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The U.S. Government's Global Hunger & Food Security Initiative





FEED THE FUTURE INNOVATION LAB FOR HORTICULTURE

WEBINAR

Dry Chain – A solution to dried commodity losses due to moisture and humidity

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Storage
A key link in the dry chain

Michael Reid and Jim Thompson

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Storage – a key link in the dry chain

- Proper storage maintains quality of grains and pulses, slows development of rancidity and kernel darkening in nuts, and maintains vitality of seeds
- Prevents mold
- Stops insect damage
- Prevents rodent and bird attack

Poor storage!

Good storage?

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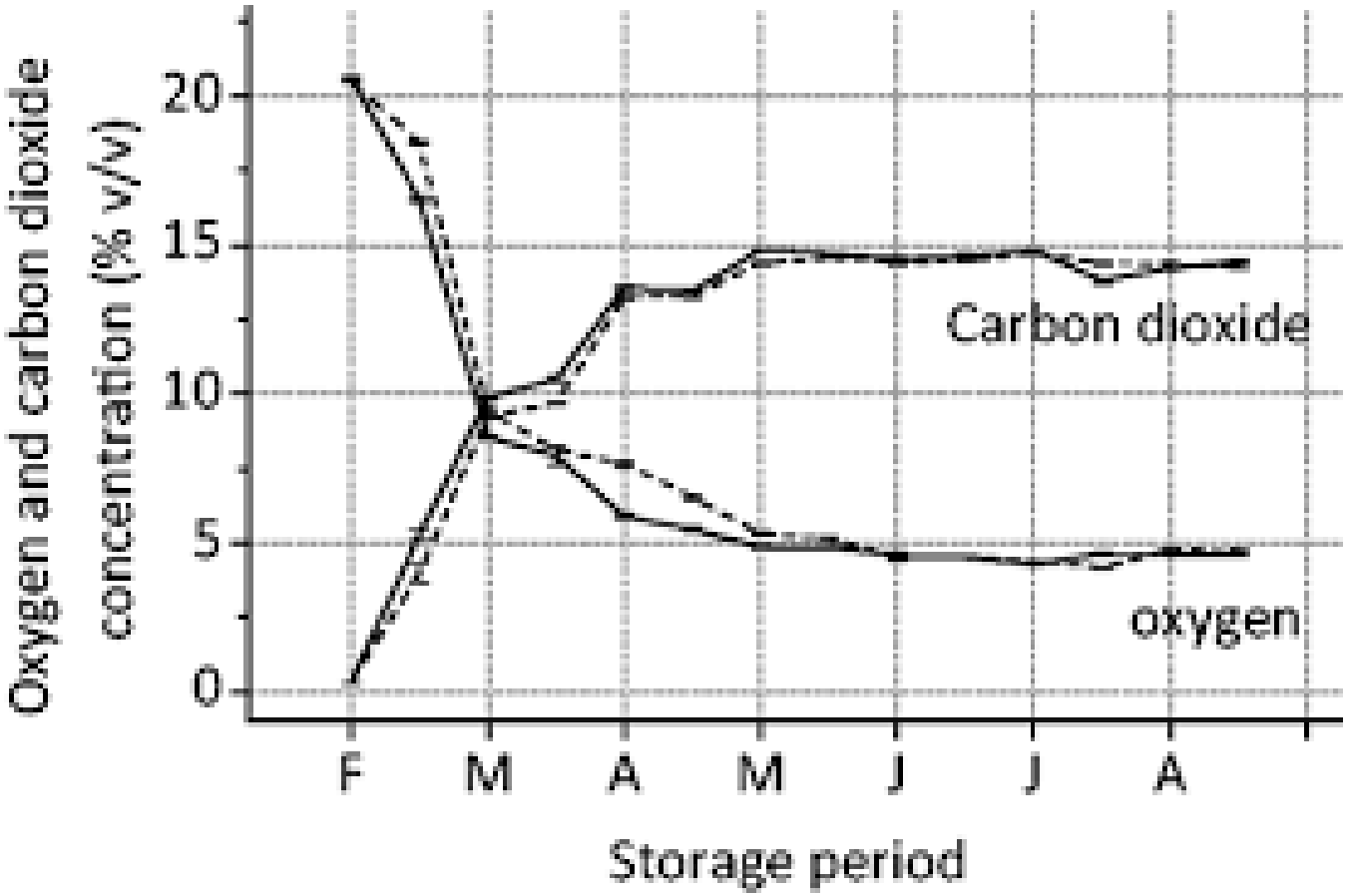
Maintain the dry chain!

- Storage below 0.65 water activity reduces insect attack and prevents fungal infection
- To prevent rehydration, store in hermetic containers
  - Sealed
  - Plastic bags or drums
  - Steel canisters or silos

Benefits of hermetic storage

- Hermetic storage bags, like the inner polyethylene liner of the Purdue PICS bags, are sealed
- Infesting insects rapidly deplete the available oxygen
- Low oxygen prevents additional insect damage and may reduce mold growth too
- The insects kill themselves!



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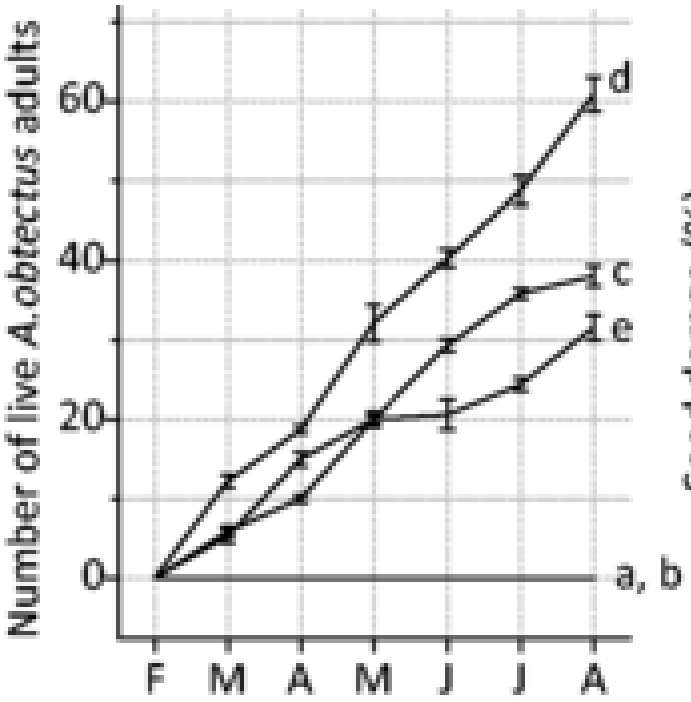

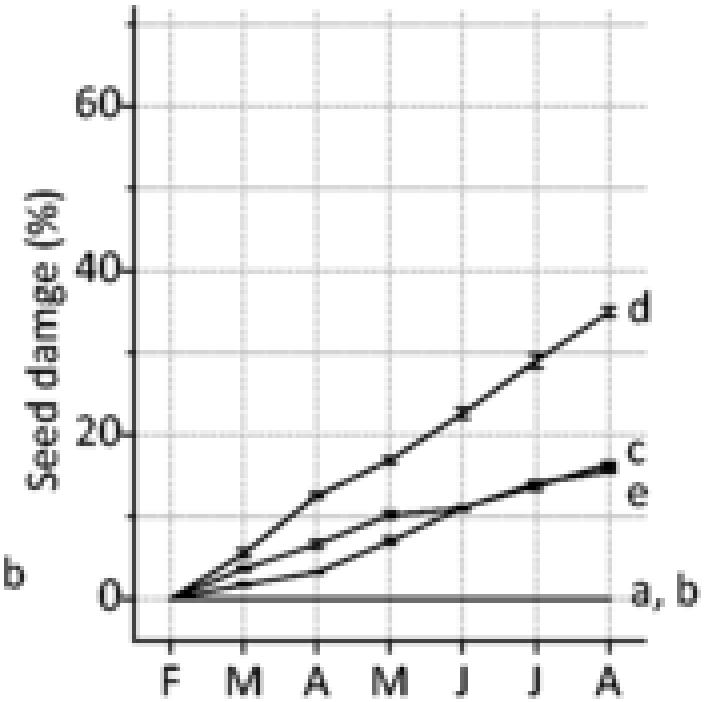

Storage period (February - August)

a: non-infested PICS
b: infested PICS
c: non-infested PP
d: infested PP
e: actellic-treated infested PP

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Key Concepts

- Storing products below 0.65 WA slows quality loss and prevents insect and decay damage.
- Hermetic storage can prevent insect infestation and mold growth by maintaining low WA and reducing the oxygen concentration
- Hermetic storage containers are an essential link in the dry chain

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Drying technologies

Michael Reid

Leader, Technology and Innovation

Horticulture Innovation Lab

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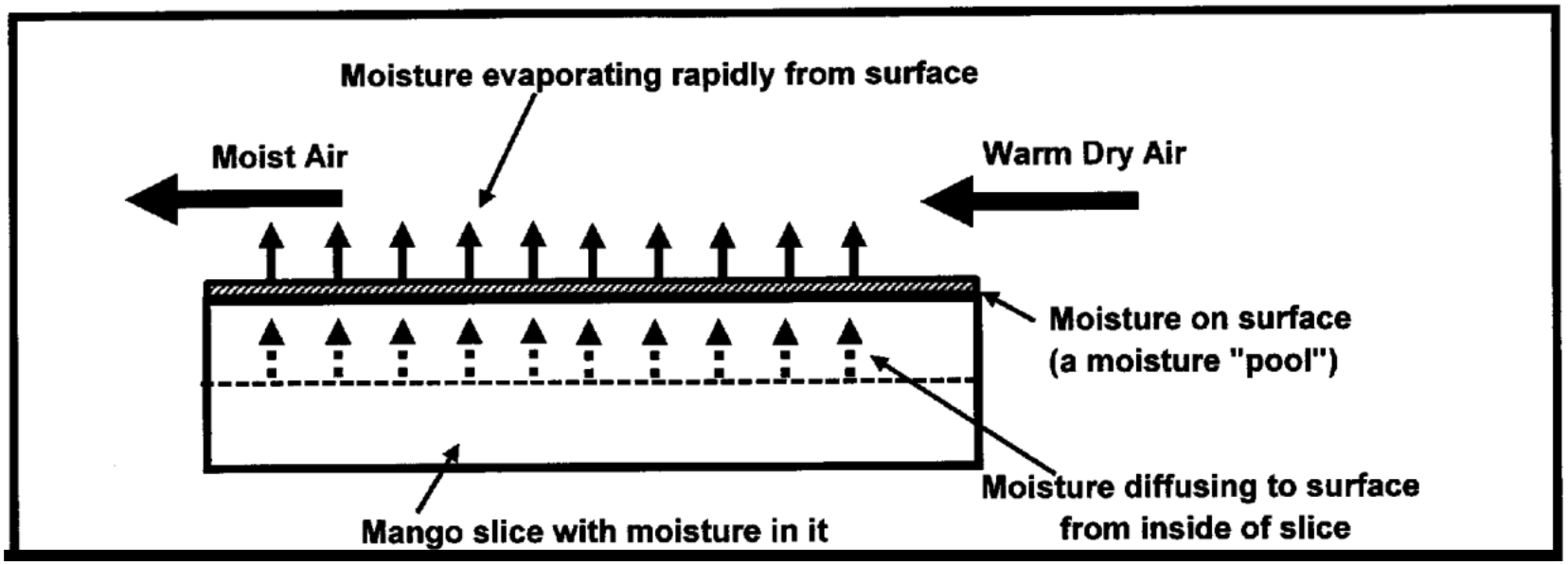
Open air drying is widely used

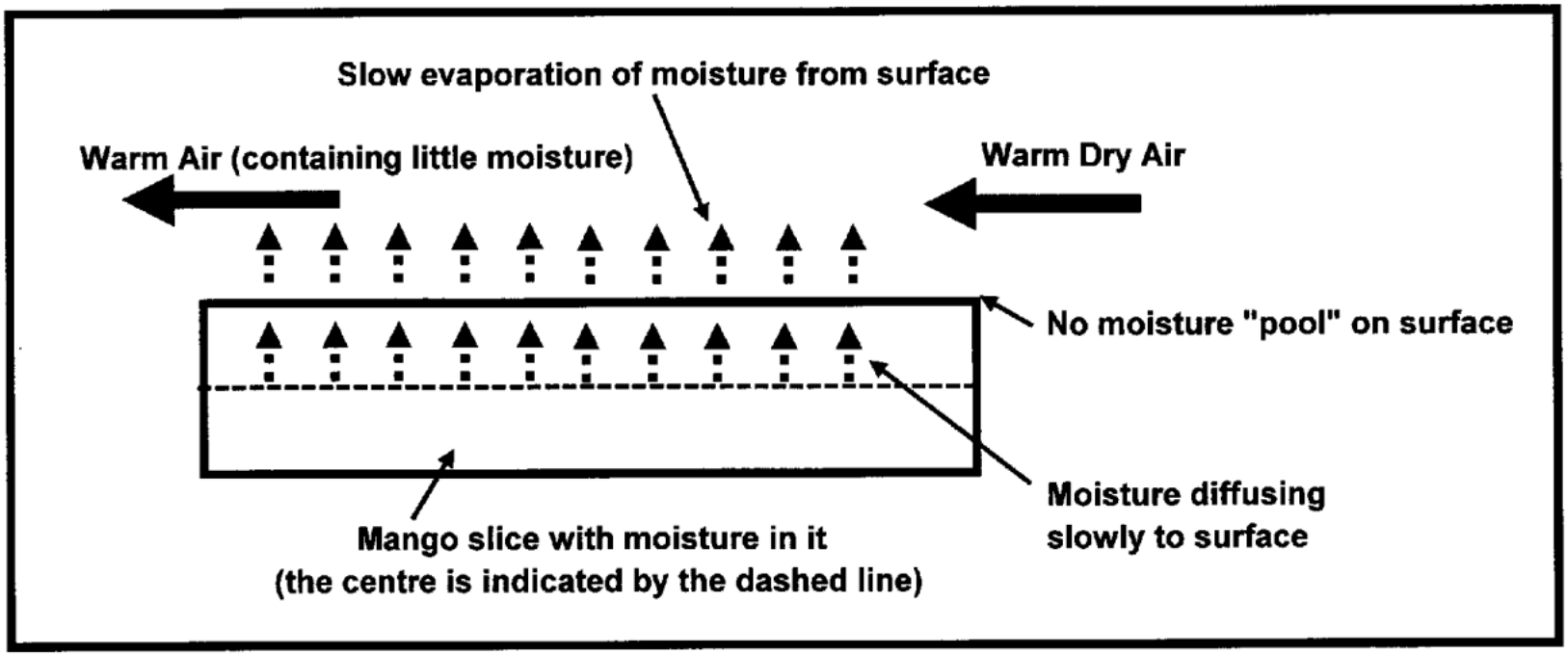
Problems with open air drying

- Rain – requires covering when rain threatens
- Birds, ducks, hens, RATS, mice
- Flies, wasps
- Dust, dirt, leaves
- Wind?
- Thieves?

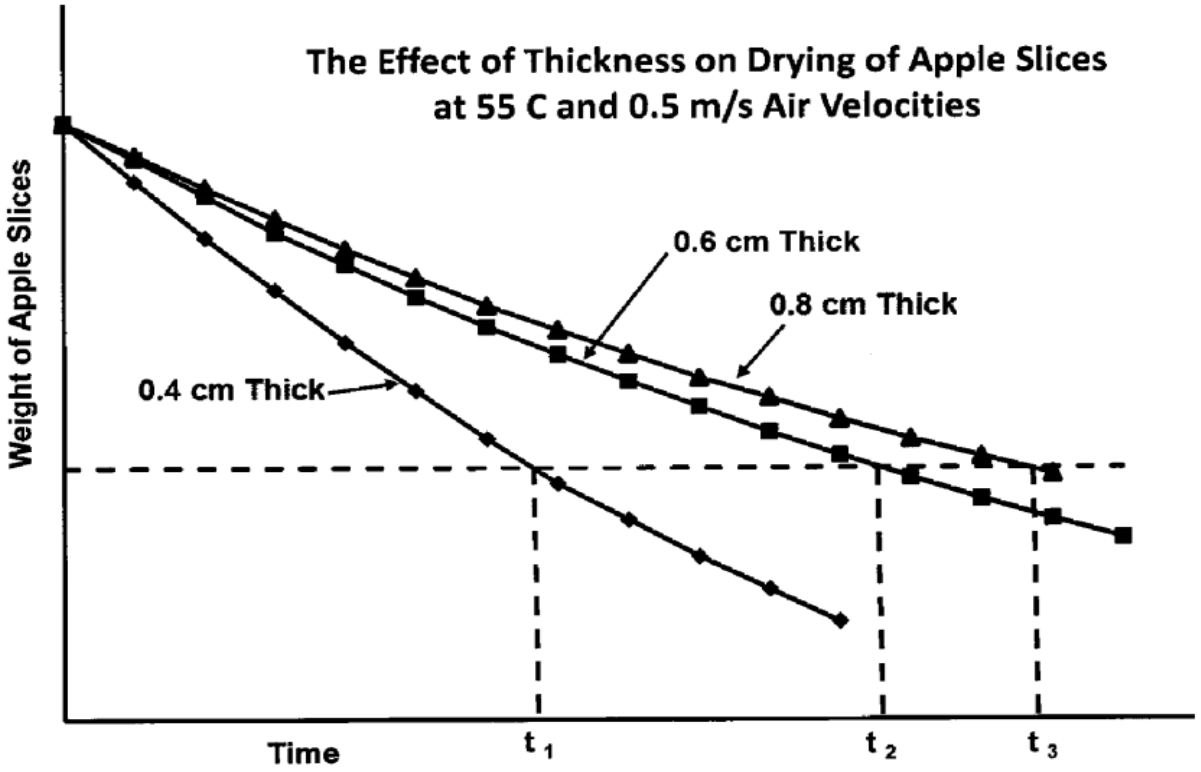
Initial drying of a fruit slice



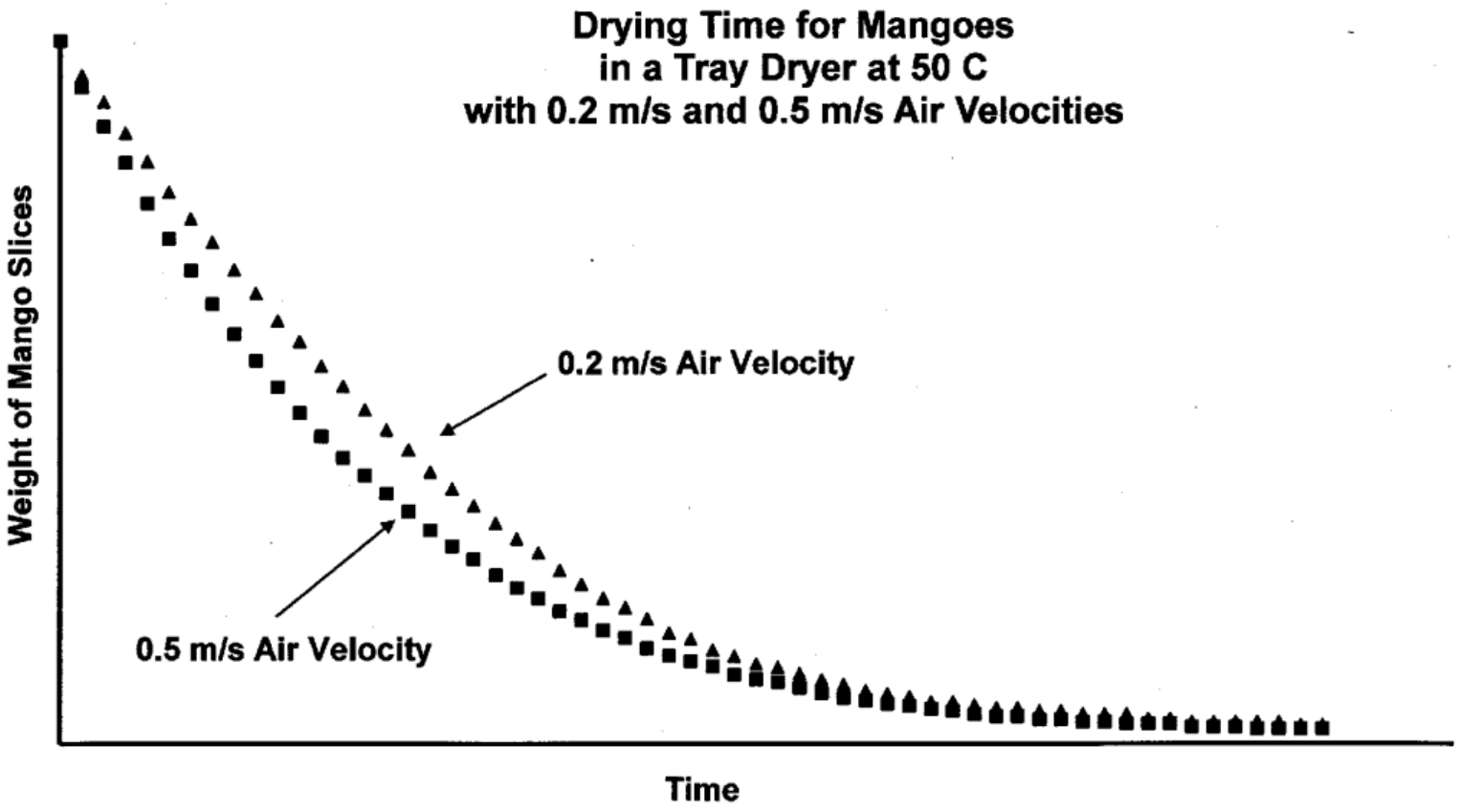
Late in the drying process



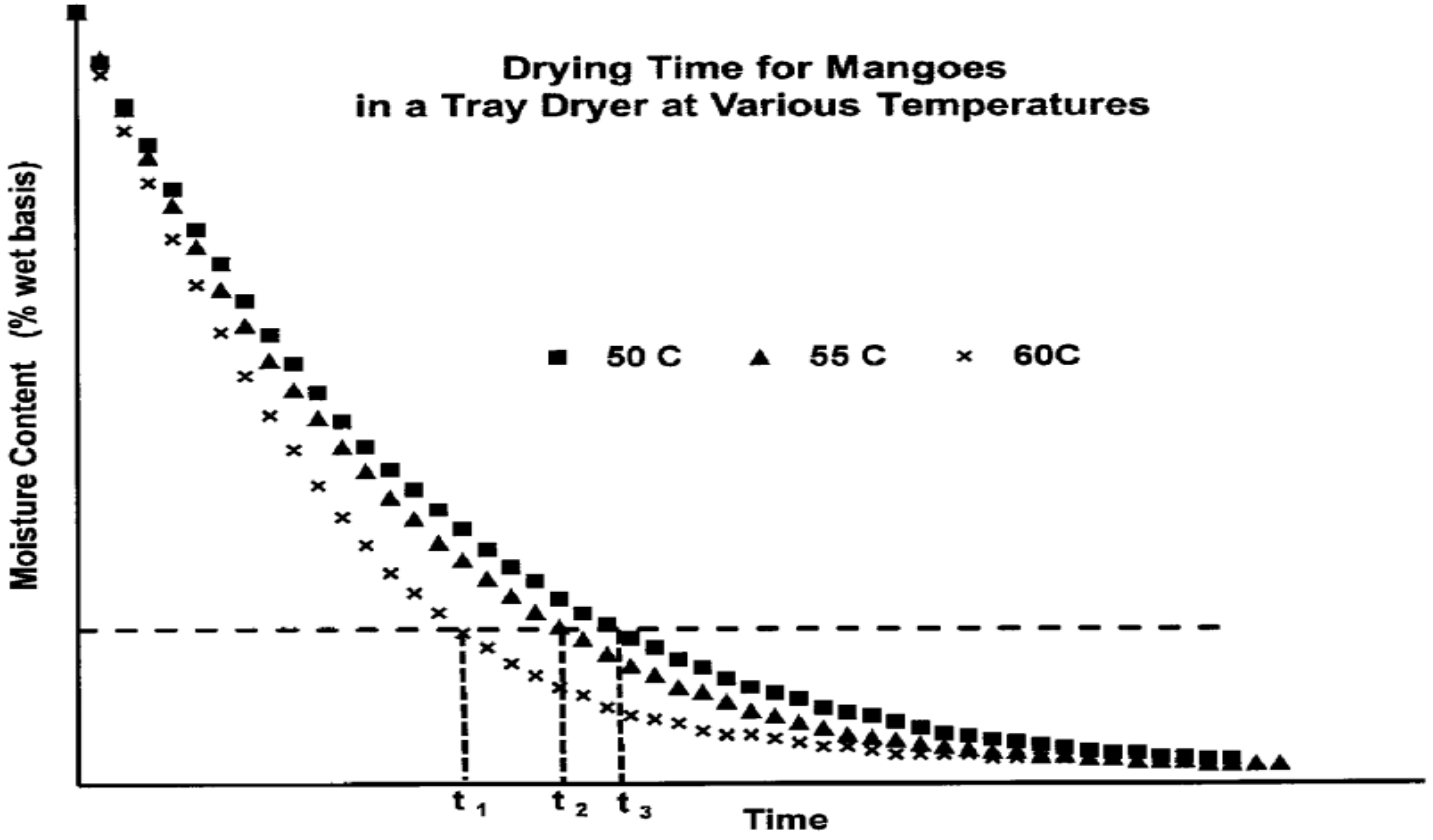
Effect of slice thickness



Effect of air speed



Effect of air temperature

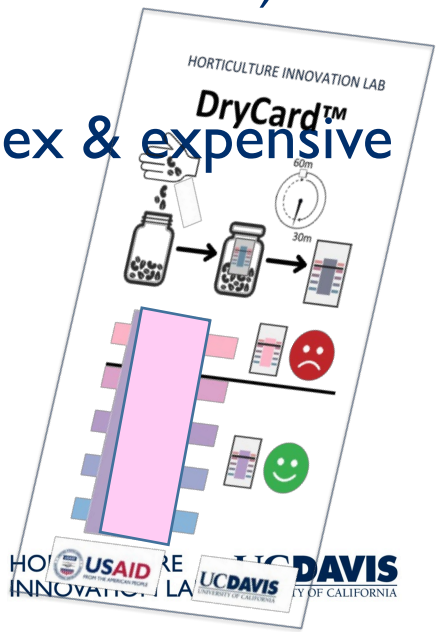


SO:

- Effective drying of high value commodities (fruit, vegetables, fish, meat) requires a system that provides:
- Thin layers
- Protection
- Air speed
- High temperature

Drying grains and pulses

- The problem
  - Frequently the DryCard shows farmers that their grain is insufficiently dry to be stored safely
  - How can they dry it?
  - On the ground (handling, rain, predation, contamination)
  - Chimney dryer (low capacity)
  - Current dryers (solar, gas, electric) are complex & expensive



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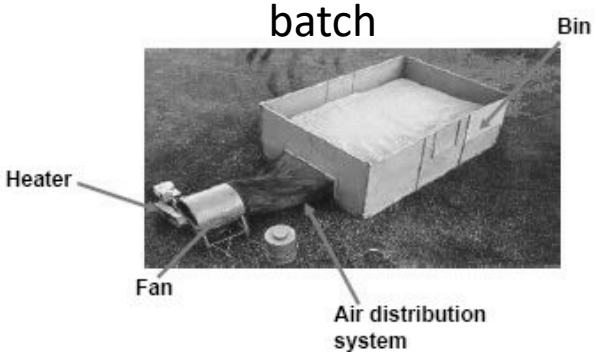
Dryer options (based on rice drying)

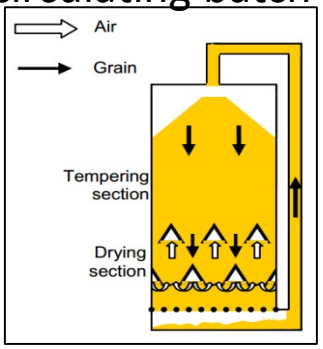
Dryer	Capacity	Dry time	Operation assumptions	Capacity (MT/day)
Sun dry	0.06 MT/m^3	2-4 days	17 m^3 area	0.25 – 0.5
Batch	1-10 MT	8-10 hrs	1 batch/day	1- 10
Recirculating batch	4-10 MT	8-10 hrs	1 batch/day	4-10
Column-continuous flow	10 MT/hr	5 passes	20 hrs/ day	40
Belt-continuous flow	10MT/hr	5 passes	20 hrs/day	40

sun

batch

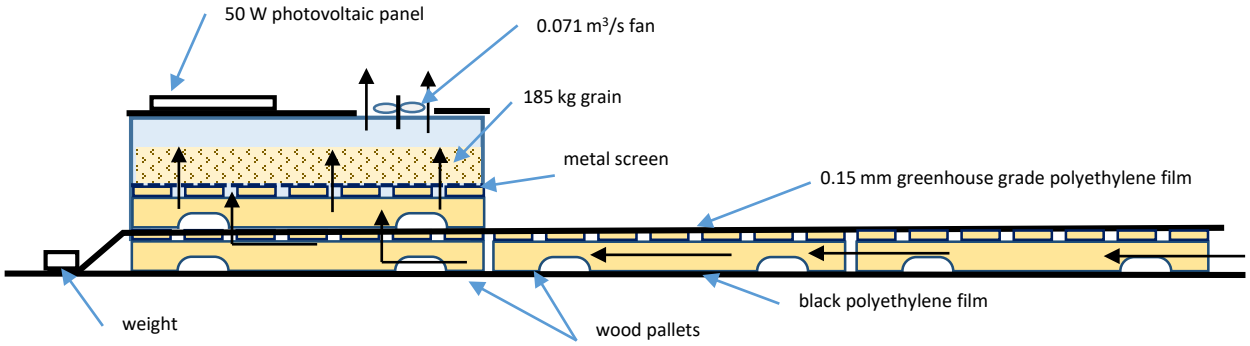


recirculating batch



The UC Davis Pallet Dryer

- We have developed a simple solar dryer that uses inexpensive materials
  - discarded wooden pallets and a sheet of plywood
  - clear and black plastic
  - a small solar panel and fan
- Estimated cost <US$100



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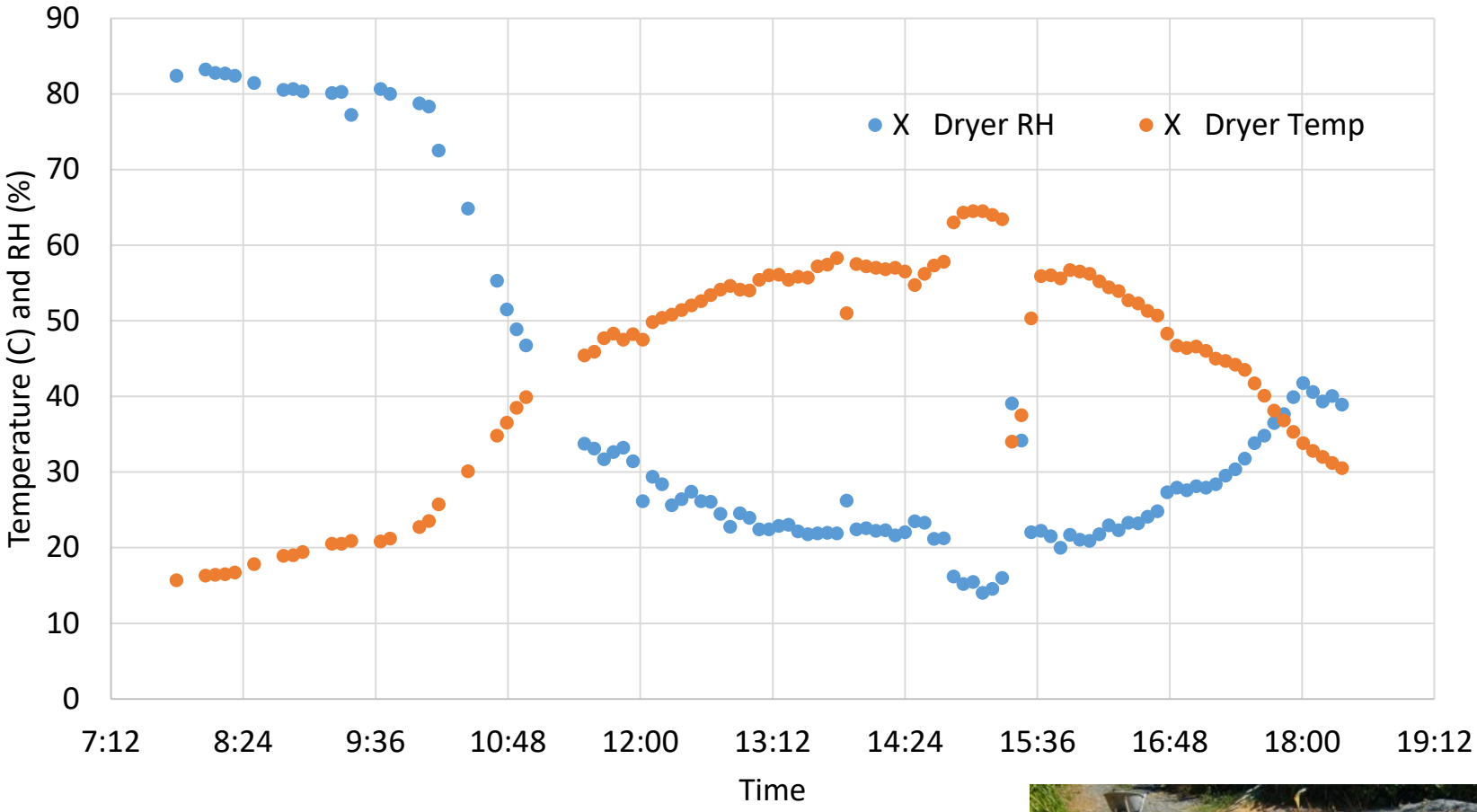
90
80
70
60
50
40
30
20
10
0
Temperature (C) and RH (%)
X Dryer RH
X Dryer Temp
7:12
8:24
9:36
10:48
12:00
13:12
14:24
15:36
16:48
18:00
19:12
Time