Data Article

Dataset on performance of solar powered agricultural produce cooling storage system under tropical conditions

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Abstract

Much of the post-harvest loss of agricultural produce in developing countries is due to lack of proper storage facilities. Agricultural produce such as peppers, tomatoes and fruits are highly perishable in nature; thus, maintaining the optimal air conditions inside the storage cabinet helps extending their shelf lives. The datasets contained in this paper are performance test carried out on agricultural produce cooling storage system under tropical conditions for various cooling pads (jute fibre) thickness and under no load and load conditions. The parameters recorded under these conditions include wet and dry bulb temperatures, relative humidity of the surroundings, relative humidity and temperature within the cooling chamber taken consecutively for 4 days with different pad thickness and for 5 days and 8 days under no load and load conditions, respectively. Results obtained show that pad thickness of 80 mm has the highest cooling efficiency of 84.7% and temperature within the cooling chamber was found dropped to 25 °C and average relative humidity of cooling chamber increased to 82.4% as compared to 64.8% for ambient condition.

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1. Data

The temperatures and humidity of cooling chamber and surrounding were collected and a set of experimental data was generated. Tests were first carried out on different cooling pad thicknesses ranged from 20 mm to 80 mm purposely to determine which thickness gives highest cooling efficiency (Tables 1-4). After which, no load and load tests were carried out on the designed post harvested agricultural produce cooling storage system at every 30 minutes through a period of 8 hours for 5 days (no load tests) and 8 days (load tests).

2. Experimental design, materials and methods

A 500 mm \( \times \) 500 mm \( \times \) 500 mm (Length \( \times \) depth \( \times \) width) postharvest agricultural produce cooling storage system was designed and constructed as shown in Fig. 1. The cooling system basically consists of a cubical shaped storage chamber, a cooling fan, and a cooling pad. The cubical shaped cooling chamber was of dimension 0.125 m\(^3\) made of aluminum on the inside and galvanized mild steel on the outside, it is internally insulated with polystyrene to prevent heat exchange with the environment, a cooling fan and a porous cooling pad made from jute fiber and a submersible pump of 50 W power.
rating having a flow rate of 240l/hr and a maximum static head of 3 m. A water reservoir of capacity 20 l, at the top of the cooling system transferring water being pumped through a piping system to the cooling pad to keep it continually wet. The system relies solely on the concept of cooling by evaporation [1–3], when the system is set up and is under operation, the dry air from the cooling fan goes directly to the wet surface of the cooling pad and evaporates the water present in the pad, thus drawing energy from its surroundings to produce cooling effect into the cooling chamber [4,5].

In this study, Floureon RC-4HC Data logger device was used to measure the internal temperature and humidity of cooling chamber. The data logger was set to record data at every 30 minutes through a period readings were taken. Floureon RC-4HC temperature and humidity data logger when connected to computer, the software reads data automatically, and forms reports. It has LCD screen which display the temperature, time, temperature upper/lower limit and maximum/minimum temperature. There are two sensors — internal and external used to record temperature over a long time. Temperature measuring range from −30 °C to +60 °C with accuracy of ±0.6 °C. Humidity range from 0 to 99% RH

### Table 1
Experimental Data for cooling pad thickness of 20 mm.

| Time (Mins.) | TC (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|--------------|---------|---------|----------|----------|---------|
| 0            | 35.8    | 63.7    | 35       | 29       | 63.5    |
| 30           | 29.7    | 78      | 33       | 28       | 68.5    |
| 60           | 30.2    | 77.7    | 34       | 28       | 63      |
| 90           | 30.2    | 77.2    | 33       | 27       | 62.5    |
| 120          | 29.8    | 78      | 34       | 27       | 58      |
| 150          | 29.8    | 78.5    | 35       | 28       | 58.5    |
| 180          | 30.2    | 78.1    | 33       | 27       | 62.5    |
| 210          | 30      | 78.1    | 33       | 28       | 68.5    |
| 240          | 30      | 78.5    | 33       | 28       | 68.5    |
| 270          | 29.9    | 76.7    | 34       | 29       | 69      |
| 300          | 30      | 76.3    | 33       | 27       | 62.5    |
| 330          | 29.8    | 78.3    | 36       | 28       | 54      |
| 360          | 28.6    | 79.5    | 34       | 28       | 63      |
| 390          | 28.2    | 80.3    | 33       | 26       | 57      |
| 420          | 28      | 81.5    | 31       | 27       | 74.5    |
| 450          | 27.7    | 82.3    | 31       | 27       | 74.5    |
| 480          | 27.3    | 83.1    | 29       | 26       | 78.5    |

**Key:** TC — Temperature of cooling chamber, RHc — Relative humidity of cooling chamber, DBT — Dry bulb temperature, WBT — Wet bulb temperature, RHa — Relative humidity of the surroundings.

### Table 2
Experimental data for cooling pad thickness of 40 mm.

| Time (Mins.) | TC (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|--------------|---------|---------|----------|----------|---------|
| 0            | 34.9    | 63      | 35       | 28       | 58.5    |
| 30           | 29.5    | 76.2    | 35       | 27       | 53.5    |
| 60           | 29      | 78.3    | 34       | 27       | 58      |
| 90           | 29.4    | 77.5    | 36       | 28       | 54      |
| 120          | 29.8    | 77.6    | 34       | 27       | 58      |
| 150          | 29.9    | 78.5    | 37       | 28       | 50.5    |
| 180          | 29.8    | 77.1    | 39       | 29       | 47.5    |
| 210          | 30.3    | 75.9    | 38       | 29       | 51      |
| 240          | 30.8    | 74.2    | 35       | 28       | 58.5    |
| 270          | 31.1    | 74.7    | 37       | 29       | 55      |
| 300          | 29.7    | 76.7    | 35       | 28       | 58.5    |
| 330          | 29.3    | 77      | 34       | 27       | 58      |
| 360          | 28.5    | 78.2    | 33       | 26       | 57      |
| 390          | 28.3    | 79.5    | 33       | 26       | 57      |
| 420          | 28.1    | 80.3    | 33       | 27       | 62.5    |
| 450          | 27.6    | 81      | 31       | 26       | 67.5    |
| 480          | 27.2    | 82.2    | 30       | 26       | 73      |
with accuracy of ±3%RH. Record capacity is RC-4HC 16000 points (MAX) while record interval is from 10 s to 24hours adjustable. The wet bulb and dry bulb temperatures of the surrounding were measured using wet bulb and dry bulb hygrometer alongside with psychometric chart. Digital anemometer was used to determine the air velocity entering into system.

Cooling efficiency of the cooling storage system was calculated using different jute fiber pads of different thicknesses based on the established formula given as [6,7]:

$$\eta = \frac{T_{db} - T_c}{T_{db} - T_{wb}} \times 100$$  \hspace{1cm} (1)

where:

- $T_{db}$ = ambient air dry bulb temperature in °C.
- $T_{wb}$ = ambient air wet bulb temperature in °C.
- $T_c$ = dry bulb temperature of the cooler in °C.

### Table 3
Experimental data for cooling pad thickness of 60 mm.

| Time (Mins.) | $T_c$ (°C) | R.H.c (%) | DBT (°C) | WBT (°C) | R.H.A (%) |
|-------------|------------|-----------|----------|----------|-----------|
| 0           | 31.7       | 66.4      | 31       | 26       | 61.5      |
| 30          | 29.4       | 80.1      | 31       | 27       | 73.5      |
| 60          | 29.2       | 81.4      | 32       | 27       | 68        |
| 90          | 29.1       | 82.2      | 34       | 28       | 63        |
| 120         | 28.9       | 82.6      | 34       | 28       | 63        |
| 150         | 29.2       | 83.1      | 39       | 30       | 51.5      |
| 180         | 29.2       | 83.5      | 39       | 30       | 51.5      |
| 210         | 29.4       | 83.5      | 40       | 30       | 48        |
| 240         | 29.5       | 83.6      | 38       | 30       | 56        |
| 270         | 29.3       | 83.5      | 36       | 29       | 59        |
| 300         | 28.9       | 84.3      | 33       | 27       | 63.5      |
| 330         | 28.6       | 84.2      | 32       | 27       | 68        |
| 360         | 28.2       | 83.7      | 31       | 27       | 73.5      |
| 390         | 28         | 84.1      | 31       | 26       | 67.5      |
| 420         | 27.7       | 84.8      | 29       | 26       | 78.5      |
| 450         | 27.4       | 84.8      | 29       | 26       | 78.5      |
| 480         | 27.1       | 85.5      | 28       | 25       | 78        |

### Table 4
Experimental data for cooling pad thickness of 80 mm.

| Time (30 mins) | $T_c$ (°C) | R.H.c (%) | DBT (°C) | WBT (°C) | R.H.A (%) |
|----------------|------------|-----------|----------|----------|-----------|
| 0              | 30.4       | 64.3      | 30       | 29       | 63        |
| 30             | 25.4       | 79.3      | 32       | 29       | 70        |
| 60             | 26.2       | 80.7      | 32       | 28       | 74        |
| 90             | 26.8       | 80.4      | 33       | 28       | 68.5      |
| 120            | 27.6       | 79.3      | 34       | 27       | 58        |
| 150            | 28.1       | 76.8      | 30       | 26       | 73        |
| 180            | 27.9       | 78.1      | 34       | 26       | 53        |
| 210            | 27.7       | 78.9      | 32       | 27       | 68        |
| 240            | 27.2       | 80.1      | 33       | 27       | 62.5      |
| 270            | 27         | 80        | 33       | 26       | 57        |
| 300            | 26.6       | 80.4      | 36       | 27       | 50        |
| 330            | 26.3       | 80.3      | 33       | 27       | 62.5      |
| 360            | 26.2       | 80.7      | 30       | 26       | 73        |
| 390            | 27         | 80        | 29       | 25       | 66        |
| 420            | 27.2       | 80.1      | 29       | 26       | 78.5      |
| 450            | 27.6       | 82.3      | 27       | 25       | 75        |
| 480            | 28.1       | 86.8      | 28       | 25       | 78        |
| **Average**    | 27.3       | 79.3      | 31.5     | 26.7     | 66.5      |
The computed cooling efficiencies under no load condition for 20 mm, 40 mm, 60 mm and 80 mm cooling pads are 61.4%; 72.2%; 82.4% and 84.7%, respectively.

Analysis displaying the data for a cooling pad of thickness 80 mm are shown in Figs. 2–3. Cooling pad of thickness 80 mm was used to examine performance of the storage cooling system under no load and load conditions for 5 days and 8 days, respectively (Tables 5–17).

Table 18 presents computed cooling efficiency of the storage cooling system for the period of 8 days under loading condition. The highest cooling efficiency (91.1%) was recorded on the 5th day of the experiment (see Table 18).

![Fig. 1. Solar powered vegetable & fruit storage system.](image)

![Fig. 2. Relative humidity readings for pad thickness of 80 mm.](image)
Fig. 4 shows loaded agricultural postharvest storage cooling system after 8 days during the experiment.

From this study, it was observed that:

➢ The drop in temperature of cooling cabinet of the storage system was relatively high during hot and sunny conditions and relatively low under cloudy and rainy conditions.

➢ Increase in air flow rate enhances the rate of evaporation efficiently.

➢ The agricultural produce (tomatoes, okra and pepper) kept in cooling chamber of agricultural cooling storage system maintained their freshness and firmness after 8 days in comparison to those kept under ambient air conditions.

Table 5
Experimental data for cooling storage under no load condition (Day 1).

| Time (30 mins) | TC (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|---------------|---------|---------|----------|----------|---------|
| 0             | 34.1    | 63.9    | 34       | 27       | 58      |
| 30            | 27      | 73.3    | 34       | 26       | 53      |
| 60            | 28      | 75.9    | 35       | 27       | 53.5    |
| 90            | 26.6    | 75.9    | 34       | 26       | 53      |
| 120           | 27.7    | 75.1    | 34       | 27       | 58      |
| 150           | 26.4    | 75      | 33       | 26       | 57      |
| 180           | 27.6    | 77      | 34       | 27       | 58      |
| 210           | 26.2    | 73.9    | 34       | 26       | 53      |
| 240           | 25.9    | 72.6    | 33       | 25       | 52      |
| 270           | 26.4    | 72.7    | 34       | 26       | 53      |
| 300           | 27.1    | 70.5    | 35       | 26       | 49      |
| 330           | 27      | 76      | 35       | 26       | 49      |
| 360           | 27.8    | 77      | 33       | 27       | 62.5    |
| 390           | 26.6    | 77.2    | 33       | 26       | 57      |
| 420           | 26.9    | 77.6    | 32       | 26       | 62      |
| 450           | 25.9    | 77.6    | 32       | 25       | 56      |
| 480           | 25.8    | 75.9    | 31       | 25       | 55.5    |

Fig. 3. Temperature readings for pad thickness 80 mm.
### Table 6
Experimental data for cooling storage under No load condition (Day 2).

| Time (Mins.) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHA (%) |
|--------------|---------|---------|----------|----------|---------|
| 0            | 35.8    | 64.5    | 34       | 31       | 63.5    |
| 30           | 29.7    | 71.8    | 33       | 30       | 68.5    |
| 60           | 30.2    | 73.1    | 33       | 30       | 63      |
| 90           | 30.2    | 72.2    | 32       | 29       | 62.5    |
| 120          | 29.8    | 72.2    | 33       | 29       | 74.1    |
| 150          | 29.8    | 73.0    | 34       | 32       | 58.5    |
| 180          | 30.2    | 73.5    | 34       | 31       | 62.5    |
| 210          | 30      | 74.1    | 34       | 31       | 68.5    |
| 240          | 30      | 74.7    | 32       | 30       | 68.5    |
| 270          | 29.9    | 75.1    | 32       | 28       | 69      |
| 300          | 30      | 75.6    | 32       | 29       | 62.5    |
| 330          | 29.8    | 76      | 30       | 27       | 54      |
| 360          | 28.6    | 76      | 31       | 27       | 63      |
| 390          | 28.2    | 76.3    | 30       | 27       | 57      |
| 420          | 28      | 76.8    | 30       | 28       | 74.5    |
| 450          | 27.7    | 76.8    | 29       | 27       | 74.5    |
| 480          | 27.3    | 77.2    | 29       | 26       | 78.5    |
| Average      | 29.7    | 74.3    | 31       | 28       | 74.1    |

### Table 7
Experimental data for cooling storage under No load condition (Day 3).

| Time (Mins.) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHA (%) |
|--------------|---------|---------|----------|----------|---------|
| 0            | 32.6    | 69.9    | 33       | 28       | 68.5    |
| 30           | 29.2    | 80.5    | 34       | 28       | 63      |
| 60           | 29.1    | 81.8    | 33       | 27       | 62.5    |
| 90           | 28.8    | 81.7    | 34       | 28       | 63      |
| 120          | 27.8    | 79.3    | 33       | 27       | 62.5    |
| 150          | 26.1    | 81.6    | 31       | 26       | 67.5    |
| 180          | 25.7    | 83.6    | 30       | 25       | 67      |
| 210          | 25.5    | 84.4    | 27       | 24       | 77.5    |
| 240          | 25.3    | 84.7    | 27       | 24       | 77.5    |
| 270          | 25.2    | 85.1    | 27       | 24       | 77.5    |
| 300          | 25      | 85.1    | 28       | 25       | 78      |
| 330          | 25      | 85.5    | 27       | 24       | 77.5    |
| 360          | 24.9    | 85.4    | 27       | 24       | 77.5    |
| 390          | 24.8    | 85.9    | 27       | 24       | 77.5    |
| 420          | 24.8    | 85.8    | 27       | 24       | 77.5    |
| 450          | 24.7    | 85.8    | 27       | 24       | 77.5    |
| 480          | 24.7    | 86.8    | 26       | 24       | 85      |
| Average      | 26.4    | 83.1    | 27.8     | 25.3     | 72.8    |

### Table 8
Experimental data for cooling storage under No load condition (Day 4).

| Time (30 mins) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHA (%) |
|----------------|---------|---------|----------|----------|---------|
| 0              | 34.9    | 63      | 35       | 28       | 58.5    |
| 30             | 29.5    | 76.2    | 35       | 27       | 53.5    |
| 60             | 29      | 78.3    | 34       | 27       | 58      |
| 90             | 29.4    | 77.5    | 36       | 28       | 54      |
| 120            | 29.8    | 77.6    | 34       | 27       | 58      |
| 150            | 29.9    | 78.5    | 37       | 28       | 50.5    |
| 180            | 29.8    | 77.1    | 39       | 29       | 47.5    |
| 210            | 30.3    | 75.9    | 38       | 29       | 51      |
| 240            | 30.8    | 74.2    | 35       | 28       | 58.5    |
| 270            | 31.1    | 74.7    | 37       | 29       | 55      |
| 300            | 29.7    | 76.7    | 35       | 28       | 58.5    |

(continued on next page)
Table 8 (continued)

| Time (30 mins) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|---------------|---------|---------|----------|----------|---------|
| 330           | 29.3    | 77      | 34       | 27       | 58      |
| 360           | 28.5    | 78.2    | 33       | 26       | 57      |
| 390           | 28.3    | 79.5    | 33       | 26       | 57      |
| 420           | 28.1    | 80.3    | 33       | 27       | 62.5    |
| 450           | 27.6    | 81      | 31       | 26       | 67.5    |
| 480           | 27.2    | 82.2    | 30       | 26       | 73      |

Table 9
Experimental data for cooling storage under No load condition (Day 5).

| Time (30 mins) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|---------------|---------|---------|----------|----------|---------|
| 0             | 35.8    | 63.7    | 35       | 29       | 63.5    |
| 30            | 29.7    | 78      | 33       | 28       | 68.5    |
| 60            | 30.2    | 77.7    | 34       | 28       | 63      |
| 90            | 30.2    | 77.2    | 33       | 27       | 62.5    |
| 120           | 29.8    | 78      | 34       | 27       | 58      |
| 150           | 29.8    | 78.5    | 35       | 28       | 58.5    |
| 180           | 30.2    | 78.1    | 33       | 27       | 62.5    |
| 210           | 30      | 78.1    | 33       | 28       | 68.5    |
| 240           | 30      | 78.5    | 33       | 28       | 68.5    |
| 270           | 29.9    | 76.7    | 34       | 29       | 69      |
| 300           | 30      | 76.3    | 33       | 27       | 62.5    |
| 330           | 29.8    | 78.3    | 36       | 28       | 54      |
| 360           | 28.6    | 79.5    | 34       | 28       | 63      |
| 390           | 28.2    | 80.3    | 33       | 26       | 57      |
| 420           | 28      | 81.5    | 31       | 27       | 74.5    |
| 450           | 27.7    | 82.3    | 31       | 27       | 74.5    |
| 480           | 27.3    | 83.1    | 29       | 26       | 78.5    |

Table 10
Experimental data for cooling storage under load condition (Day 1).

| Time (30 mins) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|---------------|---------|---------|----------|----------|---------|
| 0             | 33.6    | 58.3    | 32       | 30       | 58      |
| 30            | 31.1    | 67.3    | 32       | 30       | 53      |
| 60            | 31      | 69.1    | 33       | 31       | 53.5    |
| 90            | 30.5    | 68.1    | 31       | 30       | 53      |
| 120           | 30.4    | 70      | 32       | 30       | 58      |
| 150           | 31.2    | 69.7    | 31       | 29       | 57      |
| 180           | 30.3    | 71.3    | 31       | 29       | 56      |
| 210           | 29.6    | 73.5    | 30       | 28       | 53      |
| 240           | 29.2    | 73.9    | 30       | 29       | 52      |
| 270           | 28.8    | 75.6    | 30       | 28       | 53      |
| 300           | 28.6    | 79.1    | 29       | 28       | 49      |
| 330           | 28.4    | 80.8    | 29       | 27       | 49      |
| 360           | 28.3    | 81.4    | 29       | 28       | 62.5    |
| 390           | 28.3    | 81.9    | 29       | 28       | 57      |
| 420           | 28.2    | 82.6    | 28       | 29       | 62      |
| 450           | 28.0    | 83.4    | 28       | 27       | 56      |
| 480           | 27.7    | 83.8    | 28       | 27       | 55.5    |
Table 11
Experimental data for cooling storage under load condition (Day 2).

| Time (Mins.) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|--------------|---------|---------|----------|----------|---------|
| 0            | 32      | 69.3    | 33       | 31       | 68.5    |
| 30           | 31.6    | 73.6    | 34       | 31       | 63      |
| 60           | 30.1    | 74.1    | 33       | 31       | 62.5    |
| 90           | 29.8    | 73.2    | 33       | 30       | 63      |
| 120          | 29.8    | 74.1    | 32       | 29       | 62.5    |
| 150          | 29.5    | 74.6    | 31       | 28       | 67.5    |
| 180          | 29.1    | 78      | 30       | 27       | 67      |
| 210          | 29.1    | 79.3    | 28       | 27       | 77.5    |
| 240          | 28.7    | 80.1    | 28       | 26       | 77.5    |
| 270          | 28.6    | 80.9    | 28       | 26       | 77.5    |
| 300          | 28      | 81.7    | 29       | 27       | 78      |
| 330          | 27.6    | 82      | 28       | 28       | 77.5    |
| 360          | 27.2    | 82.5    | 28       | 27       | 77.5    |
| 390          | 26.9    | 83.3    | 28       | 27       | 77.5    |
| 420          | 26.5    | 85      | 28       | 26       | 77.5    |
| 450          | 26      | 85.6    | 28       | 25       | 77.5    |
| 480          | 25.8    | 86      | 27       | 25       | 79      |

Table 12
Experimental data for cooling storage under load condition (Day 3).

| Time (Mins.) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|--------------|---------|---------|----------|----------|---------|
| 0            | 31.8    | 65.5    | 30       | 27       | 61.5    |
| 30           | 27.5    | 74      | 30       | 26       | 73.5    |
| 60           | 26.5    | 76      | 31       | 26       | 68      |
| 90           | 25.9    | 78.1    | 29       | 26       | 63      |
| 120          | 25.5    | 81      | 29       | 25       | 63      |
| 150          | 25.3    | 82.7    | 28       | 25       | 51.5    |
| 180          | 25.4    | 83.1    | 28       | 25       | 51.5    |
| 210          | 25.5    | 84      | 28       | 25       | 48      |
| 240          | 25.6    | 85.2    | 27       | 25       | 56      |
| 270          | 25.5    | 86      | 29       | 26       | 59      |
| 300          | 25.5    | 86.4    | 28       | 25       | 63.5    |
| 330          | 25.4    | 86.8    | 29       | 26       | 68      |
| 360          | 25.4    | 87.8    | 29       | 25       | 73.5    |
| 390          | 25.4    | 87.2    | 28       | 24       | 67.5    |
| 420          | 25.6    | 87.6    | 28       | 24       | 78.5    |
| 450          | 25.7    | 87.6    | 28       | 25       | 78.5    |
| 480          | 25.5    | 87.2    | 27       | 24       | 78      |

Table 13
Experimental data for cooling storage under load condition (Day 4).

| Time (Mins.) | Tc (°C) | RHc (%) | DBT (°C) | WBT (°C) | RHa (%) |
|--------------|---------|---------|----------|----------|---------|
| 0            | 30.5    | 74.1    | 33       | 28       | 65      |
| 30           | 27.1    | 80.5    | 31       | 27       | 72.4    |
| 60           | 27.2    | 82.2    | 32       | 27       | 64      |
| 90           | 27.4    | 82.2    | 30       | 26       | 69.6    |
| 120          | 27.3    | 82.3    | 30       | 26       | 61.2    |
| 150          | 27.4    | 82.7    | 29       | 26       | 52.4    |
| 180          | 27.2    | 83.9    | 29       | 26       | 52.4    |
| 210          | 27      | 83.9    | 29       | 26       | 50      |
| 240          | 26.7    | 84.7    | 28       | 26       | 55      |
| 270          | 26.2    | 85      | 30       | 27       | 58      |
| 300          | 25.9    | 85.7    | 29       | 26       | 64.1    |
| 330          | 25.6    | 86.1    | 30       | 27       | 68      |

(continued on next page)
Table 13 (continued)

| Time (Mins.) | $T_c$ (°C) | R.H$_C$ (%) | DBT (°C) | WBT (°C) | R.H$_A$ (%) |
|--------------|------------|-------------|----------|----------|-------------|
| 360          | 25.6       | 86.4        | 30       | 26       | 72.5        |
| 390          | 25.3       | 86.7        | 30       | 25       | 66.0        |
| 420          | 25.2       | 87.0        | 29       | 25       | 79.0        |
| 450          | 25.0       | 87.2        | 29       | 26       | 74.0        |
| 480          | 24.8       | 87.6        | 28       | 25       | 73.2        |

Table 14
Experimental data for cooling storage under load condition (Day 5).

| Time (Mins.) | $T_c$ (°C) | R.H$_C$ (%) | DBT (°C) | WBT (°C) | R.H$_A$ (%) |
|--------------|------------|-------------|----------|----------|-------------|
| 0            | 31.3       | 70.2        | 33       | 27       | 93.0        |
| 30           | 28.4       | 72.0        | 31       | 26       | 80.0        |
| 60           | 28.0       | 75.6        | 32       | 26       | 74.0        |
| 90           | 27.2       | 76.1        | 30       | 26       | 68.5        |
| 120          | 27.1       | 76.7        | 30       | 25       | 58.0        |
| 150          | 26.7       | 78.6        | 29       | 26       | 73.0        |
| 180          | 26.2       | 80.4        | 29       | 25       | 53.0        |
| 210          | 25.8       | 82.1        | 29       | 25       | 68.0        |
| 240          | 25.6       | 84.6        | 28       | 25       | 62.5        |
| 270          | 25.5       | 86.2        | 30       | 26       | 57.0        |
| 300          | 25.2       | 87.5        | 29       | 25       | 50.0        |
| 330          | 25.1       | 87.5        | 29       | 26       | 62.5        |
| 360          | 25.0       | 87.5        | 29       | 25       | 73.0        |
| 390          | 24.9       | 87.9        | 28       | 24       | 66.0        |
| 420          | 24.8       | 88.2        | 28       | 24       | 78.5        |
| 450          | 24.7       | 88.2        | 28       | 25       | 85.0        |
| 480          | 24.7       | 88.2        | 27       | 24       | 78.0        |

Table 15
Experimental data for cooling storage under load condition (Day 6).

| Time (30 mins) | $T_c$ (°C) | R.H$_C$ (%) | DBT (°C) | WBT (°C) | R.H$_A$ (%) |
|----------------|------------|-------------|----------|----------|-------------|
| 0              | 30.8       | 63.9        | 33       | 31       | 63.0        |
| 30             | 29.0       | 73.3        | 32       | 30       | 67.0        |
| 60             | 29.0       | 75.9        | 31       | 29       | 68.0        |
| 90             | 28.6       | 75.9        | 31       | 29       | 72.0        |
| 120            | 28.4       | 76.0        | 30       | 28       | 56.0        |
| 150            | 28.2       | 78.0        | 30       | 28       | 56.0        |
| 180            | 28.0       | 78.0        | 31       | 28       | 64.0        |
| 210            | 27.5       | 79.0        | 29       | 27       | 68.0        |
| 240            | 27.4       | 80.0        | 29       | 27       | 56.0        |
| 270            | 26.9       | 80.5        | 30       | 26       | 68.0        |
| 300            | 26.3       | 81.3        | 29       | 26       | 52.0        |
| 330            | 26.4       | 87.5        | 31       | 26       | 68.0        |
| 360            | 26.4       | 87.5        | 30       | 25       | 73.5        |
| 390            | 26.1       | 87.9        | 29       | 24       | 67.5        |
| 420            | 25.9       | 88.2        | 29       | 24       | 78.5        |
| 450            | 25.5       | 88.2        | 27       | 25       | 78.5        |
| 480            | 25.5       | 88.2        | 28       | 24       | 78.0        |
**Table 16**
Experimental data for cooling storage under load condition (Day 7).

| Time (Mins.) | $T_C$ (°C) | R.H C (%) | DBT (°C) | WBT (°C) | R.H A (%) |
|--------------|------------|-----------|----------|----------|-----------|
| 0            | 33.6       | 81        | 29       | 28       | 58.3      |
| 30           | 31.1       | 80        | 31       | 28       | 67.3      |
| 60           | 31         | 73        | 31       | 27       | 69.1      |
| 90           | 30.2       | 72.2      | 32       | 27       | 68.5      |
| 120          | 29.8       | 72.2      | 33       | 26       | 57.2      |
| 150          | 29.8       | 73.0      | 29       | 25       | 72.2      |
| 180          | 28.3       | 77.1      | 34       | 27       | 58        |
| 210          | 27         | 84.3      | 33       | 27       | 62.6      |
| 240          | 26.8       | 84.6      | 34       | 28       | 63.2      |
| 270          | 26.7       | 85.5      | 33       | 27       | 62.6      |
| 300          | 26.5       | 85.4      | 32       | 27       | 58        |
| 330          | 26.4       | 85.9      | 31       | 27       | 73.2      |
| 360          | 26.4       | 86.4      | 30       | 26       | 73        |
| 390          | 26.1       | 86.8      | 29       | 25       | 66        |
| 420          | 25.9       | 87.2      | 29       | 26       | 78.5      |
| 450          | 25.6       | 87.3      | 27       | 25       | 85        |
| 480          | 25.5       | 87.3      | 28       | 23       | 78        |

**Table 17**
Experimental data for cooling storage under load condition (Day 8).

| Time (30 mins) | $T_C$ (°C) | R.H C (%) | DBT (°C) | WBT (°C) | R.H A (%) |
|----------------|------------|-----------|----------|----------|-----------|
| 0              | 32.8       | 86        | 32       | 30       | 65.2      |
| 30             | 30.8       | 77.6      | 32       | 28       | 73.7      |
| 60             | 29.7       | 80.4      | 32       | 27       | 67.7      |
| 90             | 29.6       | 80.7      | 33       | 27       | 62.6      |
| 120            | 29         | 79.3      | 33       | 28       | 68.3      |
| 150            | 28.6       | 80        | 32       | 29       | 76.8      |
| 180            | 28.3       | 78.1      | 33       | 29       | 74.1      |
| 210            | 28.1       | 79.5      | 31       | 28       | 62.6      |
| 240            | 27.8       | 80.1      | 30       | 27       | 63.2      |
| 270            | 27.7       | 80.2      | 30       | 27       | 62.6      |
| 300            | 27.1       | 80.4      | 29       | 25       | 72        |
| 330            | 27         | 80.8      | 30       | 26       | 72.7      |
| 360            | 26.5       | 81.2      | 29       | 26       | 78        |
| 390            | 26.2       | 82.4      | 29       | 25       | 72.7      |
| 420            | 25.8       | 83.7      | 29       | 26       | 78        |
| 450            | 25.5       | 87.3      | 27       | 25       | 78.5      |
| 480            | 24.6       | 87.3      | 28       | 24       | 78        |

**Table 18**
Computed cooling efficiency under load condition.

| Days | Cooling Efficiency (%) |
|------|------------------------|
| 1    | 47.06                  |
| 2    | 55                     |
| 3    | 72.7                   |
| 4    | 88.5                   |
| 5    | 91.1                   |
| 6    | 50                     |
| 7    | 62.2                   |
| 8    | 67.7                   |
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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Fig. 4. Loaded Agricultural Produce Postharvest Storage System showing the experimental set up.