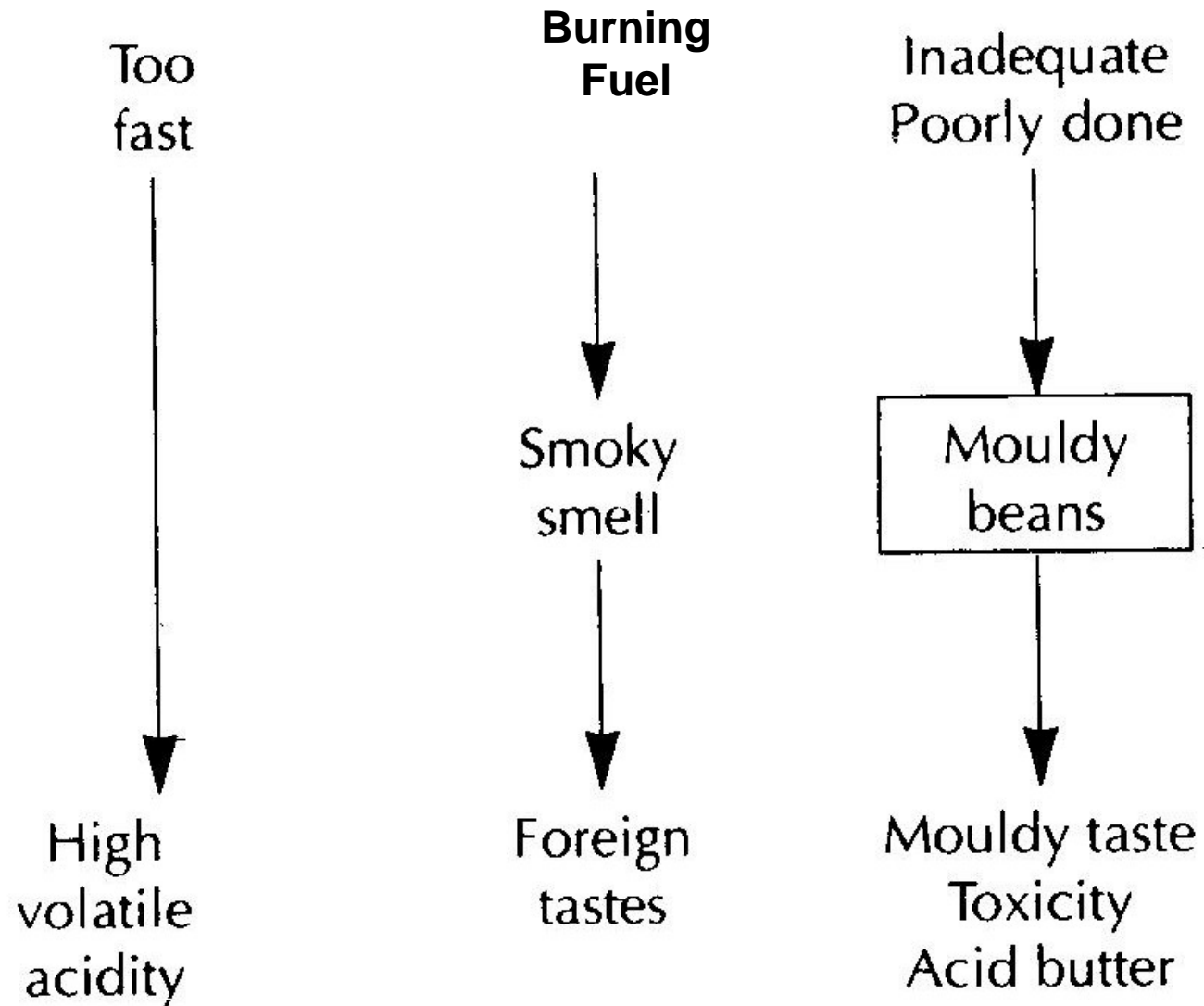
The objectives of cocoa drying

To reduce the moisture content of fermented cocoa beans (55%) to a level that is safe for storage and shipment (6-7%)

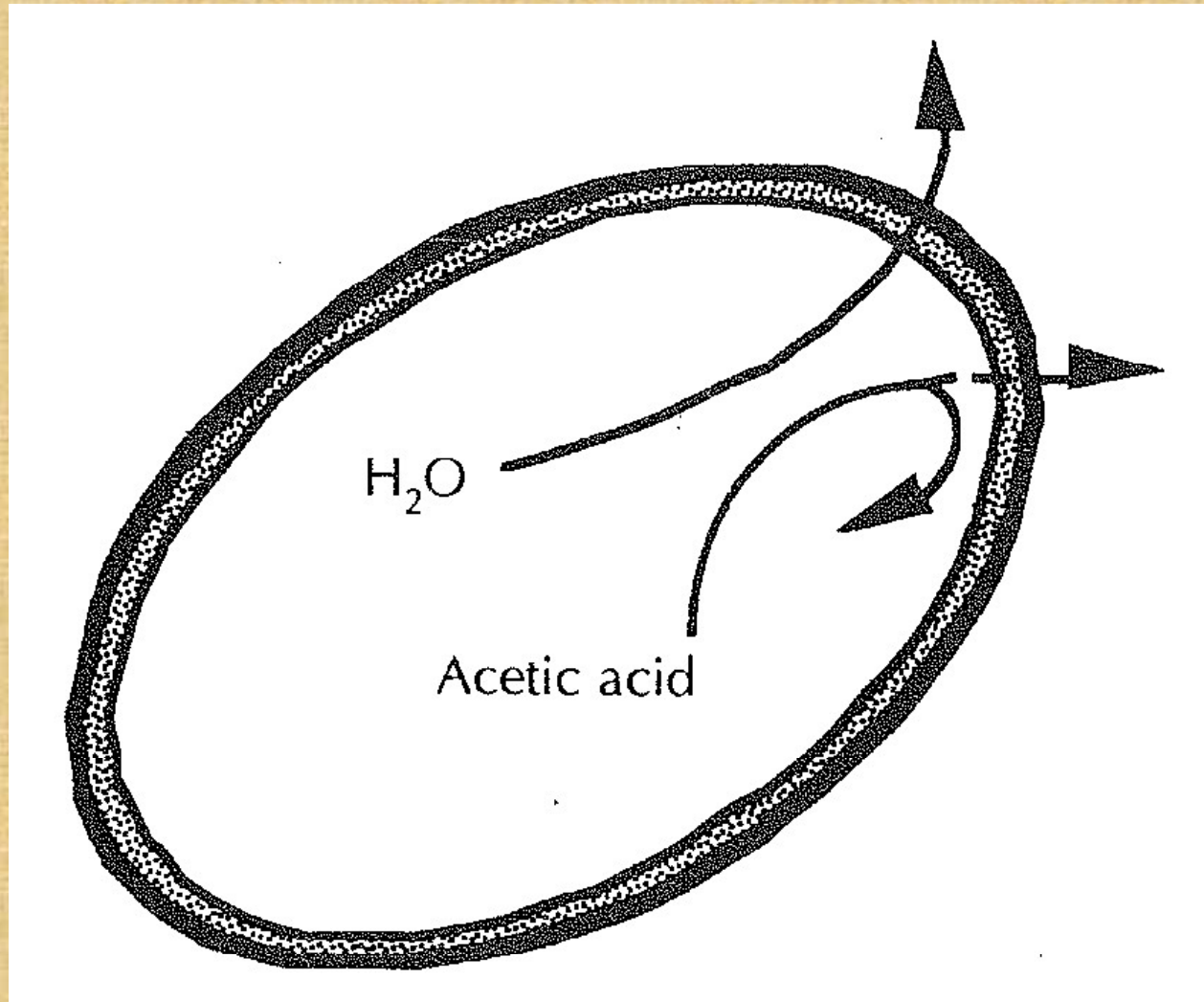
To complete the oxidative chemical changes taking place within the bean during fermentation that reduce bitterness and astringency and develops the chocolate brown colour of well fermented beans

To avoid off-flavours through faulty drying

Possible defects due to drying



If drying is too fast...



Secondary mould infestation during shipping



Inappropriate solar drying techniques



Simple open floor solar drying

On bamboo mats

On concrete floors

On plastic sheets

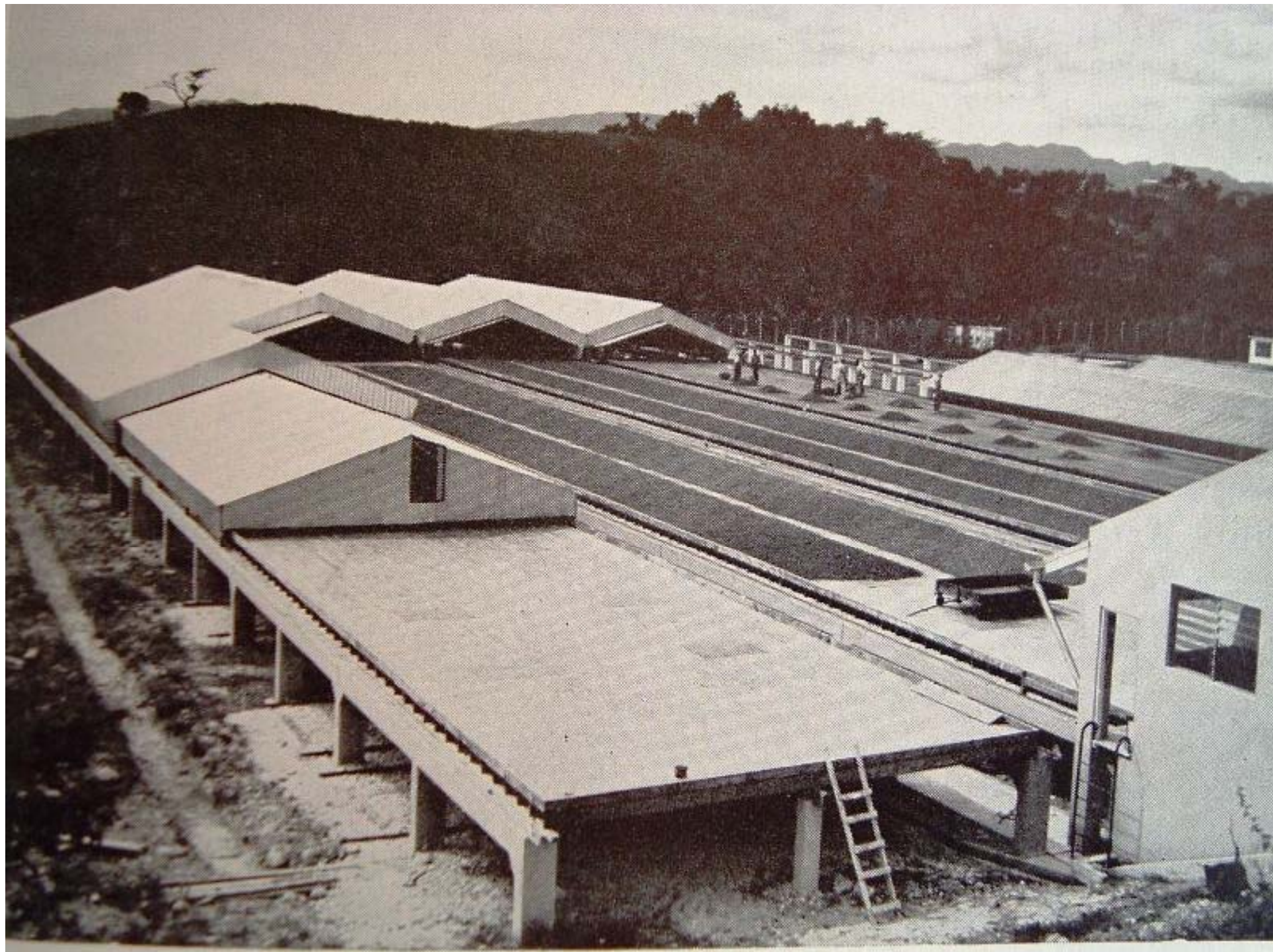


Innovations in solar drying

Dryer designs found in different cocoa producing countries to demonstrate “drying innovation”

Dryer design in Jamaica

Sun drying ways at Morgan's valley
Central Fermentary (circa 1964)



Dryer designs in Ecuador

Nested solar drying trays

Mobile solar drying trays

Covered concrete floor drying

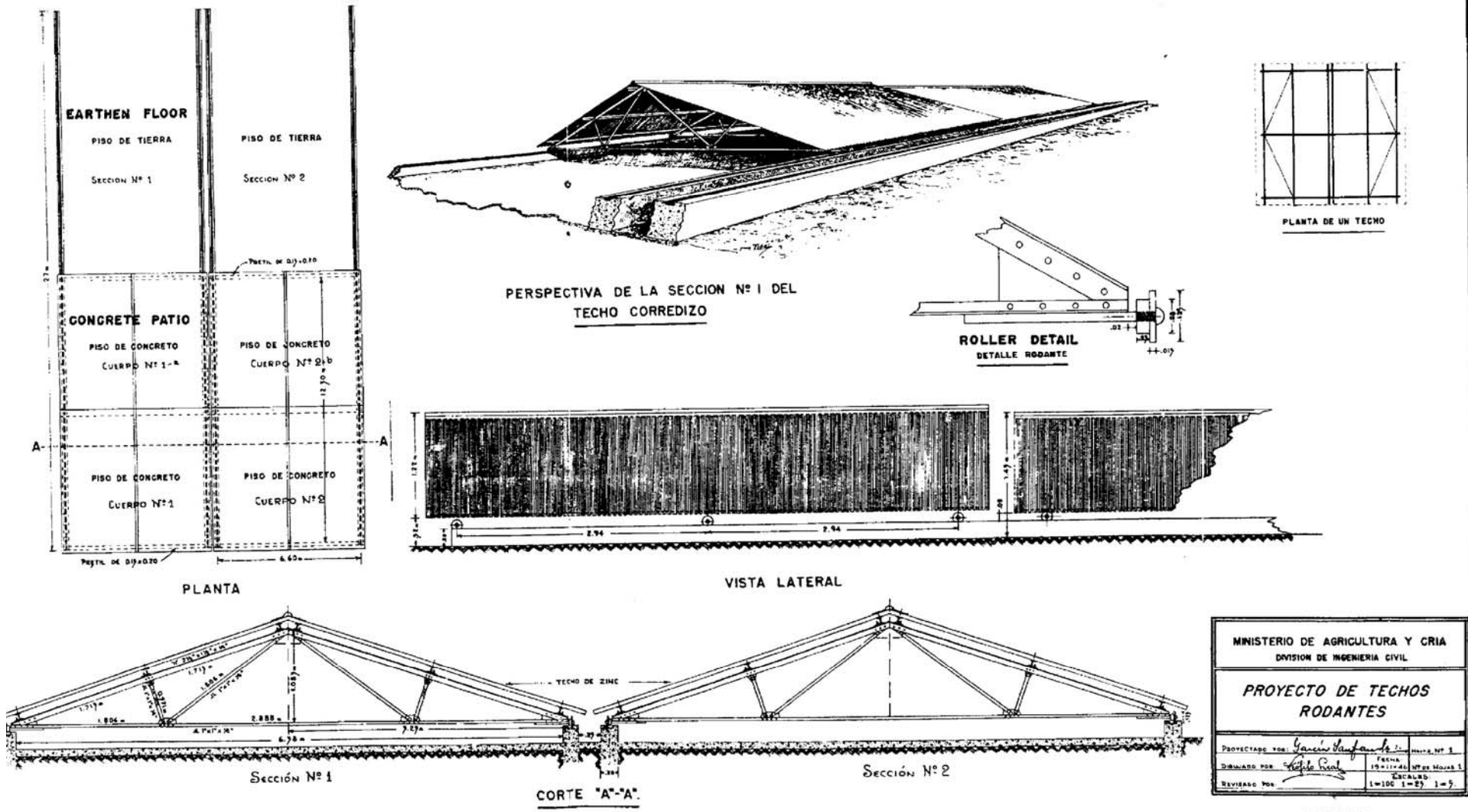




Dryer designs in Venezuela

Solar drying facility with mobile roof

Nested solar drying trays



MINISTERIO DE AGRICULTURA Y CRIA	
DIVISION DE INGENIERIA CIVIL	
PROYECTO DE TECHOS RODANTES	
PROYECTADO POR: <i>García Sanfuentes</i>	FECHA: 19-11-46
DISEÑADO POR: <i>Arturo Oval</i>	ESCALA: 1=100 1=50 1=5
REVISADO POR:	

DESIGN
FIG. 2 OF MOBILE ROOF COVERS





Dryer design in Papua New Guinea

Solar dryer with rock solar collectors
and poly carbonate sheet roof



Dryer designs in Dominican Republic and Hawaii

Tunnel type dryers

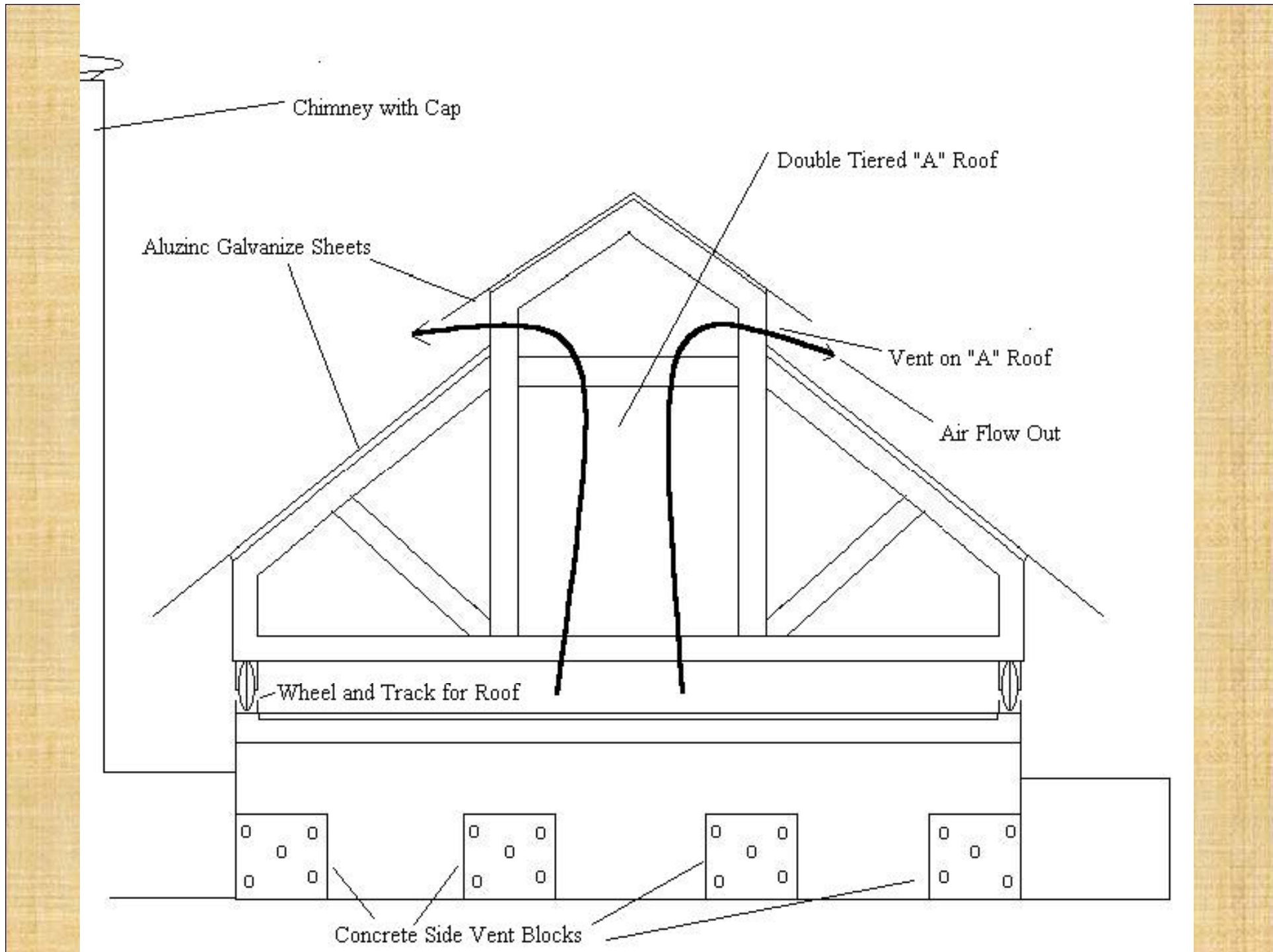


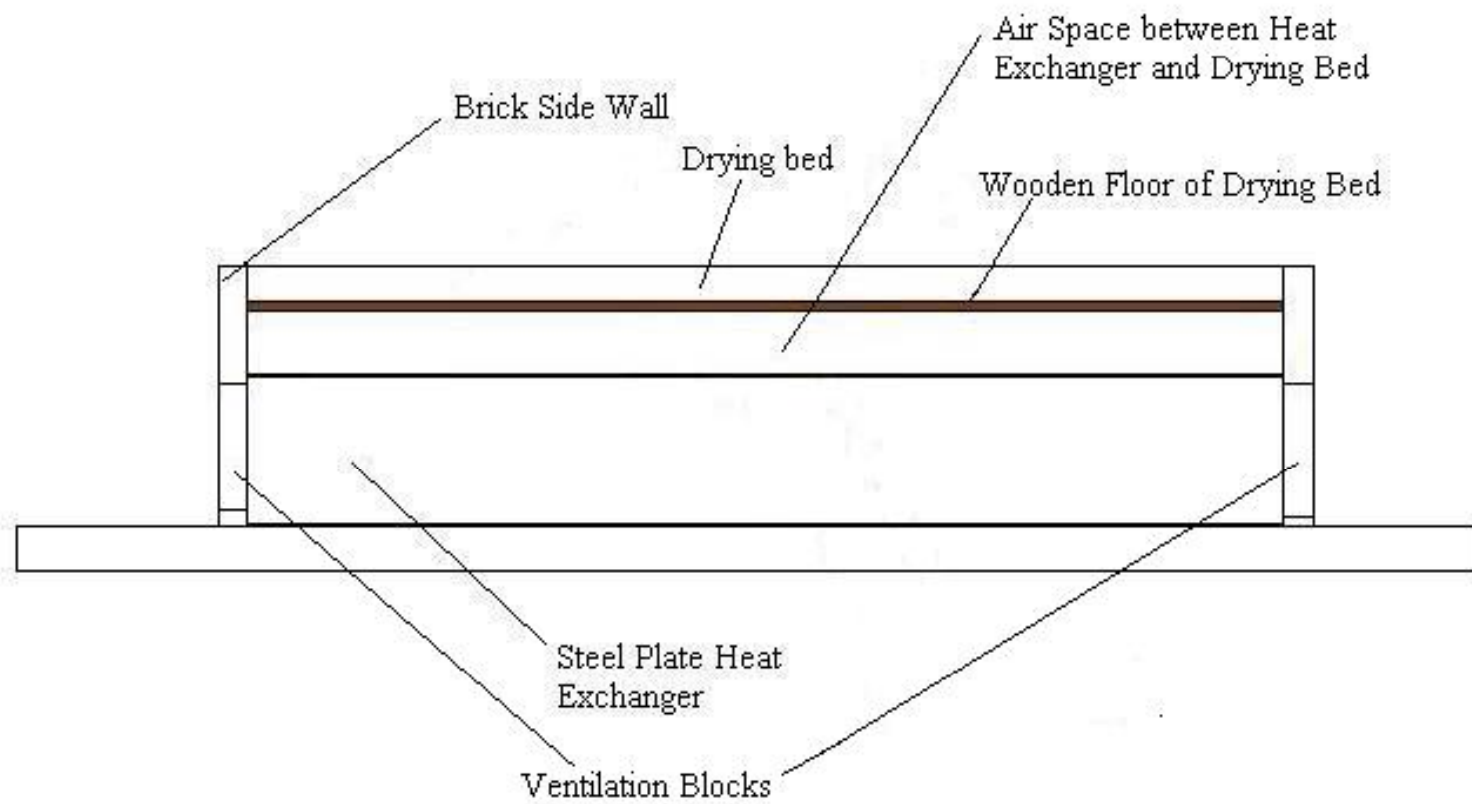




Dryer design in Guyana

Combination of solar and artificial drying





Dryers in Ilimuau

Traditional wooden floor sliding roof

Modern wooden floor sliding roof



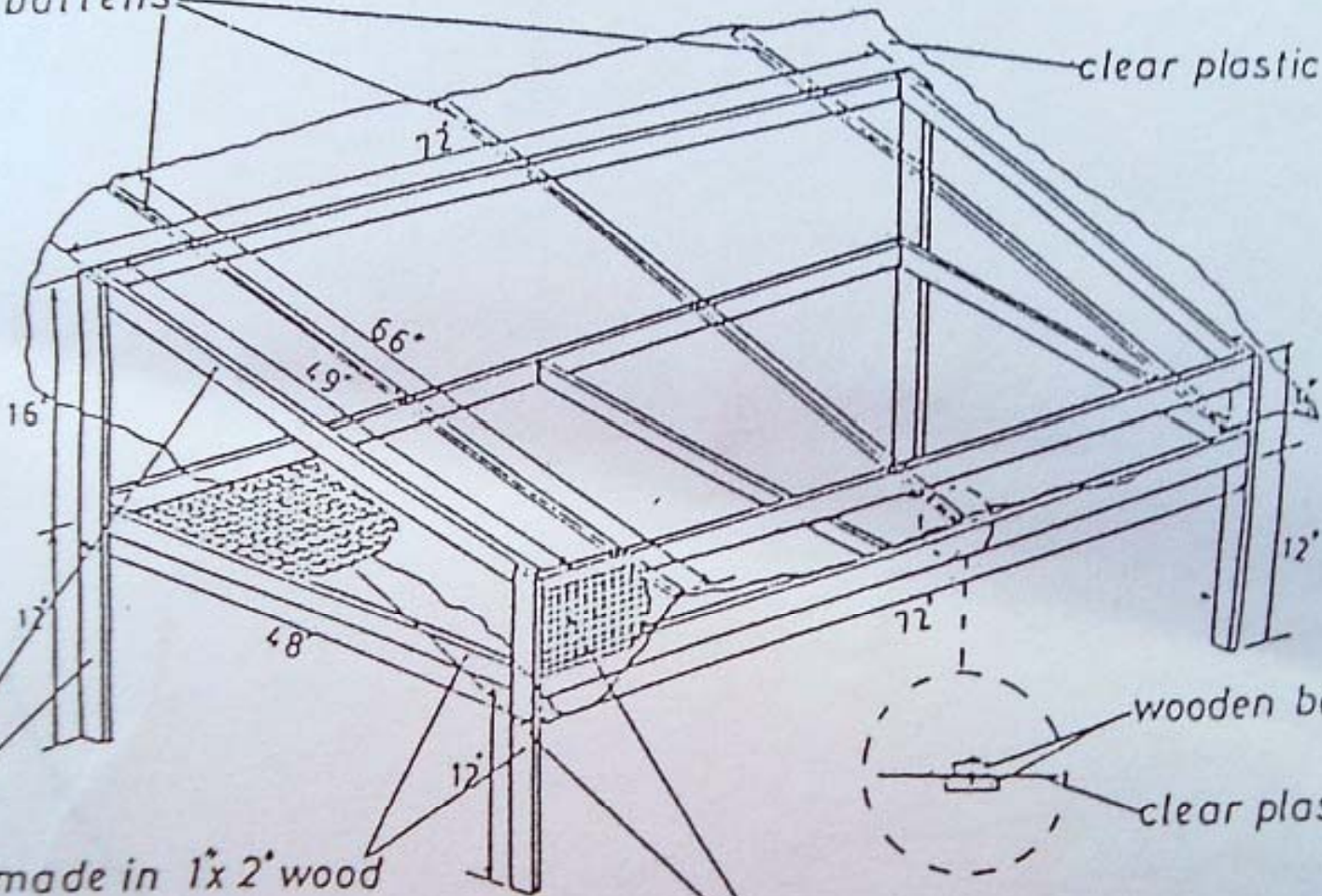
Dryer concepts in Trinidad

Convection cabinet dryer

Hybrid bed dryers with solar collectors

wooden battens

clear plastic cover

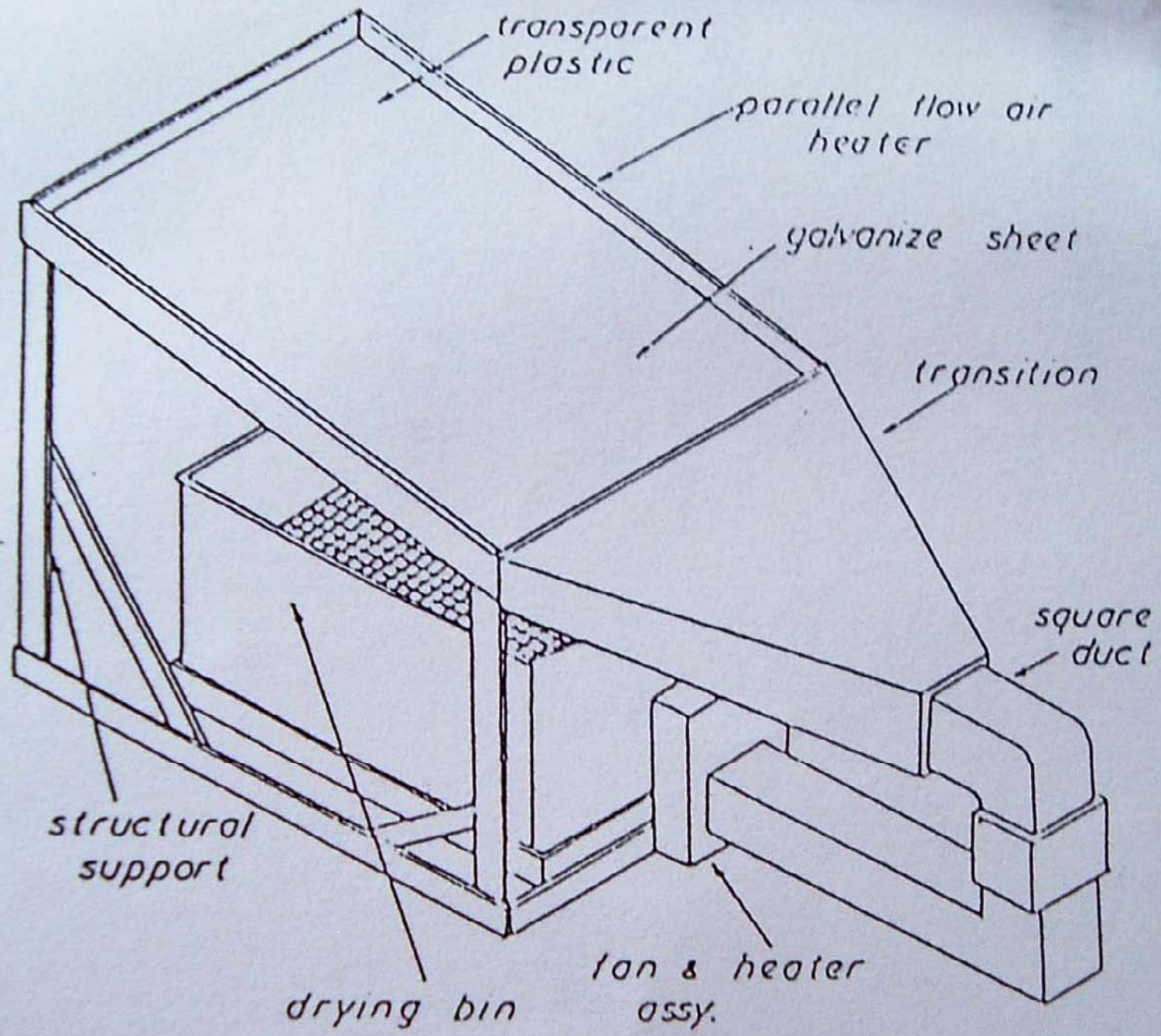


frame made in 1x2 wood

wire mesh bottom and sides

wooden battens

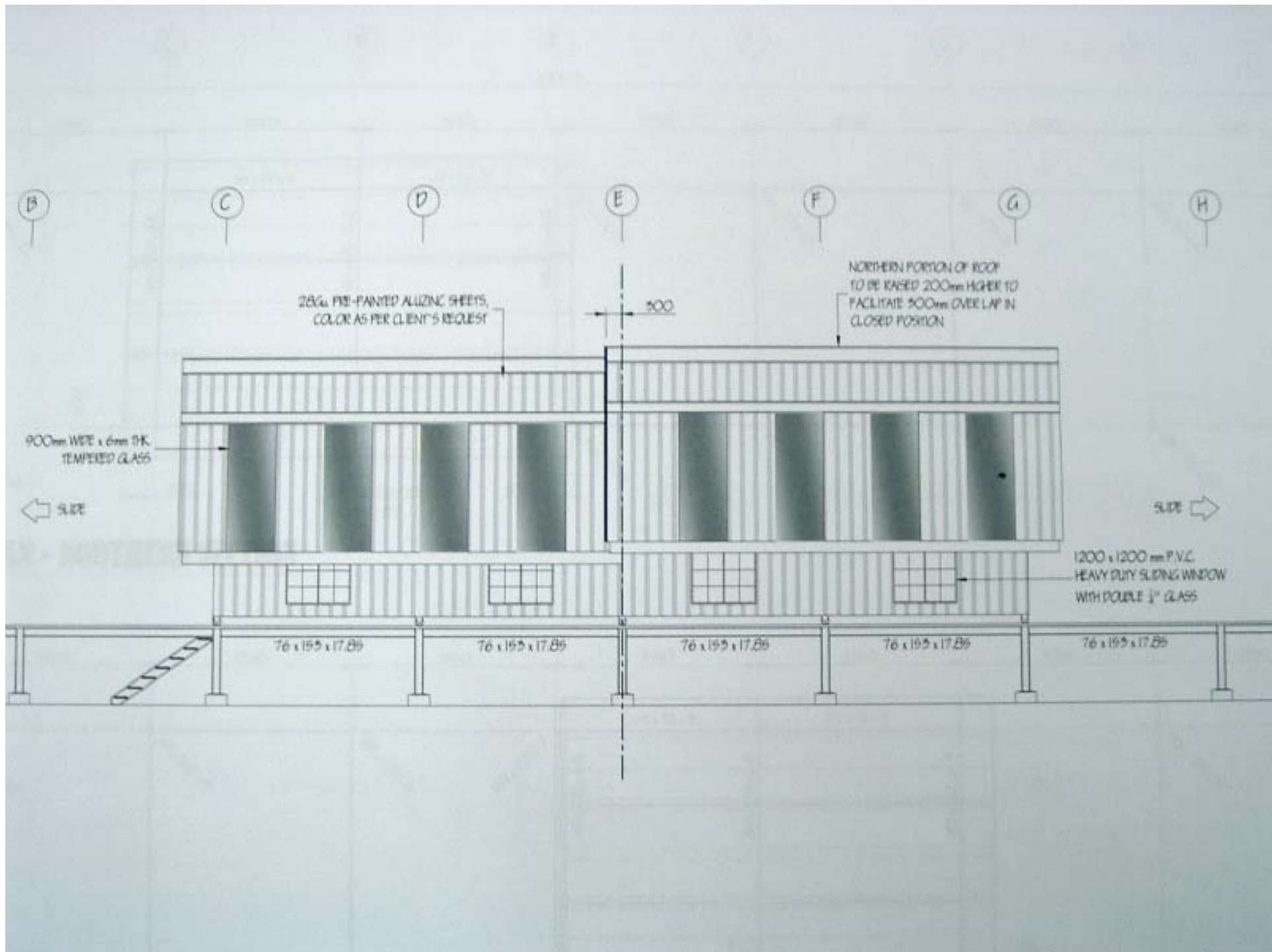
clear plastic sheet

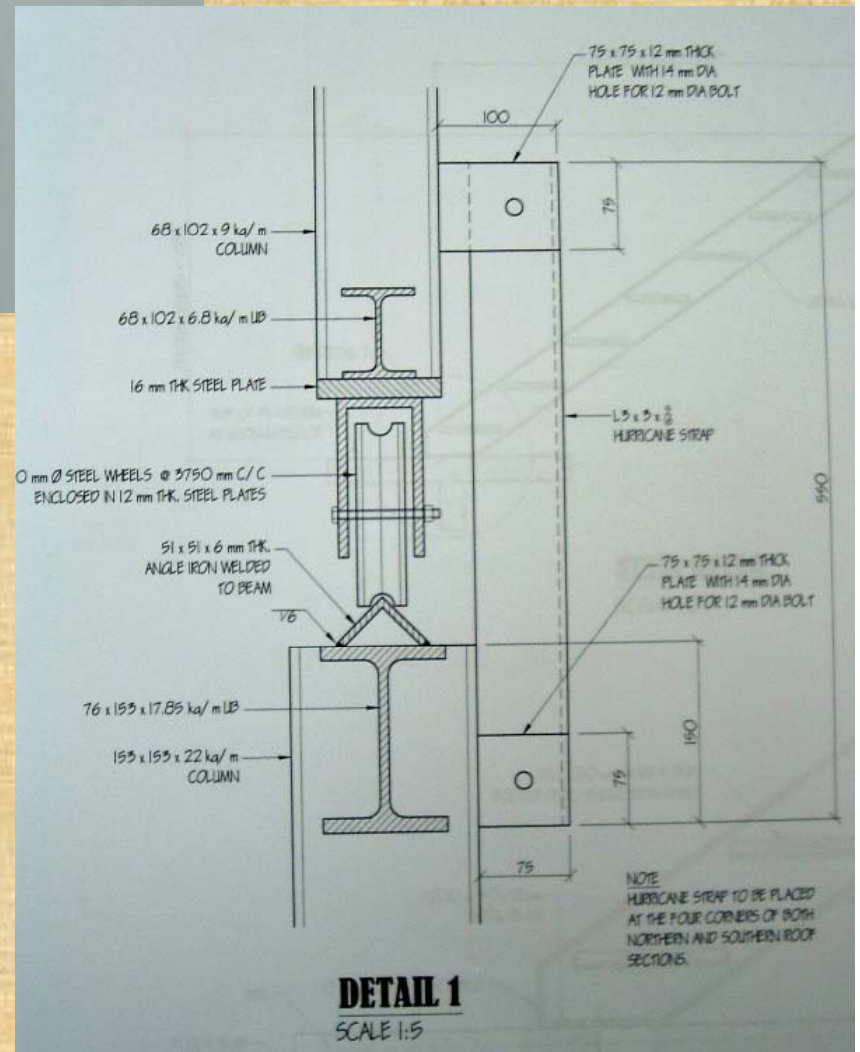
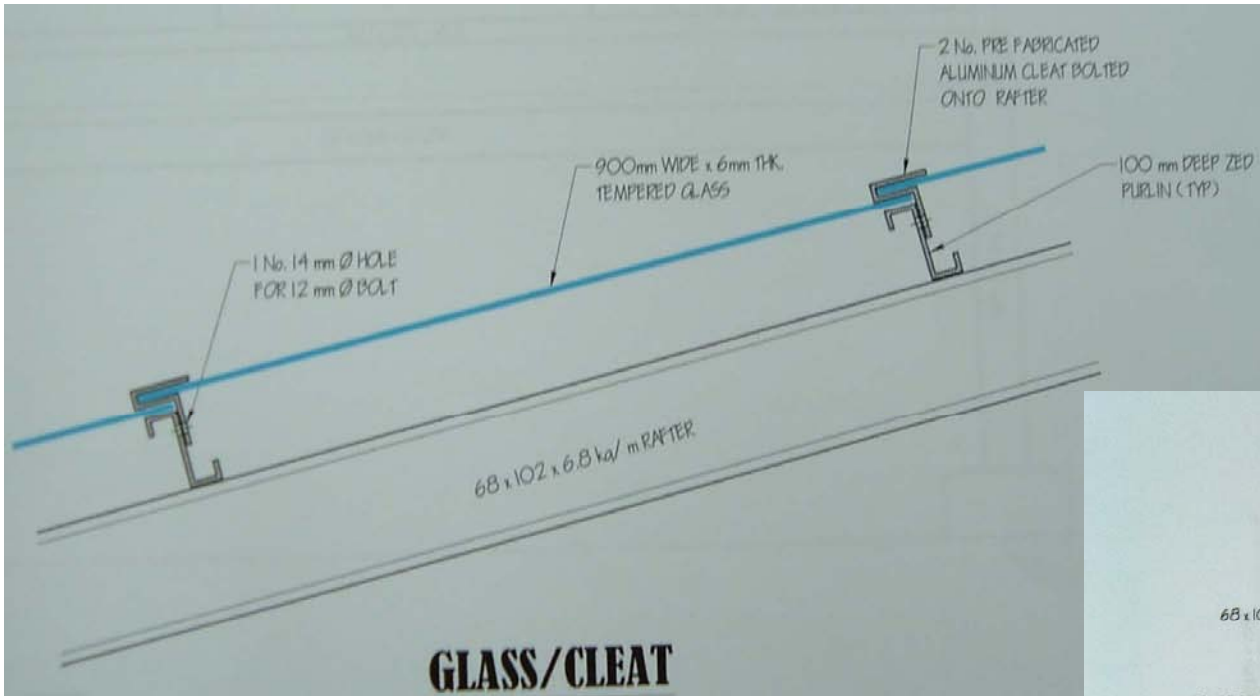


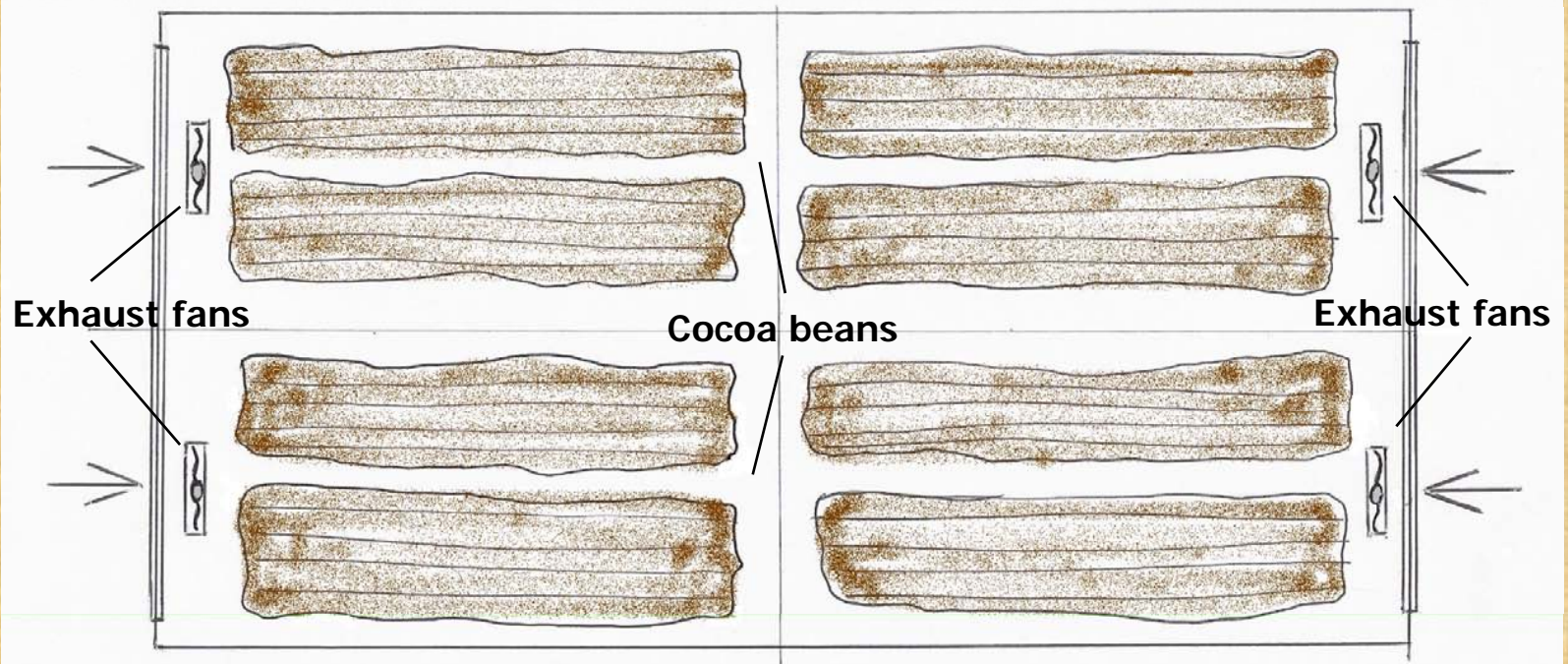
Mobile sliding roof dryer

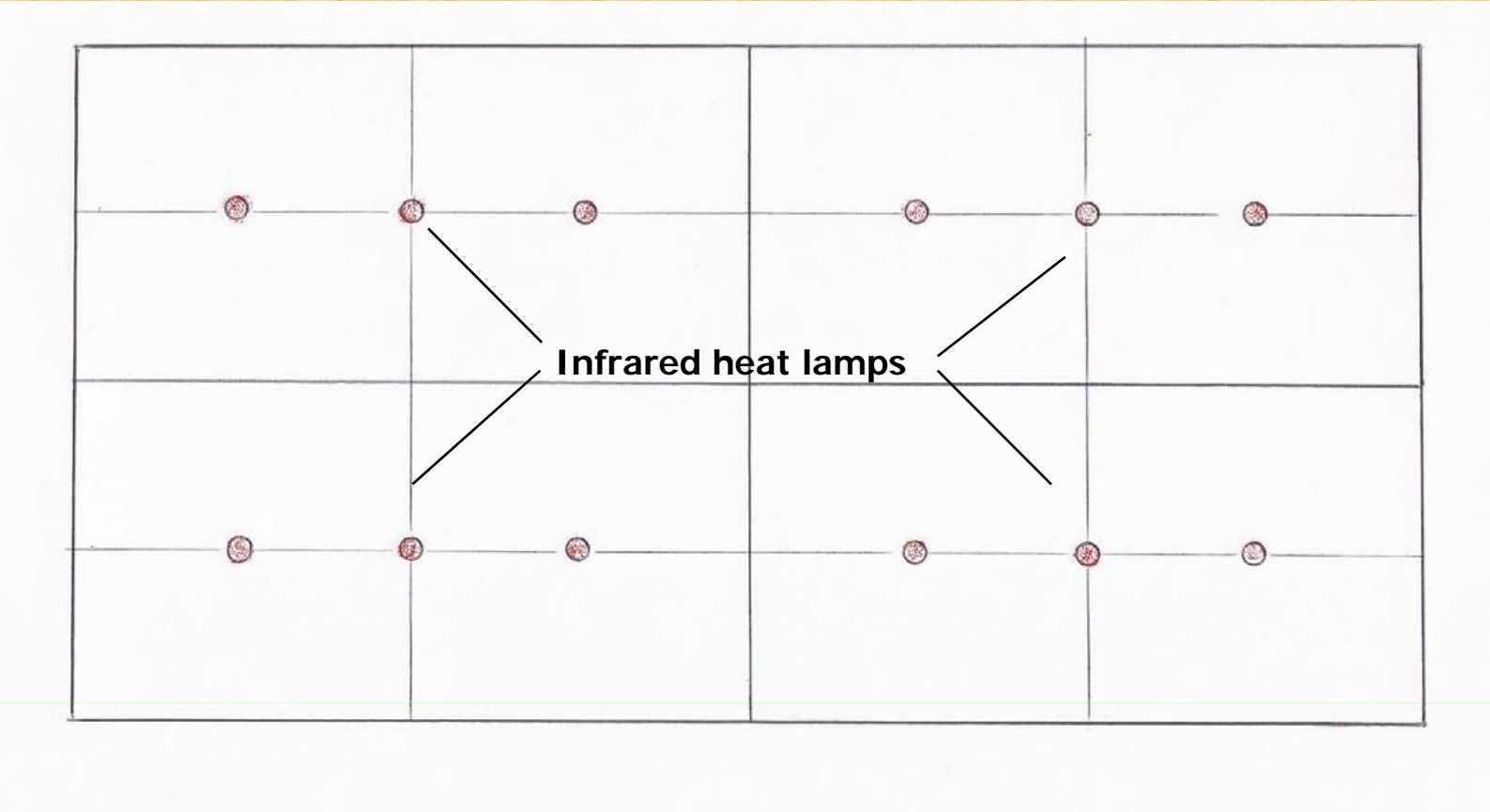


Solar drying with passive and active drying assist systems









What is right for Jamaica?

General recommendations for solar drying

Quality of end product

Cost of operation

Volume of cocoa to dry (estate throughput)

Prevailing weather conditions during cocoa crop

**Direct solar drying should be the main mode of drying
only if it is feasible**

Recommendations if weather conditions are too wet and do not allow direct solar drying

Tunnel solar dryers

Open solar drying with passive and active drying assist systems

Initial solar drying (up to 20% MC) and then artificial drying with heat exchangers

Impact of post harvest processing on Cocoa Quality

Cocoa, “*quality*” includes the all-important aspects of flavour and purity, and physical characteristics that have a direct bearing on manufacturing performance, especially yield of cocoa nib (Biscuit, Cake, Chocolate and Confectionery Alliance (BCCCA), 1996).

Aspects or specifications of quality in cocoa include:

Flavour

Purity or wholesomeness

Consistency

Yield of edible material

Cocoa butter characteristics

These criteria affect the value and price paid for a parcel of beans.

The future of cocoa in Jamaica rests with all of the stakeholders and policy makers working together to optimise cocoa quality, production costs and farmer revenue...

Thank you!

