PERFORMANCE OF UC DAVIS CHIMNEY DRYER ON DRYING AND QUALITY OF DIFFERENT VEGETABLES

M. Ashraful Islam*, S. Pias and M. A. Rahim

***M. Ashraful Islam, PhD**
Professor, Dept of Horticulture
Bangladesh Agricultural University
Mymensingh
Cell phone: +8801716807130
E-mail: ashrafulmi@bau.edu.bd

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HORTICULTURE INNOVATION LAB

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Background

- Vegetables are highly nutritious and profitable crops
- More than 100 types of vegetables of indigenous and exotic origin are grown in Bangladesh.
- The moisture content of fresh vegetables is higher than 80% (Orsat et al. 2006).

This causes vegetables to be a perishable crop incurring high postharvest losses (9-25%)

- Excess amounts of vegetables are not used for consumption due to various reasons

-Farmers are compelled to sell their product at low prices due to limited storage options which exacerbates malnutrition

Background: Malnutrition in Bangladesh

- 31% of children under age 5 are stunted
- 8% are wasted, and
- 22% are underweight
- Anaemia (women, 18-49 yrs): 39.9%
- 24% of women have BMI (Body Mass Weight) <18.5

(Healthy range of BMI is 18.5 to 24.9)

BDHS, 2017

Objectives

- Drying methods vary from simple to very sophisticated
- Properly dried, they can last for a long time.

Our goal of this experiment was to

- Test the UC Davis Solar Chimney Dryer under humid climatic conditions
- Improve storage options for vegetables by using drying as an alternative
- To support the availability of vegetables year round
- To create an opportunity to improve the nutrition and economic security for the nation.

Methodology

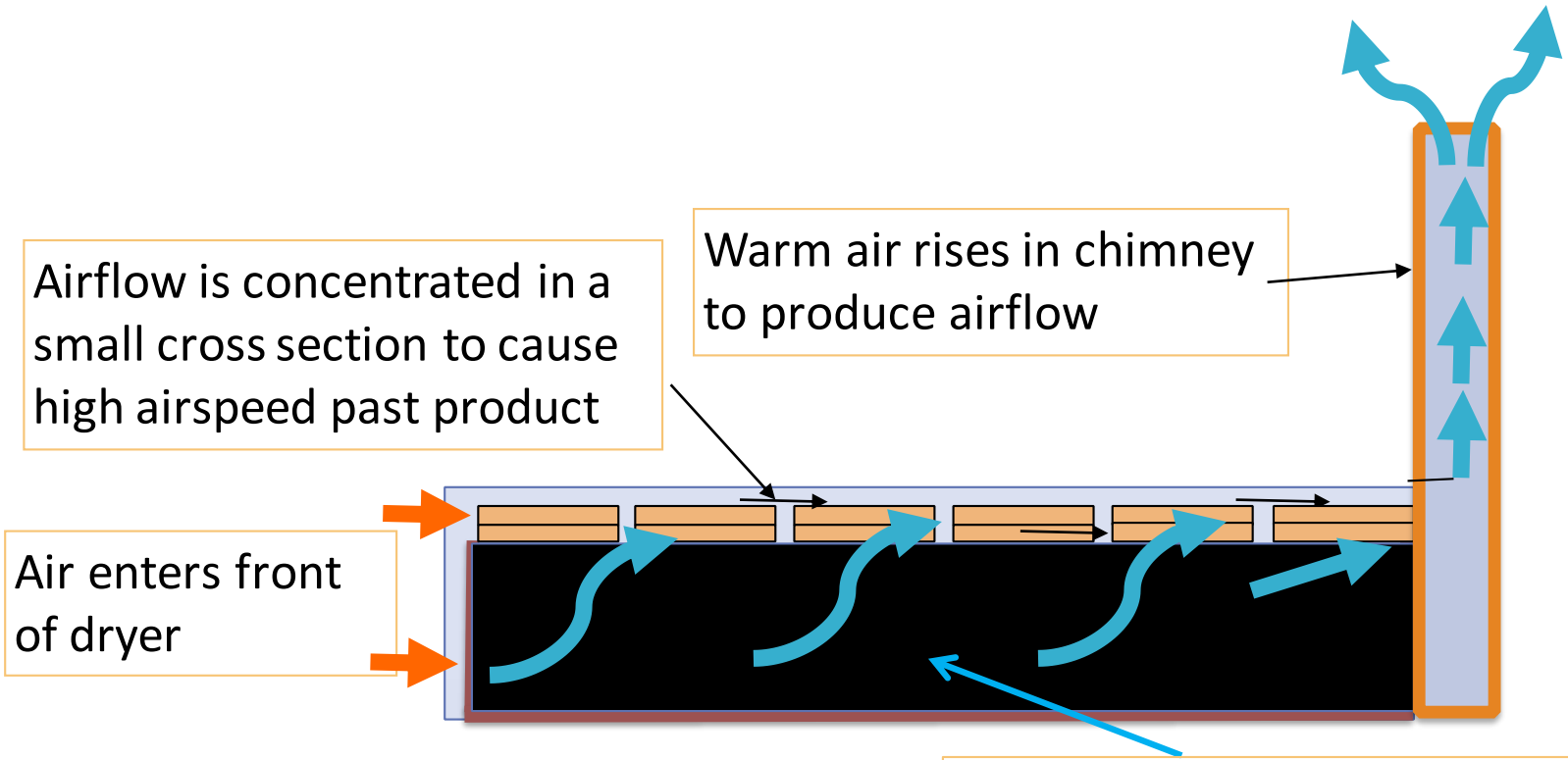
Chimney

Drying Table

Drying Table covered with black plastic

Preparation of UC Davis solar chimney dryer

Methodology: Principles of air flow in the UC Davis Chimney Dryer



Source: Michael Reid, Angelos Deltsidis

Preparation of fresh carrot for drying

Fresh carrot

Peeled
(Without skin)

Unpeeled
(With skin)

Drying of carrot under UC Davis Chimney dryer vs open sun drying

Drying under UC Davis Solar Chimney dryer conditions

Drying of carrot under open sun conditions

Preparation of fresh brinjal for drying

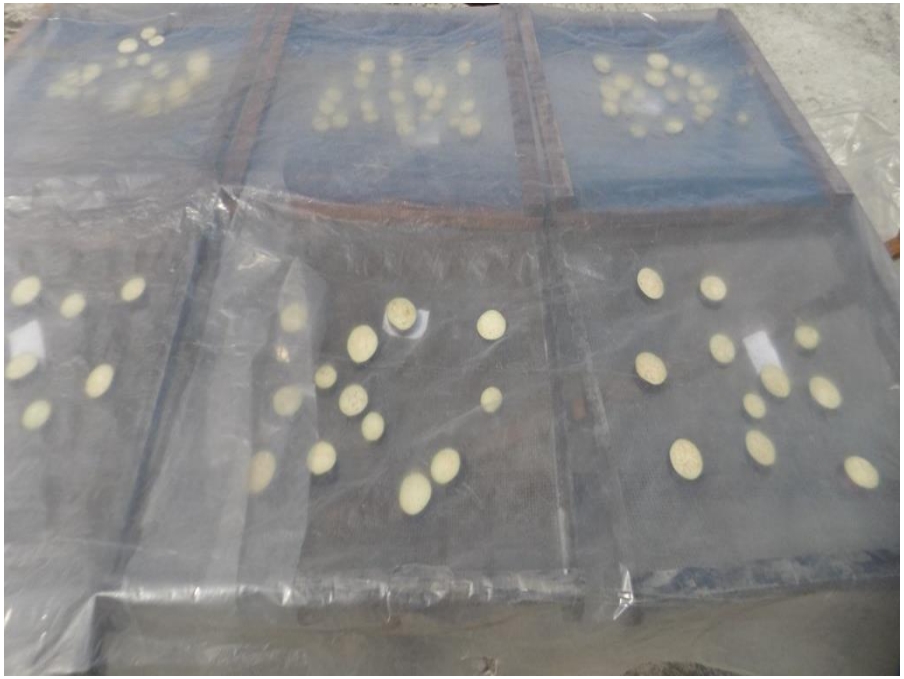
Fresh brinjal

1 cm slice of brinjal

2 cm slice of brinjal

Drying of brinjal under UC Davis Chimney Dryer and open sun drying conditions

UC Davis Chimney dryer



Open sun drying under net

Results

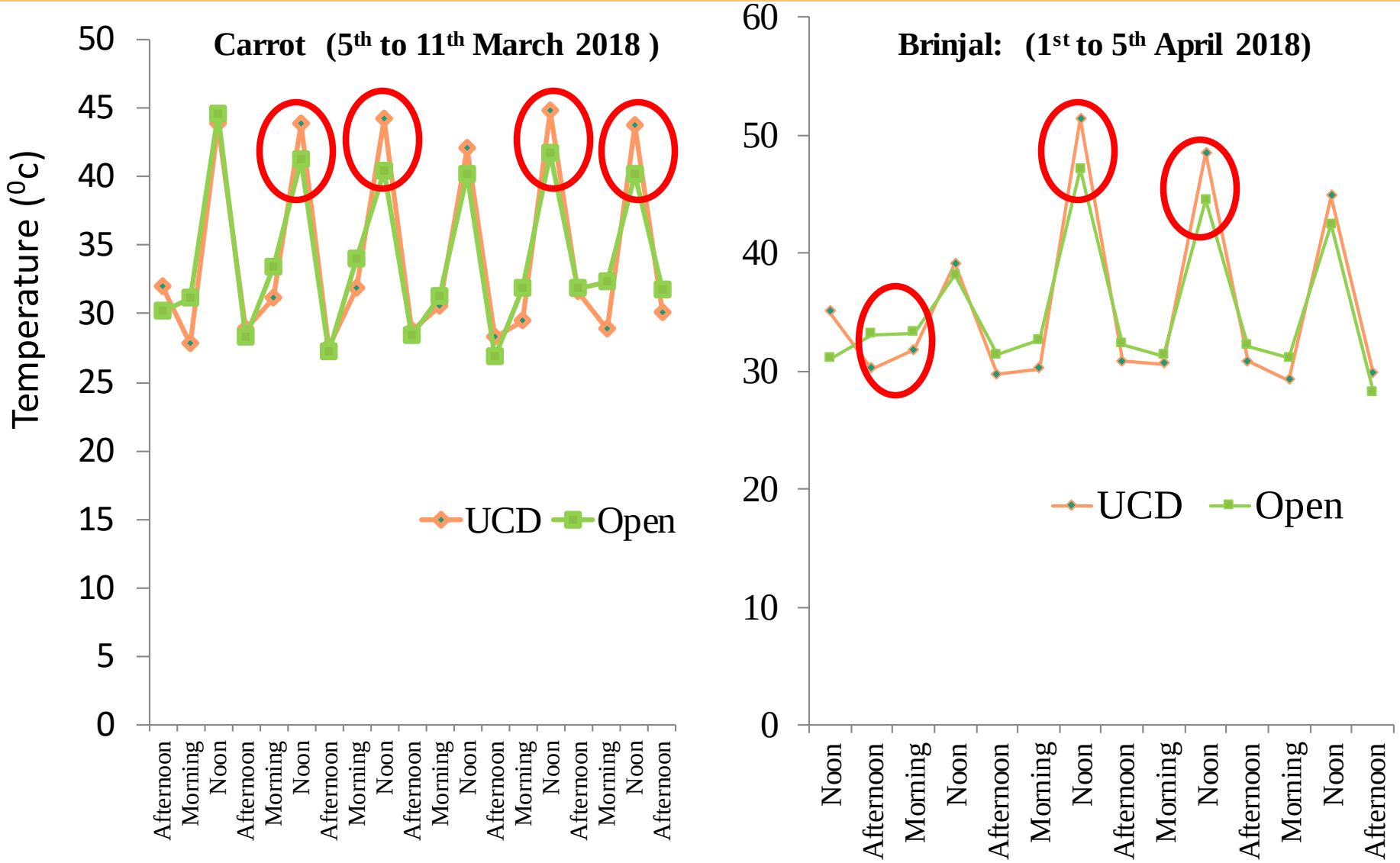
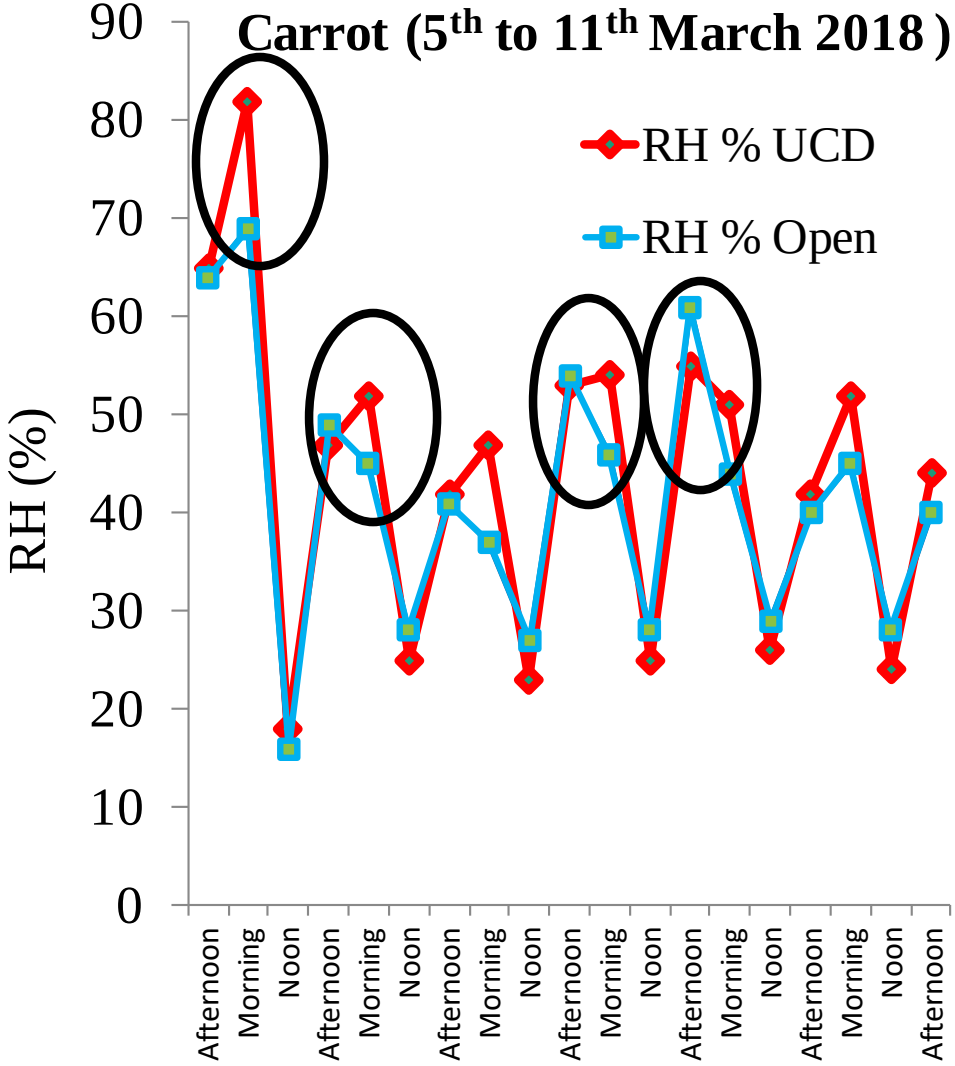


Figure: Temperature variability (^{0}C) in UC Davis solar chimney dryer and open sun dryer condition

Results



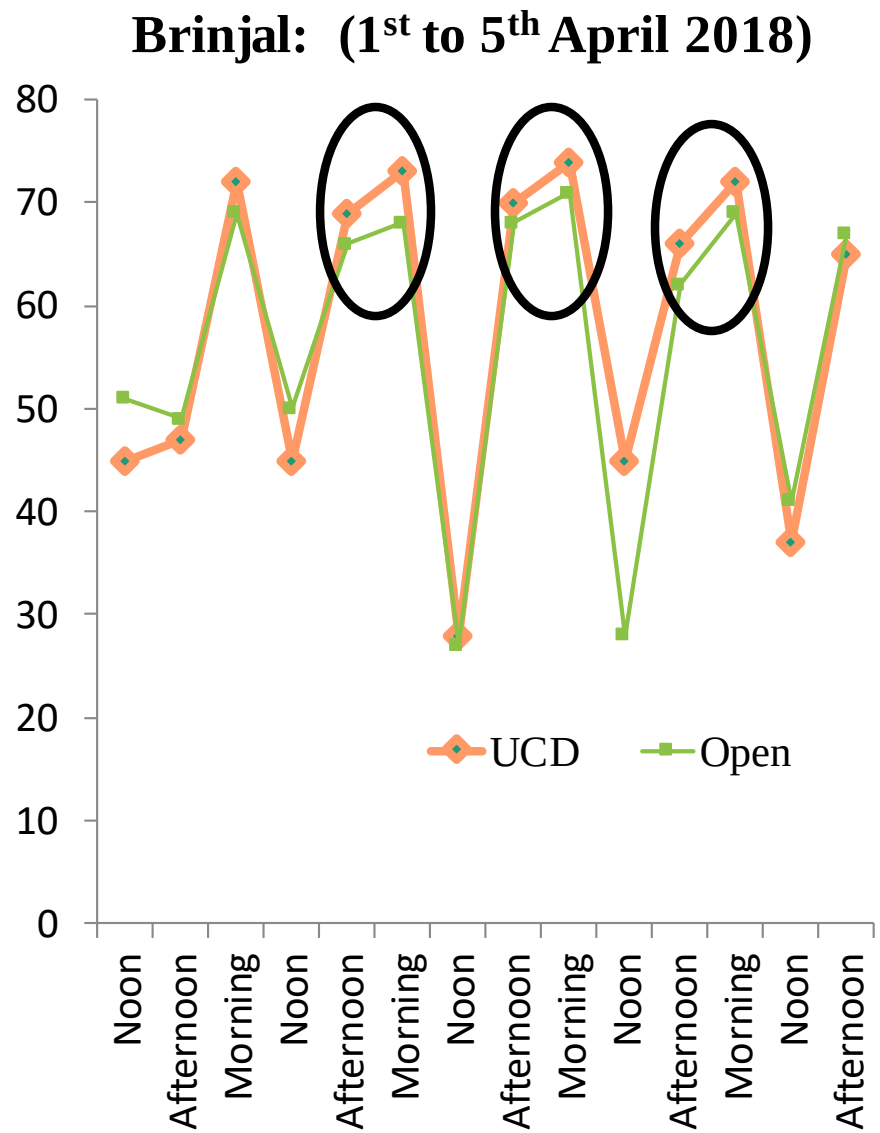
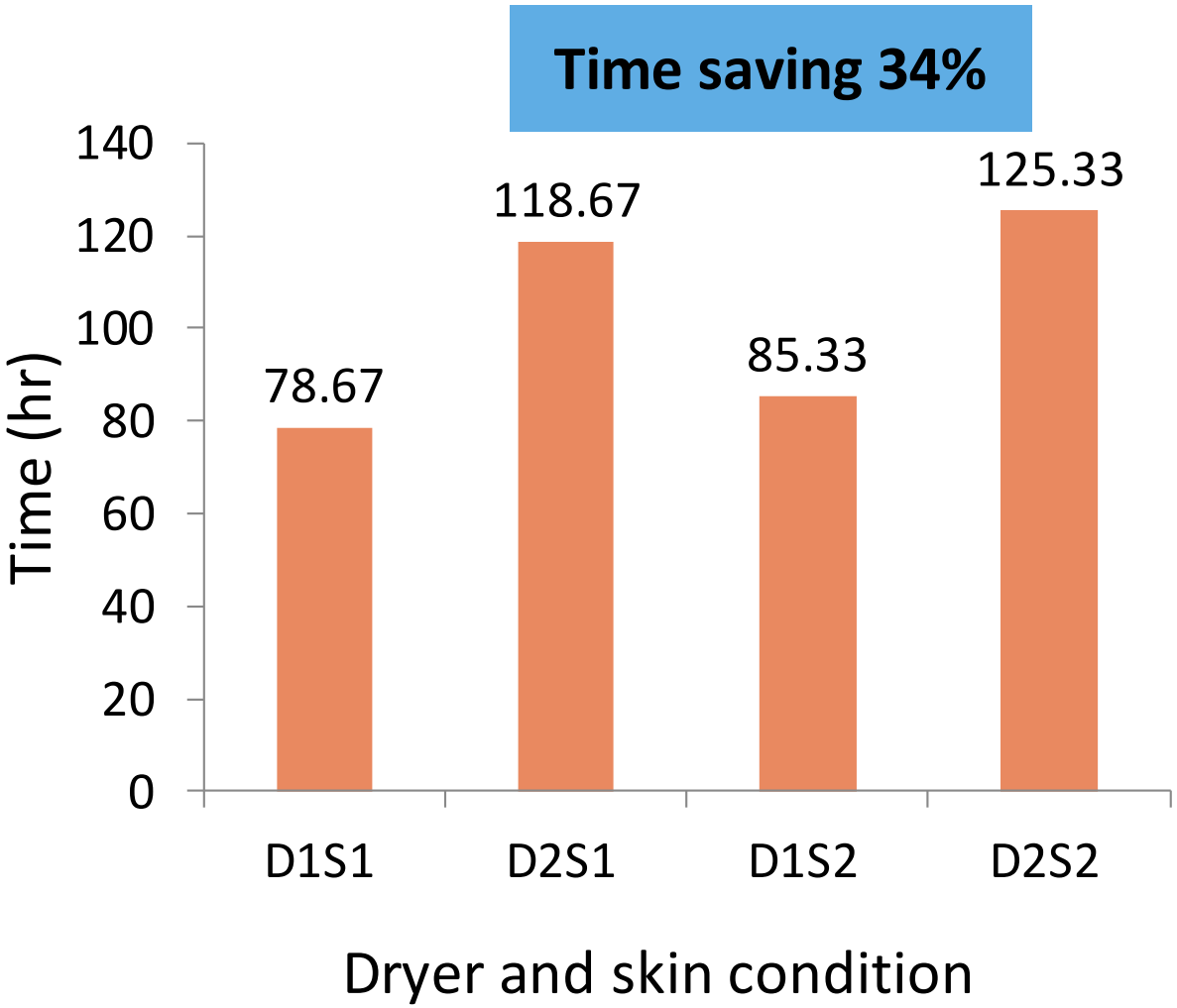


Figure: Relative humidity levels (%) in UC Davis chimney dryer and open sun dryer condition

Results

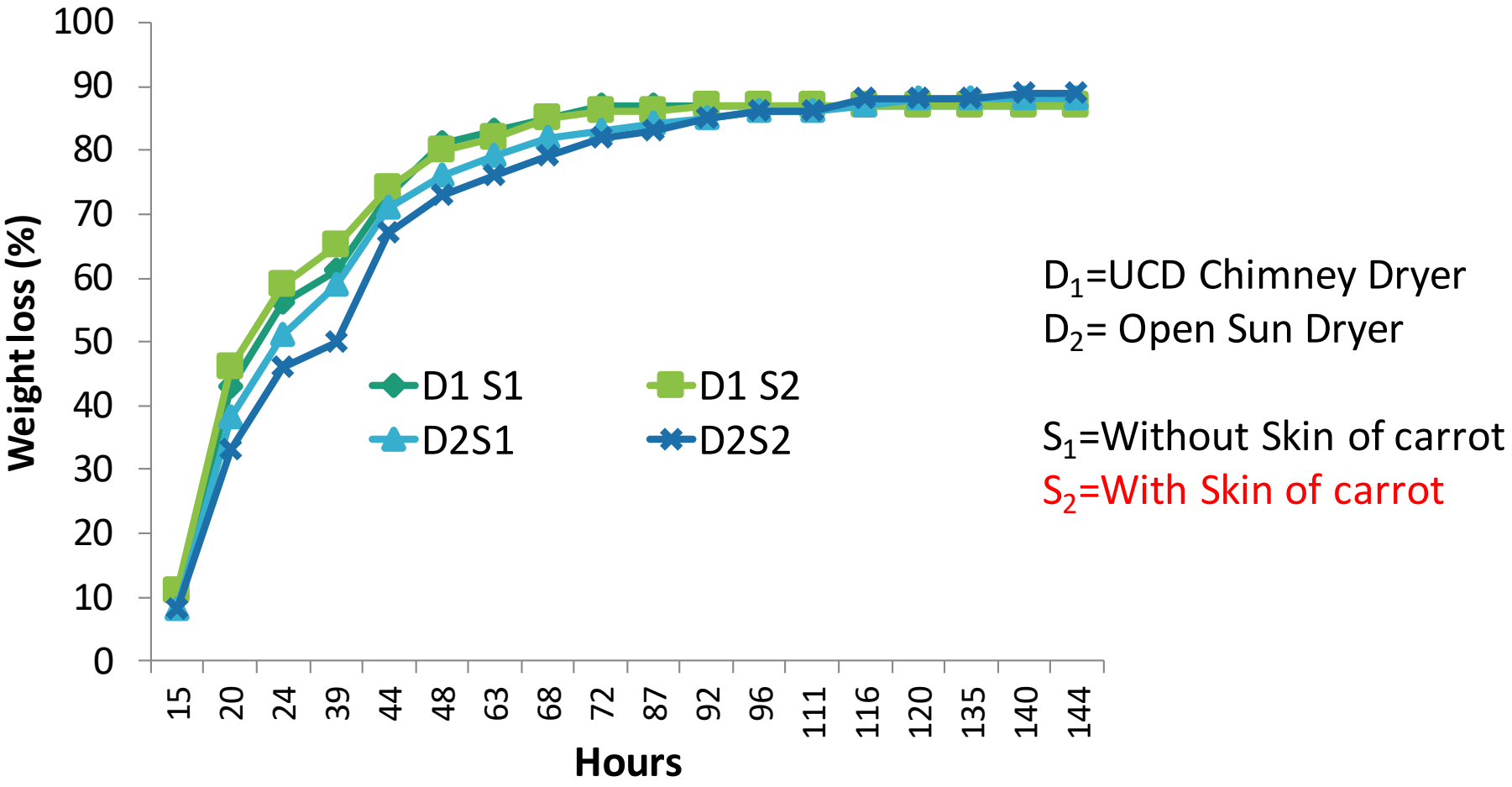


D_1=UCD Chimney Dryer
D_2= Open Sun Dryer

S_1=Without Skin of carrot
S_2=With Skin of carrot

Figure: Combined effect of dryer and skin condition on the required time to dry of carrot

Results



D_1=UCD Chimney Dryer

D_2= Open Sun Dryer

S_1=Without Skin of carrot

S_2=With Skin of carrot

weight loss (%) of the carrot

Results

Mineral and nutrient contents of dried carrot

Dryer	% Protein	% P	% K	% S
D_1	6.07 a	36.08 a	1.88 a	0.07 b
D_2	7.23 a	41.47 a	1.91 a	0.13 a

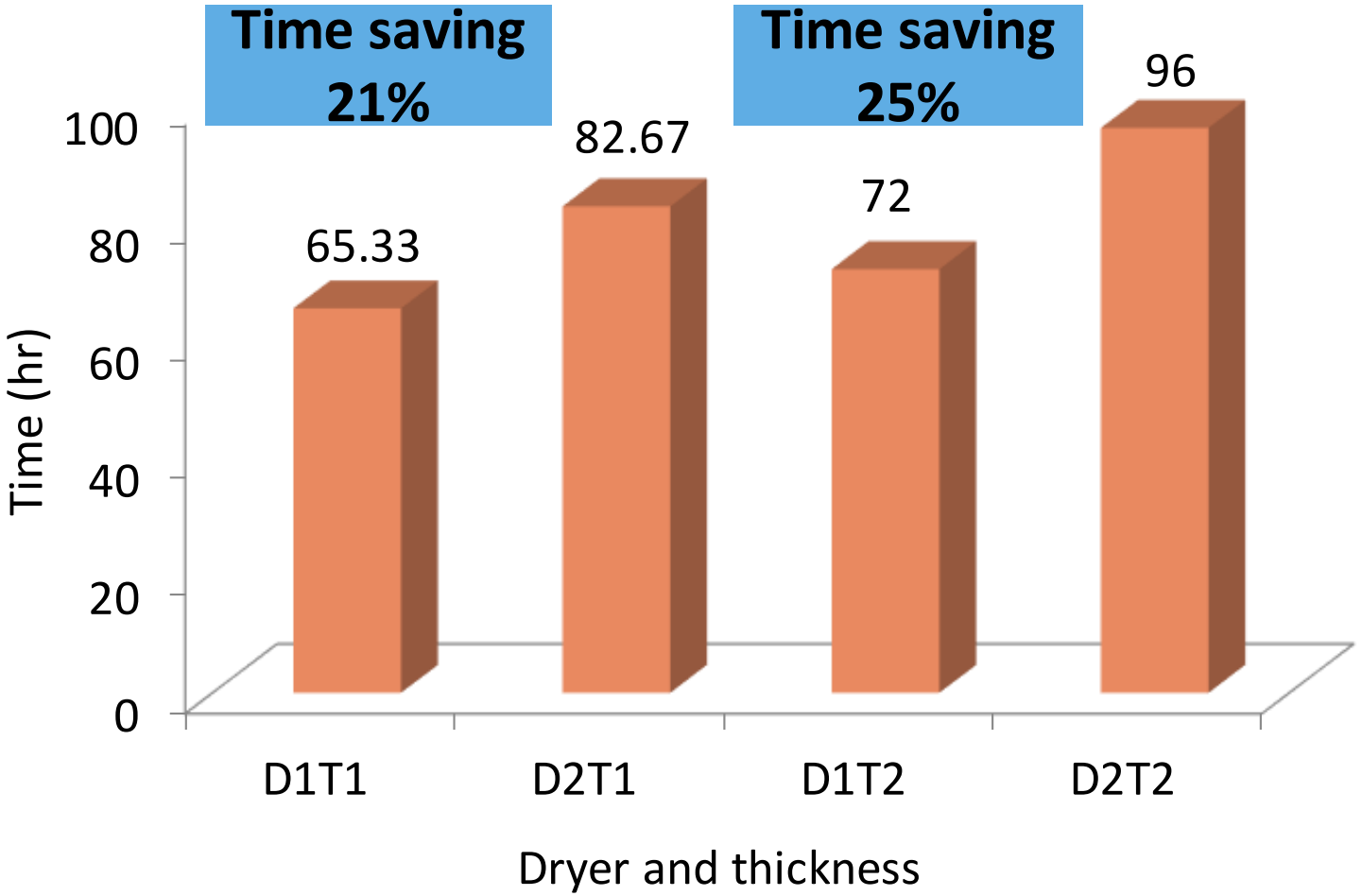
D_1= UC Davis Chimney Dryer

D_2= Open Sun Dryer

Without skin of carrot

With skin of carrot

Results

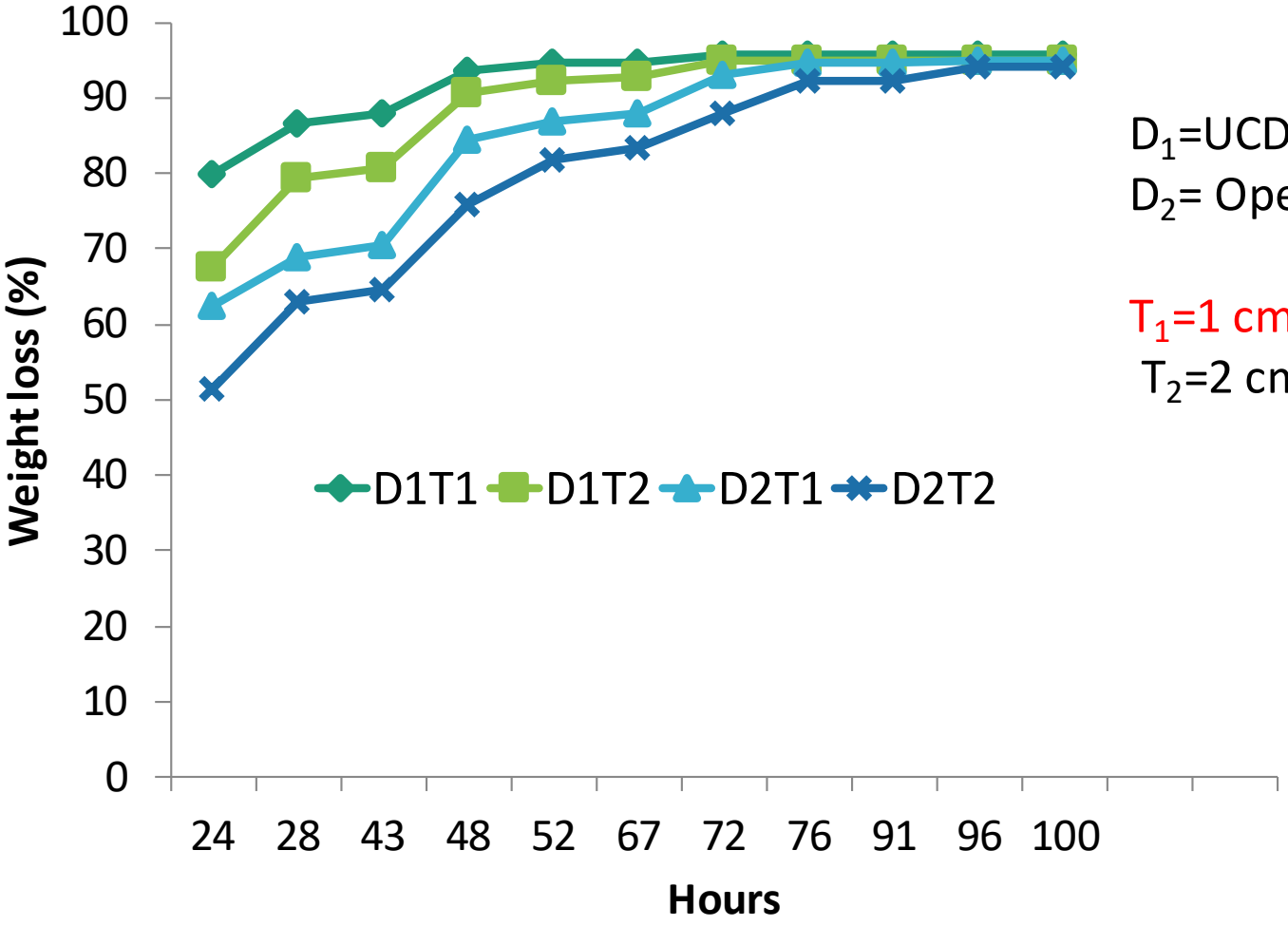


Required time to dry (hr) Brinjal

D_1=UCD Chimney Dryer, D_2= Open Sun Dryer

T_1=1 cm slice thickness, T_2=2 cm slice thickness

Results



D_1=UCD Chimney Dryer

D_2= Open Sun Dryer

T_1=1 cm slice thickness

T_2=2 cm slice thickness

Weight loss (%) of brinjal

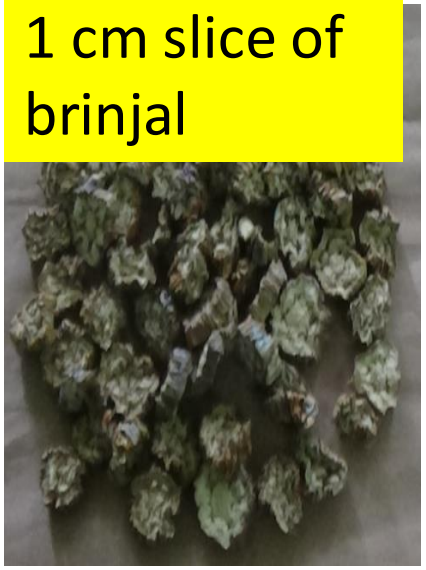
Results

Nutrient and different mineral contents of brinjal

Dryer	% Protein	% P	% K	%S
D_1	3.27 a	43.02 a	1.93 b	0.21 a
D_2	4.20 a	52.96 a	2.92 a	0.21 a

D_1= UC Davis Chimney dryer
D_2= Open sun dryer

1 cm slice of brinjal



2 cm slice of brinjal

Conclusions

- Repeated observations of carrot samples after drying and storage, showed that removing the skin prior to drying has better visual quality and meets consumer demands.
- Brinjal sliced at 1 cm thickness was more appropriate for drying compared to 2 cm slices.

•Protein, phosphorus, potassium and sulphur content of carrot and brinjal quality was similar under both dryer, although the S content in carrot was found higher under UC Davis chimney dryer.

•Overall, UC Davis chimney dryer was efficient and improved drying speeds compared to open sun drying conditions.

Chimney dryer is inexpensive, and efficient

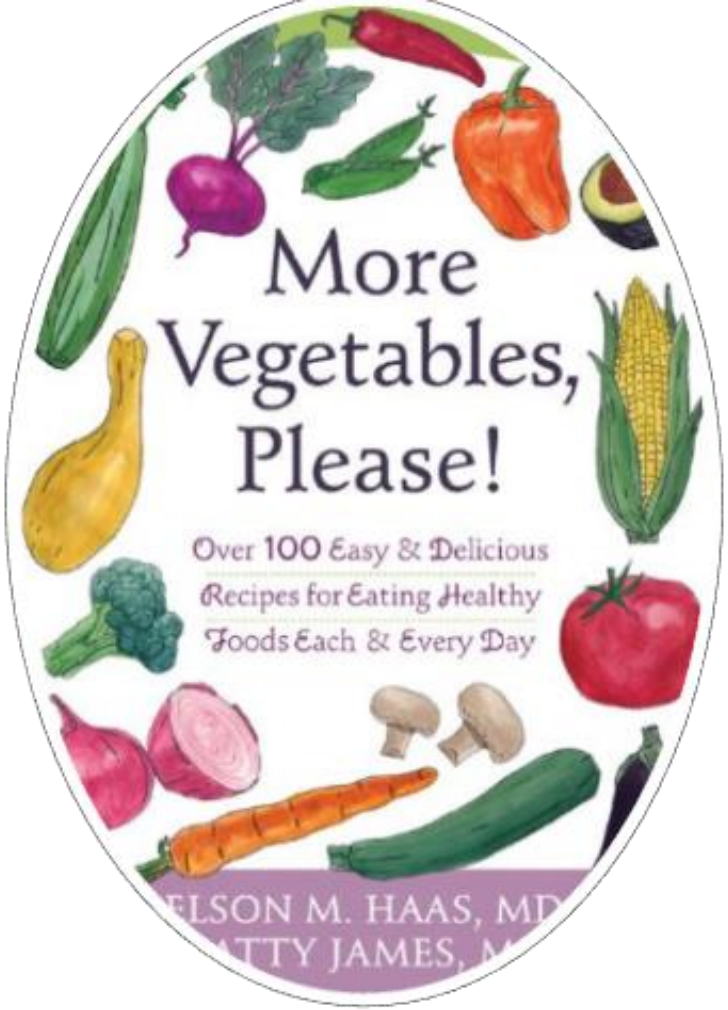
	Chimney Dryer	Cabinet Dryer
Capital cost ($)	38.93	58.84
Fruit capacity, fresh weight (kg)	4.5	2.25
Time to dry fruit to 10% MC (11h days)	2.0	5.5
Cost per drying capacity ($/kg-day)	7.33	26.66
Average air temperature leaving dryer - ambient (°C)	15.2	9.3
Air velocity past fruit (m/s)	0.63	0.11

Study of Kasetsart University, Thailand

Acknowledgements

- Bangladesh Agricultural University (BAU)
- USAID-Bangladesh
- Nutritional Innovation Lab
- Horticulture Innovation Lab

THANKS TO ALL



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