Application of different dehydration technology on Chrysanthemum for quality dry flower production under Terai region of West Bengal, India

Abstract:-

Flower is an integral part of human life and day by day the demand is increasing throughout the world. Though fresh flowers look attractive and become scented but it can't be stored for long time, so, dry flower is the substitute of fresh flowers. Dry flowers are easy tohandle and it can be stored for a long time, hence, available for year roundsupply and post-harvest losses are very low.Twenty three different techniques can be applied for dry flower production, such as - Sun drying, shade drying, sand drying, silicagel drying, borax drying, corn meal drying, alum drying, glycerol drying, hot air oven drying, embedded drying in hot air oven, solar cooker dryingand embedded drying in solar cooker. The colours of initial fresh flowers were matched with RHS (Royal Horticulture Society) Colour Chart and observed as -Yellow group 7(A) and finalcoloursof dried flowers were observedas - T_1 (22-B), T_2 (15-D), T_5 (22-B), T_8 (14-C), T_9 (15-B), T_{18} (19-A), T_{20} (22-A), T_{21} (18-C), T_{22} (18-B) meant Yellow orange group and T_3 (13-B), T_{16} (13-B), T_4 (11-A), T_6 (9-B), T_{11} (9-B), T_7 (13-C), T_{14} (13-C), T_{10} (10-A), T_{12} (8-A), T_{13} (12-A), T_{15} (12-A) meant Yellow group. Last two treatments like T_{17} (163-A) and T_{23} (162-A) showed Grey orange group. Maximum reduction infresh weight was noticed under T_{10}(1.35g) treatment and minimum with T_8(0.35g) treatment. The minimum days required for drying wasobserved under T_5(4.17days) and T_7(4.17days) treatments and maximum days requiredby T_2(22.17days) treatment. Least moisture reduction in the finished product was observed in T_8 (31.41%)whereas the moisture reduction was found highest inT_{10} [89.21(70.83) %] treatment.

Key Words:- Chrysanthemum, Dehydration technology, Moisture content

Introduction: -

Chrysanthemum also called as "Queen of flowers" belongs to Asteraceae family. Among the commercial flowers Chrysanthemum isvery popular and attractive (Joshi *et, al* 2009) and it has various range of colours, shape and size (Baskaran *et, al.*, 2009). It is cultivated all over the year but in West Bengal condition it is cultivated only in winter months.

Flowers are the gift from nature and at present days it is the integral part of human life, as it is associated to various angles in our society, like– social, ritual, marriage anniversary, worship, garden decorationand funeralas well as for several medicinal purposes too. Fresh flowers are quite attractive, highly expensive having shorter life span and only available in a particular period but dry flowers are long lasting, available throughout the year, easy tohandle and retain aesthetic look.All the plant partsare used for dehydration purpose towards ornamentation, such as- flower, root, shoot, leaf, stem, flower bud, spine and bark (Raj, 2001). Utilization of Dry flowers was considered from pre-historical period as well as for herbarium preparation and onward botanical identification of species. The dry flower technique was first introduced from Japan which was called as “Oshana” and later it was spread from Asian country to European country because of good appearance with everlasting quality (Joyce, 1998). Recently, floriculture has been proved as a profitable business as its importance, utility, and scope have been realized (Raghava, 2001). Among the floriculture sector dry flower productionis the major part of Indian Floriculture and now a day’s India is one of the leading exporters in the world (Rajaram *et al.*, 2009). A considerable amountof raw materials has been exported to UK, Japan, Australia, Russia and America (Puri, 1995). At present, India reachedaround Rs.100 Crore of business volume for dry flower purpose, but, Indian share in the global market was estimated at around 5% of dry flower product. Major segment of this industry are potpourri which alone reached 55 Crore volume and annual turnover of this industry was 15% (Sindhuja *et, al.,* 2017). Demand of dry flowers is increasing day by day, so, yearly increase in the demand (8-10%) is observedthat indicates lot of opportunities for Indian entrepreneurs to enter in the global floricultural trade (Singh, 2009). Various ornamentals are suitable to dry flower purpose, such as - Chrysanthemum, China Aster, Helichrysum, Marigold, Petunia, Phlox, Verbena, Poppy, Bougainvillea and different types of foliages are also befitting, still, techniques of drying are Sun dying, Shade dying, hot air oven drying, microwave oven drying, freeze drying, embedded media drying, Solar cooker drying, water drying and glycerol dryingthat can be used for preparation of decorated floral crafts, like - handmade paper, wall hanging paper, potpourri, greeting cards, candle decoration etc (Bhutani, 1990).

Today, a cottage scale industry based on value added dried products can offer self-employment generation of rural youth to improve rural economy. Now a days this industry provides direct and indirectemployment to around 15,000 and 60,000 people (Sankari and Anand, 2014) respectively.

Material and Methods:-

The present research work entitled “Application of different dehydration technology on Chrysanthemum for quality dry flower production under Terai region of West Bengal” was conducted at the Department of Floriculture, Medicinal and Aromatic Plants, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, Pundibari, CoochBehar, West Bengal, India in two consecutive years. Geographically the area is situated at an elevation of 43 meter above the mean sea level at 26° 19'86" N latitude and 89°23'53" E longitude. The research trial was conducted followingCRDas Design of experiment withtwenty-threetreatments replicated thrice.

23 different treatments, such as - T_1 = Sun drying, T_2 = Shade drying under room temperature, T_3 = Embedded drying in Sand at room temperature, T_4 = Embedded drying in Silica Gel at room temperature, T_5 = Embedded drying in Saw Dust at room temperature, T_6 =

Embedded drying in Corn Meal at room temperature, T_7 = Embedded drying in Borax at room temperature, T_8 = Embedded drying in Alum at room temperature, T_9 = Embedded drying in Glycerol at room temperature, T_{10} = Drying in hot air oven at 50^0C, T_{11} = Embedded drying in Sand in hot air oven at 50^0C, T_{12} = Embedded drying in Silica Gel in hot air oven at 50^0C, T_{13} = Embedded drying in Saw Dust in hot air oven at 50^0C, T_{14} = Embedded drying in Corn Meal in hot air oven at 50^0C, T_{15} = Embedded drying in Borax in hot air oven at 50^0C, T_{16} = Embedded drying in Alum in hot air oven at 50^0C, T_{17} = Drying in Solar Cooker, T_{18} = Embedded drying in Sand in Solar Cooker, T_{19} = Embedded drying in Silica Gel in Solar Cooker, T_{20} = Embedded drying in Saw Dust in Solar Cooker, T_{21} = Embedded drying in Corn Meal in Solar Cooker, T_{22} = Embedded drying in Borax in Solar Cooker and T_{23} = Embedded drying in Alum in Solar Cooker

Initial flowercolour and post drying flowercolour had been measuredthroughuniversally acceptedRHS colour chart. Change of fresh weight of flowers had been taken through electrical balanceevery day. Moisture content of finished product had been calculated through this formula –

Moisture content= [(Initial weight-Final weight)/(Initial weight)]*100.

Duration of drying meant the days required for making a finished product from Chrysanthemum fresh flowers.

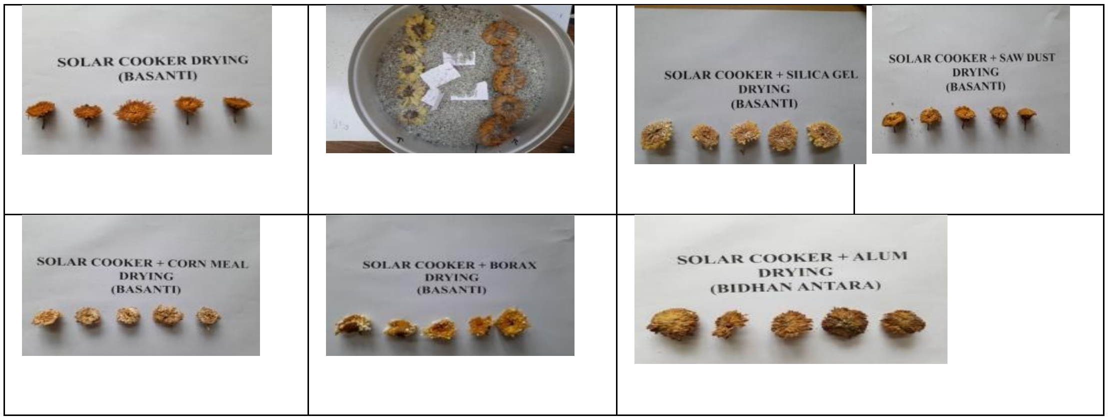

Fig 1: Finished product of dry chrysanthemum flower through different dehydration

Results

Initial flower colour-

Chrysanthemum flowers were taken from Floriculture Instructional Farm, Uttar Banga Krishi Viswavidyalaya and subjected to different dehydration techniques in the Terai region of West Bengal. After harvesting,the fresh flowers were matched with RHS (Royal Horticulture Society) Colour chart and finally observed asYellow group 7(A) in the corresponding colour chart (Table – 1).

Table – 1: Effect of drying methods on the change of colour and fresh weight of chrysanthemum flowers

TREATMENT	INITIAL COLOUR OF FLOWERS (RHS COLOUR CHART)		FINAL COLOUR OFFLOWERS(RHS COLOUR CHART)		CHANGE IN FRESH WEIGHT OF FLOWERS (g)
	YEAR 1	YEAR 2	YEAR 1	YEAR 2	POOLED
T_1	Yellow group 7(A)	Yellow group 7(A)	Yellow-orange group 22(B)	Yellow-orange group 22(B)	0.85^{e}
T_2	Yellow group 7(A)	Yellow group 7(A)	Yellow orange group 15(D)	Yellow orange group 15(D)	0.67^{g}
T_3	Yellow group 7(A)	Yellow group 7(A)	Yellow group 13(B)	Yellow group 13(B)	0.48^{h}
T_4	Yellow group 7(A)	Yellow group 7(A)	yellow group 11(A)	yellow group 11(A)	0.71^{fg}
T_5	Yellow group 7(A)	Yellow group 7(A)	Yellow orange group 22(B)	Yellow orange group 22(B)	0.79^{ef}
T_6	Yellow group 7(A)	Yellow group 7(A)	Yellow group 9(B)	Yellow group 9(B)	0.67^{g}

TREATMENT	INITIAL COLOUR OF FLOWERS (RHS COLOUR CHART)		FINAL COLOUR OFFLOWERS(RHS COLOUR CHART)		CHANGE IN FRESH WEIGHT OF FLOWERS (g)
	YEAR 1	**YEAR 2**	**YEAR 1**	**YEAR 2**	**POOLED**
T_{7}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 13©	Yellow group 13©	0.38^{i}
T_{8}	Yellow group 7(A)	Yellow group 7(A)	Yellow orange group 14©	Yellow orange group 14©	0.35^{i}
T_{9}	Yellow group 7(A)	Yellow group 7(A)	Yellow orange group 15(B)	Yellow orange group 15(B)	0.63^{g}
T_{10}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 10(A)	Yellow group 10(A)	1.35^{a}
T_{11}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 9(B)	Yellow group 9(B)	1.22^{b}
T_{12}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 8(A)	Yellow group 8(A)	1.26^{b}
T_{13}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 12(A)	Yellow group 12(A)	1.06^{c}
T_{14}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 13©	Yellow group 13©	1.34^{a}
T_{15}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 12(A)	Yellow group 12(A)	0.94^{d}
T_{16}	Yellow group 7(A)	Yellow group 7(A)	Yellow group 13(B)	Yellow group 13(B)	1.24^{b}
T_{17}	Yellow group 7(A)	Yellow group 7(A)	Greyed orange group 163(A)	Greyed orange group 163(A)	1.22^{b}
T_{18}	Yellow group 7(A)	Yellow group 7(A)	Yellow orange group 19(A)	Yellow orange group 19(A)	0.80^{e}
T_{19}	Yellow group 7(A)	Yellow group 7(A)	yellow orange group 14(A)	yellow orange group 14(A)	1.03^{c}
T_{20}	Yellow group 7(A)	Yellow group 7(A)	Yellow orange 22(A)	Yellow orange 22(A)	1.06^{c}
T_{21}	Yellow group 7(A)	Yellow group 7(A)	Yellow orange 18©	Yellow orange 18©	0.99^{cd}
T_{22}	Yellow group 7(A)	Yellow group 7(A)	Yellow orange 18(B)	Yellow orange 18(B)	0.83^{e}
T_{23}	Yellow group 7(A)	Yellow group 7(A)	Greyed yellow group 162(A)	Greyed yellow group 162(A)	0.84^{e}
SE(M)±	-	-	-	-	*0.029*
CD at 5%	-	-	-	-	**0.085**

Final Colour:-

After drying of chrysanthemum flowers using different dehydration methods,thefinal colourhad been changed as compared to initial flower colour. In this parameter -T_1 (22-B), T_2 (15-D), T_5 (22-B), T_8 (14-C), T_9 (15-B), T_{18} (19-A), T_{20} (22-A), T_{21} (18-C), T_{22} (18-B) treatments indicated Yellow orange group and T_3 (13-B), T_{16} (13-B), T_4 (11-A), T_6 (9-B), T_{11} (9-B), T_7 (13-C), T_{14} (13-C), T_{10} (10-A), T_{12} (8-A), T_{13} (12-A), T_{15} (12-A) showed Yellow group. Grey based colouration was noticed with T_{17} and T_{23} (Table – 1).

Changes in fresh weight of flowers (g):-

The maximum change in the fresh weight was found when the flowers were dried in hot air oven at 50^0C (1.35g) which was at par with the treatment T_{14}. When the flowers were subjected to drying by embedding in alum showed the least change (Table – 1) in the fresh weight of flowers(0.35g).

Table – 2: Effect of drying methods on the days required for drying of flowers and moisture reduction in dried chrysanthemum flowers

TREATMENT	DURATION TO DRY (Days)	MOISTURE REDUCTION IN FINISHED PRODUCT**(%)**
T_1	16.67^l	$65.52^g(54.04^g)$
T_2	22.17^o	$52.39^j(46.37^j)$
T_3	20.17^n	$34.98^n(36.26^n)$
T_4	14.17^i	$51.36^{jk}(45.78^{jk})$
T_5	15.17^j	$57.22^i(49.15^i)$
T_6	13.17^h	$45.89^l(42.64^l)$
T_7	13.17^h	$28.85^o(32.49^o)$
T_8	16.17^k	$27.16^p(31.41^p)$
T_9	17.07^m	$42.84^m(40.88^m)$
T_{10}	6.13^e	$89.21^a(70.83^a)$
T_{11}	5.20^c	$77.09^e(61.40^e)$
T_{12}	4.27^a	$79.41^d(63.02^d)$
T_{13}	4.17^a	$74.03^f(59.37^f)$
T_{14}	6.17^e	$86.86^b(68.76^b)$
T_{15}	4.17^a	$58.56^i(49.93^i)$
T_{16}	5.67^d	$86.01^b(68.04^b)$
T_{17}	8.07^g	$82.26^c(65.10^c)$
T_{18}	4.63^b	$61.31^h(51.54^h)$
T_{19}	5.20^c	$78.37^{de}(62.28^{de})$
T_{20}	5.77^d	$79.31^d(62.94^d)$
T_{21}	6.67^f	$75.17^f(60.12^f)$
T_{22}	4.67^b	$50.70^k(45.40^k)$
T_{23}	5.67^d	$65.78^g(54.21^g)$
SE(M)±	*0.100*	*0.521(0.345)*
CD at 5%	**0.293**	**1.525(1.010)**

Duration required for drying (days):-

Number of days required for drying was affected by different dehydration technology and the variation was noticed statistically significant in chrysanthemum flowers (Table – 2). According to the Duncan's analysis resultsdivided into fifteen subsets. Dried through embedding in saw dust or borax in hot air oven at 50^0C indicated very fast (4.17 days) drying of chrysanthemum but shade drying under room temperature resulted very slow drying (22.17 days).

Moisture content of finished product in driedchrysanthemum flowers (%):-

Different dehydration technology showed statistically significant effects in moisture reduction of dried Chrysanthemum flowers (Table – 2). The Duncan's analysis had resulted sixteen subsets and the maximum moisture reduction was found in hot air oven at 50^0C [89.21(70.83) %] and minimum moisture reduction was noticedin alum drying at room temperature [27.16(31.41)%].

Discussion and Conclusion

Sun drying is the most common drying method which is fully nature dependent. It needs more time for drying especially during cloudy period results poor quality of flowers. Lesser hours of Sunshineis a hindrance towards good drying with natural resources in this region. Major drawback of Sun drying again is blackening of flower due to greater reduction of moisture causing over pigment concentration per unit area. Till this technique is considered widelyas it is very cheap and easy to handle. Shade drying, also called as air drying, also depends on nature but it does not require any automation or any substrate even if container for drying of flowers (Rathod *et al*., 2019). Exposure time would be lesserwhen atmospheric humidity becomes lower than 75% along with hot temperature and relatively greater air velocity, otherwise the product would be liable to mould infestation leading to spoilage (Jain *et al*., 2016). Dehydration of ornamentals through air drying technique was also studied by Boyar *et al*., (2013) in rose, Yuan *et al*. (2015) in China Aster, Chandana *et al*., (2021) in chrysanthemum and gerbera.Embedded drying with sand also offers holding of flower petals in position thereby preventing deformation which is also a cheap and easy method (Vidhya *et al*., 2021). It absorbs moisture from the surface of the petals at moderate rate due to large particle size and it is not having any bleaching property.Silica gel is an amorphous and porous form of silicon dioxide (silica), consisting of an irregular tridimensional framework of alternating silicon and oxygen atoms with nanometer-scale voids and pores. The voids may contain water or some other liquids, or may be filled by gas or vacuum. In the last case, the material is properly called as silica xerogel. Silica xerogel with an average pore size of 2.4 nanometers has a strong affinity for water molecules and is widely used as a desiccant. It is hard and translucent, but considerably softer than massive silica glass or quartz; and remains hard when saturated with water; which was also studied by Meman *et al*. (2006) in China Aster, Mathapati *et al*. (2015) in gerbera and Preethi *et al*. (2019) in non-traditional flowers. Borax, basically anhydrous borate of sodium, is a crystalline compound with the chemical formula of $Na_2H_{20}B_4O_{17}$, is always used as embedded media for dehydration of flowers due to the strong hygroscopic nature of the compound that led to rapid moisture removal from flowers (Singh *et al*., 2003).Saw dust isanother embedding medium and it is available as a byproduct of wood industry. Light weight of thisdrying mediumhelps the petals of flowers a thorough liberation of moisture from the surface and it is moderately hygroscopic in nature, so, absorbing capacity is faster from flowers (Swathi *et al*., 2017).Alumis chemically crystalline hydrated double sulphate salt of potassium and aluminium capable of absorbing moisture and hence can be used as embedding material for drying of flowers. Major problem of alum and borax are hardy with cracking in nature when absorbs moisture (Bhattacharjee and Dey, 2003). Corn meal basically developedfrom dried corn which is very light in weight and hygroscopic in nature,so, used as an embedding medium for drying of flowers having a tendency to stick to the product and hence very difficult to handle but at the same time it checks thedevelopment of flattened flowers. Glycerol, also called as glycerine, is chemically an alcohol which is viscous and nontoxic in nature used for preserving twigs for botanical purposes. Now a days, glycerine is used for drying technique of flowers and foliages due to its extreme water absorbing capacity (Joyce, 1998). Plant parts dried under glycerol solution result soft and flexible (Dana, 1983). The quality of dried product looks good due to replacement of moisture in flower by water and glycerine mixture (Paul and Shylla, 2002). This dehydration technique of dried products always turns bright and attractive. Pranavi *et al*. (2022) in gerbera, Wilkins and Desborough(1986) in carnation, De *et al*. (2017) in orchids -standardized universally applicable dehydration technique of flowers using glycerol.Hot air oven is another dehydration technique and it is fully conducted by electricity. This machine produces heat uniformly that circulatesthrough fans,usually in a closed circuit to conserve the energy. It does not depend on nature and very faster drying with less chance of fungal attack is observed which is the major advantage. Generally 40-50^{0}C temperature is ideal for dehydration of Ornamentals, but, Safeena and Patil (2013) reported that Duch Rose cultivars - Skyline, Lambada, Ravel and First Red were dried at 40^{0}C in hot air oven with silica gel became more acceptable in respects of colour, appearance and texture. A solar cooker is another dehydration technique that does not require electricity but it operates with renewable source of energy which generates heat through a mirrored surface with high spectacular reflection that can converge the solar radiation into a smaller area. Concentration of light energy onto a receiver converts ultimately into heat energy through conduction. Using a glass lid, this machine, isolates the inside air to the outside leading to entrapment of heat energy within the cooker, minimizing the convection loss. Solar driers can scientifically be used for drying of high valued flowers (Pachpinde *et al*., 2019). Here,embedding drying in saw dust or borax under hot air oven at 50^{0}C required the least period for drying of Chrysanthemum flowers and hence, can be recommended.

Reference:-

Baskaran, V., Janakiram, T. and Jayanthi, R. (2009). Evaluation of post-harvest quality of some cultivars of chrysanthemum. *Journal of Ornamental Horticulture*. **12**(1): 59-6.

Bhattacharjee, S. K and De, L.C. (2003). Dried flowers and plant parts. *In advanced Commercial Floriculture*. Avishkar Publishers, Jaipur. pp. 162-173.

Bhutani, J. C. (1990). Capturing nature, a way with flower "Everlastings".*Indian Horticulture*. **34**(4)**:** 15-19.

Boyar, S., Bayhan, K. A., Dikmen, E. (2013). Investigation on drying behavior of is parta rose flowers (*Rosa damascena*mill.) under natural shade conditions. *Bulgarian Journal of Agricultural Science*, **19**(2): 361-374.

Chandana, S., Malam, V. R., Sinchana J. N. R. (2021). Evaluation of different drying methods and desiccants on physical parameters of annual chrysanthemum and gerbera. *The Pharma Innovation Journal*. **10**(12): 938-945.

Dana, M. (1983). Preserving plant materials. Extension publication HO-102, Purdue University, Indiana, 4p.

De, L. C., Singh and Thapa, S. (2017). Drying technologies in orchids. *International Journal of Environmental Sciences & Natural Resources.* **6**(1): 6-10

Jain, R., Janakiram, T., & Kumawat, G. L. (2016). Drying Techniques in Ornamental Plants. *Commercial Horticulture*, 501-12.

Joshi, M., Verma, R. L. and Masu, M. M. (2009). Performance of different varieties of chrysanthemum in respect of growth, flowering and flower yield under north Gujarat condition. *The Asian Journal of Horticulture,* **4** (2): 292-294.

Joyce, D. C. (1998). Dried and preserved ornamental plant material not new, but often overlooked and underrated. *Acta Horticulturae*. **454**: 133-145.

Mathapati, S., Naik, H. B., Chougala, S., Pujeri, S. U. and Shivakumar. (2015). Standardization of drying temperature and time in hot air oven of gerbera var. impireal. *International Journal of Scientific Research*. **4**(12): 22-24.

Meman, A. M., Barad, V. A. and Raval, J. L. (2006). Effect of drying conditions and embedding materials on post-harvest quantitative parameters in China aster (Callistephus chinensis) flowers. Journal of Hortculture Science. **1**(1): 48-51, 2006.

Pachpinde, P., P. K Sharma., K. P., Mani, I., Parray, A. H. (2019). Design and development of hybrid solar dryer for flowers. *Indian Journal of Agricultural Sciences.* **89**(11): 1837–41

Paul, D. and Shylla, B. (2002). The art of flower drying. In: Mishra R L and Mishra S (eds.). Floriculture Research Trends in India. pp. 41-46.

Pranavi, K., Verma, S.L and Gupta, P. (2022). Standardization of glycerine dehydration technique in gerbera. *The Pharma Innovation Journal*. **11**(9): 265-268.

Preethi, T. L., Thangaselvabai, T. and Sankaranarayanan, R. (2019). Standardization of drying, bleaching and dyeing techniques for non-traditional flowers. Acta Hortic. **1241**, 627-632

Puri, A. (1995). Economic potential of dried flowers. *Agricultural Marketing*. **36** (1): 43-46.

Raghava SPS. Floriculture-A viable diversification option in agribusiness. *Indian Journal of Horticulture* **45**(41): 44-45.

Raghava, S. P. S. (2001). Floriculture- a viable diversification option in agri-business. *Indian Horticulture*. **4**(5): 44–45.

Raj, D. (2001). Making floral crafts from forest product of the Himalayas. *Indian Horticulture*. **45**: 26-27.

Rajaram, P., Visalakshi, M., Jawaharlal, M. and Lakshmanan, V. (2009). Opportunities in dry flower industry for small and medium scale enterprises. *National Conference on Floriculture for Livelihood and Profitability*. IARI, New Delhi. P.P. 36-38.

Rathod, P.B., Zinjarde, R.M., Ingole, A.S., Meshram, T.A. (2019). Utilization of ginger (Zingiber officinale) juice for preparation of flavoured milk. International Journal of Chemical Studies. **7**(4): 2648-2651.

Safeena, S.A., and Patil, V.S. (2013). Effect of hot air oven and microwave oven drying on Production of quality dry flowers of Dutch roses. Journal of Agricultural Science. **5**: 179-189

Sankari, A., & Anand, M. (2014). Process of making-waste into wealth-dry flower technology. *Asian Journal of Horticlture*. ***9***(2): 466–483.

Sindhuja, S., Padmalatha, T., Padmavathamma, S. A., Prasad, N. L. A. (2017). Studies on Different Methods of Drying in Carnation. *International Journal of Current Microbioogy and Appied Sciencel*. ***6***(8): 870-882.

Singh, A., Dhaduk, B. K. and Shah, R. R. (2003). Effect of dehydration on post harvest life and quality of zinnia flowers. *Journal of Ornamental Horticulture*. **6**(2): 141-142.

Singh, H. P. (2009). Floriculture industry in India: the bright future ahead. *Indian Horticulture*, **54**(1): 3-8.

Swathi, K., Maitra, S. and Sarkar, I. (2017). Influence of temperature and embedding media on production of quality dry flowers of african marigold *cv*. Pusa narangi gainda. *Plant Archives*. **17**(2): 911-915.

Vidhya, C., Senthilkumar, S. and Manivannan, S. (2021). Recent trends in production of dry flowers and foliages. *The Pharma Innovation Journal*. **10**(11): 2135-2139.

Wilkins, F.H., Deshborough. (1986). Cryo-drying of Dianthus CaryophyllusL.Flowers. *Acta Horticulturae*. Page. **181**, 477-481.

Yuan, J., Hao, L., Wu, G., Wang, S., Duan, A. J., Xie, Y. G and Qin, J.M. (2015). Effects of drying methods on the phytochemicals contents and antioxidant properties of chrysanthemum flower heads harvested at two developmental stages. *Journal of Functional Foods*. **19**(3): 786–795