International Journal of Agricultural Sciences
Volume 12 | Issue 2 | June, 2016 | 257-260 ■ e ISSN-0976-5670
DOI:10.15740/HAS/IJAS/12.2/257-260
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RESEARCH PAPER

Response of gerbera (*Gerbera jamesonii*) to different planting times under agro-ecological condition of Bihar

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Abstract : Planting time is one of the effective means of improving cut flower output under open field conditions. A field experiment was carried out on gerbera with eight planting dates starting from 1st August to 15th November at fortnightly interval during 2010 to 2013. Difference in planting time produced significant difference in performance of gerbera due to variation of climatic condition. Planting on 1st September showed the best response in terms of plant height (28.35 cm), number of leaves/plant (26.2), flower diameter (11.55 cm) flower stalk length (65.52 cm), number of flower /plant/year (29.85) and number of flower/m^2 (268.65) compared to rest of the planting dates. The study clearly suggested that the best planting time for gerbera under open field condition in Bihar is beginning of September.

Key Words : Planting time, Vegetative growth, Flower yield, Stalk length, Gerbera

View Point Article : Singh, A.K. and Kumar, Udit (2016). Response of gerbera (*Gerbera jamesonii*) to different planting times under agro-ecological condition of Bihar. *Internat. J. agric. Sci.*, **12** (2) : 257-260, **DOI:10.15740/HAS/IJAS/12.2/257-260.**

Article History : Received : 01.02.2016**; Revised :** 05.03.2016**; Accepted :** 26.04.2016

INTRODUCTION

Gerbera (*Gerbera jamesonii*) commercially grown throughout the world in a wide range of climatic condition is the latest sensation to Indian floriculture (Lhoste, 2002). According to the global production trends gerbera occupies the 4th place among cut flowers (Sujatha *et al.,* 2002). Studies in the past showed that variation in planting time had the most profound effect on both vegetative as well as reproductive features of the crop in different parts of the country (Sarkar and Ghimiray, 2004; Khandpal *et al.,* 2003; Barooh and Talukdar, 2009 and Wankhede and Gajbhiye, 2013). In a 3-Year experiment on gerbera conducted by Parthasarathy and Nagaraju (2003), it was observed that the flower bud initiation, growth, development and flowering were faster during warmer period (April -May and June - July), while the longevity of flower was more during October to November, Similarly, studies conducted at Dharwad to evaluate the best planting time for gerbera cv. SATH BATA showed a strong influence of staggered planting on vegetative as well as reproductive attributes, with July planting resulting in maximum flower size (Singh, 2001).

The Bihar has been identified as the potential belt for the development of floriculture, as the region has suitable agro - climatic conditions and there is rapid changes in the transport facilities for domestic trade. However, the major constraint lies in the extended availability of gerbera for major part of the year on

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account of its limited availability in the market.

Seasonal influence on growth and flower yield of gerbera provides a greater flexibility in modulating the growing conditions to improve better vegetative growth and harness higher flower yield. Open field production is always highly sensitive to climatic condition. While evaluating the response of planting time, other associated co-factors, especially the metrological conditions also aid in raising the flower yield as well as the floral characteristics. Jamaludin *et al.* (2012) observed the significant influence of different light intensities (full sunlight equivalent to 10,000 Lux or more, 60 per cent reduce sunlight as 2400 - 4000 Lux and 40 per cent reduced sunlight as 6000 - 6500 Lux) on the growth and flower characteristics of gerbera. No work has been done to standardize its suitable planting time in agro - ecological conditions of Bihar. Therefore, the present study was undertaken with the objective to standardize the planting time for producing gerbera under field conditions in agro- ecological conditions of North Bihar (India).

MATERIAL AND METHODS

A field experiment was laid out at Horticulture experimental area, RAU Pusa (Samastipur) under humid sub tropical climate. The experimental soil was calcarious sandy loam having pH 8.3. The climate of the area was humid sub-tropical.

The experimental plot was ploughed deeply and thoroughly harrowed to a fine tilth. Individual bed of 1.2 m × 1.2 m size, raised to a height of 15 cm were prepared. At the time of planting 150 q FYM/ha along with recommended dose of fertilizer consisting of 120 kg N (Urea), 50 kg P_2O_5 (Single superphosphate) and 60 kg K_2O /ha (Muriat of potash) were applied uniformly. Healthy tissue cultured plants of gerbera cv. LIBERTY were collected from reliable sources and used as the planting material. Eight plantings were done at fortnightly interval starting from 1st August and lasting on 15th November. The experiment was carried out continuously for three years *i.e.*, from 2011 to 2013. The individual plants were planted with almost care not to cover the crown with soil. The plants were planted at a spacing of 30 x 20 cm, accommodating 24 plants in each plot. Planting was done during evening hours immediately followed by irrigation. The plots were kept free from weeds throughout the growing period by manual weeding. For proper growth and development of the plants, various intercultural operations such as irrigation, earthling up, removal of dried leaves and flowers etc were done at regular intervals.

The observations were recorded at the time first flowering. The plant height was measured with the help of linear scale and expressed in centimeter from the base of the plant to tip of the plant. Number of leaves were counted at monthly interval from date of planting to flower initiation. Days taken from planting to the visibility of the flower bud (pea stage) at the ground level, days taken from planting to the first bud opening, number of days taken from bud emergence to bud burst stage, days taken from the planting to the full opening of disc floret, diameter of the flower measured at full bloom stage. Length of flower stalk measured from the base of the stalk to the point where the head is attached. The flowers were harvested when the outer rows of the disc floret were perpendicular to the stalk. Harvesting was done in the morning hours by giving a sideward pull at the base of the flower stalk. Immediately after harvesting, the stem/stalk end is immersed into a container half filled with clean water. The harvested flower stalk/stem were counted on the basis of number per plants per year and per square meter. The data collected were statistically analyzed to draw valid conclusions.

RESULTS AND DISCUSSION

The time of planting inflicted a significant response on number of leave/plant (Table 1). The number of leaves/plant was maximum when planting was under taken on 1st September followed by 15th September planting. The highest number of leaves was observed in November planting. Height of the plant is another effective index of measuring the magnitude of vegetative growth. Pooled data on the plant height for all treatments were analyzed and results obtained were almost of the same magnitude compared to data when analyzed for separate years. The treatment D_3, 1st September planting) continued its superiority over rest of the treatments. November planting produced shortest plants in height.

Change in planting time influenced other parameters like time of bud emergence, bud burst and time taken to bud burst. Planting on 1st September and on 15th November took 95.15 and 110. 50 days, respectively, for the bud emergence from the date of planting. The same treatments 1st September and 15th November plantings were found as most effective and least effective

treatment, respectively (Table 1) for time taken to bud burst from planting time. However, other treatments showed similar variation in response when compared between seasons. The penology of flowering behaviour is characterized on the basis of time taken in terms of days consumed to bud emergence, time taken to reach bud burst stage from planting time and time taken to full bloom from planting time. These parameters were most favourable with 1st September planting because of the most suitable agro pedalogical setting achieved during this month of planting. These could be characterized as better soil moisture, triggered nutrient flow and good temperature nearby 15 to 25°C and sunshine hours of 6 to 8 h/day plus minimum variation in air temperature as diurnal variation with relative humidity of 85 per cent.

Time taken from bud emergence to bud burst holds a strong promise in the context of readiness of flower to full bloom. Number of days taken from bud emergence to bud burst was significantly influenced by different dates of planting (Table 1). The treatment D_3 (1st September planting) took minimum days of 10.35 days closely were taken from bud emergence to bud burst. It was significantly superior to other treatments.

The time taken for full bloom from planting time is considered the most important criterion deciding the time of harvest which triggers a significant influence on vase-life of the cut flowers. Influence of the change in planting time significantly affected the time taken (number of days) in attaining full bloom from planting time. The time taken for attaining full bloom from planting time varied from minimum of 121.25 days (with D_3 1st September. days of planting) to maximum of 142.50 days (with 1st Sep. planting) coinciding with most effective and least effective treatment, respectively. Hence, by the changing of date of planting, the flowers can be cut earlier by 21.25 days, keeping all other cultural practices of cultivation the same, simply by virtue of variation in soil moisture and climate.

The time of planting also showed significant impact on the size of the flower, which varied from minimum size 7.15 cm with treatment D_8 (15th November date of planting) to the maximum flower size of 11.55 cm with treatment D_3 (1st September planting). These two treatments D_8 and D_3 were observed as least effective and most effective treatments, respectively, on the basis of responses obtained during both the seasons. The treatment D_3 displayed its clear cut superiority over rest of the treatments (Table 1).

In cut flowers, higher stalk length of flower is a desirable feature. The stalk length was significantly affected by various planting time. The maximum (65.52 cm) and minimum (40.15 cm) stalk length were recorded with the treatment D_3 1st September date of planting and D_8 15th November date of planting, respectively. suggesting, there by, the suitability of September as most suitable time of planting (Table 1). Changing the time of planting has brought significant changes in number of flowers. The highest number of flowers (268.65 flowers/m^2) were observed with 1st September planting (Table 1). This date of planting proved to be highly superior to rest of the planting dates. For example, deference of 164.07 flowers/m^2 was observed between least effective treatment *i.e.*, 15th November planting and most effective treatment *i.e.*, 1st September planting.

Table 1: Effect of planting time on the vegetative growth and flowering parameters of gerbera cv. LIBERTY

Treatments	Plant height (cm)	No. of leaves	Bud emergence from planting time (days)	Bud brust stage from planting time	Bud emergence to bud burst (days)	No. of flower/ plant/ year	Full bloom from planting days	Flower diameter (cm)	Flower stack length (cm)	No. of flower per m^2
D_1 (1st Aug.)	21.50	18.15	99.76	112.25	12.49	26.65	132.50	8.55	53.25	203.71
D_2 (15th Aug.)	24.16	19.62	102.30	117.06	14.76	24.36	140.03	9.62	57.65	219.24
D_3 (1st Sept.)	28.35	26.20	95.15	105.75	10.35	29.85	142.50	11.55	65.52	268.65
D_4 (15th Sept.)	27.10	23.52	99.40	111.55	12.15	27.62	135.50	10.42	62.72	248.58
D_5 (1st Oct.)	24.45	21.65	103.55	116.50	12.85	24.35	136.35	8.72	60.10	219.15
D_6 (15th Oct.)	23.65	21.10	105.72	119.35	13.65	21.50	132.20	8.25	55.75	184.50
D_7 (1st Nov.)	19.82	16.85	107.82	122.15	14.35	15.10	130.55	7.62	45.20	135.90
D_8 (15th Nov.)	18.75	14.43	110.50	125.60	15.10	11.62	142.50	7.15	40.15	104.58
SE mean	1.247	1.222	3.178	2.615	0.814	1.310	NS	0.850	2.987	9.893
C.D. (P=0.05)	3.782	3.709	9.641	7.933	2.469	3.976	NS	1.579	9.061	30.011
CV	9.201	10.490	5.314	3.896	10.676	10.250	NS	10.035	9.399	8.652

NS=Non-significant

The optimum conditions for achieving good floral response in gerbera have to be met through adjustments in planting time only if a sound foundation for better flower yield is to be laid effectively exploiting the other co-factors. Such growing conditions could be easily transformed into agro pedagogical analogues for exploiting upon the growing conditions with much costlier inputs. It is equally interesting to pinpoint the other prevailing conditions as unsuitable for favourable flowering behaviour. Flower yield is an index of productivity which takes in to account of the growing conditions at their optimum use. The response of planting time on flower yield was observed more distinctively (Table 1). The magnitude of response on flower yield was observed maximum with 1st September planting on account of suitable soil moisture, air temperature, relative humidity and a maximum nutrient flow. These conditions collectively created the optimum desired requisites for the plants to remain metabolically active for an extended period within the growth period. With other dates of planting, these conditions were far from optimum. These observations lend a strong support in favour of necessity to have different soil nutrient and climatic analogues in relations to optimum flower yield of gerbera, if the optimum growing conditions via suitable planting time are to be maintained. Earlier studies established that gerbera is highly nutrient responsive crop depending upon nutrient supply level of growing medium (Sirin, 2011 and Ahmad *et al.*, 2012).

Conclusion :

The response of gerbera to differential planting time is the combined outcome of soil, climatic conditions and genotype selected for cultivation. The observation made through present studies have strongly indicated that, simply changing the time of planting can bring 2.5 times improvements in flower yield. For field production of gerbera in north Bihar 1st September is the best planting time to get early bud burst and higher flower yield coupled with other favorable vegetative growth parameters *viz.*, plant height, number of leaves/plants.

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