Performance Testing of a Solar Thermal Fruit Dryer

A Case Study to Reduce Food Waste in Mozambique

The Swedish Research Council Formas
Committed to excellence in research for sustainable development
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Hello!

We are

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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)

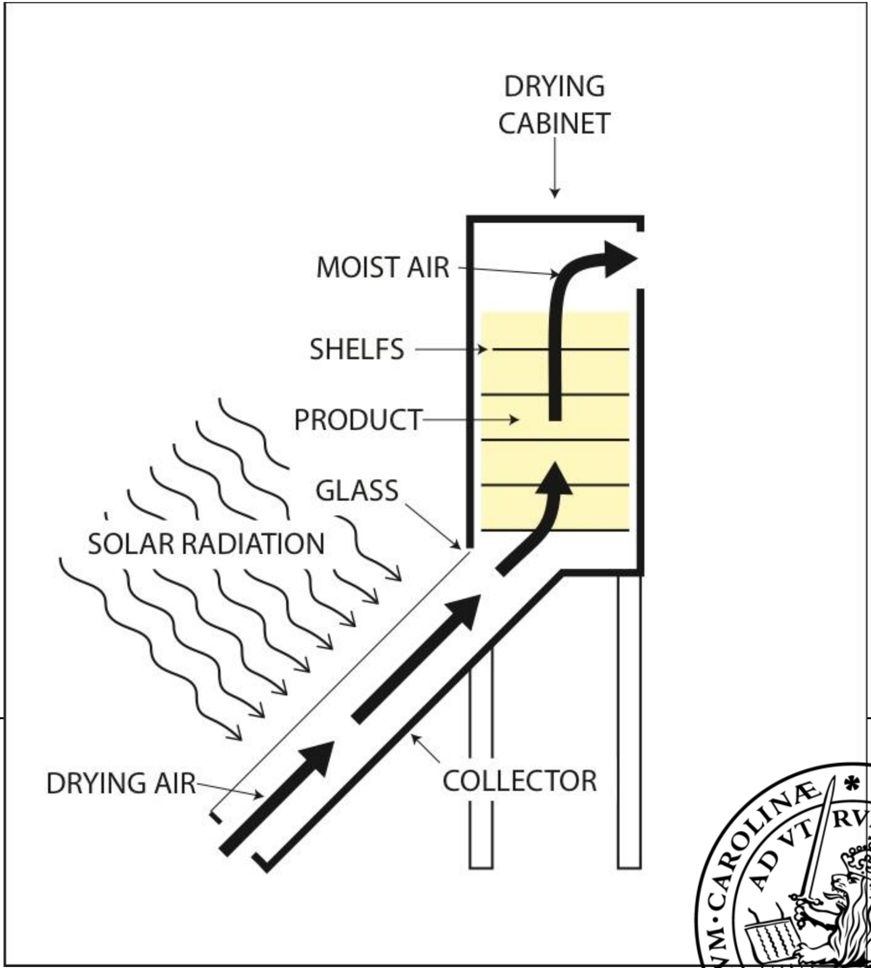
25-40%

Post harvest losses

Twice the irradiance compared to Lund

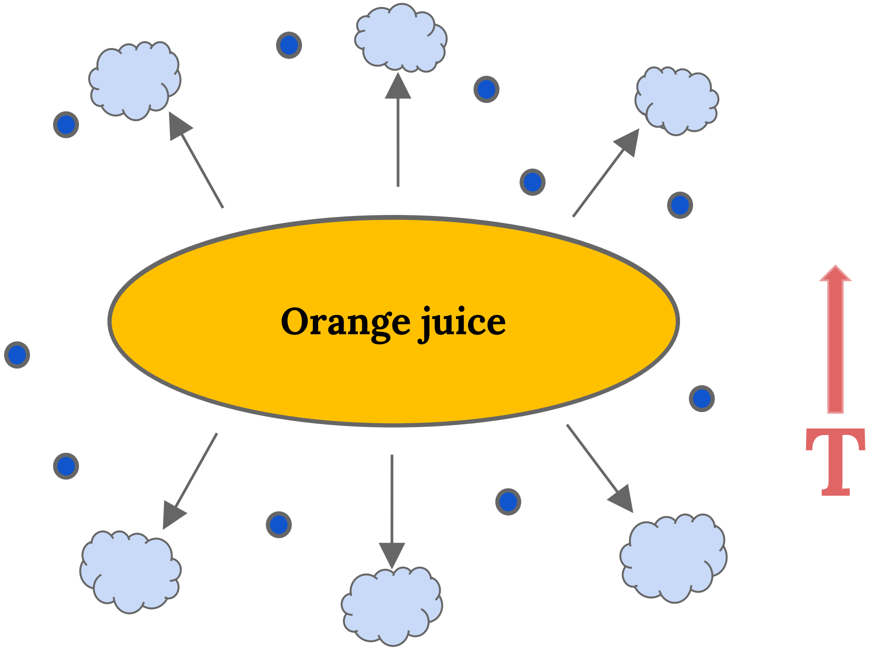
Solar Potential

Principles & Objective



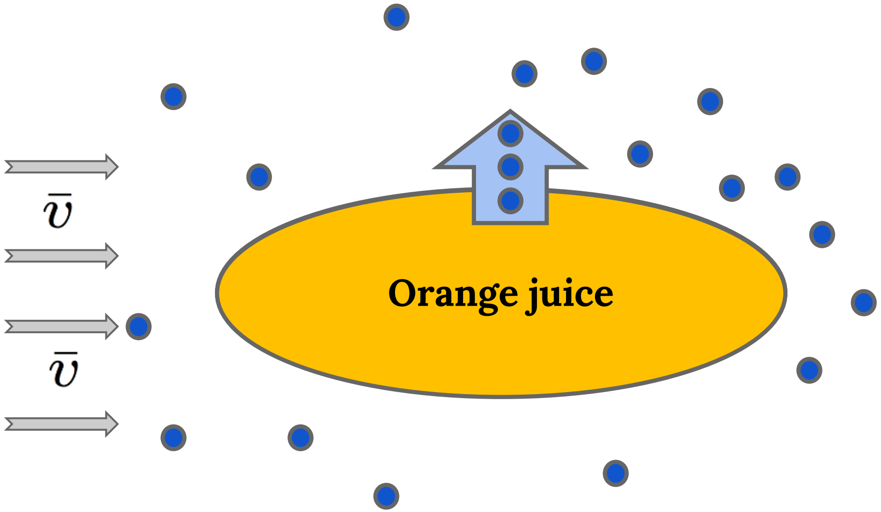
Pervaporation:

- 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

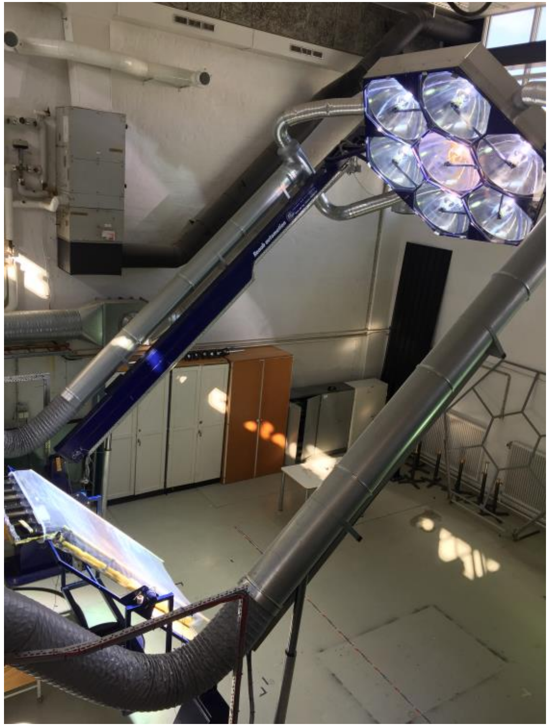
Type of solar dryer → Passive and active

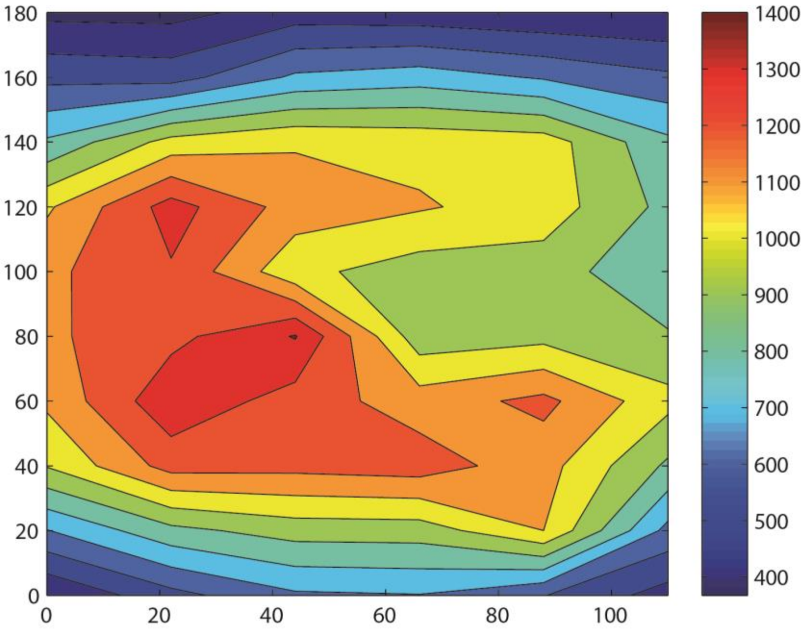
Materials → Available in Mozambique. Avoid wood.

Temperature interval → 50 - 65 °C

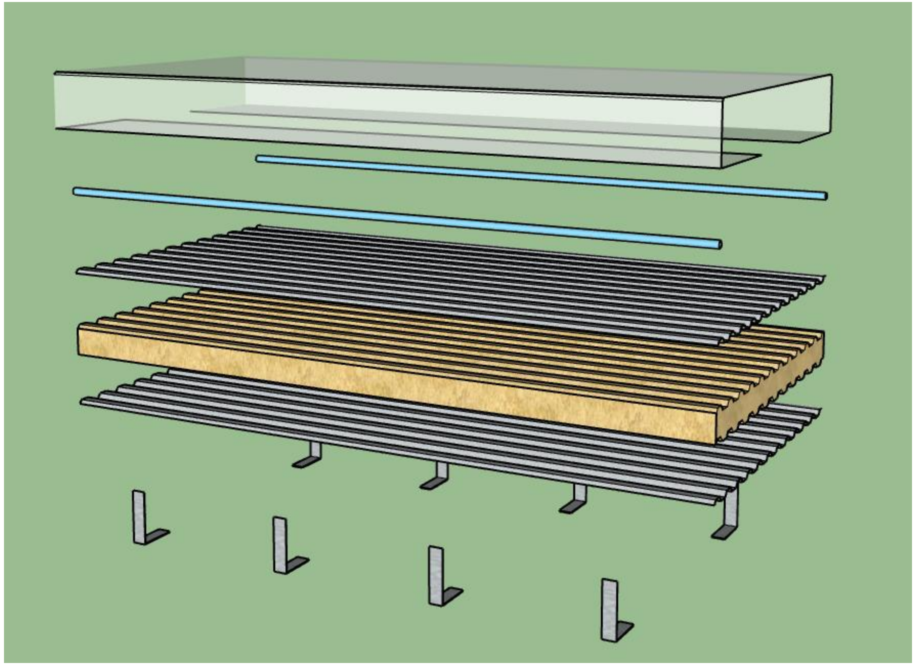
Drying time → Two to three sunny days

Laboratory in Lund

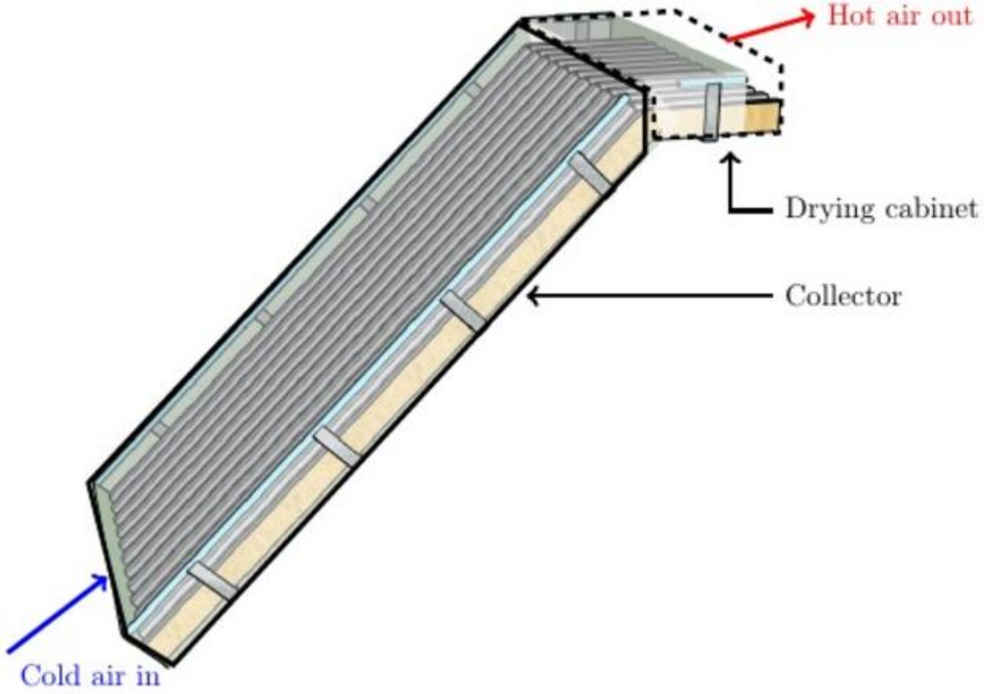


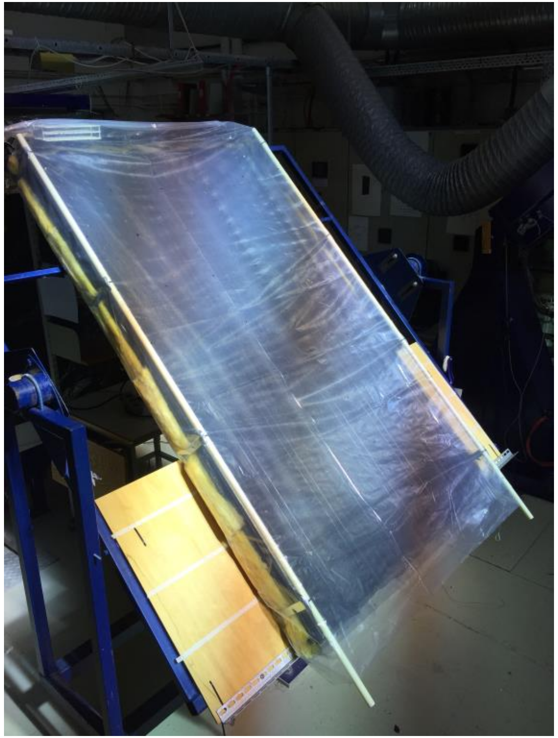


Solar dryers tested in Lund

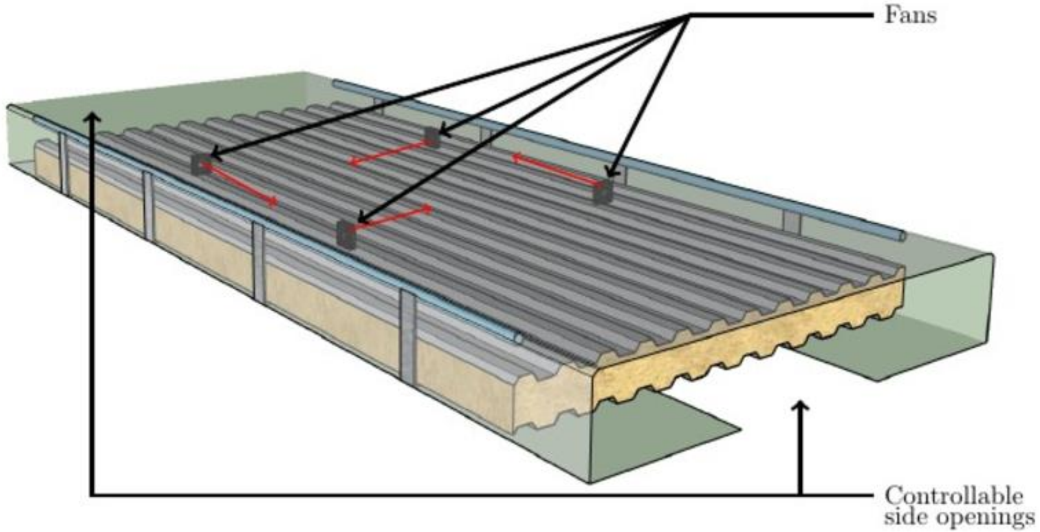


Solar dryers tested in Lund - passive

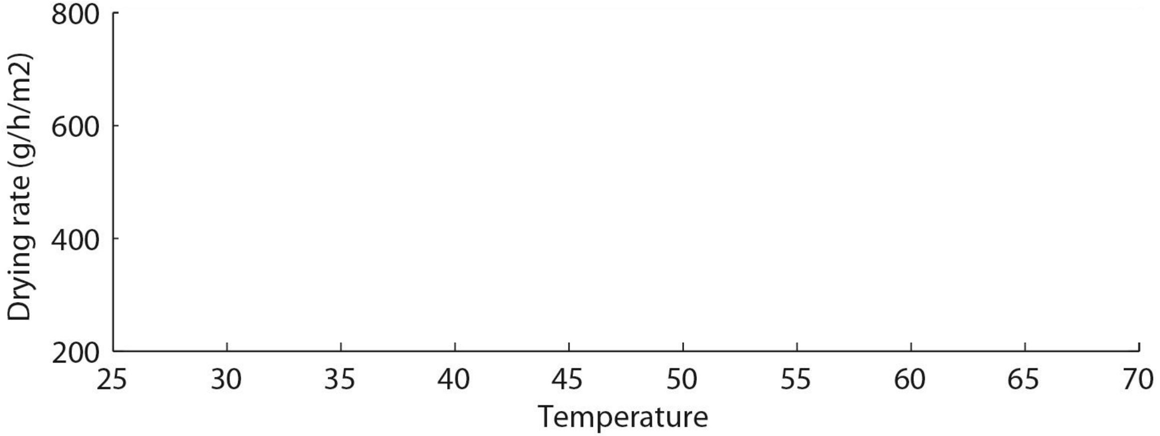


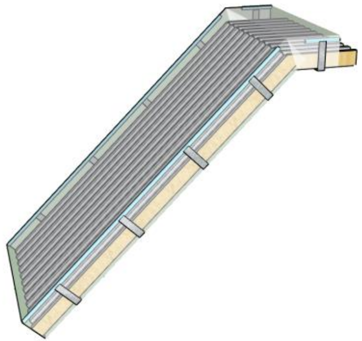


Solar dryers tested in Lund - active



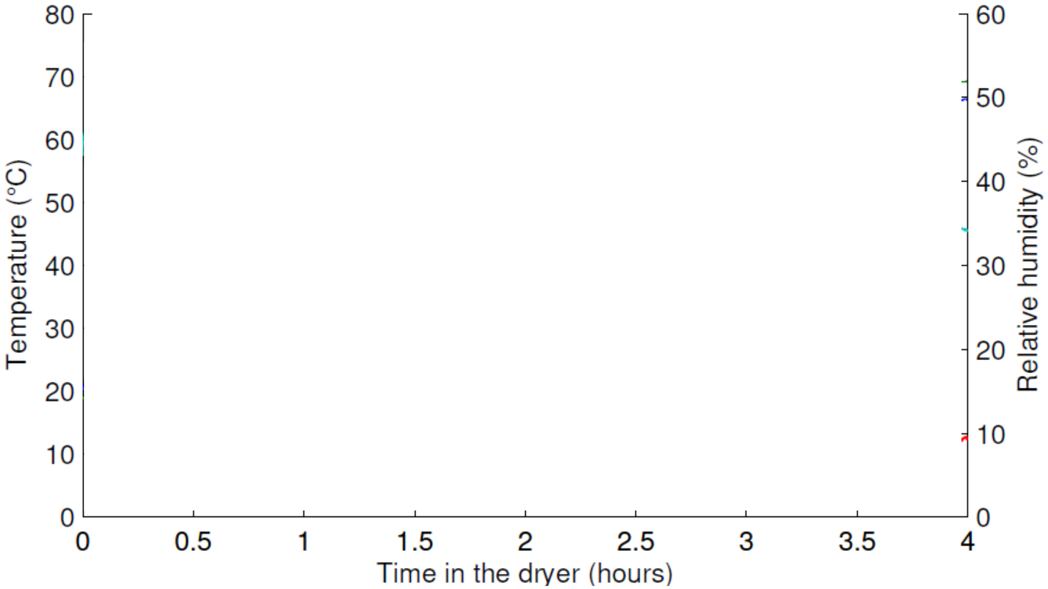
Results in Lund – passive dryer

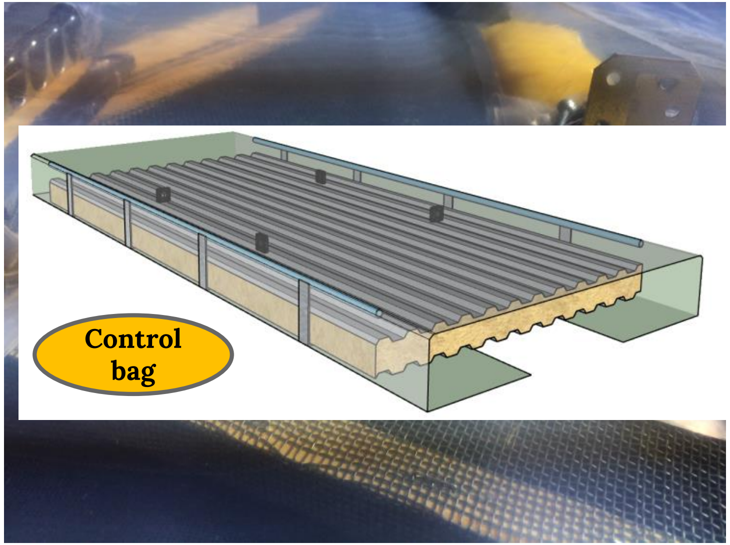




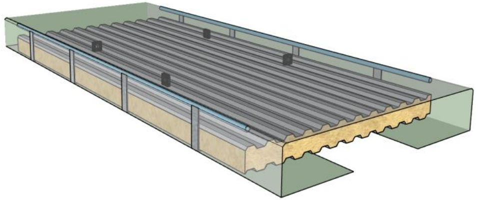
Control bag

Results in Lund – active dryer



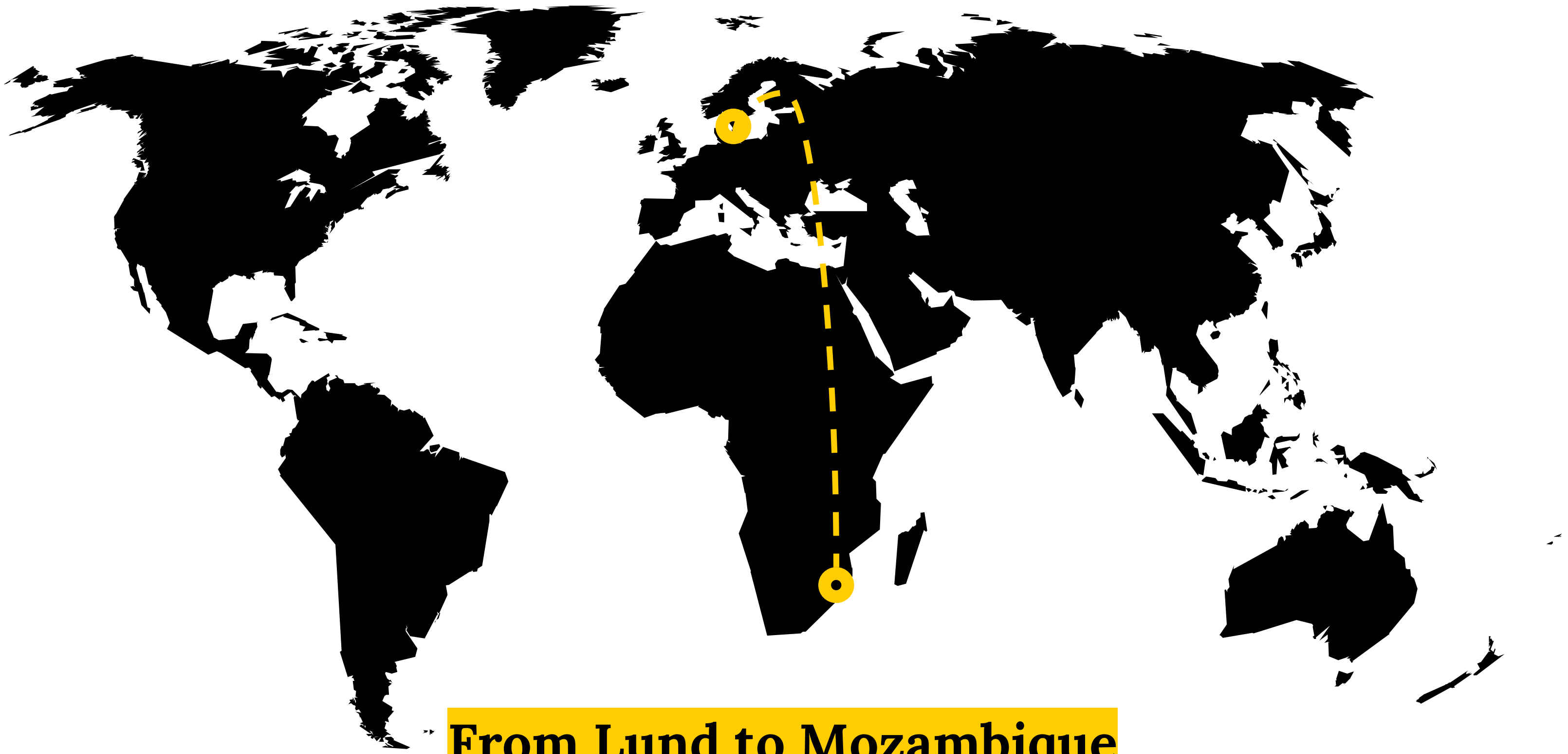


Results in Lund – active dryer



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

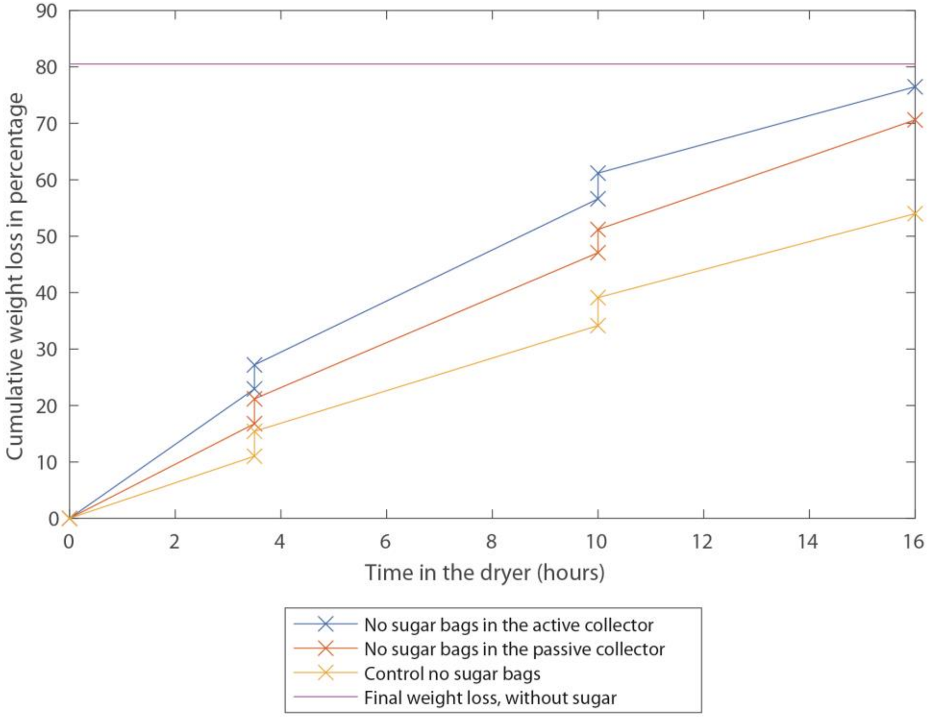
Solar dryers tested in Mozambique

Control bags

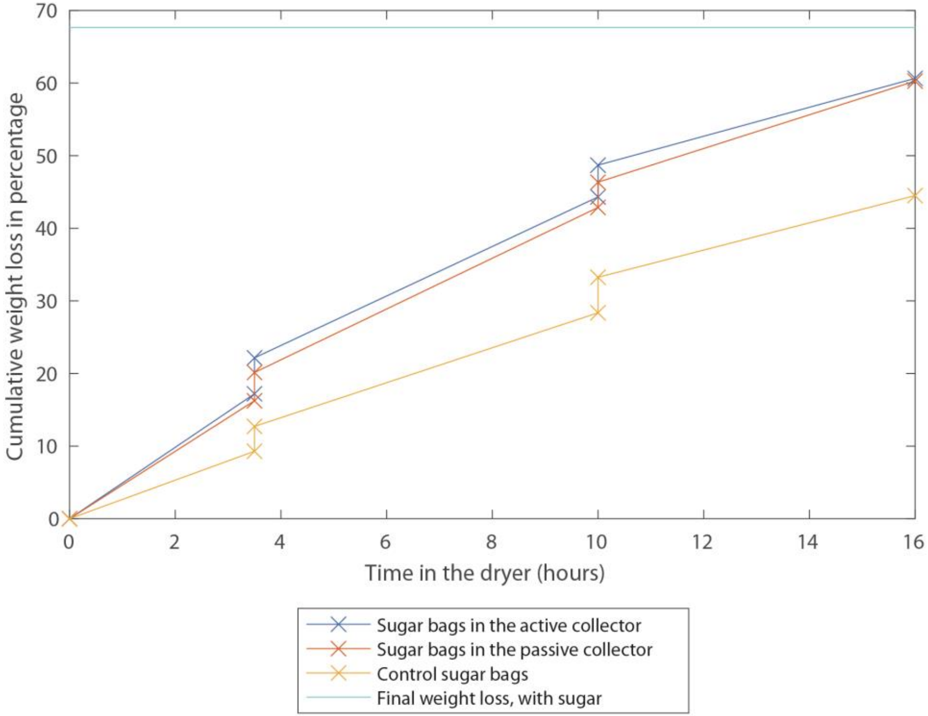
Passive dryer

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!