

Impact of seasonal variation on rose flower production under greenhouse conditions in Kuwait

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Abstract

Seasonal variation on flower production in imported rose (*Rosa indica*) varieties was studied under greenhouse conditions in Kuwait. The study focused on testing the fluctuations in quantity and quality of rose flowers produced during summer and winter months. Ten cultivars of cut flower rose procured from Netherlands were selected for the experiment. The selection was based on the morphological characters and flowering pattern. Plants were planted in ten gallon pots filled with a mixture of potting soil: perlite: peat moss in the ratio of 1:1:2. Data was collected on the number of flowers produced during the months of May 2006 to April 2007. Results showed highly significant difference between the number of flowers produced during summer and winter months in all the cultivars. The number of flowers and flower quality was highest during the months of September and October. The yield reduction during winter months was directly related to lower temperature inside the closed environment which resulted in reduction in flowering shoots production.

Key words: *Rosa indica*, seasonal variation, cultivars, flowering, greenhouse.

Introduction

Roses are universally acclaimed for their beauty and aesthetic appeal and are the most popular and widely cultivated garden flowers in the world ^{2, 5, 7, 9, 10, 14}. They are also considered as a symbol of love, affection and warmth and are used to mark celebrations and special occasions.

Kuwait has a thriving market for rose cut flowers whose demands are served by importing flowers from overseas sources. Therefore, imported flowers are expensive as suppliers have to bear the cost of packing, storage and transport of flowers. It is difficult to grow roses under natural environmental conditions of Kuwait because of its harsh weather, but roses can be grown successfully with some management practices under controlled environmental conditions like in greenhouses ⁶.

Potentially, this cultivation method could increase control of rose development, flexibility of production and possible automation of difficult or laborious cultural operations of rose growing ^{3, 4, 8}. Temperature has a pronounced influence on rose flower development during the period between visible bud formation and flowering ¹⁶. Rose flower production could be more increased under high light intensities in summer ^{3, 11, 12}. Therefore, the Arid Land Agriculture and Greenery Department at Kuwait Institute for Scientific Research (KISR) conducted this study with the objective of widening the knowledge base by evaluating the seasonal effect of rose flower production under enclosed greenhouse conditions in Kuwait.

Materials and Methods

The study was conducted in a closed greenhouse environment at the Urban Demonstration Garden Site (UDG) of Kuwait Institute for Scientific Research, Salmiya, Kuwait, and it was planned to test the viability of establishing a domestic production base for rose cut flowers to cater the local market ¹. Ten cultivars of rose cut flowers were selected based on the morphological characters and flowering pattern. Cultivars were: Orange Dream, True Love, Black Red, Walzer Traum, Michele Meilland, Doris Tysterman, Ingrid Bergman, Lilac Wonder, Kajmunk Paramount and Red Variety. A completely randomized block design with ten replications of all experimental cultivars was used.

The selected plants were transferred to 10 gallon plastic containers to provide better rooting environment for the plants. The containers were filled with a homogeneous mixture of soil: perlite: peat moss at a ratio of 1:1:2. Care was taken to ensure that the root ball was kept intact so as to minimize the damage caused to the root system while planting. Plants were labeled and kept separately in the closed environment. They were irrigated regularly at optimum levels. A mixture of fertilizers (Kristalon, Calcinit, Krista K, Deltaspray and Fosfato Monopotassico Cristallino) was dissolved in water and 100 ml of the fertilizer solution was given for each plant twice a week.

The plants started flowering one month after planting and the flowers were cut along with 3-4 leaves. Pruning was done after each harvest to encourage more flower shoot production, and spent flower heads were removed to encourage new bud emergence.

Results and Discussion

Data on number of flowers produced during the months of May 2006 to April 2007 were recorded and statistically analyzed (Table 1). The analysis provided a clear picture on the productivity in relation to seasonal changes.

There was highly significant difference in the quantity of flowers produced during summer and winter months regardless of the cultivars. More flowers were produced during summer compared to the winter season with maximum flower production during September-October.

Highly significant difference was observed between the cultivars with regard to flowering (Fig. 1). The cultivar Michele Meilland is the best flower producing cultivar showing the maximum number of flowers (8.23) followed by Kajmunk Paramount (7.69). As far as the performance of True Love and Walzer Traum are concerned they are medium in flower production with average values of 6.49 and 6.46 respectively, followed by Orange Dream (5.38), 'Doris Tysterman' and 'Red Variety' showed similar performance in blooming. 'Lilac Wonder' produced an average of 4.46 flowers. Black Red was the least flower producing cultivar (3.65) followed by 'Ingrid Bergman' which is the second worst in blooming. The variation shown by different cultivars in flowering can be attributed to cultivar characters. Results showed that selected cultivars of rose plants could be grown successfully for cut flower

industry under enclosed controlled greenhouse conditions in Kuwait.

Seasonal changes had a pronounced effect on flower production in both summer and winter seasons. During summer the monthly average temperature rises up to a maximum of 38°C, during August and in winter it falls down to 12°C (Table 2).

Table 2. Monthly average temperature during the study.

Season	Month	Temperature °C inside the greenhouse	Temperature °C outside the greenhouse
Summer	May	29	33
	June	30	36
	July	30	36
	August	29	38
	Sept	23	32
	October	25	31
Winter	November	23	21
	December	20	12
	January	20	12
	February	25	17
	March	27	20
	April	27	26

Table 1. Flower production of rose cultivars during the period May 2006 to April 2007.

Cultivar	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07
True Love	5.9	7.1	9.5	9.6	14.0	11.3	3.2	3.8	3.0	3.7	4.2	2.6
Orange Dream	5.2	6.1	7.0	9.7	12.7	10.3	1.6	2.9	2.2	0.5	1.1	3.8
Doris Tysterman	4.8	5.8	5.3	7.0	10.8	8.2	1.8	2.7	3.0	0.7	1.6	2.6
Ingrid Bergman	2.6	2.5	3.5	5.8	14.4	9.9	1.7	1.5	1.2	1.1	3.0	1.7
Michele Meilland	3.5	4.1	5.4	8.7	35.4	12.9	2.3	2.0	2.3	2.8	2.6	7.0
Black Red	3.4	3.9	5.0	5.4	8.7	6.5	2.9	2.3	2.3	0.5	2.2	0.8
Kajmunk Paramount	6.8	7.3	9.4	12.6	23.1	15.8	4.7	4.3	3.2	2.8	3.5	4.4
Red Variety	3.5	3.8	5.0	6.8	13.1	8.7	1.4	1.9	1.6	0.8	4.1	2.9
Lilac Wonder	0.1	5.5	3.9	7.3	15.4	10.0	3.5	2.3	1.7	0.8	0.8	0.6
Walzer Traum	4.2	6.7	8.0	8.8	13.2	11.0	4.4	3.7	2.2	1.9	3.2	2.6
Significance at $P < 0.001$	***	***	***	***	***	***	***	***	***	***	***	***
SEM	±0.75	±1.09	±1.04	±0.85	±1.26	±1.14	±6.25	±0.57	±4.42	±0.52	±0.7	±9.66

SEM-Standard error of mean, *** denotes highly significant at $P < 0.001$. Standard error of mean is indicated in the parenthesis.

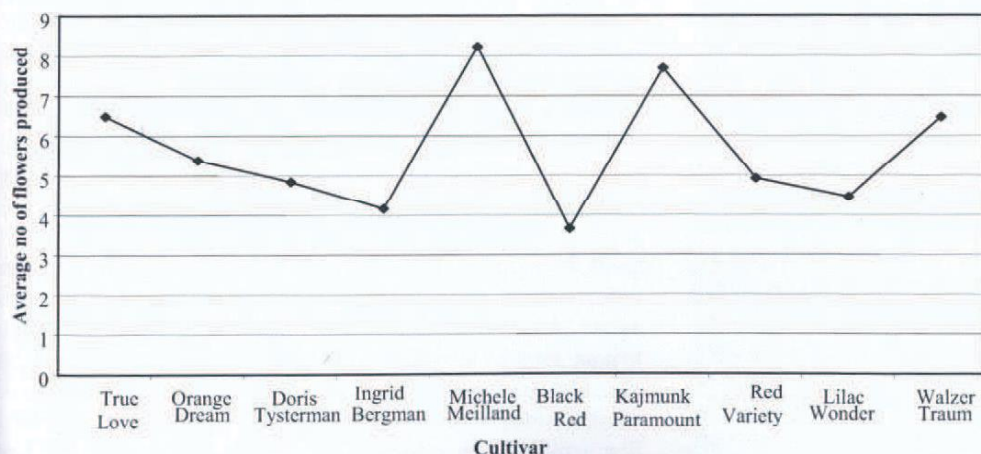


Figure 1. Average number of flowers produced by different rose cultivars.

The variation in temperature affects flower production by delaying new shoot production and also reduces flower bud formation. Since the plants were grown in an enclosed controlled environment, they were less vulnerable to the extremes of temperature. Kuwait is one of the countries that receive a large amount of solar radiation on its surface as it has large number of sunshine hours per day in summer. The rate of photosynthesis and consequently flowering is proportional to the light intensity¹⁵. In summer season, since the plants are grown in an enclosed condition, the temperature in the plant canopy is slightly lower compared to the outside temperature. During high summer months of May to August, country experiences high temperatures and cooling is required for good crop growth. During this period relative humidity is low enough to allow for evaporative cooling and since the plants were grown in an enclosed environment, evapotranspiration rates were lower than under open field conditions. The uncooled plastic greenhouses also provide some environmental modifications like protection from wind and blowing sand. The number of flowers and the flower quality was the highest during the months of September and October when there is a milder climate in Kuwait (31-32°C). Low temperature during winter can cause stunted plant growth, root retardation, wilting and flower drop¹³. Chilling temperature, experienced by the plant weeks before the flower buds are visible, can affect flowering.

In all the cultivars, maximum numbers of flowers were produced during September-October when there is a mild climate in Kuwait (31-32°C), and there was a drastic reduction in flower production during winter. This may be due to the fact that plants are physically injured because of low temperatures. Analysis based on visual interpretations suggest that the flowers produced during summer are relatively borne on short, thin stem and have shorter postharvest life compared to winter months. Use of better cooling systems and humidifiers to maintain optimum temperature of 30-32°C is likely to yield better results as the study clearly demonstrated that both flower quantity and quality were better when the temperature inside the closed environment was 30-32°C, as was prevalent during September-October.

Conclusions

Results from the trial indicate that different cultivars of rose perform well in flower production during summer season compared to winter months, and warm temperatures are preferred for flowering. Growth rates of the cultivars follow the total light curve through the year. During summer when high light intensities and total day light hours prevail, flower production is higher. During winter the opposite is true, due to the low light intensity and few daylight hours, less number of flowers was produced. Plant growth and productivity are greatly affected by the environmental conditions. Flower production depends on a complex system of chemical processes that make up plant growth. Rose flowers are highly sensitive to climate and environmental conditions existing in the closed environment. Variations in temperature, air circulation and relative humidity affect the growth and flowering of rose cultivars. Incorporation of all the proven greenhouse management technologies, water use and pest and diseases management etc. are needed for plant growth and flowering. Proper management of these factors can improve the quality and quantity of flowers tremendously. Results reported here conclusively show that irrespective of the cultivar, more

flowers can be obtained during summer months compared to the winter season.

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