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Effect of Glycerine drying on preservation of different ornamental Foliage

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Abstract
Foliage of eight types: *Thuja occidentalis, Grevillea robusta, Ficus religiosa, Polyalthia longifolia, Rosa species, Hibiscus rosa-sinensis, Murraya paniculata* and *Justicia gendarussa* were treated with two different methods (full dip and uptake) and five different levels of glycerine i.e. 20%, 40%, 60%, 80% and control (distilled water) laid out in completely randomised design (factorial) to examine its pliability as dried materials for foliar design and decoration. All levels of glycerine solutions were absorbed within 3 to 20 days by all foliage. The best concentration of glycerine solution was 40% for most of the plant foliage due to its good pliability. The best means for foliage treatment was full dip method.

Keywords: Glycerine drying, foliage, preservation

Introduction
The beauty and fresh look of fresh flowers can be retained only for few days even by using the best techniques of post-harvest technology. Dried flower products are long lasting and retain their aesthetic value irrespective of the season (Malcolm, 1994) with lesser cost. These products are eco-friendly and biodegradable and their production is labour intensive, provides self-employment and job opportunities.

Various dehydration techniques like air drying, press drying, embedded drying, oven drying and freeze drying etc. have been developed by which flowers, twigs, branches, foliage etc. retain their fresh look for several months or years (Mishra *et al.* 2003) [9]. Despite of above methods of drying, none among them suit well for foliage drying. Glycerine preserves foliage by replacing the natural moisture present in the leaf with a substance that maintains the leaf form, texture and sometimes the colour. Glycerine is a humectant that can be absorbed into plant tissue either by transpiration stream uptake or by immersing the cut foliage in the solution and preserves foliage by replacing the natural moisture present in the leaf with glycol and maintains the leaf form, texture and colour (Bale, 2006) [1]. Glycerine drying is the most suitable method for drying of foliage (Anon, 2001) as the leaves absorb enough liquid and look soft and pliable (Day, 2000) [2]. 10%-30% glycerol solution in water on actively growing foliage gives best results. (Dubois and Joyce 2005) [3]. On the basis of their earlier studies they find glycerine is a superior preserving agent for foliage drying. Hence, in present study efforts were made to assess the optimum concentration of glycerine solution as a preserving agent for foliage drying of *Grevillea robusta, Ficus religiosa, Justicia gendarussa, Rosa species, Thuja occidentalis, Polyalthia longifolia, Hibiscus rosa-sinensis* and *Murraya paniculata* to increase shelf life.

Materials and Methods
The experiment on glycerine drying of ornamental foliage was carried out at Post harvest technology laboratory of Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj (UP) during 2018-19. Two methods of glycerine drying were employed for the dehydration of foliage. The experiment was laid out in completely randomised design (Factorial). Two different methods i.e. full dip and uptake, were employed. Each method contained five treatments with five replications. Mature leaves were collected from the field. Weight of leaves were taken at fresh and after drying. Quality parameters like colour, texture, brittleness, shape retention and overall acceptability were assessed by means of sensory evaluation by scoring on ten points hedonic scale (Ranganna, 1997) [11]. The data were subjected to statistical analysis of variance as described by (Panse and Sukhatme 2000) [10].

Results and Discussion

Time taken for foliage drying (Days)

Data in Table 1 depict the effect of using different levels and methods of glycerine application on different species of foliage for drying. In both the methods (full dip and uptake) and different levels of glycerine concentration significantly affected the duration of drying.

Change in leaf weight

Table 2 in data represent the change in leaf weight (g) as affected by the different treatments. Glycerol treatment of leaves at different levels and methods used, significantly changed the weight.

Sensory attributes

All the sensory attributes showed significant difference among different treatments and non- significant in some cases for the leaves of *Grevillea robusta, Ficus religiosa, Justicia gendarussa, Rosa species, Thuja occidentalis, Polyalthia longifolia, Hibiscus rosa-sinensis* and *Murraya paniculata* (Fig. 1 and 2). Overall acceptance of leaves was maximum in 40% glycerine by full dip and uptake method and least recorded in control which consisted water. Colour quality, texture, brittleness

Table 1: Time taken for drying (days) of foliage of *Thuja occidentalis* (A), *Grevillea robusta* (B), *Ficus religiosa* (C), *Polyalthia longifolia* (D), *Rosa species* (E), *Hibiscus rosa sinensis* (F), *Murraya paniculata* (G), *Justicia gendarussa* (H) under different methods of application and different concentrations of glycerine

	Treatments	A	B	C	D	E	F	G	H
M	M_1	10.98	7.92	7.91	9.63	11.37	7.45	**11.30**	9.46
	M_2	12.52	7.49	10.09	13.06	11.19	8.31	**6.13**	7.28
	SE(m)	0.05	0.03	0.04	0.15	0.05	0.03	0.04	0.04
	$CD_{0.05}$	0.15	0.09	0.12	0.05	0.14	0.09	0.11	0.11
C	C_1	10.36	6.60	7.02	9.68	9.10	6.85	8.12	6.10
	C_2	10.94	6.77	7.60	10.10	10.15	7.25	8.50	6.56
	C_3	12.66	7.20	9.93	13.00	11.33	7.91	9.00	8.65
	C_4	14.80	8.00	10.48	13.90	13.95	7.30	9.70	10.50
	C_5	10.00	9.95	10.00	10.05	11.88	10.10	8.25	10.05
	SE(m)	0.09	0.05	0.07	0.08	0.08	0.05	0.06	0.06
	$CD_{0.05}$	0.24	0.14	0.19	0.24	0.22	0.11	0.18	0.17
MXC	M_1C_1	10.12	6.90	7.00	7.15	9.10	6.40	10.10	7.30
	M_1C_2	10.88	7.10	7.16	8.20	10.10	7.01	11.00	7.72
	M_1C_3	11.11	7.40	7.55	11.00	11.05	7.86	11.40	9.70
	M_1C_4	12.80	8.20	7.85	11.80	12.80	6.00	14.00	12.60
	M_1C_5	10.00	10.00	10.00	10.00	13.80	10.00	10.00	10.00
	M_2C_1	10.60	6.30	7.03	12.20	9.10	7.30	6.15	4.90
	M_2C_2	11.00	6.45	8.03	12.00	10.20	7.50	6.00	5.40
	M_2C_3	14.20	7.00	12.30	15.00	11.60	7.97	6.60	7.60
	M_2C_4	16.80	7.80	13.10	16.00	15.10	8.60	5.40	8.40
	M_2C_5	10.00	9.90	10.00	10.10	9.96	10.20	6.50	10.10
	SE(m)	0.12	0.07	0.09	0.12	0.11	0.07	0.09	0.09
	$CD_{0.05}$	0.35	0.20	0.27	0.34	0.31	0.20	0.26	0.24

Table 2: Percentage of moisture loss for drying of foliage of *Thuja occidentalis* (A), *Grevillea robusta* (B), *Ficus religiosa* (C), *Polyalthia longifolia* (D), *Rosa species* (E), *Hibiscus rosa sinensis* (F), *Murraya paniculata* (G), *Justicia gendarussa* (H) under different methods of application and different concentrations of glycerine

	Treatments	A	B	C	D	E	F	G	H
M	M_1	9.57	14.27	13.60	10.49	10.57	20.46	20.70	22.02
	M_2	-8.70	6.01	2.74	-10.09	-5.41	16.91	24.77	16.52
	SE(m)	0.08	0.09	0.08	0.11	0.09	0.08	0.09	0.08
	$CD_{0.05}$	0.23	0.27	0.23	0.31	0.24	0.22	0.26	0.23
C	C_1	-13.13	-3.44	-1.99	-5.64	-0.41	9.51	16.30	8.08
	C_2	-13.35	-10.87	-6.68	-20.18	-12.47	7.89	13.79	9.01
	C_3	-9.27	-2.17	-2.81	-13.31	-11.89	11.84	19.01	16.51
	C_4	-3.15	26.27	11.93	-2.3	-6.31	17.92	25.22	18.84
	C_5	41.06	40.93	40.38	42.43	43.99	46.26	39.36	43.90
	SE(m)	0.13	0.15	0.13	0.17	0.13	0.12	0.15	0.13
	$CD_{0.05}$	0.36	0.42	0.36	0.48	0.38	0.35	0.42	0.36
MXC	M_1C_1	-2.82	-3.20	-2.11	-0.36	1.89	8.61	13.27	9.88
	M_1C_2	-5.90	-10.69	-4.12	-15.19	-1.75	6.92	10.73	8.54
	M_1C_3	1.52	13.96	2.77	1.56	2.26	14.08	17.44	22.70
	M_1C_4	13.18	30.77	30.89	24.74	5.66	24.98	22.23	25.72
	M_1C_5	41.86	40.51	40.55	41.73	44.77	47.69	39.83	43.23
	M_2C_1	-23.45	-3.68	-1.87	-10.91	-2.72	10.41	19.33	6.28
	M_2C_2	-20.79	-11.05	-9.25	-25.17	-23.19	8.86	16.85	9.48
	M_2C_3	-20.06	-18.30	-8.40	-28.17	-26.04	9.60	20.58	10.32
	M_2C_4	-19.47	21.76	-7.02	-29.33	-18.28	10.86	28.20	11.95
	M_2C_5	40.27	41.34	40.21	43.13	43.20	44.82	38.88	44.57
	SE(m)	0.18	0.21	0.18	0.24	0.19	0.17	0.21	0.18
	$CD_{0.05}$	0.51	0.60	0.51	0.68	0.54	0.49	0.59	0.51

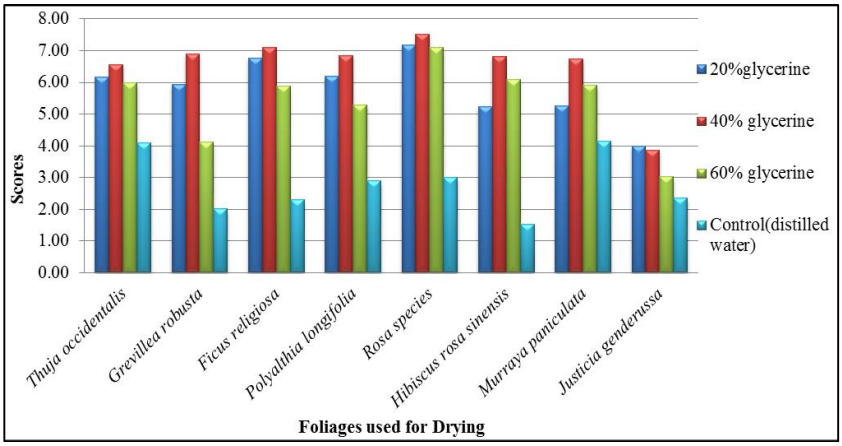

Fig 1: Score on overall acceptance for drying of different foliage under different concentration of glycerine by uptake method.

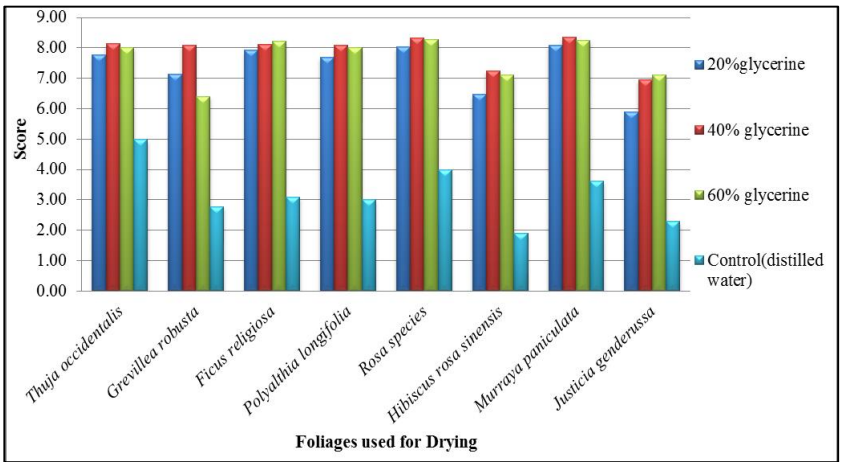

Fig 2: Score on overall acceptance for drying of different foliage under different concentration of glycerine by uptake method.

Discussion

Glycerine is modified alcohol containing two or more hydroxyl (-OH) groups (Morrison and Boyd, 1959). The effectiveness of the experiment of treatments is because of the presence of hydroxyl groups. Glycols are hydrophilic and have strong affinity for water. This endows many glycols to be used as a humectant or softening agent. Glycols have high boiling point with low viscosity and subsequently evaporates at much slower rate than water at a specific temperature. Hence, foliage of different plants treated with glycerine took longer duration compared to control.

Internal moisture of plant parts replacement with solvents like glycol by osmosis. Plant cell studies showed that, turgid cell containing cell sap with certain osmotic concentration when placed in higher osmotic concentration solution; exosmosis takes place and hypertonic solution try to become isotonic. Then, the hypotonic solution replaces the cell sap solution (Mitra *et al*., 1997) [7] to retain their original texture, shape and colour. The processed part look more natural than air dried leaves, it is less prone to shattering and mechanical damage and more natural in appearance (Leonard, 1973). Various workers used glycerine specially to preserve foliage. Relevant works with proper scientific justification were not found though the incident could be explained through simple osmosis.

Glycerine and hot water solution preservation of foliage bring them to everlasting category. As the moisture of the foliage is replaced by mixture of glycerine and water, the foliage product quality is found to be good. A pinch of antibiotic is needed to prevent microbial growth in dried specimen as it is a good source for microorganism. Water content of the leaves is replaced by giving them a strong and stable nature. Glycerine at 50 % (Full dip method) was the best with respect to all quality parameters (shape retention, texture, colour retention, brightness, brittleness and overall acceptance) supported by Vishnupriya and Jawaharlal (2014) is similar to results in present finding of 40% glycerine concentration.

Conclusions

Based on the present findings it can be concluded that full dip method of application of glycerine is better as compared to uptake method for drying foliage of *Thuja occidentalis*, *Grevillea robusta*, *Ficus religiosa*, *Rosa species*, *Polyalthia longifolia*, *Hibiscus rosa-sinensis* and *Murraya paniculata*, *Justicia gendarussa.*

By overall observations 40% solution of glycerine is most favourable concentration of glycerine for drying of cut foliage of *Thuja occidentalis*, *Grevillea robusta*, *Ficus religiosa*, *Rosa species*, *Polyalthia longifolia*, *Hibiscus rosa-sinensis* and *Murraya paniculata*, *Justicia gendarussa*.

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