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Research Article

Effect of pinching on growth and quality flower production of chrysanthemum (*Chrysanthemum indicum* L.)

Md. Ehsanullah, Shofiul Azam Tarapder, Abu Rashed Md. Maukeeb, Anayat Ullah Khan, and Ahasan Ullah Khan*

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Abstract
A field study conceded to assess the effect of pinching on growth and quality flowers yield of chrysanthemum at Horticulture Research Centre (HRC), Gazipur, Bangladesh. The research was laid out in Randomized Complete Block Design (RCBD) with six treatments and three replications. The treatment combinations were as T_0- No pinching, T_1- Once 40 days, T_2- Once 50 days, T_3- Once 60 days, T_4- Twice 40 and 50 days and T_5- Thrice 40, 50 and 60 days. It was observed that the highest plant height 60cm in no pinching (T_0) and the lowest 45 cm was recorded by pinching the plants thrice (T_5). Days of the first flowering (57 days) was observed where no pinching was followed and significantly delay in flowering (68 days) was recorded in in pinching the plants thrice (T_5). The highest number of branches (12) was recorded in pinching the plants thrice (T_5) and the lowest number of branches (05) in no pinching (T_0). The maximum number of leaves (235) was recorded in pinching the plants thrice (T_5) and minimum number of leaves (200) was observed in no pinching (T_0). The treatment T_5 (pinching the plants thrice) attained maximum plant spread (30 cm) and the treatment T_0 (no pinching) attained minimum plant spread (17cm). The highest number of flower (45) was recorded in pinching the plants thrice (T_5) treatment and the lowest flower (28) was observed in T_0 treatment. Among the six treatment, T_5 (pinching the plants thrice) showed the highest efficacy and it could be used as treatment in cultivation of *Chrysanthemum indicum* for growth and quality flower production.

Keywords: *Chrysanthemum indicum*, pinching, flower, production

1. INTRODUCTION

Chrysanthemum (*Chrysanthemum indicum* L.) is a popular marketable ornamental importance flower crop belongs to the family Compositae or Asteraceae, sub family Asteroideae, order Asterales, subclass Asteridae, tribe Anthemideae. The crop is important as floricultural, ornamental and medicinal used in modern time [1]. This flower crop is native to East Asia [2] and has been grown in garden for more than 2500 years [3]. It is globally the second economically most vital floricultural crop following rose, and one of the most significant ornamental species [4]. It is one of the most important ornamental crops around the world, it is produced as both cut flower in field and pot plant. Many plants, which have been identified as yet through pharmacology, folk medicine, homoeopathy and ethnopharmacology, are being investigated for their medicinal usage and may be proved so in due course of time. This crop use as nerve sedative, anti-oxidant, anti-inflammatory, anti-mutagenic, anti-microbial, anti-fungal, anti-angiogenic, anti-atherosclerosis and nematocidal goods [5]. The leaves remedy and use as colds, headache, bronchitis, rheumatism, swellings, boils and expectorant, bitter and stomachic, respectively. The *C. indicum* flower has a strong aroma and many of the previous studies focused on the essential oil of this plant [6]–[8]. Khan et al. [9] observed that the plant height (54.0 to 66.0 cm); number of leaves per plant (208-240); leaf size (4.5 to 8.5 cm); plant spread (19.0 to 32.0 cm); number of branches (4 to 12); number of flowers (25-40); stalk length (8.8 to 13.3 cm) and days of first flowering (55 to 70 days) varied; respectively in T_7 (100% rice husk) to T_3 (100% cocodust). The different color of leaves and flowers in chrysanthemum flower crop and also the maximum flower period was observed early December-February in germplasms. Taweesak et al. [10] observed that the irrigation effect on plant height of chrysanthemum.

Pinching is one of the most suitable tactics for effective cultivation of cut flowers. It is act of cutting or nipping off force to new development branching in the plants so that the eventual number of flowers is increased [11]. If the growing tips are

Table 1. Treatments and different pinching composition.

Treatments	Different pinching
T_0	No pinching
T_1	Once 40 days
T_2	Once 50 days
T_3	Once 60 days
T_4	Twice 40 and 50 days
T_5	Thrice 40, 50 and 60 days

pinched out, adjusts are diverted into lateral buds and branching occurs. Modification of plant planning by means of pinching has been done in several commercial flower crops. While Ma et al. [12], stated that pinching leads to late flowering in the *C. indicum* plant, as well as its effect on the branch's length. It is preferable to pinch the small plants when 10 cm height to encourage production side branches, and then pinched these branches when reached 10 cm in length [13]. Ahmade [14] observed that the twice pinching gave a significant reduction in the plant height, the inflorescence diameter, the plant dry weight and the seeds weight (100 seeds). This study also noted that the increased the branches number, chlorophyll intensity in the leaf, the period from planting to inflorescence bud formation, the period to opening 50% of inflorescences, and the total number of inflorescences, the plant aesthetic value (degree) and the plant aesthetic period. The commercial cultivation of chrysanthemum with superiority flowers and higher yield is needed for consumption in local market and to offer livelihood specially to the marginal and small farmers. Thus, the pinching can play a vital role in the improvement of flowering and yield of chrysanthemum. Keeping in view the above points the present investigation, pinching time has been evaluated on the growth, and flower yield in chrysanthemum crop. The general objective of this study is to assess the effect of pinching in the chrysanthemum crop.

2. MATERIALS AND METHODS

2.1. Experimental Site

The present investigation was carried out at the experimental farm of Landscape, Ornamental and Floriculture Division, HRC, BARI, Gazipur, Bangladesh during the period from July 2007 to June 2008. The study area situated in 23.9917° N longitude and 90.4137° E latitude at an altitude of 9 meter above the sea level.

2.2. Planting material

Seed of genotype of CM-022 were used in the experiment during the period from July 2007 to June 2008.

2.3. Methods

2.3.1. Design of the experiment and Treatments

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. One plant was planted in a pot, containing the potting media according to the treatments and five plants were constituted the unit of treatment. There were six treatments in the experiment, comprising different pinching in Table 1.

2.3.2. Pot preparation

The experiment was conducted in earthen pots of 12 cm size. The pots were washed and cleaned thoroughly before filling up of potting media.

2.3.3. Seedling raising, transplanting and fertilization

Primarily cuttings of chrysanthemum genotype (CM-022) were prepared for planting in the sand in mid-August, 2007. Immediately after rooting, the mini plantlets were transferred to the pot containing media that consists of one-part coarse sand, one part garden soil, one part cocodust, one-part cowdung, a quarter part of wood ashes and two tables spoonfuls of bone meal in mid-September, 2007. Subsequently, 10 g TSP and 3 g MP per pot were applied. Urea @ 2, 3 and 3 g per pot was applied at 20, 30 and 40 days after transplanting respectively for getting the best growth and flowering of plants [15]–[17].

2.3.4. Irrigation and weeding

Weeding and mulching were done in the pots whenever it was necessary to keep the pots free from weeds. Chrysanthemum plants need frequent irrigation. The pots were irrigated every alternate day to keep the media moistened.

Table 2. Plant and floral character of chrysanthemum as influenced by pinching.

Treatment	Plant height (cm)	Days to flowering	Branch number	Leaf number	Plant spread (cm)	Flower size (cm)
T_0	60a	57d	05c	200d	17.0d	6.9a
T_1	57ab	62c	07bc	214cd	19.0cd	6.9a
T_2	55b	63c	07bc	218c	21.0c	7.0a
T_3	52bc	63c	09b	224bc	23.0bc	7.1a
T_4	49c	68ab	10ab	228b	25.0b	7.2a
T_5	45d	70a	12a	235a	30.0a	7.3a
CV (%)	**12.40**	**10.80**	**16.30**	**13.00**	**11.72**	**8.14**

Note: T_0- No pinching, T_1- Once 40 days, T_2- Once 50 days, T_3- Once 60 days, T_4- Twice 40 and 50 days, T_5- Thrice 40, 50 and 60 days. Means followed by similar letter(s) inside the column do not vary significantly (P = 0.05).

2.3.5. Staking of plant

Each plant was supported by 40 cm long bamboo stick to facilitate the branches of the plant to keep erect. The plant in each pot was fastened loosely with the bamboo stick by jute string to prevent the plant from lodging.

2.3.6. Pest and disease control

A 2 g/L of Ridomil and 2 ml/L of Malathion in water was sprayed once fortnight to the plants as protective measures against diseases and insect attack.

2.3.7. Harvesting of flowers

The spikes were harvested when the flower attained commercial stage flower open before shedding of pollens from the outer row of the disc florets.

2.3.8. Collection of data

Data were collected on the following parameters for interpretation of the result of the experiment. The parameters were plant height (cm), days to flowering, branch number, leaf number, plant spread (cm), flower size (cm) and flower number. *Plant height (cm):* Plant height refers to the length of the plant from ground level to tip of erect leaf. Height of 5 plants was measured and the mean was calculated. It was measured in cm. *Number of leaves plant:* Number of leaves per plant was recorded by counting all the leaves from 5 plants and the mean was calculated. *Plant spread (cm):* The plant spread was measured in cross way (North -South and East-West) by measuring scale. The average of the two measurements was done and expressed in cm. *Leaf size (cm):* The length and breadth of leaf was measured by a measuring scale and the average of the two measurements was done and expressed in cm for a single leaf. Later on, the mean of individual leaf size from 5 selected plants was calculated. *Number of branches plant*: Number of branches per plant was recorded by counting all the main branches from 5 plants and the mean was calculated. *Days to flowering:* It was recorded by counting the days from planting to first visibility of flower bud in the plant from each pot. *Number of flowers plant*: Number of flowers produced per plant was counted and recorded. *Flower size:* Flower size was measured in cross way following North-South and East-West position by a measuring scale and the average of the two measurements was done and expressed in cm for a single flower. Later on, the mean of individual flower size from 5 selected plants was calculated.

2.3.9. Statistical analysis

The data recorded on different plant and floral parameters were statistically analyzed through analysis of variance with the help of 'MSTAT' software. The difference between treatment means were compared by Duncan's Multiple Range Test (DMRT) according to Baniasadi et al [18].

3. RESULTS AND DISCUSSIONS

3.1. Plants height (cm)

Height of Chrysanthemum plant (CM-022) was significantly influenced by pinching in Table 2.

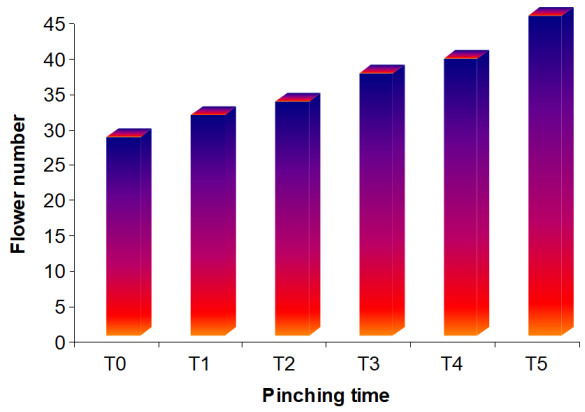

Figure 1. Flower number of chrysanthemums.

Thus, the highest plant height (60 cm) was observed under no pinching and lowest (45 cm) was recorded by pinching the plants thrice (T_5). The plant varied from 40-120 cm in the field condition [17]. This was due to repetitive removal of apical portion of main branch; axillary buds become free from correlative inhibition of apical dominance and started growing. This resulted into more branching and spread of plants. Thus, height was reduced in pinched plants. Similar results observed by Susila et al. [19] in chrysanthemum flower crop.

3.2. Days required for flowering

It is evident from the Table 2 that the increased number of pinching resulted into significant delay in the flowering of Chrysanthemum. Thus, the earliest flowering (57 days) was observed where no pinching was followed. There was no significant difference between pinching once (T_1, T_2 and T_3) which took 62, 63 and 63 days respectively, but further significant delay in flowering (68 days) was recorded by pinching the plants twice followed by pinching the plants thrice (70 days). The delay in flowering by pinching was due to removal of physiological mature portion and the new shoots which emerged out from the pinched plants took more time to become physiological inductive to produce flowers than non-pinched plants. Similar results have been observed by Rajan et al in Chrysanthemum [20].

3.3. Number of branches

The number of branches was quite variable in different treatments in Table 2. The highest number of branches (12) was observed in T_5 treatment followed by T_4 treatment (10). The lowest number of branches was recorded in T_0 treatment (05). This was due to repetitive removal of apical bud which leads to enhanced branch number observed in T_5 treatment. The above findings are in agreement with that of in marigold [21].

3.4. Number of leaves

Maximum number of leaves (235) was recorded in T_5 treatment (pinching thrice) followed by T_4 treatment (228) in Table 2. Kumar et al [22] observed increased leaf number in carnation plants while pinched thrice. Adequate numbers of leaves are essential for normal growth and production. An increase in number of leaves causes the accumulation of greater photosynthesis leading to better growth parameters.

3.5. Plant spread

It has been observed that plant spreads were significantly affected by the different treatments (Table 2). The treatment T_5 attained maximum plant spread (30 cm). This was due to higher the branch number with high leave content under pinched thrice ultimately increased plant spread. Chandel et al [23] also observed increased plant spread while pinched twice or thrice in Chrysanthemum.

3.6. Flower size (cm)

The flower size of chrysanthemum was not significantly improved by various treatment of pinching (Table 2). The results are in agreed with Yao et al [24] in carnation.

3.7. Number of flowers

Perusal of Figure 1 show that by increasing the number of pinching, there was an increase in the number (45) of flower per plant. The lowest number of flowers (28) was recorded under no pinching. Number of flowers was affected by pinching was due to increased number of branches. Similar results observed by Sharma et al. [25] and findings were varied from 19.73-42.26 in chrysanthemum plant.

4. CONCLUSIONS

The observations recorded from the present investigation revealed that the pinching effect in the morphological and flower characters in the

chrysanthemum flower crop. Timely planting and pinching effect in the plant growth and production of quality flowers in the field. Pinching carried out in chrysanthemum improved in number of flowers per plant, plot and yield per hectare. Among the six treatment, pinching the plants thrice showed the highest efficacy and it could be used as treatment in cultivation of *Chrysanthemum indicum* for growth and quality flower production.

AUTHOR INFORMATION

Corresponding Author

Ahasan Ullah Khan — Department of Agroforestry and Environmental Science, Sylhet Agricultural University, Sylhet-3100 (Bangladesh); Department of Entomology, Sylhet Agricultural University, Sylhet-3100 (Bangladesh) ;

orcid.org/0000-0002-7029-8215

Email: ahasanullahsau@gmail.com

Authors

Md. Ehsanullah — Department of Entomology, Govt. shahid Akbar Ali Science and Technology College, Thakurgaon-5120 (Bangladesh);

Shofiul Azam Tarapder — Department of Agronomy and Haor Agriculture, Sylhet Agricultural University, Sylhet-3100 (Bangladesh);

Abu Rashed Md. Maukeeb — Department of Agricultural Chemistry, Khulna Agricultural University, Khulna-9100 (Bangladesh);

Anayat Ullah Khan — Department of Mathematics, Jashore University of Science and Technology, Jashore-7408 (Bangladesh);

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