**COLLECTION AND EVALUATION OF TUBEROSE (*POLIANTHES TUBEROSA* L.) GENOTYPES**

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**Abstract**

*Six tuberose genotypes with BARI Tuberose-1 as check variety were evaluated at the Floriculture Research Field of HRC, BARI, Gazipur during 2021- 2022. A wide variation was exhibited in the qualitative parameters like flower type, bud and petal color, floret arrangement on spike and fragrance. The genotype TR-001, TR-004 and TR-005 produced heavy scented flowers. The quantitative data revealed that, BARI Tuberose-1 required minimum days (17.23) to reach 50% germination of bulbs and also to reach 50% spike initiation (88.78days). TR-001 produced the longest spike (88.02cm). The longest rachis (43.47cm) was recorded by TR-004. The maximum number of flower sticks/ha (2,65,000 sticks) were recorded in TR-003. The heaviest (32.23 g) and the largest bulbs (3.49 cm) were recorded by TR-001. BARI Tuberose-1 remained fresh for the longest time (14.75days) in the field and also in the vase (7.12 days). The highest percentage of florets (68.83%) was opened in the vase by the genotype TR-004.*

**Introduction**

Tuberose (*Polianthes tuberose* Linn.) is one of the most important flowering plant belongs to family Agavaceae (formerly known as Amaryllidaceae). It can be cultivated both in tropical and sub-tropical condition. It produces conspicuous and showy cut flower that are important as commercially and aesthetically. It is getting more importance among growers and floriculturists due to its production in summer and autumn season due to the unavailability of other ornamental flowering bulbs during this period. It is considered as one of the most important fragrant truncated (cut branch) flowers of tropical and semitropical areas (Jokar and Salehi, 2006) which are in worthy consideration in the perfume Industry. It is also used in floral arrangements, for making bouquets, garlands etc.

Tuberose is commercially cultivated in different parts of Bangladesh. The successful cultivation of tuberose depends on selection of suitable varieties. However, the species does not have much natural variability either in flower color or type. There are two cultivars of tuberose viz. single and double are commonly available in Bangladesh. Recently some varieties have been introduced through different sources which have not been characterized yet. But some of these varieties may have desirable characteristics which could possibly be used in varietal improvement. To meet out this necessity, it is indispensable that germplasm performance should be studied along with genetic diversity. Hence, the present investigation was carried out with the following objectives

* 1. to characterize the tuberose germplasm in respect of their morphological variation, growth, yield and post-harvest life.

1. to know the genetic variability which can be used in tuberose improvement program
2. to identify the suitable cultivars for commercial tuberose cultivation in Bangladesh

**Materials and Methods**

The experiment was carried out at the Floriculture Research Field of HRC, BARI, Gazipur during April, 2021 to January, 2022. Six tuberose genotypes (single and double) were collected from different sources and considered as treatments viz. TR-001, TR-002, TR-003, TR-004, TR-005, TR-006. BARI Tuberose-1 is considered as check. Medium sized bulbs of these genotypes were planted on April, 2020. The experiment was laid out in RCB design with 3 replications. The unit plot size was 1.5 m × 1.80 m and spacing was maintained at 30cmx 30 cm. The experiment field was well prepared by adding 10 t cow dung and fertilized @ 435 kg urea, 400 kg TSP, 300 kg MoP, 12kg boric acid and 8 kg ZnSo4/ha (Khan & Dadlani, 2014). Cow dung, TSP, MoP, boric acid and ZnSo4 were applied as basal and urea was top-dressed in two equal splits at 21 days after planting and spike initiation stage. The data on growth, flower and bulb characters were recorded from ten randomly selected plants from each unit plot during the study period. All the data were analyzed statistically and the mean differences were also be adjudged by DMRT.

**Table 1. Name and source of collection of tuberose genotypes**

|  |  |
| --- | --- |
| Treatments | Source of collection |
| TR-001 | Nursery and farmers field |
| TR-002 | Nursery and farmers field |
| TR-003 | Farmers field |
| TR-004 | Nursery and farmers field |
| TR-005 | Nursery |
| TR-006 | Farmers field |
| BARI Tuberose-1 | Bangladesh Agricultural Research Institute |

**Results and Discussion**

**Qualitative data of tuberose genotypes**

There were wide variations on qualitative traits among the tuberose genotypes (Table 2). The genotype TR-001, TR-002 and TR-003 produced single type flowers whereas TR-005, TR-006 and BARI Tuberose-1 were double type and only semi double type was TR-004. The bud of TR-001 and BARI Tuberose-1 was recorded deep pink in color whereas TR-003 and TR-006 those are our local genotypes produced greenish white color bud. On the other hand, light green and green flower bud was produced by the genotypes TR-002 and TR-004, respectively. The genotype TR-005 produced pink flower bud only. The petal color of all the genotypes was white except TR-006 which produced creamy white petals. The maximum genotypes like TR-002, TR-004, TR-005, TR-006 and BARI Tuberose-1 showed compact floret arrangements whereas TR-001 and TR-003 demonstrated loose floret arrangements. Regarding fragrance, TR-001, TR-004 and TR-005 were heavy scented flowers whereas TR-002 and BARI Tuberose-1 were medium scented. The local single (TR-003) emitted low to medium scent whereas the local double (TR-006) was scentless.

**Table 2. Qualitative traits of tuberose genotypes**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Flower type** | | **Bud color** | **Petal color** | **Floret arrangement on spike** | **Fragrance** |
| TR-001 | | Single | Deep pink | White | Loose | Heavy scented |
| TR-002 | | Single | Light green | White | Compact | Medium scented |
| TR-003 | | Single | Greenish white | White | Loose | Low to medium scented |
| TR-004 | | Semi double | Green | White | Compact | Heavy scented |
| TR-005 | | Double | Pink | White | Compact | Heavy scented |
| TR-006 | | Double | Greenish white | Creamy white | Compact | Scentless |
| BARI Tuberose-1 | | Double | Deep pink | White | Compact | Medium scented |

**Growth parameter of tuberose genotypes**

Various growth parameters were also significantly influenced by the tuberose genotypes except leaf length (Table 3). The minimum days (17.23 days) were required to reach 50% germination by the genotype BARI Tuberose-1 followed by TR-006 (18.31days), TR-003 (18.35days) and TR-002 (19.34days). Genotype TR-005 took the maximum days (34.95days) to reach 50% germination. The maximum number of leaves/clump (89.0) was found in TR-005 which was statistically similar with that of TR-003 (83.81) and TR-002 (76.59). The genotype TR-001 produced the minimum number of leaves/clump (36.45) which was at par with BARI Tuberose-1, TR-004 and TR-006. The widest leaf (2.26cm) was produced by the single type tuberose TR-001 whereas local single TR-003 produced the thinnest leaf (1.51cm). The minimum days (88.78) were recorded to reach 50% spike initiation in the treatment BARI tuberose-1 which was at par with TR-003 (90.61days) and the maximum days (96.23) were required by the genotype TR-005 to reach 50% spikes initiation which was statistically identical with the treatment TR-001 (94.48).

**Table 3. Growth parameters influenced by tuberose genotypes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Days to 50% germination of bulb** | **Leaves/ clump** | **Leaf length (cm)** | **Leaf breadth**  **(cm)** | **Days to 50% spike initiation** |
| TR-001 | 28.38b | 36.45c | 50.32 | 2.26a | 94.48ab |
| TR-002 | 19.34c | 76.59ab | 48.23 | 1.65bc | 93.12b |
| TR-003 | 18.35c | 83.81ab | 52.25 | 1.51c | 90.61cd |
| TR-004 | 28.13b | 55.1bc | 44.28 | 1.92ab | 92.11bc |
| TR-005 | 34.95a | 89.0a | 57.33 | 1.74bc | 96.23a |
| TR-006 | 18.31c | 55.77bc | 51.19 | 1.98ab | 92.01bc |
| BARI Tuberose-1 | 17.23c | 52.13bc | 52.24 | 1.72bc | 88.78d |
| **Level of Significance** | **\*\*** | **\*\*** | **NS** | **\*\*** | **\*\*** |
| **CV (%)** | **9.42** | **15.72** | **10.15** | **8.67** | **1.21** |

Means with the same letter(s) are not significantly different at 1% by DMRT

\*\* = Significant at 1% level of probability; NS = Not Significant

**Flower yield and yield contributing characters**

Various flowering parameters were significantly influenced by the tuberose genotypes except florets/spike (Table 4). The longest spike (88.02cm) was produced by TR-001 which was statistically similar with that of BARI Tuberose-1, TR-006, TR-003 and TR-004. The genotype TR-002 produced the shortest spike (61.74cm). The genotype, TR-004 produced the longest rachis (43.47cm) followed by BARI Tuberose-1 and TR-006. Among the genotypes, floret length varied from 5.12 to 6.27cm. The longest floret (6.27cm) was recorded in single local TR-003 followed by the other single varieties (TR-001 and TR-002). On the other hand, semi double and double type tuberose produced comparatively the shorter florets (5.24 to 5.31cm). The largest floret (3.97cm) was produced by TR-002 followed by the rest of the treatments except BARI Tuberose-1 (3.11cm) and TR-006 (2.66).

The result revealed that there was a significant variation in flower sticks/hectare among the genotypes studied (Figure 1). When considering flower sticks production in hectare, TR-003 produced the maximum yield (2,65,000) followed by the genotype BARI Tuberose-1 (2,14,000). The single genotype TR-002 demonstrated the lowest flower sticks production (91,000). This might be due to different agro ecological condition, varietal performance, management practices etc.

**Table 4. Flowering parameters as influenced by tuberose genotypes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Spike length**  **(cm)** | **Rachis length**  **(cm)** | **Florets/**  **spike** | **Floret length**  **(cm)** | **Floret diameter**  **(cm)** |
| TR-001 | 88.02a | 30.46c | 38.06 | 5.86ab | 3.38ab |
| TR-002 | 61.74c | 30.03c | 41.44 | 5.56abc | 3.97a |
| TR-003 | 80.91ab | 22.87d | 35.76 | 6.27a | 3.28abc |
| TR-004 | 80.17ab | 43.47a | 48.25 | 5.24bc | 3.27abc |
| TR-005 | 75.23b | 31.35bc | 39.23 | 5.31bc | 3.21abc |
| TR-006 | 81.15ab | 38.97ab | 41.28 | 5.24bc | 2.66c |
| BARI Tuberose-1 | 84.1ab | 42.04a | 42.93 | 5.12c | 3.11bc |
| **Level of Significance** | **\*\*** | **\*\*** | **NS** | **\*\*** | **\*\*** |
| **CV (%)** | **5.21** | **9.27** | **15.38** | **6.73** | **7.45** |

Means with the same letter(s) are not significantly different at 1% by DMRT

\*\* = Significant at 1% level of probability; NS = Not Significant

**Bulb yield and yield contributing characters**

Like growth and flowering parameters, bulb and bulblets production were also significantly influenced by the various tuberose genotypes (Table 5). TR-003 produced the maximum bulbs/plant (9.87) followed by TR-006 (9.36) and the minimum (5.54) were produced by TR-001 which produced the heaviest bulb (32.23g). This may be due to TR-001 produced the lowest number of bulbs which may help to increase the weight of bulbs. Apart from TR-001, the genotype TR-006, BARI Tuberose-1, TR-004 and TR-005 also produced the statistically similar bulb weight. The thinnest bulb (15.58g) was recorded in TR-003 which also obtained the highest number of bulbs. Due to the production of higher number of bulbs TR-003 showed such results. Regarding bulb diameter, TR-001, TR-006, BARI Tuberose-1, TR-004 and TR-005 produced statistically identical bulb (3.26 to 3.49cm). Like bulb weight, TR-003 also produced the smallest bulb (2.53 cm). Though TR-004 produced the maximum number of bulblets/clump (59.13), TR-006 exhibited the highest weight of bulblet/clump (112.12g).

**Table 5. Production of bulb and bulblets as influenced by tuberose genotypes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Bulbs/**  **clump** | **Bulb weight**  **(g)** | **Bulb diameter**  **(cm)** | **Bulblets**  **/clump** | **Bulblets weight**  **/clump (g)** |
| TR-001 | 5.54d | 32.23a | 3.49a | 24.41f | 59.32e |
| TR-002 | 8.21bc | 15.76b | 2.63b | 37.88d | 64.55d |
| TR-003 | 9.87a | 15.58b | 2.53b | 18.83g | 71.62c |
| TR-004 | 7.12c | 23.87ab | 3.27a | 59.13a | 79.03b |
| TR-005 | 5.65d | 22.78ab | 3.26a | 46.12c | 72.12c |
| TR-006 | 9.36ab | 29.52a | 3.35a | 32.43e | 112.12a |
| BARI Tuberose-1 | 8.32bc | 28.51a | 3.32a | 53.86b | 81.44b |
| **Level of Significance** | **\*\*** | **\*\*** | **\*** | **\*\*** | **\*\*** |
| **CV (%)** | **5.75** | **15.58** | **10.0** | **2.98** | **3.52** |

Means with the same letter(s) are not significantly different at 1% and 5% by DMRT

\*\* = Significant at 1% level of probability

\* = Significant at 5% level of probability

**Flowering life of tuberose in field and vase**

Flowering life of tuberose in the field as well as vase also were significantly influenced by various tuberose genotypes (Table 6). Genotype TR-003, TR-001 and BARI Tuberose-1 showed the statistically similar flowering duration (209, 208 and 205 days, respectively) whereas TR-005 showed the minimum (60.12 days only). In the genotype BARI Tuberose-1, deterioration was started in late (4.86 days). As a result, maximum vase life (7.12 days) was recorded by BARI Tuberose-1which was identical with that of TR-005 in both the parameters, deterioration started in vase and vase life (4.47 and 6.62 days, respectively). The lowest vase life (4.61 days) was recorded by TR-003 which also showed the earliest deterioration (3.27 days). Considering % floret opening in the vase, the highest percentage of florets (68.83 and 64.10%) was opened by TR-004 and TR-005, respectively whereas the local double (TR-006) showed poor performances and opened only 24.20%.

**Table 6. Flowering life of tuberose in field and vase life**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Flowering duration (days)** | **Flower life in the field (days)** | **Deterioration started in vase (days)** | **Floret opening in vase (%)** | **Vase life (days)** |
| TR-001 | 208.0a | 9.35bc | 3.56bc | 42.45bc | 5.17cd |
| TR-002 | 106.0d | 9.53bc | 3.53bc | 52.0b | 5.36bcd |
| TR-003 | 209.0a | 7.51c | 3.27c | 38.0c | 4.61d |
| TR-004 | 132.0c | 14.45a | 3.67bc | 68.83a | 5.86bc |
| TR-005 | 60.12e | 11.77abc | 4.47ab | 64.10a | 6.62ab |
| TR-006 | 167.0b | 13.21ab | 3.84bc | 24.20d | 5.83bc |
| BARI Tuberose-1 | 205.0a | 14.73a | 4.82a | 42.72bc | 7.12a |
| **Level of Significance** | **\*\*** | **\*\*** | **\*\*** | **\*\*** | **\*\*** |
| **CV (%)** | **2.73** | **13.46** | **8.63** | **9.54** | **7.78** |

Means with the same letter(s) are not significantly different at 1% by DMRT

\*\* = Significant at 1% level of probability

**Conclusion**

Tuberose genotypes showed wide variations in all qualitative and quantitative characters. The genotype TR-001, TR-004 and TR-005 produced heavy scented flowers. The longest spike, the heaviest and largest bulb were produced by TR-001 and TR-004 produced the longest rachis. The longest floret and the maximum flower yield/ha were recorded in TR-003. The highest percentage of florets was opened by the genotype TR-004. Considering fragrance, longest spike, floret length and diameter, heaviest and largest bulb, TR-001 found suitable as single cut flower and considering the longest rachis, and the highest percentage of florets opening in the vase, TR-004 found suitable as semi double cut flower for commercial cultivation in Bangladesh.

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**COLLECTION, EVALUATION, CHARACTERIZATION AND MAINTENANCE OF LILIUM**

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**Abstract**

*Eighteen genotypes of lilium along with BARI Lilium-1 and BARI Lilium-2 were evaluated under lilium shade at floriculture Division, Horticulture Research Centre, BARI during 2021-22. The longest stalk and rachis (93.8cm and 34.0cm, respectively) were produced by the genotype Lil-036. The maximum number of florets per stalk (10.0) was produced by BARI Lilium-1. Maximum vase life was observed in BARI Lilium-2 (11.0 days).*

**Introduction**

Lilium (*Lilium* sp.) belong to Liliaceae family is a high demanded flower in international flower trade and commercially it is grown as cut flower for its long lasting (12-15 days) majestic flowering sticks with wide range of color and attractiveness. This lucrative flower has recently been introduced in Bangladesh due to its high demand and profitability. Even to meet up the local demand this flower is being imported from other countries specially China. Unavailability of lilium germplasm is due to the high cost of bulb (60-80 BDT/bulb). Among the different types of Lilies, the Asiatic and Oriental hybrids have attractive flowers of different hues. Lily is also edible. Thousands of bulbs had been consumed annually in china, tasty tiger lily in particular. Considering aesthetic, medicinal and table purpose, it is very much needed to collect the lilium germplasm. Therefore, the present experiment has been under taken to collect and characterize the different species of *lilium* available in Bangladesh and also from abroad and to conserve the collected germplasm for future research.

**Materials and methods**

The present investigation was carried out at Floriculture Research Field of HRC, BARI, Gazipur during the rabi season of 2021-22. Previously collected 15 promising and 5 newly collected germplasms along with BARI Lilium-1 and BARI Lilium-2 as check were planted under UV polyfilm structured shade house and agro shade net houseon 20 to 25 November, 2021. The experimental land was well prepared by adding cocodust (50:50 soil and cocodust), 10t cow dung/ha. Chemical fertilizers were not applied up to 3 weeks of bulb planting. After 3 weeks of bulb planting, NPK@30:20:20g/m2 was applied. Urea and MoP @ 100kg/ha were top dressed before spike initiation stage and bulb lifting, respectively. No design was followed and spacing was maintained at 20cm from row to row and 15cm from plant to plant. When the lower most buds showed color, the spikes were harvested. After collecting flowers, the plants leaving 25-30cm stem were kept in the field for bulb development. When the leaves were brown and more or less damaged the bulbs were lifted carefully and stored at 2.1-2.50c temperature with media cocodust for future planting.

**Results and Discussion**

Wide variations in terms of qualitative parameters were observed (Table 1). Among the lilium germplasm, 18 attractive colored and two types of flowers viz. Asiatic lilium and Oriental lilium have been found. All of them are suitable for cut flower. Two germplasm have double type of petals. Regarding fragrance, Oriental type lilium produced strong scented flowers whereas Asiatic types have no fragrance.

**Table 1. Qualitative traits of some Lilium genotypes as cut flower**

| **Genotypes** | **Type** | **Petal description** | **Anther color** | **Fragrance** |
| --- | --- | --- | --- | --- |
| BARI Lilium-1 | Asiatic | Creamy white, greenish yellow mid rib and sporadic dark spots are present at the base of the petal | Deep maroon | Absent |
| BARI Lilium-2 | Asiatic | Yellow, no spots are present | Deep brown | Absent |
| Lili-022 | Asiatic | White petal surrounded by violet narrow markings. Numerous maroon spots are present at the base of petals | Deep maroon | Absent |
| Lil-023 | Asiatic | Light orange with glassy appearance. No spots are present | Maroon | Absent |
| Lil-024 | Asiatic | Deep blackish maroon with glassy appearance. Few black spots are present at the base of petals | Orange | Absent |
| Lil-025 | Asiatic | Light yellow. No spots are present | Orange | Absent |
| Lil-026 | Asiatic | Deep orange with glassy appearance. No spots are present | Maroon | Absent |
| Lil-027 | Asiatic | Pink with glassy appearance. No spots are present | Maroon | Absent |
| Lil-028 | Asiatic | Light maroon. Few spots are present at the base of the petals | Orange | Absent |
| Lil-029 | Asiatic | Bright yellow, no spots are present | Deep maroon | Absent |
| Lil-031 | Oriental | Pinkish white petal with numerous white hairy appearance at the base, no spots are present | Deep Orange | Present |
| Lil-032 | Asiatic | Light maroon colored long petal with few dark spots at the base | Deep maroon | Absent |
| Lil-033 | Oriental | Pink petals with some hairy appearance at the base and no spots are present | Deep Orange | Present |
| Lil-034 | Oriental | Snow white colored petal along with slight greenish appearance at the base with no spots | Deep maroon | Present |
| Lil-035 | Asiatic | Deep pink petal with whitish appearance at the base of the petal and few dark spots are present | Maroon | Absent |
| Lil-036 | Oriental | Drooping type light pink curvy petals surrounded by white colour along with whitish appearance at the base of the petal with no dark spots | Deep maroon | Present |
| Lil-037 | Oriental | Snow white colored with some hairy appearance at the base of the petal and tinted with pink color on whole petal and no spots are present | Yellowish orange | Present |
| Lil-038 | Oriental | Sweet pink ruffled flowers, each petal fades towards the centre with a greenish throat | No anther | Present |
| Lil-039 | Oriental | Crystal white ruffled flowers, each petal fades towards the centre with a greenish throat having 4-5 hairy appearance of deep pink color | No anther | Present |
| Lil-040 | Oriental | White centered deep pink curvy petals surrounded by white color, some spots are available | Deep maroon | Present |
| Lil-041 | Asiatic | White petal without any spots on petals centred with a slight greeninsh throat | Deep maroon | Absent |
| Lil-042 | Asiatic | Deep orange with glassy appearanc. Each petal fades towards the centre with a yellowish throat. No spots are present on petals | Deep maroon | Absent |

Various growth and flowering parameters were influenced by the Lilium genotypes (Table 2) as cut flower. The longest plant (80.0cm) was produced by the genotype Lil-034 and the shortest plant was observed in Lil-023 (44.0cm). Balode (2010) reported the higher phenotypic variability for plant height in Lilium genotypes. The maximum number of leaves was recorded in Lil-022 (74.3) and the minimum in Lil-033 (35.2). Variation in the vegetative parameters of Asiatic Lilium was also reported similarly by Pandey et al., 2008; Deka et al., (2010) and Sindhu and Singh (2012). Differences in vegetative growth characters of different growth cultivars may be due to varied growth rate and their genetic makeups as a result, variations in phenotypic expression are expected to occur (Sankari et al., 2020). Similar results with vegetative characters were also reported by Mishra (1997). The minimum days were required for bud initiation after planting in Lil-022 and Lil-028 (32.0 days) whereas the maximum days in Lil-033 and Lil-035 (46.0 days). The findings of the present study are in close agreement with Dhiman (2003) Sindhu and Singh (2012) who observed significant variation among Lilium. The variation in the number of days taken for flowering was primarily due to the genetic constitution of various cultivars and prevailing environmental conditions during the period of crop growth (Sankari et al., 2020). The longest and the broadest bud were produced by the genotype Lil-037 (13.2cm) and Lil-038 (3.7cm), respectively. The shortest and the narrowest bud were produced by the genotype Lil- 039 (6.1 cm) and Lil-035 (2.3 cm) respectively.

The stalk length which is another important quality parameter significantly varied among Asiatic cultivars. The cost of a flower stalk is determined mostly by the number of florets per stalk. It is an important flowering characteristic for Lilium production as a cut flower. Variations were observed in case of flowering parameters of *Lilium* genotypes as cut flower (Table 2). The longest stalk and rachis (93.8cm and 34.0cm, respectively) were produced by the genotype Lil-036. The shortest stalk was produced by Lil-026 (41.1 cm) and minimum rachis length was found in Lil-028 (14.3cm). Such varietal differences for sprouting have been also reported by Sindhu (2006).

The maximum number of florets per stalk (10.0) was produced by BARI Lilium-1 and the minimum number of florets was observed in Lil-031 (1.3). The result of the present study conforms to the findings of Deka et al., 2010; Srinivas (2002) and Srinivas (2003) who reported similar variation among Lilium cultivars concerning this parameter. Wide variation in floral parameters due to varieties has also been reported by Dhiman (2003).

The size of flowers also contributes to the quality of the flowering shoot and bigger buds on flowering stalks are always preferred **(**Sankari et al., 2020). The largest flower was produced by Lil-036 (24.5cm) and the size of the flower was minimum in Lil-038 (15.6cm). Similar performance was found by De Hertogh (1996) where flower diameter ranged from 13.8 cm to 20.2 cm among some Lilium varieties and significantly large-sized flowers were recorded in Stargazer (20.6 cm) followed by Prato (20.2 cm) and PKLH-1 (19.3 cm) which could serve as a varietal trait. The maximum vase life was observed in BARI Lilium-2 (11.0 days) whereas the minimum was in Lil-026 and Lil-027 (5.0 days).

**Table 2. Vegetative and flowering parameters of different *Lilium* genotypes as cut flower**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Genotypes** | **Plant height (cm)** | **No. of leaves/plant** | **Days to bud initiation** | **Bud length (cm)** | **Bud diameter (cm)** |
| BARI Lilium-1 | 73.6 | 67.0 | 40.0 | 10.4 | 3.3 |
| BARI Lilium-2 | 50.1 | 64.0 | 33.0 | 9.9 | 2.7 |
| Lil-021 | 53.9 | 54.0 | 35.0 | 9.6 | 2.7 |
| Lil-022 | 76.0 | 74.3 | 32.0 | 9.6 | 2.9 |
| Lil-023 | 44.0 | 55.5 | 36.0 | 9.8 | 2.7 |
| Lil-024 | 60.4 | 48.0 | 35.0 | 9.8 | 2.7 |
| Lil-025 | 48.4 | 53.0 | 35.0 | 9.1 | 2.4 |
| Lil-026 | 51.2 | 54.0 | 34.0 | 10.1 | 2.5 |
| Lil-027 | 65.3 | 80.0 | 33.0 | 9.9 | 2.7 |
| Lil-028 | 58.4 | 58.2 | 32.0 | 9.9 | 2.6 |
| Lil-029 | 67.1 | 51.5 | 34.0 | 10.7 | 3.5 |
| Lil-031 | 49.3 | 35.6 | 45.0 | 10.3 | 3.1 |
| Lil-032 | 61.9 | 59.1 | 36.0 | 9.16 | 2.9 |
| Lil-033 | 51.0 | 35.2 | 46.0 | 12.5 | 3.5 |
| Lil-034 | 80.0 | 58.1 | 37.0 | 11.8 | 3.4 |
| Lil-035 | 65.6 | 56.4 | 46.0 | 8.5 | 2.3 |
| Lil-036 | 76.9 | 56.1 | 38.0 | 12.7 | 3.1 |
| Lil-037 | 62.8 | 53.7 | 35.0 | 13.2 | 3.1 |
| Lil-038 | 45.0 | 52.5 | 36.0 | 6.8 | 3.7 |
| Lil-039 | 46.4 | 50.0 | 34.0 | 6.1 | 3.5 |
| Lil-040 | 39.1 | 51.0 | 36.0 | 12.0 | 3.5 |
| Lil-041 | 58.4 | 58.2 | 44 | 9.5 | 3.6 |
| Lil-042 | 55.8 | 50 | 42 | 10.5 | 3.3 |
| Mean | 56.57 | 55.45 | 37.13 | 10.08 | 3.03 |
| CV (%) | 21.11 | 17.94 | 12.03 | 16.62 | 13.94 |

**Table 2. Vegetative and flowering parameters of different *Lilium* genotypes as cut flower (Cont’d)**

Lil- 007

Lil001

| **Genotypes** | **Stalk length (cm)** | **Rachis length (cm)** | **Florets/**  **stick** | **Floret diameter (cm)** | **Vase life (days)** |
| --- | --- | --- | --- | --- | --- |
| BARI Lilium-1 | 80.0 | 26.0 | 11.0 | 17.0 | 10.0 |
| BARI Llilium-2 | 60.0 | 18.5 | 7.5 | 20.0 | 11.0 |
| Lil-022 | 55.4 | 27.3 | 3.8 | 20.0 | 7.0 |
| Lil-023 | 29.4 | 15.9 | 2.0 | 18.0 | 6.5 |
| Lil-024 | 42.5 | 20.3 | 4.8 | 21.1 | 5.5 |
| Lil-025 | 35.5 | 25.9 | 7.0 | 18.7 | 7.0 |
| Lil-026 | 41.1 | 31.9 | 6.4 | 20.1 | 5.0 |
| Lil-027 | 46.8 | 27.1 | 3.6 | 21.7 | 5.5 |
| Lil-028 | 33.4 | 14.3 | 3.2 | 19.9 | 8.0 |
| Lil-029 | 48.0 | 21.1 | 3.4 | 20.7 | 6.5 |
| Lil-031 | 45.5 | 16.6 | 1.6 | 18.0 | 7.0 |
| Lil-032 | 58.7 | 18.5 | 2.6 | 18.0 | 8.5 |
| Lil-033 | 48.6 | 19.5 | 2.0 | 18.5 | 8.0 |
| Lil-034 | 92.2 | 26.8 | 3.5 | 23.5 | 9.5 |
| Lil-035 | 79.8 | 17.5 | 3.0 | 18.5 | 7.5 |
| Lil-036 | 94.3 | 36.0 | 3.9 | 24.5 | 6.0 |
| Lil-037 | 55.0 | 21.7 | 4.5 | 21.0 | 7.5 |
| Lil-038 | 41.5 | 28.5 | 5.2 | 15.6 | 6.0 |
| Lil-039 | 42.0 | 26.3 | 4.8 | 15.1 | 6.5 |
| Lil-040 | 70.3 | 19.5 | 3.0 | 20.2 | 8.0 |
| Lil-041 | 55.1 | 16.6 | 3.3 | 19.8 | 8.5 |
| Lil-042 | 49.8 | 19.2 | 3.4 | 19.0 | 9.0 |
| Mean | 54.77 | 22.50 | 4.25 | 19.50 | 7.45 |
| CV (%) | 33.14 | 25.31 | 50.73 | 11.42 | 20.69 |

Like vegetative and flowering parameters, bulb and bulblet production were also influenced by the various lilium genotypes (Table 3). The maximum bulb weight (70.5g) was found in the genotypes Lil-036 whereas the minimum bulb weight (22.0g) was found in Lil-021. Similarly, Lil-036 also produced the largest bulb (6.60cm). The maximum number and weight of bulblet per plant were produced by Lil-024 (4.5) and BARI Lilium-1 (5.6g) respectively. Minimum number of bulblet per plant was recorded in Lil-021 and Lil-037 (2.5) whereas weight of bulblet per plant was minimum in Lil-035 (1.2g). Similarly, wide variation was also observed by Sheikh *et al*. (2015) where he reported that all lilium genotypes produced 1.0 daughter bulb per bulb and the range of bulblet production was 3.30-22.30 per bulb.

**Table 3. Bulb and bulblet production influenced by Lilium genotypes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Genotypes** | **Single bulb wt. (g)** | **Bulb diameter (cm)** | **Bulblet no./plant** | **Bulblet wt./plant (g)** |
| BARI Lilium-1 | 16.2 | 3.4 | 4.0 | 5.6 |
| BARI Lilium-2 | 30.0 | 4.5 | 3.0 | 2.3 |
| Lil-018 | 48.0 | 5.6 | 2.6 | 1.7 |
| Lil-019 | 48.0 | 5.3 | 3.8 | 2.1 |
| Lil-020 | 25.0 | 3.6 | 2.7 | 2.5 |
| Lil-021 | 22.0 | 3.9 | 2.5 | 2.2 |
| Lil-022 | 40.6 | 5.3 | 3.6 | 3.1 |
| Lil-023 | 22.8 | 3.7 | 4.0 | 3.7 |
| Lil-024 | 53.8 | 5.1 | 4.5 | 3.8 |
| Lil-025 | 30.8 | 4.3 | 3.0 | 3.5 |
| Lil-026 | 23.6 | 3.5 | 3.5 | 4.1 |
| Lil-027 | 27.2 | 3.9 | 4.1 | 4.5 |
| Lil-028 | 26.2 | 3.7 | 2.9 | 3.0 |
| Lil-029 | 40.4 | 5.3 | 3.0 | 3.2 |
| Lil-030 | 25.0 | 3.4 | 3.2 | 3.0 |
| Lil-031 | 38.4 | 4.6 | 3.6 | 3.2 |
| Lil-032 | 28.6 | 5.2 | 3.4 | 3.1 |
| Lil-033 | 46.5 | 5.4 | 2.6 | 3.1 |
| Lil-034 | 36.5 | 4.4 | 4.3 | 4.3 |
| Lil-035 | 44.4 | 5.9 | 3.5 | 1.2 |
| Lil-036 | 72.4 | 6.6 | 5.5 | 2.1 |
| Lil-037 | 40.8 | 5.2 | 2.5 | 2.3 |
| Lil-038 | 24.4 | 3.8 | 3.0 | 2.9 |
| Lil-039 | 42 | 3.6 | 3.0 | 2.8 |
| Lil-040 | 42.0 | 5.3 | 7.0 | 3.0 |
| Lil-041 | 56.8 | 5.5 | 5.6 | 2.3 |
| Lil-042 | 60 | 5.86 | 5.5 | 2.4 |
| Mean | 37.50 | 4.66 | 3.70 | 3.00 |
| CV (%) | 36.18 | 19.74 | 30.06 | 31.16 |

**Conclusion**

Lilium genotypes showed wide variation in all qualitative and quantitative parameters studied. Among the newly collected lilium germplasm, two have double type of petals. The longest stalk and rachis (93.8cm and 34.0cm, respectively) were produced by the genotype Lil-036. The maximum number of florets per stalk (10.0) was produced by BARI Lilium-1. Maximum vase life was observed in BARI Lilium-2 (11.0 days).

**Acknowledgement**

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**COLLECTION, EVALUATION AND MAINTENANCE OF ROSE**

A. NAZNIN, K. AMBIA, M. M. R. BHUYIN, F. N. KHAN AND M. T. RASHID

**Abstract**

*Ten genotypes of rose were evaluated that showed wide range of variation for all vegetative and floral traits under study.*

**Introduction**

Rose belongs to family *Rosaceae,* is one of the natures beautiful creations and is universally known as the Queen of Flowers (Hessayon, 1996). Rose is a symbol of love, adoration and innocence (Yadav *et al*., 1989). It may be used for planting in beds, borders, as ground covers, growing in pots and for cut flower production. Roses are also grown for their multiple uses like production of petals, extraction of perfumes, for medicinal uses and for sale as cut flowers. At present, it has become the most important commercial flower. It can be grown in Bangladesh for easy cultivation and wider adaptability. However, research works on different morphological and floral traits of rose are not characterized properly in Bangladesh. Therefore, this investigation was carried out.

**Materials and Methods**

The present investigation was carried out at Floriculture Field of HRC, BARI, Joydebpur, Gazipur. Ten different types of roses were collected from different nurseries and at the time of data recording, the age of plants was three years. All the cultural practices such as fertilization, irrigation, weeding, hoeing etc. were done uniformly for each treatment. Farmyard manure was also used for plant nutrition. Data on different traits like plant height,branch number/plant, stalk length, flower number/plant, flower size, flower durability, flower colour etc. were recorded.

**Results**

The performance of ten genotypes of rose presented in Table 1 exhibited variation on different parameters. In respect of flower colour, the observed genotypes showed remarkable variation such as yellow, orange, yelloish orange, pink, light pink, yellowish white, red, maroon etc. (Table 1). The tallest plant of 98.0 cm recorded in the genotype R-003 and shortest of 67.0 cm in R-006 and R-009. The production of maximum number of branches per plant (5.0) was recorded in genotype R-005 followed by 4.5 shoot in genotype R-004. The genotype R-002 produced the highest stalk length of 9.0 cm (Table 1). Maximum flower number was recorded in R-005 (14.0). In respect of flower size, genotype R-004 (9.0 cm) found superior to others. The genotype R-005 exhibited the maximum flowering duration (7.0 days) while minimum duration of 5.0 days was recorded in R-010.

**Table 1. Vegetative and floral traits of Rose genotypes**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Genotypes** | **Flower colour** | **Plant height (cm)** | **Branch no./plant** | **Stalk length(cm)** | **Flower no./plant** | **Flower size (cm)** | **Flower durability (days)** |
| R-001 | Yellow | 86.0 | 3.4 | 6.0 | 10.0 | 6.5 | 6.7 |
| R-002 | Orange | 87.0 | 4.1 | 9.0 | 9.5 | 5.7 | 6.3 |
| R-003 | Pink | 96.0 | 4.1 | 7.3 | 11.0 | 8.4 | 6.4 |
| R-004 | Yellowish white | 94.0 | 4.4 | 8.1 | 9.6 | 9.2 | 6.6 |
| R-005 | Yellowish orange | 83.0 | 5.1 | 6.8 | 14.3 | 7.6 | 7.1 |
| R-006 | Red | 66.0 | 4.3 | 6.3 | 10.5 | 6.0 | 6.3 |
| R-007 | Light pink | 74.0 | 4.4 | 6.5 | 8.7 | 7.5 | 6.2 |
| R-008 | Red | 83.0 | 4.1 | 5.1 | 10.3 | 6.3 | 6.5 |
| R-009 | Maroon | 68.0 | 4.2 | 5.3 | 10.1 | 5.8 | 6.4 |
| R-010 | Pink | 75.0 | 3.3 | 3.7 | 7.4 | 5.5 | 5.2 |
| STD |  | 10.23 | 0.51 | 1.53 | 1.78 | 1.26 | 0.49 |
| CV |  | 12.60 | 12.33 | 23.82 | 17.55 | 18.40 | 7.62 |

**Conclusion**

Variation was observed among genotypes in respect of vegetative and floral traits.

**Acknowledgement**

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**COLLECTION AND EVALUATION OF CHRYSANTHEMUM GENOTYPES**

K. AMBIA, A. NAZNIN, M.M.R. BHUYIN, M. T. RASHID AND F.N. KHAN

**Abstract**

*Thirty chrysanthemum genotypes with BARI Chrysanthemum-2 as check variety were evaluated at the Floriculture field of Horticulture Research Centre, Bangladesh Agricultural Research Institute, Gazipur during winter season of 2021-22. There were significant variation among the genotype in respect of plant height (35.0-64.0 cm), number of flowers per plant (15.0-75.0), diameter of flower (2.6-8.5 cm), stalk length (4.2-12.5 cm) and vase life of flowers (5.0-13.0 days). Among the genotypes, CM-004 and CM-022 were found superior for cut flower production as well as CM-012, CM-018, CM-019 and CM-021 for pot culture*.

**Introduction**

Chrysanthemum is a popular flower crop of commercial importance. It belongs to the family Compositae and has been commonly grown in gardens for more than 2,500 years (Singh, 1995). The chrysanthemum as a cut flower has no rival for versatile beauty and even economy and they often remains in good condition for two to three weeks depend on cultivars (Cumining, 1964). In recent years, demand of chrysanthemum as pot plant for house decoration and for use in amenity horticulture has steadily increased. Being unique in beauty, size and colour, it deserves necessity to garden lovers. For commercial cultivation, quality flower production is important rather than other agronomic characters and is highly influenced by environmental fluctuation (Rahman, 2005; Uddin etal., 1985). Although some sporadic works have been conducted regarding performance and characterization of chrysanthemum genotypes, more attention should be paid on these aspects to improve quality flower production. As chrysanthemum genotypes show high variability in yield performance, there is ample scope to improve flower yield, therefore, present study was undertaken to characterize the different genotypes and to find out the superior genotypes of chrysanthemum.

**Materials and Methods**

Thirty chrysanthemum genotypes, viz. CM-001, CM-002, CM-003, CM-004, CM-005, CM-006, CM-007, CM-008, CM-009, CM-010, CM-011, CM-012, CM-013, CM-014, CM-015, CM-016, CM-017, CM-018, CM-019, CM-020, CM-021, CM-022, CM-023, CM-024, CM-025, CM-026, CM-027, CM-028, CM-029, CM-030 and a check variety BARI Chrysanthemum-2 were used as planting materials. Primarily cuttings were prepared for planting in the sand in mid August, 2021. Immediately after rooting, the mini plantlets were transferred to 12" earthen pot containing media that consists of 50% soil and 50% well rotten cowdung in mid September, 2021. Subsequently 10 g TSP and 6 g MoP per pot were applied. Urea @ 3 and 5 g per pot was applied at 35 and 65 days after transplanting respectively. Uniform cultural practices were carried out throughout the experiment. The experiment was laid out in RCB design with three replications. Data were recorded on 5 randomly selected plants for plant height, flower colour, flowers/plant, stalk length, flower diameter, vase life of flower etc.

**Results and Discussion**

**Plant and flower characteristics**

The plant height differed significantly in different genotypes (Table 1). The tallest plants were recorded in CM-029 (64.0 cm) closely followed by CM-027 (63.0 cm) and CM-026 (62.0 cm) while CM-012 (35.0 cm) genotype produced shortest plant.

**Table 1. Plant and floral characteristics of chrysanthemum genotypes**

| **Genotypes** | **Plant ht. (cm)** | **No. of flower/plant** | **Dia. of flower (cm)** | **Stalk**  **length (cm)** | **Flower colour** |
| --- | --- | --- | --- | --- | --- |
| CM -001 | 43.0 | 40.0 | 4.5 | 6.5 | Light pink |
| CM -002 | 46.0 | 70.0 | 2.6 | 8.9 | Yellow |
| CM -003 | 40.0 | 25.0 | 4.2 | 7.5 | Light pink |
| CM -004 | 39.0 | 30.0 | 6.7 | 11.9 | Red |
| CM -005 | 58.0 | 42.0 | 4.4 | 6.5 | Whitish yellow |
| CM -006 | 38.0 | 30.0 | 3.9 | 5.8 | Yellow |
| CM -007 | 51.0 | 35.0 | 6.5 | 7.3 | Light pink |
| CM -008 | 43.2 | 60.0 | 5.8 | 7.2 | Purple red |
| CM -009 | 54.0 | 72.0 | 5.0 | 9.3 | Yellowish bronze |
| CM -010 | 46.4 | 30.0 | 4.5 | 6.5 | Yellow |
| CM -011 | 44.0 | 35.0 | 4.3 | 7.0 | Red |
| CM -012 | 35.0 | 75.0 | 2.6 | 4.2 | Reddish yellow |
| CM -013 | 59.0 | 45.0 | 7.5 | 8.2 | Orange |
| CM -014 | 45.0 | 25.0 | 6.8 | 8.0 | White |
| CM -015 | 42.5 | 28.0 | 6.9 | 9.0 | Reddish yellow |
| CM -016 | 47.0 | 26.0 | 7.5 | 8.5 | Creamy white |
| CM -017 | 55.0 | 25.0 | 5.7 | 6.5 | Meron |
| CM -018 | 48.0 | 47.0 | 4.5 | 6.7 | Deep pink |
| CM -019 | 39.0 | 30.0 | 4.7 | 9.7 | Blackish red & pink |
| CM -020 | 45.0 | 30.0 | 5.9 | 7.0 | Light pink |
| CM -021 | 46.0 | 50.0 | 2.6 | 5.1 | Light pink |
| CM -022 | 62.0 | 30.0 | 7.2 | 12.5 | Majenta |
| CM -023 | 60.0 | 25.0 | 8.5 | 10.5 | Blackish red |
| CM -024 | 37.0 | 20.0 | 6.4 | 10.7 | Deep yellow |
| CM -025 | 42.0 | 28.0 | 6.3 | 10.0 | Red |
| CM -026 | 62.0 | 15.0 | 8.3 | 10.5 | White |
| CM -027 | 63.0 | 18.0 | 8.1 | 10.5 | Pink |
| CM -028 | 59.0 | 20.0 | 6.2 | 8.5 | Orange yellow |
| CM -029 | 64.0 | 32.0 | 6.5 | 10.0 | Whitish yellow |
| CM -030 | 56.5 | 22.0 | 7.7 | 9.2 | Red |
| BARI Chry-2 | 45.0 | 25.0 | 6.8 | 10.0 | White |
| **LSD (0.05)** | **2.9** | **2.5** | **2.2** | **3.0** | **-** |
| **CV (%)** | **15.9** | **18.6** | **15.0** | **14.4** | **-** |

The maximum number of flowers per plant was counted in CM-012 (75.0) closely followed by CM-009 (72.0). This may be due to their greater number of tertiary branches and good adaptability under pot conditions. The minimum number of flowers per plant was counted in CM-026 (15.0). The diameter of flowers differed significantly in different genotypes. The maximum diameter of flowers was recorded in CM-023 (8.5 cm) closely followed by CM- 026 (8.3 cm) and CM-027 (8.1 cm).



**Fig. 1. Days to 50% flowering of Chrysanthemum genotypes**

On the other hand, the minimum flower diameter (2.6 cm) was recorded in CM-002, CM-012 and CM-021. CM-022 produced longest flower stalk (12.5 cm) followed by CM-004 (11.9 cm). The shortest stalk was recorded in CM-012 (4.2 cm) and it may be due to its cluster type flowering habit.

Distinct variation was also observed among the genotype for days required to 50% flowering (Fig. 1.). CM-002 and CM-010 took minimum of 44.0 days to 50% flowering while the maximum days (68 days) were required by CM-009 (Fig. 1.). The vase life significantly varied among the genotypes of chrysanthemum. The cut blooms of CM-009 exhibited maximum vase life (13 days) closely followed by CM-022 (12 days) while minimum vase duration (5 days) was recorded in genotype CM-008 (Fig. 2.).



**Fig. 2. Vase life of Chrysanthemum genotypes**

**Conclusion**

Among the genotypes CM-004 and CM-022 may be recommended for cut flower production for their long stalk, attractive colour, big flower size and extended vase life; while considering attractive colour, medium plant height, profuse flowering and small flower size, CM-012, CM-018, CM-019 and CM-021 may be recommended for pot culture.

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Cm-09

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**COLLECTION AND MAINTENANCE OF CACTUS AND SUCCULENTS**

K. AMBIA, M. T. RASHID, A. NAZNIN, M.M.R. BHUYIN AND F.N. KHAN

**Abstract**

*Thirty cactus genotypes and twenty-three genotypes of succulents were collected and maintained at Floriculture Field of HRC, BARI, Gazipur.* *Wide variation in respect of vegetative and floral traits was observed. Among the genotypes, Cac-011 exhibited distinctly large flower than the others. Flower durability varied from 2.0 to 7.0 days. The genotypes Cac-015 and Cac-016 produced higher number (15.0 and 13.0 respectively) of flower whereas Cac-008 produced lowest number of flower (2.0). A large variation was found in shape, size and colour of the observed genotypes. Succulent genotypes showed wide variation in different growth characters.*

**Introduction**

Cactus belongs to the family Cactaceae. The Cactaceae family has some of the most valid and fascinating species in the plant kingdom. It is suitable for growing in pots for indoor decoration (Prokash, 1994; Mchoy, 1994). Cactus cultivation has become a fascinating hobby among amateur gardeners and these desert plants which are mostly unknown have become the subject of greatest care and delicate handling (Hewitt, 1993). On the other hand, succulents are the xerophytic plants and members of the family Agavaceae, Euphorbiaceae Crassulaceae and Liliaceae etc. with swollen fleshy parts, curious forms, diversity of shape and colour. They can store water to survive in the drought condition. Despite of their numerous thorns and spines, they have a beauty of their own (Bose *et al*., 2003). Therefore, the present study was under taken to collect and maintain succulents for decorative and commercial purposes. Their easy cultivation methods in shallow soils are additional features for their popularity (Randhwa and Mukhopadhyay, 1999). Now-a-days more marketing opportunities for cactus and succulents are emerging in urban areas. People are interested to make their indoor garden fabulous by adding Cactus and succulents as ornamental plants. It is of urgent need to standardize their production technology to encourage more people in culticating them. Therefore, the present study was under taken to select the superior lines of Cactus and succulents suitable for decorative and commercial purposes.

**Materials and Methods**

The experiment was conducted at Floriculture Field of HRC, BARI, Gazipur during the period of 2021-2022. Thirty lines of cactus and twenty three genotypes of succulents were collected from different nurseries and accession numbers were given to each entry. Other intercultural operations such as watering, weeding, plant protection measures etc. were applied as and when necessary. Different vegetative and floral characteristics data were recorded.

**Results and Discussion**

The morphological characters of 30 genotypes were studied and presented in Table 1. During the study period, flower characteristics of 14 genotypes were recorded (Table 2). Early flowering was observed in genotype Cac-001 (170 days), whereas the genotype Cac-011 took maximum days (200 days) to flower initiation. Among the genotypes, Cac-011 exhibited distinctly large flower (7.3 cm) than the others. Durability of flowers varied from 2.0 to 7.0 days. The genotypes Cac-015 and Cac-016 produced higher number of flowers (15.0 and 13.0 respectively) during the study period whereas Cac-008 produced lowest number of flower (2.0). A large variation was found in flower colour of the observed genotypes.

**Table 1: Morphological characteristics of Cactus genotypes**

| **Genotypes** | **Common name** | **Brief description** |
| --- | --- | --- |
| Cac-001 | Gymnocalycium | This is a small cactus, dark green body. It has 8 ribs with short columnar stem and short spines. The spines are whitish grey in colour. |
| Cac-002 | Gymnocalycium | This is a globular species with a pink body. It has 8 ribs each with a swollen tuberculate structure and a distinct furrow between each aeriole position. |
| Cac-003 | Gymnocalycium | Flattened and globular in shape with red body. Small number of ribs and aerioles give this species a bold, chunky look. |
| Cac-004 | Gymnocalycium | It is a small flattened bicolour cactus. Its body is variable in shape and is most often green with straight or curved, white, bristle spines. It eventually forms a densely packed carpet of stems. |
| Cac-005 | Gymnocalycium | Flattened and globular in shape with yellow body. It has 8 ribs each with a swollen tuberculate structure and a distinct furrow between each aeriole position. |
| Cac-006 | Echinopsis | This cactus exhibits wide variation. Its stem is little shorter and thicker with yellow spine. |
| Cac-007 | Echinopsis | It is a dark green cactus. It is grown mostly for its banana like stem because its red flowers rarely appear. It has no chlorophyll, so must be grafted on to a green cactus that can supply it with food. |
| Cac-008 | Echinopsis | This small slender green plant has very short, white spines and its branches rapidly form a cluster of stems. It is easily grown from offsets. |
| Cac-009 | Cleistocactus | It is a columnar cactus with huge needle like spines. It is sun-loving and quite fast growing plants. |
| Cac-010 | *Cereus validus* | An attractive feature plant, this variable cactus flowers freely at intervals in summer. Its long thick spines are glossy and dark green on new growth. The stem produce offsets in time to form a clump. |
| Cac-011 | *Cereus hidmannianus* | The contorted stem cactus is caused by deformed growing points. It has short spines range with colour from gold to red. |
| Cac-012 | Mammillaria | It is green cactus has creamy spines easily grown from offsets. The flowers are yellow, having a short tube. Grafting will produce a healthier, faster growing and long-lived plant. |
| Cac-013 | Mammillaria | It is a slow-growing cactus forms a low dense clump. It thrives well when grown as a grafted plant. |
| Cac-014 | Notocactus | This is eventually a columnar species. It has a pale green body with numerous fine ribs and the small aerioles set very closely together and bear up fine, whitish, yellow to yellow radial spines. |
| Cac-015 | Opuntia | The cacti can be several meters or a few centimeters tall and include some with fleshy pads or branching stems and mat-forming alpine species. Barbed spines and tufts of bristles protect the body. |
| Cac-016 | Opuntia | It grows about 1.0 feet tall and bears groups of tiny hooked barbs, known as glochids. It has oval pads with tufts of golden bristles with light green body. |
| Cac-017 | Rebutia | This species readily forms a mound of tiny heads, which are densely covered in silver-grey spines. Grafting will produce a healthier, faster-growing and longer-lived plant. |
| Cac-018 | Rebutia | Olive-light green, button-like stems form a compact mound. The flowers, which have long necks and are delicately shaded rose-pink, grow from the lower stem and open fully in the sun. |
| Cac-019 | Hexacereus | It is grey-green cactus, grow very rapidly. They are flattened and globular in shapes. It has 6 ribs. This vigorous sun-loving species makes a good grafting stock. |
| Cac-020 | Rhipsalis | It is a small growing, very freely branching, epiphytic plant which has 4-5 angle segments or shoots and tiny yellowish white bristles. The flowers are pink, have a short tube. |
| Cac-021 | Pereskia | A slightly succulent shrub, climbing plants with flattish, deciduous leaves, but possessing prominent spiny aerioles. |
| Cac-022 | *Cereus chalybaeus* | It is mostly very fast growing and robust plants. It has state-blue stems and short black spines. The flowers are nocturnal, white with a pinkish tube. |
| Cac-023 | Ferocactus | The shape of a cactus is highlighted by spines and the green body fluted with deeply indented ribs or studded by chunky. They have fish-hook spines emphasize long knobbly tubercles. |
| Cac-024 | Echinopsis | This pretty cactus was developed to create a more handsome and larger deep green body, as well as produces short-necked flowers. |
| Cac-025 | Gymnocalycium | This cactus are small and globular, ranging in hue from blue-green to grey or brown. A small number of ribs and areoles give this species a bold, chunky look. Flowers range from pink to orange and open wide in full sun. |
| Cac-026 | Brain Cactus | The brain cactus, also known as Cristata cactus, is native to Central Mexico. It is rare form of the Mammillaria elongata and has a unique, crested shape. It is growth pattern kind of looks like worms or brains, bright green colour, which is how it got the nickname Brain Cactus. It forms tight clumps of ascending and erect columnar stems which resemble a brain or worms. They are sometimes used for bonsai due to their attractive but small size. |
| Cac-027 | Mammillaria | Olive light button like stems form a compact mound. The flowers are open bell shaped, light yellow with yellow stamens. They grow near the apex. The plant is propagated through cuttings or seeds suitable for home and office decorations. |
| Cac-028 | Mammillaria | Globular, about ¾ of an inch in diameter, dark green stem. The plant often grows in small clusters of offshoots. The surface of the plant is tuber culate, with a small, trianguler, white felt-covered aerole appearing at the apex of each tubercle. Widely varying numbers of thin, white radial spines grow from each aereole. The flowers are open bell shaped with pink petals and yellow stamens. |
| Cac-029 | Easter cactus | Easter cactus grows as a pendulous branching plant and lacks spines. The segmented stems are composed of flattened cladodes with notched margins. The funnel-shaped flowers have numerous petals and are usually borne at the terminal cladodes, typically bloom during February-March. |
| Cac-030 | Rat-tail Cactus | It is a trailing plant that sends out long stems with short, fine spines. The overall colour of the plant is green when young but turns to beige as it ages. Flowers are rare but when they arrive they are a glorious bright pink to red hue, tube shaped and arise on mature stems. |

**Table 2. Flower characteristics of different cactus genotypes**

| **Genotypes** | **Days to flower initiation** | **Diameter of flower (cm)** | **Durability of flower (days)** | **No. of flower** | **Colour** |
| --- | --- | --- | --- | --- | --- |
| Cac-001 | 170 | 3.5 | 6.0 | 5.0 | Pink |
| Cac-002 | 175 | 4.5 | 5.0 | 6.0 | Light yellow |
| Cac-003 | 180 | 3.6 | 6.0 | 5.0 | Off-white |
| Cac-004 | 190 | 4.3 | 5.0 | 4.0 | Pink |
| Cac-005 | 200 | 3.8 | 4.0 | 3.0 | Pale pink |
| Cac-007 | 185 | 4.5 | 5.0 | 4.0 | Off-white |
| Cac-008 | 195 | 4.2 | 5.0 | 2.0 | Golden orange |
| Cac-011 | 200 | 7.3 | 2.0 | 6.0 | White |
| Cac-012 | 185 | 2.9 | 5.0 | 4.0 | Purple |
| Cac-015 | 189 | 3.5 | 7.0 | 15.0 | Yellow |
| Cac-016 | 190 | 3.8 | 5.0 | 13.0 | Red |
| Cac-019 | 202 | 4.8 | 4.0 | 6.0 | White |
| Cac-021 | 187 | 5.3 | 3.0 | 7.0 | Pink |
| Cac-022 | 195 | 6.8 | 2.0 | 12.0 | White |
| Cac-025 | 182 | 6.5 | 5.0 | 5.0 | Light pink |
| Cac-027 | 188 | 4.8 | 1.0 | 4.0 | Light yellow |
| Cac-028 | 190 | 5.0 | 1.0 | 4.0 | Pink |
| Cac-029 | 186 | 5.0 | 8.0 | 6.0 | Pink |
| Cac-030 | 183 | 3.7 | 4.0 | 5.0 | Orange |
| **CV %** | **9.2** | **8.0** | **7.4** | **10.3** | **-** |

**Table 3: Morphological characteristics of Succulent genotypes**

| **Genotypes** | **Common name** | **Brief description** |
| --- | --- | --- |
| S-001 | Stapelia | Fleshy, five-petalled blooms yellow flower, which vary in form, are decorated with narrow, caramel-brown to purple bands. They like sun or light shade and thrive in hanging baskets but cannot tolerate prolonged drought or cold, damp conditions. |
| S-002 | Sedum | Top of Form  Bottom of Form  Sedum is flowering plants in commonly known as stonecrops. They have more fleshy and the plants have water-storing capacity. In shade, the leaves at the stem tips are pale lime-yellow but in sun they are rust in colour. They have tight clusters of dark green to purple leaves. |
| S-003 | Pachypodium | They usually have swollen bases or trunks, which are grey to brown and spiny. They are deciduous and bear trumpet-shaped flowers, appear at the stem in summer season. |
| S-004 | Pedilanthus | Pedilanthus bear with its zig-zagging stems and white with light green variegated foliage makes a fine pot plant. Tiny greenish flowers and red to yellow bracts appear near the stem. The plant dislikes harsh sun and cold, damp conditions. |
| S-005 | Sansevaria | They have rosettes of usually dark yellowish green, fleshy leaves often variegated. Spikes of pale, white flowers appear in summer. They are suitable in hanging baskets and pot. |
| S-006 | Monadenium | They have fleshy leaves. This plant forms small sparse clumps from underground stems used for indoor decoration. |
| S-007 | Pachyphytum | Stemless rosettes of fleshy leaves, in shades of green, blue orange, produce arching spikes of long-lasting, pendent flower with powder enclosed by grey-green sepals and red petals. Their glossy leaves appear in summer. Pachyphytum species are sometimes slow-growing and may prefer sun or shade. |
| S-008 | Kalanchoe | Leafy succulents plants; many are grown for their decorative, variegated often hairy foliage and some of the trailing species are excellent in hanging baskets. The mostly bell-shaped, long-lasting flowers vary in colour from white, yellow or orange to brown, red or purple. They appear at the stem tips mainly in summer. These succulents are sometimes fast-growing and many are easy to cultivate in sun or shade, but several species cannot tolerate low temperatures. |
| S-009 | Huernia | The flowers of this small succulent can differ greatly but they are most often buff-coloured with blood-red spots or stripes. The stems vary in colour form a dull green to reddish purple. |
| S-010 | Haworthia | They display a range of fine foliage. The broad, triangular, sometimes stippled leaves olive-green to purple-brown and their upper surfaces are often criss-crossed with transparent markings. They are short-stemmed which form new plants some distance from the parent. |
| S-011 | Adenium | Bushy plants are open faced appear periodically from summer to winter. They are easiest to grow, produce flowers readily in 3-4 years from seed. Its pink, white or crimson flowers, which usually have dark outer edges and paler centres are produced from summer through to winter. |
| S-012 | Agave | They are stemless, rosette-shaped succulents used for indoor and outdoor decoration. |
| S-013 | Cryptanthes | Cryptanthesis a beautiful and attractive star-like-shaped popular succulent as commercially importance which have olive green leaves spirally-arranged in a rosette, elongated and narrow, upto 11.0 cm along with serrated pink margins, bending towards the tips. However, it is one of the succulent foliage plants whose leaves are more beautiful than its flowers used for house and office decoration. |
| S-014 | Aloe | The Aloe, flowers annually and its rosette is formed by leaves that grow out rather than unfurl from the centre. Long flower stems bearing clusters of small long-lasting tubular blooms. They come in a variety of shades of red, orange, green, yellow, grey, etc. mostly in winter. |
| S-015 | Euphorbia milli | This succulent is perennial. The erect stem has a handsome rosette of variable deciaduous leaves. Their tiny flowers lack petals and sepals but are often enchosed by brightly hued, long-losting leaf bracts. They grow well in sun or shade makes a good hedging plant. |
| S-016 | Euphorbia decaryi | Short upright stems with rosettes of variable leaves at their tips grow from slow spreading underground stems. In summer, yellow-green and red leaf bracts appear at the stem trips. |
| S-017 | Lithops | This are tiny succulents consist of united pairs of swollen leaves and are known as living stones or pebble plants. |
| S-018 | Faucaria | The fleshy, bright green leaves are triangular in shape and nearly all are tipped with soft short teeth, given rise to their common name of tiger’s jaws. |
| S-019 | Echeveria | Pretty foilage stemless rosette offsets which more compact and its foliage is usually purplish green. They are good decorative. |
| S-020 | Ice plants | It is a perennial, prostrate, ground-covering herb with small heart shaped, glossy green succulent leaves. The leaves are flat, roots are flesshy & thick suitable for hanging busket. It is a long flowering period, producing small bright pink, red, or yellow star-like flowers with many petals, which close at night. |
| S-021 | Cryptanthes | Bronzy green leaves spirally-arranged in a rosette, elongated and narrow, upto 10.0 -11.0 cm along with serrated coffee colour streak, bending towards the tips. However, it is one of the succulent foliage plants whose leaves are more beautiful than its flowers used for house and office decoration. Flowers clustering, white, nestled low in the centre of the rosette. |
| S-022 | Cryptanthes | Zebra like leaf having white and coffee colour streak , bending towards the tips whose leaves are more beautiful than its flowers used for house and office decoration. This is an excellent and colourful addition to dish gardens and terrarium at home and offices. |
| S-023 | Sweet Heart Hoya | It is an indoor succulent, ovoid, dark green to yellow green leaves, popular for its unique heart-shaped appearance. They like light shade and thrive in hanging baskets but cannot tolerate prolonged damp conditions. They are attractive succulents used for indoor and outdoor decoration. |

**Conclusion**

Wide variations were observed in respect of colour, shape and size. The genotype Cac-015 and Cac-016 produced higher number (15.0 and 13.0 respectively) of flower whereas Cac-008 produced lowest number of flower (2.0). Succulent genotypes showed wide variation in different growth characters. More number of genotype will be collected for continuing the experiment in order to detailed study of flower and yield characters under Bangladesh context.

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**COLLECTION, EVALUATION AND MAINTENANCE OF GERBERA**

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**Abstract**

*Twenty-nine genotypes of gerbera with BARI Gerbera-1 were collected and evaluated that showed wide range of variation for all quantitative and qualitative characters under study. Based on colour, flower number, flower size and vase life, the genotypes GJ-013, GJ-023, GJ-024 and GJ-028 were identified as promising.*

**Introduction**

Gerbera (*Gerbera jamesonii* Bolus) belongs to the family Asteraceae has gained much importance (Nanjan, 1994). It is an important flower crop with long leafless stalks and daisy-like flowers. It is native to South Africa and a popular cut flower grown throughout the world in a wide range of climatic conditions (Singh, 2001). It is popularly known as ‘Barbeton daisy’ or ‘Transvaal daisy’. The traditional Chinese ‘tu-er-feng’ medicine is derived from the whole plants of gerbera and used for curing cold with cough and for rheumatism (Bose *et al*., 2003). In Bangladesh, the environmental conditions required for the survival and culture of gerbera are adequately available throughout the year. A large number of gerberas are being introduced in the country recently. But studies on different plant and flower characters including yield potentiality have not yet been made systematically. Considering the above facts, the present study was undertaken to find out the suitable line (s) for cut flower as well as for future breeding program.

**Materials and Methods**

The experiment was carried out at the Floriculture Field, Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur during Rabi season of 2021-2022. It was a single factor experiment included with twenty nine genotypes of gerbera along with BARI Gerbera-1 used as check which were as follows: GJ-001, GJ-002, GJ-003, GJ-004, GJ-005, GJ-006, GJ-007, GJ-008, GJ-009, GJ-010, GJ-011, GJ-012, GJ-013, GJ-014, GJ-015, GJ-016, GJ-017, GJ-018, GJ-019, GJ-020, GJ-021, GJ-022, GJ-023, GJ-024, GJ-025, GJ-026, GJ-027, GJ-028, GJ-029 and BARI Gerbera-1. The spacing between and within rows was 40 cm × 30 cm. The crop was manured and fertilized with cowdung, cocodust, Urea, TSP and MoP @ of 8 tons, +2 tons, 250 kg, 275 kg and 225 kg per hectare respectively. Full doses of well decomposed cowdung, cocodust, TSP and MoP were applied during final land preparation. Urea was applied in two equal splits at 45 and 75 days after planting (DAP) the sucker. Suckers were planted at 6 cm depth in furrows. Cultural operations such as weeding, irrigation, disease and pest management etc. were done as and when necessary. The stalks were harvested when the flower reached at commercial stage (two whorls of ray florets open). Five plants were selected randomly in each genotype per replication to record data on different characters viz. plant height (cm), number of leaves/plant, plant spread (cm), number of sucker/plant,days to flowering, flower size (cm), number of florets, stalk length (cm) and vase life (days). The data were statistically analyzed and means were separated by Least Significant Difference Test according to Steel *et al*. (1997).

**Results and Discussion**

Variations were observed in respect of flower colour (Table 1). The performances of 30 genotypes of gerbera revealed significant differences for all the characters under study (Table 2). The tallest plant was produced by GJ-023 (31.2cm) closely followed by GJ-024 (28.4cm). On the other hand, the shortest plant (17.3cm) was recorded in GJ-029. Singh and Mandhar (2004) conducted a performance trial of gerbera cultivars and reported that plant height ranged from 17.0-30.0 cm which was at par with the present investigation. The variation might be due to difference in genetic constituents among the genotypes along with the environmental effects.

**Table 1. Qualitative traits of Gerbera genotypes**

| **Genotypes** | **Flower colour** |
| --- | --- |
| GJ-001 | Light yellow |
| GJ-002 | Red |
| GJ-003 | Orange |
| GJ-004 | Orange-red |
| GJ-005 | Light yellow |
| GJ-006 | Orange red |
| GJ-007 | Rose red |
| GJ-008 | White |
| GJ-009 | Light pink |
| GJ-010 | Yellow orange |
| GJ-011 | Deep pink |
| GJ-012 | Pinkish yellow |
| GJ-013 | Yellow |
| GJ-014 | Pinkish white |
| GJ-015 | Blackish red |
| GJ-016 | Orange yellow |
| GJ-017 | Yellow |
| GJ-018 | White |
| GJ-019 | Pink |
| GJ-020 | Red |
| GJ-021 | Red |
| GJ-022 | Yellowish orange |
| GJ-023 | Pink |
| GJ-024 | Yellow |
| GJ-025 | Creamy white |
| GJ-026 | Light pink |
| GJ-027 | White |
| GJ-028 | Deep majenta |
| GJ-029 | Light Yellow |
| BARI Gerbera-1 | Red |

Maximum number of leaves/plants was produced by GJ-023 (20.0) and minimum number of leaves/plants was found in GJ-014 (10.0). Plants produce food materials through the process of photosynthesis. Generally, with the increased number of leaves, photosynthesis is supposed to be increased. Thus, plant produces more photosynthates can influence its growth and development in the long run. Genotypes which produce more leaves possess more scope for higher growth leading to better yield. Among the genotypes, plant spread varied from 13.0 to 24.6 cm (Table 2). Maximum plant spread was recorded 24.6cm in GJ-022 and GJ-024. The differences in various growth characters might be attributed to inherent genetic factors. This is in line with the findings of Nair and Medhi (2002) in gerbera.

**Table 2. Vegetative characters as influenced by different genotypes of gerbera**

| **Genotypes** | **Plant height (cm)** | **Number of leaves/plant** | **Plant spread (cm)** |
| --- | --- | --- | --- |
| GJ-001 | 24.5 | 12.0 | 13.6 |
| GJ-002 | 23.0 | 14.0 | 15.0 |
| GJ-003 | 15.5 | 13.0 | 13.0 |
| GJ-004 | 24.2 | 15.0 | 14.0 |
| GJ-005 | 24.6 | 12.0 | 15.0 |
| GJ-006 | 26.1 | 12.0 | 13.1 |
| GJ-007 | 26.3 | 15.0 | 15.1 |
| GJ-008 | 23.7 | 13.0 | 13.0 |
| GJ-009 | 21.5 | 12.0 | 15.1 |
| GJ-010 | 24.4 | 15.0 | 14.0 |
| GJ-011 | 21.3 | 15.0 | 15.1 |
| GJ-012 | 26.6 | 13.0 | 13.1 |
| GJ-013 | 27.3 | 17.0 | 19.2 |
| GJ-014 | 24.2 | 11.0 | 14.1 |
| GJ-015 | 22.5 | 15.0 | 18.2 |
| GJ-016 | 24.4 | 13.0 | 14.2 |
| GJ-017 | 27.1 | 15.0 | 17.1 |
| GJ-018 | 25.2 | 14.0 | 18.0 |
| GJ-019 | 27.1 | 15.0 | 19.3 |
| GJ-020 | 26.1 | 16.0 | 17.9 |
| GJ-021 | 27.2 | 17.0 | 17.4 |
| GJ-022 | 28.1 | 15.0 | 24.6 |
| GJ-023 | 31.2 | 20.0 | 23.5 |
| GJ-024 | 28.4 | 19.0 | 24.6 |
| GJ-025 | 27.2 | 17.0 | 19.6 |
| GJ-026 | 24.1 | 15.0 | 19.3 |
| GJ-027 | 25.2 | 17.0 | 19.2 |
| GJ-028 | 28.2 | 19.0 | 23.3 |
| GJ-029 | 17.3 | 14.0 | 19.4 |
| BARI Gerbera-1 | 25.1 | 18.0 | 21.4 |
| stdev | 3.17 | 2.30 | 3.61 |
| CV | 12.71 | 15.42 | 20.83 |

Variation in regards to number of suckers per plant among the genotypes was recorded. The maximum number of suckers per plant was produced by GJ-013(7.0), GJ-022(7.0), GJ-023(7.0), GJ-024 (7.0) and GJ-028 (7.0) while GJ-003 (3.0) produced the minimum number of suckers per plant (Fig.1). It has similarity with the findings of Nangjan (1994) who conducted an experiment with gerbera plants and reported that number of suckers varied from 5.0–10.0 which was partially similar with the present study.



**Figure 1 Production of suckers/plant.**

Differences were also observed in respect of number of days required to flower initiationamong the genotypes under investigation (Fig. 2). Early flowering was recorded in GJ-013 (100 days) followed by GJ-023, GJ- 024 and GJ- 028 which required 101 days for flowering. Late flowering was observed in GJ-019 (110 days).



**Figure 2 Variability in days to flowering.**

Distinct variation was observed in relation to number of flowers among the genotypes (Fig. 3). The maximum number of flowers (16.0) was produced by GJ-013, GJ-023, GJ-024 and GJ-028 which differs with other genotypes.



**Figure 3 Flower number in gerbera genotypes.**

Variation also recorded in case of diameter of flower head and length of flower stalk, which is presented in Table 3. Maximum diameter of flower head was found in GJ-023 (10.6 cm) and GJ-024 (10.6 cm). This might be due to greater plant spread and more number of leaves/plant, which would have been resulted in production and accumulation of more photosynthates, resulting in production of more number of flowers with larger size. This is in line with the findings of Nanjan (1994) and Negi *et al*. (1983) in gerbera. The maximum number of florets/flower head (80.0) was recorded in GJ-023 closely followed by GJ-024 and GJ-028 (78.0) (Table 3). The length of flower stalk was recorded 30.0 cm as maximum in GJ-004 which was significantly superior to other. The shortest flower stalk was produced by GJ-009 (20.0 cm).

**Table 3. Floral characters of gerbera genotypes**

| **Genotypes** | **Diameter of flower head (cm)** | **No. of florets** | **Length of flower stalk (cm)** |
| --- | --- | --- | --- |
| GJ-001 | 7.1 | 40.0 | 24.0 |
| GJ-002 | 8.4 | 38.0 | 24.0 |
| GJ-003 | 8.2 | 50.0 | 23.0 |
| GJ-004 | 8.9 | 51.0 | 30.0 |
| GJ-005 | 9.1 | 45.0 | 28.0 |
| GJ-006 | 9.3 | 72.0 | 25.0 |
| GJ-007 | 8.2 | 75.0 | 24.0 |
| GJ-008 | 8.9 | 50.0 | 24.0 |
| GJ-009 | 8.8 | 36.0 | 20.0 |
| GJ-010 | 9.1 | 78.0 | 25.0 |
| GJ-011 | 9.8 | 35.0 | 27.0 |
| GJ-012 | 8.7 | 46.0 | 29.0 |
| GJ-013 | 10.5 | 74.0 | 28.0 |
| GJ-014 | 6.7 | 41.0 | 29.0 |
| GJ-015 | 8.5 | 50.0 | 24.0 |
| GJ-016 | 9.7 | 51.0 | 24.8 |
| GJ-017 | 8.5 | 53.0 | 26.0 |
| GJ-018 | 9.0 | 68.0 | 24.0 |
| GJ-019 | 9.5 | 40.0 | 24.0 |
| GJ-020 | 10.2 | 50.0 | 25.0 |
| GJ-021 | 9.2 | 54.0 | 29.0 |
| GJ-022 | 10.3 | 70.0 | 28.0 |
| GJ-023 | 10.6 | 80.0 | 29.0 |
| GJ-024 | 10.6 | 78.0 | 29.0 |
| GJ-025 | 10.1 | 68.0 | 29.0 |
| GJ-026 | 9.2 | 63.0 | 27.0 |
| GJ-027 | 9.8 | 74.0 | 29.0 |
| GJ-028 | 10.2 | 78.0 | 29.0 |
| GJ-029 | 9.4 | 50.0 | 26.0 |
| BARI Gerbera-1 | 10.5 | 72.0 | 28.0 |
| stdev | 0.97 | 14.81 | 2.49 |
| cv | 10.51 | 25.69 | 9.44 |

The cut blooms were placed in vases with water and among the genotypes, GJ-013 (12 days) showed maximum vase life in room temperature (Fig. 4) followed by GJ-023 (10 days) and GJ-024 (10 days). On the contrary, the minimum vase life was recorded in GJ-010 (4 days) and GJ-012(4 days) which might be due to their loose arrangement of petals. The present findings more or less agreed with Bhattacharjee (1981) where he recommended that gerbera flower remains in good condition for 5-12 days. This could be due to inherent differences among genotypes. Similar results were also reported by Negi *et al*. (1983) in gerbera.



**Figure 4. Vase life of different genotypes of gerbera**

**Conclusion**

Considering cut flower production and quality aspects, GJ-013, GJ-023, GJ-024 and GJ-028 can be recommended for commercial cultivation.

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**COLLECTION, EVALUATION AND MAINTENANCE OF HELICONIA**

A NAZNIN, M. M. R. BHUIYIN, K. AMBIA, F. N. KHAN AND M. T. RASHID

**Abstract**

*A study on the performance of seven heliconia germplasm was conducted at Floriculture Field of HRC, BARI, Gazipur during 2021-2022. Wide ranges of variations for all qualitative and quantitative characters were observed. Based on flower colour, erect habit, shoot number and vase life, H-004, H-005 and H-007 were identified as good genotypes.*

**Introduction**

Heliconia is a dwarf plantain like plant belongs to Musaceae family native to South Africa. It is grown both for cut flowers and for garden or bed decoration purposes (Sachs, 1977; Fisher, 1976). It deserves special importance due to easy culture (Bhattacharjee, 2006), wide adaptability to soil and climate, summer production and less prone to disease and pests. Recently, the demand of this flowering plant is increasing due to its attractive colour, prolonged shelf life and economic value (Halevy *et al*., 1978). However, research works on different aspects of heliconia production have not been undertaken in Bangladesh. Therefore, this investigation was carried out to find out the best line(s) for cut flower.

**Materials and Methods**

The experimental material comprised of seven genotypes of heliconia, H-001, H-002, H-003, H-004, H-005, H-006 and H-007. They were grown during summer season of 2016 at the Floriculture Field of HRC, BARI. All genotypes were collected from home and abroad. Accession numbers were given to each entry. Before planting, pit was prepared properly. Manure and fertilizer were applied according to dose found in literature. Watering and other intercultural operations were done as and when necessary. Data were recorded from 5 randomly selected plants on plant height, shoots/plant, bract/shoot, bract length, stalk length, flowers/shoot, flowering area, vase life etc. The recorded data were statistically analyzed and treatment means were separated by DMRT.

**Results and Discussion**

Wide range of variability was observed among the genotypes under study in respect of flowering behaviour and leaf colour (Table 1). Among the genotypes, H-001, H-003, H-004, H-005, H-006 and H-007 produced erect type flower while H-002 had drooping type. As regards to colour of flower, the observed genotypes showed remarkable variation such as orange, reddish yellow, reddish orange, yellow, pinkish orange and red. Variation was also observed in case of leaf colour (Table 1). Duration of flowering varied from January to July.

**Table 1. Qualitative traits of heliconia genotypes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Genotypes** | **Flower type** | **Flower colour** | **Leaf colour** | **Flowering duration** |
| H-001 | Errect | Orange | Green | March-July |
| H-002 | Drooping | Reddish yellow | Deep green | April –July |
| H-003 | Errect | Reddish orange | Light green | March-June |
| H-004 | Errect | Yellow | Light green | March-July |
| H-005 | Errect | Pinkish orange | Green | March-May |
| H-006 | Errect | Red | Deep green | April-July |
| H-007 | Errect | Reddish orange | Light green | January-June |

The data presented in Table 2 revealed significant differences among the genotypes for all vegetative and floral characteristics studied. The tallest plant was recorded in H-002 (70.0 cm) while H-003 (50.0 cm) produced the smallest plant.

**Table 2. Plant and flower characteristics of different heliconia genotypes**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Genotypes** | **Plant height (cm)** | **Shoots/**  **plants** | **Bracts /shoot** | **Bract length (cm)** | **Stalk length (cm)** | **Flowers**  **/Shoot** | **Flowering**  **area (cm)** |
| H-001 | 63.0 bc | 9.0 ab | 4.0 b | 11.0 b | 55.0 c | 23.0 bc | 15.0 bc |
| H-002 | 70.0 a | 9.0 ab | 10.0 a | 6.0 c | 65.5 a | 32.0 a | 20.0 ab |
| H-003 | 50.0 e | 8.0 b | 4.0 b | 10.5 bc | 48.0 d | 20.0 c | 11.5 c |
| H-004 | 60.2 c | 13.0 a | 5.0 ab | 16.0 a | 60.0 b | 28.0 ab | 17.0 b |
| H-005 | 65.0 b | 9.0 ab | 4.0 b | 12.5 ab | 57.0 bc | 26.0 b | 19.0 ab |
| H-006 | 61.0 c | 4.0 c | 6.0 ab | 10.0 bc | 53.5 cd | 20.0 c | 15.0 bc |
| H-007 | 55.2 d | 10.0 ab | 6.0 ab | 13.3 ab | 63.0 ab | 28.0 ab | 23.0 a |
| **CV (%)** | **13.1** | **8.5** | **8.4** | **8.6** | **9.8** | **11.0** | **10.5** |

Figures having common letter in a column are not significantly different by DMRT at 5% level

H-004 (13.0) was best for the production of maximum number of shoots while the minimum was produced by H-006 (4.0). The maximum number of bracts/shoots was observed in H-002 (10.0). The longest bract (16.0 cm) was observed in H-004, which is superior to other genotypes. H-002 (65.5 cm) produced the longest flower stalk closely followed by H-007 (63.0 cm). The shortest stalk length was observed in H-003 (48.0 cm). Among the genotypes, H-002 (32.0) produced the maximum number of flowers per shoot while H-003 and H-006 had the minimum (20.0). Variation was observed within the genotypes in respect of flowering area. H-007 (23.0 cm) attained maximum flowering area while the minimum was recorded in the genotype, H-003 (11.5 cm). Vase life varied from 5 to 10 days. The maximum vase life was recorded in H-004 (10 days) while the minimum in H-001 (5 days).



**Fig. 1. Vase life of heliconia genotypes**

**Conclusion**

Based on flower colour, erect habit, shoot number and vase life, H-004, H-005 and H-007 were identified as good genotypes. However, more number of genotypes will be collected for continuing the experiment in order to improve this flower under Bangladesh context.

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**COLLECTION, EVALUATION AND MAINTENANCE OF DENDROBIUM ORCHIDS**

A. NAZNIN, M. M. R. BHUIYIN, K. AMBIA, F. N. KHAN AND M. T. RASHID

**Abstract**

*The present investigation was carried out to study the performance of some collected genotypes of Dendrobium orchid. Vegetative and flowering characters varied significantly among the genotypes. Longest plant (40.0 cm) and maximum grith of pseudobulb (15.2 mm) was found in Dendrobium Sonia genotype. For the same genotype, maximum other growth and flowering characteristics were observed and recorded as number of pseudobulb/plant (5.0), number of leaves/pseudobulb (12.0), leaf area (35.9 cm2), number of spikes/plant (3.5), spike length (35.0 cm), number of florets/spike (14.5), rachis length (15.5 cm), fresh weight of spike (30.0 cm) and longest vase life (24 days).*

**Introduction**

Orchids belong to the largest and most diverse family *Orchidaceae* consisting of about 700-800 genera and more than 25000 species (Ahsan, 2014). Orchids have occupied top position among the flowering plants valued for cut flowers as well as pot plants. They account for 27% of global cut flower production in terms of value (Das and Bhattacharjee, 2015). Various species of orchids are abundantly distributed in the country (Moniruzzaman and Ara, 2012). Export potential of orchids from Bangladesh has a bright prospect in future The genera of orchids which are commercially important are *Cymbidium, Dendrobium, Phalaenopsis, Oncidium, Vanda, Mokara, Arachnis* and *Cattleya*.Among these genera, *Dendrobiums* are most popular orchid getting fame as cut flowers in the world (Sugapriya *et al.,* 2012). Majority of *Dedrobium* orchids under cultivation are native of tropical countries and have played a major role in developing present day beautiful hybrid orchids which numbers more than 2000. In the international trade, among orchids, Dendrobium ranks the fourth position and in floricultural crops it accounts for 1.0 % of the total cut flower production (Rao *et al.,* 2013).

In Bangladesh, the agro-ecological conditions are very conducive for the survival and culture of orchid. The Flower growers of Bangladesh are now cultivating the traditional flower crops that do not give them high return. In Bangladesh, orchid was introduced recently and gaining demand. The colour variation, size of flowers, long lasting behaviour and wide adaptability for culture made orchid a flower of choice for cultivation in Bangladesh. Performance of Dendrobium orchid genotypes varies with the region, season and other growing conditions. Dendrobium orchid as a cut flower has tremendous demand in domestic and international markets. Evaluation of dendrobium orchid genotypes enables the growers to select the best performing varieties in Bangladesh. Considering the above facts, the present study was undertaken to collected and evaluated promising *Dendrobium* orchid at Gazipur for commercial production.

**Materials and Methods**

The Research work was carried out at Floriculture Division of Horticulture Research Centre, Gazipur during the year from 2020-21 till date. Twelve genotypes of *Dendrobium* orchid were used as planting material and collected from different sources for this investigation. *These are Dendrobium Alba (V1), Dendrobium Red Alba (V2), Dendrobium Candy Stripe Alba (V3), Dendrobium Sharifa Fatema Alba (V4), Dendrobium Sonia Alba (V5), Dendrobium Thong Chai Gold Alba (V6), Dendrobium Malay Alba (V7), Dendrobium Jenny Denny Alba (V8), Dendrobium Bicolour Alba (V9), Dendrobium Yellow Alba (V10), Dendoribum Paradise Alba (V11) and Dendrobium Asian Beauty (V12) under shade net house conditions.* Cultural operations such as weeding, irrigation, disease and pest management etc. were done as and when necessary. Nitrogen, phosphorus and potassium @ 1:1:1 ratio was sprayed at the entire period of the experiment.

The same aged plantlets (two years) of twelve dendrobium genotypes were used as planting material. The experiment was laid out in a Randomized Block Design (RBD) with three replications and three spikes per replication. Observation on vegetative parameters like plant height, number of leaves, number of pseudo bulb, girth of pseudo bulb, physiological trait like leaf area, flowering parameters and quality parameter like spike length, rachis length, flower diameter, number of florets per spike, fresh weight and vase life were recorded at active growth period of the crop. The data were statistically analyzed and means were separated by Least Significant Difference Test according to Steel *et al.* (1997).

**Result and Discussion**

The qualitative triats of different *Dendrobium* genotypes are presented in Table 1. Wide variations were detected in respect of leaf, flower and lip colour. As regards to the colour of floret, the observed genotypes showed remarkable variation such as white, red, white and magenta, greenish, yellow, pink etc. All the germplasm were categorized into 3 groups on the basis of their colour of leaf. These are green, light green and deep green. Remarkable differences also observed in lip colour.

**Table 1. Qualitative traits of different dendrobium orchid genotypes**

|  |  |  |  |
| --- | --- | --- | --- |
| **Genotypes** | **Leaf colour** | **Flower colour** | **Lip colour** |
| D. Alba (V1) | Light green | White | Orange purple |
| D. Red (V2) | Deep green | Red | Red |
| D. Candy Stripe (V3) | Green | White and magenta stripe | Purple with white streak |
| D. Sharifa Fatema (V4) | Light green | Greenish yellow | Purple |
| D. Sonia (V5) | Deep green | White and magenta stripe | Whitish purplish streak |
| D. Thong Chai Gold (V6) | Light green | Greenish yellow | Purple |
| D. Malay (V7) | Light green | Light pink | Purple with yellow base |
| D. Jenny Denny (V8) | Deep green | Blue | Purple with white |
| D. Bicolour (V9) | Light green | White with magenta | Magenta |
| D. Yellow (V10) | Light green | Light yellow | Light yellow with creamy with base |
| D. Paradise (V11) | Light green | Majenta | Majenta |
| D. Asian Beauty (V12) | Light green | Purple | Purple with white base |

V1= D. AIba, V2= D. Red, V3= D. Candy Stripe, V4= D. Sharifa Fatema, V5= D. Sonia, V6= D. Thong, Chai Gold,

V7= D. Malay, V8= D. Jenny Denny, V9= D. Bicolour, V10= D. Yellow, V11= D. Paradise, V12= D. Asian Beauty

The data pertaining to vegetative characters (Table 2) indicate that significant differences exist among the studied genotypes. The highest plant height was found in *Dendrobium* Sonia (41.0 cm) followed by Dendrobium Alba (39.1 cm). On the other hand, the lowest value was recorded in *Dendrobium* ‘Asian beauty’ (30.0 cm). This might be due to genotypic differences between the genotypes as the growing situation and environmental conditions of the plant were same). These findings were also in accordance with the report of Roychowdhury *et al.* (2004) in *Dendrobium* orchids. Significant variation was also found among different *Dendorbium* genotypes in terms of number of leaves. Maximum leaves number were observed in *Dendrobium* ‘Sonia’ (12.3) followed by *Dendrobium* ‘Thong Chia Gold’ (10.9) and the minimum was recorded in *Dendrobium* ‘Asian beauty’ (5.7).

**Table 2. Morphological characters of Denbrobium genotypes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Genotypes** | **Plant height (cm)** | **No. of leaves** | **No. of pseudo bulb** | **Pseudo bulb dia (mm)** | **Leaf area (cm2)** |
| D. AIba (V1) | 39.1 | 10.3 | 4.0 | 14.5 | 33.1 |
| D. Red (V2) | 33.0 | 7.6 | 3.8 | 12.2 | 31.6 |
| D. Candy Stripe (V3) | 29.0 | 6.2 | 3.4 | 14.3 | 32.2 |
| D. Sharifa Fatema (V4) | 30.7 | 7.2 | 3.9 | 14.2 | 32.9 |
| D. Sonia (V5) | 41.0 | 12.3 | 5.3 | 15.3 | 36.1 |
| D. Thong Chai Gold (V6) | 38.2 | 10.9 | 3.9 | 14.4 | 31.8 |
| D. Malay (V7) | 32.0 | 7.2 | 2.9 | 13.6 | 25.0 |
| D. Jenny Denny (V8) | 36.8 | 8.5 | 3.5 | 14.0 | 26.4 |
| D. Bicolour (V9) | 34.0 | 8.2 | 4.3 | 13.9 | 24.3 |
| D. Yellow (V10) | 36.0 | 8.3 | 3.6 | 13.7 | 24.7 |
| D. Paradise (V11) | 35.0 | 7.6 | 4.1 | 14.1 | 25.6 |
| D. Asian Beauty (V12) | 30.0 | 5.7 | 3.3 | 13.3 | 22.7 |
| stdev | 6.52 | 2.67 | 2.15 | 3.11 | 5.96 |
| CV(%) | 10.76 | 30.17 | 38.58 | 27.45 | 10.38 |

V1= D. AIba, V2= D. Red, V3= D. Candy Stripe, V4= D. Sharifa Fatema, V5= D. Sonia, V6= D. Thong, Chai Gold,

V7= D. Malay, V8= D. Jenny Denny, V9= D. Bicolour, V10= D. Yellow, V11= D. Paradise, V12= D. Asian Beauty

Variation in vegetative characters may be due to differential growth rate and their genetic makeup. Sugapriya *et al.* (2012) found the similar variation in number of leaves among the *Dendrobium* cultivars. *Dendrobium* ‘Sonia’ was vigorous in growth however recorded a greater number of pseudobulbs (5.3) and thicker pseudobulbs (15.3mm). Minimum number of pseudobulb was recorded in *Dendrobium* ‘Malay’ (2.9) and *Dendrobium* ‘Red’ having thin pseudobulb (12.8mm). Leaf area among the the *Dendrobium* genotypes varied significantly. Maximum leaf area was found with *Dendrobium* ‘Sonia’ (36.1cm2) and minimum in *Dendrobium* ‘Asian beauty’ (22.7cm2). The results were in agreement with the findings of Sugapriya *et al.* (2012), Nair *et al.* (2002) and Bhattacharjee (1981).

**Table 3. Floral characters of Dendrobium genotypes**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Genotypes** | **No. of spike** | **No. of florets** | **Flower dia. (mm)** | **Length of spike (cm)** | **Length of rachis (cm)** | **Fresh wt. of spike (g)** | **Vase life (days)** |
| D. AIba (V1) | 3.0 | 12.2 | 67.3 | 29.5 | 14.2 | 28.7 | 20 |
| D. Red (V2) | 2.2 | 9.7 | 62.2 | 28.7 | 11.5 | 25.2 | 18 |
| D. Candy Stripe (V3) | 1.7 | 9.2 | 60.3 | 26.0 | 13.6 | 27.2 | 15 |
| D. Sharifa Fatema (V4) | 2.5 | 11.2 | 68.2 | 25.8 | 14.0 | 28.3 | 22 |
| D. Sonia (V5) | 3.7 | 14.7 | 75.0 | 35.2 | 15.7 | 30.2 | 25 |
| D. Thong Chai Gold (V6) | 3.1 | 12.7 | 69.2 | 30.3 | 12.2 | 29.4 | 22 |
| D. Malay (V7) | 2.5 | 10.4 | 60.3 | 23.3 | 10.8 | 25.2 | 19 |
| D. Jenny Denny (V8) | 3.3 | 11.9 | 54.8 | 26.2 | 15.2 | 27.0 | 23 |
| D. Bicolour (V9) | 2.8 | 7.2 | 57.9 | 26.6 | 14.7 | 27.2 | 24 |
| D. Yellow (V10) | 2.7 | 11.2 | 57.2 | 25.6 | 15.0 | 27.2 | 22 |
| D. Paradise (V11) | 2.8 | 10.8 | 57.1 | 26.8 | 14.6 | 25.8 | 22 |
| D. Asian Beauty (V10) | 2.2 | 6.2 | 51.8 | 24.3 | 9.8 | 21.3 | 15 |
| stdev | 0.54 | 2.33 | 6.82 | 3.19 | 1.91 | 2.35 | 3.26 |
| cv | 19.94 | 21.99 | 11.05 | 11.66 | 14.19 | 8.75 | 15.8 |

V1= D. AIba, V2= D. Red, V3= D. Candy Stripe, V4= D. Sharifa Fatema, V5= D. Sonia, V6= D. Thong, Chai Gold,

V7= D. Malay, V8= D. Jenny Denny, V9= D. Bicolour, V10= D. Yellow, V11= D. Paradise, V12= D. Asian Beauty

Number of spikes per plant was observed higher in *Dendrobium* ‘Sonia’ (3.7) followed by *Dendrobium* ‘Thong Chai Gold’ (3.1). On the other hand, ‘Candy stripe’ exhibited lowest number of spikes per plant (1.7). Maximum number of florets per spike was obsrved in *Dendrobium* ‘Sonia’ (14.7) followed by ‘‘Thong Chai Gold’ (12.6). On the other hand, minimum number of florets was recorded in ‘Asian Beauty’ (6.2). Findings of the study were in close agreement with Sunil and Swati (2013). Data pertaining to flower diameter reveals that, ‘Sonia’ recorded maximum flower diameter (75.0mm) followed by ‘Thong Chai Gold’ (69.2mm). Minimum flower diameter was recorded in ‘*Dendrobium* ‘Asian beauty’ (51.8mm). Highest spike length (35.2cm) and rachis length (15.7cm) was recorded in *Dendrobium* ‘Sonia’ on the other hand *Dendrobium* ‘Asian Beauty’ shows shorter spike length (24.3 cm) and rachis length (9.8 cm). The similar work was also reported by Lekharani (2002) in *Dendrobium*, Ninitha Nath (2003) in monopodial orchids.

Spike weight was maximum in *Dendrobium* ‘Sonia’ (30.2g) followed by ‘Thong Chai Gold’ (29.4g). It may be due to larger size of individual florets which in turn increases the spike weight. In contrast, ‘Asian beauty’ (21.3g) showed minimum spike weight. A wide variation in floral parameters was also earlier reported by Kumar (2013), Sugapriya (2012) and Mehraj (2014) *Dendrobium* genotypes. In case of vase life *Dendrobium* ‘Sonia’ remained fresh for longer days (25 days) compared to other genotypes. On the other hand, *Dendrobium* ‘Candy stripe’ and *Dendrobium* ‘Asian beauty’ showed minimum vase life (15.0 days). The distinct variation may be due to amount and utilize of reserved food by the spikes. The findings were also co related to Kumar *et al.* (2013) in dendrobium orchid genotypes.

**Conclusion**

On the basis of result obtained from present study, it can be concluded that there was wide variation among the collected genotypes in respect to growth and yield attributes. Average performance of *Dendrobium* Sonia was excellent followed by *Dendrobium* Alba and *Dendrobium* Thong Chai Gold.

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**COLLECTION AND EVALUATION OF FOLIAGE AND ORNAMENTAL PLANTS**

M. M. R. Bhuyin, F. N. Khan, A. Naznin, K. Ambia and M. T. Rashid

**Abstract**

*Some genotypes of foliage and ornamenta1 plants were collected and evaluated that showed wide range of variation for the traits under studied.*

**Introduction**

Houseplants are domesticated wild plants that have, over the years, been cultivated and bred to thrive in an indoor environment. Though they different in appearance and cultural needs, they have one essential feature in common adaptability. They can endure the filtered light, widely varying temperatures, and low humidity levels found in most homes. In recent years, house-plants have become increasingly popular for interior decoration. Their beauty and vitality are a source of delight (Lynette, 2002). In Bangladesh, modern architectural designing of homes and flats, having larger windows and well-lighted rooms, has made indoor garden a popular, useful and absorbing hobby, particularly in big cities. It is now common to find living house plants inside homes, offices, shops, banks, hotels, restaurants, clubs, hospitals and schools. Cultivation of flowers and ornamentals for various religious and cultural festivals has existed in Bangladesh for ages (Dadlani, 2003). But in the present time, flower and ornamentals becomes important not only for their aesthetic and social values, but also for their economic contribution. Production and trade with this crop are now very much specialized in the developed counties with a significant contribution to their national economy.

The house plants which have received larger attention in recent years include anthurium, cactus, dracaena, palm, aglaeonema, fern, ficus, caladium etc. (Crockett, 2010). These house plants are being marketed in domestic as well as in the world and most of these can be grown successfully in our country. Therefore, an approach has been started for collection and conservation of house plants by Floriculture Division of Horticulture Research Centre, BARI.

**Results**

Seventy germplasm of different type of foliage and ornamental plants were collected from different areas of Bangladesh and some are presented in Table 1.

# Table 1. House plants and their mode of propagation

| **No.** | **Type of plant** | **Common name** | **Propagation** |
| --- | --- | --- | --- |
| 1 | Shrub | | |
| a) Foliage bushy plant | Croton, Acalypha, Aralia, Coleus, Jatropha etc. | Stem cutting |
| b) Flowering bushy plant | Mussaenda, Poinsettia, Hibiscus, Ixora, Lantana, Euphorbia, Jasmines, Gardenia, Vinca etc. | Stem cutting |
| 2 | Climber | Bougainvillae, Hiptage, Allamonda, Passion flower, Thunbergia, Clitoria, Morning glory etc. | Stem cutting/ seed/sucker |
| 3 | Palm | Fish tail palm, Palmyra palm, Phonix palm, Areca palm, Rhapis palm, Cantina palm etc. | Seed/sucker |
| 4 | Conifers /Jhau | Thuja, Auraucaria, Cypress, Juniper etc. | Seed/sucker |
| 5 | Fern | Birdnest fern, Sword fern, Silver fern, Boston fern, Tablefern etc. | Spore/division |
| 6 | Succulent | Agave, Adenium, Kalanchoe, Love plant, Lipstick plant, Hoa etc. | Seed/division/ leaf cutting |
| 7 | Hanging plants | Asparagus, Begonia, Monstera, Tradescantia, Zebrina, Hedera etc. | Stem cutting/ seed/sucker |
| 8 | Trellis plants | Cissus, Ficus, Hedera, Hoya, Philodendron, Scindapsus etc, | Stem cutting/ seed/sucker |
| 9 | Evergreen plants | Aspidistra, Chlorophytum, Cyperus, Dieffenbachia, Dracaena, Ficus, Monstera, Philodendron, Sansevieria, Scindapsus etc. | Stem cutting/ seed/sucker |
| 10 | Bowl and bottle-garden plants | Aglaonema, Asparagus, Begonia rex, Calathea, Cryptanthus, Dracaena, Asplenium, Nephrolepis, Pteris, Fittonia, Ficus, Maranta, Peperomia, Saintpaulia, Scindapsus, Selaginella, Tradescantia, Zebrina etc. | Stem cutting/ seed/sucker |
| 11 | Dish garden plants | Aglaonema,Araucaria, Asparagus, Begonia, Cacti, Calathea, Coleus, Chlorophytum, Diffenbachia, Dracaena, Hedera, Peperomia, Philodendron, Maranta, Pilea, pine seedlings, Saintpaulia, Sansevieria, Scindapsus, Zebrina etc. | Stem cutting/ seed/sucker |

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**COLLECTION, EVALUATION AND MAINTENANCE OF CLIMBERS AND CREEPERS**

A NAZNIN, M. M. R. BHUIYIN, K. AMBIA, F. N. KHAN AND M. T. RASHID

**Abstract**

*A study was carried out to collected and evaluated different climbers and creepers. Eleven genotypes of climbers and creepers were collected and data on different parameters were recorded. Variation was found in respect of flower and foliage colour, flowering period, days to flowering and sunlight requirement.*

**Introduction**

Climbers and creepers are a group of plants or vines which possess special structures to climb over a support. They are invaluable; their ability to cover and transform is unparalleled in the plant world. The saviour of many an unattractive eyesore, they can cling, twine, scramble or trail over tree stumps, up walls and buildings, along trellises and arches and through the branches of trees and shrubs - in fact almost anywhere. They add new dimension, color and fragrance to garden space with easy-to-grow and long-lived vines.

**Materials and Methods**

The present investigation was carried out at Floriculture Field of HRC, BARI, Joydebpur, Gazipur during 2021-2022. Eleven different types of climbers and creepers were collected from different sources and planted after collection. All the cultural practices such as fertilization, irrigation and weeding were done when necessary.

**Results**

Data on different qualitative and quantitave parameters are presented in Table 1.

**Table 1. Qualitative and quantitative traits of collected crlimbers and creepers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Climber and Creppers** | **Common Name** | **Foliage colour** | **Flower colour** | **Flowering peroid** | **Exposure to sun** | **Days to flowering** |
| Morning glory | Morning glory | Green | Blue, Pink, Purple, White | May- September | Full sun | 45-60 |
| Clitoria | Aparajita | Green | White, deep blue, light blue | June-November | Full sun | 60-65 |
| Allamanda | Allamanda | Bright green | Bright yellow | July-November | Full sun | 65-70 |
| Rangoon creeper | Madhumalti | Dark green | White to gradually darkens to pink, finally red at maturity | **March – June and**  August-October | Full sun to partial shade | 60-70 |
| Passion flower vine | Jhumkolota | Bright green | Purple, blue | July- October | Full sun to partial shade | 90-120 |
| Garlic vine | Kanaklota | Bright green | Deep lavender with white center | April-May and  October- February | Full sun to partial shade | 65-75 |
| Bleeding heart | Bleeding heart | Bright green | White, pink, red | April- June | Full sun to partial shade | 60-65 |
| Cypress vine | Kunjolota | Bright green | Red | June- October | Full sun | 45-50 |
| Star Jasmine | Kundo ful | Dark green | White | April-July | Full sun to partial shade | 60-65 |
| Common Jasmine | Jasmine | Dark green | White | March- September | Full sun | 30-35 |
| Indian Jasmine | Jui | Dark green | White | April-July | Full sun to partial shade | 70-80 |

**Conclusion**

Variation was observed among genotypes in respect of qualitative and quantitative traits.

**Acknowledgement**

The financial support for this reseach work was provided by SRHCDHFCTCA project, HRC, BARI.

##### COLLECTION, EVALUATION AND MAINTENANCE OF WATER LILY

F.N. KHAN, MT. RASHID, K. AMBIA, A. NAZNIN AND MMR. BHUIYIN

**Abstract**

*A study on the performance of twenty water lily germplasm was conducted at Floriculture Field of HRC, BARI, Gazipur during 2021-22. Wide range of variations for all qualitative and quantitative characters were observed.*

**Introduction**

Water lily (*Nymphaea spp*), belongs to family Nymphaeaceae commonly known as Shapla in Bengali is an aquatic flower that grows in wetlands like ponds, bils, haors and lakes of all over Bangladesh. It has large, disk-like, floating leaves and showy flowers. There are about 70 species of water lilies those live in freshwater areas in temperate and tropical climates around the world. In Bangladesh, there are about 5-6 varieties available in which some are in the way of extinction and two species like *N. nouchali* and *N. pubescens* are mainly available. The white water lily or sada shapla is the national flower and state symbol of Bangladesh (Kamal, 2017). The shapla flower blooms in the rainy season mainly. Some species of these flowers have commercial value in our country as vegetable. The tuberous rhizomes are also eaten, seeds on frying are eaten as puffed-grains in some places (Anon., 2020). Because of the pleasing aesthetics of their floating leaves, as well as their attractive flowers with different colours, shapes and sizes, cultivation of water lily is gaining importance now-a day mainly among enthusiast gardeners and for gardening in rooftop gardens, parks, restaurant etc. in Bangladesh. Apart from medicinal value and food item as fresh stalk or in curry of some species, water lily is mainly used to increase the beautification of nature. The genetic diversity of water lily in Bangladesh is comparatively low. Presently, Malaysia, Singapore and some other countries are earning currency through exporting seeds and seedlings of water lily. Recently some lucrative hybrids are importing from different countries to fulfill the local demand. So, water lily germplasm available in Bangladesh and other sources need to be collected and conserved for future research and development. Therefore, this experiment has been taken with following objectives

1. To collect water lily germplasm from different sources
2. To evaluate and characterize water lily germplasm
3. To conserve the collected germplasm for future research

**Materials and methods**

The experiment was conducted at Floriculture Field of HRC, BARI, Gazipur during the period of August, 2021 to June, 2022. Twenty lines of water lily both native and hybrid were collected from different nurseries and natural sources. After collection, accession numbers were given to each entry and potted in plastic tub, earthen chari etc. containing three parts of loam soil and one part of rotten cowdung. After planting of rhizome or seedlings, water should be added keeping one inch at the top of the tub/chari vacant. The water were cleaned when getting cloudy/ yellow/dark and changed the water after 2-3 days interval to reduce the algae, aedes mosquito and help plant to growing well. The dead leaves and dry flower sticks were removed. Data on different traits like flower diameter, flower durability in tub/chari and flower numbers/plant were recorded.

**Results**

The performance of twenty genotypes of water lily presented in Table 1 exhibited variation on different parameters. All native water lilies are normally tropical type. In case of hybrid water lily, maximum are hardy type except Purple and Pink Capenses, Tropic Sunset, Dauben and Chompu Mameu. Regarding flower size, two native water lily N-001 and N-002 and five hybrid water lily e.g. N-010, N-014, N-019, N-022 and N-023 produced larger flowers (= or > 10.0cm) whereas only N-004, native type and the hybrid N-013 produced the smaller flower (= or <6.0cm). Rest of the water lily produced the medium sized flowers (>6.0 to <10.0cm). Maximum water lily both native and hybrid remain in good condition for 3.0 days whereas N-16 showed comparatively good durability in tub/chari (4.0 days). On the other hand, N-018, N-020 and N-021 remain in good condition only for 2.0 days. Regarding number of flowers/plant for three and half months, a wide variation were noticed among the genotypes. The native water lily like N-002 and N-005 and the hybrid N-010, N-011, N-012, N-013, N-014, N-015, N-021 and N-24 produced more flowers (=5 to 13flowers/plant) for three and half months duration.

**Table 1. The performance of twenty genotypes of water lily genotypes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Acc. No.** | **Name** | **Type** | **Flower dia. (cm)** | **Flower durability in tub/chari (days)** | **No. of flowers/plant/ 3.5 months** |
| Native | | | | |  |
| N-001 | *N. Juno* | Tropical | 10.20 | 3.0 | 3.0 |
| N-002 | *N.Rubra* | Tropical | 12.15 | 3.0 | 5.50 |
| N-003 | *N. Pubescens* | Tropical | 8.35 | 3.0 | 4.0 |
| N-004 | *N. Nouchali* | Tropical | 5.80 | 3.0 | 3.0 |
| N-005 | *N. Stellata* | Tropical | 9.15 | 3.0 | 10 |
| Hybrid | | | | |  |
| N-010 | Gloriosa | Hardy | 10.0 | 3.0 | 5.0 |
| N-011 | Purple Capenses | Tropical | 7.55 | 3.0 | 6.0 |
| N-012 | Tropic Sunset | Tropical | 8.65 | 3.0 | 12.10 |
| N-013 | Dauben | Tropical | 5.25 | 3.0 | 5.0 |
| N-014 | Pinwaree | Hardy | 10.53 | 3.0 | 10.25 |
| N-015 | Yellow Watermelon | Hardy | 9.55 | 3.0 | 9.50 |
| N-016 | Jakkaphong | Hardy | 6.35 | 4.0 | 3.0 |
| N-017 | Peach Glow | Hardy | 8.55 | 3.0 | 2.0 |
| N-018 | Colorado | Hardy | 8.10 | 2.0 | 2.0 |
| N-019 | Perry’s Double White | Hardy | 10.25 | 3.0 | 3.0 |
| N-020 | Wanavisa | Hardy | 8.25 | 2.0 | 2.0 |
| N-021 | Pink Capenses | Tropical | 7.55 | 2.0 | 13.0 |
| N-022 | Paranee | Hardy | 10.55 | 3.0 | 2.0 |
| N-023 | Siam Fantasy | Hardy | 10.60 | 3.0 | 2.0 |
| N-024 | Chompu Mameu | Tropical | 8.20 | 3.0 | 6.55 |

**Conclusion**

Wide variations were observed in respect of flower diameter, flower durability in tub/chari and number of flowers/plant for 3 months. However, more number of genotypes should be collected for continuing the study in order to improve the depository of this flower.

**Acknowledgement**

The authors are grateful to “Program on varietal development, production and post-harvest technology of orchid, cactus-succulent, corm and bulbous flower and their dissemination in Bangladesh” for funding the research work.

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**COLLECTION AND MAINTENANCE OF CACTUS AND SUCCULENTS AT JAMALPUR REGION**

R SULTANA, F.N.KHAN, M A HOSSAIN, H RAHMAN, A AKTER AND H E M KHAIRUL MAZED

**Abstract**

*Thirteen cactus and nine succulent genotypes were collected and maintained at the Regional Agricultural Research Station, Jamalpur during the year 2021-2022. A large variation was found in shape, size and colour among the observed genotypes. Among the genotypes, Cac Jam-005 and S Jam-001exhibited distinctly vigorous*.

**Introduction**

Cactus belongs to the family Cactaceae. The Cactaceae family has some of the most valid and fascinating species in the plant kingdom. It is suitable for growing in pots for indoor decoration (Prokash, 1994; Mchoy, 1994). Cactus cultivation has become a fascinating hobby among amateur gardeners and these desert plants which are mostly unknown have become the subject of greatest care and delicate handling (Hewitt, 1993). Despite of their numerous thorns and spines, they have a beauty of their own (Bose *et al*., 2003). Their hardy nature and easy cultivation in shallow soils are additional features for their popularity (Randhwa and Mukhopadhyay, 1999). Succulents are the xerophytic plants and members of the family Agavaceae, Euphorbiaceous Crassulaceae and Liliaceae etc. with swollen fleshy parts, curious forms, diversity of shape and colour. They can store water to survive in the drought condition. Succulent cultivation has become a fascinating hobby among amateur gardeners and these desert plants which are mostly unknown have become the subject of greatest care and delicate handling (Tony and S. Mace, 2001). Their soft nature and easy cultivation in shallow soils are additional features for their popularity (Peter, M. 1996). Therefore, the present study was undertaken to collect and maintain Cactus and Succulents for decorative and commercial purposes.

**Materials and Method**

The experiment was conducted atthe Regional Agricultural Research Station, Jamalpur during the year 2021-2022. Thirteen lines of cactus and nine lines of Succulents were collected from different nurseries and accession numbers were given to each entry. Potted in medium containing 75% coco dust + 25% coarse sand. Intercultural operations such as watering, weeding, plant protection measures etc. were applied as and when necessary. Different vegetative and floral characteristics data were recorded and presented in Table 1 and Table 2, respectively.

Table 1. Morphological characteristics of Cactus genotypes

| Genotypes | Common name | Brief description |
| --- | --- | --- |
| Cac Jam-001 | *Gymnocalycium* | This is a small cactus, dark green body. It has 8 ribs with short columnar stem and short spines. The spines are whitish grey in colour. |
| Cac Jam -002 | *Gymnocalycium* | This is a globular species with a pink body. It has 8 ribs each with a swollen tuberculate structure and a distinct furrow between each aeriole position. |
| Cac Jam -003 | *Gymnocalycium* | Flattened and globular in shape with red body. Small number of ribs and aerioles give this species a bold, chunky look. |
| Cac Jam -004 | *Gymnocalycium* | Flattened and globular in shape with yellow body. It has 8 ribs each with a swollen tuberculate structure and a distinct furrow between each aeriole position. |
| Cac Jam -005 | *Echinopsis*  *calochlora* | It is a perennial plant that grows solitary or in groups. It is ball-shaped, dark green to pale green in color with buds that reach 6-9 cm in diameter. It has 13 to 16 large ribs, which are almost notched. The areolas are recessed and measure up to 1.5 cm, from them acicular yellow sponge’s bloom. The three central spines are slightly longer than the 14 to 20 radial spines. The spines are up to 1 cm long. The flowers are white in the shape of a funnel and appear to the side and open at night. They are up to 16 centimeters long. |
| Cac Jam -006 | *Cereus validus* | An attractive feature plant, this variable cactus flowers freely at intervals in summer. Its long thick spines are glossy and dark green on new growth. The stem produces offsets in time to form a clump. *Cereus validus* is known to be a beautiful cactus that has blue-green stems that are often considered to be solid almost tree like. As the plant matures you can expect it to reach up to around 6 m (20ft) tall. The plant has medium long brown spines that are a notable feature of this cacti as best seen by the image. When the plant finally flowers you can expect it to produce red flowers. |
| Cac Jam -007 | *Cleistocactus* | It is a columnar cactus with huge needle like spines. It is sun-loving and quite fast-growing plants. |
| Cac Jam -008 | *Mammillaria* | It is a sun-loving cactus has spines of variable length, shape and colour and pronounced sometimes with angular tubercles. The plant offsets freely to form large clumps. |
| Cac Jam -009  Cac Jam -010 | *Rebutia*  *Notocactus* | Olive-light green, button-like stems form a compact mound. The flowers, which have long necks and are delicately shaded rose-pink, grow from the lower stem and open fully in the sun  This is eventually a columnar species. It has a pale green body with numerous fine ribs and the small aerioles set very closely together and bear up fine, whitish, yellow to yellow radial spines. |
| Cac Jam -011  Cac Jam -012 | *Turbinicarpus*  *Opuntia* | This is eventually a columnar species. It has a pale green body with numerous fine ribs and the small aerioles set very closely together and bear up fine, whitish radial spines  The cacti can be several meters or a few centimeters tall and include some with fleshy pads or branching stems and mat-forming alpine species. Barbed spines and tufts of bristles protect the body. |
| Cac Jam -013 | *Astrophytum* | The cacti derive from the Greekwords astron. Meaning a “star” and phyton meaning “plant”. The genus name implies “star plant”. TheAstrophytum genus is comprised of 4 species of globose to short cylindrical cacti and one sprawling octopus-like member. While each species is quite distinct, these four feature a star shaped appearance when viewed from above. Hence the name Astrophytum, which means star plant. |

Table 2. Morphological characteristics of Succulent genotypes

| Genotypes | Common name | Brief description |
| --- | --- | --- |
| S Jam -001 | *Cryptanthus bivittatus* | *Cryptanthus bivittatus* is a member of the Bromeliaceae family of tropical plants. It has many common names such as starfish plant, earth star and Red Star Bromeliad. The plants can have ten to twenty leaves, each with tiny teeth or thorns on their wavy margins. The leaves taper to a point at the end which gives the plant it’s pretty star shape. The plants can be striped in both ivory tones and various shades of red and pink. Place Red Star Bromeliad in a slightly shady spot. Too much sunlight and heat can make the leaves wither and shrivel up. Some morning and late afternoon sun with protection from midday sun is ideal. If the plant has too much shade, the color of the leaves will be diminished. Small white flowers appear in the center of the rosettes of leaves. The flowers of the plant are somewhat insignificant. This bromeliad is grown more for its leaves than the flowers. |
| S Jam -002 | *Sansevaria* | *Sansevieria*, better known as Snake Plants, are hardy specimens that are more tolerant of imperfect environmental conditions than almost any other house plant. They have rosettes of usually dark yellowish green, fleshy leaves often variegated. Spikes of pale, white flowers appear in summer. They are suitable in hanging baskets and pot. |
| S Jam -003 | *Haworthia* | They display a range of fine foliage. The broad, triangular, sometimes stippled leaves olive-green to purple-brown and their upper surfaces are often criss-crossed with transparent markings. They are short stemmed which form new plants some distance from the parent. |
| S Jam -004 | Agave | They are stemless, rosette-shaped succulents used for indoor and outdoor decoration. |
| S Jam -005 | Aloe | The Aloe, flowers annually and its rosette is formed by leaves that grow out rather than unfurl from the centre. Long flower stems bearing clusters of small long-lasting tubular blooms. They come in a variety of shades of red, orange, green, yellow, grey, etc. mostly in winter. |
| S Jam -006 | Adenium | Bushy plants are open faced appear periodically from summer to winter. They are easiest to grow, produce flowers readily in 3-4 years from seed. Its pink, white or crimson flowers, which usually have dark outer edges and paler centres are produced from summer through to winter. |
| S Jam -007 | Pachyphytum | Stemless rosettes of fleshy leaves, in shades of green, blue orange, produce arching spikes of long-lasting, pendent flower with powder enclosed by grey-green sepals and red petals. Their glossy leaves appear in summer. Pachyphytum species are sometimes slow-growing and may prefer sun or shade |
| S Jam -008 | Kalanchoe | Leafy succulents’ plants: many are grown for their decorative, variegated often hairy foliage and some of the trailing species are excellent in hanging baskets. The mostly bell-shaped, long-lasting flowers vary in colour from white, yellow, or orange to brown, red or purple. They appear at the stem tips mainly in summer These succulents are sometimes fast-growing and many are easy to cultivate in sun or shade, but several species cannot tolerate low temperatures. |
| S Jam -009 | *Euphorbia milli* | This succulent is perennial. The erect stem has a handsome rosette of variable deciaduous leaves. Their tiny flowers lack petals and sepals but are often enchosed by brightly hued, long-losting leaf bracts. They grow well in sun or shade makes a good hedging plant. |

**Conclusion**

Cactus and Succulent genotypes showed wide variation in different growth characters. Among the genotypes Cac Jam -005 and S Jam -001 exhibited distinctly vigor. The experiment would be continued with more number of genotypes for detailed study of flower and yield characters under Bangladesh context.

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**PERFORMANCE OF COMMERCIAL CULTIVARS OF GERBERA COLLECTED FROM VARIOUS SOURCES UNDER PROTECTED CONDITION**

A. NAZNIN, K. AMBIA, M. M. R. BHUYIN, F. N. KHAN AND M. T. RASHID

**Abstract**

*Tissue cultured seedlings of some commercial cultivars of gerbera were collected from from different available sources and evaluated to see the performance in respect of quality and yield potential. Variation was observed for all quantitative and qualitative characters under study. Based on the studied characteristics, gerbera collected from KF-bioplants showed better performance for cut flower production.*

**Introduction**

Gerbera (*Gerbera jamesonii* Bolus ex Hooker F.) is one of the most beautiful cut flowers with exquisite shape, size and colour with over 40 species of Asiatic and African origin. There is a good demand for these flowers both in the domestic and export markets. As commercial cultivation of the cut-flowers has a good potential, introduction and popularization of high-yielding cultivars of gerbera has gained importance. To meet the qualitative and quantitative standards, hybrid cultivars have to be grown under protected conditions. Protected conditions provide favorable environment for the growth of the plants by protecting the crop from heavy winds, pests, diseases and other climatic conditions. In protected conditions, gerbera grows faster and produces larger and greener leaves with high dry matter content. As a result, the quality and yield of the flowers increases and more side shoots will be formed. Though, different cultivars of gerbera exist in Bangladesh but studies on different plant and flower characters including yield potentiality and quality have not yet been made systematically. The marketing potential can be exploited by introduction and evaluation of gerbera cultivars. Hence, it is needed to evaluate cultivars for their vegetative, yield and quality characters for the agro-climatic conditions of Bangladesh. Considering the above facts, the present research has been undertaken to study the performance of different cultivars of gerbera collected from different sources of Bangladesh.

**Materials and Methods**

The experiment was carried out at the Floriculture Field, Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur during Rabi season of 2021-2022. Commercial cultivars of gerbera were collected from different sources in Bangladesh those are considered as treatments. The treatments were S1= GETCO, S2= RARF, S3= KF-Bioplants, S4= Apex agriscience limited, S5= Krishan Botanics. Seedlings were planted in raised bed with a spacing of 40 cm × 30 cm. The crop was manured and fertilized with cowdung, cocodust, Urea, TSP and MoP @ of 8 tons, +2 tons, 250 kg, 275 kg and 225 kg per hectare respectively. Full doses of well decomposed cowdung, cocodust, TSP and MoP were applied during final land preparation. Urea was applied in two equal splits at 45 and 75 days after planting (DAP) the sucker. Cultural operations such as weeding, irrigation, disease and pest management etc. were done as and when necessary. Five plants were selected randomly in each genotype per replication to record data on different characters viz. plant height (cm), number of leaves/plants, plant spread (cm),days to flowering, flower size (cm), stalk length (cm) and vase life (days). The data were statistically analyzed and means were separated by Least Significant Difference Test according to Steel *et al*. (1997).

**Results and Discussion**

Variations were observed in respect of vegetative and floral characteristics (Table 1). The tallest plant was found in S3 (38.5cm) followed by by S2 (36.2cm) whereas the shortest plant was recorded in S1 (30.5cm). Maximum number of leaves and plant spread were recorded in S3 (23.0 and 25.5cm) and minimum was observed in S5 (14.0 and 16.6cm). In case of days to flowering, S3 (95days) took minimum time to produce flower and S1 required maximum time to produce flower. Diameter and stalk length of flower also found maximum in S3 (10.6cm and 30cm). As all the cultivars provided with the same environment and others inputs, so the variations can be genetical or the quality of tissue cultured seedlings. The stalk length is a genetic factor therefore it is expected to vary among the cultivars as earlier observed by Sarkar and Ghimaray (2004) and Jangde et al., (2019). Stalk length is a very important factor for a cut flower, especially for gerbera flower. It decides the quality cut flowers. As there will be more stalk length more reserved food will be stored in the stalk which will later be available to the flower for longer time period.

Vase life varied from 9 to 13 days in water. The maximum vase life was recorded in S3 (13 days) while the minimum in S1 (9 days). The variation in vase life of flower might de due to differences in senscencing behavior of the variety by producing higher amount of ethylene formation enzymes and ethylene as reported by Jangde et al., (2019) reported the similar results as that of the present investigation.

**Table 1. Vegetative and floral characteristics of gerebera collected from different sources**

| **Treatments** | **Plant height (cm)** | **Number of leaves/plant** | **Plant spread (cm)** | **Days to flowering** | **Diameter of flower head** | **Stalk length (cm)** | **Vase life (days)** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| S1 | 30.5 | 16.0 | 18.6 | 102 | 8.5 | 23 | 9 |
| S2 | 36.2 | 19.0 | 22.1 | 98 | 9.2 | 26 | 12 |
| S3 | 38.5 | 23.0 | 25.5 | 95 | 10.6 | 30 | 13 |
| S4 | 34.2 | 18.5 | 20.2 | 98 | 8.6 | 28 | 12 |
| S5 | 27.6 | 14.0 | 16.6 | - | - | - | - |

**Conclusion**

Gerbera collected from KF-Bioplants (S3) performed better and produced good quality of flower. Therefore, KF-Bioplants can be considered as a good source of seedlings for commercial cultivation. However, more number of quality parameters will be included for continuing the experiment in order to recommend a good source of gerbera seedlings for commercial cultivation.

**Acknowledgement**

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**INFLUENCE OF FOLIAR APPLICATION OF BA, GA3 AND NAA ON VEGETATIVE GROWTH AND FLOWERING OF CHRYSANTHEMUM (*CHRYSANTHEMUM MORIFLOIUM*)**

M. T. RASHID, K. A. ARA, F. N. KHAN, K. AMBIA, A. NAZNIN AND M. M. R. BHUIYIN

**Abstract**

*The pot experiment was conducted at the Floriculture field of Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Gazipur during August 2021 to May 2022 to evaluate the foliar spray of gibberellic acid (GA3), benzyl adenine (BA) and naphthalene acetic acid (NAA) on growth and flowering traits of chrysanthemum (Chrysanthemum morifolium). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Four weeks old seedlings of chrysanthemum genotype CM-019 (flower class: Pompon and flower colour: Orange yellow) were transplanted in pot keeping under natural sunlight. The aqueous solution of GA3, BA and NAA @ 100 and 200 ppm of each were sprayed on the flower plants at monthly interval starting after one month of transplantation of seedlings along with control (water). The results revealed that vegetative growth and flowering parameters were significantly influenced by plant growth regulators. Maximum number of leaves per plant (50.0) and leaf area per plant (7.5 cm2) were recorded from the spraying of BA @ 100 ppm closely followed by BA @ 200 ppm (48.0 and 7.0 cm2/plant) and GA3 @ 100 ppm only for number of leaves (47.0/plant). Spraying of GA3 @ 100 ppm produced the tallest plant (70.0 cm) and the highest plant spread (23.0 cm). Number of flowers (26.0/plant), flower size (7.8 cm), average weight of stalk (37.0 g) and vase life (15.0 days) were also found maximum from the application of GA3 @ 100 ppm, closely followed by GA3 @ 200 ppm (23.5/plant, 7.2 cm, 36.0 g, 14.0 days) and NAA @ 100 ppm (18.5/plant, 7.0 cm, 36.0 g, 13.0 days) and irrespective of concentrations, BA failed to improve these characters. GA3 @ 100 ppm recorded maximum length of stalk (37.5 cm) and rachis (29.0 cm), which was identical with GA3 @ 200 ppm (34.6 cm and 25.0 cm), and BA @ 100 ppm gave the lowest length of stalk and rachis. GA3 also caused faster initiation of flowering, whereas NAA and BA delayed it. GA3 @ 100 ppm took the minimum days to flowering (50.0 days) was observed when plants were sprayed with GA3 @ 100 ppm whereas it was maximum (69days) from BA @ 100 ppm treatment. It can be concluded that GA3 @ 100 ppm provided the best results for obtaining better vegetative growth of plants, maximum number of cut blooms with longer stalk as well as bigger flower size with prolonged vase life in chrysanthemum.*

**Introduction**

Chrysanthemum (*Chrysanthemum morifolium* Ramat.)  belongs to the family *Asteraceae* and  is a very popular commercial flower grown for as cut flowers for vases, as loose flowers for garland making, general decoration, hair adornments, religious functions and interior decorations at ceremonies, as well as pot plants all over the world including Bangladesh. Chrysanthemums are [native](https://en.wikipedia.org/wiki/Native_plant) to [East Asia](https://en.wikipedia.org/wiki/East_Asia) and northeastern Europe and most of the species originate from East Asia and the [center of diversity](https://en.wikipedia.org/wiki/Center_of_diversity) is in [China](https://en.wikipedia.org/wiki/China) (Liu *et al.,* 2012). There are more than 5000 different varieties with different names, grown all around the world. In some countries, it ranks next to rose in value of the crop produced. The agro-ecological conditions of the country are favorable for the culture and survival of chrysanthemum. For this, the flower growers of Bangladesh are very much interested in cultivating chrysanthemum instead of the traditional flower crops that usually do not give much return to them. As a result, recently chrysanthemum is becoming attractive to the growers as well as users, as it has great potential for local and export market.

Plant Growth Regulators (PGRs) such as auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids, salicylates, jasmonates etc. are available in synthetic forms, which are commonly used in ornamental industry for nursery production, ornamental foliage plant and several other flowering crops (Arteca, 1996; Sanap *et al*., 2000). Gibberellic acid (GA3) is a well-recognized synthetic gibberellins, which has been used for desirable plant growth, flower size, flower number and flower induction in many herbaceous flower crops. The flowering habit of long day or long short day plant can be controlled by regulating the endogenous level of gibberellins-like substances through the use of such growth promoter. The beneficial effects of GA3 on growth and flowering has been reported in chrysanthemum (Patel *et al*., 2010; Alhajhoj, 2017; Aparna *et al*., 2018; Sajid *et al*., 2018; Farag *et al*., 2018; Sing and Bala, 2018; Singh *et al.*, 2018), in calendula (Khudus *et al*., 2017) and in china aster (Mishra *et al*., 2018). Naphthalene acetic acid (NAA) is a synthetic auxins, which has various physiological roles viz., encouraging cell division and cell enlargement. This PGR can enter into plants through leaves, branches and tender skin etc. and can influence plant growth, flowering and other properties. The beneficial effects of NAA on growth and flowering has been reported in chrysanthemum (Sahu *et al*, 2021), in calendula (Khudus *et al.,* 2017) and in *Vinca rosea* (Pahare and Das, 2020). Benzyl adenine has recently been used as one of other sources that can maintain or increase the quality of various ornamental plants (Buban, 2000; Han, 2001) and. on many other physiological and developmental processes, including leaf senescence, leaf chlorosis, increase the vase life, delaying senescence of cut carnation by inhibiting ethylene biosynthesis (Cook *et al*., 1985), nutrient mobilization, apical dominance, the formation and activity of shoot apical meristems, floral development, combating drought stress in plants (Waterland *et al*., 2010). El-Ghait *et al*. (2018) recorded increased plant height and highest number of branches and leaves per plant, number of flowers per plant and maximum vase life in chrysanthemum from the application of Kinetin (a synthetic cytokinin) @ 75 ppm. Singh and Bala (2018) obtained maximum vase life in chrysanthemum from the application of BA @ 200 ppm. Nambiar *et al*. (2012) reported that application of Benzyl adenine @ 200 ppm on dendrobium orchid were found to increase maximum inflorescence%, hastens inflorescence emergence, inflorescence size (length x width), number of leaves per plant, number of flowers per inflorescence and flower size. Application of proper doses of plant growth regulators may not only ensure better yield and quality of chrysanthemum, as well as minimize the wastage of growth regulators and cost. In Bangladesh, a few studies were done regarding the use of plant growth regulators, especially plant growth retardants for growth and flowering of chrysanthemum. The present study was, therefore, conducted to find out the optimum concentration of GA3, BA and NAA to improve vegetative growth and flowering traits of chrysanthemum.

**Material and Methods**

The experiment was conducted at the field of Landscape, Ornamental and Floriculture Division of Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Gazipur during August 2021 to May 2022. Four weeks old seedling of chrysanthemum (CM-019) were collected from field of Landscape, Ornamental and Floriculture Division of Horticulture Research Centre (HRC) and transplanted in 10 x 12 cm earthen pot in the month of October 2020. The pompon type genotype (CM-019) was used in this study. The pots were filled with a mixture of 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 table spoonfuls of bone meal. Subsequently, 10 g TSP, 6 g MoP, 0.10 g B per pot were applied. The source of boron, commercially available as ‘Solubor’ with 20 per cent available boron was used. Urea @ 2, 3 and 2 g per pot was applied at 30, 50 and 70 days after transplanting, respectively. The pots were kept under natural sunlight and distance were maintained 6 centimeter apart from one pot to another pot. The experiment was laid out in Randomized Completely Block Design (RCBD) with 5 replications (one pot considered as one replication). The experiment consists of 7 treatments viz. BA, GA3 and NAA @ 100 ppm and 200 ppm of each and control. The growth regulators were sprayed on plants in the morning at monthly interval starting after one month of seedling transplantation. Control treated plants were sprayed with water. All the cultural operations such as weeding, mulching, watering, disbudding, pinching, staking etc. were done as per the need of the crop. Ridomyl Gold (a.i. Metalaxyl & Mancozeb) was sprayed on the plants @ 2.0 g/L H*2*O thrice at 15 days interval starting from 20 days after transplanting as protective measures against the incidence of diseases such as leaf spot and powdery mildew. Ripcord (a.i. Cypermethryn) was also sprayed on the plants @ 2.0 ml/L H*2*O thrice at 15 days interval starting from 30 days after transplanting as protective measures against the attack of insects such as aphids, thrips, leaf miners etc. The data were recorded on plant height, number of leaves per plant, plant spread, leaf area per plant, days to flower initiation, number of flowers per pot, stalk length, rachis length, flower size, average weight of stalk after maturity indices of chrysanthemum flower. For observing post-harvest life of the cut flowers of chrysanthemum, GA3, BA and NAA treated and untreated cut stems were collected from the field in the morning to avoid excessive heat and brought to the laboratory in a bucket containing 3-4 liters of water. Before placing cut stems in the vase water, stems were cut (slanting) to a uniform length of 25 cm and leaves near the bottom of the cut stems were removed except for few leaves below the inflorescence. Cut stems were placed in 250 ml conical flasks containing 200 ml of distilled water and kept in laboratory conditions at a room temperature of 18±2ºC and relative humidity of 70±5% under continuous illumination of florescence light. Five flowers were taken randomly and vase life was recorded from all the treatments by counting number of days from the time, when the cut flowers lose their decorative value after complete opening or shedding of petals. The recorded data were statistically analyzed with the help of computer base MSTAT software and treatment means were separated by Duncan’s Multiple Range Test (DMRT) at 1% level of probability.

**Results and Discussion**

**Vegetative growth parameters**

***Plant height***

The tallest plant (70.0 cm) was recorded from the treatment GA3 @ 100 ppm, whereas the shortest plant (52.0 cm) was recorded from BA @ 100 ppm which was closely followed by that of BA @ 200 ppm (55.0 cm) (Table 1). Patel *et al*. (2010), Singh *et al*. (2018) and Sharifuzzaman *et al.* (2011) obtained the tallest plant from GA3 @ 150 ppm in chrysanthemum. On the other hand, Farag *et al.* (2018) and Sahu *et al.* (2021) obtained the tallest plant from GA3 @ 200 ppm in chrysanthemum. Aparna *et al.* (2018), Alhajhoz (2017) and Sajid *et al*. (2018) got highest plant height when the chrysanthemum plants are treated with GA3 @ 400 ppm, GA3 @ 300 ppm and GA3 @ 250 ppm, respectively. Talukder and Paswan (1998) obtained maximum value for this same trait from the spraying of GA3 @ 40 ppm. Foliar application of GA3 at a proper concentration might have influenced plant height by stimulating cell division and elongation at internodal region, which resulted in more number of cells and increase in cell length. The shortest plant height with application of BA might be due to counteracting the apical dominance.

**Number of leaves per plant**

The Maximum number of leaves (50.0) per plant was recorded from BA @ 100 ppm, which was identical with BA @ 200 ppm (48.0/plant) and GA3 @ 100 ppm (47.0/plant), whereas the minimum number of leaves per plant (39.0) was recorded from control. The maximum number of leaves per plant with application of BA @ 100 ppm might be due to higher number of suckers per plant. Sahu *et al.* (2021), El-Ghait *et al.* (2018) and Sajid *et al.* (2018) reported that maximum number of leaves per plant was observed from the plants sprayed with treatment containing GA3 @ 200 ppm, GA3 300 ppm and GA3 @ 100 ppm, respectively. Aparna *et al*. (2018) reported that the result of higher number of leaves per plant might be due to GA3 application at a proper concentration enhanced biosynthesis of protein and carbohydrates leading to enhancement of initiation of leaf primordial growth and consequently production of more leaves.

**Table 1. Effect of BA, GA3 and NAA on vegetative growth parameters of chrysanthemum**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Growth regulators (ppm)** | **Plant height (cm)** | **Number of leaves/ plant** | **Leaf area (cm2)/plant** | **Plant spread (cm)** |
| BA @ 100 ppm | 52.0 d | 50.0 a | 7.5 a | 14.9 bc |
| BA @ 200 ppm | 55.0 cd | 48.0 ab | 7.0 ab | 14.4 bc |
| GA3 @ 100 ppm | 70.0 a | 47.0 ab | 6.4 bc | 23.0 a |
| GA3 @ 200 ppm | 65.0 b | 44.8 b | 6.0 bc | 20.0 ab |
| NAA @ 100 ppm | 63.0 bc | 42.3 bc | 5.9 bc | 17.0 b |
| NAA @ 200 ppm | 61.0 bc | 42.0 bc | 5.8 bc | 15.0 bc |
| Control | 58.0 c | 39.0 c | 5.5 c | 12.0 c |
| **CV (%)** | **8.7** | **7.5** | **9.5** | **9.2** |

In a column mean values with common letters do not differ significantly at 1% level of probability by DMRT

**Leaf area per plant**

The maximum leaf area per plant (7.5 cm2) was recorded from BA @ 100 ppm closely followed by that of BA @ 200 ppm (7.0 cm2/plant), whereas, the minimum leaf area per plant (5.5 cm2) was recorded in control. This might be due to production of higher number of leaves per plant, when plants are treated with benzyl adenine at a specific concentration. On the contrary, Farag *et al.* (2018) got maximum leaf area per plant through application of GA3 @ 200 ppm, closely followed by GA3 @ 100 ppm, though they obtained increased leaf area per plant from BA @ 200 and 100 ppm compared to control. These results of GA3 might be attributed to the role of gibberellic acid at a proper concentration on stimulation of cell division and cell elongation of the leaves or on increasing the number of leaves per plant, or all of them, consequently the leaf area per Chrysanthemum plant could be increased reported by Farag *et al.*, (2018).

**Plant spread**

The maximum plant spread (23.0 cm) was noticed in GA3 @ 100 ppm which was statistically similar to GA3 @ 200 ppm (20.0 cm) and the minimum plant spread (12.0) was recorded in control (Table 1). Singh *et al.* (2018) and Patel *et al.* (2010) obtained maximum plant spread in chrysanthemum from GA3 @ 150 ppm closely followed by GA3 @ 100 ppm among three GA3 concentrations (50, 100 and 150 ppm). Alhajhoj (2017) reported that application of GA3 @ 300 ppm produced maximum plant spread in chrysanthemum. Sahu *et al*. (2021) reported that maximum spread of plant was noticed from the chrysanthemum plants sprayed with treatment containing GA3 @ 200 ppm. Patel *et al.* (2010) explained that higher plant spread might be due to GA3 which enhanced cell division and cell enlargement, promotion of protein synthesis coupled with dry matter accumulation.

**Flowering parameters**

**Days to flower initiation**

There was a significant difference in days to flowering among the different treatments. The minimum days (50) required for flower initiation was observed in GA3 @ 100 ppm which was closely followed by GA3 @ 200 ppm (52 days) (Fig. 1). Application of BA @ 100 ppm took maximum days (69) to initiate flowers followed by control (66 days) and BA @ 200 ppm (64 days). Application of NAA @ 100 ppm took 58 days required for flower imitation followed by NAA @ 200 ppm (56 days). Singh *et al*. (2018) also reported that minimum number of days required for first flower bud appearance was recorded with 100 ppm concentration of GA3 in chrysanthemum. It is evident that GA3 @ 100 ppm and GA3 @ 200 ppm reduced time to initiate flower by 16 and 14 days, respectively for early bloom compared to control. Irrespective of concentrations, NAA also took less time to initiate flower compared to control, but BA @ 100 ppm took more time to initiate flower compared to control, whereas BA @ 200 ppm reduced time only by two days compared to control. GA3 decreased the concentration of abscisic acid in plant shoot, which might enhance flower initiation and early flowering. Moreover, as the leaf numbers were increased in present study, which improved photosynthetic activity to enhance early flowering. These findings are confirmed by those reported by Sajid *et al*., (2018), Sharifuzzaman *et al*., (2011) and Patel *et al*., (2010) who observed that plant treated with GA3 took minimum time to initiate flower in chrysanthemum.

**Fig. 1. Effect of BA, GA3 and NAA on flower initiation in chrysanthemum**

Mean values on top of the bar with uncommon letter(s) are significantly different at 1% probability by DMRT

**Stalk length and rachis length**

From marketing point of view, length of flower stalk is important parameters of flower growth.

Using GA3 at 100 ppm concentration gave the maximum stalk length (37.5 cm) and rachis length (29.0 cm), compared with other PGR (BA and NAA) concentrations and control, which were statistically similar to those of GA3 @ 200 ppm (34.6 cm and 25.0 cm). Minimum stalk length (26.5 cm) and rachis length (18.0 cm) were observed in BA @ 100 ppm closely followed by BA @ 200 ppm and NAA @ 100 ppm and control. This is in close conformity with the result of Singh *et al.* (201) who got maximum stalk length using GA3 @ 150 ppm being identical with GA3 @ 100 ppm in chrysanthemum. The increased stalk length with GA3 @ 100 ppm treatment might be due to rapid internodal elongation, rapid cell division and cell elongation in the intercalary meristem. Singh *et al.* (2018) opined the reason of increased stalk may be that the flowers stalk length due to redirecting the movement of organic metabolism and in establishing sink. The increase in rachis length with GA3 @ 100 ppm might be due to increased activity of growth promoting enzymes by synthesizing more nucleic acid and other compounds. Whereas, the minimum rachis length with BA @ 100 ppm might be due to BA showed reduced plant height and stalk length, which directly influenced the rachis length.

**Table 2. Effect of plant growth regulators on flowering parameters of chrysanthemum**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Stalk length (cm)** | **Rachis length (cm)** | **Flower number/plant** | **Flower size (cm)** | **Avg.weight of stalk (g)** |
| BA @ 100 ppm | 26.5 c | 18.0c | 15.0 c | 6.7 ab | 25.5 c |
| BA @200 ppm | 30.0 bc | 20.8 bc | 19.0 bc | 6.8 ab | 26.8 bc |
| GA3 @100 ppm | 37.5 a | 29.0 a | 26.0 a | 7.8 a | 37.0 a |
| GA3 @200 ppm | 34.6 ab | 25.0 ab | 23.5 ab | 7.2 ab | 36.0 ab |
| NAA @100 ppm | 31.8 bc | 21.5 bc | 18.5 ab | 7.0 ab | 29.0 ab |
| NAA @200 ppm | 32.5 b | 22.0 bc | 20.0 b | 7.1 ab | 31.0 b |
| Control | 30.0 bc | 22.7 b | 17.0 bc | 6.0 b | 26.5 bc |
| **CV (%)** | **7.5** | **7.2** | **8.6** | **6.9** | **8.7** |

In a column mean values with common letters do not differ significantly at 1% level of probability by DMRT

**Number of flowers per plant**

Plants treated with GA3 @ 100 ppm concentration produced maximum number of flowers per plant (26.0) which was identical with GA3 @ 200 ppm (23.5/plant) and NAA @ 100 ppm (18.5/plant),but BA @ 100 ppm treatment produced the lowest number of flowers per plant (15.0) being identical with BA @ 200 ppm (19.0/plant) and control treatment (17.0/plant) (Table 2). The increase in flower numbers by GA3 with a specific concentration might be due to increase in leaf numbers and leaf area, which might have boosted the production and accumulation of assimilates that were translocated from source to sink for flower production.

Alhajhoj (2017) reported that application GA3 @ 300 ppm gave maximum number of flowers per plant which was identical with that of GA3 @ 200 ppm. Patel *et al*. (2018) obtained the highest number of flowers per plant from GA3 @ 150 ppm being identical with GA3 @ 100 ppm. Sharifuzzaman *et al*. (2011) and Singh *et al*. (2018) got maximum number of flowers per plant from the spraying of GA3 @ 150 ppm which were significantly higher than GA3 @ 150 ppm. Sahu *et al.* (2021) and Sajid *et al*. (2016) reported maximum number of flowers per plant was from GA3 @ 200 ppm and GA3 @ 250 ppm, respectively.

**Flower size**

Maximum size of flower (7.8 cm) was observed with GA3 @ 100 ppm concentration which was statistically similar to GA3 @ 200 ppm (7.2 cm), NAA (100 & 200 ppm) and BA (100 & 200 ppm) and the lowest flower size was observed in control (Table 2). Singh *et al.* (2018) and Sharifuzzaman *et al.* (2011) got maximum flower size from GA3 @ 150 ppm. Frag *et al*. (2018) and Sajid *et al.* (2016) reported that using GA3 @ 200 ppm gave the maximum flower size, whereas Alhajhoj (2017) found flower size maximum from GA3 @ 300 ppm treated plant. The result of increased flower size with GA3 was probably due to that using gibberellic acid at a proper concentration led to extend the length of ray florets, or promote more initiated florets per capitulum or both of them, accordingly the flower size of chrysanthemum plant would be increased (Frag *et al*.,2018). Singh *et al*. (2018) opined regarding the cause of increased flower size with GA3 at a specific concentration that it may have been due to a close parallelism between vegetative growth and flowering and it is possible that stimulatory effect of GA3 on vegetative growth associated with efficient mobilization capacity.

**Average weight of stalk**

The average fresh weight of stalk (37.0 g) was recorded to be the maximum with treatment involving GA3 @ 100 ppm closely followed by 36.0 g weight with GA3 @ 200 ppm and NAA @ 100 ppm (29.0 g), whereas the minimum weight (25.5 g) was recorded in stalk harvested from the pot where plants were sprayed with BA @ 100 ppm which was identical with normal water (control) (26.5 g). Singh and Bala (2018) got increased stalk weight compared to control when GA3 was applied at the rate of 50, 100 and 150 ppm. However, they got maximum stalk weight from GA3 @ 150 ppm being identical with GA3 @100 ppm. Increase in weight of stalk might be due to increased activity of enzymes which are involved in cell division and elongation process.

**Vase life**

Treatment consisting of GA3 @ 100 ppm significantly produced maximum vase life (flower life) (15 days) which was closely followed by that of GA3 @ 200 ppm (14 days) and minimum vase life was recorded in control treatment (10 days) (Fig. 2). It is observed that flower life was increased by 5 days when the solution of GA3 @ 100 ppm was used. This is in perfect agreement with the results of Sajid *et al.* (2018) and Sharifuzzaman *et al.* (2011) who got maximum vase life from the chrysanthemum plants treated with 100 ppm GA3 closely followed by 150 ppm GA3. Talukder and Paswan (1998) reported that application of GA3 at 40 ppm concentration increased vase life by 9 days in chrysanthemum.

a

**Fig. 2. Effect of BA, GA3 and NAA on vase life in chrysanthemum**

Mean values on top of the bar with uncommon letter(s) are significantly different at 1% probability by DMRT.

Sajid *et al*. (2018) explained that the vase life could be correlated with ethylene production which is inhibited by the foliar application of GA3, because it may had retarded the onset of senescence in whole cut inflorescence stalk by containing higher amount of RNA content. Farag *et al*. (2018) gave the same opinion that the increased vase life was probably due to that using GA3 at a suitable concentration led to delay the flower's senescence and reduce ethylene production in the cut flowers, consequently the flower duration in the vase could be increased.

**Conclusion**

Vegetative growth and flowering parameters of chrysanthemum as well as vase life of flowers were influenced by the application of plant growth regulators, namely GA3, BA and NAA in chrysanthemum. GA3 @ 100 ppm was superior regarding plant height and plant spread and all flowering traits and reduced time to flower initiation by 16 days for early bloom. The same treatment also increased vase life of flowers by 5 days. Furthermore, GA3 @ 200 ppm concentration also exhibited better results and stood as the second best treatment. From the present study, it is concluded that foliar application of GA3 @ 100 ppm was superior for obtaining better vegetative growth of plants, maximum number of flowers with longer stalk as well as bigger flower size with prolonged vase life in chrysanthemum

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**EFFECT OF POTTING MEDIA ON GROWTH AND QUALITY IN AGLAONEMA**

M.T. RASHID, K. A. ARA, M.M.R. BHUIYIN, F.N. KHAN, A. NAZNIN AND K. AMBIA

**Abstract**

*An experiment was conducted at the Floriculture Shade Net House under Horticulture Research Centre of Bangladesh Agricultural Research Institute, Gazipur during 2021-22 to evaluate the effect of different potting media on growth and quality of ornamental foliage plant, Aglaonema. Six treatments T1-Soil (Control), T2-Vermicompost + perlite (1:1), T3- FYM + perlite (1:1), T4 Cocodust + perlite (1:1), T5-Cocodust + perlite + FYM (1:1:1) and T6-Cocodust + perlite + Vermicompost + (1:1:1) were laid out in a Completely Randomized Design and replicated five. Maximum plant height (70.0 cm), number of leaves (11.6), leaf length (35.0 cm), leaf width (9.5 cm), basal stem diameter (2.5 cm), visual plant grade (4.50) and colour grade (4.58) were recorded with the (T6 ) treatment containing cocodust + perlite + vermicompost in 1:1:1, (v/v) combination. Poor performance of all characteristics of Aglaeonema was exhibited in only soil (T1). This finding can support to the urban people and commercial entrepreneurs for successfully cultivation of Aglaeonema*,*.*

**Keywords:** *Aglaeonema*, cocodust, perlite, vermicompost, growth and quality

**Introduction**

Indoor gardening has gained a considerable importance due to paucity of ground space for development of gardens in the present day apartment culture in most of the cities and towns. In this context indoor foliage plants or house plants play a significant role in indoor gardening which are extensively used for interior decoration. Several foliage plants suitable for this purpose are used by the plant lovers under tropical and subtropical climatic conditions. Among these plants, Aglaonema is an important and popular foliage plant which is widely used by the people for its attractive variegated foliage, tolerance to low light and easy culture (Henny *et al.,* 2008). It belongs to the family Araceae and is native to South East Asia. However, for successful growing of this foliage plant in addition to providing ideal environmental condition, suitable potting media is also equally important which enhances its look thus making the plants more attractive. Various potting media compositions have been tried by the researchers for pot culture of these foliage plants with varying degrees of success. The potting media used to grow house plants can range from 100 per cent organic to approximately 50 per cent organic and 50 per cent inorganic matter (Swetha *et al.*, 2014). The key factors in selecting potting media include aeration, moisture retention and nutrient status. The present investigation was carried out to study the impact of different media compositions and to find out the most suitable media for successful culture of indoor foliage plants Aglaonema CV. Silver Queen under local climatic condition.

**Materials and Methods**

The research work was carried out to study the “Effect of potting media on growth and quality in Aglaonema” at Floriculture Shade Net House of Horticulture Research Centre, Gazipur during the year 2021-22. One-month old plants of Aglaonema CV. Silver Queen, obtained from a nursery located in Dhaka were used in the experiment. Six treatments T1-Soil (Control), T2-Vermicompost + perlite (1:1), T3- FYM + perlite (1:1), T4 Cocodust + perlite (1:1), T5-Cocodust + perlite + FYM (1:1:1) and T6-Cocodust + perlite + Vermicompost + (1:1:1) were laid out in Completely Randomized Design and replicated thrice. Each component of the mixture was added on the basis of volume while preparing the potting mixture which was added to plastic pots of 10cm size stopping at 2cm from the top. The study was carried out in a sub-tropical climate characterized by heavy rainfall during the period from July to September and scanty rainfall during the period from October to March. The average relative humidity (RH) inside the Shade Net House was measured by installing dry bulb and wet bulb thermometer which ranged from as high as 60 percent in October 2021 to as low as 35 percent in May 2022. The potting media were made available two months before planting of suckers and kept in a shady place covering with polythene paper. At that time, cowdung, vermicompost, perlite and cocodust were already decomposed. Watering was done to decompose media twice in a week for one month. The pots were washed and cleaned thoroughly before filling up of potting media.

Each plant in individual pot was applied with 4.0 g urea, 6.0 g single super phosphate and 4.0 g muriate of potash at two months interval. Plants were hand watered immediately after planting and thereafter at two to three days interval with a rose can. Intercultural operations like forking and weeding were carried out at regular interval. Plants inside the shade net house were more or less free from any insect pest attack or fungal infestation. However, foliar spraying of autostin [@ 2.0](mailto:@3.0) g/l and Ripcord @ 1.0 ml was done occasionally to avoid any fungal disease or pest attack in the plants.

Five plants per treatment under each replication were earmarked for recording various growth and quality parameters. The mean value of data collected on these five plants in respect of various parameters, viz plant height, leaf number, leaf length, leaf width, basal stem diameter were calculated and data were statistically analyzed through analysis of variance with the help of MSTAT software. Difference between treatments means were compared by Duncan’s Multiple Range Test (DMRT) according to Steel *et al*., (1997).

Foliage colour of a plant is a quality parameter which improves the aesthetic value of the plant. The leaves with their natural colour free from any blemishes were visually evaluated by five persons based on 1 to 5 point .scale (poorest to best). The value of assessment was presented by the mean value of five observations. Visual plant grade which represented the overall appearance with respect to growth, colour and presentability were also visually assessed by five persons based on 1 to 5 (poorest to best) scale (Swetha *et al*., 2014) and the value of assessment were presented by the mean value of five observations.

**Results and Discussion**

Observations on plant height, leaf number, leaf length, leaf width and basal stem diameter under various potting media are presented in Table-1. Maximum plant height was recorded in T6 -cocodust + perlite + vermicompost in 1:1:1 ratio (70.0 cm) followed by T5 - cocodust + perlite + FYM in 1:1:1 ratio (v/v) (67.0 cm). Minimum plant height (55.2 cm) was recorded in T1 - (soil). High nitrogen content available to plants grown in cocodust, perlite and vermicompost medium (Table-1) could be the reason for greatest plant height. Maximum number of leaves (11.6) were recorded in treatment T6 - cocodust + perlite + vermicompost in 1:1:1 ratio (v/v) followed by T5 - cocodust + perlite + FYM in 1:1:1 ratio (v/v) (9.0). Higher number of leaves in T6­ - cocodust + perlite+ vermicompost (1:1:1, v/v) medium, where cocodust and perlite affords higher total pore space and water holding capacity and vermicompost is richer in humic compounds (Merrow, 1995).

**Table 1. Effect of potting media on growth and quality performance in Aglaeonema**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Plant height (cm)** | **No. of leaves** | **Leaf length (cm)** | **Leaf width (cm)** | **Basal stem diameter (cm)** | **Visual plant grade** | **Visual colour grade** |
| T1 | 55.2c | 6.0 b | 24.5 c | 6.0 b | 1.8 | 3.0 | 2.0 |
| T2 | 60.0 bc | 7.5 ab | 26.2 bc | 7.0 ab | 2.0 | 3.0 | 3.0 |
| T3 | 58.9 bc | 8.0 ab | 28.0 bc | 7.4 ab | 2.0 | 3.0 | 3.0 |
| T4 | 63.8 b | 8.3 ab | 30.0 b | 7.8 ab | 2.0 | 4.0 | 4.0 |
| T5 | 67.0 ab | 9.0 ab | 32.5 ab | 8.2 ab | 2.3 | 4.0 | 4.0 |
| T6 | 70.0 a | 11.6 a | 35.0 a | 9.5 a | 2.5 | 5.0 | 5.0 |
| **CV%** | **7.8** | **8.9** | **7.2** | **6.7** | **NS** | **-** | **-** |

T1-Soil (Control), T2-Vermicompost+Perlite (1:1), T3- FYM+Perlite (1:1), T4 Cocodust+Perlite (1:1), T5-Cocodust+Perlite+ FYM (1:1:1) and T6-Cocodust+Perlite+Vermicompost+ (1:1:1)

Plant grade system where 1=Dead, 2= Poor quality, 3=Fair quality, 4=Good quality and 5 = Excellent quality

Colour grade system where 1= Poor, 2= Fair, 3= Good, 4= Very good and 5= Excellent

Maximum leaf length was recorded in T6 - cocodust + perlite + vermicompost + (1:1:1 ratio, v/v) (35.0 cm) followed by T5 - cocodust perlite + FYM (1:1:1 ratio, v/v) (32.5 cm). Minimum leaf length was recorded in T1 - soil (24.5 cm). High water-holding capacity of cocodust, perlite and high nutrient content of vermicompost may have been responsible for maximum leaf length. Tilt *et al.,* (1987) demonstrated positive correlation between water-holding capacity and increased top growth in several landscape species. Treatment T6 - cocodust + perlite + vermicompost (1:1:1 ratio, v/v) showed maximum leaf width (9.5 cm) and T5 - cocodust + perlite + FYM (1:1:1 ratio, v/v) was on par (8.2 cm) with it. Better performance in this medium can be attributed mainly to characteristics of cocodust, perlite and vermicompost. Cocodust has the ability to store and release nutrients to plants for an extended period of time. Perlite affords high water holding capacity, light in weight and good aeration to plants (Evans and Stamps (1996). Vermicompost has considerable amounts of humic substances and improves plants nutrition (Swetha *et al.*, 2014).

Effect of potting media in Aglaonema with respect to basal stem diameter is presented in Table-1. Among various combinations of potting media, maximum (2.5 cm) diameter was recorded under T6 treatment. That is Aglaonema grown in media composed of cocodust + perlite + vermicompost (1:1:1) and it was closely followed by the same grown in media T5 - cocodust + perlite+ FYM (1:1:1) which recorded a diameter of 2.3 cm. On the other hand, the minimum diameter (1.8 cm) was recorded when Aglaonema was grown in media T1 composed of only garden soil. However, no significant impact of various potting media on Aglaonema was in case of basal stem diameter noticed during any of the observations.

Data on visual plant grade and colour grade of Aglaonema grown in different potting media are presented in Table-1. Significantly higher plant grade and colour grade was recorded in T6 -cocodust + perlite + vermicompost (1:1:1 ratio, v/v) (5.0). Cultivars growing in cocodust + vermicompost + perlite amended medium are shown to have higher production or accumulation of total protein and amino acids in their stem (Evans and Stamps, 1996). This could be a reason for high visual plant grade. Improved nutrition from vermicompost changes biochemical properties of a plant like chlorophyll, enzymes, and protein synthesis (Tomati *et al,* 1995) which could be one of the reasons for high visual plant grade. Higher nitrogen available to plants in this medium may be the reason for higher colour intensity. These results are in accordance with Scagel (2003) and Sachin *et al*., (2020) in foliage plants.

**Conclusion**

These results revealed that potting media containing cocodust+ perlite + vermicompost in (1:1:1) ratio showed result in best growth parameters and improved quality in Aglaonema among the media studied. This finding can support to the urban people and commercial entrepreneurs for successfully cultivation of Aglaeonema.

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**EFFECT OF SUBSTRATES ON GROWTH, YIELD AND QUALITY OF ANTHURIUM IN SOILLESS CULTURE**

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**Abstract**

*An experiment was conducted at the Floriculture Shade Net House under Horticulture Research Centre of Bangladesh Agricultural Research Institute, Gazipur during 2021-22 to evaluate the effect of different substrate on growth, flowering, yield and quality of anthurium. Six treatments were used in the experiment viz. T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + Perlite (1:1), and T6: Cocodust + Sawdust (1:1). The experiment was laid out in Completely Randomized Design with five replications. Among the treatments, Cocodust+ perlite (1:1) (T5) followed by Cocodust singly (T2) performed the best in respect of growth, flower number and quality characteristics of anthurium. Poor performance of all characteristics of anthurium was exhibited in only soil (T1). Gross return and BCR was the highest in T5 treatment. The result suggested that Perlite + Cocodust (1:1 ratio) followed by Cocodust (100%) could be used for flower yield maximization and quality improvement of anthurium in pot cultivation. This finding can support to the urban people and commercial entrepreneurs for successfully cultivation of anthurium.*

**Introduction**

Anthurium is highly praised flowering plant belongs to Araceae family (Singh *et al*., 2019). It is considered as a promising and valuable cut flower crop next to rose, ranks fifth among top ten cut flowers of the world market (Bose and Yadav, 2015). Anthurium has been recently introduced in Bangladesh and gaining its demand day by day. It has wide ranges of form, size and colour. Anthurium are now cultivated for dramatic indoor garden display, home decoration, cut-flowers, bedding, floral arrangement and other useful purposes (Singh *et al*., 2019). In city area, there is a little or no longer space for flower garden. Therefore, demand for pot cultured plants and flowers for house decoration as well as roof gardening has immensely increased in recent years. Soil alone as a growing medium does not fulfill all requirements for its higher yield and quality. The introduction of the soilless medium has brought radical change in its protected cultivation and is gaining importance day by day. Anthurium grows well in substrates such as coco peat, cocodust, vermicompost, perlite etc. (Sindhu *et al.,* 2010). The cocodust, perlite and sawdust have been identified as an agricultural by product which can be a suitable substrate component (Buck and Evans, 2010; Paramveer and Chawla, 2011) for flower crops. Growing in artificial substrates has many advantages over soil as mixes contain the same composition, diseases and weed free, light in weight and porous (Nowak and Strojny, 2004) with low salt content, good water-holding capacity, ion exchange capacity and near neutral pH (Singh *et al*., 2019). So keeping in view, an attempt has been made to study the performance of different substrates on growth, flowering and economics of anthurium.

**Materials and Methods**

A pot experiment was conducted in the Floriculture Shade Net House under Horticulture Research Centre of Bangladesh Agricultural Research Institute, Gazipur during 2021-22 with four different substrates. Six weeks old hardened tissue cultured anthurium plantlets of BARI Anthurium-1 were used as planting material. Ten inches plastic pots were taken for the experiment. Four different potting substrates like soil, cocodust, perlite and sawdust were used as six treatment combinations. The treatment combinations were T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + perlite (1:1), and T6: Cocodust + sawdust (1:1). The experiment was laid out following Completely Randomized Design (CRD) with five replications. Before setting of the experiment the chemical composition of potting substrates were analyzed following standard method as outlined by Page *et al.* (1982). The chemical properties are presented in Table 1 and Table 2. Well- decomposed saw dust, perlite and cocodust were used singly and combined before 25 days of seedling transplanting. The seedlings of anthurium were transplanted singly in the respective treatment pot on 20 January 2020. The anthurium plants were nourished with Cooper’s nutrient solution having EC of 1.5 dS/m throughout the growing period. Irrigation/water was applied as and when required. Data on survivability %, plant height, number of leaves, plant spread, sucker number, days to flowering, flower number, stalk length, flower weight, vase life and flowering duration were recorded from five randomly selected plants of each treatment and averaged. Treatment wise post-harvest potting substrates were analyzed following same method (Page *et al*., 1982). Data were statistically analyzed with the help of MSTAT software. Difference between treatments means were compared by Duncan’s Multiple Range Test (DMRT) according to Steel *et.al*, (1997). The benefit cost ratio (BCR) was calculated for each treatment pot. Total variable costs were calculated by adding the cost incurred for labor and inputs for each treatment. Flower stick and sucker of anthurium was utilized to calculate gross return. Shadow prices (sucker and others) were not considered. Gross return was estimated by multiplying following flower stick and sucker yield by unit price (farm gate) of anthrium flower and sucker. Net return was calculated by subtracting variable cost from gross return.

**Table 1. Chemical properties of different potting substrates (initial)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Materials | pH | OM (%) | Ca | Mg | K | Total N (%) | P | S | B | Cu | Fe | Mn | Zn |
| (meq/100g) | | | (µg/g) | | | | | | |
| Cocodust | 7.5 | 28 | 1.1 | 0.3 | 1.5 | 1.65 | 1.0 | 2.0 | 0.015 | 0.005 | 0.80 | 0.020 | 0.012 |
| Perlite | 7.4 | 25 | 0.9 | 0.3 | 1.2 | 1.60 | 0.8 | 1.8 | 0.010 | 0.004 | 0.40 | 0.090 | 0.010 |
| Sawdust | 6.6 | 20 | 0.8 | 0.2 | 1.1 | 1.40 | 0.5 | 1.6 | 0.004 | 0.001 | 0.20 | 0.005 | 0.008 |

**Table 2. Chemical properties of initial soil (potting substrate)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Materials | pH | OM (%) | Ca | Mg | K | Total N (%) | P | S | B | Cu | Fe | Mn | Zn |
| (meq/100g) | | | (µg/g) | | | | | | |
| Soil (Sandy loam) | 7.2 | 0.50 | 13.0 | 3.0 | 0.20 | 0.03 | 11.0 | 10.0 | 0.18 | 1.10 | 20.0 | 17.0 | 0.90 |
| \*Critical level | - | - | 2.0 | 0.5 | 0.12 | 0.10 | 8.0 | 8.0 | 0.16 | 0.20 | 3.0 | 1.0 | 0.50 |

\*FRG (2018)

**Results and Discussion**

**Effect of substrates on survivability and growth parameters of anthurium**

Different potting substrates affected the percent survival of anthurium plantlets (Figure 1). Among different treatments, T5 (cocodust + perlite @ of 1:1) showed 100% survivability of the plants followed by T2 (only cocodust) with 90% survivability. The reason for the best performance might be due to cocodust with the perlite is having the higher organic matter content, which increased water holding capacity and nutrient availability for easy uptake by the plant. The lowest survivability percentage (70%) was noted from T1 (only soil) treatment. Similar observation was reported by Sharifuzzaman *et al.* (2010) in euphorbia house plant.

**Figure 1. Effect of potting substrates on survivability of anthurium**

Error bars represent the standard error, Note: T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + perlite (1:1), and T6: Cocodust + Sawdust (1:1).

Data on the plant height from Table 3 exhibited that the tallest plant (52.0 cm) was measured in the treatment T5 (cocodust + perlite) which was statistically similar with most of the treatments. The shortest plant (45.0 cm) was in T1 treatment. Most of the potting substrates especially cocodust (T2) and cocodust + perlite (T5) contained more organic matter in decomposed form which release essential plant nutrient particularly nitrogen that accelerated the plant growth. Meyer and Anderson (2003) reported that nitrogen enhances cell division and formation of more plant tissues resulting in luxuriant vegetative growth and thereby increased plant height. The number of leaves per plant was significantly influenced by different potting substrates/media (Table 3). Maximum number of leaves per plant (8.00) was recorded from substrate amended with cocodust (T2) comparable with most of the treatment. The increase in number of leaves per plant might be due to cocodust enabled better aeration, moisture holding capacity and nutrient retention (Khan *et al*., 2019). However, adequate number of leaves is essential for normal plant growth and production. Similar result was reported by Sindhu *et al.* (2010) in gerbera. The substrate amended only with soil (T1) recorded the minimum number of leaves per plant (4.5). The result revealed that there was a significant difference in plant spread among the treatments (Table 3). Maximum plant spread (30.5 cm) was observed in T2 which was statistically identical to T5, T3 and T6 treatment. Minimum plant spread (20.9 cm) was observed in T1 (only soil) treatment. The highest number of suckers per plant (4.8) was found in T5 treatment which was statistically similar with most of the treatments and the lowest (2.5) was in T1 treatment. Saha *et al.* (2018) also reported that perlite and cocodust (1:1) (T5) and cocodust (100%) (T2) contain higher amount of plant nutrient and have potential for restoration of soil fertility resulting increase number of suckers per plant. This finding is in agreement with the findings of Thangam *et al.* (2009) who obtained that maximum number of suckers in gerbera, when the potting substrate was cocodust + perlite.

**Table 3. Effect of potting substrates on growth parameters of anthurium**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatments | Plant height (cm) | Number of leaves/plant | Plant spread (cm) | Number of sucker/plant |
| T1 | 45.0b | 4.50b | 20.9 c | 2.50b |
| T2 | 50.0ab | 8.00a | 30.5 a | 4.00ab |
| T3 | 49.0ab | 6.50ab | 27.9ab | 3.50ab |
| T4 | 48.8ab | 6.00ab | 25.7 b | 3.30ab |
| T5 | 52.0a | 6.70ab | 30.0 a | 4.80a |
| T6 | 49.0ab | 6.00ab | 27.2 ab | 3.40ab |
| CV % | 5.9 | 6.9 | 7.5 | 8.7 |

Means within the same column with a common letter do not differ significantly (P≤0.05)

T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + Perlite (1:1, v/v), and T6: Cocodust + Sawdust (1:1, v/v)

**Effect of substrates on flower parameters of anthurium**

Variation was observed regarding the number of flowers per plant (Figure 2). The number of flowers per plant varied from 4.0-8.0 across the treatments. Flowering is a complex process in plant’s life for which the plants require essential nutrients from optimum and suitable substrate for growth and produce higher number of flowers. The highest number of flowers per plant (8.0) was recorded from T5 followed by T2 (6.0) treatment. Plants of the treatment T1 produced the lowest number of flowers (7.0) (Figure 2). Maximum number of flowers was also obtained using cocodust alone or cocodust with perlite reported by Pivot (1989) in gerbera. Considering the chemical properties of different potting substrates, T5 (cocodust + perlite) and T2 (cocodust) provided higher amount of N, P, K, B and Zn nutrient (Table 2). This is in line with the findings of Ahmad *et al*., (2012) and Keshev and Dubey, (2008) in gerbera and anthurium production.

**Figure 2. Effect of potting substrates on number of flowers per plant in anthurium**

Error bars represent the standard error, Note: T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + Perlite (1:1), and T6: Cocodust + Sawdust (1:1).

Days to flowering were significantly affected by different potting substrates (Table 4). Plants took more time (74.0 days) for flowering in T1 treatment where the nutrients availability was restricted i.e. T1 (only soil). On the other hand, plants grown in nutrient enriched media took less time for flowering that means 64.0 and 65.0 days for flowering in T2 (cocodust) and T5 (cocodust + perlite), respectively. Present results are in agreement with the findings of Ahmad *et al.* (2012) where the mixture of cocodust + perlite and cocodust singly resulted early flowering in gerbera. Stalk length of anthurium influenced significantly by different potting substrates (Table 4). The treatment T5 produced the longest stalk (25.0 cm) which was followed by T2, T3 and T4 treatment and shortest stalk was observed from T1 followed by T6 treatment (Table 4). Ahmed *et al.* (2012) reported similar that the longer flower stalks of rose were achieved in the substrate combination of perlite with coco fiber. The media cocodust singly or along with perlite had more phosphorus content which was facilitated to produce longer and thicker stalks of anthurium as compared to other treatments. Phosphorus is the key nutrient involved in stimulating and enhancing the bud development and blooming (Ji Kim and Li, 2016). The mentioned findings also confirmed by the findings of Meyer and Anderson (2003) who observed that thick flower stalks of gladiolus and lily grown in nutrient rich various media like cocodust along with perlite. Significant variation was observed in respect of stalk weight among the substrates (Table 4). The highest stalk weight (27.0g) was recorded from the treatment T5 which was statistically similar with T2 (25.0g) treatment. The lowest stalk weight (16.0 g) was from T1 treatment. More or less similar results were reported by Pivot (1989) in gerbera. The parameter vase life is related to post-harvest handling of cut flowers. This is one of the most important commercial aspects of anthurium production. The longer vase life (20.0 days) was found from the plants grown in T5 (cocodust + perlite) comparable with most of the treatments. The shorter (14.0 days) vase life was recorded from the plants grown in T1 (soil). Ahmad *et al.* (2012) also reported similar results who stating that the combination of cocodust + perlite had eventually increased the vase life of gerbera flower.

**Table 4. Effect of different potting substrates on flower parameters of anthurium**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatments | Days to flowering | Stalk length (cm) | Stalk weight (g) | Vase life (days) |
| T1 | 74.0a | 19.8b | 16.0 c | 14.0 b |
| T2 | 64.0c | 23.7 ab | 25.0 ab | 17.8 ab |
| T3 | 68.0bc | 23.0 ab | 18.8 bc | 15.8 ab |
| T4 | 70.0b | 22.0 ab | 17.5 bc | 15.5 ab |
| T5 | 65.0c | 25.0 a | 27.0 a | 20.0 a |
| T6 | 70.0b | 20.0 b | 22.0 b | 15.9ab |
| CV % | 8.1 | 6.9 | 7.8 | 7.6 |

Means within the same column with a common letter do not differ significantly (P≤0.05)

Note: T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + Perlite (1:1, v/v) and T6: Cocodust + Sawdust (1:1, v/v)

Maximum flowering duration of anthurium of 28 days was observed in cocodust with perlite media (T5) followed by 25 days of flowering duration in substrate containing cocodust singly (T2). Dutta *et al.* (2002) obtained similar results in gerbera where higher duration from full bloom to flower deterioration was observed in plants grown in cocodust substrate. The increased flowering duration might be attributed to helpful conditions in the substrate T2 and T5. The minimum flowering duration of 23 days was recorded in T1 (soil).

**Figure 1. Effect of potting substrates on flowering duration (days) of anthurium**

Error bars represent the standard error,

Note: T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + Perlite (1:1), and T6: Cocodust + Sawdust (1:1).

**Nutrient status in post-harvest potting substrates**

Most of the nutrients showed variation among the treatments (Table 5). The highest OM (9.80%) was obtained from T5 followed by T2 treatment and lowest organic matter from T1 treatment. Total N content was highest (0.45%) in T2 treatment followed by T5 treatment. Table 5 indicated that most of the nutrient content exhibited comparatively higher in cocodust alone (T2) or cocodust+perlite (1:1) (T5) treatment than the other treatments (Table 5).

**Table 5. Nutrient status in post-harvest potting substrates**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Treatments | pH | OM (%) | Ca | Mg | K | Total  N (%) | P | S | B | Cu | Fe | Mn | Zn |
| (meq/100g) | | | (µg/g) | | | | | | |
| T1 | 7.7 | 0.45 | 12.0 | 3.2 | 0.15 | 0.024 | 10.5 | 12.0 | 0.015 | 1.0 | 19 | 17 | 2.0 |
| T2 | 7.0 | 9.75 | 10.5 | 2.5 | 0.38 | 0.450 | 14.3 | 15.0 | 0.070 | 1.2 | 30 | 12 | 2.3 |
| T3 | 7.6 | 8.00 | 10.0 | 2.3 | 0.28 | 0.250 | 13.0 | 13.0 | 0.050 | 1.8 | 36 | 13 | 2.4 |
| T4 | 7.8 | 5.50 | 8.5 | 2.0 | 0.26 | 0.035 | 12.5 | 12.5 | 0.023 | 1.7 | 40 | 25 | 2.3 |
| T5 | 7.2 | 9.80 | 10.8 | 2.6 | 0.35 | 0.400 | 14.0 | 15.2 | 0.075 | 1.3 | 35 | 14 | 2.5 |
| T6 | 7.7 | 6.10 | 9.0 | 2.5 | 0.25 | 0.010 | 13.0 | 13.0 | 0.030 | 0.7 | 48 | 25 | 2.3 |

Note: T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + Perlite (1:1, v/v), T6: Cocodust+Sawdust (1:1, v/v)

**Effect of potting substrates on cost and return analysis**

Application of different substrates in pot had a positive impact on gross return of anthurium (Table 6). The highest increase of gross return and margin were from application of cocodust with perlite (T5) in pot. Both were the lowest from T1 treatment. The calculated benefit cost ratio (BCR) was the highest (2.36) in T5 treatment.

**Table 6. Effect of different potting substrates on partial economics of anthurium**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatments | \*TVC (BDT/pot/yr.) | Gross return (BDT/pot/yr.) | Gross margin (BDT/pot/yr.) | BCR |
| T1 | 1533 | 1900 | 367 | 1.24 |
| T2 | 1540 | 3000 | 1460 | 1.95 |
| T3 | 1545 | 2600 | 1055 | 1.68 |
| T4 | 1540 | 2380 | 840 | 1.54 |
| T5 | 1543 | 3680 | 2137 | 2.38 |
| T6 | 1540 | 2540 | 1000 | 1.65 |

Note: T1: Soil (control), T2: Cocodust, T3: Perlite, T4: Sawdust, T5: Cocodust + Perlite (1:1, v/v) and T6: Cocodust + Sawdust (1:1, v/v)

Inputs price: Plastic pot= BDT 30/pot, Sandy loam soil= BDT 3/pot, Wage rate= BDT 100/hour, Autostin= BDT 160/100g, Ripcord=BDT 130/100ml, Output price: Flower stick=BDT 100/stick, Sucker= BDT 400/sucker, TVC= Total variable cost, BDT is Bangladesh currency.

**Conclusion**

All the substrates used in the present experiment, cocodust + perlite (1:1) was the best and suitable potting substrate followed by cocodust (100%) on the basis of growth, yield, economics and flower parameters of anthurium. So, the result suggests that perlite + cocodust (1:1 ratio) followed by cocodust (100%) could be used for flower yield maximization and quality improvement of anthurium in pot cultivation. This finding can support the urban people and commercial entrepreneurs for successfully cultivation of anthurium.

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**EFFECT OF DIFFERENT POTTING MEDIA ON PLANT GROWTH AND YIELD OF GROUND ORCHID**

M. T. RASHID, K. A. ARA, F. N. KHAN, K. AMBIA, A. NAZNIN AND M. M. R. BHUIYIN

**Abstract**

*The present investigation entitled effect of different potting media on plant growth and yield of ground orchid under shade net conditions was carried out at Floriculture field of Horticulture Research Centre, Bangladesh Agricultural Research Institute during 2021-22. The experiment was laid out in a completely randomized design with 6 treatments and each treatment replicated thrice. The data recorded on various parameters viz., plant height, leave number, leaf area, shoot girth, spike length, rachis length, spike weight, floret number, spike yield, vase life, flowering duration and were statistically analyzed. Significant differences were observed among different potting media on various parameters in ground orchids CV. Spathogottis Orchids. Among all the treatments, T5- Cocodust + Sphagnum moss (1:1) showed significantly the best results with respect to plant height (60.5 cm), number of leaves (9.5), leaf area (40.0 cm), number of shoots (5.0), spike length (45.0 cm), rachis length (30.0 cm) number of florets (14.0), spike yield (5.0), flowering duration (20.0 days) and vase life (15.8 days).*

**Introduction**

Orchids are the most beautiful flowers in God’s creation and have conquered the cut flower industry all over the world during the last few decades (Bose and Bhattacharjee, 2018). Spathoglottis species are ground orchids and are from subtropical regions and is a popular genus valued for cut flower production and as potted plant in commercial floriculture owing to wide range of colours, shapes, sizes and fragrance they display. They are also suitable for interior decoration and remain fresh for many days (Rajeveen *et al.,* 2008).

At present cultivation of orchids, particularly Spathoglottis orchid hybrids is gaining momentum in Bangladesh. Despite of having diversified climate, it has got an excellent market potential in our Floriculture industry (Rahman *et al*., 2017) due to cheap labour and progressive farming technology. The orchid industry is still in an infant stage for commercial cultivation. An ideal growing media facilitates proper aeration, adequate drainage and good anchorage to the plant and should provide healthy environment for roots (Savithri and Khan, 1994). It should be inert, porous and resistant to organic decomposition. It should be cheap, retard disease and pathogenic factors, keep the plant free from rotting and provide a bit of nutrient, eco-friendly and readily available (Saravanan, 2011; Bhattachajee, 2015). Therefore, the present study was aimed to investigate the effect of potting media on growth and yield of ground orchid.

**Material and Methods**

The present study was conducted at the Orchidarium of Floriculture field, in a Shade Net House of Bangladesh Agricultural Research Institute during 2021-22. Two months old tissue cultured plants of Ground orchid CV. *Spathoglottis plicata* were used as planting material for conducting experiment. Planting was taken up in plastic pots of size 10 cm diameter. Orchids require a suitable potting medium for growth and development and it varies with type of orchid and the environmental conditions (Chowdhery, 2011). This orchids were grown in different pots containing different potting media i.e. T1- Garden soil (control), T2 - Cocodust , T3 - Sphagnum moss , T4 - Perlite, T5 - Coco dust + Sphagnum moss (1:1, v/v) and T6 - Coco dust + perlite (1:1, v/v). After planting, the potting media were immediately irrigated thoroughly to maintain the optimum moisture condition. During vegetative phase N, P2O5 and K2O at the ratio of 3:1:1 and during blooming phase at the ratio of 1:2:2 (0.2% concentration) were provided weekly once. Nutrient combinations were made using ammonium nitrate, orthophosphoric acid and potassium nitrate.

The commercially available water soluble fertilizers (19-19-19, 13-0-45) of different grades were also used as source for nutrients. Micronutrients were sprayed monthly once. Calcium nitrate and Magnesium sulphate @ 0.1% was given once in a month. Completely Randomized Design was set with three replications having five plants in each replication and each replication contains six different treatments. The data recorded at 150 DAP on various parameters viz. Plant height, leave number, leaf area, shoot girth, spike length, rachis length, spike weight, floret number, spike yield, vase life, flowering duration and were statistically analyzed through analysis variance with the help of MSTAT software. Difference between treatments means were compared by Duncan’s Multiple Range Test (DMRT) according to Steel *et al.,* (1997).

**Results and Discussion**

**Plant height**

The data pertaining to the effect of different potting media on plant height of ground orchid CV. *Spathogloltis plicata* is presented in Table 1. Among all the treatments T5 - Coco dust + Sphagnum moss (1:1, v/v) has recorded significantly the maximum plant height (60.5 cm) while, T1- garden soil recorded significantly the minimum plant height (50.0 cm). ). It was also conformity by of Gufran. and Saravanan (2014) in orchid and Barman *et al.,* (2006) in rose.

**Number of leaves per plant**

The data pertaining to the effect of different potting media on number of leaves per plant of ground orchid CV. *Spathoglottis plicata* is presented in Table 1. Among all the treatments the maximum number of leaves per plant was noted with T5 - Coco dust + Sphagnum moss (1:1, v/v) (9.5). The minimum number of leaves per plant was observed in T1- garden soil (6.0). Similar results were obtained by Jawaharlal *et al.,* (2019) in anthurium, Bhatia *et al*., (2004) in carnation and Jagtap (2006) in gerbera.

**Leaf area (cm2)**

Regarding leaf area, a highly significant variation was also noted as influenced by different potting media (Table 1). From the Table 1, it was observed that leaf area gradually increased with the increment of time and it was found maximum in Table 1 (40.0 cm) at 150 DAP in T5 followed by T6 (38.0 cm2). On the other hand, the narrowest leaf (31.0 cm2) was produced in T1 at 150 DAP. Similar trend was of using potting also found in leaf area by Puchooa (2004) in Dendrobium orchids. Different potting media at different DAP. The maximum leaf area in T5 treatment might be associated with availability of essential nutrients especially nitrogen released from Cocodust and Sphagnum moss.

**Number of shoots**

A noticeable variation was found in number of shoots per plant by different potting media (Table 1). Among the potting media, the maximum shoots per plant (5.0) were produced in T5 which was statistically similar with that of T6 (4.9). Whereas, the minimum shoots per plant was obtained from T1 (2.5). Similar trend was also observed in number of shoots per plant by different potting media at different DAP. It might be due to organic materials such as Cocodust and Sphagnum moss maintain the desirable water holding capacity, aeration by preventing the crusting and compaction of the potted soil and also released available nutrients which enhanced the production of new shoots from the mother sucker.

**Table 1: Effect of potting media on vegetative characteristics of ground orchid**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Potting media** | **Plant height (cm)** | **No. of leaves** | **No. of shoot** | **Leaf area (cm2)** | **Shoot girth (cm)** |
| T1 | 50.0 c | 6.0 b | 2.5 b | 31.0 c | 1.5 b |
| T2 | 53.0 bc | 7.0 ab | 3.0 ab | 33.0 bc | 2.1 ab |
| T3 | 56.7 ab | 8.0 ab | 4.0 ab | 37.0 ab | 2.1 ab |
| T4 | 55.0 b | 7.5 ab | 3.8 ab | 35.3 b | 2.1 ab |
| T5 | 60.5 a | 9.5 a | 5.0 a | 40.0 a | 2.6 a |
| T6 | 58.0 ab | 8.3 ab | 4.2 ab | 37.5 ab | 2.2 ab |
| **CV%** | **9.2** | **8.3** | **7.5** | **8.1** | **6.0** |

T1- Garden soil (control), T2 - Coco dust, T3 - Sphagnum moss , T4 - Perlite, T5 - Coco dust + Sphagnum moss (1:1, v/v) and T6 - Coco dust + perlite (1:1, v/v)

**Shoot girth**

Different potting media showed significant girth in shoot of plants (Table 1). From Table 1, it can be revealed that the maximum shoot girth (2.7 cm) was produced by the plants grown in T5. On the other hand, the minimum shoot girth (1.5 cm) was obtained from plants grown in T1. These results are in agreement with Rajeveen *et al.* (2008) that maximum shoot girth in orchid was obtained, when a potting substrate containing Coco dust + Sphagnum moss (1:1) was used.

**Spike length**

The data pertaining to the effect of different potting media on spike length of ground Orchid CV. *Spathoglottis plicata* is presented in Table 1. Plant grown in a mixture of Coco dust + Sphagnum moss (1:1) (T5) has recorded significantly the maximum spike length (45.0 cm) while, plant grown in garden soil (T1) recorded significantly the minimum spike length (34.0 cm). The plants grown in the media containing Coconut husk chips + sphagnum moss + vermicompost + farmyard manure (1:1:1:1) (T5) registered maximum spike length of plant which might be due to improved photosynthetic efficiency and higher carbohydrate accumulation in plants.

**Floret number per spike**

Maximum numbers of florets per spike (14.0) were produced in treatment T5 containingthe growing media with Coco dust + Sphagnum moss (1:1). This might be due to the fact that the media is not compact, provided good aeration and allowed free growth of roots which resulted in increase of number of florets. Similarly, Paul and Rajeevan (2009) found that a combination of Sphagnum moss + brick pieces and cocodust gave the maximum number of floret in Dendrobium orchids. The minimum number of florets (10.0) was produced in T1 - Garden soil might be due to the fact that garden soil contains low amounts of nutrients which resulted in poor florets number per spike.

**Table 2: Effect of potting media on floral characteristics of ground orchid**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Potting media** | **Spike length (cm)** | **Rachis length (cm)** | **Floret number/ spike** | **Yield of spike/plant** | **Flowering duration (days)** | **Vase life (days)** |
| T1 | 34.0 c | 21.0 c | 10.0 b | 2.0 b | 14.0b | 10.0 b |
| T2 | 36.0 bc | 23.6 bc | 12.0 ab | 3.5 ab | 16.4 ab | 13.0 ab |
| T3 | 37.2 bc | 25.5 b | 12.0 ab | 3.7 ab | 17.0 ab | 14.0 ab |
| T4 | 40.0 b | 26.8 ab | 12.5 ab | 4.0 ab | 17.8 ab | 14.2 ab |
| T5 | 45.0 a | 30.0 a | 14.0 a | 5.0 a | 20.0 a | 15.8 a |
| T6 | 43.0 ab | 27.3 ab | 13.0 ab | 4.3 ab | 18.5 ab | 15.0 ab |
| **CV%** | **8.0** | **9.0** | **7.8** | **6.7** | **6.9** | **7.1** |

T1- Garden soil (control), T2 - Coco dust, T3 - Sphagnum moss , T4 - Perlite, T5 - Coco dust + Sphagnum moss (1:1, v/v) and T6 - Coco dust + perlite (1:1, v/v)

**Yield of spikes per plant per year**

The data pertaining to the effect of different potting media on number of spikes per plant of ground orchid CV. *Spathoglottis plicata* is presented in Table 2. Number of spikes per plant differed significantly for different potting media. T5 had marked influence on number of spikes per plant and among all the treatments, T5 - Coco dust + Sphagnum moss (1:1) has recorded significantly the maximum number of spikes per plant (5.0) while T1 (garden soil) recorded significantly the minimum number of spikes per plant (2.0). Cocodust has been reported to contain some amount of major, secondary and micronutrients (Saravanar *et al.,* 2011), free from any admixture of heavy metals and due to higher porosity, adequate nutrient availability and lower pH and EC in the media enhanced plant growth and flower yield. The lowest number of spikes was recorded in garden soil media (T1) might be due to the fact that garden soil contains low nitrogen and phosphorus resulting in poor root and vegetative growth that ultimately affected the reproductive growth and thus produced lesser number of spikes per plant.

**Flowering duration**

The data pertaining to the effect of different potting media on flowering duration of ground orchid CV. *Spathoglottis plicata* is presented in Table 2. Significant differences were reported in longevity of spike on plant with different potting media in ground orchid CV. *Spathoglottis plicata*. Among all the treatments, Coco dust + Sphagnum moss (1:1) has recorded significantly the maximum longevity of spike on plant (20.0) further, garden soil noticed significantly the minimum longevity of spike on plant (14.0).

**Vase life**

The data pertaining to the effect of different potting media on vase life of ground orchid CV. *Spathoglottis plicata* is presented in Table 2. Significant differences were observed in vase life with different potting media in ground orchid CV. *Spathoglottis plicata*. Tabulated data clearly indicated that significantly the maximum vase life was recorded when plants grown in potting media combination of Coco dust + Sphagnum moss (1:1) (15.8 days) while, plants grown in potting media in ground soil recorded significantly the minimum vase life (12.0 days). The combination of Coco dust + Sphagnum moss (1:1) recorded maximum vase life which might be due to increase in internal carbohydrate content of the flowers which enhanced the vase life. Saha *et al*., (2018) also reported more or less similar results by stating that combination of Coco dust + Sphagnum moss (1:1) had eventually increased the vase life of ground orchid.

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**EFFECT OF SUBSTRATES ON THE GROWTH AND YIELD OF BARI CACTUS-1**

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**Abstract**

*An experiment was conducted to observe the effect of six kinds of potting media (T1 =100% Vermicompost, T2 =100% Soil, T3=100% Cocodust, T4=50% Soil + 50% Cocodust, T5=50% Cocodust+ 25% soil+ 25% Perlite, T6 = 50% Cocodust+ 25% Vermicompost+ 25% Perlite on* *BARI cactus-1during the year 2021-2022. Data on plant growth characters of BARI cactus-1like plant height, Plant diameter, number of roots, Root length, number of baby cactus,Number of spines etc. were recorded. Among the various potting media 50% Cocodust+ 25% Vermicompost+ 25% Perlite (T6) performed the best in respect of growth characteristics of BARI cactus-1. Contrasting to this, the soil medium (T2) alone performed poor result*.

**Introduction**

BARI Cactus-1 (*Mammillaria beneckei*) belongs to family Cactaceae is a popular Cactus of commercial importance. It is green cactus, forms a mound of tiny heads, which are densely covered in creamy spines. It thrives well when grown as a grafted plant. In recent years, demand of Mammillaria cactus as pot plant for house and office decoration and for use in amenity in Bangladesh floriculture has steadily increased. Mammillaria has been considered as member one among the major pot crops of cactus. Being unique in beauty, size and colour of stem and flower are the reasons for its increasing demand in Bangladesh and worldwide too. BARI has been conducted research for evaluating different Cactus lines collected from different sources. Therefore, BARI Cactus-1 has been developed through selection which was evaluated at different agroecological zones of Bangladesh with respect to growth, yield, colour and quality. However, no efforts were made in Bangladesh in the past to identify suitable potting media forMammillaria. Taking this aspect into consideration, six different potting media were tested to identify best performing ones for its successful cultivation.Mammillaria needs optimum media for their proper growth and yield. Perlite and cocodust has been reported to be good substrates for flower and ornamentals (Dutta *et al*., 2002). Growing in artificial substrates has many advantages over soil as mixes contain the same composition, diseases and weed free, light in weight and porus (Tomati*et al*., 2013) with low salt content, good water-holding capacity, ion exchange capacity and near neutral pH. However, no efforts were made in Bangladesh in the past to identify suitable potting media for Mammillaria. Taking this aspect into consideration, six different potting media were tested to identify best performing ones for its successful cultivation.

**Materials and Methods**

The present investigation was carried out at Regional Agricultural Research Station, Jamalpur during the period from 2021-2022. The basic substrates were Soil, cocodust, perlite, Vermicompost and soil which were used singly and in combinations. All the mixtures were made on v/v basis. Liquid fertilizer was applied for getting best growth. The experiment was laid out in RCB design with 3 replications. Data on different parameters like survivability %, plant height, number of leaves, leaf size, number of roots, plant spread etc. were recorded. All data were analyzed statistically.

**Results and Discussion**

The effect of different potting media on morphological character of Mammillariawas investigated in this study. The findings of the present study presented in Table (1) and Figure (1) have been discussed in the following heading:

**Plant height**

Significant variation was observed among the treatments for plant height (Table 1). It varied from 5.31 to 9.66 cm. The treatment T6 (50% Cocodust+ 25% Vermicompost+ 25% Perlite) had the tallest plant (9.66 cm) followed by T5 (50% Cocodust+ 25% soil+ 25% Perlite) (8.33) T3 (100% Cocodust) (7.88 cm), T1 (100% Vermicompost) (7.66 cm) and T4 (50% Soil + 50% Cocodust) (5.33 cm) respectively. The height of plant was found minimum in T2 (100% Soil) (5.31 cm). The results are in more or less close conformity with findings of Tomati*et al*., (2013).

**Plant spread**

The number of leaves produced in different treatments varied significantly and ranged from (22.66 -30.33). The treatment T6 was the superior and produced the highest number of leaves per plant (30.33) followed by T5 (28.36). An increase in plant spread causes the accumulation of greater photosynthates leading to better growth parameters. The treatment T2 produced the lowest spread (22.66).

Table 1: Effect of potting media on some morphological characteristics of BARI cactus-1

| Treatments | Plant height (cm) | Plant spread (cm) | | No. of root | Root length  (cm) | Number  of baby cactus/plant | Number of spine/  plant |
| --- | --- | --- | --- | --- | --- | --- | --- |
| T1 | 7.66 c | | 23.02 c | 21.33 b | 4.85 e | 1.00 | 11.23 c |
| T2 | 5.31 d | | 22.66 c | 19.63 c | 3.06 f | 0.00 | 9.63 d |
| T3 | 7.88 c | | 27.66 b | 24.56 b | 6.45 c | 1.00 | 11.33 c |
| T4 | 5.33 d | | 23.33 c | 23.36 c | 5.12 d | 1.00 | 12.56 b |
| T5 | 8.33 b | | 28.36 b | 25.66 b | 7.33 b | 1.00 | 14.60a |
| T6 | 9.66 a | | 30.33 a | 32.62 a | 9.66 a | 2.00 | 14.66 a |
| CV (%) | 2.56 | | 3.64 | 5.89 | 11.24 | 66.32 | 5.36 |
| LS | \*\* | | \* | \*\* | \*\* | NS | \*\* |

Note: NS: Not Significant \* indicates significant at 5% level of probability; \*\* indicate significant at 1% level of probability.

(T1 =100% Vermicompost, T2 =100% Soil, T3=100% Cocodust, T4=50% Soil + 50% Cocodust,

T5=50% Cocodust+ 25% soil+ 25% Perlite, T6 = 50% Cocodust+ 25% Vermicompost+ 25% Perlite)

**Number of roots**

The difference in number of roots among the treatments was observed to be statistically significant. The maximum number of root (32.62 cm) was recorded in treatment T6 while the minimum was in T2 (19.63cm).

Figure 2. Number of Mammillaria root growth as influenced by different potting media

(T1 =100% Vermicompost, T2 =100% Soil, T3=100% Cocodust, T4=50% Soil + 50% Cocodust, T5=50% Cocodust+ 25% soil+ 25% Perlite, T6 = 50% Cocodust+ 25% Vermicompost+ 25% Perlite)

**Root length**

The root length in different treatments varied significantly and ranged from (3.06 to 9.66cm). The maximum root length found (9.66 cm) was recorded in treatment T6 while the minimum was in T2 (3.06cm).

**Number of baby cactus/plant**

The baby cactus was observed some plant. It varied from 1 to2 number. The highest baby cactus was recorded from the treatment T6 (2.00) followed by treatment T5, T4, T3, T1 (1.00). The number of cacti was not found in T2 (0.0). The increased number of baby cactus could be attributed to conducive conditions in the media and higher nutrient uptake and utilization in plant grown.

**Number of spines/plant**

The number of spines/plant was quite variable in different treatments. The maximum number of spine (14.66) was observed in T6 treatment and lowest number of spine (9.63) was observed in T2 treatment.

**Conclusion**

The treatment T6 (50% Cocodust+ 25% Vermicompost+ 25% Perlite) was found to be the best media in respect of growth and yield characteristics of BARI Cactus-1.

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**EFFECT OF SUBSTRATES ON THE GROWTH AND YIELD OF CRYPTANTHUS**

R SULTANA, F.N.Khan, M A HOSSAIN, H RAHMAN, A AKTER AND H E M KHAIRUL MAZED

**Abstract**

*An experiment was conducted to observe the effect of seven kinds potting media (T1 =50% Soil + 50% Cocodust, T2 =50% Cocodust+ 50% Perlite, T3=50% Cocodust+ 50% Vermicompost, T4=100% Cocodust, T5=100% Vermicompost, T6 =100% Soil on Cryptanthus during the year 2021-2022. Data on plant growth characters like plant height, number of leaves, leaf size, plant spread, number of suckers, survivability % etc. were recorded. Among the various potting media, 50% cocodust + 50% Vermicompost (T3) performed the best in respect of growth characteristics ofCryptanthus. Contrasting to this, the soil medium (T6) alone performed poor result*.

**Introduction**

CryptanthusBivittatus is a member of the Bromeliaceaefamily native to Madagascar and has pink leave with reddish edges which is very much lucrative as indoor plant. Moreover, these plants are easy to grow and highly profitable crop. Recently, it has been introduced in Bangladesh and gaining its demand at home and abroad. Cryptanthus needs optimum media for their proper growth and yield. Perlite and cocodust has been reported to be good substrates for flower and ornamentals (Dutta *et al*., 2002). Growing in artificial substrates has many advantages over soil as mixes contain the same composition, diseases and weed free, light in weight and porus with low salt content, good water-holding capacity, ion exchange capacity and near neutral pH. However, no efforts were made in Bangladesh in the past to identify suitable potting media forCryptanthus.Taking this aspect into consideration, six different potting media were tested to identify best performing ones for its successful cultivation.

**Materials and Methods**

The present investigation was carried out at the Regional Agricultural Research Station, Jamalpur during the period from 2021-2022.The basic substrates were cocodust, perlite, Vermicompost and soil which were used singly and in combinations. All the mixtures were made on v/v basis. Liquid fertilizer was applied for getting best growth. The experiment was laid out in RCB design with 3 replications. Data on different parameters like plant height, number of leaves, leaf size, number of flower/plant, no. of baby succulent /plant, plant spread etc. were recorded. All data were analyzed statistically.

**Results and Discussion**

The effect of different potting media on morphological character ofCryptanthus was investigated in this study. The findings of the present study presented in Table (1) and Figure (1 and 2) and have been discussed in the following heading:

**Number of leaves**

The number of leaves produced in different treatments varied significantly and ranged from 16.33 to 22.67. The treatment T3 was the superior and produced the highest number of leaves per plant (22.67cm) followed by T2 (21.34). Adequate numbers of leaves are essential for normal growth and production. An increase in number of leaves causes the accumulation of greater photosynthates leading to better growth parameters. The treatment T1 produced the lowest number of leaves (16.33).

**Plant height**

Significant variation was observed among the treatments for plant height (Table 1). It varied from 5.30 to 7.40 cm. The treatment T3 had the tallest plant (7.40 cm) followed by T2 (7.36 cm). The height of plant was found minimum in T6 (5.30 cm). The results are in more or less close conformity with findings of Tomati*et al*., (2013).

Table 1. Effect of potting media on some morphological characteristics of Cryptanthus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatments | No. of leaves | Plant height | No. of root | Root length | Leaf length |
| T1 | 18.67 c | 5.40c | 20.33 c | 6.67 b | 5.33 b |
| T2 | 21.34 b | 7.36 a | 25.00 b | 8.10 a | 5.67 b |
| T3 | 22.67 a | 7.40 a | 37.33 a | 8.33 a | 6.33 a |
| T4 | 21.33 b | 6.33 b | 21.67 c | 7.00 a | 5.40 c |
| T5 | 21.33 b | 7.33 a | 14.67 d | 6.17 b | 4.67 d |
| T6 | 16.33 d | 5.30 c | 10.33 e | 5.97 b | 4.33 d |
| CV (%) | 2.36 | 5.63 | 4.63 | 8.63 | 7.41 |
| LS | \*\* | \* | \*\* | \*\* | \*\* |

Note: NS: Not Significant \* indicates significant at 5% level of probability; \*\* indicate significant at 1% level of probability

**Number of roots**

The number of roots produced in different treatments varied significantly and ranged from 10.33 to37.33. The treatment T3 was the superior and produced the highest number of roots per plant (37.33cm) followed by T2 (25.00). Adequate numbers of root are essential for normal growth and production. An increase in number of roots leading to better growth parameters. The treatment T6 produced the lowest number of leaves (10.33).

**Root length**

The root length produced in different treatments varied significantly and ranged from 5.97 to 8.33. The treatment T3 was the superior and produced the highest number of root length per plant (8.33cm) followed by T2 (8.10). The treatment T6 produced the lowest number of leaves (5.97).

**Leaf length**

The difference in leaf length among the treatments was observed to be statistically significant. The maximum leaf size (6.33 cm) was recorded in treatment T3 while the minimum was in T6 (4.33 cm).

Fig. 2. Number of Cryptanthus root growth as influenced by different potting media

(T1 =50% Soil + 50% Cocodust, T2 =50% Cocodust+ 50% Perlite, T3=50% Cocodust+ 50% Vermicompost, T4=100% Cocodust, T5=100% Vermicompost, T6 =100% Soil)

Table 2. Effect of potting media on some morphological characteristics of Cryptanthus (Continued)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatments | Leaf breadth | No. of flower/  plant | No. of baby succulent | 1st flower initiation (DAT) |
| T1 | 0.47 | 1.02 d | 1.00 | 182.67 a |
| T2 | 0.60 | 1.67 b | 1.33 | 177.67 b |
| T3 | 0.70 | 2.00 a | 1.67 | 176.33 b |
| T4 | 0.46 | 1.33 c | 0.67 | 181.33 a |
| T5 | 0.53 | 1.66 b | 0.33 | 183.67 a |
| T6 | 0.33 | 1.00 d | 0.00 | 186.33 a |
| LSD (0.05) | 1.22 | 0.11 | 2.11 | 6.33 |
| CV (%) | 9.52 | 4.26 | 5.36 | 7.12 |
| Significance | NS | \* | NS | \*\* |

Note: NS: Not Significant \* indicates significant at 5% level of probability; \*\* indicate significant at 1% level of probability

T1 = 100% soil, T2 = 100% perlite, T3 = 100% cocodust, T4 = 50% soil + 25% cowdung + 25% perlite,

T5 = 50% soil + 25% cowdung + 25% cocodust, T6 = 50% cocodust + 25% cowdung + 25% soil,

T7 = 50% perlite + 25% soil + 25% cowdung

**Leaf breadth**

The difference in leaf breadth among the treatments was observed to be statistically significant. The maximum leaf breadth (0.70 cm) was recorded in treatment T3 while the minimum was in T6 (0.33 cm).

**Number of flowers/plant**

The number offlower/plants was quite variable in different treatments. The maximum number of flower (2) was observed in T3 treatment. The increased flower number could be attributed to conducive conditions in the media and higher nutrient uptake and utilization in plant grown. In T6 and media lowest number of flowers was recorded in (01). Similar observation was also reported by Sharifuzzaman*et al.* (2010) and Wilson (1983) while working with different potting media in house plants.

**Number of baby succulent**

The difference number of baby cactus among the treatments was observed to be statistically significant. The maximumbaby succulent (1.67 cm) was recorded in treatment T3 while the minimum was in T6 (0.00 cm).

**1st flower initiation**

The 1st flower initiation was quite variable in different treatments. It depends on media conditions nutrient uptake and utilization in plant grown. The 1st flower initiation was observed in the treatment T6 (177 days) while the maximum days was required in T6 (187days).

**Conclusion**

The treatment T6 (50% cocodust + 25% cowdung + 25% soil) was found to be the best media in respect of growth and yield characteristics ofCryptanthus.

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**RESPONSE OF *SANSEVIERIA* SPP.TO ROOTING HORMONE IN PROPAGATING SUBSTRATES**

A. NAZNIN, K. AMBIA, M. M. R. BHUYIN, F. N. KHAN, K.A. ARA AND M. T. RASHID

**Abstract**

*A pot experiment was conducted at Floriculture Division of HRC, BARI to find out suitable natural rooting hormone and propagation media for Sansevieria cuttings. Combinations of propagation media were M1= cocodust+sand+cowdung (1:1:1), M2= sawdust+sand+cowdung (1:1:1), M3 =cocodust+sawdust+sand+cowdung (1:1:1:1) and the rooting hormones were R1= Honey, R2= coconut water, R3= IBA, R4= control (without hormone). Among the various treatments, combination of cocodust, sawdust, sand and cowdung with IBA rooting hormones enhanced early shoot emergence, better root formation, increased plant weight and height. This study provided the empirical evidence that rooting hormone and substrate combination influenced root development of Sanseveria spp.*

**Introduction**

*Sansevieria spp.* is a perennial herb found in dry tropical and subtropical parts of the world (Randall, 2012). It remains small which makes it ideal for indoor. Propagation of this species can be done by dividing the rootball, from offsets and from leaf cuttings. Leaf cutting is an easy and rapid method of propagation. Rooting hormone accelerates root initiation, increase the number and percentage of cutting rooted as well as quality of root produced by cutting. Although rooting hormones aid root formation however they are expensive and not readily available to the farmers. So, there is a need to conduct studies on local alternatives which is accessible and can be used by farmers as alternative means of stimulating cuttings to increase rooting percentage. Growing media is an important factor in plant propagation; the selection of the medium is highly important in terms of plant growth and quality because rooting performance depends on the type of medium used in propagation (Chadha, 2007; Mehmood, 2013). Different types of media like cocodust, sawdust, vermiculite, perlite, soil, etc. can be used as a growing media for *Sansevieria* propagation. The characteristics of ideal propagation medium for its successful growing should be porous with better aeration, well drained, good water holding capacity and cheap too. Therefore, standardization of a suitable propagation medium for *Sansevieria* cuttings is of utmost importance. Therefore, the current study aims to evaluate the influence of rooting hormone on leaf cuttings of *Sansevieria* spp. and also to find out the appropriate substrate for the propagation.

**Materials and Methods**

A pot experiment was carried out at the shade house of Floriculture Research Division, HRC, BARI, Gazipur during 2020-2021. Different combination of propagation media (3) was used as one factor and different rooting hormones (4) used as second factors. Tweleve different combinations of growing media and rooting hormones were used as treatments. Combinations of propagation media were M1= cocodust + sand + cowdung (1:1:1), M2 = sawdust + sand + cowdung (1:1:1), M3 = cocodust + sawdust + sand + cowdung (1:1:1:1) and the rooting hormones were R1= Honey, R2= coconut water, R3= IBA, R4= control (without hormone). Dwarf *Sansevieria* (*Sansevieria trifasciata)* was used as plant material. The experiment was laid out in a randomized complete design (CRD) with three replications. Each planted pot represented one replication and each pot consisted of five leaf cuttings. All rooting hormones were prepared just before the planting of cuttings. Honey was prepared by dissolving two table spoon honey (10ml) into same amount of cool boiled water and then the cutting end were soaked for 5 minutes. 100ml coconut water was taken and cutting end were directly soaked in it for five minutes then planted in the media. In case of IBA, 2.5g of IBA was taken, dissolved in ethanol first and 250ml of distilled water was added in it. Cuttings were dipped for one minute and then planted in propagation media. In case of control no hormones were used, cuttings were planted directly as it is. No chemical fertilizer was applied during the experiment. After six months of planting, plants were transplanted in individual pot containing common media used for succulents. The data on different growth parameters were recorded and statistically analyzed using analysis of variance (ANOVA) to check any differences between the means. The data was then subjected to Least significant differences (LSD) for the comparison of means at a 5% probability level.

**Results and Discussion**

**Effect of rooting hormone and growing media on growth parameters of *Sansevieria***

In case of main effect, all the parameters showed significant differences in different propagating substrate except survival (%) (Table 1). Early shoot emergence was observed in M3. Number of leaves (6.67), root length (9.31cm), fresh weight (30.5g) and plant height (14.82 cm) also found maximum in M3 *i.e.* combinations of all the substrates. This study has also revealed the importance of growing media in root development as earlier highlighted by several authors. Ikeda et al. (2001) stated that inorganic substrates enhanced growth and development of vegetables. The excellent performance of substrate combination (cocodust+sawdust+sand+cowdung) may be due to the presence of cocodust in the media combination. This result conforms with the finding of the following authors Böhme et al., (2008); Kobryń, (2002); Okunlola and Oyedokun (2016). The organic substrates will help increase water holding capacity and improve aeration while the inorganic substrates will provide required nutrients necessary for plant development. Findings from Gao et al. (2010) also confirmed this result.

On the other hand, rooting hormone did not produce any significant differences among the treatments in all the parameters studied except root length (Table 1). Maximum root length (9.62 cm) found in R3 which is significantly different from other treatments. Although rooting hormone did not produce any significant effect but better result was observed in R3 for all the parameters and control gave the poor performance than others.

Table 1. Efect of propagating substrates and rooting hormone on growth parameters of *Sansevieria*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Days to shoot emergence** | **Survival (%)** | **Number of leaves/ plants** | **Root length (cm)** | **Fresh weight (g)** | **Plant height (cm)** |
| **Propagation media** | | | | | |  |
| M1 | 64.75 a | 66.67 | 5 b | 7.73 b | 24.67 b | 11.78 b |
| M2 | 60.67 b | 78.33 | 5.5 b | 7.85 b | 25.58 b | 13.08 b |
| M3 | 52.08 c | 90 | 6.67 a | 9.31 a | 30.5 a | 14.82 a |
| Level of significance | \*\*\* | NS | \*\* | \* | \*\*\* | \*\* |
| **Rooting hormone** | | | | | |  |
| R1 | 58.89 | 80 a | 6.44 | 8.28 ab | 27.56 | 13.93 |
| R2 | 59.33 | 71.11 | 5.22 | 8.13 b | 24.67 | 12.8 |
| R3 | 58.56 | 93.33 | 6 | 9.62 a | 28.22 | 14.27 |
| R4 | 59.89 | 68.87 | 5.22 | 7.13 b | 27.22 | 11.89 |
| Level of significance | NS | NS | NS | \* | NS | NS |
| **CV (%)** | **3.71** | **32.35** | **19.34** | **17.32** | **11.55** | **15.27** |

Means with the same letter(s) are not significantly different

\*\* = Significant at 1% level of probability; \*= Significant at 5% level of probability, NS = Not Significant M1=cocodust+sand+cowdung (1:1:1), M2=sawdust+sand+cowdung (1:1:1), M3=cocodust+sawdust+sand+cowdung (1:1:1:1) R1= Honey, R2= coconut water, R3= IBA, R4= control (without hormone)

Considering, combined effect, significant effect was observed in case of days to shoot emergence, fresh weight and plant height (Table 2). Early shoot emergence was observed in M3 substrate with all the rooting hormone (R1, R2 and R3). Fresh wight found maximum in M3R3 (34.67g) followed by M3R2 (33g). Tallest plants were recorded in M3R3 (18cm) followed by M3R2 (14.9cm). Application of IBA with combined substrates stimulated early shoot emergence, improved fresh weight and plant height as compared to untreated control. IBA has been reported to markedly increase rooting and growth parameters in many species. This is in support with the study conducted by Okunlola and Oyedokun (2016); De Klerk et al. (1999).

Table 2. Combined effect of propagating substrates and rooting hormone on growth parameters of *Sansevieria*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Days to shoot emergence** | **Survival (%)** | **Number of leaves/ plants** | **Root length (cm)** | **Fresh weight (g)** | **Plant height (cm)** |
| M1 R1 | 64.67 ab | 60 | 4.33 | 7.73 | 25 de | 14.03 bc |
| M1 R2 | 63.67 abc | 46.67 | 7 | 7 | 26.33 cde | 12.93 bc |
| M1 R3 | 67 a | 66.67 | 5 | 6.50 | 28 bcd | 14.30 bc |
| M1R4 | 63.67 abc | 100 | 4.67 | 9.67 | 26.33 cde | 9.2 d |
| M2 R1 | 61.33 bcd | 86.67 | 5.67 | 7.77 | 26. 33 cde | 14.57 b |
| M2 R2 | 63.33 abc | 66.67 | 4.33 | 5.40 | 22.67 e | 11.83 bcd |
| M2 R3 | 58 de | 80 | 6 | 9.50 | 30.33 abc | 10.9 cd |
| M2 R4 | 60 cd | 80 | 6 | 8.70 | 23 de | 11 cd |
| M3 R1 | 50.67 f | 93.33 | 6.33 | 8.90 | 23.33 de | 13.2 bc |
| M3 R2 | 51 f | 100 | 7.33 | 9 | 33 ab | 14.9 ab |
| M3 R3 | 50.67 f | 60 | 7.33 | 10.50 | 34.67 a | 18 a |
| M3 R4 | 56 e | 100 | 4.67 | 8.83 | 24 de | 13.8 bc |
| Level of significance | \*\* | NS | NS | NS | \* | \* |
| **CV (%)** | **3.71** | **32.35** | **19.34** | **17.32** | **11.55** | **15.27** |

Means with the same letter(s) are not significantly different

\*\* = Significant at 1% level of probability; \*= Significant at 5% level of probability, NS = Not Significant M1=cocodust+sand+cowdung (1:1:1), M2=sawdust+sand+cowdung (1:1:1), M3=cocodust+sawdust+sand+cowdung (1:1:1:1) R1= Honey, R2= coconut water, R3= IBA, R4= control (without hormone)

**Conclusion**

Root formation is very important; because it enables plant anchorage and seedling vigour. Based on the outcomes of the research, the combination of cocodust, sawdust, sand and cowdung with IBA rooting hormones enhanced early shoot emergence, better root formation, increased plant weight and height.

**Acknowledgement**

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**COLLECTION AND EVALUATION OF GLADIOLUS GERMPLASM**

M. M. R. Bhuyin, F. N. Khan, A. Naznin, K. Ambia and M. T. Rashid

**Abstract**

*A study was conducted at Floriculture Farm, Horticulture Research Centre, BARI, Joydebpur, Gazipur during the period from November 2021 to May 2022 for evaluation of ten gladiolus lines. It was revealed from the study that GL-002, GL-012, GL-025 and GL-037 found as promising genotypes for selection on the basis of its flower characters such as attractive color, early flowering, maximum number of florets, longest spikes and rachis, highest weight of spike, longest shelf life, etc.*

**Introduction**

The genus Gladiolus belongs to the family Iridaceae and is a native of South Africa. It is one of the most important cut flowers in the flower industry. It is known as the queen of the bulbous plants (Chattopadhyay, 1995). Its elegant spikes with rich variation of colour and long vase life are the reasons for its ever increasing demand (Prakash and Bhandary, 1994). Now-a-days, its cultivation is gaining importance in Bangladesh. Gladiolus is commercially grown in Jessore, Satkhira, Gazipur, Chittagong, Cox’s bazar and Dhaka. Presently, Jhikargacha Thana of Jessore is the largest producer of gladiolus in Bangladesh. But there is a few recommended/released varieties in Bangladesh which has export potential as well. This study was, therefore, undertaken to evaluate the performance of different genotypes of gladiolus in order to select promising genotypes in respect of flower production.

**Materials and Methods**

The study was conducted at the Floriculture Farm of Horticulture Research Centre, BARI, Joydebpur,Gazipurduring the period from November 2021 to May 2022. The experimental land was prepared with deep ploughing, manures and fertilizers were applied @ 10 ton, 200 kg, 225 kg and 190 kg per hectare of cowdung, urea, TSP and MP, respectively. Cowdung, TSP and MP were applied as basal and urea was top-dressed in two equal splits at 4 leaf stage and spike initiation stage. The experiment was laid out in RCB design with 3 replications. Gladiolus genotypes were collected from different places and nurseries of Jessore and Dhaka and were given the accession numbers, GL-001 (V1), GL-002 (V2), GL-003 (V3), GL-012 (V4), GL-018 (V5), GL-025 (V6), GL-037 (V7), GL-040 (V8), GL-042 (V9) and BARI Gladiolus-1 (V10) was used as check (Table 1). These were maintained at the Landscape, Ornamental and Floriculture Division of the Horticulture Research Centre, BARI, Joydebpur.

**Table 1. Basic information of the different genotypes of gladiolus**

|  |  |  |
| --- | --- | --- |
| **Accession No.** | **Source of collection** | **Floret colour** |
| GL-001(V1) | Sharsha, Jessore | Off white |
| GL-002(V2) | Godkhali, Jessore | Yellowish orange |
| GL-004(V3) | Jhicargacha, Jessore | Light yellow |
| GL-012(V4) | Sharsha, Jessore | Blue |
| GL-018(V5) | Benapol, Jessore | Deep pink |
| GL-025(V6) | Benapol, Jessore | Orange yellow |
| GL-037(V7) | Godkhali, Jessore | Light pink |
| GL-040(V8) | Savar, Dhaka | Red |
| GL-042(V9) | Savar, Dhaka | Reddish purple |
| BARI Gladiolus -1(V10) | Godkhali, Jessore | Red |

Healthy corms (3-5 cm dia.) of GL-001, GL-002, GL-004, GL-012, GL-018, GL-025, GL-037, GL-040, GL-042 and BARI Gladiolus -1 were planted on 30th November, 2021 at 25 cm × 15 cm spacing in 1.5 m x 1.0 m sized plot. Intercultural operations like weeding, watering, spraying, etc. were done as and when necessary. Data on disease incidence was scored like: 0-1 = Tolerant, 2 = Moderately tolerant, 3= Susceptible, 4= Highly susceptible. The spikes were cut when lower 2-3 florets showed their blushes of colour. Corms and cormels were lifted three months after cutting flower and treated with Bavistin (0.2%) for 30 minutes to prevent incidence of leaf blight disease (Sahni, 1980 and Shah *et al*., 1983). Data recorded on different parameters were analyzed statistically and the mean separation was done by DMRT.

**Results and Discussion**

The data recorded on plant and flower parameters of different genotypes of gladiolus under study are presented in Table 2. The genotypes differed significantly among themselves.

**Table 2. Plant and flower characteristic of gladiolus genotypes**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Genotypes** | **Plant height (cm)** | **Floret no/**  **spike** | **Spike length (cm)** | **Rachis length (cm)** | **Stick wt. (g)** | **Disease reacton**  **(Leaf blight)** | **Insect reaction** |
| V1 | 53.0 cd | 10.2 ab | 80.0 d | 45.0 b | 35.0 f | Moderately tolerant | Nil |
| V2 | 55.0 c | 15.0 a | 90.0 b | 48.5 ab | 55.0 b | Moderately tolerant | Nil |
| V3 | 52.0 cd | 11.0 ab | 77.5 de | 35.0 d | 45.0 d | Moderately tolerant | Nil |
| V4 | 60.0 ab | 9.5 b | 85.0 c | 40.0 c | 50.0 c | Moderately tolerant | Nil |
| V5 | 49.0 d | 6.0 c | 74.0 e | 33.0 de | 28.0 g | Susceptible | Nil |
| V6 | 66.0 ab | 15.0 a | 95.0 a | 50.0 a | 60.0 a | Moderately tolerant | Nil |
| V7 | 62.0 b | 14.5 a | 90.0 b | 48.0 ab | 58.0 ab | Moderately tolerant | Nil |
| V8 | 68.0 a | 8.5 bc | 87.0 bc | 40.0 c | 40.0 e | Moderately tolerant | Nil |
| V9 | 51.0 cd | 8.8 bc | 65.0 f | 30.0 e | 30.0 fg | Moderately tolerant | Nil |
| V10 | 58.0 bc | 9.5 b | 86.0 bc | 48.0 ab | 52.0 bc | Moderately tolerant | Nil |

Means followed by uncommon letters in a column are significantly different

It is observed from Table 2. that the plants of the genotype V8 (GL-040) attained maximum height (68.0 cm) followed by V6 (66cm) and V4 (60) differed significantly from other genotypes. The minimum plant height (49 cm) was attained by V5 (GL-018). The maximum number of 15 florets per spike was recorded from plants of V2 (GL-02) and V6 (GL-025) treatments closely followed by V7 (GL-037) (14.5). Spike length is considered one of the most important characters in gladiolus and >75 cm is considered to be standard length (Negi *et al*., 1994). The longest spikes were produced by the genotype V6 (GL-025) (95 cm) closely followed by V7 (GL-037) (90.0 cm) and V2 (GL-002) (90.0 cm) and the spike length in other genotypes was below the standard level. Similar trend was also found in case of rachis length and spike weight (Table 1). Flower yield was also recorded higher in V7 (GL-037) (230000/ha) followed by V6 (GL-025) (225000/ha). All genotypes showed moderately tolerant against disease reaction. There was no pest incidence occurred in the field study. It was also observed that V3 (GL-003) was earliest in days to 50% spike initiation (47 days) followed by V2 (GL-002) (49 days) and V4 (GL-012) (50 days).



Fig. 1. Days to 50% spike initiation in gladiolus genotypes

.

Shelf life was maximum (9 days) in case of V6 (GL-025) and V7 (GL-037) followed by V2 (GL-002), V4 (GL-012) and V10 (BARI Gladiolus-1) (8 days).



**Fig. 2. Shelf life of gladiolus genotypes.**

**Conclusion**

It was revealed from the study that GL-002, GL-012, GL-025 and GL-037 was found as promising genotypes for selection in consideration of its flower characters such as attractive color, early flowering, floret number, spike length, rachis length, spike weight, shelf life etc.

**Acknowledgement**

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**EFFECT OF COCO COIR BASED SOIL LESS MEDIA ON YIELD AND FLOWER QUALITY OF GERBERA**

M. M. R. Bhuyin, F. N. Khan, A. Naznin, K. Ambia and M. T. Rashid

**Abstract**

*A study was conducted at Floriculture Farm, Horticulture Research Centre, BARI, Joydebpur, Gazipur during the period from November 2021 to May 2022 to find out the effect of different substrate on growth and yield of gerbera was carried out in a Completely randomized design with 6 treatments and 3 replications. Treatments consists of were as follows: T0: Fine sand, T1: Coco-coir: Perlite (0:100), T2: Coco-coir: Perlite (25:75), T3: Coco-coir: Perlite (25:75), T4: Coco-coir: Perlite (75:25) and T5: Coco-coir: Perlite (100:0). plants were fertilized with a same nutrient solution. Results showed that, the growing medium T4: Coco-coir: Perlite (75:25) was better than other treatments. In this substrate, flower number, flower diameter, shoot diameter, stem neck diameter, flower height and vase life showed better result among other growing media.*

**Introduction**

Traditional Gerbera cultivation is costly because it requires special care with drip irrigation facility and needed to be cultivated under shade. It is needed to explore alternative cultivation process that is future proof and more sustainable. In soil, a plant’s roots grow downward or outward seeking water and nutrients. In hydroponics, plants are grown in a growing media that replaces soil. One of the reasons hydroponic plants usually grow faster than soil plants is growing media designed to give roots ideal growing conditions. This is having water, nutrients and fresh air available in the root area. A hydroponic grow media is something that will hold both water and air for the plants. There is no special type of growing media that is necessary for success. Many types of growing media have been used for hydroponics and there may be more yet to be tried. Media is often selected based on availability and low cost. Therefore, the experiment is undertaken to compare available and low-cost growing media in soilless culture along with traditional gerbera cultivation.

**Materials and Methods**

The study was conducted at the Floriculture Farm of Horticulture Research Centre, BARI, Joydebpur, Gazipurduring the period from November 2021 to May 2022. The experiment was prepared in an 10 L earthen pot with the mix of coco coir and perlite according to the treatments. Coco coir was well grinded and mixed with perlite by volume not by weight. BARI Gerbera-1 was used as a planting material. Planting material was collected form tissue culture laboratory with the age of 2 weeks. All of these growing media including roots of seedlings were treated with Autostin with 2gm per litre before planting. Plants were fertilized with a same nutrient solution. 25% Enshi Nutrient Solution was used two times daily as a liquid fertilizer. No other fertilizer was applied. In this experiment perlite were used with 1-2 mm in diameter range. Experiment was setup under poly shed to protect direct sunlight. They were irrigated 1-2 times in the basis of every day. The experiment was laid out in CRD design with 3 replications. In a period of six months, some quality and quantity characteristics of flowers were measured such as: flower number, flower stem height, flower disc diameter, stem diameter, stem neck diameter and vase life. Standard procedures were followed to collect the data for growth and flowering parameters. The data collected were analyzed statistically by using Duncan’s Multiple Range (DMR) test at 1 per cent and 5 per cent probability level and used to compare the difference among treatments means (Steel *et al.,* 1996).

**Results and Discussion**

The selection of media is based on many factors as existence; ease of use, chea for producers. The different types of media can be used as peat and recently coco peat (coconut fiber), rock wool, vermiculite, perlite, expanded clay, pumice, sand and... . In this experiment, based on various sources of external and internal reviews, common media used in various gerbera cultures were evaluated (Sindahu *et al.,* 2010; Khalaj, 2007; Venezia *et al*., 1997; Mascecarini, 1998; pisanu *et al*., 1994). The data recorded on plant and flower parameters of gerbera under study are presented in Table 1. The data differed significantly among themselves.

**Table 1 : Effect of different substrates on the yield and growth of gerbera**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| treatments | Flower height (cm) | Stem neck diameter (cm) | Stem diameter (cm) | Flower disc diameter (cm) | Flower number (per plant) | Vase  life (days) |
| T0 | 48.4 | 0.49 | 0.66 | 10.9 | 3.77 | 10.6 |
| T1 | 51.3 | 0.52 | 0.69 | 11.6 | 3.9 | 11.4 |
| T2 | 50.4 | 0.52 | 0.66 | 11.1 | 5.67 | 10.7 |
| T3 | 45.0 | 0.5 | 0.65 | 11 | 7.9 | 11.6 |
| T4 | 54.5 | 0.58 | 0.79 | 12.4 | 10.33 | 13.6 |
| T5 | 51.6 | 0.51 | 0.64 | 11.1 | 7.43 | 10.8 |
| CV(%) | 7.59 | 12.19 | 8.47 | 5.66 | 44.18 | 8.14 |

The results of analysis (Table 1) showed that 4th treatment, which includes a mixture of coco coir and perlite (*75:25)* produced maximum flower numbers against others with 10.33 numbers and sand bed alone produced 3.77 flowers that had lowest production. The flower numbers of gerbera in 4th treatment could be the results of faster plant development due to good root system and better physicochemical properties of mixes. Growth medium is known to have a large effect on value of potted ornamental plants (Vendrame et al., 2005). Among the physical characteristics, aeration and water holding capacity are probably the most important factors while, among the chemical characteristics, nutritional status, and salinity level have a crucial role on plant development (Dewayne et al., 2003). Nowak and Strojny (2004) reported that the total porosity, bulk density, shrinkage water capacity and air capacity of the growing substrates had significant effects on the number and weight of fresh flowers in gerbera.

Data showed that flower disc diameter was influenced by the different media and the largest flower diameter (11.6 cm) was in 4th treatment while the lowest flower diameter 10.9 cm from 1st (sand alone) was derived (Table 1). Fakhri et al. (1995) reported, that the largest flower diameter obtained from mixes of peat and perlite. They noted that media physicochemical characteristics improving because of the organic matter existence was the main reason of differences. There was significant difference in the flower height, significantly greater mean flower height was produced in T4 treatment (54.5 cm), the highest of growing media. Greater flower height and more yields produced by plants grown in T4 treatment suggest that this treatment is best suited for growing gerbera flower in among these media. Ozcelik et al. (1997) studied during the 1994-95 the effects of different planting media as the alone or the combination on quality and quantity of gerbera, they observed that the most appropriate mixture for gerbera yield in 15-month period. A strong relationship between substrate physicochemical properties, gerbera quantity and quality characteristics has been reported in this survey.

Data showed that significant differences in the gerbera vase life grown on media were observed with varying substrate. Treatment 4 had the longest gerbera vase life (13.6 days). The vase life is directly related to dry matter production as well as size of flowers. This finding is in agreement with Manins et al. (1995) findings which showed significant differences between different substrates on gerbera vase life. De Jong (1978) found that gerbera flowers with strong stem were less likely to fold in the vase due to turgor pressure maintained. As the vegetative growth was found to be better in cocopeat combinations, the flower set was early producing high quality cut flowers. The resent study confirms the fact that selection of the appropriate medium of growth for cut flower plants (in this case Gerbera jamesonii L.) was very important from yield and quality point of view. The medium must ensure the production of plants of the required quality on cost effective basis. In the present study, *Coco-coir: Perlite (75:25)* produced significantly the maximum number of flowers per plant and other quality characteristics among different media.

**Conclusion**

Results showed that, the growing medium T4: Coco-coir: Perlite (75:25) was better than other treatments. In this substrate, flower number, flower diameter, shoot diameter, stem neck diameter, flower height and vase life showed better result among other growing media. This experiment is needed to be executed again for further confirmation.

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**COMBINATION EFFECT OF DIFFERENT GROWING MEDIA ON THE YIELD AND FLOWER QUALITY OF GERBERA IN SOILLESS CULTURE**

M. M. R. Bhuyin, F. N. Khan, A. Naznin, K. Ambia and M. T. Rashid

**Abstract**

*A study was conducted at Floriculture Farm, Horticulture Research Centre, BARI, Joydebpur, Gazipur during the period from November 2021 to May 2022 to find out the effect of different substrates on growth and yield of gerbera under an open soil-less production system was carried out in a completely randomized design with 6 treatments and 3 replications. Treatments consists of were as follows: T1: Soil + sand +coco peat + vermicompost (1:1:2:2), T2: Sand + coco peat + vermicompost (1:2:2), T3: Sand + coco peat + vermicompost + vermiculite (1:2:2:0.5), T4: Sand + coco peat +vermicompost + perlite (1:2:2:0.5) and T5: Sand + coco peat + vermicompost + vermiculite + perlite (1:2:2:0.25:0.25) and T6: Control(sand). plants were fertilized with a same nutrient solution. Results showed that, the growing medium T5: Sand + coco peat + vermicompost + vermiculite + perlite (1:2:2:0.25:0.25) was better than other treatments. In this substrate, flower number, flower diameter, shoot diameter, stem neck diameter, flower height and vase life showed better performance among growing media.*

**Introduction**

Gerbera (Gerbera jamesonii Bolus) belongs to the family Asteraceae, a popular cut flower grown throughout the world in a wide range of climatic conditions. In Bangladesh, the environmental conditions required for the survival and culture of gerbera are adequately available throughout the year. Various planting beds around the world is used for growing gerbera such as perlite, rock wool, vermiculite, sand, coconut fibre (coco peat), expanded clay, organic substrates, compost cow, zeolite, pumice, sand etc. Soil-less cultures have been successfully used for several decades with the aim to intensify production and reduce cost of cultivation (Maloupa et al. 2012). Peat is the most widely used substrate for potted plant production in the nurseries and accounts for a significant portion of the materials used to grow potted plants (Marfa` et al., 2018). Since the last few years, coco peat, also known as coir dust has been considered as a renewable sphagnum peat substitute for the use in horticulture (Pisame et al.2015,). Perlite has been widely used in soil-less cultures too. Perlite, an alumino-silicate of volcanic origin, is rather inert (low buffering and cation exchange capacities of 0-1 mg l-1). In general, it has a closed cellular structure, with the majority of water being retained superficially and released slowly at a relatively low tension, providing excellent drainage of the medium and aeration of rhizosphere (Maloupa et al., 2012). The objective of this study was to determine the effect of different substrates on growth and yield of gerbera under an open soil-less production system.

**Materials and Methods**

The study was conducted at the Floriculture Farm of Horticulture Research Centre, BARI, Joydebpur, Gazipurduring the period from November 2021 to May 2022. BARI Gerbera-1 was used as a planting material. Planting material was collected form tissue culture laboratory with the age of 3 weeks. The roots were trimmed off and one-thirds of the top portion of the leaves was cut off. The suckers were then dipped in 0.2 per cent solution of Bavistin for 15-20 minutes to protect the plants from root rot disease. The planting was done on last week of November, 2021. Single plant was planted in a 10 L earthen pot. Plants were fertilized with a same nutrient solution. 25% Enshi Nutrient Solution was used two times daily as a liquid fertilizer. No other fertilizer was applied. The media compositions were T1: soil + sand + coco peat + vermicompost (1:1:2:2), T2: sand + coco peat + vermicompost (1:2:2), T3: sand + coco peat + vermicompost + vermiculite (1:2:2:0.5), T4: sand + coco peat + vermicompost + perlite (1:2:2:0.5) and T5: sand + coco peat + vermicompost + vermiculite + perlite (1:2:2:0.25:0.25) and T6: Control(sand). The experiment was laid out in CRD design with 3 replications. In a period of six months, some quality and quantity characteristics of flowers were measured such as: flower number, flower stem height, flower disc diameter, stem diameter, stem neck diameter and vase life. Standard procedures were followed to collect the data for growth and flowering parameters. The average data were recorded on plant growth characters like plant height (cm), number of leaves per plant, flower characters like days to visibility of flower bud, days to bud opening from visibility, days to full bloom, number of sprays per plant and flowering period (from first to last flower) were recorded at maturity or at final growth stage. Experiment was setup under poly shed to protect direct sunlight. They were irrigated 1-2 times in the basis of every day. The data collected were analyzed statistically by using Duncan’s Multiple Range (DMR) test at 1 per cent and 5 per cent probability level and used to compare the difference among treatments means (Steel *et al.,* 1996).

**Results and Discussion**

The selection of media is based on many factors as existence; ease of use, chea for producers. The different types of media can be used as peat and recently coco peat (coconut fiber), rock wool, vermiculite, perlite, expanded clay, pumice, sand and... . In this experiment, based on various sources of external and internal reviews, common media used in various gerbera cultures were evaluated (Sindahu *et al.,* 2010; Khalaj, 2007; Venezia *et al*., 1997; Mascecarini, 1998; pisanu *et al*., 1994). The data recorded on plant and flower parameters of gerbera under study are presented in Table 1. The data differed significantly among themselves.

**Table 1 : Effect of different combination of substrates on the yield and growth of gerbera**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| treatments | Flower height (cm) | Stem neck diameter (cm) | Stem diameter (cm) | Flower disc diameter (cm) | Flower number (per plant) | Vase  life (days) |
| T1 | 54.10 | 0.49 | 0.68 | 11.51 | 7.76 | 10.23 |
| T2 | 50.51 | 0.53 | 0.68 | 11.42 | 3.8 | 11.21 |
| T3 | 50.3 | 0.54 | 0.64 | 11.2 | 5.66 | 10.5 |
| T4 | 44.2 | 0.4 | 0.63 | 11.1 | 7.8 | 11.5 |
| T5 | 54.5 | 0.58 | 0.79 | 11.8 | 11.34 | 12.7 |
| T6 | 48.4 | 0.49 | 0.66 | 9.98 | 3.56 | 10.6 |
| CV(%) | 7.59 | 12.19 | 8.47 | 5.66 | 44.18 | 8.14 |

The results of analysis (Table 1) showed that T5 treatment, which includes a mixture of Sand, coco peat, vermicompost, vermiculite and perlite (1:2:2:0.25:0.25) produced maximum flower numbers against others with 11.34 numbers and sand bed alone produced 3.56 flowers that had lowest production. The flower numbers of gerbera in T5 treatment could be the results of faster plant development due to good root system and better physicochemical properties of mixes. Growth medium is known to have a large effect on value of potted ornamental plants (Vendrame et al., 2005). Among the physical characteristics, aeration and water holding capacity are probably the most important factors while, among the chemical characteristics, nutritional status, and salinity level have a crucial role on plant development (Dewayne et al., 2003). Nowak and Strojny (2004) reported that the total porosity, bulk density, shrinkage water capacity and air capacity of the growing substrates had significant effects on the number and weight of fresh flowers in gerbera.

Data showed that flower disc diameter was influenced by the different media and the largest flower diameter (11.8 cm) was in T5 treatment while the lowest flower diameter 9.98 cm from sand alone was derived (Table 1). Fakhri et al. (1995) reported, that the largest flower diameter obtained from mixes of peat and perlite. They noted that media physicochemical characteristics improving because of the organic matter existence was the main reason of differences. There was significant difference in the flower height, significantly greater mean flower height was produced in T5 treatment (54.5 cm), the highest of growing media. Greater flower height and more yields produced by plants grown in T5 treatment suggest that this treatment is best suited for growing gerbera flower in among these media. Ozcelik et al. (1997) studied during the 1994-95 the effects of different planting media as the alone or the combination on quality and quantity of gerbera, they observed that the most appropriate mixture for gerbera yield in 15-month period. A strong relationship between substrate physicochemical properties, gerbera quantity and quality characteristics has been reported in this survey.

Data showed that significant differences in the gerbera vase life grown on media were observed with varying substrate. Treatment 5 had the longest gerbera vase life (12.7 days). The vase life is directly related to dry matter production as well as size of flowers. This finding is in agreement with Manins et al. (1995) findings which showed significant differences between different substrates on gerbera vase life. De Jong (1978) found that gerbera flowers with strong stem were less likely to fold in the vase due to turgor pressure maintained. As the vegetative growth was found to be better in cocopeat combinations, the flower set was early producing high quality cut flowers. The resent study confirms the fact that selection of the appropriate medium of growth for cut flower plants (in this case Gerbera jamesonii L.) was very important from yield and quality point of view. The medium must ensure the production of plants of the required quality on cost effective basis. In the present study, *Coco-coir: Perlite (75:25)* produced significantly the maximum number of flowers per plant and other quality characteristics among different media.

**Conclusion**

Results showed that, the growing medium T5: Sand + coco peat + vermicompost + vermiculite + perlite (1:2:2:0.25:0.25) was better than other treatments. In this substrate, flower number, flower diameter, shoot diameter, stem neck diameter, flower height and vase life showed better results among growing media. This experiment is needed to be executed again for further confirmation.

**Acknowledgement**

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**HYBRIDIZATION IN GLADIOLUS FLOWER**

F.N. KHAN, A. NAZNIN, K. AMBIA, MMR. BHUIYIN AND MT. RASHID

**Abstract**

*A hybridization program on gladiolus was conducted in the flowering season November, 2016 to June, 2022 at Floriculture Farm, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Gazipur. Four crossing were done among five attractive gladiolus genotypes and pods were successfully produced. A large number of cormels were produced from a single cross from first generation. After a successive year of maintenance 4 new gladiolus hybrids have been found.*

**Introduction**

Gladiolus is one of the most important cut flower in Bangladesh. Breeding of gladiolus is a fascinating aspect. Different attractive colours, various shapes and large number of florets are demand to the users. So, there is a great scope for hybrid varieties in our country. In view of the importance of this crop, systemic breeding was initiated to produce hybrids. The present study was undertaken with following objectives:

1. To develop new hybrid varieties

**Materials and Methods**

The experiment was conducted at the floriculture field of Horticulture Research Centre, Bangladesh Agricultural Research Institute, Gazipur, during November, 2016 to June, 2022. Eight gladiolus genotypes were included in this study viz Gl-004, BARI Gladiolus-5, BARI Gladiolus-6, GL-037 and GL-039. Parents were selected depends on the attractive criteria of flowers like colour, spike length, number of florets/spike etc. Four crossing were done with attractive parent GL-039 during January, 2017 without following any fashion. Pollination was done in the morning. One day before pollination, emasculation was done. Recommended dose of fertilizers were applied. Intercultural operations were done as and when necessary. After getting pods the seeds were sown in pot on 29 November, 2017. Lifting of cormels was done on 16 May, 2018. After data collection cormels were kept at 5 to 70c on 22 May, 2018 for further corm production. Later on these cormels planted on 11 November, 2018 for further development of corm. As this study is a continuous process, the cormels are planted every year until getting desired quality of flowers.

**Results**

After inter specific hybridization among 5 gladiolus genotypes, 100% pods were produced. The time was taken to pod maturity ranges from 30-45 days. A large number of cormels were found from a single cross after 1st generation (Table 1). Similarly, after 2nd , 3rd and 4th generation, a good number of large corm (some corms are >2.5cm) and cormel produced from cormel by one pod (Table 2).

**Table 1. Cormel production from crosses between gladiolus parents after 1st generation**

|  |  |  |
| --- | --- | --- |
| **Crossing between Gladiolus parents** | **Number of cormels/pod** | **Weight of cormels/pod (g)** |
| GL-004 x GL-039 | 179 | 60 |
| BARI Gladiolus-5 x GL-039 | 70 | 20 |
| BARI Gladiolus-6 x GL-039 | 65 | 24 |
| GL-037 x GL-039 | 87 | 30 |

**Table 2. Corm and Cormel production after 3rd generation from cormels produced/pod during 2nd generation**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Crossing between Gladiolus parents** | No. of corm/pod | Wt. of single corm (g) | Diameter of corm (cm) | Corm no./pod (>2.5cm)\* | No. of cormel/pod | Wt. of cormel/  pod |
| GL-004 x GL-039 | 35.0 | 6.0 | 2.75 | 14.0 | 287.0 | 103.0 |
| BARI Gladiolus-5 x GL-039 | 15.0 | 7.50 | 2.82 | 9.0 | 92.0 | 38.5 |
| BARI Gladiolus-6 x GL-039 | 16.0 | 7.65 | 2.90 | 9.0 | 115.0 | 58.0 |
| GL-037 x GL-039 | 7.0 | 5.35 | 2.60 | 4.0 | 62.0 | 41.0 |

\* 2.5 cm is flowering sized corm

**Table 3. Flower production after 4th generation from corm produced/pod during 3rd generation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Crossing between Gladiolus parents** | No. of leaves/plant | No. of florets/  plant | Spike length  (cm) | Rachis length (cm) | Dia. of florets (cm) |
| GL-004 x GL-039 | 6.50 | 10.0 | 65.0 | 35.0 | 10.50 |
| BARI Gladiolus-5 x GL-039 | 7.20 | 5.0 | 55.50 | 24.0 | 9.50 |
| BARI Gladiolus-6 x GL-039 | 6.70 | 6.0 | 58.0 | 22.0 | 9.50 |
| GL-037 x GL-039 | 6.50 | 5.0 | 48.0 | 24.0 | 9.50 |

Regarding flower production, corm produced/pod during 3rd generation showed variations among different crosses (Table 3).

**Conclusion**

Four new gladiolus hybrids have been obtained. Besides a good number of flowering sized corm from various crossing has been obtained through which more new gladiolus flowers may be bloomed in the next season.

**Acknowledgement**

The authors are grateful to the Ministry of Agriculture funded SRHCDHFCTCA project for financial support to conduct the research.

**BULB AND BULBLET PRODUCTION OF LILIUM INFLUENCED BY PLANTING MATERIALS AND GROWING CONDITION**

F.N. KHAN, K. AMBIA, A. NAZNIN, MMR. BHUIYIN AND MT. RASHID

**Abstract**

*An experiment was conducted at Floriculture Research Field, HRC, BARI during August 2021 to June 2022 to find out the suitable planting materials under optimum growing conditions for quality bulb production. Considering various planting materials and growing conditions, bulblet produced significantly longest root (13.65cm), maximum number of bulbs/hill (0.85), the heaviest and largest bulb (5.42g and 2.0cm, respectively). The plants grown under UV shade house produced the maximum number of roots/plant (8.07), maximum number of leaves/plant at 90 and 120 DAT (12.25 and 17.64, respectively), maximum number of bulbs/hill (1.13), the heaviest and largest bulb (8.34g and 2.82cm, respectively). On the other hand, the plants grown under the plastic shade house produced the longest root (14.18cm) and also longest plant at various date after transplanting (13.50cm to 16.98cm). The plants grown under greenhouse produced the maximum number of bulblets/hill (3.43) and the heaviest bulblet (3.05). The bulblet combined with the plants grown under UV shade house showed better performances at maximum cases.*

**Introduction**

Lilium belongs to the family *Liliaceae,* commercially grown as cut flower but it may also be grown as potted plants, herbaceous borders etc. It is a high demanded cut flower in international flower trade due to its wide diversity of color, attractive shape, multi-flowering stalk, and having long post-harvest vase life (Lucidos *et al.*,2013). This lucrative flower is recently being imported from other countries specially from China to meet up the demand of the users and is selling in the market with high price (Tk. 150-200/- per stick) (Khan and Ambia 2015). Normally this flower propagated asexually by natural formation of daughter bulbs, by axillary bulblets developed in the axils of leaves, stem bulblets and through scales. Availability of a large quantity of bulbs is one of the prerequisites for commercial cultivation of lilium flower. A single bulb normally produces one or two daughter bulb and with average of 5-8 bulblets in each season. Due to a very low rate of natural multiplication of its bulb and bulblet, the result is non-availability of enough planting materials. To mitigate this problem, multiplication of bulbs through improved techniques may play an important role.

Various planting materials like bulblet, scales are very important for producing initial stock of lilium bulbs. Van Aartrijk *et al.* (1990) reported that the main constraints in conventional propagation of lilium include the inadequate availability of healthy, disease-free planting material, and slow multiplication rates. The conventional method of propagating lilium involves scaling yields at most three to five bulbs from each scale, depending on the bulb scale size and species/variety. Moreover, the growth of plant, bulb and bulblets are influenced by various growing conditions like shade, temperature, humidity etc. Besides, for good plant growth and quality flower production, the night temperature should be around 10-150 C and the day temperature should be 20-250C (Thangam *et al.,* 2016). The higher temperature produced a dwarf crop with a smaller number of flower buds per stem. The plant should not be grown under direct sunlight. A shading screen with 50-75% shade is beneficial for lilium production (Thangam *et al.,* 2016). So, suitable propagating material with appropriate growing condition is much important to produce quality bulbs of lilium. Considering the aforementioned situation, the present investigation has been planned to undertake to standardize the suitable planting materials under optimum growing condition for quality bulb production.

**Materials and Method**

An experiment was conducted at Floriculture Research Field, HRC, BARI during August 2021 to June 2022 to find out the suitable planting materials under optimum growing conditions for quality bulb production*.* Bulblets and scale of BARI Lilium-1 were considered as planting materials. There were 6 treatment combinations which are as follows:

Factor A: Planting materials

A1 = Bulblet

A2 = Scale

Factor B: Growing conditions

B1 = Greenhouse (55% sunlight cut)

B2 = UV poly house (50% sunlight cut)

B3 =Plastic shade house (70% sunlight cut)

**Design and Layout:**

The two factors pot experiment was laid out in CRD (Completely Randomized Design) with 3 replications. Two planting materials bulblet and scale in combination with three growing conditions Greenhouse, UV poly house, Plastic shade house were the treatment combinations.

**Management of Experiment:**

A cork sheet box of 45cm L x 25cm B x 24cm D contained 75% cocodust, 25% soil and compost were taken for sowing of bulblets and scales. The planting materials were placed at the upper portion of the media and then covered by some media and kept under different growing condition as per treatments. After one month, planting materials were transplanted to plastic tray. The plastic tray contains 36 hole and each hole contain one transplanted plant. Some data were taken during transplantation. During vegetative growth of plants, data were recorded on various parameters and finally the plants were transferred to the 10inch pot (Each pot contain 3 plants) for bulb and bulblet production.

Harvesting of bulbs were done only when the leaves turn brown. After taking necessary data, the bulb and bulblets were stored at cold storage containing 2.1-2.40c temperature and 85-91%. Duringtransplantation and vegetative growth stage, some data were recorded from randomly chosen 5 plants from cork sheet box, plastic tray and also pot. The data of bulb and bulblets on various parameters were taken just after bulb lifting. The recorded quantitative data were analyzed statistically by using R software to find out the variation among different treatments. Treatment means were compared by Tukeys test (Gomez and Gomez, 1984).

**Result and discussion**

**Main effect of planting materials and growing conditions on vegetative growth of lilium plants**

All the parameters did not show significant differences on the bulb and bulblet characteristics except the longest root length by planting materials (Table 1). During transplanting from cork sheet to plastic tray, it was observed that the treatment bulblet produced the longest root (13.65 cm) compare to scale (11.38 cm). Though other parameters did not show significant differences but bulblet showed better performances regarding germination (9.61%), survival (9.94%) and root number (7.52).

Considering various levels of growing condition, all the parameters showed significant variations except germination percentage (Table 1). The survival rate is maximum in case of greenhouse and UV poly house condition (100%). But it is minimum (95.46%) in plastic shade house. Root number/plant is maximum (8.07) in case of UV poly house followed by the plants under plastic shade house (7.63) and the minimum roots (6.43) were found in the plants of greenhouse and also followed by the plants under plastic shade house. The longest root (14.18 cm) was found in the plants grown under plastic shade house followed by the plants grown in greenhouse (12.75 cm).

**Table 1. Vegetative growth of lilium plants influenced by the main effect of planting materials and growing conditions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatments | Germination (%) | Survival (%) | Root number/plant | Length of longest root (cm) |
| **Planting materials** | | | | |
| Bulblet (A1) | 92.59 (9.61) | 98.99 (9.94) | 7.52 | 13.65a |
| Scale (A2) | 89.82 (9.47) | 97.98 (9.89) | 7.23 | 11.38b |
| Level of significance | NS | NS | NS | \*\* |
| **Growing Conditions** | | | | |
| Greenhouse (B1) | 93.06  (9.64) | 100a  (9.99) | 6.43b | 12.75a |
| UV shade house (B2) | 93.06  (9.64) | 100a  (9.99) | 8.07a | 10.63b |
| Plastic shade house (B3) | 87.50  (9.35) | 95.46b (9.76) | 7.63ab | 14.18a |
| Level of significance | NS | \* | \* | \*\* |
| CV (%) | 3.04 | 1.47 | 10.48 | 8.26 |

Means with the same letter(s) are not significantly different at 1% by LSD

\*\* and \* are significant at 1% and 5% level of significance respectively, NS = Not Significant

Figures in parenthesis are transformed values

**Combined effect of planting material and growing conditions on vegetative growth of lilium plants**

All the parameters like germination percentage, survival percentage, root number and length of longest root did not show any significant variation among the treatment combinations (Table 2). The treatment bulblet combination with UV shade house showed better performance in the maximum parameters which may be due to the bigger size of bulblet compare to scale and the sufficient light penetration through UV polythene and also protection from harmful radiation.

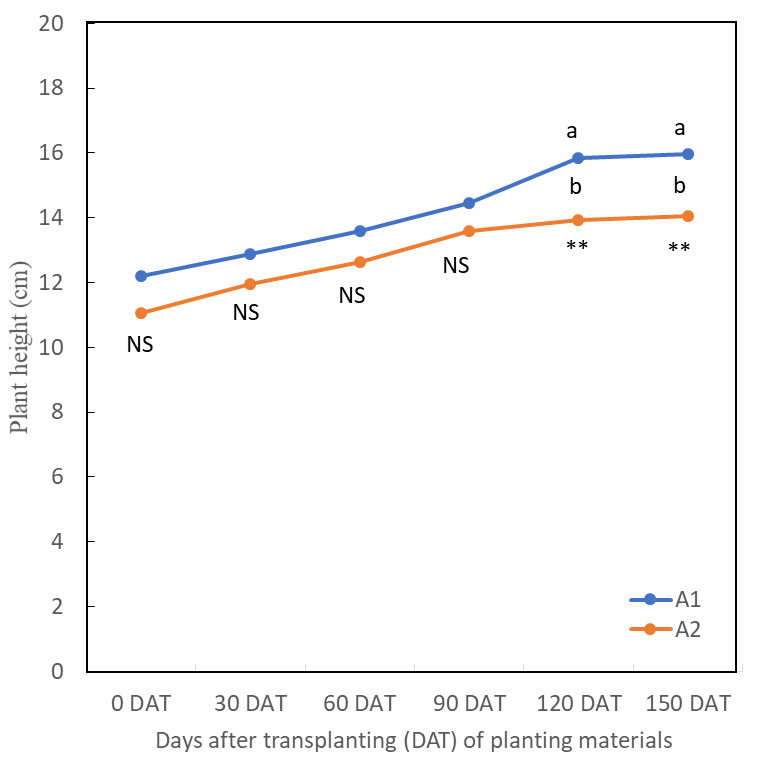
**Table 2. Vegetative growth of lilium plants influenced by the combined effect of planting materials and growing conditions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatments | Germination (%) | Survival (%) | Root number | Length of longest root (cm) |
| A1B1 | 94.45  (9.71) | 100  (9.99) | 6.47 | 13.97 |
| A1B2 | 94.45  (9.71) | 100  (9.99) | 8.33 | 11.25 |
| A1B3 | 88.89  (9.42) | 96.97  (9.84) | 7.75 | 15.73 |
| A2B1 | 91.67  (9.57) | 100  (9.99) | 6.4 | 11.53 |
| A2B2 | 91.67  (9.56) | 100  (9.99) | 7.8 | 10.0 |
| A2B3 | 86.11  (9.28) | 93.94  (9.68) | 7.5 | 12.62 |
| Level of significance | NS | NS | NS | NS |
| CV (%) | 3.04 | 1.47 | 10.48 | 8.26 |

NS = Not Significant. A1=Bulblet, A2=Scale, B1=Greenhouse, B2=UV poly house, B3=Plastic shade house. Figures in parenthesis are transformed values

**Main effect of planting materials and growing conditions on plant height of lilium plants**

Plant height measured at different days after interval did not show significant variations except at 120 and 150 DAT (Figure 1). The treatment bulblet produced the longest plant at 120 DAT and 150 DAT (15.83cm and 15.96cm, respectively) compare to scale (13.94cm and 14.04cm, respectively). Though other parameters were not statistically significant by the treatments but bulblet showed better performances.



\*\*

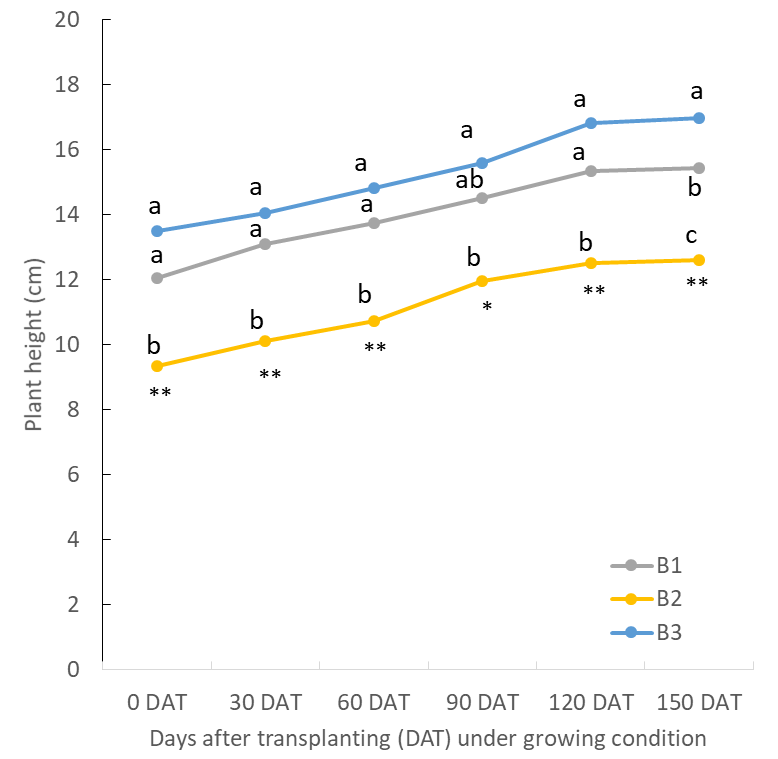
a

b

A1=Bulblet, A2=Scale

Figure 1. Height of lilium plant at different days after transplanting influenced by planting materials

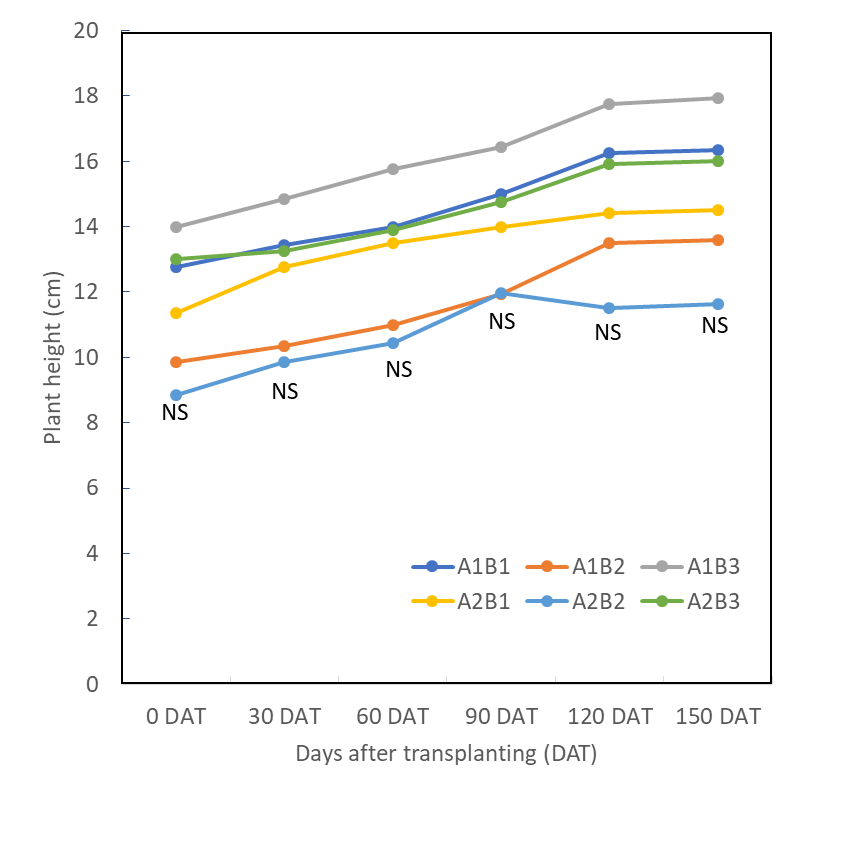
When consider growing conditions, plant height measured at different days after interval showed significant variations (Figure 2). During transplanting of the plants to 150 days after transplanting, plants grown under plastic shade house were found longer (16.98 cm) followed by plants grown under greenhouse condition (15.43 cm). These results indicate that due to lack of sufficient sunlight at both conditions, plants were involved in a competition for sunlight within themselves. Though plants grown under UV poly house were found comparatively shorter but they performed better finally.

****

B1=Greenhouse, B2=UV Poly house, B3=Plastic shade house

Figure 2. Height of lilium plant at different days after transplanting influenced by growing conditions

Plant height measured at different days after interval was not significantly influenced by the combination of planting materials and growing conditions (Figure 3). The treatment bulblet combination with plastic shade house produced the longest plant measured at different days after interval. This might be due to that plastic shade house allowed to enter very less sun which encouraged the plants to become longer.

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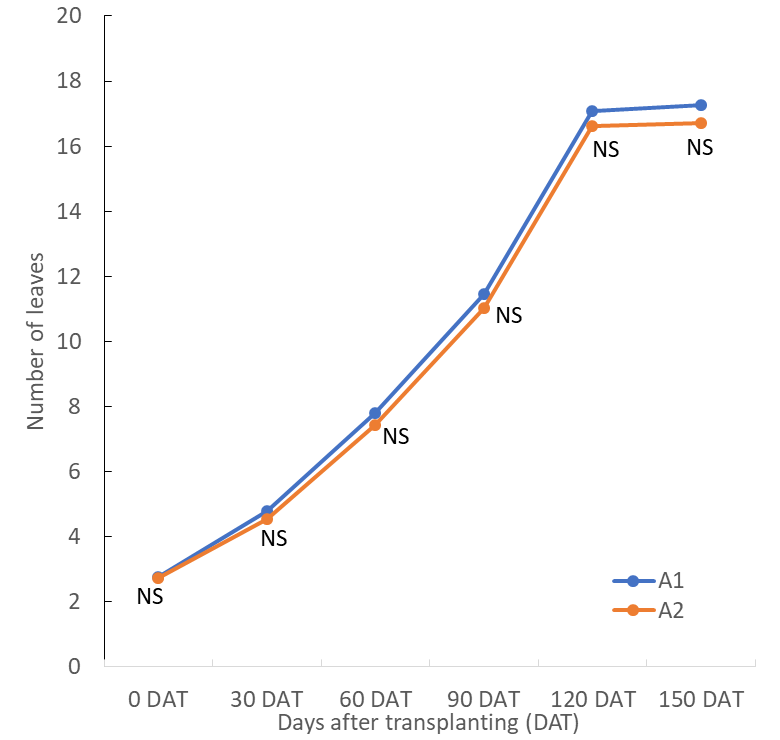
A1=Bulblet, A2=Scale

B1=Greenhouse, B2=UV Poly house, B3=Plastic shade house

Figure 3. Height of lilium plant at different days after transplanting influenced by the combined effect of planting material and growing conditions

**Main effect of planting materials and growing conditions on Leaf number of lilium plants**

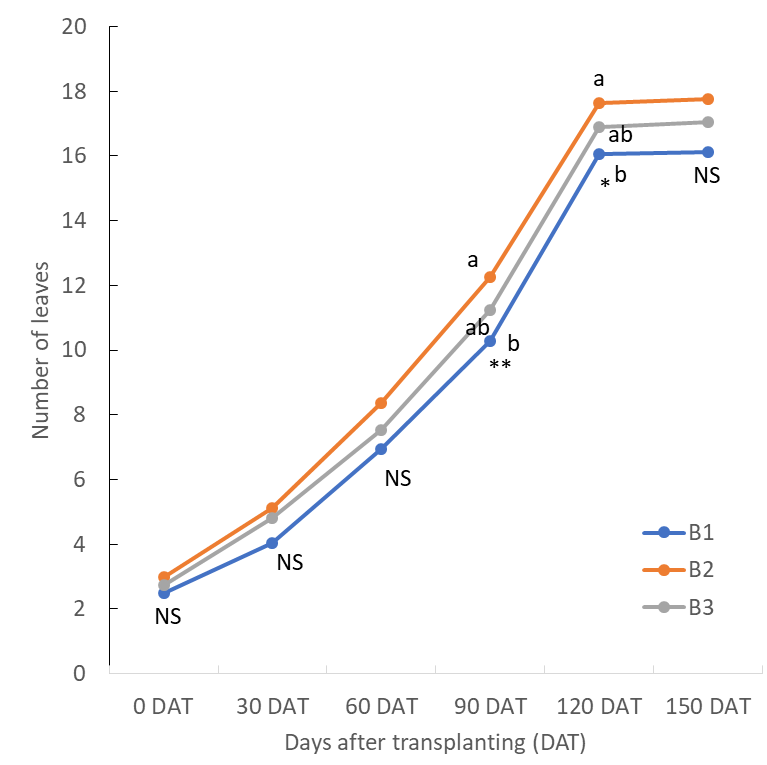
Leaf number measured at different days after interval did not show any significant variations by the planting materials (Figure 4). The treatment bulblet showed better performances at different days after interval.



A1=Bulblet, A2=Scale

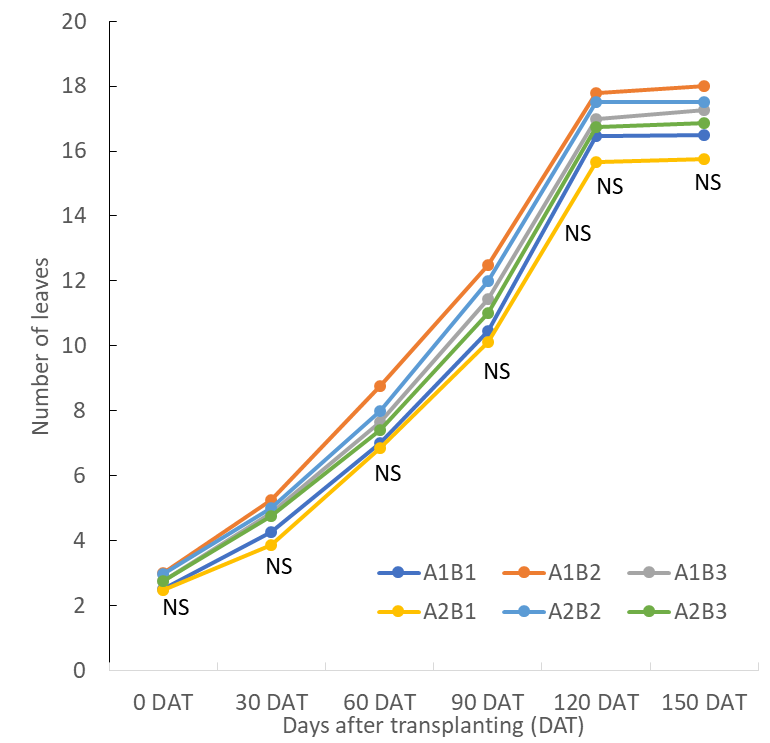
Figure 4. Leaf numbers of lilium plant at different days after transplanting influenced by planting materials

When consider growing conditions, leaf number measured at different days after interval did not show significant variations except 90 DAT and 120 DAT (Figure 5). At 90 days after transplanting, the plants grown under UV shade produced more leaf numbers (12.25) followed by the plants grown under plastic shade house (11.23) condition. Similarly, at 120 days after transplanting, the plants grown under UV poly house also produced more leaf numbers (17.64) followed by the plants grown under plastic shade house (16.88) condition. Though leaf number measured at different days after interval were not significantly influenced by the combination of planting materials and growing conditions (Figure 6), bulblet in combination with UV poly house showed better performance regarding the leaf number measured at different days after interval.



B1=Greenhouse, B2=UV Poly house, B3=Plastic shade house

Figure 5. Leaf numbers of lilium plant at different days after transplanting influenced by growing conditions

****

A1=Bulblet, A2=Scale

B1=Greenhouse, B2=UV poly house, B3=Plastic shade house

Figure 6. Leaf numbers of lilium plant at different days after transplanting influenced by the combined effect of planting material and growing conditions

**Main effect of planting materials and growing conditions on bulb and bulblet production of lilium**

The planting materials did not show significant differences on bulb and bulblet characteristics except bulb number/hill and bulb weight (Table 3). The treatment bulblet produced the maximum number of bulbs/hill (0.85) compared to the planting materials scale (0.73). Van Aartrijik *et al.* (1990) also agreed with those findings. Similarly, the heaviest bulb (5.42 g) was produced by the planting material bulblet compared to scale (4.49 g).

All the parameters were significantly influenced by the plants grown under various levels of growing conditions (Table 3). The maximum number of bulbs/hill (1.13), the heaviest and the largest bulb (8.34 g and 2.82 cm, respectively) were produced by the plants grown under UV shade house. On the other hand, the maximum bulblet numbers/hill (3.43) and weight/hill (3.05gm) were produced by the plants grown under green house. This may be due to the plants of greenhouse produced very less number of bulbs/hill (0.50) and the thinnest and smallest bulbs (0.50g and 0.50cm).

**Table 3. Bulb and bulblet production of lilium influenced by the main effect** **of planting materials and growing conditions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatments | Bulb number/hill | Bulb weight (g) | Bulb diameter (cm) | Bulblet number/hill | Bulblet weight (gm) |
| **Planting Materials** | | | | | |
| Bulblet (A1) | 0.85a | 5.42a | 2.0 | 2.98 | 2.85 |
| Scale (A2) | 0.73b | 4.49b | 1.91 | 2.87 | 2.69 |
| Level of significance | \* | \* | NS | NS | NS |
| **Growing Conditions** |  |  |  |  |  |
| Green House (B1) | 0.50c | 0.50c | 0.50c | 3.43a | 3.05a |
| UV shade House (B2) | 1.13a | 8.34a | 2.82a | 2.73b | 2.73b |
| Plastic Shade house (B3) | 0.75b | 6.03b | 2.55b | 2.61b | 2.53b |
| Level of significance | \*\* | \*\* | \*\* | \*\* | \*\* |
| CV (%) | 12.23 | 15.47 | 7.09 | 8.91 | 6.46 |

\*\* and \* are significant at 1% and 5% level of significance respectively, NS = Not Significant

**Combined effect of planting materials and growing conditions on bulb and bulblet production of lilium**

No significant variations were observed on bulb and bulblet production by the combined effect of planting material and growing conditions except bulbs number/hill (Table 4). The treatment bulblets grown under UV poly house produced the maximum number of bulbs (1.29) whereas both the planting materials grown under greenhouse produced very less number of bulbs (0.50). Though other parameters were not influenced by the treatment combination but the bulblets grown under UV poly house produced the heaviest (9.13 g) and the largest bulbs (2.89 cm) (Plate 28-33).

**Table 4. Bulb and bulblet production of lilium influenced by the combined effect** **of planting materials and growing conditions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatments | Bulb number/hill | Bulb weight (g) | Bulb diameter (cm) | Bulblet number/hill | Bulblet weight (g) |
| A1B1 | 0.50c | 0.50 | 0.50 | 3.50 | 3.17 |
| A1B2 | 1.29a | 9.13 | 2.89 | 2.75 | 2.80 |
| A1B3 | 0.77bc | 6.64 | 2.61 | 2.68 | 2.58 |
| A2B1 | 0.50c | 0.50 | 0.50 | 3.37 | 2.93 |
| A2B2 | 0.96b | 7.55 | 2.73 | 2.71 | 2.67 |
| A2B3 | 0.74bc | 5.24 | 2.49 | 2.53 | 2.48 |
| Level of significance | \* | NS | NS | NS | NS |
| CV (%) | 12.23 | 15.47 | 7.09 | 8.91 | 6.46 |

\*\* and \* are significant at 1 and 5% level of significance respectively, NS = Not Significant

A1=Bulblet, A2=Scale, B1=Greenhouse, B2=UV Poly house, B3=Plastic shade House

**Conclusion**

The treatment bulblet performed well in respect of vegetative growth, bulb and bulblet production of Lilium. The planting materials bulblet grown under UV polyhouse showed better performance regarding all the parameters.

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**INFLUENCE OF PLANTING DATES ON THE PRODUCTION OF ASIATIC LILIUM UNDER PROTECTIVE CONDITION**

F.N. KHAN, K. AMBIA, A. NAZNIN, MMR. BHUIYIN AND MT. RASHID

**Abstract**

*An experiment was conducted at Floriculture Research Field, HRC, BARI during October, 2021 to June, 2022 to find out the optimum planting time for better flower production and to extend the flowering duration of lilium. Lilium bulbs planting at 01 December produced the longest plant (72.0cm). Considering spike length, planting at November 15 showed better performances and produced the longest spike (72.0cm). Lilium bulbs planted at November 15 produced the maximum number of florets per spike (10.50) followed by all the planting dates except 15 February planting which produced only 7.0 florets/spike. Bulb planting at 15 November produced the heaviest and largest bulbs (25g & 5.11cm, respectively) and the maximum number and weight of bulblets/plant (4.0 & 5.26g, respectively).*

**Introduction**

Lilium is one of the most important bulbous flowers, belongs to Liliaceae family which have a very good demand in the flower market as cut flower and pot plants (Lucidos *et al.,* 2013). Recently, this crop has become popular in Bangladesh and being started to cultivate commercially. Among the different types of lilies, the Asiatic and Oriental hybrid lilies are very popular. Asiatic lily are relatively easier to grow and can be grown in the tropical region during the cooler months. Normally, November is the optimum planting time to produce Asiatic lilium by which flowers are available in the market during January to February. Sometimes, more flowers are produced considering market demand. There is a great demand of lilium flower round the year which is little bit difficult in Bangladesh climatic condition. But it is possible to extend the flowering time by minimizing the planting time. If flowering duration can be increased, lilium growers will be able to supply flowers on the basis of market demand, will get higher price as well as users will be benefited. So, this program was undertaken with following objectives

1. To find out the optimum planting time for better flower production
2. To extend the flowering duration of lilium

**Materials and Methods**

The experiment was carried out at Floriculture Research Farm of HRC, BARI, Gazipur during October, 2021 to June, 2022. Ten different planting dates were considered as treatments starting from 01 October with 15 days interval and ended on 15 February, 2022. Bulbs of BARI Lilium-1 were taken as planting materials. The experiment was laid out in RCB design with 3 replications. The unit plot size was 1.2 m x 1.50 m and spacing was maintained at 15cmx 15cm. The experimental land was well prepared by adding cocodust (50:50 soil and cocodust) and10t cow dung/ha. No need to apply any chemical fertilizer up to 3 weeks of bulb planting. After 3 weeks of bulb planting, NPK@30:20:20g/m2 was applied. Urea and MoP @ 100kg/ha were top dressed before spike initiation stage and bulb lifting, respectively. The data on growth, flowering and bulb characters were recorded from ten randomly selected plants from each unit plot during the study period. ANOVA and mean comparison by LSD were followed using R-software.

**Results and Discussion**

All the parameters of growth and flowering of lilium were statistically influenced by various planting time except rachis length and floret diameter (Table 1). Lilium bulbs planting at 01 December produced the longest plant (72.0cm) followed by the planting at November 15, November 01, December 15 and October 15. Considering spike length, planting at November 15 showed better performances and produced the longest spike (72.0cm) followed by the planting at 01 November up to 01 January planting. Lilium bulbs planted at November 15 produced the maximum number of florets per spike (10.50) followed by all the planting dates except 15 February planting which produced only 7.0 florets/spike. The reasons for the difference in various plant characters at different plantings as mentioned above may be due to the variations in temperature, day length and sunshine.

Table 1. Growth and flowering of Lilium influenced by various planting time

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Plant height (cm)** | **Spike length (cm)** | **Rachis length (cm)** | **Floret number/spike** | **Floret diameter (cm)** |
| Planting at 01 October (T1) | 62.50 bcd | 62.50 bcd | 27.0 | 9.0 ab | 15.25 |
| Planting at 15 October (T2) | 64.75 abc | 63.0 bcd | 27.70 | 9.50 ab | 15.75 |
| Planting at 01 November (T3) | 68.0 abc | 68.0 ab | 28.25 | 9.75 a | 16.50 |
| Planting at 15 November (T4) | 69.50 ab | 72.0 a | 30.0 | 10.50 a | 18.0 |
| Planting at 01 December (T5) | 72.0 a | 70.0 ab | 29.25 | 10.0 a | 17.50 |
| Planting at 15 December (T6) | 65.50 abc | 69.75 ab | 29.0 | 10.0 a | 17.0 |
| Planting at 01 January (T7) | 60.50 cde | 65.0 abc | 28.0 | 9.75 a | 16.33 |
| Planting at 15 January (T8) | 55.75def | 62.50 bcd | 26.50 | 8.50 ab | 14.75 |
| Planting at 01 February (T9) | 50.55 f | 57.0 cd | 26.50 | 8.0 ab | 14.0 |
| Planting at 15 February (T10) | 52.0 ef | 55.0 d | 25.0 | 7.0 b | 13.50 |
| Level of Significance | \*\* | \*\* | NS | \*\* | NS |
| CV (%) | 4.76 | 4.45 | 12.65 | 9.76 | 10.21 |

All the parameters of bulb and bulblet production of lilium were significantly influenced by various planting time (Table 2). Bulb planting at 15 November produced the heaviest and largest bulbs (25g & 5.11cm, respectively) and the maximum number and weight of bulblets/plant (4.0 & 5.26g, respectively), Planting at 01 December also showed better performances regarding all parameters. Though delay and early planting did not show good performances compare to normal planting but moderate performances were showed. Hong et al. (1989) also reported that the weight of new corm production in gladiolus decreased with delay in planting

Table 2. Bulb and bulb production of Lilium influenced by various planting time

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatments** | **Bulb weight (g)** | **Bulb diameter (cm)** | **Bulblet number/plant** | **Bulblet weight/plant (g)** |
| Planting at 01 October (T1) | 15.0 de | 3.42 ef | 2.70 bc | 3.75 bc |
| Planting at 15 October (T2) | 16.80 cd | 3.77 de | 2.75 bc | 3.90 bc |
| Planting at 01 November (T3) | 19.25 bc | 4.50 bc | 3.0 abc | 4.70 ab |
| Planting at 15 November (T4) | 25.0 a | 5.11 a | 4.0 a | 5.26 a |
| Planting at 01 December (T5) | 22.25 ab | 4.99 ab | 3.90 a | 5.00 ab |
| Planting at 15 December (T6) | 20.0 bc | 4.80 ab | 3.50 ab | 4.85 ab |
| Planting at 01 January (T7) | 18.75 c | 4.15 cd | 3.0 abc | 4.69 ab |
| Planting at 15 January (T8) | 13.0 ef | 3.06 fg | 2.70 bc | 3.70 bc |
| Planting at 01 February (T9) | 11.50 f | 2.53 gh | 2.50 bc | 3.20 c |
| Planting at 15 February (T10) | 10.0 f | 2.40 h | 2.0 c | 2.90 c |
| Level of Significance | \*\* | \*\* | \*\* | \*\* |
| CV (%) | 6.81 | 4.70 | 11.86 | 11.0 |

**Conclusion**

Lilium bulbs planted at November 15 and December 01 showed better performances but these can be planted up to 15 February for extending the flowing time in the market. This is the result of first year. For final conclusion this experiment should be continued.`

**Acknowledgement**

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**DETERMINING OPTIMUM STORAGE TEMPERATURE WITH PACKAGING ON FOR PRESERVATION OF LILIUM FLOWER**

M. S. ARFIN, A. NAZNIN, K. AMBIA, T. A. A. NASRIN and M. N. ISLAM

***Abstract***

*An experiment was conducted at the floriculture division research field and Postharvest Technology Laboratory of Horticulture Research Centre, BARI, Gazipur during 2019-2020 to find out the optimum temperature and storage duration for preservation of lilium flower. Among three levels of temperature (80C, 120C and room temperature (23±10C) and two storage duration (2 days and 4 days), 80C temperature with 2 days duration performed best in case of vase life of lilium flowers.*

**Introduction**

Lilium produce very large and beautiful flowers with various colors. This unique flower is gaining peoples concentration and standing out alone of the crowd. The main problem of all cut flowers is vase life performance. The more flower stays longer in vase, the more profitable is in the flower business. Lilium cultivation is getting popularity day by day among the flower growers of Bangladesh. Cut flower sector of Bangladesh have many obstacles. One of the major areas of problem is related to flower transportation system from growing area to the market. Many flowers are wasted during transportation. Absence of cold storage to preserve fresh flowers and cold chain to transport flowers are two major limitations in maintenance of quality and extending shelf life of flowers in Bangladesh. There is no cold storage in the country to preserve or store flowers during emergency.

Therefore, a large number of flowers perish in the field or market. Lilium is not an exception. In spite of its commercial importance, there is limited information on its postharvest preservation temperature and time as a cut flower. Sometimes due to some unavoidable circumstances it is not possible to sell the harvested flowers within the optimum time. So, flower becomes dull appearance with reduced quality and it lost consumer preference. Therefore, the present study is taken to find out the optimum storage temperature and duration for preservation of lilium flowers.

**Materials and methods**

The study was conducted at floriculture division research field and Postharvest Technology laboratory of Horticulture Research Centre, BARI, Gazipur during 2019-2020. Three storage temperature T1, T2 and T3 (80C, 120 C and room temperature (23±10C)and two duration of storage time D1 and D2 (2 days and 4 days) were included in this study. Flowers of BARI Lilium 1 were used as materials. Flower sticks were collected when first two florets of a flower stick showed color. Selected stalks were cut with sharp knife from 12 cm apart above the ground. Data were recorded on change in fresh weight of flower spike (g), days taken for the opening of first floret and vase life (days). Vase life was recorded as the number of days on vase until the flowers showed symptoms of bent neck or advanced signs of fading on all petals. It was calculated when half of florets of the stick became unattractive. The weight of flower sticks was measured after 30 minutes of dipping into pulsing solution.

**Results and discussion**

The main effect of fresh weight (g) change and vase life (days) of lilium flower spike under different treatments was shown in table 1. In case of temperature levels, the fresh weight change (g) of lilium spike showed no significant variation whereas vase life varied significantly. Vase life was maximum in T1 (4.50 days) and minimum in T3 (1.66days) treatment. Further, in case of storage duration all the parameters showed no significant variation except in day 6, day7 and vase life performance. Maximum fresh weight observed for both day 6 and day 7 was in D1 (43.00 and 36.88g) and for vase life D1 showed maximum performance (4.00 days).

**Table 1. Main effect of fresh weight (g) change and vase life (days) of lilium flower spike under different treatments**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Fresh weight of lilium flower stalk (g)** | | | | | | | | Vase life (days) |
| Initial day | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 |
| Temperature |  |  |  |  |  |  |  |  |  |
| T1 | 66.66 | 64.16 | 61.33 | 64.33 | 61.83 | 61.50 | 39.83 | 36.16 | 4.50a |
| T2 | 66.00 | 63.16 | 60.16 | 64.00 | 59.00 | 58.00 | 40.00 | 35.00 | 3.33b |
| T3 | 67.00 | 60.50 | 55.66 | 54.00 | 50.33b | 45.00 | 32.33 | 26.33 | 1.66 c |
| LS | NS | NS | NS | NS | NS | NS | NS | NS | \* |
| Duration |  |  |  |  |  |  |  |  |  |
| D1 | 64.55 | 61.55 | 58.00 | 60.33 | 58.33 | 52.33 | 43.00a | 36.88 a | 4.00a |
| D2 | 68.55 | 63.66 | 60.11 | 61.22 | 55.77 | 57.33 | 32.11b | 28.11 b | 2.33b |
| LS | NS | NS | NS | NS | NS | NS | **\*** | **\*** | **\*** |
| **CV (%)** | **7.69** | **7.15** | **7.67** | **8.96** | **9.87** | **8.78** | **13.64** | **12.29** | **15.25** |

T1 = 80C, T2 = 120 C and T3 = room temperature (23±10C), D1 = 2 days D2 = 4 days \*Significant at 0.05 level; LS= Level of significance

**Table 2.** **Combined effect of fresh weight (g) change and vase life (days) of lilium flower spike under different treatments**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Fresh weight of lilium flower stalk (g)** | | | | | | | | Vase life (days) |
|  | Initial | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 |
| T1D1 | 56.66d | 55.66c | 52.66 b | 55.66 b | 55.00 b | 54.00 cd | 45.66a | 40.66 a | 5.66 a |
| T1D2 | 76.66a | 72.66a | 70.00 a | 73.00 a | 68.66 a | 72.00 a | 34.00 bc | 31.66 b | 3.33 c |
| T2D1 | 71.00ab | 69.00 ab | 66.00 a | 69.00 a | 66.00 a | 61.66 b | 53.66a | 46.00 a | 4.33 b |
| T2D2 | 61.60ab | 57.33 c | 54.33 b | 59.00 b | 52.00 b | 54.33 bc | 26.33 c | 24.00 c | 2.33 d |
| T3D1 | 66.00 cd | 60.00 c | 55.33 b | 56.00 b | 54.00 b | 44.33 d | 29.66 bc | 24.00c | 2.00 de |
| T3D2 | 68.00abc | 61.00bc | 56.00 b | 51.66 b | 46.66 b | 45.66 cd | 36.00b | 28.66 bc | 1.33 e |
| Level of significance | NS | NS | NS | NS | NS | NS | \* | \* | \* |
| **CV (%)** | **7.69** | **7.15** | **7.67** | **8.96** | **9.87** | **8.78** | **13.64** | **12.29** | **15.25** |

T1 = 80C, T2 = 120 C and T3 = room temperature (23±10C), D1 = 2 days D2 = 4 days \*Significant at 0.05 level;

The combined effect of fresh weight (g) change and vase life (days) of lilium flower spike under different treatments was shown in table 2. All the parameters showed non-significant variation among the combinations except day 6, day 7 and vase life. Fresh weight was maximum in T1D1 (45.66 g) at day 6 followed by T2D1 (53.66 g) and minimum fresh weight was in T2D2 (26.33 g) followed by T1D2 (34.00 g) and T3D1 (29.66 g). In day 7, fresh weight was highest in T2D1 (46.00 g) followed by T1D1 (40.66 g) and lowest fresh weight was found in T2D2 (24.00 g) and T3D1 (24.00 g) followed by T3D2 (28.66 g). Again, in case of vase life maximum vase life was performed by T1D1 (5.66 days) and minimum vase life was found in T3D2 (1.33 days) followed by T3D1 (2.00 days).

**Conclusion**

Considering the vase life of lilium flower the combination of 80C temperature with 2 days storage duration had significant influence on vase life enhancement. This experiment is needed to be continued for confirming the result.

**Acknowledgement**

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**ADAPTIVE TRIAL OF GLADIOLUS VARIETIES AT FARMERS FIELD**

**Abstract**

*A trial was conducted at Gazipur, Rajshahi, Bogura, Rangpur, Khagrachori and Jamalpur during 2021-2022 to evaluate the performance of gladiolus varieties and to popularize among the farmers. Varieties like BARI Gladiolus-3, BARI Gladiolus-4 and BARI Gladiolus-5 showed better performance and produced higher yield at all locations than BARI Gladiolus-1 variety. The demand of BARI Gladiolus-3 and BARI Gladiolus-5* *was more in Gazipur, Rajshahi and Bogra depending on the consumer’s choice, early flowering and economic value. But the demand of BARI Gladiolus-3 and BARI Gladiolus-4 were more in Rangpur and Jamalpur.*

**Introduction**

The aesthetic value of flowers in the daily life is increasing with the advancement of civilization. Gladiolus is used as cut flower in Bangladesh. The major production belts of this flower in the country are Jashore sadar, Sharsha, Chowgacha, Kushtia, Chuadanga, Satkhira, Khulna, Chattogram, Mymensingh, Dhaka, Savar, Narayangonj and Gazipur regions. Now a days, farmers are cultivating different cultivars of gladiolus in different locations. However, yield potential of those cultivars is not known and some of them are not performing well in our country. BARI has developed 6 varieties of gladiolus which have high potential in yield and other characters but these varieties are not widely cultivated in Bangladesh. Therefore, quick dissemination and popularization of BARI released gladiolus variety is urgently needed. Widespread and effective demonstration of them at farmers’ field will lead to ensure availability of gladiolus flowers in Bangladesh.

**Materials and Methods**

A trial was conducted at Vitipara (Gazipur), Sonatola (Bogura), Aamchattor(Rajshahi), Baruamari (Jamalpur), Parachora (Khagrachori) and Burirhat (Rangpur) during Rabi 2021-2022. The experiment was laid out in RCB design with four dispersed replications. The unit plot was 1500 m2 areas with plant spacing of 20 × 20 cm. Four varieties of gladiolus viz. BARI Gladiolus-1 (Red), BARI Gladiolus-3 (White), BARI Gladiolus-4 (Pink) and BARI Gladiolus-5 (Yellow) were included in the trial. The field was well prepared by adding 10 t cowdung and fertilized @ 200 Kg N, 50 Kg P, 150 Kg K, 20 Kg S, 2 kg B and 3 kg Zn/ha. Cowdung, P, K, B, S and Zn were applied as basal and N was top-dressed in two equal splits at 4 leaf stage and spike initiation stage. Intercultural operations were done as and when necessary. Pest and other crop management practices were done as and when necessary. The spikes were cut when lower 2-3 florets showed their blushes of colour. The data on yield and yield contributing characters were taken and analyzed statistically and means were separated by LSD test at 5% level of significance. The gross economic return was calculated on the basis of prevailing market price of the commodities.

**Results and Discussion**

**Gazipur:** Yield and yield attributing characters differed significantly among the varieties (Table 1). Early flowering was observed in BARI Gladiolus-5 followed by BARI Gladiolus-3. The highest floret number (14.4) was observed in BARI Gladiolus-3 and BARI Gladiolus-5. Spike length (102.0 cm) and Rachis length (55.0 cm) was highest in BARI Gladiolus-3. However, maximum weight of flower (105.0 g) was recorded in BARI Gladiolus-5. Maximum yield/ha (188000) was observed in BARI Gladiolus-5 which differed significantly from other varieties. BARI Gladiolus-1 showed poor performances in all the parameters. Highest gross margin and gross return were recorded from BARI Gladiolus-5 (Table 2) followed by BARI Gladiolus-3.

**Table 1. Yield and yield component of different gladiolus varieties at Gazipur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./spike** | **Spike length (cm)** | **Rachis length (cm)** | **Flower stick wt. (g)** | **Yield (no/ha) (’000)** |
| BARI Gladiolus-3 | 77 bc | 14.6 a | 100.0 a | 56.0 a | 93.0 b | 185 b |
| BARI Gladiolus-4 | 84 a | 12.7 ab | 90.0 c | 48.0 bc | 88.0 c | 180 c |
| BARI Gladiolus-5 | 74 c | 14.5 a | 96.0 b | 51.0 b | 100.0 a | 188 a |
| BARI Gladiolus-1 (Check) | 80 b | 10.2 b | 85.0 d | 45.0 c | 80.0 d | 176 d |
| **Level of significance** | \* | \* | \* | \* | \* | \* |
| **CV (%)** | **9.0** | **8.8** | **7.5** | **8.8** | **8.9** | **10.2** |

\* Significant at 5% level

**Table 2. Economic performances of different gladiolus varieties at Gazipur**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no/ha) (’000)** | **Gross return (Tk./ha)** | **Variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR (Tk./Tk.)** |
| BARI Gladiolus-3 | 185 b | 1850000/- | 600000/- | 1250000/- | 3.1 |
| BARI Gladiolus-4 | 180 c | 1800000/- | 600000/- | 1200000/- | 3.0 |
| BARI Gladiolus-5 | 188 a | 1900000/- | 600000/- | 1300000/- | 3.2 |
| BARI Gladiolus-1 (Check) | 175 d | 1050000/- | 450000/- | 600000/- | 2.3 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Gladiolus-1 (4 Tk./stick, 2 Tk./corm), BARI Gladiolus-3 (7 Tk./stick, 3 Tk./corm),

BARI Gladiolus-4 (7 Tk./stick, 3 Tk./corm) and BARI Gladiolus-5 (7 Tk./stick, 3 Tk./corm)

**Rajshahi:**

The variety BARI Gladiolus-5 gave higher yield (190000/ha) compared to other varieties. Other yield contributing characters viz. floret number, spike length and rachis length were higher in BARI Gladiolus-3 (Table 3). Benefit cost ratio was maximum in BARI Gladiolus-3 (Table 4).

**Table 3. Yield and yield component of different gladiolus varieties at Rajshahi**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./spike** | **Spike length (cm)** | **Rachis length (cm)** | **Flower stick wt. (g)** | **Yield (no/ha) (’000)** |
| BARI Gladiolus-3 | 75 bc | 14.3 a | 100.0 a | 64.0 a | 88.0 b | 186 ab |
| BARI Gladiolus-4 | 83 a | 12.5 ab | 90.0 c | 49.5 bc | 79.0 c | 185 b |
| BARI Gladiolus-5 | 73 c | 14.4 a | 95.0 b | 58.0 b | 102.0 a | 190 a |
| BARI Gladiolus-1 (Check) | 78 b | 9.7 b | 84.0 d | 47.0 c | 70.0 d | 176 c |
| **Level of significance** | \* | \* | \* | \* | \* | \* |
| **CV (%)** | **8.7** | **6.9** | **7.2** | **7.4** | **6.8** | **10.3** |

\* Significant at 5% level

**Table 4. Economic performances of different gladiolus varieties at Rajshahi**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no/ha) (’000)** | **Gross return (Tk./ha)** | **Variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR (Tk./Tk.)** |
| BARI Gladiolus-3 | 186 ab | 2418000/- | 600000/- | 1818000/- | 4.1 |
| BARI Gladiolus-4 | 185 b | 2035000/- | 600000/- | 1435000/- | 3.4 |
| BARI Gladiolus-5 | 190 a | 2090000/- | 600000/- | 1490000/- | 3.5 |
| BARI Gladiolus-1 (Check) | 176 c | 1232000/- | 450000/- | 782000/- | 2.7 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Gladiolus-1 (5 Tk./stick, 2 Tk./corm), BARI Gladiolus-3 (10 Tk./stick, 3 Tk./corm),

BARI Gladiolus-4 (8 Tk./stick, 3 Tk./corm) and BARI Gladiolus-5 (8 Tk./stick, 3 Tk./corm)

**Bogura :** Yield and yield contributing characters are presented in Table 5. Flower yield was found more in BARI Gladiolus-5 followed by BARI Gladiolus-3. However cost and return analysis showed that BARI Gladiolus-3 gave the highest gross margin, which was economically profitable (Table 6).

**Table 5. Yield and yield component of different gladiolus varieties at Bogura**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./spike** | **Spike length (cm)** | **Rachis length (cm)** | **Flower stick wt. (g)** | **Yield (no/ha) (’000)** |
| BARI Gladiolus-3 | 72 bc | 14.3 a | 102.0 a | 58.5 a | 88.8 b | 188 ab |
| BARI Gladiolus-4 | 82 a | 12.5 ab | 92.0 c | 46.5 bc | 75.2 c | 186 b |
| BARI Gladiolus-5 | 68 c | 14.3 a | 97.0 b | 53.5 b | 100.0 a | 191 a |
| BARI Gladiolus-1 (Check) | 76 b | 10.0 b | 88.0 d | 45.0 c | 69.3 d | 177 c |
| **Level of significance** | \* | \* | \* | \* | \* | \* |
| **CV (%)** | **7.5** | **6.8** | **7.2** | **7.4** | **7.1** | **10.2** |

\* Significant at 5% level

**Table 6. Economic performances of different gladiolus varieties at Bogura**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no/ha) (’000)** | **Gross return (Tk./ha)** | **Variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR (Tk./Tk.)** |
| BARI Gladiolus-3 | 188 ab | 2068000/- | 600000/- | 1468000/- | 3.5 |
| BARI Gladiolus-4 | 186 b | 1860000/- | 600000/- | 1260000/- | 3.1 |
| BARI Gladiolus-5 | 191 a | 1910000/- | 600000/- | 1310000/- | 3.2 |
| BARI Gladiolus-1 (Check) | 177 c | 1239000/- | 450000/- | 7890000/- | 2.8 |

**Source :** Farmer’s Field (2021-2022)

Price : BARI Gladiolus-1 (5 Tk./stick, 2 Tk./corm), BARI Gladiolus-3 (8 Tk./stick, 3 Tk./corm),

BARI Gladiolus-4 (7 Tk./stick, 3 Tk./corm) and BARI Gladiolus-5 (7 Tk./stick, 3 Tk./corm)

**Rangpur:**

Yield and yield contributing characteristics of gladiolus are presented in Table 7. Significant variation was observed among all the characteristics studied. However the highest yield was observed in BARI Gladiolus-4 followed by BARI Gladiolus-5. Gross return (Tk. 2090000/ha) and benefit cost ratio (3.5) were also maximum in BARI Gladiolus-4. BARI Gladiolus-1 gave the lowest gross return due to lower yield than other varieties.

**Table 7. Yield and yield component of different gladiolus varieties at Rangpur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./spike** | **Spike length (cm)** | **Rachis length (cm)** | **Flower stick wt. (g)** | **Yield (no/ha) (’000)** |
| BARI Gladiolus-3 | 67 bc | 14.5 a | 103.5 a | 58.0 a | 83.4 b | 185 b |
| BARI Gladiolus-4 | 74 a | 12.7 ab | 94.5 bc | 46.3 c | 65.9 c | 190 a |
| BARI Gladiolus-5 | 65 c | 14.2 a | 96.5 b | 52.2 b | 105.0 a | 187 ab |
| BARI Gladiolus-1 (Check) | 70 b | 10.1 b | 88.5 c | 42.2 d | 59.5 d | 180 c |
| **Level of significance** | \* | \* | \* | \* | \* | \* |
| **CV (%)** | **8.5** | **6.9** | **7.8** | **7.9** | **7.4** | **10.2** |

\* Significant at 5% level

**Table 8. Economic performances of different gladiolus varieties at Rangpur**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no/ha) (’000)** | **Gross return (Tk./ha)** | **Variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR (Tk./Tk.)** |
| BARI Gladiolus-3 | 185 b | 1850000/- | 600000/- | 1250000/- | 3.1 |
| BARI Gladiolus-4 | 190 a | 2090000/- | 600000/- | 1490000/- | 3.5 |
| BARI Gladiolus-5 | 187 ab | 1683000/- | 600000/- | 1830000/- | 2.8 |
| BARI Gladiolus-1 (Check) | 180 c | 1080000/- | 450000/- | 1630000/- | 2.4 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Gladiolus-1 (4 Tk./stick, 2 Tk./corm), BARI Gladiolus-3 (7 Tk./stick, 3 Tk./corm),

BARI Gladiolus-4 (8 Tk./stick, 3 Tk./corm) and BARI Gladiolus-5 (6 Tk./stick, 3 Tk./corm)

**Khagrachori :**

BARI Gladiolus-5 gave higher yield (190000/ha) compared to other varieties. Other yield contributing characters viz. floret number, spike length and rachis length were higher in BARI Gladiolus-3 (Table 9). Benefit cost ratio was maximum in BARI Gladiolus-3 (Table 10).

**Table 9. Yield and yield component of different gladiolus varieties at Khagrachori**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./spike** | **Spike length (cm)** | **Rachis length (cm)** | **Flower stick wt. (g)** | **Yield (no/ha) (’000)** |
| BARI Gladiolus-3 | 72 bc | 14.1 a | 102.0 a | 58.0 a | 84.0 b | 186 ab |
| BARI Gladiolus-4 | 80 a | 12.5 ab | 94.0 c | 47.5 bc | 69.0 c | 185 b |
| BARI Gladiolus-5 | 68 c | 14.0 a | 99.0 b | 52.0 b | 102.0 a | 190 a |
| BARI Gladiolus-1 (Check) | 74 b | 9.5 b | 87.0 d | 46.0 c | 61.0 d | 176 c |
| **Level of significance** | \* | \* | \* | \* | \* | \* |
| **CV (%)** | **8.7** | **6.9** | **7.2** | **7.4** | **6.8** | **10.3** |

\* Significant at 5% level

**Table 10. Economic performances of different gladiolus varieties at Khagrachori**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no/ha) (’000)** | **Gross return (Tk./ha)** | **Variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR (Tk./Tk.)** |
| BARI Gladiolus-3 | 186 ab | 2418000/- | 600000/- | 1818000/- | 4.1 |
| BARI Gladiolus-4 | 185 b | 2035000/- | 600000/- | 1435000/- | 3.4 |
| BARI Gladiolus-5 | 190 a | 2090000/- | 600000/- | 1490000/- | 3.5 |
| BARI Gladiolus-1 (Check) | 176 c | 1232000/- | 450000/- | 782000/- | 2.7 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Gladiolus-1 (5 Tk./stick, 2 Tk./corm), BARI Gladiolus-3 (10 Tk./stick, 3 Tk./corm),

BARI Gladiolus-4 (8 Tk./stick, 3 Tk./corm) and BARI Gladiolus-5 (8 Tk./stick, 3 Tk./corm)

**Jamalpur:**

The result revealed that higher yield was found in BARI Gladiolus-4, followed by BARI Gladiolus-5 and BARI Gladiolus-3. However other yield contributing characters like floret number, spike length and rachis length were higher in BARI Gladiolus-3 (Table 11). Benefit cost ratio was also higher in BARI Gladiolus-4 (Table 12).

**Table 11. Yield and yield component of different gladiolus varieties at Jamalpur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./spike** | **Spike length (cm)** | **Rachis length (cm)** | **Flower stick wt. (g)** | **Yield (no/ha) (’000)** |
| BARI Gladiolus-3 | 67 b | 14.5 a | 102.0 a | 58.9 a | 89.0 b | 187 ab |
| BARI Gladiolus-4 | 72 a | 12.6 ab | 89.0 c | 46.6 c | 76.0 c | 192 a |
| BARI Gladiolus-5 | 66 b | 14.5 a | 94.0 b | 52.5 b | 105.2 a | 188 ab |
| BARI Gladiolus-1 (Check) | 71 ab | 10.4 b | 84.5 d | 42.2 d | 68.8 d | 182 b |
| **Level of significance** | \* | \* | \* | \* | \* | \* |
| **CV (%)** | **8.7** | **6.8** | **7.2** | **7.5** | **6.7** | **9.7** |

\* Significant at 5% level

**Table 12. Economic performances of different gladiolus varieties at Jamalpur**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no/ha) (’000)** | **Gross return (Tk./ha)** | **Variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR (Tk./Tk.)** |
| BARI Gladiolus-3 | 187 ab | 1870000/- | 600000/- | 1270000/- | 3.1 |
| BARI Gladiolus-4 | 192 a | 1920000/- | 600000/- | 1320000/- | 3.2 |
| BARI Gladiolus-5 | 188 ab | 16920000/- | 600000/- | 1392000/- | 2.9 |
| BARI Gladiolus-1 (Check) | 182 b | 10920000/- | 450000/- | 642000/- | 2.4 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Gladiolus-1 (4 Tk./stick, 2 Tk./corm), BARI Gladiolus-3 (7 Tk./stick, 3 Tk./corm),

BARI Gladiolus-4 (7 Tk./stick, 3 Tk./corm) and BARI Gladiolus-5 (6 Tk./stick, 3 Tk./corm)

**Farmer’s Opinion**

**Gazipur :** Farmers showed their keen interest to grow BARI Gladiolus-3 and BARI Gladiolus-5 due to their higher yield potentialities, shorter duration and economic profit.

**Rajshahi :** Considering different flower character like floret number, spike length as well as economic value, farmers preferred BARI Gladiolus-3.

**Bogura :** Farmers of this area are interested to cultivate BARI Gladiolus-3 and BARI Gladiolus-5 due to its higher yield potentiality, early flowering and economic profit.

**Rangpur :** Farmers were very positive to cultivate BARI Gladiolus-3 and BARI Gladiolus-4 due to its attractive colour and economic profit.

**Khagrachori :** Considering different flower character like floret number, spike length as well as economic value, farmers preferred BARI Gladiolus-5.

**Jamalpur :** Farmers are interested and happy on cultivation of BARI Gladiolus-3 and BARI Gladiolus-4 due to it’s higher yield potentiality and better market price over local variety. They preferred both the gladiolus varieties that there was no incidence of disease and insect in these varieties.

**Acknowledgement**

The authors are grateful to NATP-2, BARC funded DPPHCROSUAB sub-project for financial support to conduct the research

**ADAPTIVE TRIAL OF TUBEROSE VARIETIES AT FARMERS FIELD**

**Abstract**

*Trials were conducted at Gazipur, Bogura, Rangpur, Rajshahi, Khagrachori and Jamalpur during 2021-2022 to observe the performance of BARI released Tuberose variety under farmer’s field condition. BARI Tuberose-1 variety showed better performance and produced higher yield over local variety at all locations.*

**Introduction**

Tuberose (*Polianthes tuberosa* L.) is an important cut flower in Bangladesh from aesthetic as well as commercial point of view. It is suitable for use in herbaceous borders, beddings, pots and for cut flowers. Sometimes it is used for loose flower also. Apart from ornamental value, tuberose is extensively utilized in medicines for headache, diarrhoea, rheumatism and allied pains. Due to its increasing demand, farmers have started growing tuberose as a field crop under different management practices. Good variety, proper spacing, optimum size of bulbs, fertilizer requirement, irrigation schedule, use of growth regulators, optimum time of planting etc. are some of the important factors that may help to increase the yield and quality of tuberose. The major production belts of this flower in the country are Jeshore sadar, Sharsha, Chowgacha, Kushtia, Chuadanga, Rangpur, Bogura, Satkhira, Khulna, Chattogram, Dhaka, Savar and Gazipur regions. Now a days, farmers are cultivating different cultivars of tuberose in different locations. However, yield potential of those cultivars is not known and some of them are not performing well in our country. BARI developed tuberose variety that need to be popularize among the farmers. To do so, on-farm trial is one of the ways to demonstrate better performance of the variety. Therefore, trials on BARI Tuberose-1 with promising line PT-001 as check were conducted at Gazipur, Rajshahi, Bogura, Rangpur Khagrachori and Jamalpur to evaluate the performance of tuberose varieties and to popularize among the farmers.

**Materials and Methods**

A trial was conducted at Vitipara (Gazipur), Sonatola (Bogura), Aamchattar (Rajshahi), Parachora (Khagrachori), Burrirhat (Rangpur) and Baruamari (Jamalpur) during 2021-2022. The experiment was laid out in RCB design with two dispersed replications. The unit plot was 1500 m2 areas with plant spacing of 30 × 20 cm. Bulbs of BARI Tuberose-1 along with check (PT-001) were used as planting material. Manure, fertilizer, insecticide, fungicide, netted bag, secateurs, budding knife etc. were supplied for making availability of inputs among the farmers in time. The experimental field was well prepared by adding 10t cowdung and fertilized @ 435 kg urea, 400 kg TSP, 300 kg MoP, 12 kg boric acid and 8 kg ZnSO4/ha (Khan & Dadlani, 2014). Cowdung, TSP, MoP, boric acid and ZnSO4 were applied as basal and urea was top-dressed in two equal splits at 30 days after planting and spike initiation stage.

**Results**

Farmers are interested to cultivate the variety of BARI Tuberose-1 for getting higher yield over local variety at all locations (Table 1-6). They also preferred BARI Tuberose-1 because there was no incidence of pest and disease recorded in the field. On the other hand, benefit cost ratio was also higher in BARI Tuberose-1.

**Table 1. Economic performances of different tuberose varieties at Gazipur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Tuberose -1 | Flower | 215000 | 1947500 | 600000 | 1347500 | 3.24 |
| Bulb | 490000 |
| PT-001 | Flower | 145000 | 840000 | 500000 | 340000 | 1.68 |
| Bulb | 270000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Tuberose - 1 (4.5 Tk./stick, 2.0 Tk./bulb), PT-001 (3.0 Tk./stick, 1.5 Tk./bulb)

**Table 2. Economic performances of different tuberose varieties at Bogura**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Tuberose -1 | Flower | 220000 | 1600000 | 500000 | 1100000 | 3.2 |
| Bulb | 480000 |
| PT-001 | Flower | 150000 | 937500 | 430000 | 507500 | 2.18 |
| Bulb | 275000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Tuberose - 1 (4 Tk./stick, 1.5 Tk./bulb), PT-001 (3.5 Tk./stick, 1.5 Tk./bulb)

**Table 3. Economic performances of different tuberose varieties at Rangpur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Tuberose -1 | Flower | 225000 | 1635000 | 500000 | 1135000 | 3.27 |
| Bulb | 490000 |
| PT-001 | Flower | 155000 | 962500 | 430000 | 532500 | 2.23 |
| Bulb | 280000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Tuberose - 1 (4 Tk./stick, 1.5 Tk./bulb), PT-001 (3.5 Tk./stick, 1.5 Tk./bulb)

**Table 4. Economic performances of different tuberose varieties at Rajshahi**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Tuberose-1 | Flower | 228000 | 1647000 | 500000 | 1147000 | 3.29 |
| Bulb | 490000 |
| PT-001 | Flower | 155000 | 735000 | 430000 | 305000 | 1.70 |
| Bulb | 270000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Tuberose - 1 (4.0 Tk./stick, 1.5 Tk./bulb), PT-001 (3.0 Tk./stick, 1.0 Tk./bulb)

**Table 5. Economic performances of different tuberose varieties at Khagrachari**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Tuberose-1 | Flower | 230000 | 1515000 | 500000 | 1015000 | 3.03 |
| Bulb | 550000 |
| PT-001 | Flower | 160000 | 750000 | 430000 | 320000 | 1.74 |
| Bulb | 350000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Tuberose - 1 (3 Tk./stick, 1.5 Tk./bulb), PT-001 (2.5 Tk./stick, 1 Tk./bulb)

**Table 6. Economic performances of different tuberose varieties at Jamalpur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Tuberose -1 | Flower | 220000 | 1600000 | 500000 | 1100000 | 3.2 |
| Bulb | 480000 |
| PT-001 | Flower | 150000 | 937500 | 430000 | 507500 | 2.18 |
| Bulb | 275000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Tuberose - 1 (4 Tk./stick, 1.5 Tk./bulb), PT-001 (3.5 Tk./stick, 1.5 Tk./bulb)

**Acknowledgement**

The authors are grateful to NATP-2, BARC funded DPPHCROSUAB sub-project for financial support to conduct the research.

**ADAPTIVE TRIAL OF MARIGOLD VARIETIES AT FARMERS FIELD**

**Abstract**

*Trials were conducted at Gazipur, Bogura, Rangpur, Rajshahi, Khagrachori and Jamalpur during 2021-2022 to observe the performance of BARI released Marigold variety under farmer’s field condition. BARI Marigold -1 variety showed better performance and produced higher yield over local variety at all locations.*

**Introduction**

Marigold gained popularity amongst gardeners and flower growers on account of its easy culture and wide adaptability (Randhawa and Mukhopadhyay, 2018). Its habit of free flowering to produce marketable flowers, wide spectrum of attractive colour, shape, size and good keeping quality attracted the attention of flower growers (Sharifuzzaman *et al.,* 2013). BARI developed summer marigold variety that needs to be popularize among the farmers. To do so, on-farm trial is one of the way to demonstrate better performance of the variety. Therefore, trial on BARI Marigold-1 was conducted at Gazipur, Rajshahi, Bogura, Rangpur, Khargrachori and Jamalpur during 2020-21 to evaluate the performance of marigold variety and to popularize among the farmers.

**Materials and Methods**

A trial on marigold was conducted at Vitipara (Gazipur), Sonatola (Bogura), Aamchattar (Rajshahi), Parachora (Khagrachori), Burrirhat (Rangpur) and Baruamari (Jamalpur) during 2021-2022. The experiment was laid out in RCB design with two dispersed replications. The unit plot size was 1500 m2 areas with plant spacing of 30 × 20 cm. Cuttings of BARI Marigold-1 along with check (PT-001) were used as panting materials. Manure fertilizer, insecticide, fungicide, netted bag, secateurs, budding knife etc. were supplied for making availability of inputs among with farmers in time. The experimental field was well prepared by adding 5t cowdung and fertilizer @ 250 kg urea, 200 kg TSP, 150 kg MoP, 8 kg boric acid and 5 kg Zn SO4/ha. Cowdung, TSP, MoP, boric acid and Zn SO4 were applied as basal and urea was top-dressed in two equal splits at 30 days after planting and spike initiation stage.

**Results**

Farmers are interested to cultivate the variety of BARI Marigold-1 for getting higher yield over local variety at all locations (Table 1-6). They also preferred BARI Marigold-1 because there was no incidence of pest and disease recorded in the field. On the other hand, benefit cost ratio was also higher in BARI Marigold-1.

**Table 1. Economic performances of different marigold varieties at Gazipur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Marigold-1 | Flower | 4,50,000 | 560000 | 180000 | 380000 | 3.1 |
| Seedling | 200000 |
| TE-001 | Flower | 3,00000 | 450000 | 180000 | 270000 | 2.5 |
| Seedling | 150000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Marigold- 1 (0.8 Tk./flower, 1.0 Tk./seedling), TE-001 (0.4 Tk./flower, 0.8Tk./ seedling)

**Table 2. Economic performances of different marigold varieties at Bogura**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Marigold-1 | Flower | 4,51,000 | 435500 | 180000 | 255500 | 2.4 |
| Seedling | 210000 |
| TE-001 | Flower | 3,10000 | 283000 | 180000 | 103000 | 1.6 |
| Seedling | 160000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Marigold- 1 (0.5 Tk./flower, 1.0 Tk./seedling), TE-001 (0.5 Tk./flower, 0.8Tk./ seedling)

**Table 3. Economic performances of different marigold varieties at Rangpur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return (Tk.)** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Marigold-1 | Flower | 4,75,000 | 447500 | 180000 | 267500 | 2.4 |
| Seedling | 210000 |
| TE-001 | Flower | 3,25000 | 302500 | 180000 | 122500 | 1.7 |
| Seedling | 175000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Marigold- 1 (0.5 Tk./flower, 1.0 Tk./seedling), TE-001 (0.5 Tk./flower, 0.8Tk./ seedling)

**Table 4. Economic performances of different marigold varieties at Rajshahi**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Marigold-1 | Flower | 4,65,000 | 489000 | 180000 | 255500 | 2.4 |
| Seedling | 210000 |
| TE-001 | Flower | 3,25,000 | 290500 | 180000 | 110500 | 1.6 |
| Seedling | 160000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Marigold- 1 (0.6 Tk./flower, 1.0 Tk./seedling), TE-001 (0.5 Tk./flower, 0.8Tk./ seedling)

**Table 5. Economic performances of different marigold varieties at Khagrachori**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Marigold-1 | Flower | 4,00,000 | 202500 | 120000 | 82500 | 1.7 |
| Seedling | 205000 |
| TE-001 | Flower | 3,00000 | 150000 | 120000 | 30000 | 1.3 |
| Seedling | 150000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Marigold- 1 (0.25 Tk./flower, 0.5 Tk./seedling), TE-001 (0.25 Tk./flower, 0.5Tk./ seedling)

**Table 6. Economic performances of different marigold varieties at Jamalpur**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variety** | **Yield (no./ha)** | | **Net return** | **Total variable cost (Tk./ha)** | **Gross margin (Tk./ha)** | **BCR**  **(Tk./Tk.)** |
| BARI Marigold-1 | Flower | 4,60,000 | 683000 | 180000 | 503000 | 3.8 |
| Seedling | 210000 |
| TE-001 | Flower | 3,50000 | 303000 | 180000 | 123000 | 1.6 |
| Seedling | 160000 |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI Marigold- 1 (0.8 Tk./flower, 1.5 Tk./seedling), TE-001 (0.5 Tk./flower, 0.8Tk./ seedling)

**Acknowledgement**

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**ADAPTIVE TRIAL OF LILIUM VARIETY AT FARMERS FIELD**

**Abstract**

*Trials were conducted at Gazipur, Savar, Jashore and Rangpur during rabi season of 2021-2022 to observe the performance of BARI released lilium varieties under farmer’s field condition. BARI lilium-1and BARI lilium-2 getting higher yield and better market price at all locations.*

**Introduction**

Lilium (*Lilium* sp.) belong to Liliaceae family is a high demanded flower in international flower trade and commercially it is grown as cut flower for its long lasting (12-15 days) majestic flowering sticks with wide range of color and attractiveness ( Bose *et al*., 2013; Masterova *et al*.,1987). This lucrative flower has recently been introduced in Bangladesh due to its high demand and profitability. BARI developed lilum varieties that need to be popularize among the farmers. To do so, on-farm trial is one of the ways to demonstrate better performance of these varieties. Therefore, trial on BARI lilium-1and BARI lilium-2 were conducted at Gazipur, Savar, Jashore and Rangpur to evaluate the performance of lilium varieties and to popularize among the farmers.

**Materials and Methods**

Trials were conducted at Pajulia and Kanaia (Gazipur), Birulia (Savar) Jhikorgacha (Jashore) and Kamar para and Goalu (Rangpur) during the rabi season of 2021-2022. The experiment was laid out in RCB design with two dispersed replications. The unit plot was 500 m2 areas with plant spacing of 15 × 15 cm. Bulbs of BARI lilium-1and BARI lilium-2was used as planting material. Manure, fertilizer, insecticide, fungicide, netted bag,shade net,secateurs etc. were supplied for making availability of inputs among the farmers in time. The experimental land was well prepared by adding cocodust (50:50 soil and cocodust), 10t cow dung/ha. Chemical fertilizers were not applied up to 3 weeks of bulb planting. After 3 weeks of bulb planting, NPK@30:20:20g/m2 was applied. Urea and MoP @ 100kg/ha were top dressed before spike initiation stage and bulb lifting, respectively. No design was followed and spacing was maintained at 20cm from row to row and 15cm from plant to plant. When the lower most buds showed color, the spikes were harvested. After collecting flowers, the plants leaving 25-30cm stem were kept in the field for bulb development.

**Results**

Farmers are very much interested to cultivate the new variety of BARI lilium-1and BARI lilium-2 for getting higher yield and better market price at all locations.

**Table 1. Yield and yield component of Lilium varieties at Gazipur**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./stalk** | **Stalk length (cm)** | **Rachis length (cm)** | **Yield (no/ha) (’000)** |
| BARI lilium-1 | 40 | 4.2 | 51.4 | 20.3 | 370 |
| BARI lilium-2 | 33 | 2.3 | 44 | 20 | 350 |
| **Mean** | **36.5** | **3.25** | **47.7** | **20.15** | **360** |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI lilium-1 (75Tk./stick), BARI lilium-2 (75 Tk./stick)

**Gazipur:**

BARI lilium-1gave higher yield (370000/ha) compared to BARI lilium-2. Other yield contributing characters viz. floret number, spike length and rachis length were also higher in BARI lilium-1 (Table 1).

**Table 2. Yield and yield component of Lilium varieties at Savar**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./stalk** | **Stalk length (cm)** | **Rachis length (cm)** | **Yield (no/ha) (’000)** |
| BARI lilium-1 | 45 | 3.1 | 50.3 | 18.5 | 360 |
| BARI lilium-2 | 36 | 2.4 | 47.7 | 15.8 | 340 |
| **CV (%)** | **40.5** | **2.75** | **49** | **17.15** | **350** |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI lilium-1 (60 Tk. /stick)

BARI lilium-2 (60 Tk. /stick)

**Savar:**

BARI lilium-1gave higher yield (360000/ha) compared to BARI lilium-2. Other yield contributing characters viz. floret number, spike length and rachis length were also higher in BARI lilium-1 (Table 2).

**Table 3. Yield and yield component of Lilium varieties at Jashore**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./stalk** | **Stalk length (cm)** | **Rachis length (cm)** | **Yield (no/ha) (’000)** |
| BARI lilium-1 | 40 | 4 | 53.4 | 21.3 | 360 |
| BARI lilium-2 | 39 | 2 | 48 | 20 | 360 |
| **CV (%)** | **39.5** | **3** | **50.7** | **20.65** | **360** |

**Source :** Farmer’s Field (2021-2022)

Price : BARI lilium-1 (60 Tk./stick)

BARI lilium-2 (60 Tk./stick)

**Jashore:**

Both the varieties gave similar yield (360000/ha) in this region. Other yield contributing characters viz. floret number, spike length and rachis length were higher in BARI lilium-1 (Table 3).

**Table 4. Yield and yield component of Lilium varieties at Rangpur**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variety** | **Days to 50% spike initiation** | **Floret no./stalk** | **Stalk length (cm)** | **Rachis length (cm)** | **Yield (no/ha) (’000)** |
| BARI lilium-1 | 42 | 4.5 | 60.6 | 20.5 | 370 |
| BARI lilium-2 | 33 | 2.5 | 50 | 21.4 | 360 |
| **Mean** | **37.5** | **3.5** | **55.3** | **20.95** | **365** |

**Source :** Farmer’s Field (2021-2022)

**Price :** BARI lilium-1 (50 Tk./stick)

BARI lilium-2 (50 Tk. /stick)

**Rangpur:**

BARI lilium-1gave higher yield (370000/ha) compared to BARI lilium-2. Other yield contributing characters viz. floret number, spike length and rachis length were also higher in BARI lilium-1 (Table 4).

**Farmer’s Opinion**

Gazipur : Farmers showed their keen interest to grow BARI lilium-1 and BARI lilium-2 due to their higher yield potentialities, shorter duration and economic profit.

Savar : Farmers showed their keen interest to grow BARI lilium-1 and BARI lilium-2 due to their higher yield potentialities, shorter duration and economic profit.

Jashore : Farmers showed their keen interest to grow BARI lilium-1 and BARI lilium-2 due to their higher yield potentialities, shorter duration and economic profit.

Rangpur : Farmers showed their keen interest to grow BARI lilium-1 and BARI lilium-2 due to their higher yield potentialities, shorter duration and economic profit.

**ADAPTIVE TRIAL OF GYPSOPHILA VARIETY AT FARMERS FIELD**

**Abstract**

*Trials were conducted at Gazipur, Jamalpur, Rajshahi, Khagrachori, Bogura and Rangpur during Rabi season of 2021-2022 to observe the performance of BARI released Gypsophila variety under farmer’s field condition. The variety BARI Gypsophila-1 getting* higher yield and better market price at all locations.

**Introduction**

Gypsophila (*Gypsophila sp.*) belongs to Caryiophilaceae family is an important flower found in international flower trade and now commercially it is grown in Bangladesh as cut flower and in flower arrangements such as bouquets (Quddus *et al*., 2021). It has great economic value for cut flower trade for beauty and loving people because of its prettiness. It is also used in herbal medicine and food (Sugai, 1987). Due to its aesthetic and medicinal values for mankind and economic importance, BARI developed Gypsophila variety that needs to be popularizing among the farmers. To do so, on-farm trial is one of the way to demonstrate better performance of the variety. Therefore, trial on BARI Gypsophila-1 was conducted at Gazipur, Jamalpur, Bogura, Rajshahi, Khagrachori and Rangpur to evaluate the performance of Gypsophila variety and to popularize among the farmers.

**Materials and Methods**

Trials were conducted at Vitipara (Gazipur), Sonatola (Bogura), Aamchattor(Rajshahi), Baruamari (Jamalpur), Parachora (Khagrachori) and Burrirhat (Rangpur) during the Rabi season of 2021-2022. The unit plot was 500 m2 areas with plant spacing of 15 × 15 cm. Seeds of BARI Gypsophila-1 was used as planting material. Manure, fertilizer, insecticide, fungicide, netted bag, secateurs etc. were supplied for making availability of inputs among the farmers in time. The experimental field was well prepared by adding 5t cowdung and fertilized @ 250 kg urea, 200 kg TSP, 215 kg MoP, 8 kg boric acid and 6 kg ZnSo4/ha (Bose *et al*., 2014). Cowdung, TSP, MoP, boric acid and ZnSo4 were applied as basal and urea was top-dressed in two equal splits at 30 days after planting and flower initiation stage.

**Results**

Farmers are very much interested to cultivate the new variety of BARI Gypsophila-1 for getting higher yield and better market price at all locations.

**Acknowledgement**

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**RESEARCH PROGRAMME ON FLOWERS AND ORNAMENTALS (2022-23)**

|  |  |  |  |
| --- | --- | --- | --- |
| PROJECT I | : | **VARIETAL IMPROVEMENT (ON GOING)** | |
| **EXPERIMENT # 1** | : | **COLLECTION, EVALUATION AND MAINTENANCE OF GLADIOLUS** | |
| **OBJECTIVE (S)** | : | 1. Finding out of germplasm in terms of yield and quality 2. Maintaining the genetic purity | |
| **RATIONALE** | : | Gladiolus (*Gladiolus grandiflorus* L.), an herbaceous annual flower belongs to the family Iridaceae, is one of the most important cut flower in Bangladesh. It is popular for its attractive spikes having florets of huge forms, dazzling colors, varying size and long durable quality as a cut flower. The aesthetic value of gladiolus in the daily life is increasing with the advancement of civilization for the spikes being elegant and having long vase life. It is also used as bedding flower, herbaceous borders or does quite well in pots (Bose and Yadav, 1989). But studies on different plant and flower characters including yield potentiality and quality has not yet been made systematically. Considering the above facts, the present study will be undertaken to find out the suitable germplasm for high yielding and quality flowers through collection and evaluation. | |
| **PROCEDURE/METHODS** |  |  | |
| **MATERIALS** | : | Gladiolus | |
| **DESIGN** | : | Nil | |
| **TREATMENT** | : | As per collection | |
| **REPLICATION** | : | Non replicated | |
| **SPACING** | : | 25 cm x 15 cm | |
| **MANURES & FERTILIZERS** | : | N200 P50 K150 S30 B2Zn3 kg/ha and CD 5 t/ha | |
| **APPLICATION METHODS** | : | Entire quantity of cowdung, P, K, S, B and Zn were applied during land preparation. N was applied in two equal installments of 25 and 50 days after emergence | |
| **IRRIGATED/RAINFED** | : | Irrigated | |
| **PLANT PROTECTION MEASURES** | : | As and when necessary | |
| **DATA TO BE RECORDED** | : | 1. Plant height (cm) 2. Number of leaves/plant 3. Date of spike initiation 4. Days to flowering 5. Length of spike (cm) 6. Length of rachis (cm) 7. No. of floret/rachis 8. Weight of stick (g) | 1. No. of spike/hill 2. Colour of flower 3. No. of corm/plant 4. No. of cormel/ plant 5. Wt. of corm (g) 6. Wt. of cormel (g) 7. Vase life (days) 8. Flowering duration (days) |
| **INVESTIGATOR (S)** | : | M. M. R. Bhuyin, F. N. Khan, A. Naznin, K. Ambia and M. T. Rashid | |
| **SEASON** | : | Rabi | |
| **DATE OF INITIATION** | : | November 2019 | |
| **EXPT. OUTPUT/BENEFIT** | : | Variety will be developed | |
| **LOCATION** | : | HRC, BARI, Joydebpur and RARS, Jamalpur | |
| **STATUS** | : | On-going | |
| **ESTIMATED COST** | : | Tk. 1,00,000/- (Tk. 50,000/- per location) | |
| **SOURCE OF FUND** | : | GOB | |
| **PRIORITY** | : | 1st | |

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| **EXPERIMENT # 2** | **:** | **COLLECTION AND EVALUATION OF TUBEROSE** |
| **OBJECTIVE (S)** | : | 1. To characterize the tuberose germplasm in respect of their morphological variation, growth, yield and post- harvest life 2. To know the genetic variability which can be used in tuberose improvement programme 3. To identify the suitable cultivars for commercial cultivation in Bangladesh |
| **RATIONALE** | : | Tuberose (*Polianthestuberosa* Linn.) is one of the most important flowering plants which is native to Mexico and belongs to family Agavaceae (formerly known as Amaryllidaceae). It is commercially cultivated in different parts of Bangladesh. The successful cultivation of tuberose depends on selection of suitable varieties. However, the species does not have much natural variability either in flower colour or type. There are two white-coloured cultivars of tuberose viz. single and double are commonly available in Bangladesh. Recently some varieties have been introduced through different sources which have not been characterized yet. But characterization, evaluation and variability studies of different varieties will help in tuberose crop improvement programme. Hence, the present study has been taken to know the genetic variability in tuberose. |
| **MATERIALS AND METHODS** |  |  |
| **MATERIALS** | : | Different species of Tuberose |
| **TREATMENTS** | : | 1. TR-001 (Prajwal) 2. TR-002 (PhuleRajani) 3. TR- 003 (Single local) 4. TR-004 (Vaibhav) 5. TR-005 (Suvasini) 6. TR-006 (Nameless) 7. BARI Tuberose-1 |
| **PLANT PROTECTION MEASURES** | : | As and when necessary |
| **DATA TO BE RECORDED** | : | i) Days to 50% sprouting of bulb ii) Plant height (cm) iii) Leaves/ clump iv) Days to 50% spike initiation v) Spike length (cm) vi) Rachis length (cm) vii) No. of floret/stick viii) Reaction to disease & insect ix) Flower sticks yield/unit area x) Vase life (days) etc. |
| **INVESTIGATOR(S)** | : | M. M. R. Bhuyin, F. N. Khan, A. Naznin, K. Ambia and M. T. Rashidv |
| **SEASON** | : | Kharif |
| **DATE OF INITIATION** | : | April, 2016 |
| **EXP. OUTPUT/BENEFIT** | : | Potential germplasm for crop improvement will be identified |
| **LOCATION** | : | HRC, BARI, Joydebpur |
| **ESTIMATED COST** | : | 40000/- |
| **STATUS** | : | On-going |
| **SOURCE OF FUND** | : | GOB |
| **PRIORITY** | : | 1st |

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| **EXPERIMENT # 3** | : | **COLLECTION, EVALUATION AND MAINTENANCE OF LILIUM** |
| **OBJECTIVE(S)** | : | 1. To collect the different species of lilium available in Bangladesh 2. To conserve the collected germplasm for future research 3. Variety development |
| **RATIONALE** | : | The genus Lilium includes less than 100 species that grow from bulbs. True lilies belong to the genus lilium. Lilies are a group of flowering plants which are important in culture and literature in much of the world. Most lilies produce very beautiful flowers those are large, often fragrant, and come in a range of colour including whites, yellows, oranges, pinks, reds and purples. It’s attractive colour and long vase life makes it popular cut flower. Therefore, it is needed to collect the germplasm for future research. |
| **MATERIALS AND METHODS** |  |  |
| **MATERIAL** | : | Different species of Lilium |
| **TREATMENTS** | : | As per collection |
| **PLANT PROTECTION MEASURES** | : | As and when necessary |
| **DATA TO BE RECORDED** | : | 1. Flower colour 2. Flower size (cm) 3. Stalk length (cm) 4. No. of flower stick/plant 5. Disease & insect reaction 6. Flower sticks yield/unit area 7. Vase life of flower (days) |
| **INVESTIGATOR(S)** | : | F. N. Khan, K. Ambia, A. Naznin, M. M. R. Bhuyin and M. T. Rashid |
| **DATE OF INITIATION** | : | October, 2016 |
| **EXP. OUTPUT/BENEFIT** | : | Potential germplasm for crop improvement will be identified |
| **LOCATION** | : | HRC, BARI, Joydebpur |
| **ESTIMATED COST** | : | 1,00,000/- |
| **STATUS** | : | On-going |
| **SOURCE OF FUND** | : | KGF |
| **PRIORITY** | : | 1st |

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| **EXPERIMENT # 4** | : | **COLLECTION, EVALUATION AND MAINTENANCE OF ROSE** |
| **OBJECTIVE (S)** | : | 1. Finding out the suitable germplasm for cut-flower and pot plant 2. Monitoring of vase life and yield parameters 3. Maintaining the genetic purity |
| **RATIONALE** | : | Rose is the best known and most popular of all garden flowers throughout the world and is one of the natures beautiful creations and is universally known as the Queen of Flowers. Rose is a symbol of love, adoration and innocence. At present, it has become the most important commercial flower. It can be grown in Bangladesh for easy cultivation and wider adaptability. However, research works on different morphological and floral traits of rose are not characterized properly in Bangladesh. Recently, attractive colour of rose with long stalk and prolong vase life makes it popular cut flower and receive attention. Therefore, this investigation will be carried out. |
| **PROCEDURE/ METHODS** | : |  |
| **MATERIALS** | : | Rose |
| **DESIGN** | : | Nil |
| **TREATMENT** | : | As per collection |
| **REPLICATION** | : | Non replicated |
| **MANURES & FERTILIZERS** | : | Cowdung - 5 t/ha  Bone meal - 2 t/ha  Mustard cake- 2 t/ha  N- 170 kg/ha  P- 60 kg/ha  K-125 kg/ha |
| **METHOD OF FERTILIZER APPLICATION** | : | The entire quantity of cowdung, P, K, mustard cake and bone meal were applied during final land preparation. N was applied in 3 equal installments at 35, 65 and 85 days after transplanting. |
| **IRRIGATED/RAINFED** | : | Irrigated |
| **DATA TO BE RECORDED** | : | 1. Plant height (cm) 2. No. of leaves/plant 3. Days taken to 50% flowering 4. No. of flowers/hill 5. Flower size (cm) 6. Flower sticks wt. (g) 7. Vase life (days) |
| **INVESTIGATOR (S)** | : | A. Naznin, M. M. R. Bhuyin, F. N. Khan, K. Ambia, and M. T. Rashid |
| **SEASON** | : | Year round |
| **DATE OF INITIATION** | : | November 2016 |
| **EXP. OUTPUT/BENEFIT** | : | New rose variety will be developed |
| **LOCATION** | : | HRC, BARI, Joydebpur |
| **STATUS** | : | On-going |
| **ESTIMATED COST** | : | 80,000/- |
| **SOURCE OF FUND** | : | GOB |
| **PRIORITY** | : | 1st |

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| **EXPERIMENT # 5** | : | | **COLLECTION, EVALUATION AND MAINTENANCE OF CHRYSANTHEMUM** | |
| **OBJECTIVE (S)** | : | | 1. Monitoring of vase life and yield parameters 2. Finding out of germplasm in terms of yield and quality 3. Maintaining the genetic purity | |
| **RATIONALE** | : | | Chrysanthemum, a member of the family Compositae, is popular flower crop of commercial importance. It has no rival as a cutflower for versatile beauty and even economy and they often remains in good condition for two to three weeks depend on cultivars (Tewari and Shankar, 1994). The wide variation exhibited by the large number of cultivars in respect of growth habit, size, colour and shape of blooms make them suitable for every purpose conceivable of a flower. Genetic variation for flower yield and its component character were not properly assessed in the past. Attempt will be undertaken to produce quality cut flower and pot plant in Bangladesh for which suitable chrysanthemum lines (s) will be selected. | |
| **PROCEDURE/ METHODS** |  | |  | |
| **MATERIALS** | : | | Chrysanthemum | |
| **DESIGN** | : | | Nil | |
| **TREATMENT** | : | | As per collection | |
| **REPLICATION** | : | | Non replicated | |
| **MANURES AND FERTILIZERS** | : | | Cowdung - 2 Kg /pot  N - 2.2 g/pot  P - 2.0 g/ pot  K - 2.5 g/ pot  Mustard Cake liquid -1.0L / pot  Bone Meal - 2 table spoonful | |
| **METHOD OF FERTILIZER APPLICATION** | : | | The entire quantity of cowdung, P, K and bone meal will be applied during final pot media preparation. The entire quantities of N and mustard cake liquid will be applied in 2 equal installments at 40 and 60 days after transplanting. | |
| **IRRIGATED/RAINFED** | : | Irrigated | | |
| **PLANT PROTECTION MEASURES** | : | As and when necessary | | |
| **DATA TO BE RECORDED** | : | 1. Days taken to appearance of first flower bud  2. Days taken to flowering  3. Plant height (cm)  4. Number of leaves/plant  5. Days to harvest | | 6 Size of flower (cm)  7. No. of flower/plant  8. Length of flower stick (cm)  9. Colour of flower  10.Vase life (days)  11. No. of sucker/plant |
| **INVESTIGATOR (S)** | : | K. Ambia,A. Naznin, M. M. R. Bhuyin, M. T. Rashid and F. N. Khan | | |
| **SEASON** | : | Rabi | | |
| **DATE OF INITIATION** | : | October 2005 | | |
| **EXPECTED OUTPUT/BENEFIT** | : | Variety will be developed | | |
| **LOCATION** | : | HRC, BARI, Gazipur | | |
| **STATUS** | : | On-going | | |
| **ESTIMATED COST** | : | Tk. 60,000/- (Tk. 30,000/- per location) | | |
| **SOURCE OF FUND** | : | GOB | | |
| **PRIORITY** | : | 1st | | |

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| EXPERIMENT # 6 | | : | **COLLECTION AND MAINTENANCE OF CACTUS AND SUCCULENTS** | |
| **OBJECTIVE (S)** | : | | 1. Finding out of germplasm in terms of yield and quality 2. Maintaining the genetic purity | |
| **RATIONALE** | : | | Cactus and succulents are the xerophytic plants and members of the family Agavaceae, Euphorbiacae, Crassulaceae and Liliaceae with swollen fleshy parts, curious form, diversity of shape and color. They can store water to survive in the drought condition. They are suitable for planting in bed, pot, shrubbery, indoor decoration and in landscaping. Cactus and succulent cultivation has become a fascinating hobby among amateur gardeners and these desert plants which are mostly unknown have become the subject of greatest care and delicate handling (Hewitt, 1993). Their hardy nature and easy cultivation are additional features for their popularity (Randhwa and Mukhopadhyay, 1999). However research works on different morphological and floral traits of cactus and succulents are not characterized properly in Bangladesh. Therefore, this investigation will be carried out. | |
| **PROCEDURE/METHODS** |  | |  | |
| **MATERIAL** | : | | Cactus and Succulents | |
| **DESIGN** | : | | Nil | |
| **TREATMENT** | : | | As per collection | |
| **REPLICATION** | : | | Non replicated | |
| **MANURES & FERTILIZERS** | : | | As per recommendation | |
| **PLANT PROTECTION MEASURES** | : | | As and when necessary | |
| **DATA TO BE RECORDED** | : | | 1. Growth vigour 2. Plant height (cm) 3. No. of leaves/plant 4. Colour of leaf 5. Type of leaf 6. Leaf size (cm) | 1. No. of shoots 2. Flower colour 3. Flower size (cm) 4. Days to bloom 5. Flowering duration (days) 6. Disease and insect reaction etc. |
| **INVESTIGATOR (S)** | : | | K. Ambia, M. T. Rashid, A. Naznin, M.M.R. Bhuyin and F.N. Khan | |
| **SEASON** | : | | Year round | |
| **DATE OF INITIATION** | : | | November 2017 | |
| **EXP. OUTPUT/BENEFIT** | : | | Genetic resources will be conserved and nurserymen will be benefited knowing proper propagation and management technology | |
| **LOCATION** | : | | HRC, BARI, Joydebpur | |
| **STATUS** | : | | On-going | |
| **ESTIMATED COST** | : | | Tk. 80,000/- | |
| **SOURCE OF FUND** | : | | GOB | |

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| EXPERIMENT # 7 | : | **COLLECTION, EVALUATION AND MAINTENANCE OF GERBERA** | |
| **OBJECTIVE (S)** | : | 1. Monitoring of vase life and yield parameters 2. Finding out of germplasm in terms of yield and quality 3. Maintaining the genetic purity | |
| **RATIONALE** | : | Gerbera (*Gerbera jamesonii* Bolus) belongs to the family Asteraceae, a popular cut flower grown throughout the world in a wide range of climatic conditions. In Bangladesh, the environmental conditions required for the survival and culture of gerbera are adequately available throughout the year. Recently, a large number of gerbera are being introduced in the country. But studies on different plant and flower characters including yield potentiality and quality has not yet been made systematically. Considering the above facts, the present study will be undertaken to find out the suitable germplasm for high yielding and quality flowers through collection and evaluation. | |
| **PROCEDURE/ METHODS**  **MATERIAL**  **DESIGN**  **TREATMENT**  **REPLICATION** | :  :  :  : | Gerbera  Nil  As per collection  Non replicated | |
|  | : | Cowdung -5 t/ha  N -150 kg/ha  P -75 kg/ha  K -150 kg/ha  S - 30 kg/ha  Cocodust -500 kg/ha | |
| **METHOD OF FERTILIZER APPLICATION** | : | The entire quantity of cowdung, cocodust, P, K and S will be applied during the final land preparation. N will be applied in three equal installments at 30, 45 and 60 days after planting the sucker. | |
| **IRRIGATED/RAINFED** | : | Irrigated | |
| **PLANT PROTECTION MEASURES** | : | As and when necessary | |
| **DATA TO BE RECORDED** | : | 1. Plant height (cm) 2. Days to flowering 3. Flower colour 4. Number of flower/sucker | 1. Flower size (cm) 2. Stalk length (cm) 3. Vase life (days) 4. Disease and insect reaction |
| **INVESTIGATOR (S)** | : | 1. Naznin, K. Ambia, F.N. Khan, M.M.R. Bhuyin and M.T. Rashid | |
| **SEASON** | : | Year round | |
| **DATE OF INITIATION** | : | November 2005 | |
| **EXPECTED OUTPUT/BENEFIT** | : | Commercial growers and nurserymen will be benefited from the findings of this experiment by using the superior germplasm | |
| **LOCATION** | : | HRC, BARI, Gazipur | |
| **STATUS** | : | On-going | |
| **ESTIMATED COST** | : | Tk. 50,000/- | |
| **SOURCE OF FUND** | : | GOB | |
| **PRIORITY** | : | 1st | |

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| **EXPERIMENT # 8** | **:** | **COLLECTION, EVALUATION AND MAINTENANCE OF HELICONIA** | |
| **OBJECTIVE** | **:** | To find out suitable line (s) for cut flower | |
| **RATIONALE** | **:** | Heliconia is a dwarf plantain like plant belongs to Musaceae family native to South Africa. It is grown both for cut flowers and for garden or bed decoration purposes. It deserves special importance due to easy culture, wide adaptability to soil and climate, summer production and less prone to disease and pests. Recently, the demand of this flowering plant is increasing due to its attractive colour, prolonged shelf life and economic value (Halevy *et al*., 1998). Recently some genotypes have been introduced through different sources which have not been characterized yet. But characterization, evaluation and variability studies of different varieties/ genotypes will help in Heliconiacrop improvement programme. Hence, the present study has been taken to know the genetic variability and to find out the best line (s) for cut flower. | |
| **PROCEDURE/ METHODS** | **:** |  | |
| **MATERIAL** | **:** | Heliconia | |
| **DESIGN** | **:** | Nil | |
| **TREATMENT** | **:** | As per collection | |
| **REPLICATION** | **:** | Non replicated | |
| **PLANT PROTECTION MEASURES** | **:** | As and when necessary | |
| **DATA TO BE RECORDED** | **:** | 1. Growth vigour  2. Plant height (cm)  3. No. of leaves/plant  4. Colour of leaf  5. Leaf size (cm)  6. No. of shoots/hill | 7. Number of stalk  8. Stalk length (cm)  9. Flower colour  10. Flower size  11. Vase life (days)  12. Days to harvest etc. |
| **INVESTIGATOR (S)** | **:** | A. Naznin, F. N. Khan, M.T. Rashid, M.M.R. Bhuyin and K. Ambia | |
| **DATE OF INITIATION** | **:** | November 2020 | |
| **EXP. OUTPUT/BENEFIT** | **:** | Commercial growers will be benefited from the findings of the experiment | |
| **LOCATION** | **:** | HRC, BARI, Gazipur | |
| **STATUS** | **:** | Ongoing | |
| **ESTIMATED COST** | **:** | 1,50,000/- (Tk. 30,000/- per location) | |
| **SOURCE OF FUND** | **:** | GOB | |
| **PRIORITY** | **:** | 1st | |

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| **EXPERIMENT # 9** | : | **COLLECTION AND MAINTENANCE OF TULIP AND DAFFODIL** |
| **OBJECTIVE (S)** | : | 1. To collect the different species of tulip and daffodil 2. To conserve the collected germplasm for future research |
| **RATIONALE** | : | Among all ornamental bulbous plants, the tulip and daffodil ranks first and fourth in the world and thus has gained popularity due to its beauty and economic value. Tulips and daffodils are excellent for cut flowers, growing in beds, borders and pots and also for indoor gardening. They are suitable for naturalization in grass under the trees and shrubs (Bhattacharjee, 1997). They are the top most flowering genotypes of the Netherlands. In India, tulips and daffodils thrive well in the temperate as well as tropical regions and other similar hilly regions but do not grow satisfactorily in the plains. However, there is a great scope of growing tulips and daffodils for the production of quality cut flowers and bulbs in plain land also. Therefore, it is needed to collect tulip and daffodil germplasm for future research. |
| **MATERIALS AND METHODS** |  |  |
| **MATERIAL** | : | Different species of Tulip and Daffodil |
| **TREATMENTS** | : | As per collection |
| **PLANT PROTECTION MEASURES** | : | As and when necessary |
| **DATA TO BE RECORDED** | : | 1. Plant height (cm) 2. Flower colour 3. Flower size (cm) 4. Days to flowering 5. No. of flower/plant 6. Flower durability (days) 7. Disease & insect reaction etc. |
| **INVESTIGATOR (S)** | : | F. N. Khan, M. T. Rashid, A. Naznin, K. Ambia and M.M.R. Bhuyin |
| **SEASON** | : | Rabi |
| **DATE OF INITIATION** | : | November, 2017 |
| **EXP. OUTPUT/BENEFIT** | : | Future research can be taken on the basis of tulip and daffodil collection |
| **LOCATION** | : | HRC, BARI, Joydebpur and RARS, Burirhat |
| **ESTIMATED COST** | : | 60000/- (Tk. 30,000/- per location) |
| **STATUS** | : | On-going |
| **SOURCE OF FUND** | : | GOB |
| **PRIORITY** | : | 1st |

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| **EXPERIMENT # 10** | : | | **COLLECTION, EVALUATION AND MAINTENANCE OF DENDROBIUM ORCHIDS** | |
| **OBJECTIVE (S)** | : | | 1. Finding out the suitable germplasm for cut flower and pot plant 2. Monitoring of vase life and yield parameters 3. Maintaining the genetic purity | |
| **RATIONALE** | : | | Dendrobium orchids are important cut flowers with multiple forms, attractive colours, long vase life and economic value. Dendrobium orchids are marketed as pot plants and cut flowers. Bangladesh is bestowed with a wealth of Dendrobium orchid flora; more than 20 species of orchids are available many of which are commercially potential. Moreover many of those endemic species are under serious threat of extinction due to the destruction of their habitats (Akhter, 2004). Though, there is often a preference for hybrids in commercial markets, but beauty and quality of many local species are unique and conspicuous which can compete with the best hybrids. Selection of better plant type from the collected local and exotic germplasms can be of immense value for further improvement and development of this crop. Therefore, this investigation will be carried out. | |
| **PROCEDURE/ METHODS** |  | |  | |
| **MATERIAL** | : | | Dendrobium Orchid | |
| **DESIGN** | : | | Nil | |
| **TREATMENT** | : | | As per collection | |
| **REPLICATION** | : | | Non replicated | |
| **MANURES AND FERTILIZER** | : | | N- 2 g/ pot  P- 1 g/ pot  K-1 g/ pot | |
| **MANURE AND FERTILIZER APPLICATION** | : | | The entire quantity of P, K and N will be applied 15 days after interval | |
| **IRRIGATED/RAINFED** | : | | Irrigated | |
| **PLANT PROTECTION MEASURES** | : | | As and when necessary | |
| **DATA TO BE RECORDED** | : | 1. No. of leaves 2. No of branches 3. Plant type 4. Plant height (cm) 5. Leaf colour 6. Leaf shape 7. Leaf size | | 1. Spike number 2. Spike length (cm) 3. Rachis length (cm) 4. Stick weight (g) 5. Floret number 6. Floret colour 7. Vase life (days) etc. | |
| **SEASON** | : | Year round | | | |
| **INVESTIGATOR (S)** | : | A. Naznin, M.M.R. Bhuyin, M.T. Rashid K. Ambia, and F.N. Khan | | | |
| **DATE OF INITIATION** | : | November 2018 | | | |
| **EXP. OUTPUT/BENEFIT** | : | New variety of orchid will be developed | | | |
| **LOCATION** | : | HRC, BARI, Joydebpur | | | |
| **STATUS** | : | On- going | | | |
| **ESTIMATED COST** | : | TK. 40,000/- | | | |
| **SOURCE OF FUND** | : | GOB | | | |
| **PRIORITY** | : | 1st | | | |

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| **EXPERIMENT # 11** | : | **COLLECTION, IDENTIFICATION, CHARACTERIZATION AND EVALUATION OF FOLIAGE AND ORNAMENTAL PLANTS** |
| **OBJECTIVE(S)** | : | 1. To collect, identify and characterize the different species of native foliage and ornamental plants available in Bangladesh 2. To evaluate the performance of collected germplasm 3. To conserve the collected germplasm for future research |
| **RATIONALE** | : | Due to diverse agro-ecological conditions, Bangladesh flora is richly endowed with various foliage and ornamental plants. Their elegance nature and wild colours gave them a haunting beauty. At present the use of ornamental plants for outdoor and indoor decorations, and cut foliage are gaining importance in the Bangladesh and a huge amount of foliage and ornamental plants are imported from different countries by the spending of lucrative money. But those are available in all parts of Bangladesh especially in the hilly areas of the country and the maximum germplasm can be collected from our nature easily. Moreover, these native germplasms are considered threatened due to large-scale destruction of their natural habitat. So, there is an urgent need for collection, identification, characterization, documentation and conservation of these various native germplasm which could be used for future improvement of those crops. |
| **MATERIALS AND METHODS** | : |  |
| **MATERIAL** | : | Different species of native foliage and ornamental plants |
| **TREATMENTS** | : | As per collection |
| **PLANT PROTECTION MEASURES** | : | As and when necessary |
| **DATA TO BE RECORDED** | : | Data will be recorded based on the nature of the germplasm |
| **INVESTIGATOR(S)** | : | M.M.R. Bhuyin, A. Naznin, F. N. Khan, K. Ambia, and M. T. Rashid |
| **DATE OF INITIATION** | : | November 2020 |
| **EXP. OUTPUT/BENEFIT** | : | Source of different species of native foliage and ornamental plants will be identified and future research can be taken on the basis of collection |
| **LOCATION** | : | HRC, BARI |
| **ESTIMATED COST** | : | 80,000/- |
| **STATUS** | : | Ongoing |
| **SOURCE OF FUND** | : | GOB |
| **PRIORITY** | : | 1st |

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| **EXPERIMENT # 12** | : | **COLLECTION, EVALUATION AND MAINTENANCE OF CLIMBERS AND CREEPERS** | |
| **OBJECTIVE (S)** | : | 1. Finding out of germplasm in terms of yield and quality 2. Maintaining the genetic purity | |
| **RATIONALE** | : | Climbers and creepers is a group of plants or vines which possess special structures to climb over a support. They are invaluable; their ability to cover and transform is unparalleled in the plant world. The saviour of many an unattractive eyesore, they can cling, twine, scramble or trail over tree stumps, up walls and buildings, along trellises and arches and through the branches of trees and shrubs - in fact almost anywhere. They add new dimension, color and fragrance to garden space with easy-to-grow and long-lived vines. So, it is needed to collect all types of climbers and creepers available in Bangladesh on which further research can be taken. | |
| **PROCEDURE/METHODS** | : |  | |
| **MATERIAL** | : | Climbers and creepers | |
| **DESIGN** | : | Nil | |
| **TREATMENT** | : | As per collection | |
| **REPLICATION** | : | Non replicated | |
| **MANURES & FERTILIZERS** | : | As per recommendation | |
| **PLANT PROTECTION MEASURES** | : | As and when necessary | |
| **DATA TO BE RECORDED** | : | 1. Growth vigour 2. No. of leaves/plant 3. Colour of leaf 4. Leaf size (cm) 5. Leaf type 6. No. of shoots 7. Flower colour | 1. Flower size (cm) 2. Flower durability 3. Seed number/plant 4. Days to seed maturity 5. Seedling germination % 6. Days to seedling germination 7. Cutting success % etc. |
| **INVESTIGATOR (S)** | : | A. Naznin, F. N. Khan, M. M. R. Bhuyin, M. T. Rashid and K. Ambia | |
| **SEASON** | : | Year round | |
| **DATE OF INITIATION** | : | December 2021 | |
| **EXP. OUTPUT/BENEFIT** | : | Commercial growers and nurserymen will be benefited | |
| **LOCATION** | : | HRC, BARI, Gazipur | |
| **STATUS** | : | Ongoing | |
| **ESTIMATED COST** | : | Tk. 50,000/- | |
| **SOURCE OF FUND** | : | GOB | |
| **PRIORITY** | : | 1st | |

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| EXPERIMENT # 13 | **:** | **HYBRIDIZATION OF GLADIOLUS** |
| **OBJECTIVE** | **:** | To develop new varieties |
| **RATIONALE** | **:** | Gladiolus is one of the most important cut flowers in Bangladesh. Breeding of gladiolus is a fascinating aspect. Different attractive colours, various shapes and large number of florets are demand to the users. So, there is a great scope for hybrid varieties in our country. |
| **MATERIALS AND METHODS** | **:** |  |
| **METHODOLOGY** | **:** | Hybridization will be initiated with the following combinations  Cross combinations   1. BARI Gladiolus-3 x BARI Gladiolus-4 2. BARI Gladiolus-3 x BARI Gladiolus-5 3. BARI Gladiolus-3 x BARI Gladiolus-6 |
| **DATA TO BE RECORDED** | **:** | 1. Days to pod formation 2. Days to seed germination 3. Growth characteristics 4. Flower characteristics 5. Fruit characteristics 6. Incidence of disease & pest 7. Climatic data etc. |
| **INVESTIGATOR (S)** | **:** | F. N. Khan, K. Ambia, A. Nazin, M. M. R. Bhuyin and M.T. Rashid |
| **DATE OF INITIATION** | **:** | November, 2016 |
| **EXP. OUTPUT/BENEFIT** | **:** | New varieties of gladiolus with good quality will be developed |
| **LOCATION** | **:** | HRC, BARI, Joydebpur |
| **ESTIMATED COST** | **:** | 40,000/- |
| **STATUS** | **:** | On-going |
| **SOURCE OF FUND** | **:** | GOB |
| **PRIORITY** | **:** | 1st |

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| **EXPERIMENT # 14** | **:** | **PERFORMANCE OF COMMERCIAL CULTIVARS OF GERBERA COLLECTED FROM VARIOUS SOURCES UNDER PROTECTED CONDITION** | |
| **OBJECTIVE(S)** | : | To investigate the relative performance of gerbera cultivars collected from different sources for their growth, flower quality and yield characters under protected conditions | |
| **RATIONALE** | : | Gerbera (*Gerbera jamesonii* Bolus ex Hooker F.) is one of the most beautiful cut flowers with exquisite shape, size and colour with over 40 species of Asiatic and African origin. Protected conditions provide favorable environment for the growth of the plants by protecting the crop from heavy winds, pests, diseases and other climatic conditions. In protected conditions, gerbera grows faster and produces larger and greener leaves with high dry matter content. As a result, the quality and yield of the flowers increases and more side shoots will be formed. Though, different cultivars of gerbera exist in Bangladesh but studies on different plant and flower characters including yield potentiality and quality has not yet been made systematically. The marketing potential can be exploited by introduction and evaluation of gerbera cultivars. Hence, it is needed to evaluate cultivars for their vegetative, yield and quality characters for the agro-climatic conditions of Bangladesh. Considering the above facts, the present research work will be undertaken to study the performance of different cultivars of gerbera collected from different sources of Bangladesh. | |
| **MATERIALS & METHODS** | : |  | |
| **CROP/VARIETY** | : | Gerbera | |
| **DESIGN**  **TREATMENT** | : : | RCB Factorial  Factor A: Genotypes (As per collection)  Factor B: Collecting sources (As per availability) | |
| **REPLICATIONS** | : | 3 | |
| **PLOT SIZE** | : | 8m × 80cm | |
| **PLANTING SYSTEM/ SPACING** | : | 30 cm × 40 cm | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | Cowdung-5t/ha, Cocodust- 500kg/ha, Urea-350 kg/ha, TSP- 375 kg/ha, MoP- 375 kg/ha, MOC- 600 kg/ha, Gypsum- 150 kg/ha and Boric acid- 7.5 kg/ha.  The entire quantity of cowdung, Cocodust, TSP, MoP, MOC, Gypsum and Boric acid will be applied during the final bed preparation. | |
| **IRRIGATED/RAINFED** | : | Irrigated | |
| **DATA TO BE RECORDED** | : | Plant height (cm)  Plant spread (cm)  Number of leaves/plants  Length of leaf  number of suckers/plants | Days to flowering  Number of flower/plants  stalk length  flower diameter  Vase life |
| **INVESTIGATORS (S)** | : | A. Naznin, K. Ambia, F. N. Khan, M. M. R. Bhuyin, and M. T. Rashid | |
| **SEASON** | : | Year round | |
| **DATE OF INITIATION** | : | November 2021 | |
| **DATE OF COMPLETION** | : | May 2024 | |
| **EXPECTED OUTPUT/BENEFIT** | : | Suitable variety can be recommended for commercial cultivation under the agro-climatic condition of Bangladesh | |
| **LOCATION** | : | HRC, Gazipur | |
| **STATUS (1ST YEAR/2ND YEAR/..)** | : | New | |
| **ESTIMATED COST** | : | Tk. 50,000/- | |
| **SOURCE OF FUND** | : | GOB | |
| **PRIORITY** | : | 1st | |

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| **PROJECT II** | **:** | **PROPAGATION** | |
| **EXPERIMENT # 15** | : | **LILIUM BULB PRODUCTION FROM SCALE INFLUENCED BY N AND K** | |
| **OBJECTIVE** | : | To standardize the optimum doses of N and K for quality bulb production from scale | |
| **RATIONALE** | : | Most lilium produce very beautiful flowers those are large, often fragrant, and come in a range of colors. It’s attractive color and long vase life makes it popular cut flower in Bangladesh. Production of healthy and vigorous bulbs depends on many factors of which soil nutrient is considered as one of the most important one. Lilium requires nutrient throughout the period of growth, flowering and bulb development. Increasing N augmented plant growth, number of leaves, spike length and florets number/spike. Production of bulb and bulblets are also affected when N supply is less. Moreover, K plays a vital role in bulb growth and development. Increased potassium fertilizer enhances the number of leaves, dry matter accumulation of whole plant and big bulb size of lilium (Huang Peng, 2007). The effect of nitrogen is enhanced when potassium is applied. Due to this reason this experiment is undertaken. | |
| **MATERIALS AND METHOD** |  |  | |
| **MATERIALS** | : | Scale of Lilium (BARI Lilium-1) | |
| **DESIGN** | : | RCB | |
| **REPLICATION** | : | 3 | |
| **TREATMENT(S)** | : | N-0, 100, 150, 200 & 250  K-0, 75,100,125 & 150 | |
| **PLANT SPACING** | : | 20 × 15 | |
| **PLANT PROTECTION MEASURES** | : | As and when necessary | |
| **DATA TO BE RECORDED** | : | 1. Plant stands per plot 2. Number of leaves per plant 3. Leaf length(cm) 4. Leaf breath(cm) 5. Plant height (cm) | 1. Bulb obtained (%) 2. Bulb weight(g) 3. Bulb diameter(cm) 4. Flowering sized bulb (%) 5. Bulb yield per plot 6. Bulb number per hectare |
| **DATE OF INITIATION** | : | October, 2020 | |
| **INVESTIGATOR(S)** | : | M. M. R. Bhuyin, F. N. Khan, A. Naznin, K. A. Ara, K. Ambia and M. T. Rashid | |
| **SEASON** | : | Rabi | |
| **EXP. OUTPUT/BENEFIT** | : | Optimum dose of nitrogen and potassium can be standardized for bulb production from scale | |
| **LOCATION** | : | HRC, BARI, Gazipur | |
| **ESTIMATED COST** | : | 50000/- | |
| **STATUS** | : | On going | |
| **SOURCE OF FUND** | : | KGF | |
| **PRIORITY** | : | 1st | |

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| **EXPERIMENT # 16** | **:** | **EFFECT OF BULBLET SIZE AND PLANTING DEPTH ON THE BULB PRODUCTION OF LILIUM FROM BULBLET** | |
| **OBJECTIVE(S)** | : | 1. To determine suitable size of bulblet and 2. To find out optimum planting depth for lilium bulb production from bulblet | |
| **RATIONALE** | : | Lilium have large flowers with attractive colors and an excellent vase life. Liliums are propagated sexually by seeds or asexually by natural formation of daughter bulbs, bulblets, bulbils, and through scales. The infrequent insufficient production of bulb and bulblets is a great hurdle in mass propagation. The bulblets produce customary flower spike and bulb after two or three seasons which ultimately affect the commercial production. Planting depth is also important for quality bulb production in lilium. Correct planting depth influences the available space for development of plant and, therefore, bulbs, bulblets or seeds should be planted according to their requirement. Additionally, the planting depth influences time to emergence and subsequently the growth of bulb and total crop duration. Hence, planting at a uniform depth is necessary for a uniform crop time. Therefore, it is essential to find out proper size of bulblets and optimum planting depth for obtaining the best results. Considering the fact, this investigation will be undertaken. | |
| **MATERIALS AND METHODS** | : |  | |
| **CROP/VARIETY** | : | Bulblets of BARI Lilium-1 | |
| **DESIGN**  **TREATMENT** | : : | RCBD factorial  Factor A: Planting depth (3cm, 6cm and 9cm)  Factor B: Bulblet size  Small=12-14mm  Medium=15-17mm  Large=27-30mm | |
| **REPLICATIONS** | : | 3 | |
| **PLOT SIZE** | : | 1.0m x 1.5m | |
| **PLANTING SYSTEM/ SPACING** | : | 15 cm × 20 cm | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | Cow-dung 10 t/ha will be applied at the land preparation. No chemical fertilizer will be applied up to 3 weeks of bulb planting. After 3 weeks of bulb planting, NPK@30:20:20 g/m2 will be applied | |
| **IRRIGATED/RAINFED** | : | Irrigated | |
| **DATA TO BE RECORDED** | : | Plant stand per m2  Number of leaves per plant  Leaf length(cm)  Leaf breath(cm)  Plant height (cm) | Bulb obtained (no.)  Bulb weight(gm)  Bulb diameter(cm)  Flowering sized bulb (%)  Bulb yield per m2 |
| **INVESTIGATORS (S)** | : | A. Naznin, K. Ambia, F. N. Khan, M. M. R. Bhuyin, and M. T. Rashid | |
| **SEASON** | : | Rabi | |
| **DATE OF INITIATION** | : | November 2021 | |
| **DATE OF COMPLETION** | : | June, 2023 | |
| **EXPECTED OUTPUT/BENEFIT** | : | Quality bulb can be produced which is the prerequisite for commercial cultivation of quality flower | |
| **LOCATION** | : | HRC, BARI, Gazipur | |
| **STATUS (1ST YEAR/2ND YEAR/....)** | : | New | |
| **ESTIMATED COST** | : | 30,000/- | |
| **SOURCE OF FUND** | : | KGF | |
| **PRIORITY** | : | 1st | |
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| **EXPERIMENT # 17** | **:** | **PERFORMANCE OF CHRYSANTHEMUM CUTTING INFLUENCED BY DIFFERENT DATES AND MEDIA** | |
| **OBJECTIVE(S)** | : | 1. To observe the performance of chrysanthemum cutting related to different times 2. To standardize the perfect media for chrysanthemum cutting | |
| **RATIONALE** | : | Chrysanthemum (*Chrysanthemum morifolium*), is a leading commercial flower belonging to family *Asteraceae*. Recently, this flower is getting importance in Bangladesh as cut flower. Uniform seedling from chrysanthemum cutting is essential for better stand establishment in field. Appropriate time and media are correspondingly a key concern for getting uniform seedling and lower rotting of chrysanthemum cutting. Keeping these views in mind, the present study can be undertaken. | |
| **MATERIALS AND METHODS** | : |  | |
| **CROP/VARIETY** | : | Chrysanthemum | |
| **DESIGN**  **TREATMENT** | : : | RCB Factorial   |  |  | | --- | --- | | Factor A: Dates (4)   1. June 15 2. July 1 3. July 15 4. August 1 | Factor B:Media (3)   1. Sand 2. Coco dust 3. Sand+ Coco dust (1:1) | | |
| **REPLICATIONS** | : | 3 | |
| **PLOT SIZE** | : | N/A | |
| **PLANTING SYSTEM/ SPACING** | : | N/A | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | N/A | |
| **IRRIGATED/RAINFED** | : | N/A | |
| **DATA TO BE RECORDED** | : | Mortality rate (%)  Normal seedling percentages (healthy and well-developed plants)  Abnormal seedling percentages  Number of leaves per plant  Number of primary branches per plant | |
| **INVESTIGATORS (S)** | : | A.Naznin, K. Ambia, F.N. Khan, M.M.R. Bhuyin and M.T. Rashid | |
| **SEASON** | : | Kharif | |
| **DATE OF INITIATION** | : | June, 2022 | |
| **DATE OF COMPLETION** | : | August 2022 | |
| **EXPECTED OUTPUT/BENEFIT** | : | Seedling losses of Chrysanthemum due to inappropriate time and media can be minimized. | |
| **LOCATION** | : | HRC, Gazipur | |
| **STATUS (1ST YEAR/2ND YEAR/...)** | : | New | |
| **ESTIMATED COST** | : | Tk. 20,000/- | |
| **SOURCE OF FUND** | : | GOB | |
| **PRIORITY** | : | 1st | |

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| **PROJECT III** |  | **CULTURAL MANAGEMENT** | | |
| **EXPERIMENT # 18** | **:** | **INFLUENCE OF PLANTING DATES ON THE PRODUCTION OF ASIATIC LILIUM UNDER PROTECTIVE CONDITION** | | |
| **OBJECTIVE(S)** | : | 1. To find out the optimum planting time for better flower production 2. To extend the flowering duration of lilium | | |
| **RATIONALE** | : | Lilium is one of the most important bulbous flowers, belongs to Liliaceae family which have a very good demand in the flower market as cut flower and pot plants. Recently, this crop has become popular in Bangladesh and being started to cultivate commercially. Among the different types of lilies, the Asiatic and Oriental hybrid lilies are very popular. Asiatic lily are relatively easier to grow and can be grown in the tropical region during the cooler months. Normally, November is the optimum planting time to produce Asiatic lilium by which flowers are available in the market during January to February. Sometimes, more flowers are produced considering market demand. There is a great demand of lilium flower round the year which is little bit difficult in Bangladesh climatic condition. But it is possible to extend the flowering time by minimizing the planting time. If flowering duration can be increased, lilium growers will be able to supply flowers on the basis of market demand, will get higher price as well as users will be benefited. So, this program was undertaken to fulfill the above-mentioned objectives | | |
| **MATERIALS & METHODS** | : |  | | |
| **CROP/VARIETY** | : | Bulbs of BARI Lilium-1/BARI Lilium-2 | | |
| **DESIGN**  **TREATMENT** | : : | RCBD  T1: Planting at 01 October  T2: Planting at 15 October  T3: Planting at 01 November  T4: Planting at 15 November  T5: Planting at 01 December | | T6: Planting at 15 December  T7: Planting at 01 January  T8: Planting at 15 January  T9:: Planting at 01 February  T10: Planting at 15 February |
| **REPLICATIONS** | : | 3 | | |
| **PLOT SIZE** | : | 1m×1.2m | | |
| **PLANTING SYSTEM/ SPACING** | : | 20 cm×15 cm | | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | Chemical fertilizers will not be applied up to 3 weeks of bulb planting. After 3 weeks of bulb planting, NPK@30:20:20g/m2 will be applied. Urea and MoP @ 100kg/ha will be top dressed before spike initiation stage and bulb lifting, respectively. | | |
| **IRRIGATED/RAINFED** | : | Irrigated | | |
| **DATA TO BE RECORDED** | : | Germination (%)  Plant height (cm)  Leaf number  Floret no. /plant  Bud length (cm)  Bud diameter (cm) | Floret diameter (cm)  Spike length (cm)  Rachis length (cm)  Bulb weight (g)  Bulblet number/bulb  Bulb diameter (cm) | |
| **INVESTIGATORS (S)** | : | F. N. Khan, K. Ambia, A. Naznin and M. M. R. Bhuyin | | |
| **SEASON** | : | Rabi | | |
| **DATE OF INITIATION** | : | October, 2021 | | |
| **DATE OF COMPLETION** | : | July, 2022 | | |
| **EXPECTED OUTPUT/BENEFIT** | : | Flowering duration of lilium can be extended by which lilium growers will be able to supply flowers on the basis of market demand, will get higher price as well as users will be benefited. | | |
| **LOCATION** | : | HRC, Gazipur | | |
| **STATUS**  **(1ST YEAR/2ND YEAR/...)** | : | 1st year | | |
| **ESTIMATED COST** | : | Tk. 30,000/- | | |
| **SOURCE OF FUND** | : | KGF | | |

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| **EXPERIMENT # 19** | : | **EFFECT OF POTTING MEDIA ON GROWTH AND YIELD OF SPIDER LILY** |
| **OBJECTIVE (S)** | : | 1. To find out the suitable media(s) for spider lily  2. To produce the quality foliage |
| **RATIONALE** | : | Spider lily is a tender bulbous perennial as a valuable ornamental plant belongs to Amaryllidaceae family native to Latin America and has yellowish green and glossy leaves which are very much lucrative as indoor plant. This foliage plant is profitable crop in terms of production and market demand. Moreover these plants are easy to grow and maintain and have few pest or disease problems. Selecting proper growing media prerequisite for optimum growth and development of potted plants. It supplies the basic nutrients and essentials support for plants throughout its life cycle. Therefore, the present investigation will be undertaken to develop standard media for its successful cultivation. |
| **MATERIALS AND METHODS** | : |  |
| **CROP/ VARIETY** | : | Spider lily |
| **DESIGN** | : | CRD |
| **TREATMENTS** | : | Potting media -6  i) 100% Soil  ii) 100% Vermicompost  iii) 100% Cocodust  iv) 50% Soil + 50% Cocodust  v) 50% Cocodust + 25% Soil + 25% Perlite and  vi) 50% Cocodust + 25% Vermicompost + 25% perlite |
| **REPLICATION** |  | 3 |
| **PLOT DIMENSION** |  | - |
| **PLANTING SYSTEM** | : | - |
| **FERTILIZER DOSE** | : | - |
| **METHODS OF APPLICATION** | : | - |
| **IRRIGATED/RAINFED** | : | Irrigated |
| **DATA TO BE RECORDED** | : | 1. Plant characteristics  2. Flower characteristics  3. Disease and insect infestations. |
| **INVESTIGATOR** | : | M. T. Rashid, F. N. Khan, A. Naznin, K. Ambia and M. M. R. Bhuyin |
| **SEASON** | : | - |
| **DATE OF INITIATION** | : | September 2021 |
| **DATE OF COMPLETION** | : | June 2023 |
| **EXPECTED OUTPUT** | : | Growth media for spider lily will be standardized |
| **LOCATION** | : | HRC, BARI, Gazipur |
| **STATUS** | : | New |
| **ESTIMATED COST** | : | 60,000 |
| **SOURCE OF FUND** | : | GOB |
| **PRIORITY** | : | 1st |

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| **PROJECT IV** | : | **POSTHARVEST MANAGEMENT** |
| **EXPERIMENT # 20** | **:** | **DETERMINING OPTIMUM STORAGE TEMPERATURE WITH PACKAGING FOR PRESERVATION OF LILIUM** |
| **OBJECTIVES** | : | i) To study the effect of different packaging material on lilium flower  ii) To study the shelf life of lilium flower with packaging material |
| **RATIONALE** | : | Lilium production is well suited for specialty cut flower growers selling to retail florists or at farmers’ markets. High quality fresh cut liliums have high demand to the buyer or consumer. Post-harvest temperature plays a vital role for preserving the quality of cut flower. Most of the liliums produce very large and beautiful flowers with vibrant colour including whites, yellows, oranges, pinks, reds, purples and so on. It’s attractive colour and long vase life makes it popular cut flower. Sometimes due to some unavoidable circumstances it is not possible to sell the harvested flower within the optimum time. So, flower becomes dull appearance with reduced quality and it lost consumer preference. Therefore, the present study is taken to find out the optimum storage temperature and duration for preservation of lilium flowers well as extending the postharvest life to some extent. |
| **MATERIALS AND METHODS** | : | Lilium flowers |
| **CROP/VARIETY** | : | Lilium flowers of Lil-001 |
| **DESIGN**  **TREATMENT**  **REPLICATION** | : | CRD  Factor A: Temperature:  T1= 80C, T2= 120C  Factor B: Packaging technique  P1 = 1% perforated polyethylene  P2 = 2% perforated polyethylene  P3 = 5% perforated polyethylene  P3= non-perforated polyethylene  P4= without packaging  3 |
| **PLOT SIZE** | : | As recommended for Lilium production by Floriculture Division, HRC, BARI |
| **PLANTING SYSTEM/ SPACING** | : | As recommended for Lilium production by Floriculture Division, HRC, BARI |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | As recommended for Lilium production by Floriculture Division, HRC, BARI |
| **IRRIGATED/RAIN FED** | : | Irrigated |
| **DATA TO BE RECORDED** | : | Water uptake by flower spike (%), change in fresh weight of flower spike, days taken for opening of top floret, length and diameter of floret (cm), opening of floret (%),days taken to deterioration started, vase life (days) |
| **INVESTIGATORS (5)** | : | M. S. Arfin, A. Naznin, K. Ambia, and T. A. A. Nasrin |
| **SEASON** | : | Winter |
| **DATE OF INITIATION** | : | January 2022 |
| **DATE OF COMPLETION** | : | June 2022 |
| **EXP. OUTCOME/BENEFIT** | : | Suitable temperature and packaging technique will help the growers, transporters and whole salers to store, transport and marketing the lilium cut flowers. |
| **LOCATION** | : | Joybedpur |
| **STATUS** | : | New |
| **ESTIMATED COST** | : | 40,000/- |
| **SOURCES OF FUND** | : | HRC, BARI |
| **PRIORITY** | : | 1st |

**PROPOSED NEW EXPERIMENTS (2022-2023)**

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| **PROJECT I** | : | **VARIETAL IMPROVEMENT (New)** | |
| **EXPERIMENT # 21** | : | **COLLECTION, EVALUATION AND MAINTENANCE OF LILY** | |
| **OBJECTIVE** | : | To find out suitable line (s) for cut flower | |
| **RATIONALE** | : | Lily is an ornamental bulbous flowering plant. It has large and showy flowers with many bright colours (Znadbegen, 1980). It belongs to the family Amaryllidaceae, which includes about 60 to 70 species. They are also popular as cut flowers because of their large size, attractive colour and good keeping quality (Dohare, 1989). It can be grown in Bangladesh for easy cultivation and wider adaptability. The Floriculture Division collected some lilies from home and abroad to evaluate and find out the suitable one in Bangladesh condition. | |
| **PROCEDURE/ METHODS** | : |  | |
| **CROP/VARIETY** | : | Lily | |
| **DESIGN** | : | Nil | |
| **TREATMENT** | : | As per collection | |
| **REPLICATION** | : | 3 | |
| **PLOT SIZE** | : | - | |
| **SPACING** | : | - | |
| **IRRIGATED/RAINFED** | : | Irrigated | |
| **DATA TO BE RECORDED** | : | 1. Growth vigour  2. Plant height (cm)  3. No. of leaves/plant  4. Colour of leaf  5. Leaf size (cm)  6. No. of shoots/hill | 7. Number of stalk  8. Stalk length (cm)  9. Flower colour  10. Flower size  11. Vase life (days)  12. Days to harvest |
| **INVESTIGATOR (S)** | : | M. A. Alam, R. Sultana, M. O. Haque, A. K. Saha, M.T. Rashid, F. N. Khan, M. Akhter and S. Zaman | |
| **SEASON** | : | Year round | |
| **DATE OF INITIATION** | : | November 2021 | |
| **DATE OF COMPLETION** | : | November 2024 | |
| **EXP. OUTPUT/BENEFIT** | : | Commercial growers will be benefited from the findings of the experiment | |
| **LOCATION** | : | RARS, Jashore, RARS, Jamalpur, RARS, Burirhat, RARS, Akbarpur and HRC, BARI, Gazipur | |
| **Status**  **(1st year/2nd year/….)** | : | New | |
| **SOURCE OF FUND** | : | GOB | |
| **ESTIMATED COST** | : | Tk. 75,000/- (Tk. 15,000/- per location) | |
| **PRIORITY** | : | 1st | |

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| **EXPERIMENT # 22** | : | **COLLECTION, EVALUATION AND MAINTENANCE OF ORNAMENTAL CUCURBITS** |
| **OBJECTIVE(S)** | : | 1. To collect the different species of ornamental cucurbits available in Bangladesh 2. To evaluate the performance of different species of ornamental cucurbits 3. To conserve the collected germplasm for future research |
| **RATIONALE** | : | Ornamental cucurbits belong to the Cucurbitaceae family which includes the melon, squashes and pumpkins. They are highly coloured and fancifully shaped. They have been grown in every temperate, tropical and sub-tropical regions of the world. They are usually hard shelled, durable, non-edible types suitable for storage vessels, dippers, bird houses, craftwork and artistic decoration. Some species of these ornamental cucurbits have commercial value in our country as ornamentals as well as value additive materials. |
| **MATERIALS AND METHODS** | : |  |
| **MATERIAL** | : | Different species of ornamental cucurbits |
| **TREATMENT** | : | As per collection |
| **MANURES AND FERTILIZER** | : | Cowdung - 10 kg/pit  N- 10 kg/ pit  P- 6 kg/ pit  K-8 kg/ pit |
| MANURE AND FERTILIZER APPLICATION | : | The entire quantity of cowdung, P and K will be applied during final pit preparation. N will be applied in two equal installments at 30 and 60 days after transplanting. |
| **PLANT PROTECTION MEASURES** | : | As and when necessary |
| **DATA TO BE RECORDED** | : | 1. Days to 1st female flower 2. Fruit colour 3. Fruit shape 4. Fruit surface 5. Fruit number/plant 6. Length/fruit (cm) 7. Weight/ fruit (g) 8. Diameter/fruit (cm) 10. Days to harvest of mature fruit (days) 11. Disease and insect reaction etc. |
| **SEASON** | : | Rabi |
| **INVESTIGATOR(S)** | : | M.T. Rashid K. Ambia, A. Naznin, M.M.R. Bhuyin and F.N. Khan |
| **DATE OF INITIATION** | : | October, 2016 |
| **EXP. OUTPUT/BENEFIT** | : | Future research can be taken on the basis of collection |
| **LOCATION** | : | RARS, Burirhat and HRC, BARI, Joydebpur |
| **ESTIMATED COST** | : | Tk.80, 000/- (Tk. 40,000/- per location) |
| **STATUS** | : | On-going |
| **SOURCE OF FUND** | : | GOB |
| **PRIORITY** | : | 1st |

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| **EXPERIMENT # 23** | : | **COLLECTION, EVALUATION AND MAINTENANCE OF CANNA** | |
| **OBJECTIVE (S)** | : | 1. Finding out of germplasm in terms of yield and quality 2. Maintaining the genetic purity | |
| **RATIONALE** | : | Cannas are very important and popular perennial flowering plants native to tropical and subtropical regions. They belong to the family Cannaceae, which includes about 20 to 30 species. They are suitable for planting in bed, pot, shrubbery and in landscaping. The flowers and leaves have many shades of colour, appear throughout the year and make a wonderful display of colour which can hardly be surpassed by any other perennial plant. They are also popular as flower arrangers because of their large size, attractive colour and good keeping quality (Bose *et al.,* 2003). It can be grown in Bangladesh for easy cultivation and wider adaptability. However research works on different morphological and floral traits of canna are not characterized properly in Bangladesh. Therefore, this investigation will be carried out. | |
| **PROCEDURE/METHODS** | : |  | |
| **MATERIAL** | : | Canna | |
| **DESIGN** | : | Nil | |
| **TREATMENT** | : | As per collection | |
| **REPLICATION** | : | Non replicated | |
| **MANURES AND FERTILIZERS** | : | As per recommendation | |
| **PLANT PROTECTION MEASURES** | : | As and when necessary | |
| **DATA TO BE RECORDED** | : | 1. Growth vigour 2. Plant height (cm) 3. No. of leaves/plant 4. Colour of leaf 5. Type of leaf 6. Leaf size (cm) | 1. No. of shoots 2. Flower colour 3. Flower size (cm) 4. Days to bloom 5. Flowering duration (days) 6. Disease and insect reaction etc. |
| **INVESTIGATOR (S)** | : | F. N. Khan, M. M. R. Bhuyin, M. T. Rashid, | |
| **SEASON** | : | Year round | |
| **DATE OF INITIATION** | : | November 2016 | |
| **EXP. OUTPUT/BENEFIT** | : | Commercial growers and nurserymen will be benefited | |
| **LOCATION** | : | HRC, BARI, Joydebpur | |
| **STATUS** | : | New | |
| **ESTIMATED COST** | : | Tk. 80,000/- | |
| **SOURCE OF FUND** | : | VDPPHTOCSD/SRHCDHFCTCA, HRC, BARI | |
| **PRIORITY** | : | 1st | |

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| **EXPERIMENT#24** | : | **COLLECTION AND MAINTENANCE OF NATIVE FLOWER AND FOLIAGE GERMPLASM AT JAMALPUR REGION** |
| **OBJECTIVES** | : | 1. To conserve the collected germplasm for future research 2. Variety development |
| **RATIONALE** | : | Bangladesh is unique in having diversified Native flower and foliage crop genetic resources in a range of habitats. Their elegant nature and wild colours gave them a hunting beauty. Many species, in fact, are widely adapted and found to grow in more than one of these ecological categories. However, these native germplasms are considered threatened due to large scale destruction of their natural habitat. Therefore, it is needed to collect, characterize and conserve wild flower germplasm for future research. |
| **MATERIALS AND METHODS** | : |  |
| **VARIETY/LINE(S)** | : | Native flower and foliages |
| **DESIGN** | : | Nil |
| **TREATMENTS** | : | As per collection |
| **REPLICATION** |  | - |
| **PLOT DIMENSION** |  | - |
| **PLANTING SYSTEM** | : | - |
| **FERTILIZER DOSE** | : | - |
| **METHODS OF APPLICATION** | : | - |
| **IRRIGATED/RAINFED** | : | - |
| **DATA TO BE RECORDED** | : | 1. Plant characteristics  2. Fruit characteristics  3. Disease and insect infestations. |
| **INVESTIGATORS** | : | R SULTANA,F.N.Khan,M A HOSSAIN, A AKTER AND H.E.M KHAIRUL MAZED |
| **SEASON** | : | - |
| **DATE OF INITIATION** | : | 10 September2022 |
| **DATE OF COMPLETION** | : | 25 June 2028 |
| **EXPECTED OUTPUT** | : | New variety will be developed and genetic resources will be conserved for future exploitation |
| **LOCATION** | : | RARS, Jamalpur |
| **STATUS** | : | New |
| **ESTIMATED COST** | : | 80,000 |
| **SOURCE OF FUND** | : | HRC, BARI |
| **PRIORITY** | : | 1st |

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| **EXPERIMENT # 25** | **:** | **COLLECTION AND EVALUATION OF ORCHID GERMPLASM IN SYLHET REGION** |
| **OBJECTIVE** | : | To develop new variety(s) of orchid. |
| **RATIONALE** | : | The orchidaceae are a diverse and widespread family of flowering plants commonly known as orchids. Highest rainfall occurs at sylhet region of Bangladesh and this region occupies the most rainforest of Bangladesh. Simply, rainforest is one of the best home ground for orchids. Most rainforests are reserved here, so, there is a huge possibility that there are some native orchid plants still undiscovered and unutilized. Through collecting those wild orchid germplasms and evaluating them for a commercial variety development will ensure a better utilization of our native resources. |
| **MATERIALS AND METHODS** | : | - |
| **CROP/VARIETY** | : | Orchid |
| **DESIGN** | : | As per collection |
| **1) TREATMENT** | : |  |
| **2) REPLICATION** | : |  |
| **PLOT SIZE** | : |  |
| **PLANTING SPACING** | : | Pot plantation |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | Aerial spray of necessary fertilizer and micronutrients will be applied. |
| **IRRIGATED/RAINFED** | : | Rain fed |
| **DATA TO BE RECORDED** | : | Location of the native germplasm, Distribution, Plant taxonomy, leaf pattern, flower color, Morphological features of flower, vase life. |
| **INVESTIGATOR (S)** | : | M. A. sumi and F. N. Khan |
| **SEASON** | : | - |
| **DATE OF INITIATION** | : | September 2022 |
| **DATE OF COMPLETION** | : | September 2024 |
| **EXPECTED OUTCOME/ BENEFIT** | : | New variety(s) developed from local germplasm will result better adaptation and acceptance in local climate and local community. |
| **LOCATION** | : | RARS, Akbarpur, Moulvibazar. |
| **STATUS** | : | 1st |
| **ESTIMATED COST** | : | Tk. 40,000/ Year |
| **SOURCE OF FUND** | : | BARI |
| **PRIORITY** | : | 1st |
| **PROGRAM** | : | Horticulture |
| **PROJECT** | : |  |

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| **PROJECT II** | : | **PROPAGATION** | | |
| **EXPERIMENT # 26** | **:** | **GERMINATION AND SEEDLING QUALITY OF ZINNIA AND ASTER INFLUENCED BY SEED PRIMING** | | |
| **OBJECTIVE(S)** | : | 1. To accelerate the germination 2. To obtain quality seedling | | |
| **RATIONALE** | : | Germination and seedling growth are critical stages for successful stand establishment and transplant production. Low water potential seed hydration, i.e. priming, has been widely used to reduce the germination period, synchronize emergence and increase stand establishment in small seed flowers (Heydecker et al., 1975). Among the various priming strategies, hydration is shown to be an efficient, low cost, easy and effective method to enhance seed germination and seedling growth (and Powell, 1992). Zinnia and aster seeds generally take more than two weeks for germination and ununiformed germination is an important issue regarding these seeds. Seed loss due to ungerminated seeds is a major concern in production of winter flower. Priming is a technique that can improve pansy (Car-penter and Boucher, 1991), salvia (Carpenter, 1989; Demiret al., 2012) and impatiens (Frett and Pill, 1989) seed germination and transplant quality. Keeping this in mind, the investigation can be undertaken. | | |
| **MATERIALS AND METHODS** | : |  | | |
| **CROP/VARIETY** | : | Zinnia and Aster | | |
| **DESIGN**  **TREATMENT** | : : | RCB Factorial   |  |  | | --- | --- | | Factor A: Seeds of   1. Zinnia 2. Aster | Factor B:Priming methods   1. Hydro-primed and surface dried 2. Hydrated and dried back 3. Control (untreated) | | | |
| **REPLICATIONS** | : | 3 | | |
| **PLOT SIZE** | : | N/A | | |
| **PLANTING SYSTEM/ SPACING** | : | N/A | | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | N/A | | |
| **IRRIGATED/RAINFED** | : | N/A | | |
| **DATA TO BE RECORDED** | : | Total seedling emergence (daily counts)  Normal seedling percentage (%)  Abnormal seedling percentage (%)  Fresh weight of seedlings (mg/plant)  Dry weight of seedlings (mg/plant)  The mean germination / emergence time (MGT / MET) | | |
| **INVESTIGATORS (S)** | : | K. Ambia, M. S. Rahman, A. Naznin and F. N. Khan | | |
| **SEASON** | : | Kharif | | |
| **DATE OF INITIATION** | : | September, 2022 | | |
| **DATE OF COMPLETION** | : | October, 2022 | | |
| **EXPECTED OUTPUT/BENEFIT** | : | Losses due to ungerminated and ununiformed seedling can be minimized | | |
| **LOCATION** | : | HRC, Gazipur | | |
| **STATUS (1ST YEAR/2ND YEAR/...)** | : | New | | |
| **ESTIMATED COST** | : | Tk. 20,000/- | | |
| **SOURCE OF FUND** | : | GOB | | |
| **PRIORITY** | : | 1st | | |
| **EXPERIMENT # 27** | **:** | ***IN VITRO* PROPAGATION OF LILIUM** |
| **OBJECTIVE(S)** | **:** | To developa suitable and reproducible protocol for in-vitro propagation of Lilium (*Lilium longiflorum*) |
| **RATIONALE** | **:** | Lilium (*Lilium longiflorum*) is an ornamental bulbous flowering plant belongs to the family Liliaceae. It has large and showy flowers with many bright colours. It has a wide applicability in the floral industry as cut flower and potted plants. In our country, lilium is a newly introduced flower. Bangladesh Agricultural Research Institute has so far developed a total of 2 varieties of Lilium; BARI Lilium-1 and BARI Lilium-2. Lilium propagation is usually done by vegetative means which produces 3-4 bulbs per bulb scale depending on size and variety. The multiplication efficacy by bulb is low which is not sufficient for large scale cultivation of this plant. Moreover, the plants are more susceptible to diseases. Therefore, there is a need to develop a tissue culture protocol for its propagation. Tissue culture is not only ensuring a continuous supply of bulblets but true-to-type and disease free plants can also be obtained. In-vitro propagation is the only method for the rapid large-scale multiplication. Hence, the study has been taken for In-vitro propagation protocol development of lilium. |
| **MATERIALS AND METHODS** | **:** |  | |
| **CROP/VARIETY** | **:** | BARI Lilium-1. | |
| **DESIGN**  **TREATMENT** | **:** | MS (Murashige and Skoog, 1962) supplemented with different concentrations of cytokinins and Auxins.  Explant: Node | |
|  | **:** |  | |
| **DATA TO BE RECORDED** | **:** | 1. % of explant survival 2. % of explant produce shoots 3. No. of multiple shoots/explants 4. Length of shoots 5. No. of roots/ explant 6. Length of roots 7. ℅ of *ex vitro* survival | |
| **INVESTIGATORS (S)** | **:** | S.R. Haque, A. Naznin, F. N. Khan and M. K. Jamil. | |
| **DATE OF INITIATION** | **:** | September 2022 | |
| **DATE OF COMPLETION** | **:** | June, 2023 | |
| **EXPECTED OUTPUT/BENEFIT** | **:** | The developed protocol will be used for large scale rapid production of BARI Lilium-1. | |
| **LOCATION** | **:** | Tissue culture lab, HRC, BARI, Gazipur | |
| **STATUS (1ST YEAR/2ND YEAR/...)** | **:** | New | |
| **ESTIMATED COST** | **:** | TK. 100,000/- | |
| **SOURCE OF FUND** | **:** | BARI | |
| **PRIORITY** | **:** | 1st | |

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| **EXPERIMENT # 28** | **:** | ***IN VITRO* PROPAGATION OF GLADIOLUS HYBRIDS** |
| **OBJECTIVE(S)** | **:** | To developa suitable and reproducible protocol for in-vitro propagation of BARI developed Gladiolus hybrids |
| **RATIONALE** | **:** | Gladiolus is one of the most important cut flower in Bangladesh which is belongs to family Iridaceae. There is a great scope for hybrid varieties in our country because different attractive colours, various shapes and large number of florets are demand to the users. In view of the importance of this crop, Bangladesh Agricultural Research Institute has so far developed a total of 3 hybrids of gladiolus; GL-004 x GL-039, GL-012 x GL-039 and GL-024 x GL-039. Tissue culture is not only ensures a continuous supply of seedlings but true-to-type and disease free plants can also be obtained. In-vitro propagation is the only method for the rapid large-scale multiplication. Hence, the present study has been taken for In-vitro propagation protocol development of gladiolus hybrids of BARI. |
| **MATERIALS AND METHODS** | **:** |  |
| **CROP/VARIETY** | **:** | Three BARI developed Gladiolus hybrids (GL-004 x GL-039, GL-012 x GL-039 and GL-024 x GL-039). |
| **DESIGN**  **TREATMENT** | **:** | MS (Murashige and Skoog, 1962) supplemented with different concentrations of cytokinins and Auxins.  Explant: Shoot bud, meristem |
|  | **:** |  |
| **DATA TO BE RECORDED** | **:** | 1. % of explant survival 2. % of explant produce shoots 3. No. of multiple shoots/explants 4. Length of shoots 5. No. of roots/ explant 6. Length of roots 7. ℅ of *ex vitro* survival |
| **INVESTIGATORS (S)** | **:** | S.R. Haque, A. Naznin, F. N. Khan and M. K. Jamil. |
| **DATE OF INITIATION** | **:** | September 2022 |
| **DATE OF COMPLETION** | **:** | June, 2023 |
| **EXPECTED OUTPUT/BENEFIT** | **:** | The developed protocol will be used for large scale rapid production of gladiolus hybrids. |
| **LOCATION** | **:** | Tissue culture lab, HRC, BARI, Gazipur |
| **STATUS (1ST YEAR/2ND YEAR/...)** | **:** | New |
| **ESTIMATED COST** | **:** | TK. 100,000/- |
| **SOURCE OF FUND** | **:** | BARI |
| **PRIORITY** | **:** | 1st |

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| **PROJECT III** | : | **CULTURAL MANAGEMENT** | |
| **EXPERIMENT # 29** | **:** | **GROWTH AND PRODUCTION OF HELICONIA UNDER DIFFERENT SHADE CONDITIONS** | |
| **OBJECTIVE(S)** | : | To evaluate aspects of the growth, yield, and quality of floral stems of Heliconiagrown under different shade conditions. | |
| **RATIONALE** | : | Heliconia is a perennial, rhizomatous cut flower, prefers tropical to sub-tropical weather conditions. There are almost 200 to 220 species and numerous varieties varying in their height, season of flowering, color and shape. The response to shade requirement varies with species and cultivars. Colored photoconversion screens, in addition to providing protection against adverse weather conditions, modulate lighting by modifying the portion of the light spectra that radiates the plant. This enables the control of radiation, in order to facilitate the development of certain specific plant characteristics, including the physiological traits related to variation in the light spectrum. The demand for heliconia inflorescences has increased in several countries, and this growing popularity has stimulated studies that identify culture traits of interest for the cut flower agribusiness. Therefore, this experiment has been undertaken. | |
| **MATERIALS & METHODS** | : |  | |
| **CROP/VARIETY** | : | Heliconia | |
| **DESIGN**  **TREATMENT** | : : | RCB Factorial  Factor A: Genotypes- 3  Factor B: Colored shade net- 5  N1= White colored shade net  N2=Blue colored shade net  N3=Green colored shade net  N4=Black colored shade net  N5= Full sunlight (No cover) | |
| **REPLICATIONS** | : | 3 | |
| **PLOT SIZE** | : | 4m x 3m | |
| **PLANTING SYSTEM/ SPACING** | : | 1m × 1m cm | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | Nitrogen, Phosphorus and Potassium will be applied at the rate of 1.2, 0.5, 0.63 kg/m2 | |
| **IRRIGATED/RAINFED** | : | Irrigated | |
| **DATA TO BE RECORDED** | : | Number of spikes per clump  dry mass of aerial parts (g)  Dry mass of roots + rhizome (g)  Length of the stalk (cm)  diameter of the flower stalk (cm) | Leaf chlorophyll content  Leaf area (cm2)  Plant height (cm)  No. of leaves  Inflorescence Length (cm) |
| **INVESTIGATORS (S)** | : | A. Naznin, K. Ambia, F. N. Khan, M. M. R. Bhuyin, and M. T. Rashid | |
| **SEASON** | : | Year round | |
| **DATE OF INITIATION** | : | November 2021 | |
| **DATE OF COMPLETION** | : | May, 2023 | |
| **EXPECTED OUTPUT/BENEFIT** | : | Commercial production of heliconia may be popularized thereby quality flower may be available in the market | |
| **LOCATION** | : | HRC, BARI, Gazipur | |
| **STATUS**  **(1ST YEAR/2ND YEAR/….)** | : | New | |
| **ESTIMATED COST** | : | 50,000/- | |
| **SOURCE OF FUND** | : | GOB | |
| **PRIORITY** | : | 1st | |

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| **EXPERIMENT # 30** | : | **PRODUCTION AND QUALITY OF *CORDYLINE SPP*. INFLUENCED BY DIFFERENT COLOURED SHADE NETS** | |
| **OBJECTIVE** | : | To standardize the appropriate shade net to produce quality *Cordyline* plants. | |
| **RATIONALE** | : | Cut greens are an important component of thefloricultural industry and are largely used for decoration as a-filler in floral compositions. They provide freshness, colour and variety to various decorations, arrangements and bouquets. *Cordyline* plants are used extensively as cut florist greensfor its beautiful foliage. Shade nets are commonly used to protect the agricultural crops from excessive solar radiation, extreme temperature and pests. In recent period, nets are used for specific modification of sunlight, improving micro-environment, and providing physical protection. Colour nets represent new agro-technological concept which combine physical protection with differential filtration of solar radiation andpromoting desired physiological response. Colored shade nets not only exhibit special optical properties that allow the control of light, but also have the advantage of influencing the micro-climate to which the plant is exposed and offer physical protection against excessive radiation and environmental changes. Therefore, this experiment has been undertaken. | |
| **MATERIALS AND METHODS** |  |  | |
| Material | : | *Cordyline* plants | |
| Design | : | RCB | |
| Replication | : | 3 | |
| Treatment(s) | : | 6  T1= White coloured shade net  T2= Red coloured shade net  T3= Green coloured shade net  T4= Black coloured shade net  T5= Polythene  T6= Without shade net (control) | |
| Plant Spacing | : | 50 cm × 40 cm | |
| **DATA TO BE RECORDED** | : | Plant height (cm)  No. of leaves  Petiole length (cm)  Leaf chlorophyll content  Leaf area (cm2) | Photosynthetic rate  Fresh weight  Dry weight  Harvest index |
| **DATE OF INITIATION** | : | October, 2022 | |
| **INVESTIGATOR(S)** | : | F. N. Khan, A. Naznin, K. Ambia, M. M. R. Bhuyin, M. T. Rashid and | |
| **SEASON** | : | Year round | |
| **EXP. OUTPUT/BENEFIT** | : | Commercial production of cordyline plants may be encouraged thereby quality plants as well as cut greens may be available in the market. | |
| **LOCATION** | : | HRC, BARI, Gazipur | |
| **ESTIMATED COST** | : | 40,000/- | |
| **STATUS** | : | Ongoing | |
| **SOURCE OF FUND** | : | GOB | |
| **PRIORITY** | : | 1st | |

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| **EXPERIMENT # 31** | **:** | **GROWTH AND FLOWER PRODUCTION OF HELICONIA VARIETIES UNDER COCONUT TREE** | | | | |
| **OBJECTIVE(S)** | : | 1. To find out the suitable varieties of heliconia under coconut tree 2. To find out the possibilities of heliconia flower production as inter crop in the coconut garden | | | | |
| **RATIONALE** | : | Heliconia, is a rhizomatous, herbaceous perennial plant and commonly known as ‘Lobster-claws’, ‘Wild plantains’ or ‘False bird of paradise’. Heliconia (*Heliconia* spp.) belongs to family Heliconiaceae and is amongst the most attractive of all the exotic tropical flowering plants, comprises of single genus, with about 250-300 species. According to flowering habit, they are grouped in different groups *viz*., erect growing ones and pendant or hanging type. So, there is a need to evaluate hybrids and varieties in any particular agro-climatic region. Coconut is the major plantation crop in coastal region of Bangladesh which is perennial in nature and it needs more space to grow and interspace in majority of the coconut farms is either unutilized or underutilized. Coconut garden offers greater scope for intercropping. Intercropping with compatible flower crops in coconut gardens not only enhances the farm income but also ensures aesthetic values promoting ecotourism. Therefore, It is very essential to study the performance of heliconia varieties in a particular place before recommending to the farmers and also to see the possibilities of the commercial production of heliconia under coconut tree. | | | | |
| **MATERIALS &METHODS** | : |  | | | | |
| **CROP/VARIETY** | : | Heliconia | | | | |
| **DESIGN**  **TREATMENT** | : | RCB  Factor A: Genotypes- 3  Factor B: Under coconut tree & open | | | | |
| **REPLICATIONS** | : | 3 | | | | |
| **PLOT SIZE** | : | - | | | | |
| **PLANTING SYSTEM/ SPACING** | : | 20 plants in four coconut plant | | | | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | Half dose of vermin-compost and neem cake (100g and 50g/plant) along with 13:5:13 NPK (5g/plant) can be given at 3 months interval. Drenching diluted cowdung slurry in a 1: 10 ratios at 6 monthly interval enhances the production of quality inflorescence. | | | | |
| **IRRIGATED/RAINFED** | : | Irrigated | | | | |
| **DATA TO BE RECORDED** | : | Number of spikes per clump  dry mass of aerial parts (g)  Dry mass of roots + rhizome (g)  Length of the stalk (cm)  diameter of the flower stalk (cm) | | Leaf chlorophyll content  Leaf area (cm2)  Plant height (cm)  No. of leaves  Inflorescence Length (cm) | | |
| **INVESTIGATORS (S)** | : | F. N. Khan, S. Hasna, K. Ambia, A. Naznin and M. R. Bhuyin | | | | |
| **SEASON** | : | Round the year | | | | |
| **DATE OF INITIATION** | : | September, 2021 | | | | |
| **DATE OF COMPLETION** | : | August, 2024 | | | | |
| **EXPECTED OUTPUT/BENEFIT** | : | Commercial production of heliconia may be popularized thereby quality flower may be available in the market | | | | |
| **LOCATION** | : | RARS, Barishal | | | | |
| **STATUS**  **(1ST YEAR/2ND YEAR/..)** | : | 1st year | | | | |
| **ESTIMATED COST** | : | Tk. 50,000/- | | | | |
| **SOURCE OF FUND** | : | GOB | | | | |
| **PRIORITY** | : | 1st | | | | |
| **EXPERIMENT # 32** | | | : | **PRODUCTION AND QUALITY OF *DRACAENA FRAGRANS* INFLUENCED BY DIFFERENT COLOURED SHADE NETS** | | |
| **OBJECTIVE** | | | : | To standardize the appropriate shade net to produce quality *Dracaena* plants and cut foliage. | | |
| **RATIONALE** | | | : | Cut greens are an important component of the floricultural industry and are largely used for decoration as a-filler in floral compositions. They provide freshness, colour and variety to various decorations, arrangements and bouquets. Dracaena is one of the important cut green which are traded in the world and used for its beautiful foliage. Shade nets are commonly used to protect the agricultural crops from excessive solar radiation, extreme temperature and pests. In recent period, nets are used for specific modification of sunlight, improving micro-environment, and providing physical protection. Colour nets represent new agro-technological concept which combine physical protection with differential filtration of solar radiation and promoting desired physiological response. Colored shade nets not only exhibit special optical properties that allow the control of light, but also have the advantage of influencing the micro-climate to which the plant is exposed and offer physical protection against excessive radiation and environmental changes. Therefore, this experiment has been undertaken. | | |
| **MATERIALS AND METHODS** | | |  |  | | |
| Material | | | : | *Dracaena* | | |
| Design | | | : | RCB | | |
| Replication | | | : | 3 | | |
| Treatment(s) | | | : | T1= White coloured shade net  T2= Red coloured shade net  T3= Green coloured shade net  T4= Black coloured shade net  T5= Polythene  T6= Without shade net (control) | | |
| Plant Spacing | | | : | 50 cm × 40 cm | | |
| **DATA TO BE RECORDED** | | | : | 1. Plant height (cm) 2. No. of leaves 3. Petiole length (cm) 4. Leaf chlorophyll content 5. Leaf area (cm2) | | 1. Photosynthetic rate 2. Fresh weight 3. Dry weight 4. Harvest index |
| **DATE OF INITIATION** | | | : | October, 2022 | | |
| **INVESTIGATOR(S)** | | | : | F. N. Khan, A. Naznin, K. Ambia, M. M. R. Bhuyin, M. T. Rashid and K. A. Ara | | |
| **SEASON** | | | : | Year round | | |
| **EXP. OUTPUT/BENEFIT** | | | : | Commercial production of dracaena plants may be encouraged thereby quality plants as well as cut greens may be available in the market. | | |
| **LOCATION** | | | : | HRC, BARI, Gazipur | | |
| **ESTIMATED COST** | | | : | 40,000/- | | |
| **STATUS** | | | : | Ongoing | | |
| **SOURCE OF FUND** | | | : | GOB | | |
| **PRIORITY** | | | : | 1st | | |

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| **EXPERIMENT # 33** | **:** | **FLOWER AND BULB QUALITY OF LILIUM INFLUENCED BY DURATION OF VERNALIZATION** | | |
| **OBJECTIVE** | : | To study the effect of different duration of vernalization on flower and bulb quality of lilium | | |
| **RATIONALE** | : | Vernalization is a process required by certain plant species, including *Lilium* spp. to enter the reproductive phase, through an exposure to low, non-freezing temperatures. Most of the lilium species require an exposure to low, non-freezing, temperatures to accelerate shoot emergence and flowering. The exposure to low temperatures either in natural or in artificial cold treatment is called vernalization. Lilium respond to vernalization by decreasing their time to flowering. Plant response to vernalization is given by the combination of two factors, the temperature and the duration of the period. Vernalization models should be developed for lilium for better plant growth and flower quality. Therefore, this investigation may be undertaken to standardize an effective vernalization method for lilium. | | |
| **MATERIALS AND METHODS** | : |  | | |
| **CROP/VARIETY** | : | Bulbs of BARI Lilium-1 | | |
| **DESIGN**  **TREATMENT** | : : | RCBD  T1: 6 weeks of vernalization  T2: 8 weeks of vernalization  T3: 10 weeks of vernalization  T4: 12 weeks of vernalization | T5: 14 weeks of vernalization  T6: 16 weeks of vernalization  T7: 18 weeks of vernalization | |
| **REPLICATIONS** | : | 3 | | |
| **PLOT SIZE** | : | 2m×1m | | |
| **PLANTING SYSTEM/ SPACING** | : | 20 cm×15 cm | | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | Chemical fertilizers will not be applied up to 3 weeks of bulb planting. After 3 weeks of bulb planting, NPK@30:20:20g/m2 will be applied. Urea and MoP @ 100kg/ha will be top dressed before spike initiation stage and bulb lifting. | | |
| **IRRIGATED/RAINFED** | : | Irrigated | | |
| **DATA TO BE RECORDED** | : | Weight of bulbs before vernalization (g)  Weight of bulbs after vernalization (g)  Plant height (cm)  Leaf number | | Flower diameter (cm)  Bulb weight (g)  Bulblet number/bulb  Bulb diameter (cm) |
| **INVESTIGATORS (S)** | : | K. Ambia, A. Naznin and F. N. Khan | | |
| **SEASON** | : | Kharif and Rabi | | |
| **DATE OF INITIATION** | : | May, 2021 | | |
| **DATE OF COMPLETION** | : | March, 2022 | | |
| **EXPECTED OUTPUT/BENEFIT** | : | Flowering of lilium can be ensured year round | | |
| **LOCATION** | : | HRC, Gazipur | | |
| **STATUS (1ST YEAR/2ND YEAR/…)** | : | 1st year | | |
| **ESTIMATED COST** | : | Tk. 30,000/- | | |
| **SOURCE OF FUND** | : | KGF | | |
| **PRIORITY** | : | 1st | | |

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| **EXPERIMENT # 34** | **:** | **COMPARATIVE PERFORMANCE EVALUATION OF MECHANIZED PLASTIC MULCH LAYING WITH CONVENTIONAL MULCHING FOR CHRYSANTHEMUM** |
| **OBJECTIVE(S)** | : | 1. To evaluate the field performance of different mulch laying methods 2. To evaluate the yield performance of chrysanthemum due to different method of mulch laying |
| **RATIONALE** | : | Chrysanthemum is a leading commercial flower crop grown for both cut and loose flowers. The growth and yield of the plants is mainly influenced by two principle factors *e i.,* genetic characters and management factors. Managing soil temperature can enhance the yield quality. Plastic mulch can be used effectively to modify soil temperature. Black or clear mulches intercept sunlight, which warms the soil. This includes preparation of seed bed, spread mulch film and anchoring of edges of film. Raised seed bed has to be prepared for plastic mulching (Scott, 1995). To perform this operation, two persons are required for laying over the soil bed, while one more person is required behind them to shovel the soil onto the edges of the mulch. These operations when done by manually become very time consuming, labour intensive, tedious and costly. In modern agriculture, power tiller has become one of the major sources of power which is generally used for majority of the agricultural operations like land development, tillage, sowing, harvesting, threshing and transportation. Power tiller helps in reducing the time required for these operations. Hence, it has become the integral part of mechanized agriculture. Plastic mulching by conventional method requires more human labour, more time and more cost of operation. Keeping the above facts in view present study will be undertaken to perform. |
| **MATERIALS & METHODS** | : |  |
| **CROP/VARIETY** | : | Chrysanthemum |
| **DESIGN:** |  | RCB |
| **TREATMENT** | : | T1= Plastic mulch laying through mechanized way  T2= Manually plastic mulch laying  T0= Control |
| **REPLICATION** | : | Four |
| **PLOT SIZE** | : | 2 m × 3 m |
| **PLANTING SYSTEM /SPACING** | : |  |
| **FERTILIZER DOSE AND**  **METHODS OF APPLICATION** | : | Recommended dose and manual application |
| **IRRIGATED/RAINFED** | : | Irrigated |
| **DATA TO BE RECORDED** | : | Time of unit operation, Fuel consumption of machine, Quantity of irrigated water (time or volume /unit plot), Soil moisture content in three times interval, plant height, branch no., leaf no., flower bud initiation, flower no., stalk length, economic data, etc. |
| **INVESTIGATOR(S)** | : | M.T Rashid, M.R. Karim, F.N. Khan, K. Ambia, A. Naznin and M.M.R. Bhuyin |
| **SEASON** | : | Rabi (2021-22) |
| **DATE OF INITIATION** | : | November 2021 |
| **DATE OF COMPLETION** | : | June 2023 |
| **EXPECTED OUTPUT/BENEFIT** | : | Will reduce the cost of plastic mulch laying, higher yield and benefits, reduce human drudgery, save time and water, conserve soil moisture and improve soil health. Can be used for cultivation of other vegetables and flowers. |
| **LOCATION** | : | BARI, Gazipur |
| **STATUS** | : | New |
| **ESTIMATED COST** | : | Taka 1,00,000.00 |
| **SOURCE OF FUND** | : | GOB |
| **PRIORITY** | : | 1st |

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| EXPERIMENT # 35 | | : | | | **INFLUENCE OF ORGANIC AMENDMENTS ON PRODUCTION OF QUALITY FLOWER AND BULB PRODUCTION IN TUBEROSE** | | |
| **OBJECTIVE** | | : | | | 1. Standardization the nutrient for better growth and yield 2. Reducing disease and insect reaction 3. Increasing shelf life | | |
| **RATIONALE** | | : | | | Tuberose (*Polianthes tuberosa* L.), is an ornamental bulbous plant suitable as cutflower and display herbaceous borders in gardens (Mollah, 2004). It is popular owing to its colour, forms and sweet fragrance. It has been investigated earlier those organic amendments like crop residues, poultry manure, green manure, mustard oil cake etc. are helpful in improving soil productivity and fertility. Again, Trichoderma increased the microbial diversity of soil, thus, enhancing growth, yield and disease- insect resistance (Siqueira *et al*, 2008; Yousuf, 2008). There are meagre studies regarding organic amendment on tuberose in Bangladesh. However, a number of investigations were done abroad. Therefore, the present investigation will be undertaken. | | |
| **MATERIALS & METHODS** | |  | | |  | | |
| **CROP/ VARIETY** | | : | | | Bulb of BARI Tuberose-1 | | |
| **TREATMENT(S)** | | : | | | 6  T1 = Farmyard manure (5 t/ha)  T2 = Vermicompost (5 t/ha)  T3= Trichocompost (3 t/ha)  T4 = Farmyard manure (5 t/ha) + Trichocompost (3 t/ha)  T5 = Vermicompost (5 t/ha) + Trichocompost (3 t/ha)  T6 = Control (Recommended doses of fertilizer:CD-10t and N200 P50 K150 S30 B2Zn1.5 kg/ha) | | |
| **DESIGN** | | : | | | RCB | | |
| **REPLICATION** | | : | | | 3 | | |
| **PLOT SIZE** | | **:** | | | 1.50 m × 1.25 m | | |
| **PLANT SPACING** | | **:** | | | 25 cm × 15 cm | | |
| **MANURES AND FERTILIZERS** | | **:** | | | As per treatment | | |
| **METHOD OF FERTILIZER APPLICATION** | | **:** | | | All fertilizer except N will be applied and mixed up well with the soils during final land preparation according to treatments. Nitrogen will be applied in two equal installments at 35 and 55 days after planting | | |
| **PLANT PROTECTION MEASURES** | | **:** | | | As and when necessary | | |
| **IRRIGATED/RAINFED** | | **:** | | | Irrigated | | |
| **DATA TO BE RECORDED** | | : | | | 1. Plant height (cm) 2. Leave number 3. Days to flower bloom 4. Spike length (cm) 5. Rachis length (cm) 6. Flowering duration (days) 7. Vase life (days) 8. Flower yield (t/ha) 9. Bulb yield (t/ha) 10. Disease & insect reaction etc. | | |
| **INVESTIGATOR (S)** | | : | | | M.T. Rashid, M. A. Alam, M. O. Haque, A. K. Saha, R. Sultana, M. M. Kader, M. Akhter, S. Zaman and F. N. Khan | | |
| **DATE OF INITIATION** | | : | | | FEBRUARY 2023 | | |
| **DATE OF COMPLETION** | | : | | | JANUARY 2025 | | |
| **EXPT. OUTPUT/BENEFIT** | | : | | | Commercial growers will be benefited using this technology | | |
| **LOCATION** | | : | | | HRC, BARI, Gazipur, RARS, Jashore, RARS, Burirhat, RARS, Jamalpur, and RARS, Akbarpur | | |
| **STATUS** | | : | | | New | | |
| **ESTIMATED COST** | | : | | | Tk. 60,000/- | | |
| **SOURCE OF FUND** | | : | | | GOB | | |
| **PRIORITY** | | : | | | 1st | | |
| **EXPERIMENT # 36** | : | | **EFFECT OF GROWING MEDIA AND DEPTH ON ROOFTOP CULTIVATION OF GERBERA** | | | | |
| **OBJECTIVE(S)** | : | | To find out suitable media for quality gerbera flower production in soilless culture | | | | |
| **RATIONALE** | : | | Roof gardens which are the precursors of contemporary green roofs have ancient roots. Rooftops are underutilized and rarely considered as urban space which otherwise could be utilized with potential for creative development. There are essentially three options for rooftop gardens. In container gardening, few to no modifications are made to the existing roof-structure; containers like old bath tubs, tyres, wooden box, fish cartoons etc. are placed on a rooftop and filled with soil and plants. The second type of roof garden, in which the rooftop actually becomes a planting medium, involves more intensive investments. The third rooftop garden possibility is rooftop hydroponics, in which plants are grown in a soilless medium and fed a special nutrient solution. Rooftop hydroponics can be the lightest of the three options and may offer the possibility for faster plant growth and increased productivity. The objective of this study was to determine Effect of Growing Media and Depth on Rooftop Cultivation of Gerbera | | | | |
| **MATERIALS & METHODS** | : | | Factorial experiment | | | | |
| **CROP/VARIETY** | : | | BARI Gerbera-1 | | | | |
| **DESIGN**  **TREATMENT** | : : | | Factorial experiment  Factor 1  Depth: D1: 10 cm, D2: 20 cm, D3: 30 cm  Factor 2  Media:  T1: Soil + sand +coco peat + vermicompost (1:1:2:2),  T2: Sand + coco peat + vermicompost (1:2:2),  T3: Sand + coco peat + vermicompost + vermiculite (1:2:2:0.5),  T4: Sand + coco peat +vermicompost + perlite (1:2:2:0.5)  T5: Sand + coco peat + vermicompost + vermiculite + perlite (1:2:2:0.25:0.25)  T6: Control(sand) | | | | |
| **REPLICATIONS** | : | | 3 | | | | |
| **PLOT SIZE** | : | | Single plant will be planted in an earthen pot | | | | |
| **PLANTING SYSTEM/ SPACING** | : | | Nil | | | | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | : | | 25% Enshi Nutrient Solution | | | | |
| **IRRIGATED/RAINFED** | : | | Irrigated | | | | |
| **DATA TO BE RECORDED** | : | | Leaf area (cm2), Plant height (cm), Days to flowering, Flower colour, Number of flower/suckers, Flower diameter (cm), Stalk length (cm), Fresh weight of flower(gm), Shelf life (days), Vase life (days), Yield/plant, Insect and disease reaction. | | | | |
| **INVESTIGATORS (S)** | : | | M. M. R. Bhuyin, F. N. Khan, K. Ambia, M. T. Rashid and M. Asaduzzaman | | | | |
| **SEASON** | : | | Rabi | | | | |
| **DATE OF INITIATION** | : | | October, 2022 | | | | |
| **DATE OF COMPLETION** | : | | June 2023 | | | | |
| **EXPECTED OUTPUT/BENEFIT** | : | | Suitable substrate and planting depth for growing Gerbera in rooftop soilless culture will be identified | | | | |
| **LOCATION** | : | | HRC, Gazipur | | | | |
| **STATUS**  **(1ST YEAR/2ND YEAR/..)** | : | | New | | | | |
| **ESTIMATED COST** | : | | Tk. 40,000/- | | | | |
| **SOURCE OF FUND** | : | | GOB | | | | |
| **PRIORITY** | : | | 1st | | | | |
| **PROJECT IV** | | : | | | **DISEASE MANAGEMENT** | |
| **EXPERIMENT # 37** | | : | | | **EFFECT OF DIFFERENT GENERATIONS OF CORMS FOR DISEASE FREE CORM PRODUCTION** | |
| **OBJECTIVE(S)** | | : | | | To find out the corm generation level at which Fusarium wilt initiate | |
| **MATERIALS AND METHODS** | | : | | | RCB Factorial | |
| **CROP/VARIETY** | | : | | | Corm of BARI released Gladiolus Varieties | |
| **DESIGN**  **TREATMENT** | | : | | | Factor A: Variety (3)   1. BARI Gladiolus-3 2. BARI Gladiolus-4 3. BARI Gladiolus-5   Factor B: Corm from different generation (4)   1. Corm from cormel 2. Corm produced from 1st generation of corm 3. Corm produced from 2nd generation of corm 4. Corm produced from unknown generation (Control) | |
| **REPLICATIONS** | | : | | | 3 | |
| **PLOT SIZE** | | : | | | 54m x 9cm | |
| **PLANTING SYSTEM/ SPACING** | | : | | | 20cm x 30cm | |
| **FERTILIZER DOSE AND METHODS OF APPLICATION** | | : | | | As recommended by Fertilizer Recommendation Guide 2018; P.143 | |
| **IRRIGATED/RAINFED** | | : | | | Irrigated | |
| **DATA TO BE RECORDED** | | : | | | 1. Days to spike initiation 2. Days to flowering 3. Length of spike (cm) 4. Length of rachis (cm) 5. No. of flower/rachis 6. Weight of ten stick (kg) 7. No. of spike/hill | 1. No. of corm/plant 2. No. of cormel/ plant 3. Vase life (days) 4. Corm weight (g) 5. Cormel weight (g) 6. Disease reaction |
| **INVESTIGATORS (S)** | | : | | | M. M. R. Bhuyin, L. Yesmin, F. N. Khan, K. A. Ara, K. Ambia and M. T. Rashid | |
| **SEASON** | | : | | | Year round | |
| **DATE OF INITIATION** | | : | | | October 2021 | |
| **DATE OF COMPLETION** | | : | | | June 2024 | |
| **EXPECTED OUTPUT/BENEFIT** | | : | | | Fusarium wilt free plant can be achieved and flower quality will be improved | |
| **LOCATION** | | : | | | HRC, Gazipur | |
| **STATUS**  **(1ST YEAR/2ND YEAR/….)** | | : | | | New | |
| **ESTIMATED COST** | | : | | | Tk. 30,000/- | |
| **SOURCE OF FUND** | | : | | | GOB | |
| **PRIORITY** | | : | | | 1st | |

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| **PROJECT V** | : | **TECHNOLOGY TRANSFER** | |
| **EXPERIMENT # 38** | **:** | **ADAPTIVE TRIAL OF DIFFERENT VARIETIES OF GLADIOLUS, LILIUM, AND GYPSOPHILA AT FARMERS FIELD** | |
| **OBJECTIVE** | **:** | To evaluate the performance of the varieties in farmer’s field | |
| **RATIONALE** | **:** | Gladiolus, Tuberose, Lilium, Gypsophila and Marigold are important flowers in Bangladesh. BARI developed gladiolus, tuberose, lilium, gypsophila and marigold varieties which need to popularize among the farmers. As such On-farm trial will help popularize the varieties to the farmers. | |
| **PROCEDURE/METHODS** |  |  | |
| **MATERIALS** | **:** | Gladiolus, Tuberose, Lilium, Gypsophila and Marigold | |
| **DESIGN** | **:** | RCB (Dispersed) | |
| **TREATMENT** | **:** | (BARI Gladiolus-3, BARI Gladiolus-4 and BARI Gladiolus-5)  (BARI Lilium-1 & BARI Lilium-2)  (BARI Marigold-1and check)  (BARI Tuberose-1 and check)  (BARI Gypsophila-1) | |
| **SPACING** | **:** | 20 × 20 cm (Gladiolus)  15 × 15 cm (Lilium)  50 × 40 cm (Marigold)  30 × 20 cm (Tuberose)  20 × 15 cm (Gypsophila) | |
| **MANURES AND FERTILIZERS** | **:** | N200 P50 K150 B2 Zn3 S30 kg/ha and CD 5 t/ha (Gladiolus)  N190 P60 K150 B2 Zn3 S30 kg/ha and CD 5 t/ha (Lilium)  N100 P30 K80 B1 Zn2 S10 kg/ha and CD 5 t/ha (Marigold)  N200 P50 K150 B2 Zn3 S30 kg/ha and CD 5 t/ha (Tuberose)  N100 P30 K80 B1 Zn2 S10 kg/ha and CD 5 t/ha (Gypsophila) | |
| **APPLICATION METHODS** | **:** | Entire quantity of cowdung, P, K, B, Zn and S were applied during land preparation. N was applied in two equal installments of 30 and 60 days after emergence. | |
| **IRRIGATED/RAINFED** | **:** | Irrigated | |
| **PLANT PROTECTION MEASURES** | **:** | As and when necessary | |
| **DATA TO BE RECORDED** | **:** | 1. Days of all operation 2. Yield and yield contributing characters 3. Plant characters | 1. Disease and insect reaction 2. Economics 3. Farmer’s reaction etc. |
| **INVESTIGATOR (S)** | **:** | Horticulture scientist along with OFRD / DAE personnel | |
| **DATE OF INITIATION** | **:** | November-December 2021 and March-April 2022 | |
| **LOCATION** | **:** | Jashore, Rangpur, Jamalpur, Khagrachori and Gazipur | |
| **EXPT. OUTPUT/BENEFIT** | **:** | Farmer will be benefited | |
| **ESTIMATED COST** | **:** | Tk. 2,00,000/- (Tk. 40,000/- per location) | |
| **SOURCE OF FUND** | **:** | KGF and GOB | |
| **STATUS** | **:** | New | |
| **PRIORITY** | **:** | 1st | |

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| **BREEDERS PROPAGULE PRODUCTION OF FLOWER CROPS** | | | | | |
| **OBJECTIVE (S)** | | **:** | i) Producing breeder propagules of different flower crops for distribution among the growers and nurserymen  ii) Maintain genetic purity | | |
| **RATIONALE** | | **:** | The breeder seed provide the source of the first and the subsequent increase of foundation seeds. This seed is produced by or under the direct control of the sponsoring breeder. A good number of flower varieties under different species have been developed and released for countrywide cultivation. Moreover, a considerable number of commercial/ promising flower varieties are available in the country. These materials need vegetative propagation for maintaining their mother’s characters. As such the present work will be undertaken to multiply the selected flower plants for extension of the same. | | |
| **METHODS** | | **:** | The following stations will produce the breeder’s propagules of different crops | | |
| **Crop** | **No. of propagules/Seed** | | | **Stations** |
| Gladiolus | 5000 | | | Jashore,Joydebpur, Jamalpur, and Burirhat,Rangpur |
| Tuberose | 7000 | | | Jashore, Joydebpur,Jamalpur, and Burirhat, Rangpur |
| Gerbera | 50 | | | Joydebpur |
| Red ginger | 100 | | | Joydebpur, Jamalpur, Khagrachori and Burirhat, Rangpur |
| Heliconia | 100 | | | Joydebpur, Pahartali, Jamalpur,Akbarpur, Burirhat and Khagrachori |
| Cactus | 400 | | | Joydebpur, Jamalpur and Burirhat, Rangpur |
| Succulents | 250 | | | Joydebpur, Jamalpur and Burirhat, Rangpur |
| Chrysanthemum | 400 | | | Joydebpur, Burirhat and Jashore |
| Orchids | 200 | | | Joydebpur, Akbarpur and Khagrachori |
| Lillies&Lilium | 400 | | | Joydebpur, Jamalpur and Burirhat, Rangpur |
| Bougainvillea | 150 | | | Joydebpur |
| Climbers | 150 | | | Joydebpur |
| Ornamental plants | 300 | | | Joydebpur |
| Ornamental trees | 50 | | | Joydebpur |
| Wild/native flowers | 50 | | | Joydebpur |
| Aster | 0.5kg seed | | | Joydebpur, Burirhat, , Rangpur and Jashore |
| Marigold | 1.0 kg seed | | | Joydebpur, Burirhat, Rangpur and Jashore |
| Dianthus | 0.5kg seed | | | Joydebpur, Burirhat , Rangpur and Jashore |
| Corn flower | 0.5kg seed | | | Joydebpur, Burirhat, Rangpur and Jashore |
| Poppy | 0.2 kg seed | | | Joydebpur, Burirhat and Jashore |
| Sylvia | 0.5 kg seed | | | Joydebpur, Burirhat and Jashore |
| Gypsophila | 4.0 5kg seed | | | Joydebpur, Burirhat, , Rangpur, Bogura and Jamalpur |

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| **INVESTIGATOR (S)** | **:** | Horticulture scientists of concerned station |
| **DATE OF INITIATION** | **:** | November-April(2021-2022) |
| **EXP. OUTPUT/BENEFIT** | **:** | Appropriate amount of genetically pure propagules produced |
| **LOCATION** | **:** | Already mentioned |
| **ESTIMATED COST** | **:** | Tk. 1,50,000/- |
| **SOURCE OF FUND** | **:** | KGF and GOB |
| **PRIORITY** | **:** | 1st |

**TRAINING ON FLOWER TECHNOLOGY**

**Objective (s):** Floriculture Division, HRC, BARI has developed numerous improved technologies for flower production, seed/propagule production, hydroponic culture, post- harvest technologies including the development of improved varieties. The training program has been designed to train scientists, officers, SA, SAAO and farmers.

**PROCEDURE/METHODS:**

**Topics:**

1. Improved flower cultivation
2. Quality seed and propagule production
3. Dissemination of technologies on increasing shelf life, post- harvest handling and packaging
4. Interior decoration of flowers
5. Hydroponic culture of flowers

**Table-1: Location with number of training and field day**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Location** | **Trainer’s training** | **Farmers training** | **Field day** |
|  | HRC, Joydebpur | - | 1 | 1 |
|  | RHRS, Jashore | - | 1 | 1 |
|  | RARS,Burirhat, Rangpur | - | 1 | 1 |

|  |  |  |
| --- | --- | --- |
| **INVESTIGATOR (S)** | **:** | Floriculture and scientists of concerned station |
| **EXPECTED OUTPUT/BENEFIT** | **:** | Farmers/nurserymen will be benefited |
| **ESTIMATED COST** | **:** | Tk. 4,00,000/- |
| **SOURCE OF FUND** | **:** | KGF and GOB |
| PRIORITY | **:** | 1st |