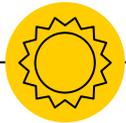


Performance Testing of a Solar Thermal Fruit Dryer

A Case Study to Reduce Food Waste in Mozambique



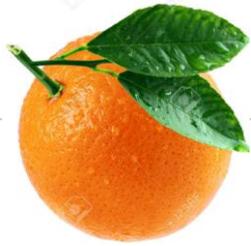
The Swedish Research Council Formas

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Ruralis
Institute for Rural and Regional Research





Hello!

We are

Ricardo Bernardo

&

Pia Otte



The Swedish Research Council Formas

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Background & Purpose



fruit drying solution for
small-scale farmers in
development countries
(case-study in Mozambique)

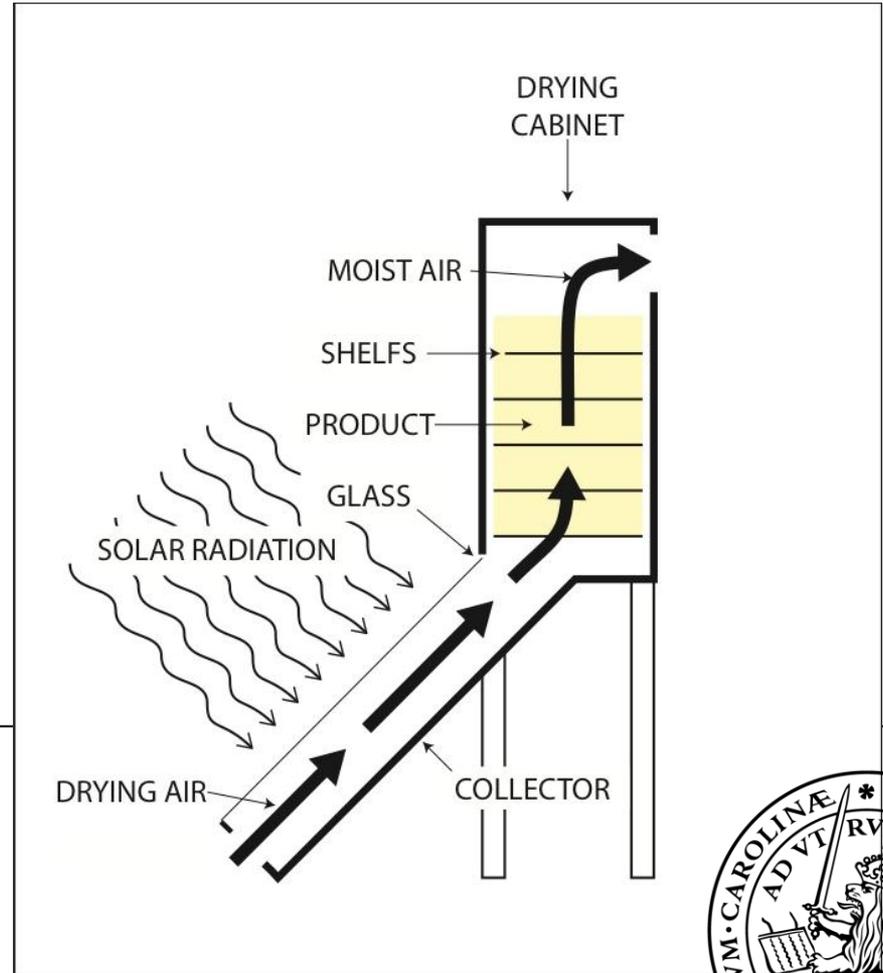
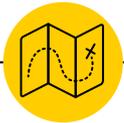
25-40%
Post harvest losses

Twice the irradiance compared to Lund

Solar Potential

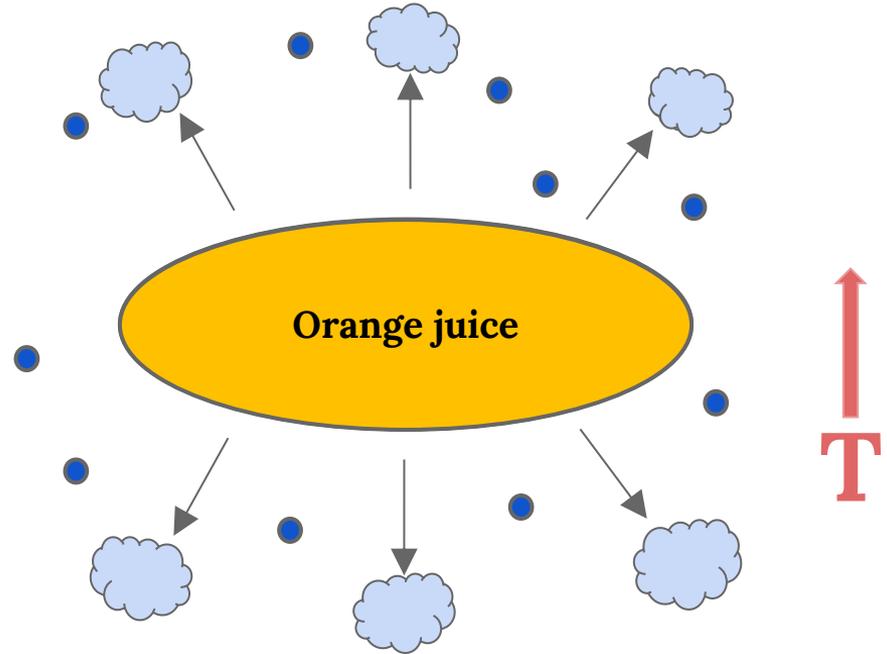


Principles & Objective



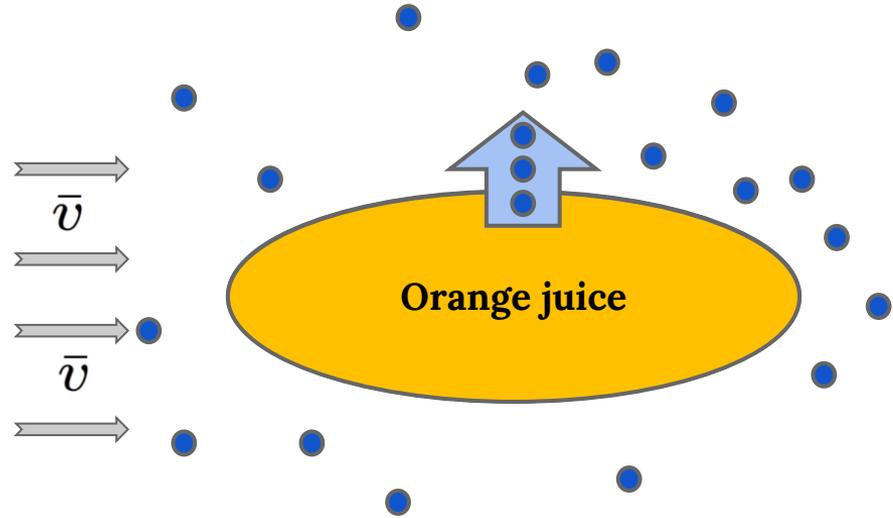
Pervaporation:

- Driven by **diffusion**
- Relative Humidity
- Temperature increase:
 - Effectively **lower RH**
 - **Increase** Pervaporation



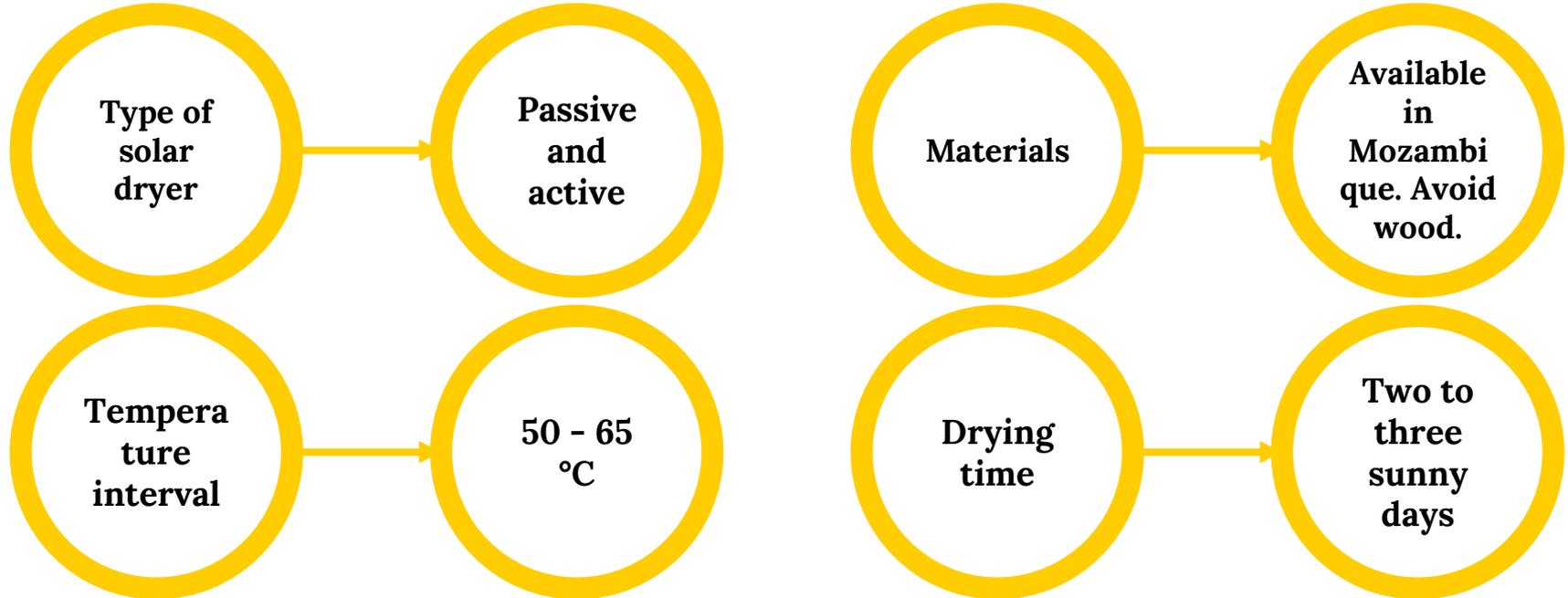
Pervaporation:

- Driven by **diffusion**
- Relative Humidity
- Temperature increase:
 - Effectively **lower RH**
 - **Increase** Pervaporation
- Air Flow **counteract Saturation**



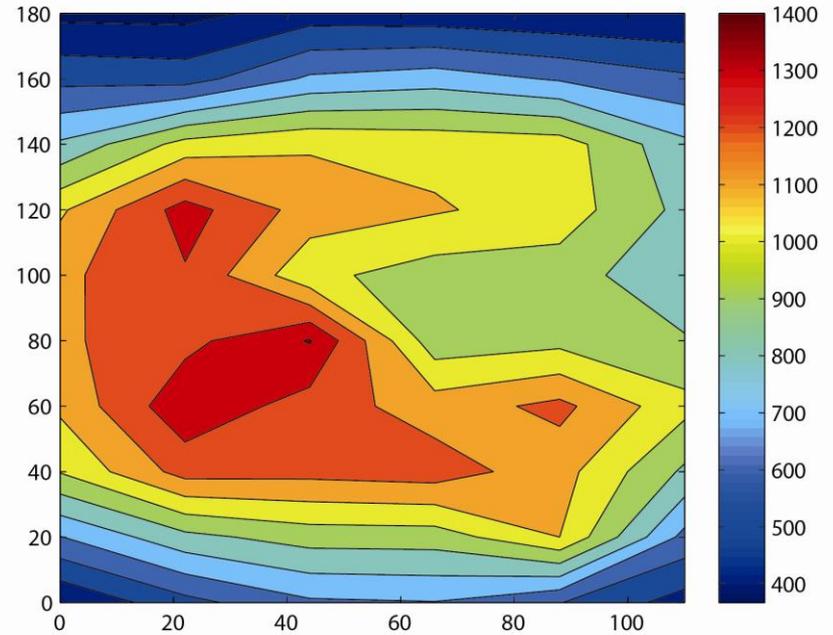
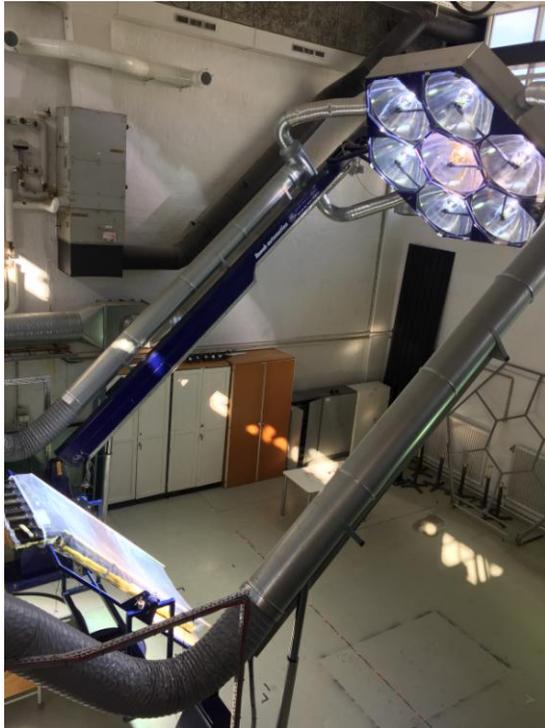


Design criteria for solar dryer prototypes



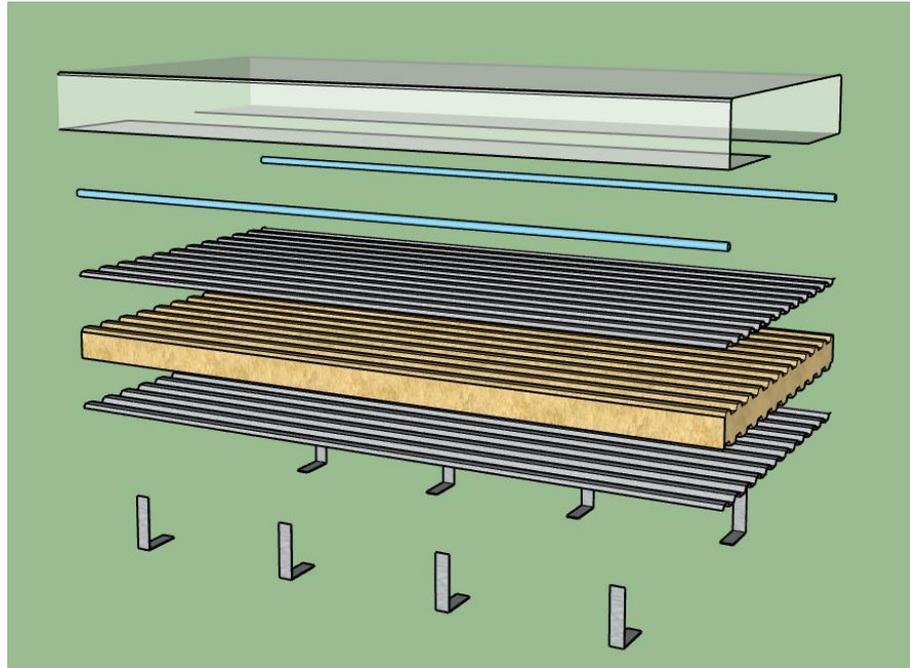


Laboratory in Lund



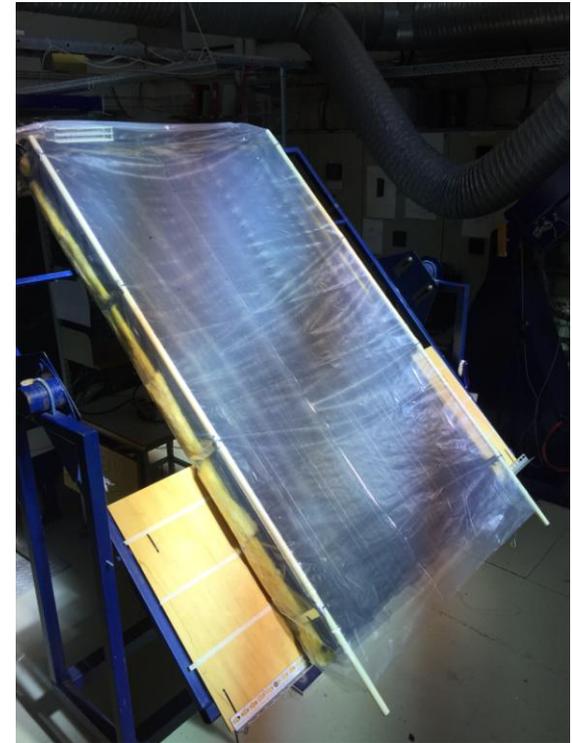
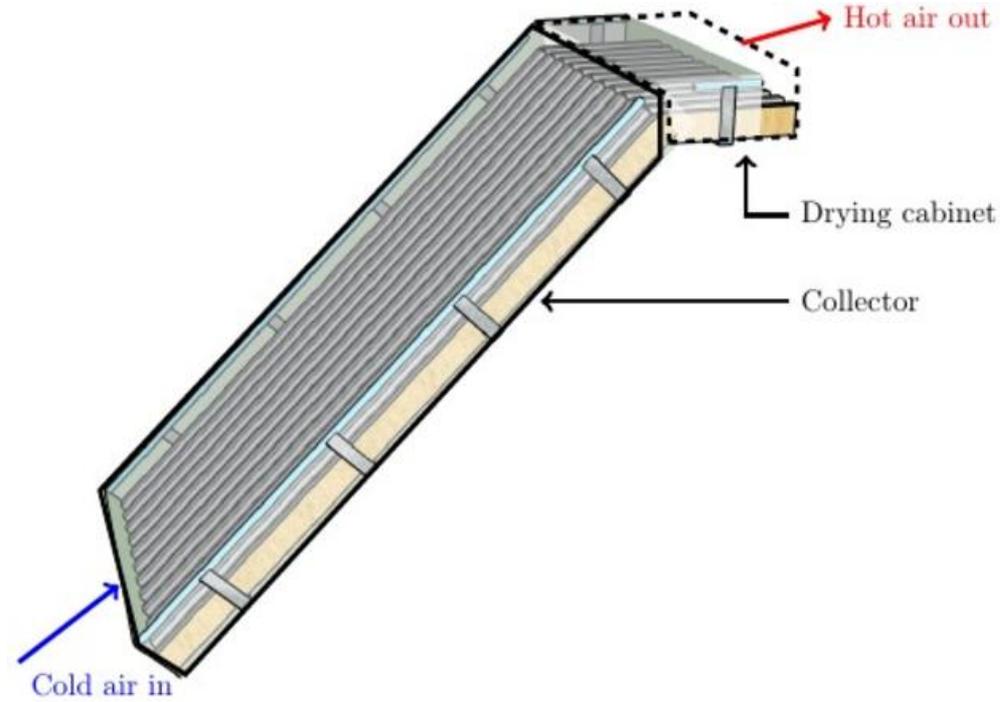


Solar dryers tested in Lund



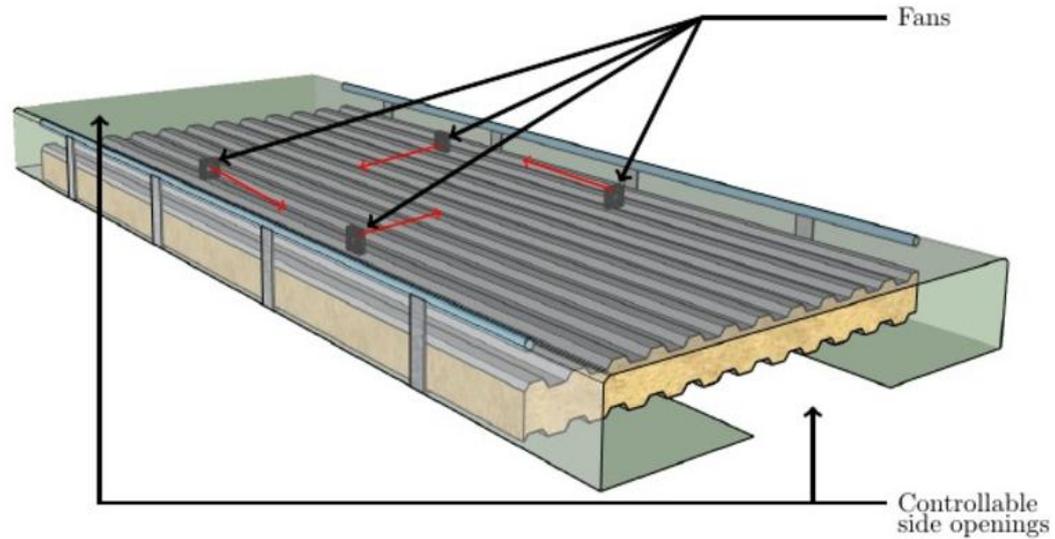


Solar dryers tested in Lund - passive



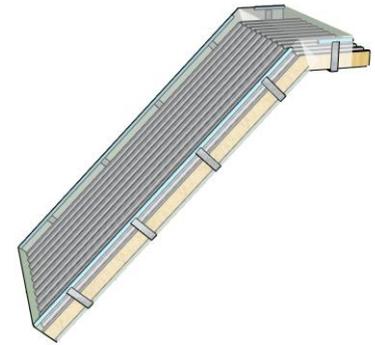
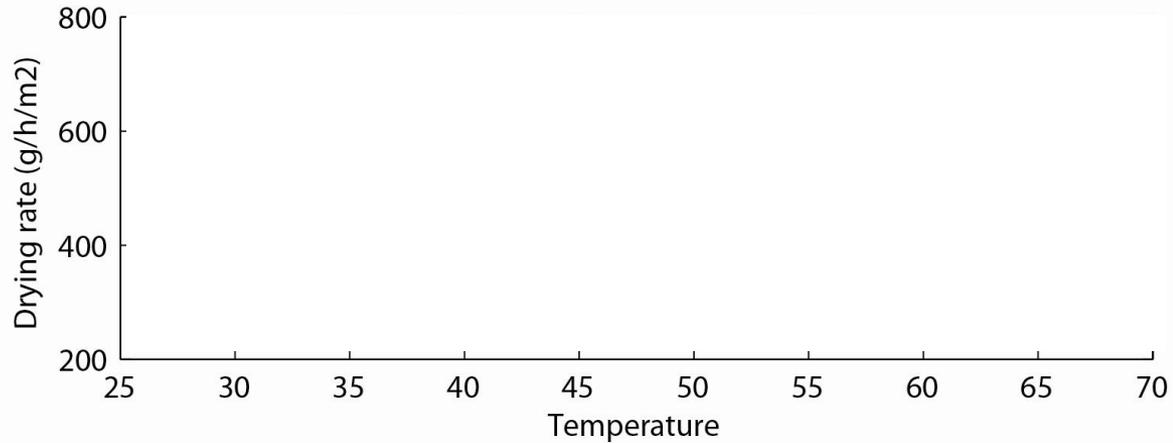


Solar dryers tested in Lund - active





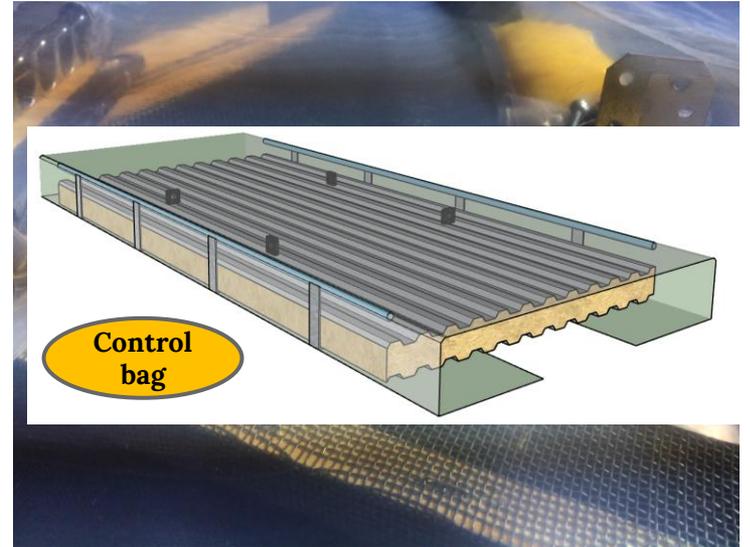
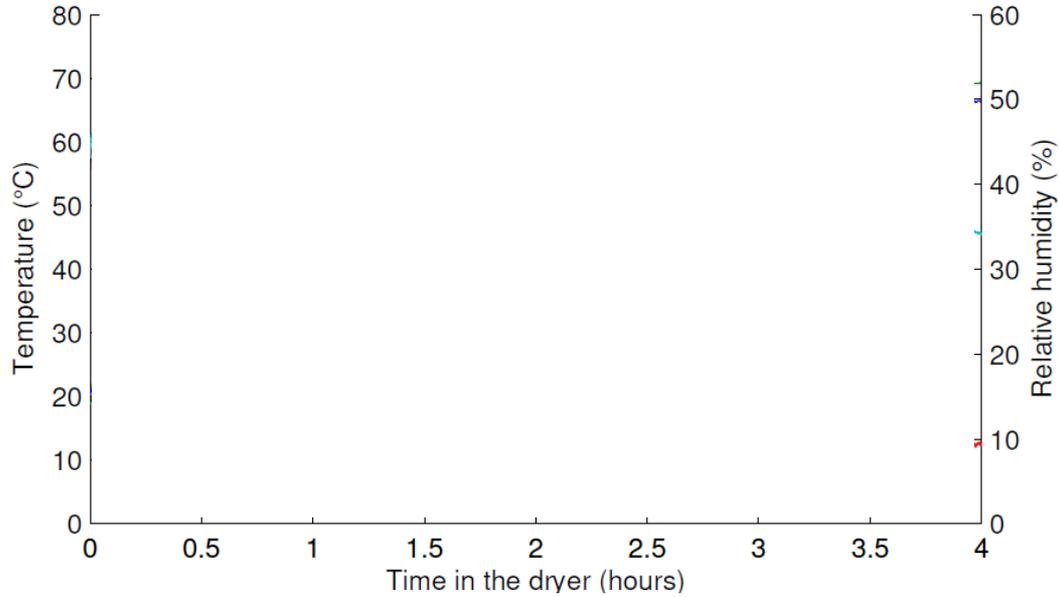
Results in Lund – passive dryer



Control bag

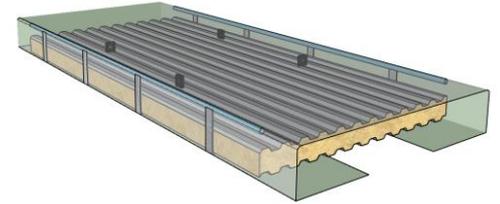


Results in Lund – active dryer



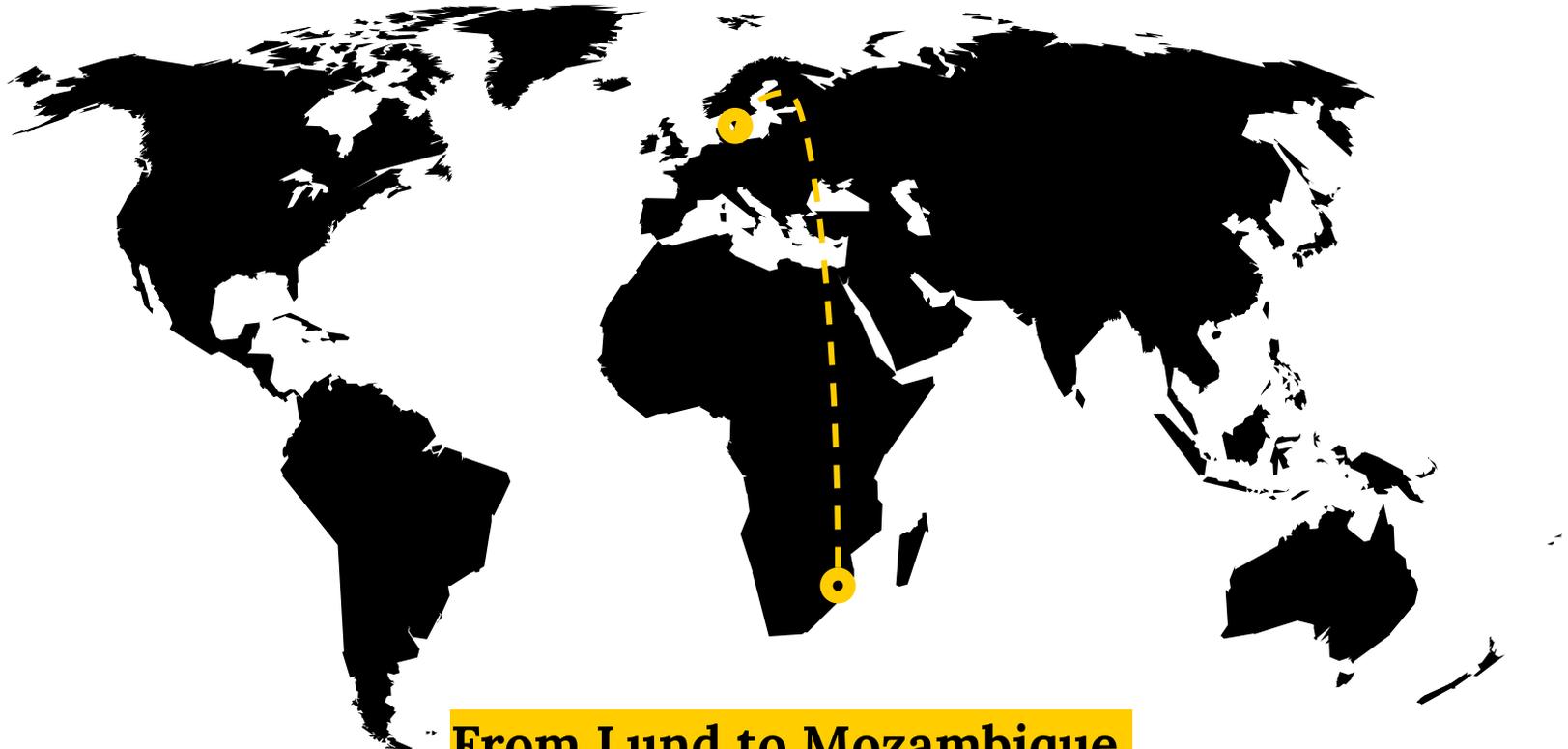


Results in Lund – active dryer



Ratio of dry rates (-)

Type of bag	Both sides open	One side open	Both sides closed	No fans active
In dryer (ratio to control)				
Control				



From Lund to Mozambique





Solar dryers tested in Mozambique



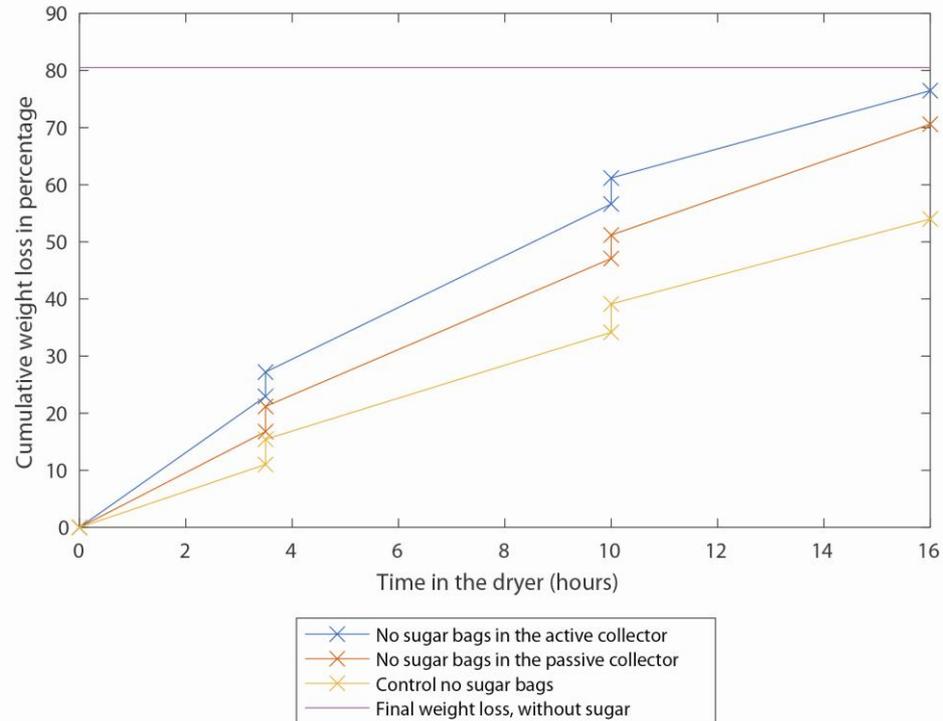
Control bags

Passive dryer

Active dryer

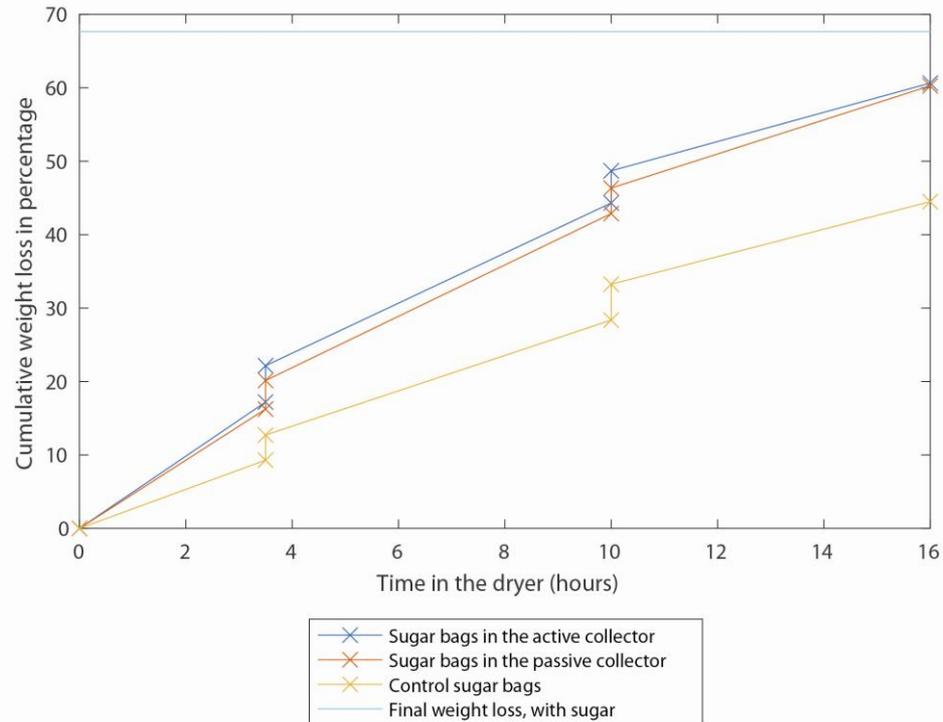


Results in Mozambique – juice without sugar





Results in Mozambique – juice WITH sugar





Results in Mozambique – both dryers

Ratio of dry rates (-)

Day number	Day 1		Day 2		Day 3	
Type of dryer	Sugar	No sugar	Sugar	No sugar	Sugar	No sugar
Active (ratio to control)						
Passive (ratio to control)						
Control						



Let's Conclude

Temperature

Both dryers reached temperature above 50°C

Performance

Close to 2 times faster than control bag (lab and field),
Three days for fully dried.

Which dryer is best?

Active is faster, Passive is cheaper. Season dependent performance.

Food safety

Need for pasteurisation.
Not possible in dryers yet,

Evaluation of drying

Drying speed not good indicator to compare drying.

Future Work

- Drying as a function of cumulative weight loss for specific recipe?
- Plastic sheet not practical
- Passive dryer has too little space for bags
- Increase drying speed.



**Thank you for your
time!**



*“... the most effective factor on the drying rate is the **temperature** of the air inside the cabinet; the effect of variation of speed of air inside the drying cabinet drying cabinet is small and can be neglected...”*

“

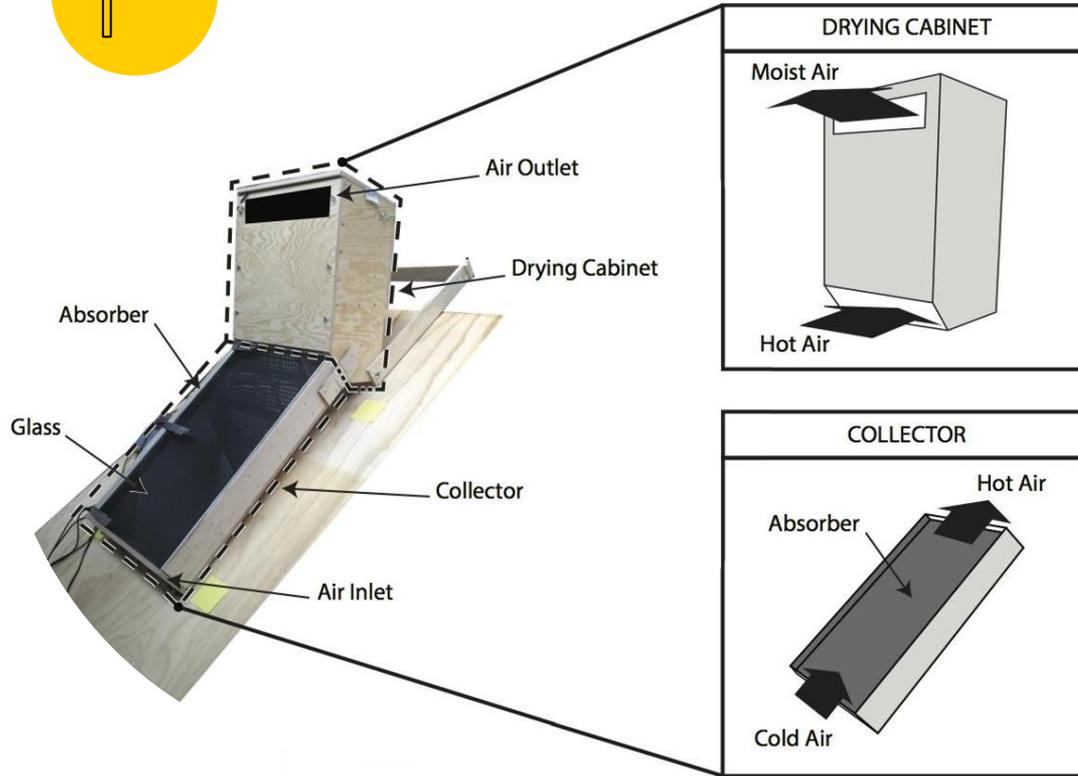
- A review of solar drying technologies
S. VijayaVenkataRaman et.al., 2011.

“...Studies on the drying of fruits and vegetables indicate that the air velocity has little influence on the drying kinetics of most of them...”

“

- Modeling the Thin-Layer Drying of Fruits and Vegetables: A Review

Daniel I. Onwude et.al., 2016

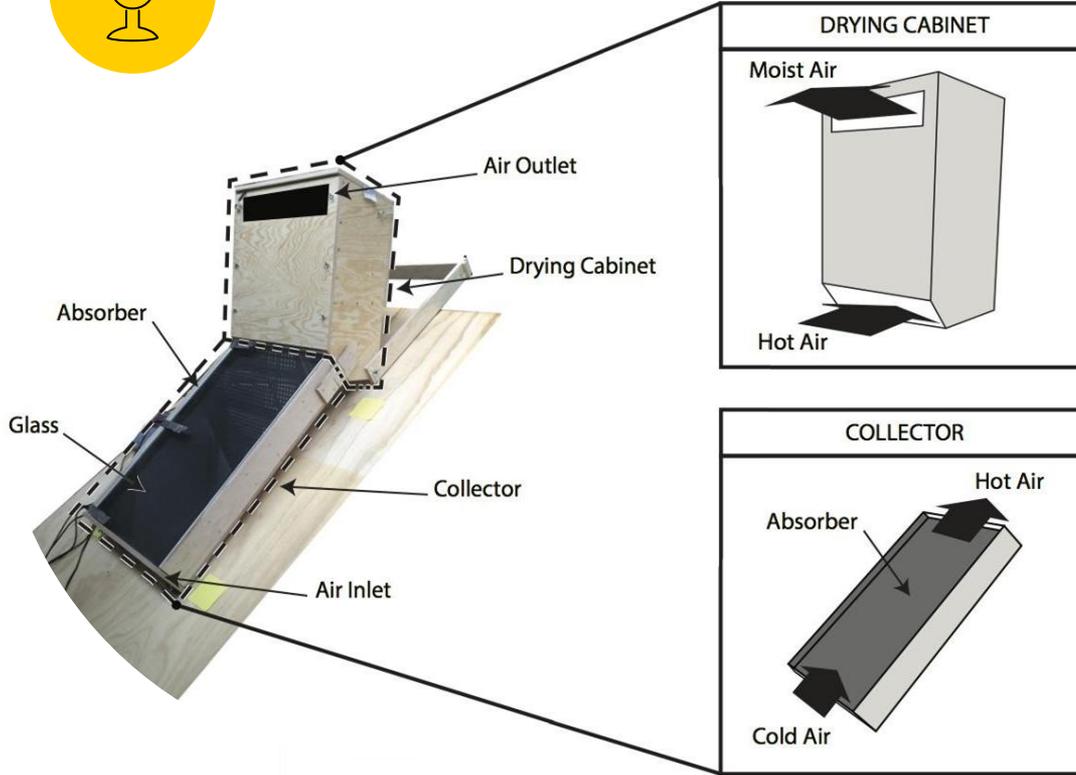


The Premises

A solar dryer was built after a required Temperature

Air Flow:

- Counteract Saturation
- Regulate Temperature



Design Result

- Possible to Transport
- Temperature interval Reached
- Temp. Regulatable by Air Flow
- Easy to Assemble by hand



Interesting Observations

- Saturation Around Bag
- Bag Temperature Rose

