



Fruit and Vegetables
for Sustainable
Healthy Diets



Improved postharvest management of indigenous vegetables in the Philippines

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(for my colleagues at University of the Philippines Mindanao
and the University of the Philippines Los Banos)

Our Filipino partners

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The Filipino situation...

The Philippines is a large group of individual islands

- ▶ Transport often requires a ferry
- ▶ Islands are mountainous and roads may be poor

The climate is tropical

- ▶ Daily temperatures are 30 to 35°C and humidity is high
- ▶ There is little or no refrigeration

The UN estimates that nearly 51 million Filipinos are food insecure

- ▶ Highest in SE Asia

Vegetable consumption is extremely low

- ▶ Average 58g of vegetables and 17g fruit daily (WHO recommends 400g daily)
- ▶ Many people don't like vegetables, but prefer chicken and rice



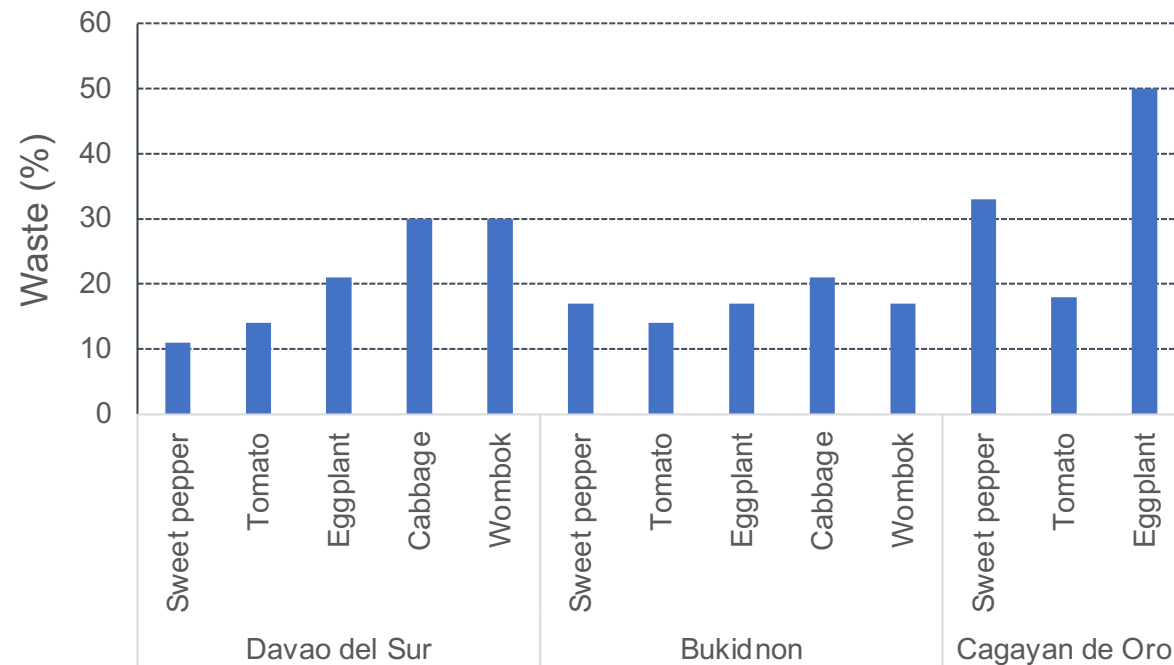
The Filipino situation

Postharvest losses are **HIGH**

- Usually estimated at 30% but can be 50% or more
- Both total loss and loss of value



Estimated market losses



Actual total loss
(UPMin data)



Potential low-cost cooling solutions

CoolBot

- Turns a normal air conditioner plus insulated room into a cold room



Evaporative cooling

- Uses evaporation from a permeable surface (e.g. bricks) to reduce temperature and increase relative humidity



Ice cooler

- A simple, short term storage option for store holders



Other ideas tested

Packaging

- ▶ Plastic wrap or bag
- ▶ Perforated plastic film
- ▶ Banana leaves
- ▶ Paper



Dips and solutions

- ▶ Benzylaminopurine (BAP) (*a plant hormone that stimulates cell division*)
- ▶ Salicylic acid / acetyl salicylic acid (*elicitor of plant defences and precursor of aspirin*)
- ▶ Water or solution applied as a dip OR in a holding solution

Moringa /
drumsticks
(*Moringa oleifera*)



Indigenous vegetables of the Philippines

Indigenous vegetables can sustain local economies, enhance human nutrition and health, preserve cultural heritage, and improve climate and crisis resilience

Indigenous Filipino vegetables include ;



Edible fern or 'pako'
(*Diplazium
esculentum*)



Water spinach or
'kangkong' (*Ipomoea
aquatica*)



Sweet potato
tops (*Ipomoea
batatas*)



Saluyot or jute
(*Corchorus olitorius*)



Alugbati
(*Basella alba*)



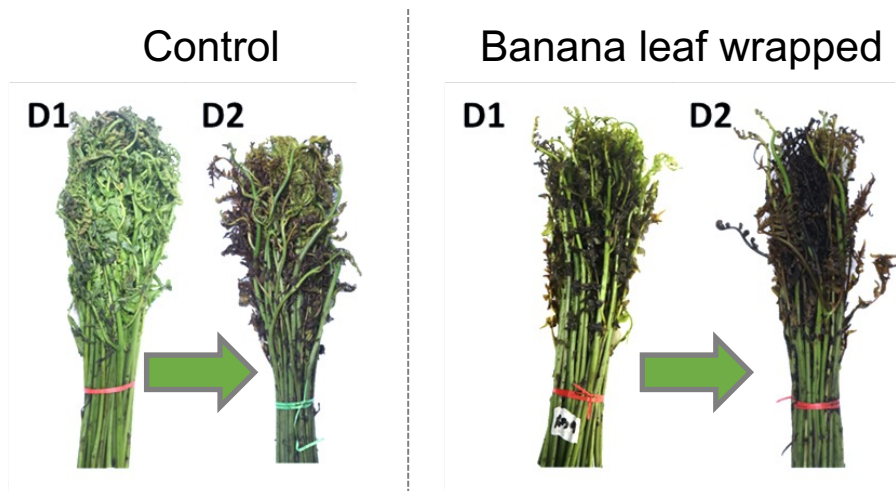
Watercress
(*Nasturtium
officinale*)

Edible fern

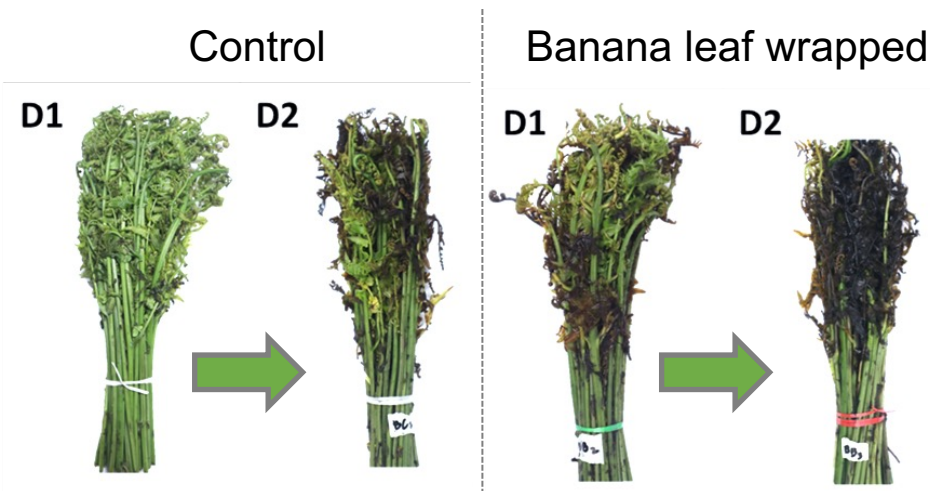
Extremely short storage life – Fronds wilt and blacken within one or two days under ambient conditions

- ▶ The evaporative cooler at UP Mindanao reduced weight loss and resulted in better, although not saleable, quality after 2 days
- ▶ Wrapping with banana leaves **increased**, not decreased, blackening due to rots

AMBIENT CONDITIONS



EVAPORATIVE COOLER

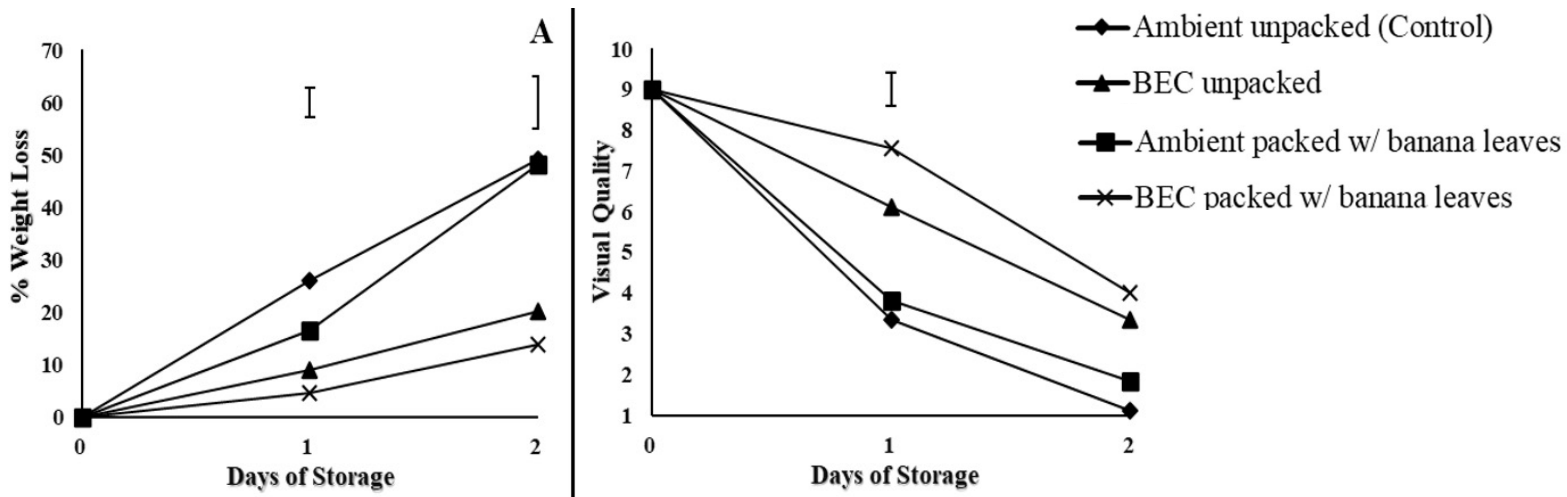


UPMin data

Moringa

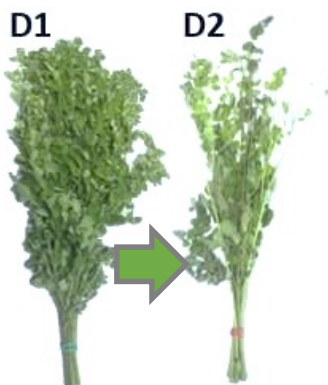
Evaporative cooling plus banana leaf wrapping increased saleable life of Moringa from 1 to 2 days

► Plastic was not tested



AMBIENT CONDITIONS

Control

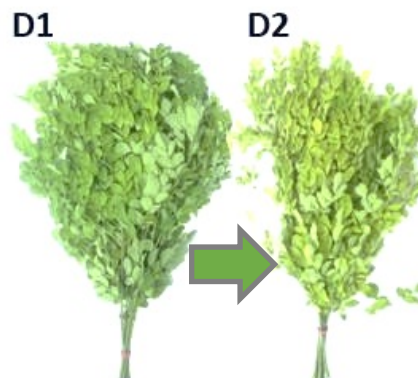


Banana leaf wrapped

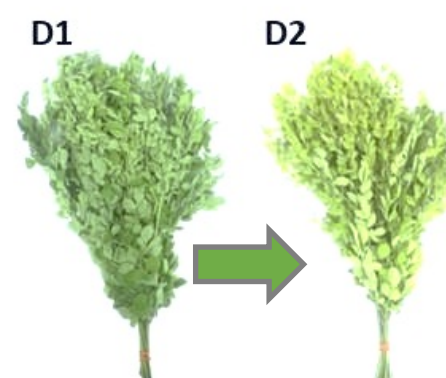


EVAPORATIVE COOLER

Control



Banana leaf wrapped

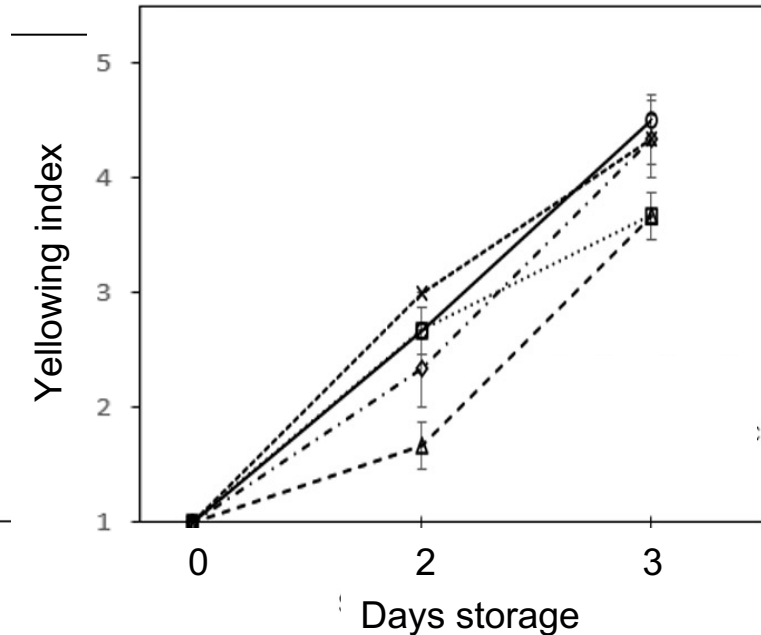
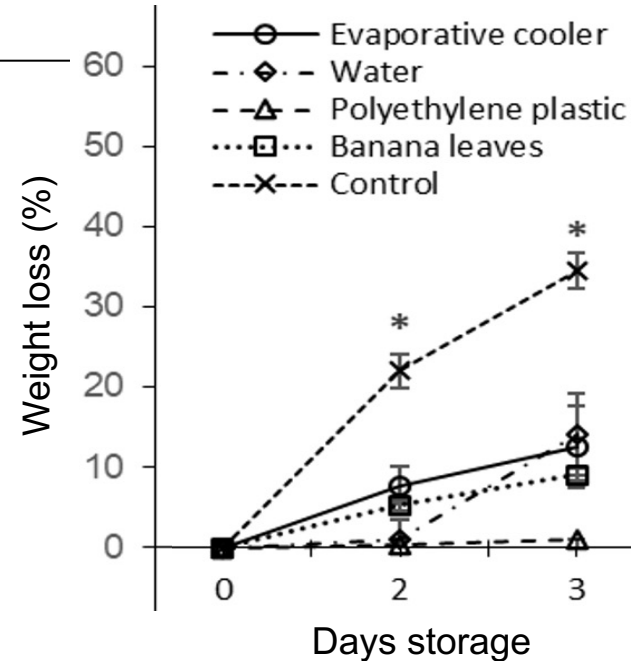


UPMin data

Sweet potato tops

Sweet potato tops are more resistant to weight loss than fern (by approx 30%), but still only last 2 days at ambient

- ▶ The evaporative cooler slightly reduced weight loss
- ▶ In this case, the best results were from packing in plastic



Condition after 2 days



Control



Banana
leaves



Evaporative
cooler



Stems in
water



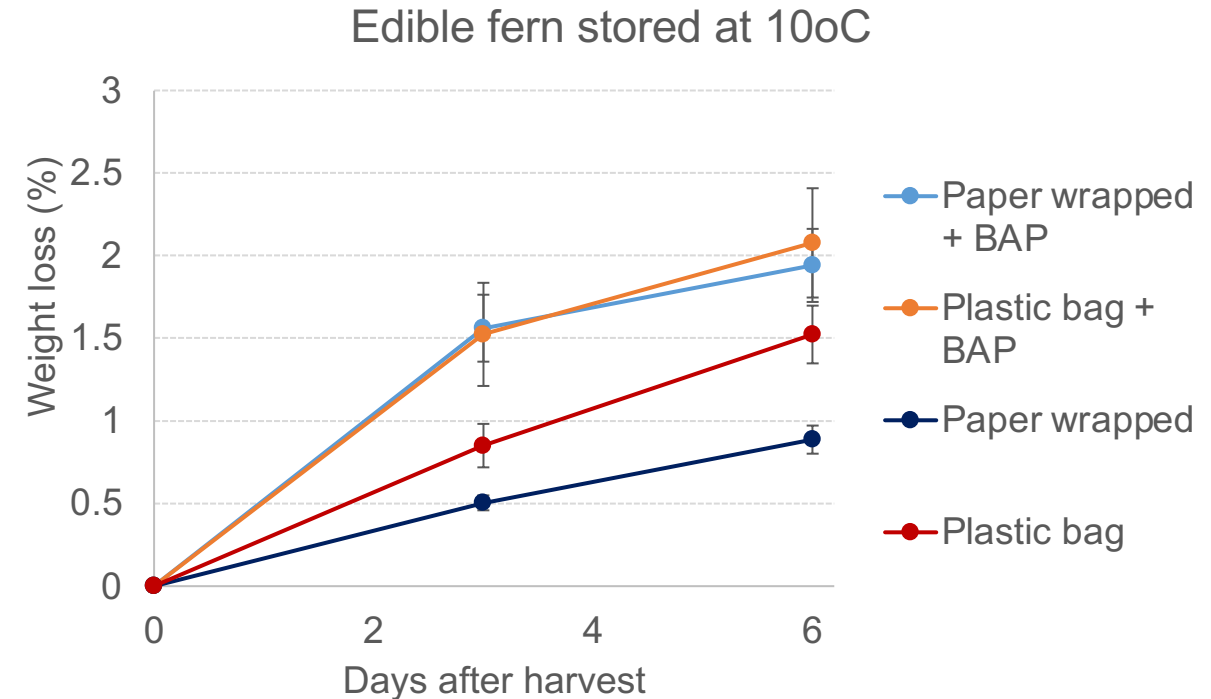
Plastic bag

UPLB data

Edible fern

Cooling is the only answer....

- ▶ Cooling from ambient to 10°C increases storage life from 1 day to 3 days
- ▶ Dipping in 100ppm Benzyladenine purine (BAP) did not increase storage life (and may have reduced it)
- ▶ Wrapping in paper was better than placing in a plastic bag



Plastic wrapped



Paper towel wrapped

UPMin data

Water spinach

Even the small amount of cooling provided by an ice cooler box reduces weight loss and wilting

This may be partly due to reduced ethylene production!

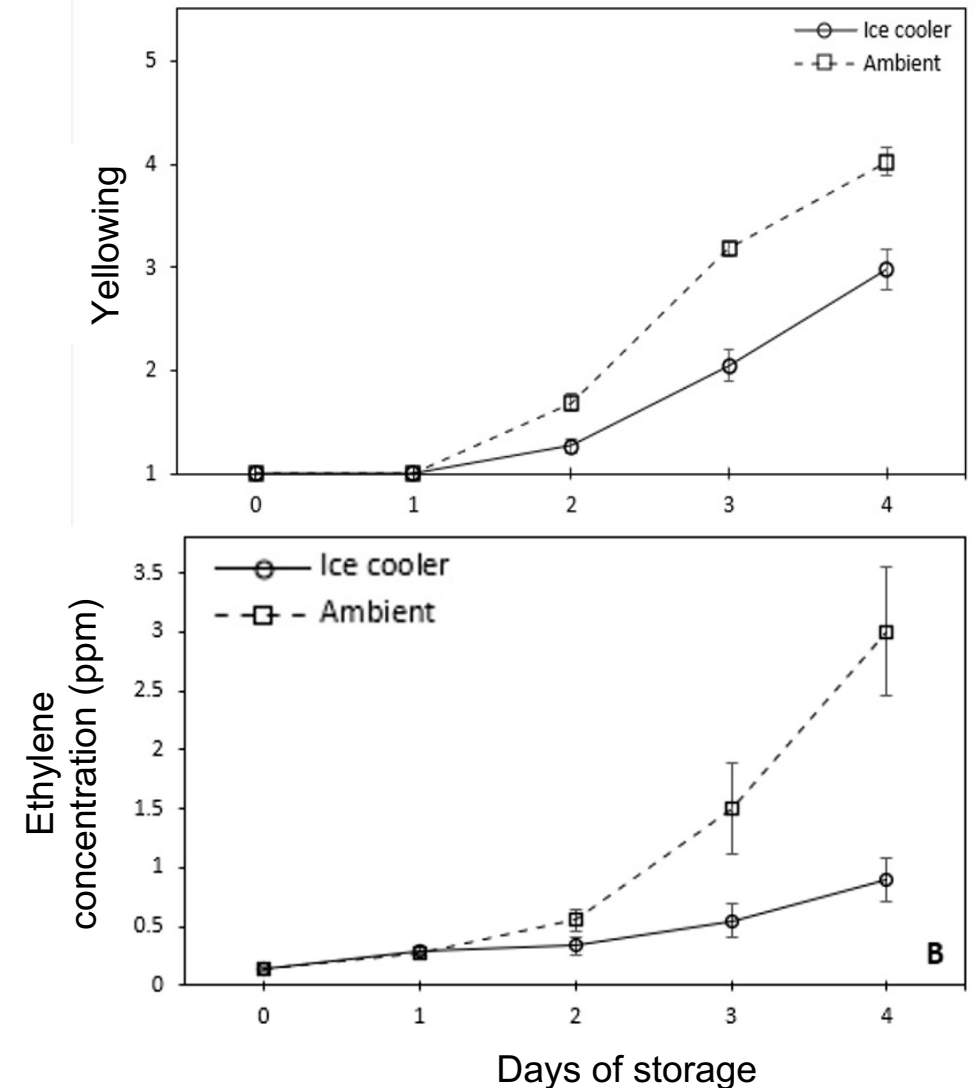


Ice cooler



Ambient

UPLB data



Watercress

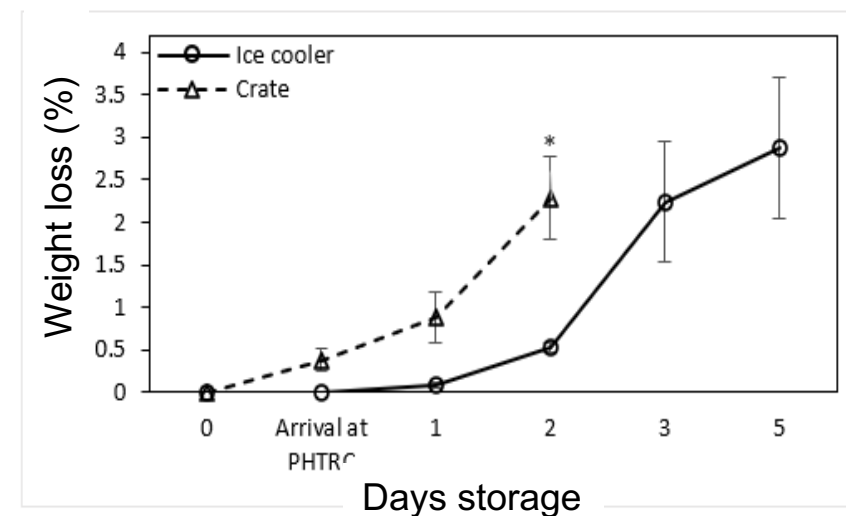
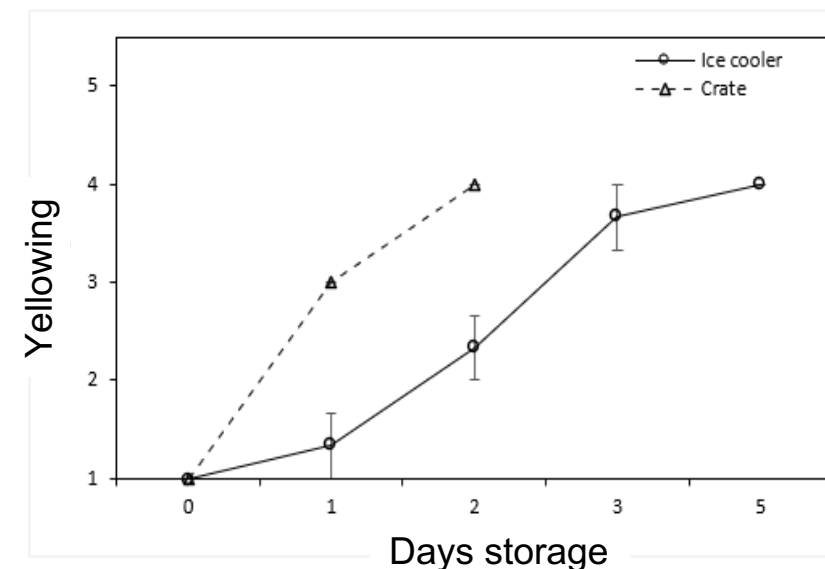
The ice cooler box was very effective at storing watercress

- ▶ Temperature was reduced from 23°C to 8°C
- ▶ Storage life was extended from 2 days to 5 days
- ▶ Transporting watercress in an ice box instead of a crate improved quality and reduced weight loss during retail display

At harvest



+ 1 day at ambient



UPLB data

Just can't beat cooling

Temperature and **humidity** are the most important factors affecting quality and shelf life

- ▶ Without temperature control, leafy indigenous vegetables cannot be stored for more than a day or two
- ▶ However, the cold room must be properly humidified OR products must be packed in plastic to prevent wilting

Day 6

Purple sweet potato tops



Green sweet potato tops



Jute mallow



Ambient

Cold

Cold + plastic

Evaporative cooling does not always work

- In a hot, dry climate, evaporative cooling can reduce the temperature by up to 15°C
- Evaporative cooling was not very effective due to the humid conditions

What's possible in an evaporative cooler

Temperature	Relative humidity (%)	Temperature drop (°C)
38°C	20	13.9
	50	5.6
32°C	20	11.7
	50	5.6
27°C	20	8.9
	50	3.9

What happened in these trials

	Temperature	Relative humidity (%)
Ambient	27.4°C	86.4
Evaporative cooler	26.4°C	98.6
Cool-Bot equipped room	10.2°C	75.4

Summary and conclusions

None of the **solutions** tested increased shelf life (*salicylic acid, BAP, leaving in water....*)

Packaging did increase shelf life, but effects were mixed

- ▶ Banana leaf wrapping was good for moringa
- ▶ Paper was best for fern
- ▶ Combining plastic wrapping and cold storage was the optimum combination for many products

Evaporative cooling was only effective **sometimes**; the temperature drop depends on humidity

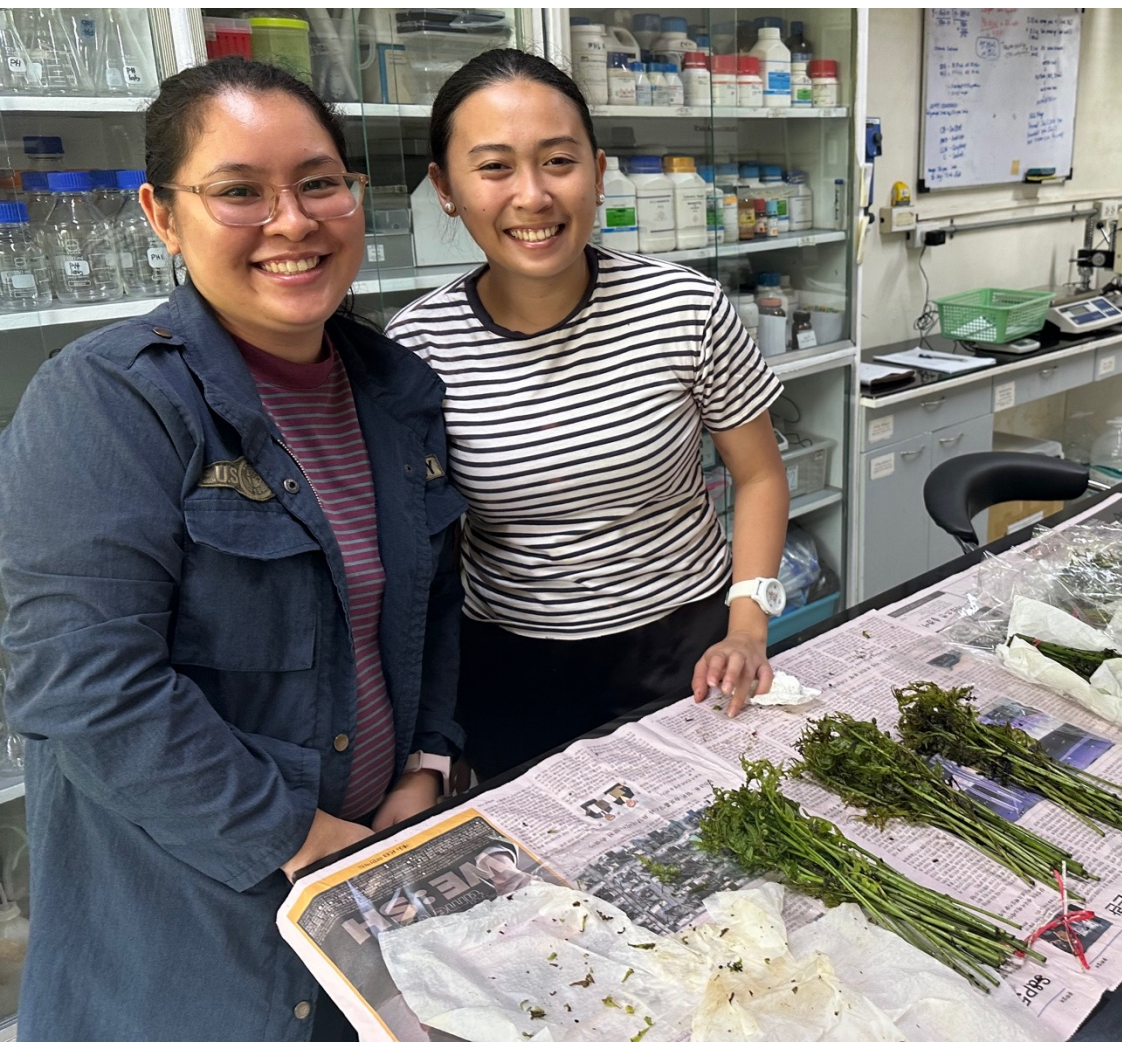
The **ice cooler** could be effective for short periods

- ▶ Definitely provided a better outcome than ambient
- ▶ Scaling may be an issue

A simple cold room, equipped with CoolBot + Air conditioner is the best way to maintain quality of leaf indigenous vegetables

- ▶ BUT humidity must be high, either through humidification or use of plastic wrapping

Next steps



Develop a pre-cooling facility with the Sariaya High Value Crops Cluster

- ▶ Refrigerated container van, air conditioner and CoolBot
- ▶ Training in cooling methods and postharvest management
- ▶ Cost:benefit assessment

Thankyou

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