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Effect of different packaging material under different temperature conditions on physical properties and shelf life of rose (*Rosa indica*) and *plumeria* (*Plumeria alba*)

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Abstract
An experiment was conducted at Agriculture Lab, Department of Agriculture, D.A.V College, Abohar, Punjab during academic year 2018-19 to study the effect of different packaging material under different temperature conditions on physical properties and shelf life of Rose and Plumeria flower. The different packaging material such as aluminium foil container, transparent zip-pouch polythene and open as control were used for experiment. The flowers were kept at room temperature and under refrigerated conditions. The effect of different packaging under different temperature conditions on change in weight and size of flowers were observed. Minimum weight loss was observed in flowers packed in polythene pouch at room temperature followed by flowers kept without any covering under refrigerated conditions. Minimum reduction in size was observed in polythene pouch packed flowers stored under refrigerated conditions followed by aluminium foil packed flowers stored at room temperature.

Keywords: Packaging, temperature conditions, physical properties, *Rosa indica, Plumeria alba*

Introduction
Rose is a woody perennial flowering plant. Its name comes from the Latin word Rosa (wikipedia.com). Rose belong to family *Rosaceae* and Genus *Rosa* which contains more than 150 species and 1400 cultivars. Rose are symbol of beauty, fragrance and are used to convey the message of love. Rose is top ranking cut flower, in the flower trade on the basis of average, production and consumption (Arora) [1]. Rose enjoys superiority over all other flowers being extensively used for decorative purposes and is prized for its delicate nature, beauty, charm and aroma. Rose plants produce an aquisite floral display consisting of many vibrant colours, shapes, sizes and perfumes (Farooq *et al.*) [2]. Plumeria is national flower of Laos, known as *Dok Champa* and the symbol of luck. Plumeria belong to family *Apocynaceae* and Genus *Plumeria.* Flowers are strongly perfumed and white in colour with a yellow center. Their sweet scent and sheer beauty make them universally loved and the blooms look sensational on the tree and as a cut flower. Common names for plants in the genus vary widely according to region, variety and whim but frangipani are the most common. Plumeria also is used directly as a common name, especially in horticultural circles (Wikipedia.com).
Under ordinary conditions, the flowers could be a source of beautification and attraction for only two to three days. Since most of the people like to enjoy the beauty and scenery of flowers for a longer period of time, so keeping in view the socioeconomic value of flowers, there is a dire need to explore the possibilities of extending vase life by using different packaging material like cellophane paper, butter paper, aluminium lamination foil, polythene sheet etc. Due to perishable nature of flowers, there is huge post harvest loss ranging from 30-50 percent. Quantitative losses occur due to lack of knowledge on 'post-harvest handling' of flowers. These losses can only be minimized by proper handling, packaging, storage, marketing and processing of flowers. Different types of packaging material like polythene sheet and aluminium lamination foil are used to enhance the shelf life of flowers under different temperature conditions (Senapati *et al.*) [3].

Material and Methods

The experiment was conducted at Agriculture Lab, Department of Agriculture, D.A.V College, Abohar, Punjab, India. The flowers were collected from market and then shifted to Agriculture lab, D.A.V College, Abohar on the same day. Size of sample for Rose is 4 flowers and 10 flowers for Plumeria in each treatment. Three samples of Rose and three samples of Plumeria flowers were taken and kept one sample of both without any covering, one sample of both packed in transparent zip-pouch polythene and one sample of both packed in aluminium foil container at room temperature and under refrigerated conditions. The weight of flowers was measured daily with the help of weighing machine. Flower size was measured with the help of measuring scale.

Treatments

- Room Temperature
  T_1- Open
  T_2- Aluminium foil
  T_3- Polythene pouch
- Refrigerated conditions
  T_4- Open
  T_5- Aluminium foil
  T_6- Polythene pouch

Results and Discussions

Physiological loss in weight (%)

As from experiment, minimum weight loss (34.52% at 9th day) was observed in T_3 and maximum weight loss was recorded (80.82 % at 4th day) in T_1 followed by T_2 (43.18% at 5th day). Srivastava *et al.* [4] found the similar result that maximum loss of weight in flowers kept without any covering at room temperature. Kumawat *et al.* [5] also found the similar results that minimum weight loss of flowers in control treatment (Without packaging). Under refrigerated conditions, minimum weight loss (59.03% at 19th day) was observed in T_6 and maximum in T_4 (79.31% at 6th day) followed by T_5 66.66% after 12 days of storage. Similarly in Plumeria flowers, minimum weight loss (12.50% at 5th day) was observed in T_3 and maximum weight loss was observed in T_1 (72.72% at 4th day) followed by T_2 (40.78% at 5th day). Under refrigerated conditions, minimum weight loss (45.94% at 16th day) was observed in flowers packed in T_6 and maximum weight loss (68.75% at 9th day) was observed in T_4 followed by T_5 (60.00% at 12th day). Lavanya *et al.* [6] found the results that minimum physiological loss in weight was observed in flowers pre treated with 4% boric acid and packed in polyethylene and maximum physiological loss in weight was observed in open treatment (without wrapping).

Change in size of flower

From the conducted experiment, it was concluded that size of flowers at 4th day of storage was 3.10 cm in T_1 6.05 cm in T_2, 5.25 cm in T_3. Size of flower packed in T_1 until 9th day of storage 4.75 cm was observed at room temperature. Under refrigerated conditions, size of flowers at 6th day of storage was 3.00 cm in T_4, 4.50 cm in T_5 and 6.00 cm in T_6. Flower size at 12th day of storage in T_5 was 4.10 cm and at 19th day 3.50 cm in T_6. In Plumeria, flower size at 4th day of storage was 6.15 cm in T_1, 5.15 cm in T_2 and 5.75 cm in T_3. After 4-5 days of storage flowers in T_1, T_2 and T_3 became unfit for marketing. Under refrigerated conditions, flower size at 9th day of storage was 3.50 cm in T_4, 4.15 cm in T_5 and 4.75 cm in T_6. Flower size at 16th day of storage in T_6 was 4.00 cm. Bhaskar and Rao [7] found the similar result as flower packed in polythene sheet with combination of corrugated fibre box (CFB) shows maximum diameter. Dastagirid *et al.* [8] found that the flowers packed in cellophane paper shows maximum diameter and minimum diameter was observed in control (without wrapping).

Observations and Tables

Table 1: Effect of different packaging material under different temperature conditions on weight of Rose (%)

Days	Treatments					
	Room Temperature			Refrigerated conditions		
	(T_1)	(T_2)	(T_3)	(T_4)	(T_5)	(T_6)
1	0.00	0.00	0.00	0.00	0.00	0.00
2	77.16	14.77	10.71	29.65	11.11	9.63
3	80.82	26.13	13.09	58.12	22.22	27.71
4	80.82	32.95	16.66	65.02	22.22	39.75
5	Unfit for marketing	43.18	23.80	79.31	38.88	51.80
6		Unfit for marketing	30.95	79.31	38.88	51.80
7			34.52	Unfit for marketing	44.44	51.80
8			34.52		55.55	51.80
9			34.52		55.55	51.80
10			Unfit for marketing		55.55	51.80
11					57.77	51.80
12					66.66	51.80
13					Unfit for marketing	54.21
14						54.21
15						56.62
16						56.62
17						57.59
18						57.59
19						59.03
20						Unfit for marketing

Table 2: Effect of different packaging material under different temperature conditions on weight of Plumeria flowers (%)

Days	Treatments					
	Room Temperature			Refrigerated conditions		
	(T_1)	(T_2)	(T_3)	(T_4)	(T_5)	(T_6)
1	0.00	0.00	0.00	0.00	0.00	0.00
2	35.06	14.47	2.77	12.50	0.00	5.40
3	58.44	21.05	4.16	12.50	0.00	5.40
4	72.72	30.26	6.94	25.00	20.00	18.91
5	Unfit for marketing	40.78	12.50	37.50	33.33	18.91
6		Unfit for marketing	Unfit for marketing	50.00	33.33	18.91
7				62.50	46.66	25.67
8				68.75	46.66	25.67
9				68.75	46.66	25.67
10				Unfit for marketing	60.00	32.43
11					60.00	32.43
12					60.00	45.94
13					Unfit for marketing	45.94
14						45.94
15						45.94
16						45.94
17						Unfit for marketing

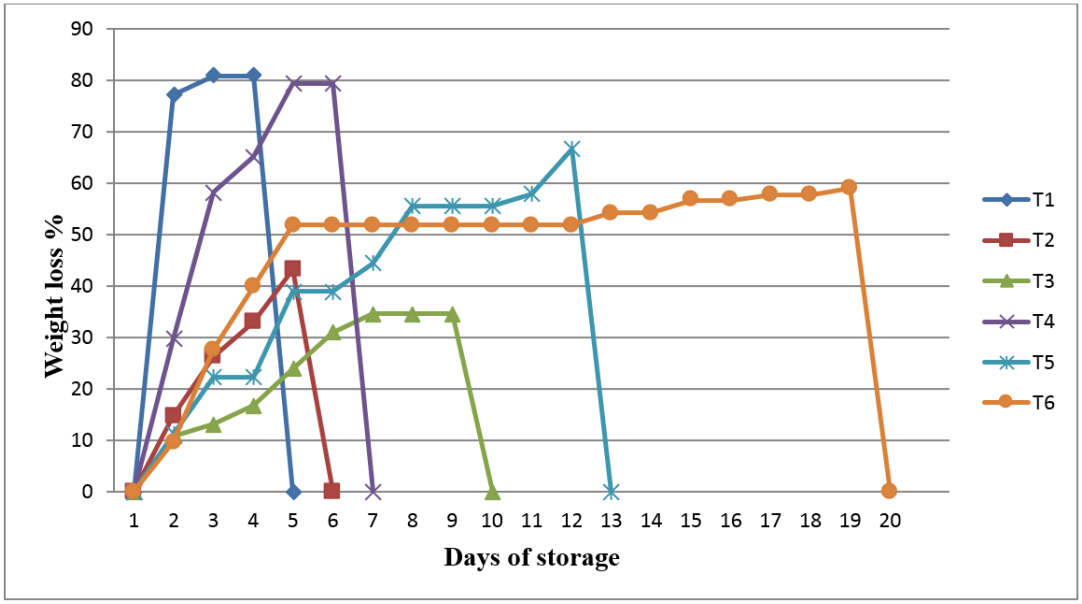

Fig 1: Effect of different packaging material under different temperature conditions on weight loss of Rose (%)

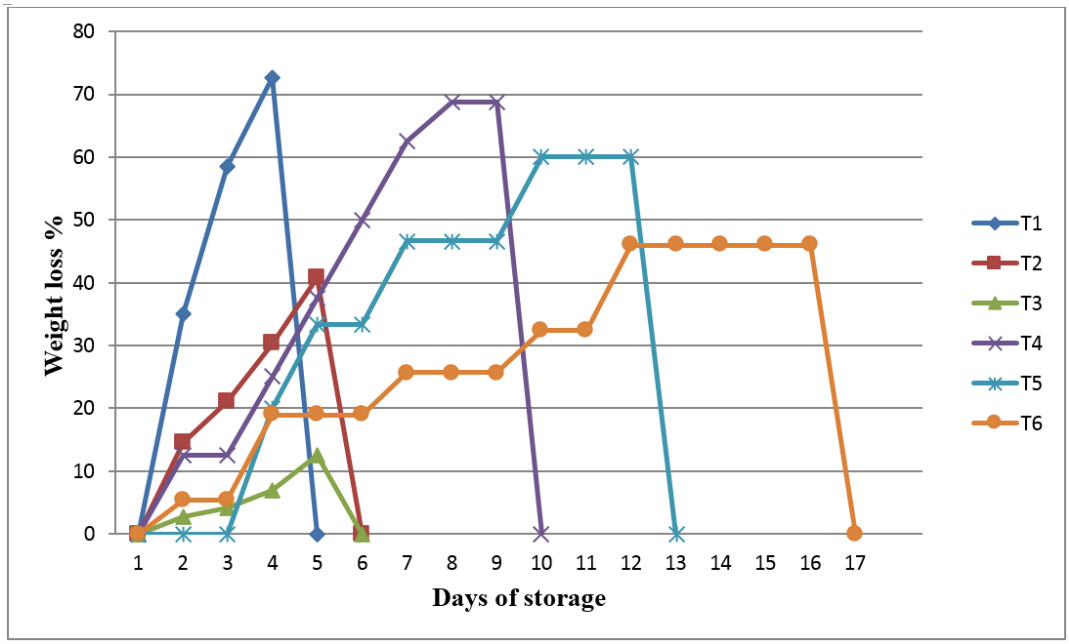

Fig 2: Effect of different packaging material under different temperature conditions on weight loss of Plumeria flowers (%)

Table 3: Effect of different packaging material under different temperature conditions on size of Rose (cm)

Days	Treatments					
	Room Temperature			Refrigerated conditions		
	(T_1)	(T_2)	(T_3)	(T_4)	(T_5)	(T_6)
1	6.96	7.06	6.18	6.80	6.11	6.08
2	3.13	7.05	6.05	4.72	6.05	6.25
3	3.13	7.00	5.75	3.60	5.85	6.11
4	3.10	6.05	5.25	3.10	5.30	6.11
5	Unfit for marketing	4.86	5.05	3.00	4.55	6.00
6		Unfit for marketing	5.00	3.00	4.50	6.00
7			4.90	Unfit for marketing	4.25	5.90
8			4.75		4.20	5.50
9			4.75		4.20	5.40
10			Unfit for marketing		4.10	5.00
11					4.10	4.90
12					4.10	4.50
13					Unfit for marketing	4.00
14						4.00
15						3.75
16						3.75
17						3.75
18						3.50
19						3.50
20						Unfit for marketing

Table 4: Effect of different packaging material under different temperature conditions on size of Plumeria flowers (cm)

Days	Treatments					
	Room Temperature			Refrigerated conditions		
	(T_1)	(T_2)	(T_3)	(T_4)	(T_5)	(T_6)
1	6.25	5.92	5.98	6.08	5.80	6.05
2	6.22	5.25	5.95	6.05	5.75	5.95
3	6.15	5.18	5.75	5.41	5.18	5.36
4	6.15	5.15	5.75	5.08	4.97	5.32
5	Unfit for marketing	5.15	5.50	5.00	4.50	5.25
6		Unfit for marketing	Unfit for marketing	4.50	4.50	5.25
7				4.00	4.15	5.00
8				3.75	4.15	4.75
9				3.50	4.15	4.75
10				Unfit for marketing	4.00	4.75
11					4.00	4.50
12					3.75	4.20
13					Unfit for marketing	4.20
14						4.20
15						4.10
16						4.00
17						Unfit for marketing

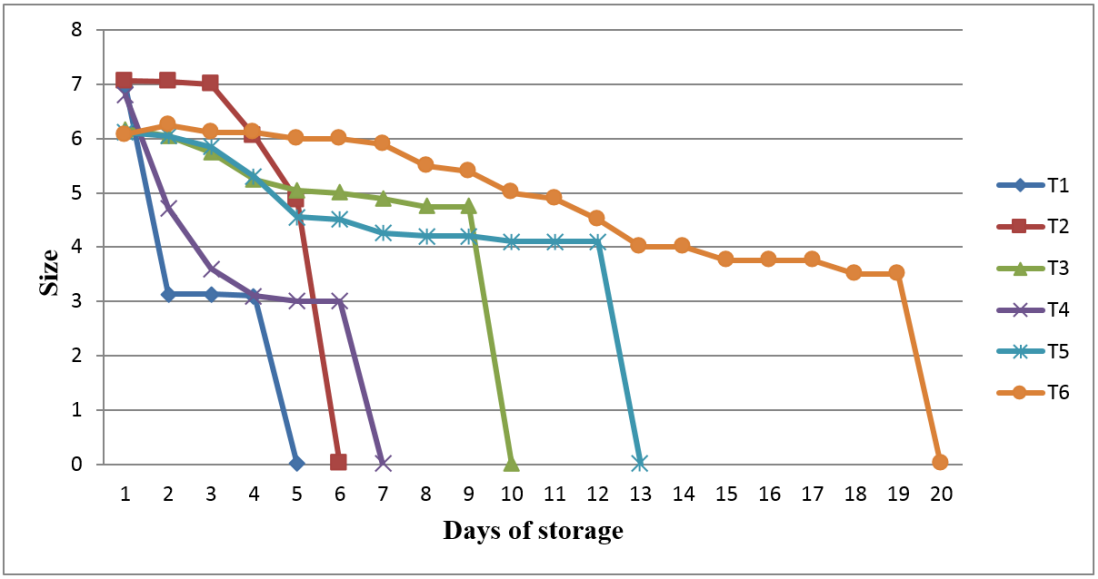

Fig 3: Effect of different packaging material under different temperature conditions on size of Rose

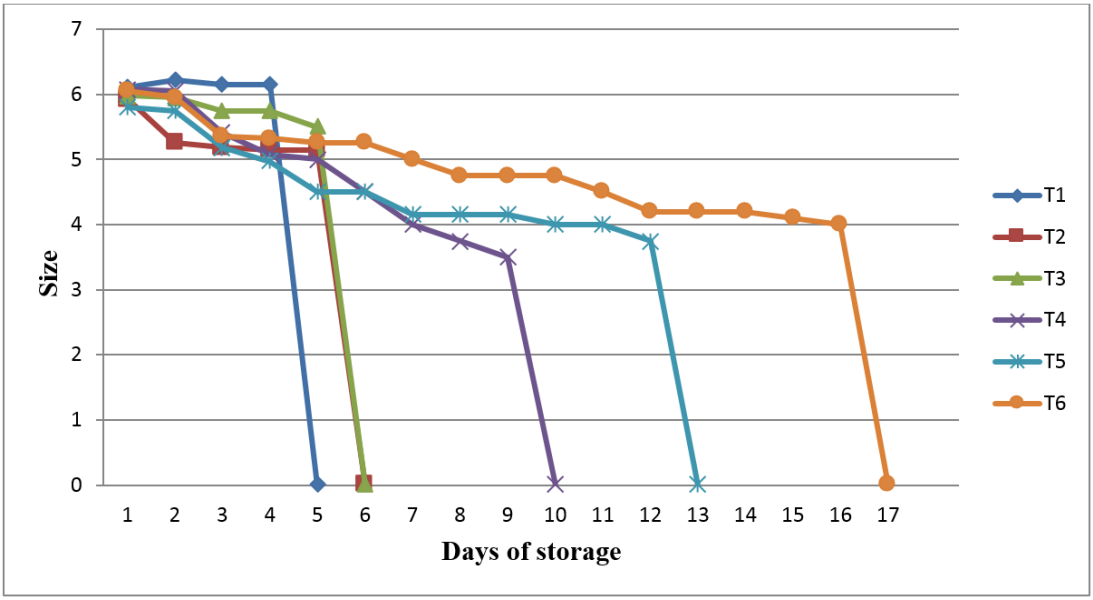

Fig 4: Effect of different packaging material under different temperature conditions on size of Plumeria

Conclusion

Different wrapping materials and storage conditions has marked effect on weight loss percentage and size of flowers. In Rose and Plumeria flowers, minimum loss in weight was observed in flowers packed in polythene pouch at room temperature and maximum weight loss was observed in unwrapped flowers kept at room temperature. Minimum reduction in size was observed in polythene pouch packed flowers stored under refrigerated conditions followed by aluminium foil packed flowers stored at room temperature. Among different wrapping materials, flowers packed in polythene pouch and kept under refrigerated conditions to be best for quality of flowers.

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