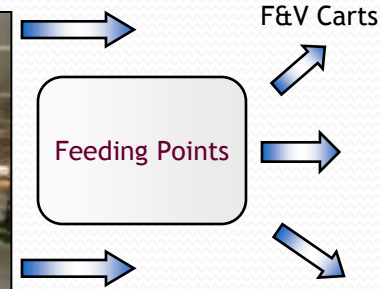


The Cold Chain & the Street Hawker

India's Last-mile Connectivity

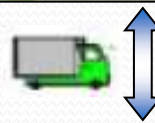
Cold Chain – Farm to Fork

Your Cold Chain end up on a hawking cart?



Farmers

Local Cooling



City Consolidation Centre



Is there a change possible here?

Fair Average Quality

Food Saleable Quality

Moisture

Color

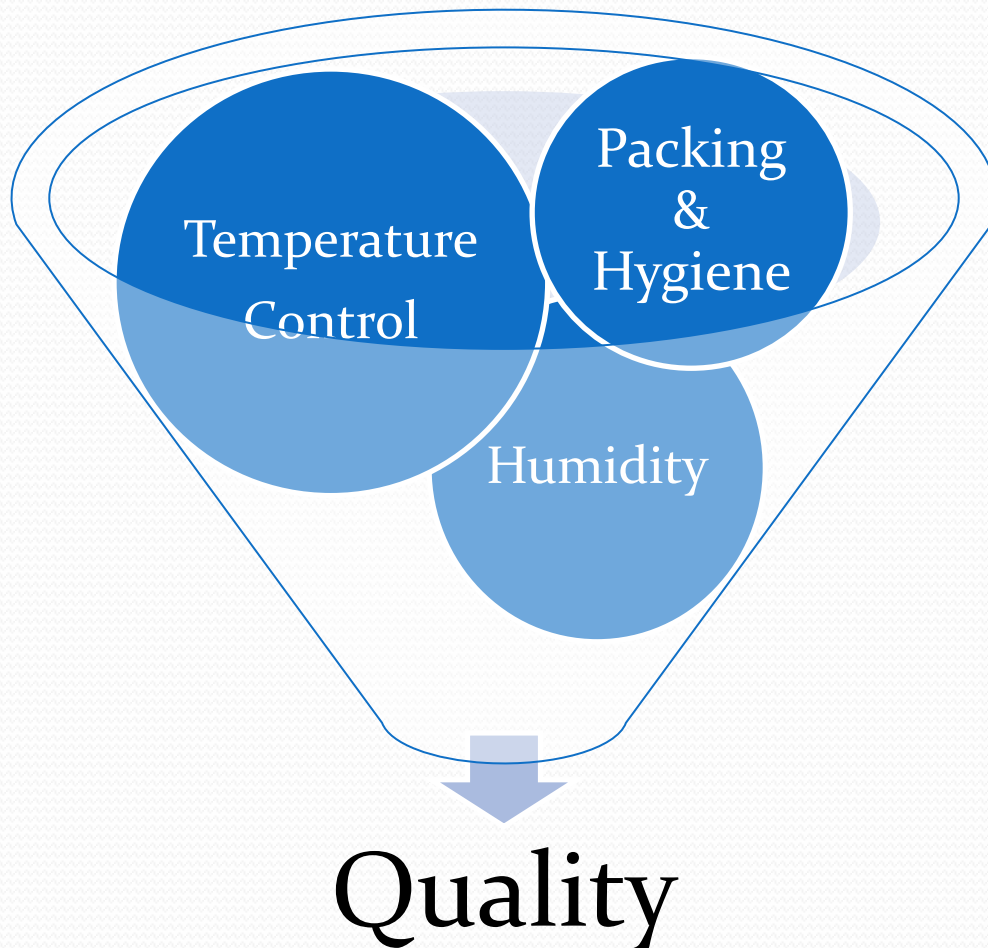
Shrinkage

Firmness

Rot

Disease

Preserving Quality

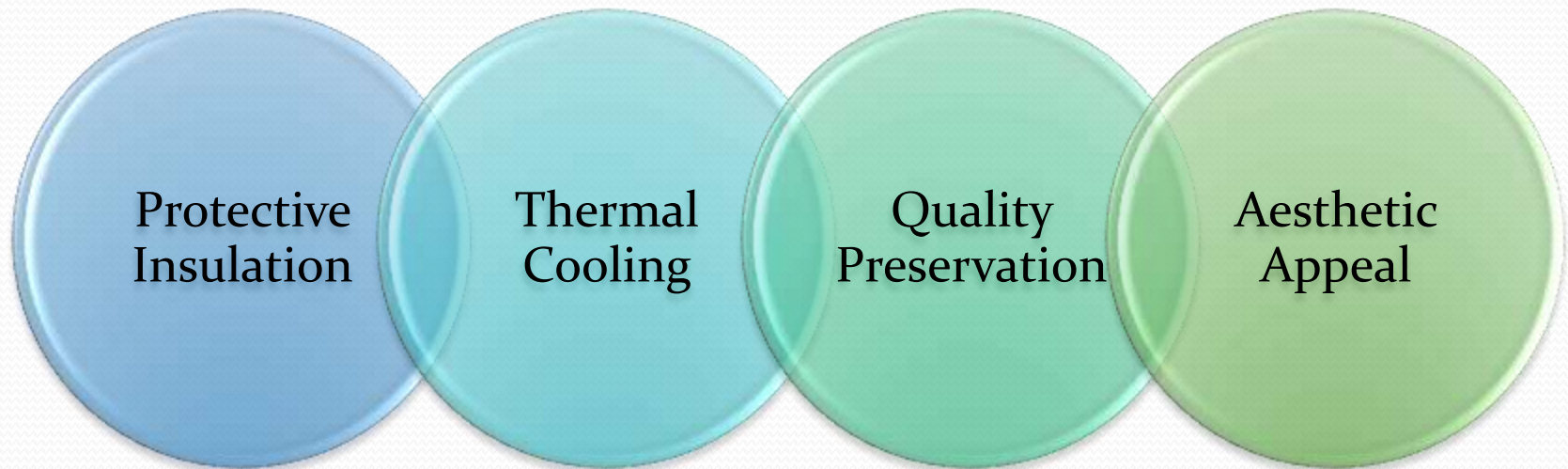


A thermally controlled vending Cart brings all the factors into play - For the common Street Hawker.



Cart Design

- A Street Vending cart that will Provide the following



- Utilising optimal designing, Passive Cooling System, Portable and Reusable technology.

What Technology

Carts with canopy, double skinned and insulated from harsh environment.

- Double skin with PUF insulation.
- Compartmented for storage.

Cooling packs using Phase Change Material – thermal storage cells.

- Encapsulated thermal cells store cooling from ordinary freezers or any ice factory outlet.

Mobile and static in accordance with street vending norms.

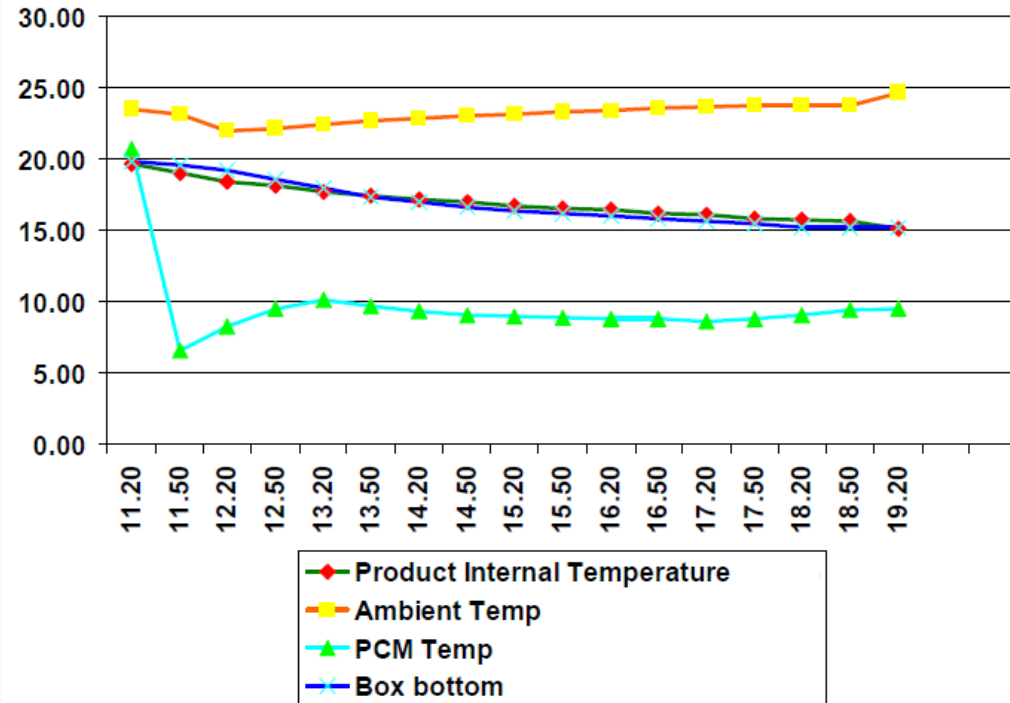
- Rickshaw Model and Push Cart Models.
- Offers advertising space on sides & roof.



Experiment

- Qty 98 kgs in cart, 28 kgs as control in open.
- No pre-cooling of F&V done.
- Product drop in Temp 0.55 deg C / hr.
- Max Weight loss avg 1.3%.
- Vs 4.8 % in ambient product.
- No Spoilage / dump

Thermal dynamics set 1



Final Temps.



Results



- Left side with Passive Cooling
- Right in ambient of 25 °C

Results



- Left side with Passive Cooling
- Right in ambient of 25 °C



Results



- Left side with Passive Cooling
- Right in ambient of 25 °C



Trials - with Gherkins

- Validate the concept - confirm the temperature range & retention of Fresh gherkin.
- Confirms that gherkins stayed fresh and saleable for a 24 hours period
- The temperature retained at less than 12 °C while in ambient it raised to 25 °C.
- Trial Confirms that with proper application of Passive Cooling Medium, temperature control is applied.

RECORD 1					
	Date	Time	Box Internal °C	Gherkin °C	Gherkin in Ambient °C
Hour 2	12.06.08	9.30PM	8.1	7.6	17
Hour 4	12.06.08	11.30PM		7.7	16
Hour 6	13.06.08	1.30AM		7.8	17.5
Hour 8	13.06.08	3.30AM	8.2	7.9	20
Hour 10	13.06.08	5.30AM		7.9	20
Hour 12	13.06.08	7.30AM		7.9	20
Hour 14	13.06.08	9.30AM	8.5	9.1	22
Hour 16	13.06.08	11.30AM		8.8	22
Hour 18	13.06.08	1.30PM		10.2	24
Hour 20	13.06.08	3.30PM	13.8	10.5	24
Hour 22	13.06.08	5.30PM		10.7	24
Hour 24	13.06.08	7.30PM		11.9	25

What are Gherkins

Gherkins stowage Factor:

2 to 3 m³ per ton.

70 to 105 ft³ per ton.

Gherkin Respiration rate:

@ 10 °C, 60 watts per ton, 10 ml CO₂/kg/h

@ 15 °C, 96 watts per ton, 16 ml CO₂/kg/h

@ 20 °C, 141 watts per ton, 24 ml CO₂/kg/h

@ 25 °C, 168 watts per ton, 28 ml CO₂/kg/h

Gherkin Water Content:

96% water, Specific heat (kJ/kg/°C) 4.06

Gherkin Other Properties:

Ethylene– Low Producer, Ethylene sensitivity – High, Freezes at -0.5 °C

Ice Compatible – No, Optimal RH – 90 – 95%, Impact/Pressure

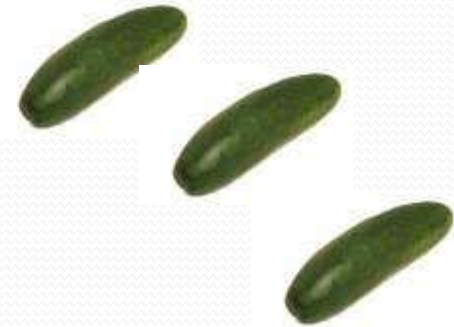
sensitive.

Gherkin Optimal Conditions:

Stored at 7 to 12 °C / 90 – 95% RH, lasts from 10 to 14 days.

Benefit of Controlled Atmosphere, Fair (+7 days).

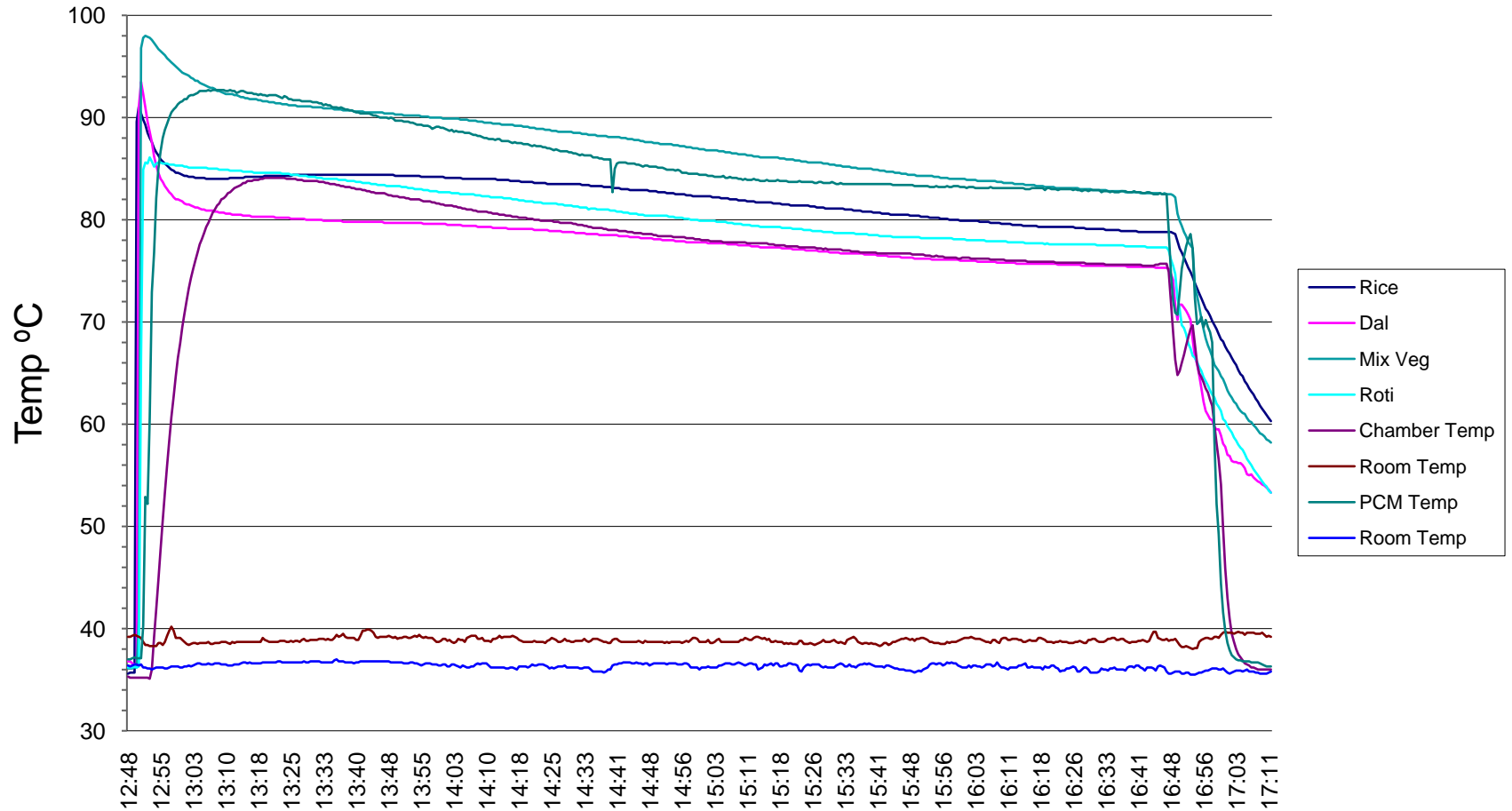
Sensitive to contamination by fats and oils.



- Left unexposed in ambient, un-processed Gherkin will lose value within 24-30 hours. They are very susceptible to mold and other micro loads.
- With proper post harvest care, Gherkins can last 10 to 14 days.

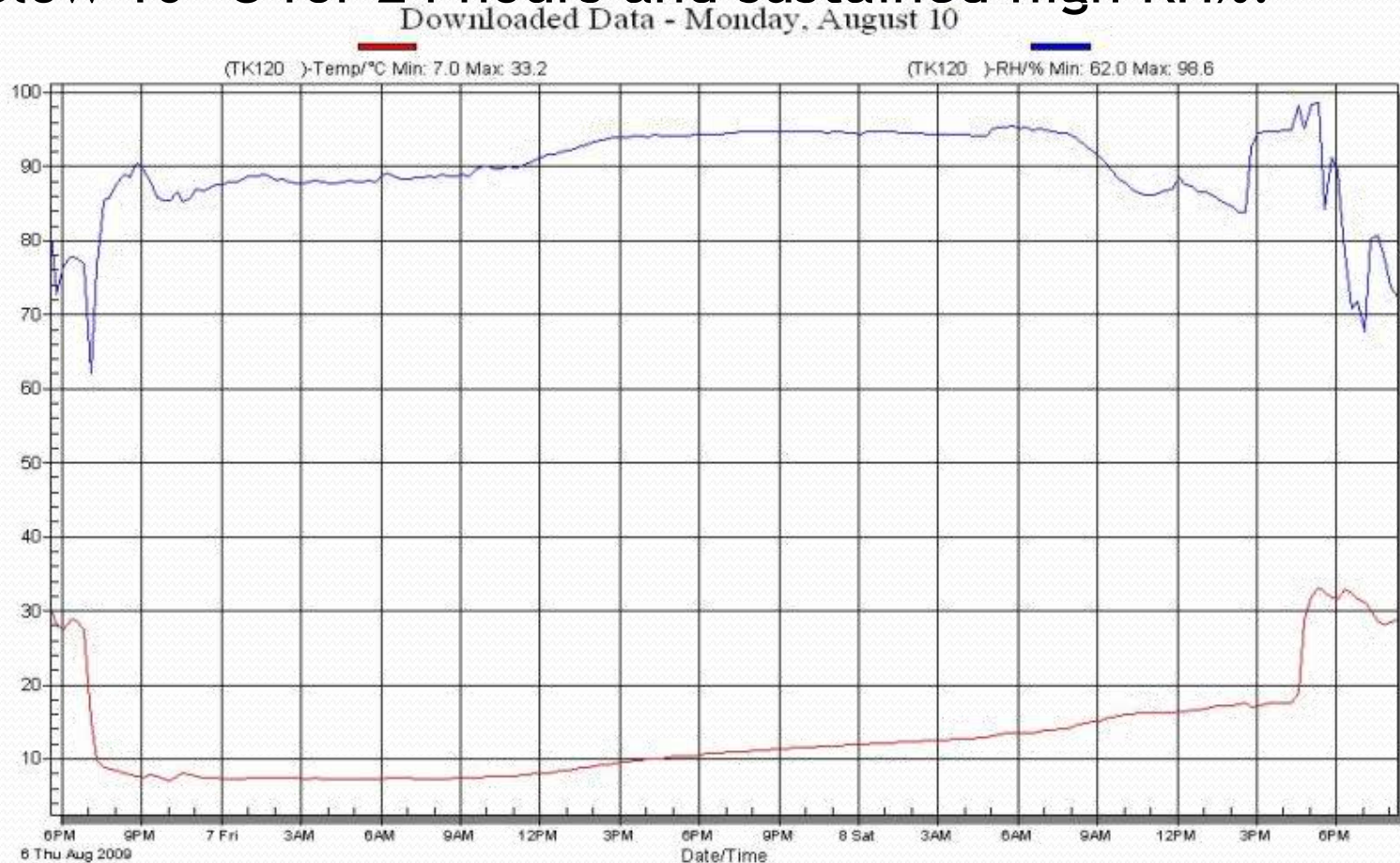
IRCTC Trials – hot trials

Temp-Time Graph - IRCTC Trials



Experiments

- In live 48 hours transit of fresh produce, maintained below 10 °C for 24 hours and sustained high RH%.



Common Types of PCM

Type	Phase Change temp °C	Contents	Operating Temp °C	Density (kg/m ³) Liquid	Latent Heat (kJ/Kg)	Flammability	Qty per kWh (kg)
Negative	-26	Inorganic Salts	-25 to -26	1280	205	No	23
Negative	-23		-22 to -24	1180	210	No	18
Negative	-19		-17 to -21	1170	200	No	18
Negative	-7		-7 to -5	1120	230	No	16
Frost	0		-1 to +1	1010	300	No	12
Positive	22		21 to 23	1540	185	No	19
Positive	24		23 to 25	1540	185	No	19
Positive	29		27 to 29	1550	190	No	19
Positive	58		57 to 59	1290	250	No	15
Positive	89		87 to 89	1540	180	No	20

- Energy storage in kWh indicates cost of energy used with added cost of service provision.

Usage

- Though entirely design dependant, one large cart would use from 15 to 30 kgs of PCM (1.1 to 2.2 kWh of energy).
- This would suffice between 12 to 16 hours of cooling or heating duration, with about 100 door openings of 10 secs each.
- Any limitation in duration, would still bring benefits when compared to existing uncontrolled system.
- PCM does not require any maintenance, has no machinery component, and simple to use once charged.

Advantages

- Improved design of on road street hawking carts.
- No complicated machinery to confuse the hawker.
- Reusable on a daily basis after recharging.
- Provides aesthetics and hygiene to an age old retail business.
- Allows the common hawker to compete with organised retail.
- Reduces last mile wastage of food.
- Brings viable and visible support to poor man - with the support of the government.

Conclusion

Thermally Controlled Vending Carts

Protects Hawkers
Product

Offers
Hygiene

Allows
Portability

Brings
Technology

Enhances
Income

A new life style

Cart designs by **DESIGN DIRECTIONS**[®]
Managing Innovations



Technology



New Cart Concepts

Cart designs by **DESIGN DIRECTIONS**[®]
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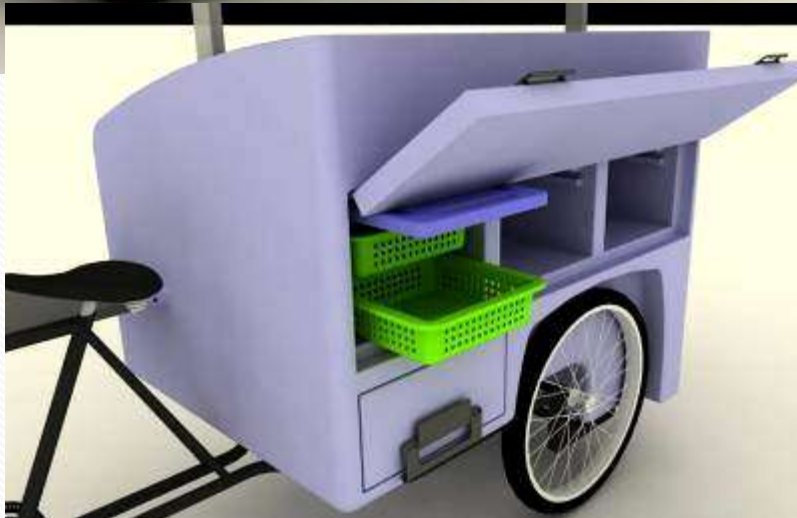


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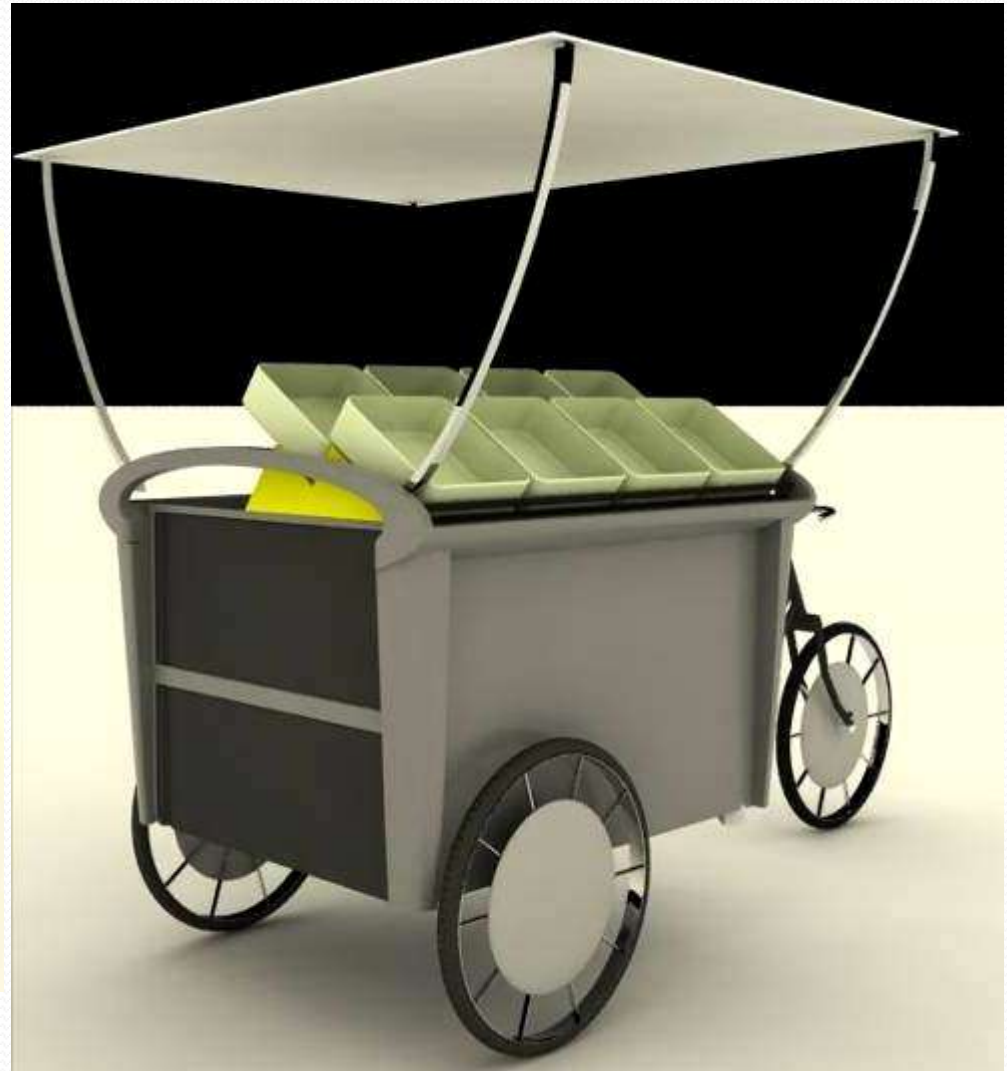




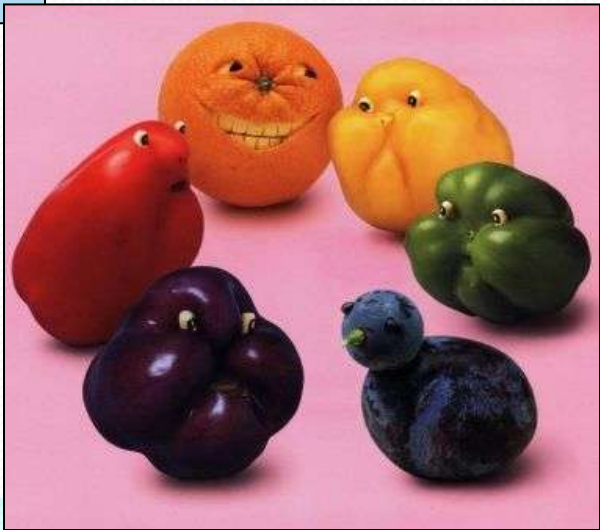
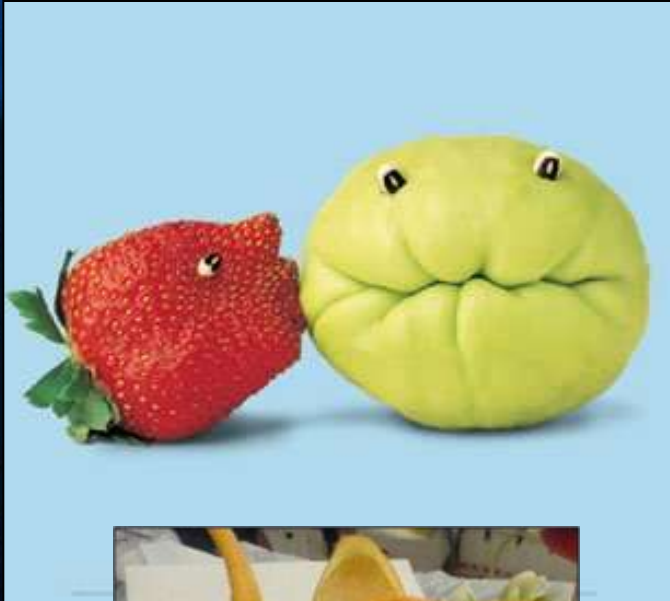
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Keep Fruits and Vegetables Happy



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THANK YOU

Linking the Farm-to-Fork

