

**EVALUATION OF GERBERA**  
**(*Gerbera jamesonii hybrida* Bolus)**  
**GENOTYPES**

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**NOVEMBER, 1995**

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**EVALUATION OF GERBERA**  
**(*Gerbera jamesonii hybrida* BOLUS) GENOTYPES**

Thesis Submitted to the  
University of Agricultural Sciences, Dharwad  
in partial fulfilment of the requirements for the  
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**MASTER OF SCIENCE (AGRICULTURE)**  
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**BY**

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**CERTIFICATE**


This is to certify that the thesis entitled "EVALUATION OF GERBERA (*Gerbera jamesonii hybrida* Bolus) GENOTYPES" submitted by Mr. VIDYANAND C. BHAT for the degree of MASTER OF SCIENCE (AGRICULTURE) in HORTICULTURE, of the University of Agricultural Sciences, Dharwad, is a record of research work done by him during the period of his study in this University, under my guidance and supervision and the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar titles.

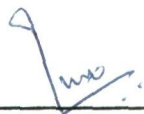
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To

**My Beloved**

*Brother* : **Subray**

and

*Uncle* : **Ganapathi**

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**CHAPTER - I**

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**INTRODUCTION**

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## I . INTRODUCTION

Gerbera (*Gerbera jamesonii* Bolus) also called Barberton Daisy or Transvaal Daisy or African Daisy, is a popular perennial ornamental plant commercially grown for its attractive flowers. It is grown throughout the world in a wide range of climatic conditions.

The flowers of gerbera are ideally suited for vase decoration and other floral arrangements because of its long and stout pedicel. The flowers are available in many colours like pink, white, yellow, orange, crimson, purple and in many combinations and shades. Another useful trait of this flower is its transport quality because of hardy stem. It is also suitable for growing in mixed border, rock garden, beds and in pots.

The genus *Gerbera* was named in honour of a German Naturalist, Traugott Gerber. It is considered as native to South African and Asiatic regions. They mostly inhabit temperate and mountainous regions. The plant is reported to be widely distributed in South Africa, Europe, Asia and Indonesia. In India they are distributed from Kashmir to Nepal at altitudes of 1300 to 3200 metres. It is grown as an ornamental plant in subtropical and temperate regions of India.

The genus *Gerbera* consists of forty species of semi hardy and perennial flowering plants (Baily, 1963). Among the

different species of *Gerbera* viz., *G. asplenifolia*, *G. aurantiaca*, *G. kunzeana*, *G. viridifolia* and *G. jamesonii*, the only species under cultivation is *Gerbera jamesonii*. This belongs to family *Asteraceae* with chromosome number  $n=x=25$ . Changes in chromosome number influence the expression of phenotypes. Polyploids have been reported with desirable plant and flower characters, especially tetraploid with increased plant and flower size (Pryor, 1972).

The plants of *Gerbera jamesonii* are dwarf, stemless, tender and grow in clumps. The leaves are numerous; petiolated, lanceolate, deeply lobed, narrow at the base, wide at the top and arranged in a rosette. The flowers known as head or capitulum are solitary, many flowered, 6-12 centimetres in diameter. Stalks are hardy, upright and devoid of leaves. Flower heads may be grouped as 'single', 'semidouble' or 'double' based on number of ray florets and presence or absence of disc florets. Flowers with one or two rows of ray florets on the periphery of the disc with disc florets in the center of disc are known as 'single' types. In 'double' types there will be more than two rows of ray florets and disc is absent. Sometimes flowers with more than two rows of ray florets and disc in the center are grouped as 'semidouble'. The 'double' cultivars have sometimes bicoloured flowers which are very attractive. The fruit is an achene, beaked and with a pappus.

Among the cut flowers gerbera ranks seventh in the international market. It is a popular cut flower in Holland, Germany and United States. But in India, it is yet to be popularised and there is a need to place it in limelight. Gerbera can contribute largely to floriculture industry by virtue of its yield potential, colour variation and long vase life. Flowers remain in vase for 10-15 days and the vase life can be extended upto 30 days with suitable varieties and pretreatments (Nanjan, 1994). An added advantage of gerbera plant is that it can be grown both outdoors, under protected cultivation and also in soilless culture or hydroponics. Generally plants bloom throughout the year with sparse flower production during rainy season.

At present in India, it is cultivated commercially in and around cities like Poona, Ooty, and in parts of Punjab, Kashmir, Sikkim and West Bengal. In Karnataka it is grown in a few pockets around Bangalore, Dharwad and Belgaum districts.

Considering the importance of this crop there is a prime need for its improvement through selection of suitable genotypes. The yield varies due to environmental condition and genetic potentialities of the cultivars and all cultivars may not be adaptable for cut flower production in all agroclimatic zones of Karnataka. However, the genetic diversity that exists in the crop would greatly facilitate selection of suitable types for transitional tract of Karnataka.

Information on nature and magnitude of variability in the germplasm collection is very essential for any crop improvement programme. This necessitates the partitioning of the observed phenotypic variability into its heritable and non heritable components with suitable genetic parameters such as genetic coefficients of variation, heritability and genetic advance.

Inheritance of quantitative characters is often influenced by variation in other characters which may be due to pleiotropy or genetic linkage. Hence knowledge of association among economic characters and their attributes obtainable through estimation of phenotypic and genotypic correlation helps in determining the extent of improvement that could be brought about in the economic characters and also in selecting suitable genotypes. Correlations between different characters is an aspect which should be kept in mind for better planning of selection programmes.

Correlations of agronomic and morphological characters with yield in different crops have been reported by several workers. Although these estimates are helpful in determining the components of a trait, such as yield, they don't provide an exact picture of the relative importance of direct and indirect influence of each of the component characters towards this trait. Path coefficient analysis developed by Wright (1921) which is simply a standardized

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partial regression analysis appears to be helpful in partitioning the correlation coefficients into direct and indirect effects.

Keeping all these aspects in view the present investigation was carried out with the following objectives.

1. To study the performance of different genotypes of gerbera under transitional tract of Karnataka.
2. To select better performing gerbera genotypes for cut flower production for transitional tract conditions.
3. To estimate genetic variability, heritability and genetic advance for flower yield and its attributes and flower characters.
4. To study phenotypic and genotypic correlations among yield and yield determining characters.
5. To assess the direct and indirect effects of different attributes on flower yield by employing path analysis.

**CHAPTER - II**

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**REVIEW OF LITERATURE**

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## II. REVIEW OF LITERATURE

In any crop information on genetic architecture of various quantitative traits, particularly of those that contribute to yield and quality would be most useful in planning in breeding programme so as to make effective selections. There are many factors which account for variation in yield, as it is very much influenced by environment and genotypic potential of a crop plant. The former is controllable to some extent through cultural practices, while the latter is governed by heridity. Various biometric techniques have been developed to know the genetic architecture of quantitative characters. A brief review of work done on gerbera and other related flower crops is presented under the following headings.

- 2.1 Varietal performance
- 2.2 Variability
- 2.3 Heritability and genetic advance
- 2.4 Correlation
- 2.5 Path coefficient analysis

### 2.1 VARIETAL PERFORMANCE

The selection of cultivar is very important for success in growing of gerbera for commercial cut flower production or for garden decoration. There are many cultivars

with wide range of colours in different parts of the world, and many varieties have been developed and critically evaluated for different climatic conditions based on flower quality and quantity. It is a known fact that a variety performing well in a particular region may not perform well when it is shifted to a different region because of obvious reasons.

### 2.1.1 Vegetative characters

Bhattacharjee (1981) studied the performance of 31 varieties of *Gerbera jamesonii hybrida* under Bangalore condition. The maximum number of side shoots were recorded in variety 'White Perfection' (6.6) and other significant group including 'Agnihotri V.P.' (6.0) and 'Daintiness' (6.0). Rest of the varieties produced two to four shoots per plant. Highest number of leaves per plant was obtained in 'Himadevi' (70.4) and the varieties next in order were 'Debendra's Glory' (53.6). 'Indu Kumari' (52.4) 'White Perfection' (52.0). 'Sun Rise' (48.0) 'Sri Chandra' (45.0) 'Primerose Queen' (41.2). Minimum number of leaves were observed in the variety 'Lady Mary Herbert' (14.0) and 15.2 to 20.4 leaves were observed in 'Cherry Blossom', 'Guinea Gold', 'Salmon Pink', 'Pink Perfection' and 'Gloriosa'. Leaf area index was highest in varieties like 'Kalyani' and 'Salmon Pink' and the smallest leaves were observed in variety 'Cherry Blossom'.

While comparing 24 cultivars Fischer *et al.* (1985) stated that most vigorous cultivars were 'Clivia' and red clone 15/79 and some what less vigorous were the cultivars 'Rufiana' and 'Terra Visa'.

Kannan and Rammdas (1990) studied variability in 48 accessions of gerbera. The maximum and minimum number of leaves per plant was recorded by Acc.14 (74.53) and Acc. 17 (23.95), respectively. The Acc. 22 recorded the highest number of suckers per plant (29.43) followed by Acc. 23 (29.01) where as it was the lowest (5.08) in Acc. 9.

#### 2.1.2 Reproductive and flower characters

In an experiment with five clones planted in mid July, 'Sympathie' was the slowest to flower. Variety 'Salmrosa' gave the highest yield of cut flowers. Productivity was lowest in January planting except in the case of cv. 'Mandarin' which produced flowers uniformly each month after a slow start (Steen, 1975).

The double pink cv. 'Fredaisy' was compared with single red and pink 'Richon' selections. During the 8 months of trial, cv. 'Fredaisy' produced more flowers per plant and flowers were of greater diameter with larger stalks. Homogeneity, stability of colour and general quality were also excellent in this variety (Baillot, 1976).

Bhattacharjee (1981) evaluated 31 varieties of *Gerbera jamesonii hybrida* under Bangalore condition. The earliest flower bud opening from its appearance was observed with 'Lady Mary Herbert' and 'Primerose Queen' which took 10 to 11 days, while the maximum time (20 days) was taken by variety 'Sun Rise'. The longest flower stalk was recorded with the varieties 'Lady Mary Herbert' (40.4 cm) and 'Orange Boven' (40.0 cm) and the majority of varieties produced stalks of 30.0 to 36.6 cm length. Maximum number of flowers per plant was produced by 'Indu Kumari' (13.4) and other significant groups were 'Ada', 'Agnihotri V.P.', 'Debendra's Glory', 'Red Beauty' and 'White Perfection'. Lowest number of flowers were produced by 'Yellow Mist'. Largest flower diameter was observed in variety 'Indu Kumari' and smallest flower was obtained in 'Orange Boven'. Flowers in 'Debendra's Glory' lasted for 22 days. Varieties in which flowers remained fresh for a period of 15 to 18 days were 'Autumn Glow', 'Advance', 'Agnihotri V.P.', 'Cherry Blossom', 'Daintiness', 'Indu Kumari', 'Orange Gleam', 'Salmon Pink', 'Sri Chandra' and 'White Perfection'.

Eberhardt (1982) described some newly released gerbera varieties. 'Enzett Bootes' has semidouble pink flowers and gave 15.1 blooms per plant, 'Enzett Orien' with golden coloured flowers gave 21 blooms per plant. 'Enzett Perseus' was small flowered double pink cv. yielded 18 blooms per plant. 'Enzett Auriga Violetrosa' had long stems and yielded 13 blooms per

plant. 'Enzett Dorado' had bright orange red flowers and yielded 13 flowers per plant.

A comparison of 24 gerbera cultivars planted in winter was made by Fischer *et al.* (1985). The most prolific flower producing cultivars were 'Pink Fleur' and 'White Maria'.

Trial on the performance of 20 cultivars of Gerbera indicated that productivity was highest with 'Appel bloesem' and 'Amber'. Overall, 'Appel bloesem', 'Rozamunde' and 'Romilda' were considered the best (Gelder and Reijnders, 1985).

Vidalie *et al.* (1985) reported that cultivars 'Clementine' and 'Valentine' yielded well both quantitatively and qualitatively.

Forty four cultivars grown under glass house were compared by Loeser (1986a). These cultivars yielded from 20 (cv. Suzan) to 50 (cv. Joyce) cut flowers per plant annually.

Loeser (1986b) reported that among 55 cultivars grown in green house trials, the highest cut stem yield per plant was recorded in cultivars 'Alexis' (36), 'Bilitis' (33), 'Salm rosa' (33), 'Anke' (31) and 'Labalga' (30).

Some cultivars recommended by Reimherr (1986) for greenhouse cultivation in Germany based on cut stem yield and vase life. The different cultivars viz., 'Fredeking', 'Nadja',

'Terraqueen', 'Dusty' and 'Labalga' yielded 28, 23, 22, 22 and 30 cut stems, respectively.

Loeser (1989) studied the performance of 41 gerbera cultivars grown under glass between May, 1986 and June, 1987. Yield (36 stems per plant), quality, vase life were all above average in cv. 'Fredeking'. Cultivars 'Red Urnas', 'Kabandha', 'Frosch king', 'Sq. Lila Rosa' all showed satisfactory quality and vase life. Cultivars 'Terraqueen', 'Labinel', 'Denise' and 'Terramixa' gave good yield.

Kannan and Rammdas (1990) in their study with 48 accessions of gerbera, maximum number of flowers per plant was recorded in accessions 7, 6, 11 and 4. The flower diameter among accessions varied from 4.78 to 9.68 (Acc. 47 and Acc. 36 respectively). The period flower retention in the plant was longest in Acc. 4 (22 days), while it was shortest in Acc. 40 (10.5 days). Length of flower stalk varied from 36.88 cm in Acc. 31 to 58.47 cm in Acc. 43.

### 2.1.3 Vase life

Nalawadi et al. (1980) studied vase life in some varieties of gerbera. They reported that varieties 'Firefly', 'Mins Glory', 'Kasju Glory' and 'Saborna' were having good vase life, varieties 'Dr. H.C. Mukerjee', 'General Choudry', 'Sahitya', 'Sunset', 'Summer Yellow', 'Zakir Hussain', 'Delight' and 'Minerva' were having medium vase life and

varieties 'Bhim Bhadur', 'Swadeshi', 'Niranjan' and 'Vermilon Colour' were having poor vase life.

Eberhardt (1982) studied the vase life of some newly released gerbera varieties. The varieties 'Enzett Bootes', 'Enzett Orion', 'Enzett Persus', 'Enzett Auriga Violetrosa' ✓ and 'Enzett Dorado' were having vase life of 11, 10, 11.3, 15.3 and 19.7 days, respectively.

Reimherr *et al.* (1986) recommended cultivars 'Fredeking', 'Nadja', 'Terraqueen', 'Dusty' and 'Labalga' for green house cultivation which were having vase life of 19, 20.5, 19, 17.5 and 14 days, respectively.

## 2.2 VARIABILITY

The variability existing in the crop material and the genetic diversity present in the collection would be valuable for selection. Genotypic coefficient of variation indicates the relative magnitude of genetic diversity present in the material and helps to compare the genetic variability present for different characters.

A study conducted by Bhattacharyya *et al.* (1976) on the performance of 65 different varieties of Dahlia indicated ✓ that 29 were most promising under Calcutta conditions. The height of the plant ranged from 60 cm (Albino) to 160 cm (Annapurna) and the days required for first flower appearance

varied from 40 to 92 days. Flowers of maximum diameter (29 cm) were noted in 'Masterpiece'. Flowers of variety 'Blackout' lasted for 13 days.

Phenotypic and genotypic coefficients variations were observed to be high for number of laterals per plant, flower weight, number of ray florets per plant and medium for stalk length, plant spread, stem girth, plant height and number of main branches per plant and low for flower size, duration of flowering and days to flower in China aster. The difference between phenotypic and genotypic coefficients of variation was medium for number of laterals per plant and narrow for the remaining characters (Manjunath Rao, 1982).

Ponnuswamy *et al.* (1985) reported that genotypic variances were lower ranging from 12.79 to 26234.65 than phenotypic variances that ranged from 26.01 to 52870.8. This indicates the larger measure of influence by the environment. Among the various characters studied, number of flowers per plant and earliness to flower exhibited high degree of both genotypic and phenotypic variation consistently indicating a wide range of genetic variability.

Kannan and Rammdas (1990) studied variability for different characters in gerbera and reported that number of flowers per plant showed variation from 44 to 80.98. In respect of flower stalk girth the variation was found to be

minimum. The genotypic coefficients of variation ranged from 5.27 to 40.95 while the phenotypic coefficient of variation varied from 7.89 to 42.51 among the different characters.

### 2.3 HERITABILITY AND GENETIC ADVANCE

The effectiveness of selection for any character does not depend on the amount of phenotypic variability alone. It is of great interest to the breeder to determine how much of phenotypic variability which is present in a particular character is heritable. The heritability estimate provides such a measure.

Heritability value alone may not provide clear predictability of the breeding value. Its estimate along with genetic advance are usually more useful than simple heritability values in predicting the resultant effect for selecting the best individuals (Johnson *et al.* 1955). This is due to the fact that a character may have very high heritability but very less phenotypic variation thus giving low values of genetic advance.

Schiva (1972/73) studied the selfed progeny of *G. jamesonii* and found high heritability for diameter of the inflorescence and number of ray florets and relatively low for stem length.

Harding *et al.* (1981) estimated heritability in gerbera for cut flower yield. Broad sense heritability averaged 62 per cent and narrow sense heritability averaged 42 per cent. Estimates of realised heritability averaged only 16 per cent.

Bhattacharjee and Wahi (1962) reported from their study with Dahlia that highest estimates of broad sense heritability was observed for flower per plant with moderate genetic advance. Also high heritability for plant height and moderate heritability for the number of branches per plant were observed.

Manjunath Rao (1982) observed medium to high heritability (broad sense) for different characters in China aster. High heritability as well as high genetic gain was observed for flower weight and number of ray florets whereas medium heritability along with high genetic gain was observed for laterals per plant. High heritability accompanied by medium genetic gain was found for plant height, plant spread, stalk length and stem girth.

Ponnuswamy *et al.* (1985) reported high heritability estimate for number of flowers per plant which was closely followed by plant spread in chrysanthemum. The heritable estimates were invariably higher, amounting to more than 45.6 per cent for all the characters studied. Despite the high

except earliness to flower. Such a high heritability a low genetic advance are attributable to the non additive gene effect. Regarding the character earliness to flower, the genetic advance was consistently more than the heritability. This is due to additive gene effects and hence is considered as less influenced by environment thus offering a better scope for selection.

Heritability repeatability and components of variance for 68 morphological characters describing the inflorescence, scape, and florets of *Gerbera hybrida* was tabulated by Drennan *et al.* (1986). Heritability estimates were generally moderate to high for simple dimension character which were the mean of several measurements, low to moderate for ratio of composite characters and low for enumeration character and those describing intraplant variation.

Kannan and Rammdas (1990) studied heritability and genetic advance in *Gerbera jamesonii* for seven characters viz., number of leaves per plant, number of suckers per plant, flower diameter, period of flower retention in plants, stalk length, stalk girth, and number of flowers per plant. The heritability was high for all characters except flower diameter and stalk girth. It was the highest in respect of leaves per plant (97.37 %). The genetic advance estimated was also in line with heritability in all characters. The genetic advance was the highest for number of leaves per

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plant (29.62%) followed by number of flowers per plant (18.13%) while for remaining characters it ranged from 0.315 per cent (flower diameter) to 12.22 per cent (number of suckers per plant).

#### 2.4 CORRELATION

In white and yellow varieties of chrysanthemum, Shanmugam *et al.* (1972) worked out correlation coefficients between the flower yield and each of the six characters viz., height at first flowering, total increase in height, number of laterals, duration of flowering, number of days to first flowering and size of flowers. All relationships were significant at 5 per cent level except for size of flowers in the white variety and height at flowering in the yellow variety.

Leffring (1973) studied the relationship of flower yield and its components in gerbera. He stated that the flower production was positively related to the number of lateral shoots and number of leaves per plant. The most productive plants were those which formed 2.5 lateral shoots during the first year and had a leaf flower ratio of 2:4. There was positive relationship between the number of lateral shoots and total leaf number, but hardly any relationship between total leaf number and flower production although an increase in lateral shoots resulted in more leaves. The leaf to flower ratio increased with the number of lateral shoots.

Correlation studies carried out by Maheswar (1977) in China aster indicated that yield of cut flowers was significantly influenced by parameters such as plant height, leaf area index, final dry weight of plants, number of branches and flower diameter during monsoon season.

Manjunath Rao (1982) reported that number of flowers per plant exhibited positive and significant relationship with plant height, plant spread, stalk length, number of main branches per plant, number of laterals per plant and days to flower in China aster.

In marigold positive correlation between flower yield and plant spread, branches per plant, flower size, weight of ten flowers at all locations and seasons was reported by Nalawadi (1982). Further he noted that the flower yield was negatively correlated with plant height and flowering duration in most of the situations.

Chaugule (1985) reported that the weight of flowers per plant had a significant positive correlation with height and spread of plants, duration of flowering, number of branches per plant and shelf life of chrysanthemum flowers both at phenotypic and genotypic levels.

Misra *et al.* (1987) reported that in Dahlia, number of flowers per plant had positively significant correlation with plant spread which indicated that with the increase in

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more number of flowers per plant, larger spread may be obtained. Days to first flower had negative correlation with plant spread.

Accati and Jona (1989) reported that gerberas with wide petals showed the longest vase life and the vase life was directly correlated with the length of floral stalk.

Kannan and Rammdas (1990) reported that in gerbera flower yield per plant had significant and positive association with period of flower retention on the plants. Significant positive correlations were also found between number of leaves per plant and number of suckers per plant and flower stalk girth. On the other hand number of leaves per plant had negative significant correlation with flower stalk girth whereas flower diameter had significant positive correlation with flower stalk girth.

Barigidad (1991) reported that in chrysanthemum yield had significant positive correlation with plant height, number of branches, number of leaves, plant spread and number of flowers per plant.

Raghava *et al.* (1992) reported that in chrysanthemum flower yield per plant had positive and significant association with plant height, days to flower, flower size and flower number per plant.

Ashwath and Parthasarathy (1994) studied association analysis in gerbera. They reported that days taken to flower had a positive significant correlation with stalk length and stalk diameter. The diameter of entire flower was highly associated with diameter of transfloret. Negative association between number of flowers and total number of days from bud to wilting was found. Vase life was closely associated with diameter of flower and diameter of transfloret. Length of stalk, involucre length, number of flowers have failed to show any correlation with vase life.

## 2.5 PATH COEFFICIENT ANALYSIS

Path coefficient analysis in China aster revealed that plant height and plant spread were the major factors influencing stalk length directly. Number of flowers per plant, number of ray florets per head and flower size were also important as their total indirect effect on stalk length was high. Flower size was found to be influenced directly by stalk length, number of ray florets per head and plant spread. Plant height had the maximum total indirect effect on flower size. Number of laterals per plant had the maximum direct effect on number of main branches per plant. Stalk length and plant height exhibited high total indirect effect on number of flowers per plant (Manjunath Rao, 1982).

In chrysanthemum Chaugule (1985) reported that the number of flowers per plant followed by plant height had the highest direct positive effects on weight of flower at genotypic level. Flowering duration, lasting quality of flower and plant spread though had positive direct effect on weight of flowers per plant their corresponding indirect effects via number of flowers per plant were comparatively higher. The effects of all other characters were direct but in negative direction. On the contrary, maximum indirect effect was observed in case of the number of branches per plant followed by plant spread and plant height via number of flowers per plant. The weight of flowers was indirectly influenced by the number of flowers per plant and diameter of flowers at phenotypic level. Number of main branches per plant had maximum indirect effect followed by plant spread, plant height and days to flowering viz number of flowers per plant.

Barigidad (1991) reported that number of flower per plant had the highest positive direct effect on yield per plant, followed by duration of flowering, plant spread, and diameter of flower. The negative direct effect on yield was exerted by number of petals, leaf area, number of leaves and plant height. The maximum indirect positive effect was exerted by number of branches per plant, number of leaves and plant height on yield per plant through number of flowers per plant. The maximum total indirect effect was contributed by

leaf area, followed by number of leaves per plant, plant height and number of petals per plant. Indirect effect was mainly contributed through duration of flowering and number of flowers per plant.

Raghava *et al.* (1992) reported that in chrysanthemum path analysis revealed that days to flower influence flower yield indirectly through number of florets per spike. Plant height and flower size exerted indirect effect on flower yield through the number of flowers per plant and plant height respectively.

Ashwath and Parthasarathy (1994) reported that in gerbera, flower life in the field had a very direct effect on the number of flowers eventhough it was negative followed by diameter of the transfloret which was also negative. They further reported that the absence of association of diameter of transfloret with yield was mainly due to its high negative effect as well as negative effect via flower life in the field. Diameter of the entire flower had a high negative direct and indirect effect on vase life.

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**CHAPTER - III**

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**MATERIAL AND METHODS**

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### III. MATERIAL AND METHODS

The present investigations were carried out in the 'Floriculture Unit' of Division of Horticulture, University of Agricultural Sciences, Dharwad during 1994-95 to study the performance of 20 Gerbera genotypes under transitional tract of Northern Karnataka.

#### 3.1 GEOGRAPHICAL LOCATION OF EXPERIMENTAL SITE

Dharwad is situated in transitional tract, of Karnataka at 15°26' North latitude and 75°7' East longitude, at an altitude of 678 m above mean sea level.

#### 3.2 CLIMATE

The average annual rainfall of the area for the past 45 years is 806.80 mm which is fairly well distributed from April to November. Rainfall has two peaks, one in July and another in October. The mean maximum temperature varied from 18.81°C (December) to 36.31°C (April), whereas the mean minimum temperature ranged from 13.57°C (December) to 21.01°C (May). The mean monthly maximum and minimum relative humidity ranged from 86.22 per cent (July) and 54.23 per cent (February) respectively.

The average rainfall for the experimental period was 667.5 mm which was 139.3 mm less than the average of past 45 years. The meteorological data for the period of

investigation and the average of past 45 years are presented in Appendix-I.

### 3.3 SOIL CHARACTERISTICS

The experimental site had red soil of the sandy clay type. The physical and chemical characteristics of the soil are furnished in the Appendix-II.

### 3.4 SELECTION OF THE EXPERIMENTAL MATERIAL

The materials for the present study comprised of 20 double gerbera (*Gerbera jamesonii hybrida*) genotypes which were procured from 'Flowerwood Nursery', Kalimpong. The flower colours of these genotypes are given in Appendix-III.

### 3.5 DETAILS OF THE EXPERIMENT

#### 3.5.1 Treatments

The treatments included 20 genotypes of gerbera, they are as under (Plate-2 to 10).

- |                             |                    |
|-----------------------------|--------------------|
| 1. Asha                     | 11. Pink Supreme   |
| 2. Cream Beauty             | 12. Pride of Pong  |
| 3. Cream Son                | 13. Red Board      |
| 4. Day Light                | 14. Rowel Pride    |
| 5. Double Galve Indu Magnet | 15. Salmon Pink    |
| 6. HH of Sikkim             | 16. Sath Baba      |
| 7. Missri White             | 17. Snow Gleen     |
| 8. Orange Gleem             | 18. Subarna Yellow |
| 9. Pink Favourite           | 19. Sun Gleen      |
| 10. Pink Perfection         | 20. Sweet Dream    |
-

### 3.5.2 Design and experimental layout

The experiment was laid out in a randomized block design with,

Replications : 3

Treatments : 20

### 3.5.3 Preparation of experimental site

The land was brought to a good tilth by ploughing and harrowing. A spacing of 0.5 m between two replications was provided for laying out irrigation channels and working space.

### 3.5.4 Planting

Plantlets which were procured from Kalimpong were raised in nursery for two months. The plants with four to five leaves and without any side shoots were selected and planted in the experimental site, at a spacing of 60 x 40 cms in each row along the sides of the raised beds. In each treatment (genotype) eight plants were planted. Light irrigation was given immediately after planting.

### 3.5.5 Application of manures and fertilizers

Well decomposed FYM @ 7.5 kg per square metres was applied at the time of land preparation. Nitrogen, phosphorus and potassium were applied in the form of urea, Single super phosphate and muriate of potash respectively. Recommended dosage of 15:10:10 g/sq.m of NPK was applied at the time of planting.

### 3.5.6 Provision of shade

Shade was provided from November to May in order to prevent the plants from sun scorch by using coconut fronds (Plate-1).

### 3.5.7 Cultural operations

The plot was kept free from weeds by periodic hand weeding. Protective irrigations were given at an interval of four to five days regularly, during crop growth period, as and when required.

### 3.5.8 Plant protection measures

The whole plot was drenched with 0.2 per cent carbendazim one week after planting. Carbendazim (0.1%) with Dimethoate 0.1 per cent was sprayed to the crop 80 days after planting (DAP).

### 3.5.9 Harvesting

The flowers were harvested regularly when two to three outermost rows of ray florets were opened and used for recording different parameters. To study field life of flowers, some flowers were left in the field.

## 3.6 BIOMETRICAL OBSERVATIONS

Observations were recorded on six plants in each treatment. The mean value of the data observed from six plants

Plate 1. General view of the experimental plot showing shade provision



Plate 1.

Plate 2 - 3. Flower heads of different genotypes under study



Plate 2.



Plate 3.

Plate 4-5. Gerbera flowers of different genotypes under study showing flower head and stalk

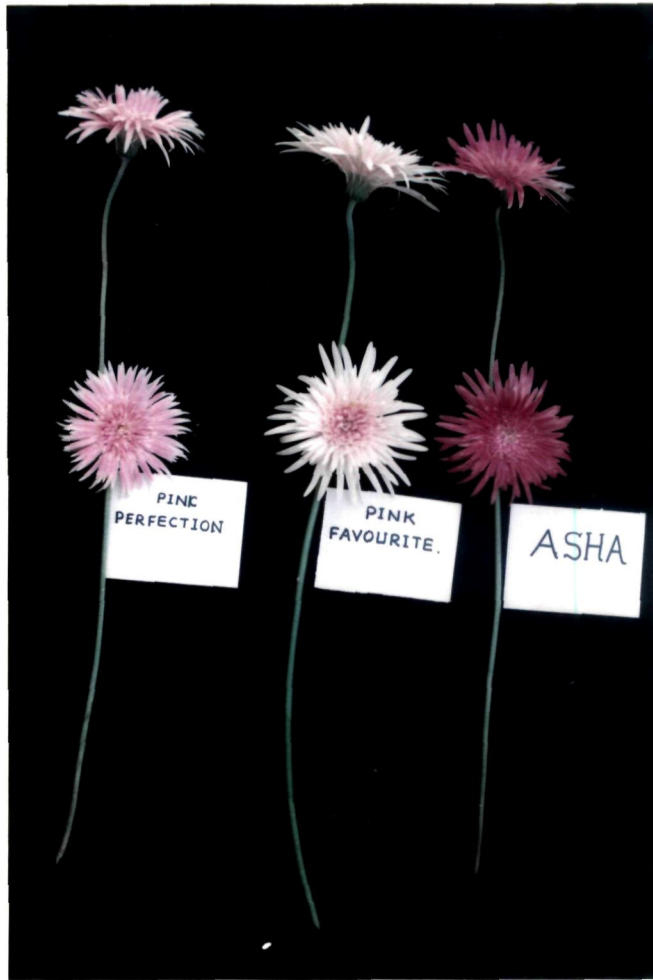


Plate 4.

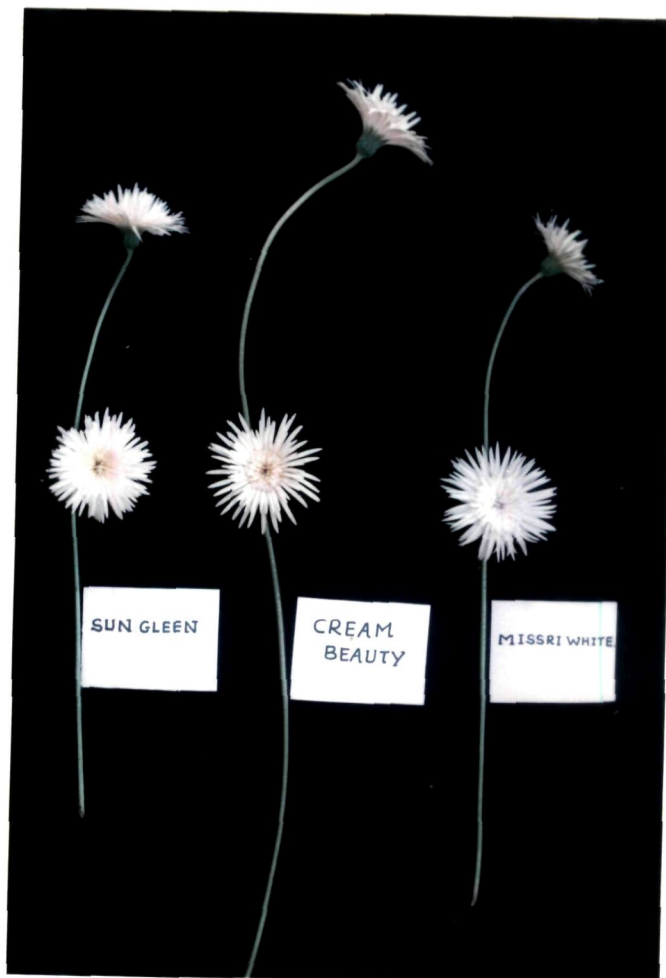


Plate 5.

Plate 6-7. Gerbera flowers of different genotypes under study showing  
flower head and stalk



Plate 6.



Plate 7.

Plate 8-10. Gerbera flowers of different genotypes under study showing flower head and stalk

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Plate 8.



Plate 9.



Plate 10.

in each treatment was taken to represent a particular genotype with respect to a character. The observations on growth parameters like number of leaves, leaf area and spread of plant were recorded at seven stages of plant growth viz., 40, 80, 120, 160, 200, 240 and 280 DAP and the number of suckers were recorded at two stages viz., 160 and 280 DAP.

### **3.7 OBSERVATIONS ON GROWTH PARAMETERS**

#### **3.7.1 Number of leaves**

The number of fully opened leaves were counted and average was worked out.

#### **3.7.2 Leaf area**

Leaf area was calculated with the help of planimeter and expressed in square centimetres.

#### **3.7.3 Spread of the plant**

The maximum horizontal spread of the plant was recorded with the help of a scale and expressed in centimetres.

#### **3.7.4 Number of side shoots (suckers) per plant**

Number of side shoots or suckers were counted at two intervals of plant growth viz., 160 and 280 DAP and average was worked out.

### 3.8 OBSERVATIONS ON REPRODUCTIVE ATTRIBUTES

#### 3.8.1 Days to first flower opening

Number of days taken from transplanting of plants to flower opening was recorded. Flowers were considered open when two to three outermost rows of ray florets have opened.

#### 3.8.2 Number of days from appearance of bud to bloom

Number of days from appearance of bud to flower opening was recorded.

### 3.9 OBSERVATIONS ON FLOWER YIELD (NUMBER OF FLOWERS PER PLANT)

The count of number of flowers opened in every month between December to July was recorded. The flowers with two to three outermost open ray florets were considered as open for recording the observation.

### 3.10 OBSERVATIONS ON FLOWER CHARACTERS

Two flowers from each of the six plants were selected randomly and used for recording observations and its mean value was used for analysis. Observations on flower characters were recorded once during the experimental period when all the plants were in bloom i.e., at the end of March.

#### 3.10.1 Stalk length

Stalk length was recorded from base of the stalk to capitulum with a scale and expressed in centimetres.

### 3.10.2 Stalk diameter below capitulum

The diameter of the stalk below capitulum was recorded with the help of a vernier callipers and expressed in millimetres.

### 3.10.3 Stalk diameter at the centre of the stalk

The diameter of the stalk at the centre of the stalk was recorded with the help of a vernier callipers and expressed in millimetres.

### 3.10.4 Flower diameter

Maximum diameter of the the flower was recorded and expressed in centimetres.

### 3.10.5 Number of whorls

Number of whorls were counted in each flower and average was worked out.

### 3.10.6 Length of the ray floret

Five ray florets were selected randomly from the outermost whorls of each flower and its length was noted and expressed in centimetres.

### 3.10.7 Width of the ray floret

The ray floret selected as mentioned above and width at the centre of the ray floret was recorded and expressed in millimetres.

### 3.10.8 Length of involucre

Maximum length of involucre was measured and expressed in centimetres.

### 3.10.9 Field life of flower

After flower opening, the number of days taken by the flower to wilt in the field was noted as field life of flower which is nothing but the period of flower retention in plant. On each plant two randomly selected flowers were used to record field life of flowers.

### 3.10.10 Vase life of flower

The open gerbera flower with 30 cm stalk was placed in conical flask containing 250 ml tap water and mouth of the flask was plugged with cotton. The days taken by the flower to wilt in the conical flask was noted as vase life of the flower. In each treatment five such flasks were taken and the average was worked out.

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### 3.11 STATISTICAL ANALYSIS

Statistical analysis of observations were carried out at UAS, Dharwad computer centre.

#### 3.11.1 Analysis of variance

Analysis of variance for all characters was carried out adopting the method suggested by Sundaraj *et al.* (1972). Statistical significance was tested with the help of 'F' table value (Fisher and Yates, 1963).

#### 3.11.2 Coefficient of variation (CV)

Coefficient of variation was calculated as follows :

$$CV = \frac{\sqrt{\text{Error MSS}}}{\text{Mean}} \times 100$$

#### 3.11.3 Phenotypic and genotypic variance

Phenotypic and genotypic variance were calculated as per Singh and Chaudhary (1979).

$$\text{Genotypic variance } (\sigma^2_g) = \frac{\text{Treatment MSS} - \text{Error MSS}}{\text{Number of replications}}$$

$$\text{Phenotypic variance } (\sigma^2_p) = \sigma^2_g + \sigma^2_e$$

Where  $\sigma^2_e = \text{Error MSS}$ .

### 3.11.4 Coefficients of variation

The phenotypic and genotypic coefficients of variation for all characters were calculated by the method suggested by Singh and Chaudhary (1979).

Phenotypic coefficient of variation (PCV)

$$PCV = \frac{\sqrt{\sigma^2_p}}{\bar{X}} \times 100$$

Where,

$$\begin{aligned} \sigma^2_p &= \text{Phenotypic variance} \\ \bar{X} &= \text{General mean of the character} \end{aligned}$$

Genotypic coefficient of variation (GCV)

$$GCV = \frac{\sqrt{\sigma^2_g}}{\bar{X}} \times 100$$

Where,  $\sigma^2_g$  = Genotypic variance

$\bar{X}$  = General mean of the character.

### 3.11.5 Heritability ( $h^2$ )

Heritability in broad sense was estimated as a ratio of genotypic variance (Falconer, 1981).

$$h^2 = \frac{V_g}{V_p} \times 100$$

Where,  $V_g$  and  $V_p$  are genotypic and phenotypic variances respectively.

### 3.11.6 Genetic advance

This was calculated by using the formula given by Johnson et al. (1955).

$$GA = \frac{Vg}{Vp} \times Ky \cdot \sigma p$$

Where,

$Vg$  = Genotypic variance

$Vp$  = Phenotypic variance

$\sigma p$  = Phenotypic standard deviation

$K$  = Selection differential at a particular selection intensity. The 'K' value is 2.06 at 5 per cent intensity of selection as per Falconer (1981).

As shown by Johnson et al. (1955), the genetic advance can also be expressed as percentage of the population mean to show the relationship of the genetic coefficient of variation and heritability.

$$GAM = \frac{GA}{\text{General mean}} \times 100$$

### 3.11.7 Phenotypic and genotypic correlation coefficient

Simple correlation coefficients pertaining to the phenotype and genotype for characters were computed as per

Singh and Chaudhary (1979). For growth parameters, observations at 160 DAP were considered for correlation studies.

$$\text{Genotypic correlation} = r_{xy}(g) = \frac{\text{CoV}_{xy}(g)}{\sqrt{V_x(g) \times V_y(g)}}$$

$$\text{Phenotypic correlation} = r_{xy}(p) = \frac{\text{CoV}_{xy}(p)}{\sqrt{V_x(p) \times V_y(p)}}$$

Where,

$\text{CoV}_{xy}(g)$  = Genotypic covariance between x and y

$\text{CoV}_{xy}(p)$  = Phenotypic covariance between x and y

$V_x(g)$  = Genotypic variance of character x

$V_x(p)$  = Phenotypic variance of character x

$V_y(p)$  = Phenotypic variance of character y.

### 3.11.8 Path coefficient analysis

The estimates of direct and indirect effects were calculated by the path coefficients analysis method as suggested by Wright (1921) and illustrated by Dewey and Lu (1959). The direct path coefficients were calculated by solving the following sets of 'P' simultaneous equations by the observed 'Doo-Little Technique' as described by Goulden (1959).

$$P_{01} + P_{02}r_{12} + \dots \dots \dots P_{0p}r_{1p} = r_{01}$$

$$P_{02}r_{12} + P_{02} + \dots \dots \dots P_{0p}r_{2p} = r_{02}$$

$$P_{01}r_{1p} + P_{02}r_{2p} + \dots \dots \dots P_{0p}r_{2p} = r_{0p}$$

Where,

$P_{01}, P_{02}, \dots P_{0p}$  are direct path effecting of 1, 2, ..., P variables on '0' variables.

$r_{12}, r_{13}, \dots, r_{1p}, \dots, r_p (P-1)$  are the possible correlation coefficient between various independent variables and  $r_{01}, r_{02}, \dots, r_{0p}$  are the correlations of independent variables with the dependent variable.

The indirect effect of  $i^{\text{th}}$  variable via  $j^{\text{th}}$  variable was worked out as  $(P_{0j} \times r_{ij})$ . From the simultaneous equation it is clear that the correlation coefficient is the sum of direct and indirect path coefficients. Residual effect was calculated as under :

$$P_{0x}^2 = 1 - \{P_{01}^2 + 2P_{01}P_{02}r_{12} + 2P_{01}P_{03}r_{13} \dots \dots \dots$$

$$2P_{02}P_{03}r_{23} + \dots \dots \dots + P_{0p}^2\}$$

$$\text{Residual Factor} = \sqrt{P_{0x}^2}$$

**CHAPTER - IV**

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**EXPERIMENTAL RESULTS**

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## **IV. EXPERIMENTAL RESULTS**

The findings of the present investigation are reported under the following headings:

- 4.1 Performance of genotypes
- 4.2 Genetic variability, heritability and genetic advance
- 4.3 Phenotypic and genotypic correlations
- 4.4 Path coefficient analysis

### **4.1 PERFORMANCE OF GENOTYPES**

#### **4.1.1 GROWTH PARAMETERS**

##### **4.1.1.1 Number of leaves**

The data on number of leaves at different stages of plant growth is presented in Table-1. At all the stages, the genotypes differed significantly with regard to number of leaves. The average leaf production at seven stages of its growth viz., 40, 80, 120, 160, 200, 240 and 280 DAP was 6.42, 11.66, 18.14, 25.25, 33.09, 41.23 and 47.58 leaves per plant respectively. 'Pride of Pong' produced 8.94, 15.89, 25.00, 36.00, 47.78, 58.11 and 65.28 leaves at different stages of growth and was superior to other genotypes at all the stages of growth except at 120 DAP during which 'Subarna Yellow' (25.11 leaves) was superior to other genotypes. Leaf production was above average at all the stages of growth in genotypes 'Cream Beauty', 'Pink Favourite', 'Pink Perfection', 'Rowel Pride' and 'Subarna Yellow' whereas 'Cream Son', 'Pink

Table 1 : Number of leaves at different intervals of plant growth in gerbera genotypes

Genotypes	Days after planting						
	40	80	120	160	200	240	280
1 Asha	7.00	13.28	20.28	27.11	33.83	40.22	46.61
2 Cream Beauty	7.10	13.00	20.22	27.83	35.94	43.83	48.99
3 Cream Son	4.55	9.28	14.17	20.33	25.67	31.39	37.44
4 Day Light	6.49	11.78	17.50	24.45	31.55	38.67	44.72
5 Double Galve Indu Magnet	7.72	12.56	19.52	28.00	38.33	52.61	57.06
6 HH of Sikkim	5.72	9.67	14.72	19.44	28.05	30.00	38.00
7 Missri White	6.33	12.50	18.72	26.39	32.78	40.00	45.83
8 Orange Gleem	4.11	8.06	13.28	18.33	23.33	28.39	35.11
9 Pink Favourite	6.67	12.83	20.00	28.00	36.33	44.06	49.45
10 Pink Perfection	7.50	14.44	21.78	30.17	38.28	47.50	52.61
11 Pink Supreme	6.17	11.22	16.94	23.39	29.28	36.83	42.17
12 Pride of Pong	8.94	15.89	25.00	36.00	47.78	58.11	65.28
13 Red Board	3.83	8.11	13.22	19.39	25.61	32.83	35.95
14 Rowel Pride	7.94	13.72	20.33	26.83	36.11	47.05	55.17
15 Salmon Pink	7.06	12.28	17.28	23.44	30.78	39.28	47.78
16 Sath Baba	5.06	9.11	15.72	20.44	27.00	34.28	40.89
17 Snow Gleem	5.67	7.89	12.83	17.78	22.50	28.79	36.61
18 Subarna Yellow	8.33	15.50	25.11	33.50	45.33	54.50	60.61
19 Sun Gleem	4.83	10.67	16.83	24.61	34.50	44.11	52.22
20 Sweet Dream	6.39	11.44	19.39	29.61	41.78	52.22	59.00
Mean	6.42	11.66	18.14	25.25	33.09	41.23	47.58
S. Err	0.50	0.57	0.86	0.88	1.05	1.04	1.00
C.D. at 5%	1.43	1.63	2.47	2.51	3.00	2.98	2.86

Supreme', 'Salmon Pink' and 'Snow Gleen' produced leaves less than the average at all stages.

#### 4.1.1.2 Leaf area

The data pertaining to leaf area at different intervals is presented in Table-2. From the Table it is clear that at all the stages the genotypes differed significantly with regard to leaf area. Genotype 'Pride of Pong' showed significantly higher leaf area at all the stages of development. However, genotype 'Sun Gleen' was on par with 'Pride of Pong' at all the stages except at 80 DAP. The average leaf area at seven stages of its growth was 14.29, 43.41, 77.64, 79.72, 81.44, 82.84 and 84.25 cm<sup>2</sup>. Genotypes 'Double Galve Indu Magnet', 'Pink Perfection', 'Sath Baba' and 'Sweet Dream' showed higher leaf area than the average leaf area at all the stages whereas leaf area was less than the average at all the stages in 'Cream Beauty', 'Cream Son', 'Missri White' and 'Red Board'.

#### 4.1.1.3 Spread of plant

The genotypes differed significantly with respect to spread of the plant at all the stages of growth (Table-3). The mean spread at 40, 80, 120, 160, 200, 240 and 280 DAP was 11.28, 22.07, 29.30, 35.43, 41.28, 45.79 and 49.81 cm respectively. 'Pride of Pong' was significantly superior to

Table 2 : Leaf area (cm<sup>2</sup>) at different intervals of plant growth in gerbera genotypes

Genotypes	Days after planting						
	40	80	120	160	200	240	280
1 Asha	10.48	43.40	77.55	78.28	80.28	81.42	81.54
2 Cream Beauty	11.72	43.22	61.84	66.02	66.38	66.41	66.31
3 Cream Son	10.19	42.15	45.05	47.73	48.16	48.71	48.99
4 Day Light	12.75	45.06	82.70	86.69	87.79	88.00	90.34
5 Double Galve Indu Magnet	15.71	47.31	97.53	98.56	99.63	101.77	101.72
6 HH of Sikkim	15.82	42.41	86.74	87.10	87.98	89.87	89.64
7 Missri White	10.72	41.98	66.73	68.59	69.79	70.58	71.45
8 Orange Gleem	14.68	41.59	83.21	83.70	83.91	85.95	90.77
9 Pink Favourite	12.92	42.08	83.90	85.84	87.08	88.78	90.78
10 Pink Perfection	15.78	45.41	82.96	85.18	86.42	86.76	86.79
11 Pink Supreme	13.53	41.56	84.14	86.04	88.34	88.85	90.50
12 Pride of Pong	18.57	53.80	99.99	101.38	106.05	112.15	112.75
13 Red Board	13.77	36.38	51.75	52.57	56.17	57.35	57.82
14 Rowel Pride	14.23	42.06	83.37	86.15	87.96	88.51	91.13
15 Salmon Pink	14.77	36.35	86.59	88.08	89.35	91.04	91.23
16 Sath Baba	14.78	46.91	88.76	90.65	92.17	93.54	95.82
17 Snow Gleen	16.91	43.96	58.52	60.82	62.34	64.83	69.19
18 Subarna Yellow	13.60	45.43	43.49	47.35	50.48	51.30	57.27
19 Sun Gleen	16.72	39.11	96.96	101.37	104.92	106.53	106.94
20 Sweet Dream	18.29	47.81	90.98	92.21	93.62	94.48	95.03
Mean	14.29	43.41	77.64	79.72	81.44	82.84	84.25
S. E <sub>m</sub> ±	0.93	1.43	1.53	1.89	2.51	3.11	2.48
C.D. at 5%	2.67	4.09	4.39	5.41	7.17	8.91	7.02

Table 3 : Spread of the plant (cm) at different intervals of plant growth in gerbera genotypes

Genotypes	Days after planting						
	40	80	120	160	200	240	280
1 Asha	15.00	20.48	26.47	30.35	34.68	38.31	43.61
2 Cream Beauty	13.17	21.50	28.96	35.87	44.65	55.27	59.06
3 Cream Son	7.92	15.03	19.06	23.04	27.98	32.05	37.42
4 Day Light	9.94	19.94	26.77	32.21	36.60	40.73	45.56
5 Double Galve	15.25	30.11	38.31	46.84	53.01	57.26	59.51
Indu Magnet							
6 HH of Sikkim	9.50	17.29	23.99	28.69	31.95	35.97	40.45
7 Missri White	11.79	20.60	27.52	33.68	37.78	43.05	47.18
8 Orange Gleem	8.46	15.29	20.42	24.73	28.51	33.17	37.35
9 Pink Favourite	15.89	30.63	39.95	47.25	56.62	58.87	62.31
10 Pink Perfection	14.40	30.17	40.32	48.65	55.35	58.79	61.84
11 Pink Supreme	9.08	16.17	21.80	27.99	33.46	38.35	44.14
12 Pride of Pong	15.90	31.60	41.72	49.76	55.99	59.55	62.60
13 Red Board	7.48	15.43	21.09	25.16	30.43	33.24	36.50
14 Rowel Pride	11.62	23.56	33.18	39.97	46.45	51.16	55.16
15 Salmon Pink	11.27	23.51	31.37	39.42	46.04	51.95	55.88
16 Sath Baba	9.54	17.05	23.32	29.67	35.05	39.89	44.78
17 Snow Gleen	7.76	13.84	17.52	20.22	23.56	25.81	31.05
18 Subarna Yellow	9.94	23.21	30.24	36.93	43.77	48.19	53.38
19 Sun Gleen	10.89	26.45	35.57	44.37	48.54	53.21	56.47
20 Sweet Dream	11.36	29.44	38.45	44.76	53.15	58.92	61.99
Mean	11.28	22.07	29.30	35.43	41.28	45.79	49.81
S. Err	0.51	0.87	0.91	1.22	1.34	0.94	0.90
C.D. at 5%	1.46	2.51	2.62	3.50	3.83	2.70	2.58

other genotypes at all the stages which had the spread of 15.90, 31.60, 41.72, 49.76, 55.99, 59.55 and 62.60 cm respectively. At 40 DAP genotype 'Red Board' and at other stages 'Snow Gleen' recorded the lowest spread. Genotypes 'Double Galve Indu Magnet', 'Pink Favourite', 'Pink Perfection' and 'Sweet Dream' recorded the spread above the average at all the stages of growth and in 'Cream Son', 'Red Board' and 'Sath Baba' the spread was below average at all the stages of growth.

#### 4.1.1.4 Number of suckers per plant

The data on the number of suckers at two intervals of plant growth viz., 160 DAP and 280 DAP is presented in Table-4. which shows that the genotypes differed significantly with respect to the production of side shoots at 160 DAP and 280 DAP. At 160 DAP, the number of suckers ranged from 2.80 in 'Snow Gleen' to 5.33 in 'Pride of Pong'. The mean number of suckers produced per plant was 3.73. 'Subarna Yellow' which produced 4.97 suckers per plant was statistically on par with 'Pride of Pong'. At 280 DAP, suckers per plant ranged from 5.57 in 'Red Board' to 10.50 in 'Pride of Pong' with a mean of 7.82 suckers per plant. Genotypes 'Subarna Yellow' (9.93 suckers) and 'Sweet Dream' (9.90 suckers) were on par with 'Pride of Pong'.

#### 4.1.2 Reproductive attributes

The data pertaining to the reproductive attributes is presented in Table-5.

Table 4 : Number of suckers at two intervals of plant growth in gerbera genotypes

Genotypes	Days after planting	
	160	280
1 Asha	3.83	7.50
2 Cream Beauty	3.87	8.20
3 Cream Son	3.37	6.17
4 Day Light	3.53	7.37
5 Double Galve Indu Magnet	3.93	9.27
6 HH of Sikkim	3.03	6.20
7 Missri White	3.60	7.67
8 Orange Gleem	3.17	5.93
9 Pink Favourite	4.13	8.80
10 Pink Perfection	4.40	9.07
11 Pink Supreme	3.43	6.97
12 Pride of Pong	5.33	10.50
13 Red Board	3.07	5.57
14 Rowel Pride	3.87	9.03
15 Salmon Pink	3.40	7.87
16 Sath Baba	2.97	6.50
17 Snow Gleen	2.80	6.10
18 Subarna Yellow	4.97	9.93
19 Sun Gleen	3.50	7.83
20 Sweet Dream	4.37	9.90
Mean	3.73	7.82
S. Em±	0.17	0.23
C.D. at 5%	0.50	0.65

#### 4.1.2.1 Days to first flower opening

In general a significant difference among the genotypes was noticed for the days taken to first flower opening from the date of transplanting. The mean days taken was 88.42 days. The earliest genotype to flower was 'Pride of Pong' which took 71.05 days. This was followed by 'Pink Perfection' (72.50 days), 'Pink Favourite' (73.33 days), 'Day Light' (75.44 days), 'Sath Baba' (81.38 days), 'Pink Supreme' (82.33 days), 'Double Galve Indu Magnet' (83.22 days), 'Sweet Dream' (83.39 days), 'Subarna Yellow' (83.89 days). Genotype 'Red Board' took the highest number of days for the first flower opening (113.78 days).

#### 4.1.2.2 Number of days from bud to bloom

It is clear from the Table that there was a significant difference among the genotypes for this character. 'Pride of Pong' took the least number of days to flower opening from appearance of bud (11.53 days) followed by 'Double Galve Indu Magnet', 'Rowel Pride', 'Pink Favourite', 'Day Light', 'Asha', 'Pink Perfection', 'Sweet Dream' and 'Red Board' (11.63, 12.03, 12.30, 12.40, 12.47, 12.67, 12.70 and 12.83 days respectively). The highest number of days was taken by 'Snow Gleen' (13.97 days). The average number of days to flower opening from bud appearance was 12.96 days.

Table 5 : Reproductive attributes of different genotypes in gerbera

Genotypes	Days to first flower opening	Number of days from bud to bloom
1 Asha	88.83	12.47
2 Cream Beauty	92.39	13.17
3 Cream Son	103.67	13.50
4 Day Light	75.44	12.40
5 Double Galve Indu Magnet	83.22	11.63
6 HH of Sikkim	103.56	13.57
7 Missri White	85.99	13.63
8 Orange Gleem	103.00	13.07
9 Pink Favourite	73.33	12.30
10 Pink Perfection	72.50	12.67
11 Pink Supreme	82.33	13.53
12 Pride of Pong	71.05	11.53
13 Red Board	113.78	12.83
14 Rowel Pride	96.39	12.03
15 Salmon Pink	88.17	13.60
16 Sath Baba	81.38	13.67
17 Snow Gleen	96.67	13.97
18 Subarna Yellow	83.89	13.00
19 Sun Gleen	89.94	13.87
20 Sweet Dream	83.39	12.70
Mean	88.42	12.96
S.Em $\pm$	1.52	0.22
C.D. at 5%	4.36	0.63

#### 4.1.3 Flower yield (total number of flowers) per plant

The data on monthwise flower production and total flower yield per plant in different genotypes is presented in Table-6 and Fig. 1 and 2. This shows that in December flowering was observed in only five genotypes viz., 'Day Light', 'Pink Favourite', 'Pink Perfection', 'Pride of Pong' and 'Sweet Dream' of which 'Pride of Pong' recorded the highest number of flowers per plant (0.89). In January all genotypes flowered except 'Red Board'. In January, among all the genotypes 'Day Light' produced 2.94 flowers per plant and was superior to other genotypes. 'Pink Perfection', 'Pride of Pong' and 'Sweet Dream' were on par with 'Day Light'. In February and March 'Sweet Dream' produced highest number of flowers per plant (3.78 and 4.11 respectively). In February 'Cream Beauty' and 'Pride of Pong' and in March 'Asha', 'Cream Beauty' and 'Pride of Pong' were stastically on par with 'Sweet Dream'. In February 'Red Board' and in March 'Snow Gleen' produced the least number of flowers per plant (1.17 and 1.28 flowers per plant respectively). In April 'Pride of Pong' produced the highest number of flowers (3.17) followed by 'Cream Beauty', 'Sweet Dream', 'Subarna Yellow', 'Double Galve Indu Magnet', 'Orange Gleem' and 'Pink Supreme'. The least number of flowers were noted in 'Snow Gleen' (1.06). In May 'Double Galve Indu Magnet' produced 2.17 flowers per plant and was superior to other genotypes. This was followed by 'Pride of Pong', 'Sweet

Table 6 : Flower yield (number of flowers) per plant in gerbera genotypes in different months

Genotypes	Months												Total	
	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July						
1 Asha	0.00	1.83	3.06	3.78	2.28	0.89	1.50	0.72	0.72	15.05				
2 Cream Beauty	0.00	2.00	3.33	3.94	3.11	0.83	2.67	0.72	0.72	16.61				
3 Cream Son	0.00	0.55	1.55	2.22	2.00	0.72	0.95	0.28	0.28	8.27				
4 Day Light	0.33	2.94	3.22	3.05	2.33	0.61	0.58	0.28	0.28	13.33				
5 Double Galve Indu Magnet	0.00	2.28	3.05	3.39	2.94	2.17	2.06	1.05	1.05	16.94				
6 HH of Sikkim	0.00	0.56	1.72	2.44	2.05	0.56	0.39	0.17	0.17	7.89				
7 Missri White	0.00	1.28	2.28	2.89	2.58	0.72	1.00	0.39	0.39	11.11				
8 Orange Gleem	0.00	0.39	2.50	2.94	2.67	0.72	1.00	0.22	0.22	10.45				
9 Pink Favourite	0.44	2.22	2.61	3.22	2.50	0.94	1.56	0.39	0.39	13.88				
10 Pink Perfection	0.72	2.89	3.17	3.61	2.49	1.06	0.72	0.56	0.56	15.22				
11 Pink Supreme	0.00	1.94	3.00	3.39	2.67	0.78	0.94	0.61	0.61	13.33				
12 Pride of Pong	0.89	2.78	3.39	3.78	3.17	1.22	1.72	0.61	0.61	17.56				
13 Red Board	0.00	0.00	1.17	1.89	2.06	0.61	0.67	0.28	0.28	6.67				
14 Rowel Pride	0.00	1.58	2.89	3.11	2.39	0.78	1.00	0.56	0.56	12.30				
15 Salmon Pink	0.00	1.44	2.72	3.00	2.22	0.61	0.89	0.44	0.44	11.33				
16 Sath Baba	0.00	1.11	1.61	1.89	1.50	0.61	0.55	0.22	0.22	7.50				
17 Snow Gleen	0.00	1.06	1.22	1.28	1.06	0.61	0.33	0.17	0.17	5.73				
18 Subarna Yellow	0.00	1.78	2.94	3.56	2.83	0.78	1.56	0.67	0.67	14.11				
19 Sun Gleen	0.00	1.28	1.78	2.61	2.00	0.67	0.78	0.22	0.22	9.34				
20 Sweet Dream	0.11	2.89	3.78	4.11	3.00	1.11	1.83	0.56	0.56	17.39				
Mean	0.13	1.64	2.55	3.01	2.39	0.85	1.33	0.46	0.46	12.15				
S.Em±	0.04	0.15	0.17	0.15	0.21	0.14	0.12	0.09	0.09	0.68				
C.D. at 5%	0.13	0.42	0.47	0.44	0.61	0.39	0.34	0.27	0.27	1.96				

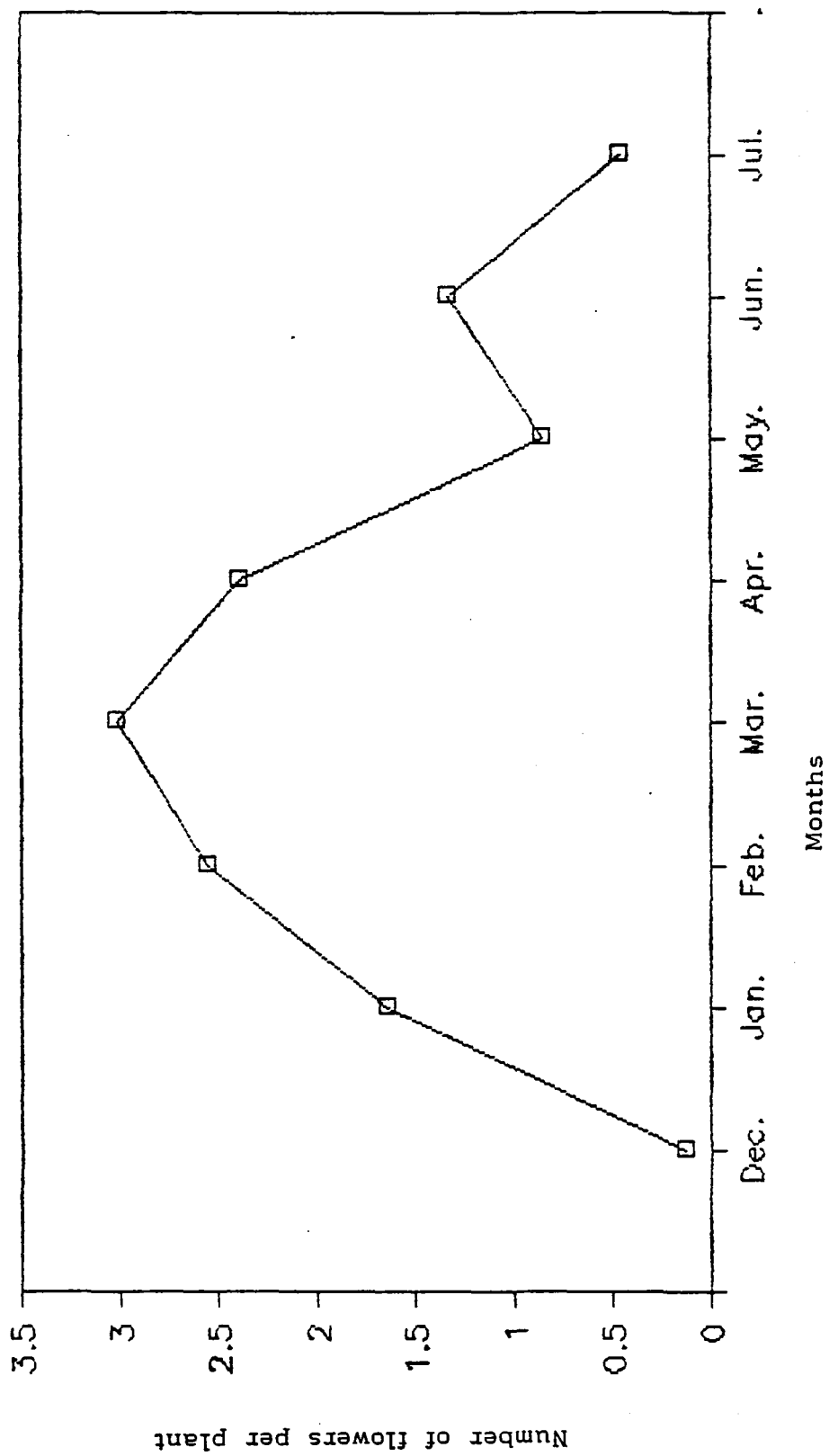


Fig. 1. Monthwise flower yield (number of flowers) per plant in gerbera

**GENOTYPES :**

- 1 Asha
- 2 Cream Beauty
- 3 Cream Son
- 4 Day Light
- 5 Double Galve Indu Magnet
- 6 HH of Sikkim
- 7 Missri White
- 8 Orange Gleem
- 9 Pink Favourite
- 10 Pink Perfection
- 11 Pink Supreme
- 12 Pride of Pong
- 13 Red Board
- 14 Rowel Pride
- 15 Salmon Pink
- 16 Sath Baba
- 17 Snow Gleem
- 18 Subarna Yellow
- 19 Sun Gleem
- 20 Sweet Dream

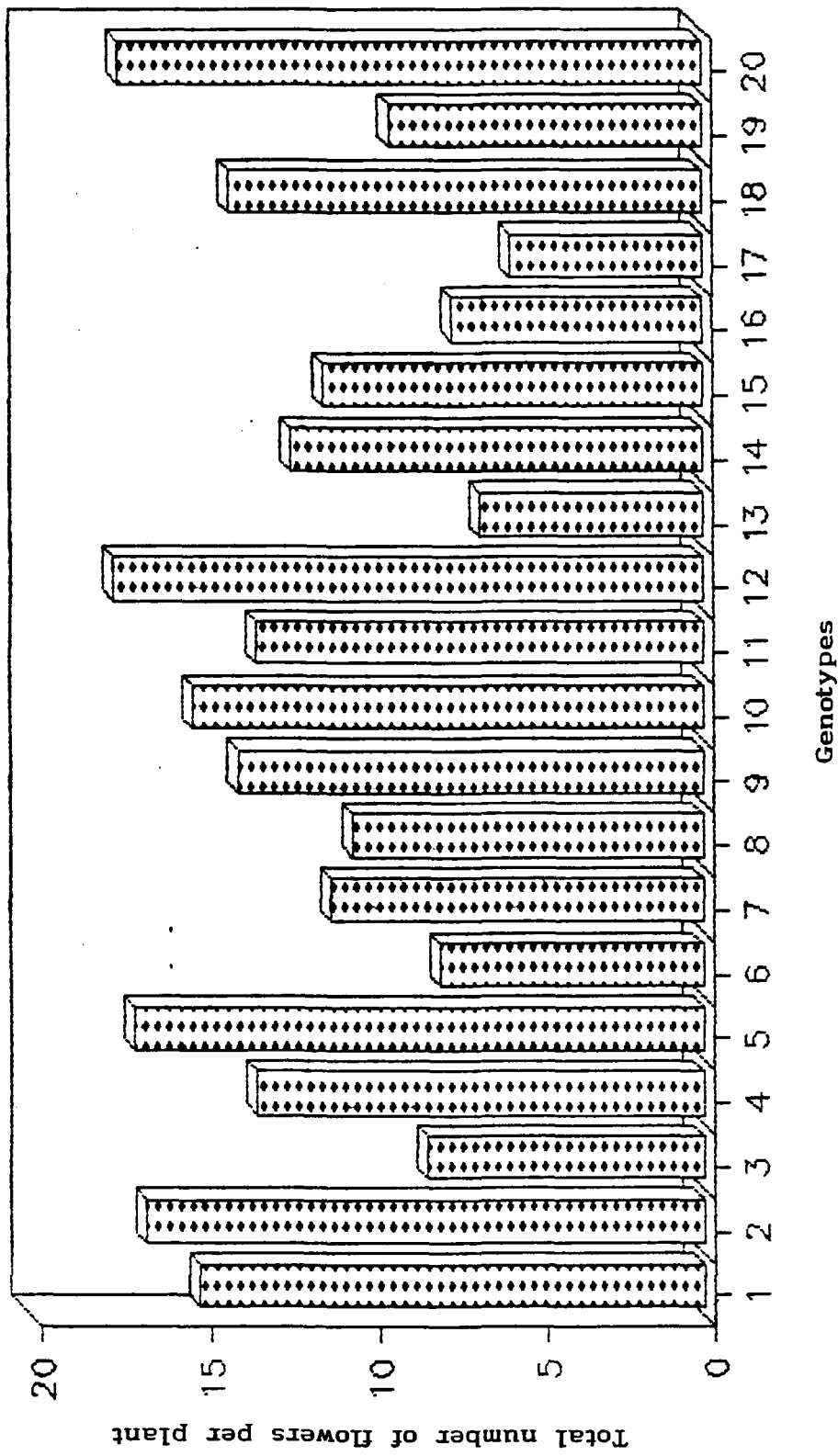


Fig. 2. Total flower yield (number of flowers) per plant in different genotypes of gerbera

Dream' and 'Pink Perfection'. In June 'Cream Beauty' which produced 2.67 flowers per plant was significantly superior to other genotypes. This was followed by 'Double Galve Indu Magnet' (2.06 flowers per plant). In July no genotype produced more than one flower per plant except 'Double Galve Indu Magnet' (1.05 flowers per plant).

In general the mean flower production of different genotypes was highest in March (3.01 flowers per plant) followed by February (2.55), April (2.39), January (1.64), June (1.33), May (0.85), July (0.46) and December (0.13). The flower yield in genotype 'Pride of Pong' was above the mean in all the months. In genotypes 'Pink Favourite', 'Pink Perfection' and 'Sweet Dream' the flower yield was above average in all the months except in July, June and December respectively. In genotypes, 'Cream Son', 'HH of Sikkim', 'Red Board', 'Sath Baba', 'Snow Gleen' and 'Sun Gleen' the flower production was below the average in all the months.

The total flower production per plant was highest in 'Pride of Pong' (17.56 flowers). Genotypes 'Cream Beauty', 'Double Galve Indu Magnet' and 'Sweet Dream' were statistically on par with 'Pride of Pong'. The mean total flower production was 12.15 flowers per plant. The total flower production per plant was more than mean in genotypes 'Asha', 'Day Light', 'Pink Favourite', 'Pink Perfection', 'Pink Supreme', 'Rowel Pride' and 'Subarna Yellow'. The least number of flowers was produced by 'Snow Gleen' (5.73 flowers per plant).

#### 4.1.4 Flower characters

The data pertaining to different flowers characters of the genotypes are presented in Table-7.

##### 4.1.4.1 Stalk length

The genotypes showed great variation and significant difference with respect to stalk length which ranged from 30.36 to 49.39 cm with a mean of 38.06 cm. 'Cream Beauty' produced the longest stalk (49.39 cm) and the shortest stalk was produced in 'Snow Gleen' (30.36 cm) 'Pride of Pong' (48.40 cm) and 'Sweet Dream' (48.55 cm) were statistically on par with 'Cream Beauty'. In 'Day Light', 'Missri White', 'Pink Perfection', 'Pink Supreme', 'Rowel Pride', 'Salmon Pink', 'Sath Baba' and 'Subarna Yellow' the stalk length was above the mean.

##### 4.1.4.2 Stalk diameter below the capitulum

The range observed for this character was 3.23 mm to 4.50 mm with a mean of 3.84 mm. Maximum diameter was recorded in 'Day Light' (4.50 mm) followed by 'Pride of Pong' (4.27 mm), 'Pink Perfection' (4.23), 'Pink Favourite' (4.20), 'Sweet Dream' (4.07), 'Missri White' (4.03) and 'Sath Baba' (4.00). 'Sun Gleen' recorded the minimum stalk diameter below the capitulum (3.23 mm).

#### 4.1.4.3 Stalk diameter at the centre of stalk

The range observed for this character was 3.83 mm to 5.80 mm, with a mean of 4.52 mm. Maximum stalk diameter at the centre of stalk was recorded in 'Day Light' (5.80 mm) followed by 'Pride of Pong' (5.17 mm), 'Pink Perfection' (5.03 mm) and 'Double Galve Indu Magnet' (4.90 mm). The least stalk diameter at the centre of stalk was recorded in 'Sun Gleen' (3.83 mm).

#### 4.1.4.4 Flower diameter

Genotypes differed significantly with respect to flower diameter which ranged from 6.09 cm in 'Snow Gleen' to 10.88 cm in 'Pride of Pong'. The mean flower diameter was 8.55 cm. Flower diameter was more than the mean in 'Asha', 'Day Light', 'Double Galve Indu Magnet', 'Orange Gleem', 'Pink Favourite', 'Pink Perfection', 'Pink Supreme' and 'Rowel Pride' (8.97, 10.61, 9.96, 9.80, 8.80, 9.95, 9.83, 9.58 and 10.12 cm respectively) and among these 'Day Light' was statistically on par with 'Pride of Pong'.

#### 4.1.4.5 Number of whorls

Genotypes differed significantly with respect to number of whorls per flower which ranged from 4.07 in 'HH of Sikkim' to 10.43 in 'Double Galve Indu Magnet'. The mean number of whorls observed was 8.18 per flower. In 'Asha', 'Day Light', 'Pink Favourite', 'Pink Perfection', 'Pink Supreme',

`Pride of Pong', `Red Board' and `Rowel Pride' the number of whorls were more than the average (8.77, 10.36, 9.83, 9.86, 9.27, 10.06, 8.53 and 8.60 respectively).

#### 4.1.4.6 Length of ray floret

Length of ray floret differed significantly and ranged from 3.18 cm in `Snow Gleen' to 5.62 cm in `Pride of Pong' with a mean ray floret length of 4.40 cm. Genotypes, `Asha', `Day Light', `Double Galve Indu Magnet', `Missri White', `Orange Gleem', `Pink Favourite', `Pink Perfection', `Pink Supreme', `Rowel Pride' and `Sweet Dream' had ray floret length higher than the mean (4.60, 5.35, 5.08, 4.71, 4.53, 4.96, 4.90 4.76, 4.41 and 4.66 cm respectively).

#### 4.1.4.7 Width of the ray floret

There were significant differences among the genotypes with respect to width of the ray floret. This trait exhibited a mean value of 3.37 mm and ranged from 2.40 mm to 4.40 mm in `Red Board' and `Double Galve Indu Magnet', respectively. Genotypes `Asha', `Pink Supreme', `Rowel Pride', `Salmon Pink', `Sath Baba' and `Sweet Dream' had ray floret width more than the mean (3.80, 4.37, 3.93, 3.83, 3.83, 3.39, 4.00 3.47 and 3.47 mm respectively).

#### 4.1.4.8 Length of involucre

The genotypes differed significantly with respect to this character which ranged from 1.00 cm in 'Snow Gleen' to 1.53 cm in 'Missri White'. The mean value for this character was 1.29 cm. Genotypes 'Cream Beauty' and 'Cream Son' were statistically on par with 'Missri White'.

#### 4.1.4.9 Field life of flower

Significant differences in the period of flower retention in the plant were observed among the genotypes. The field life of flower ranged from 10.53 days to 16.28 days in 'Red Board' and 'Sweet Dream' respectively, with a mean field life of 13.60 days. Genotypes 'Day Light', 'Double Galve Indu Magnet', 'Pink Favourite', 'Pink Perfection', 'Pride of Pong', 'Rowel Pride' and 'Subarna Yellow' retained the flowers in the plants more than the mean (14.25, 14.69, 14.00, 14.11, 15.75, 14.22 and 14.95 days respectively).

#### 4.1.4.10 Vase life of flower

The genotypes showed great variation and significant difference with respect to vase life which ranged from 6.67 to 11.60 days, with a mean of 9.13 days. 'Pride of Pong' had the longest vase life (11.60 days) and 'Snow Gleen' the least (6.67 days). Genotypes 'Cream Beauty', 'Day Light', 'Double Galve Indu Magnet', 'Missri White', 'Pink Favourite', 'Pink

Table 7 : Some flower characters of different genotypes in gerbera

Genotypes	Stalk length (cm)	Stalk diameter below capitulum of stalk (mm)	Stalk diameter at centre of stalk (mm)	Flower diameter (cm)	No. of whorls	Length of ray floret (cm)	Width of ray floret (mm)	Length of involucre (cm)	Field life of flower (days)	Vase life (days)
1 Asha	34.12	3.77	4.50	8.97	8.77	4.60	3.80	1.26	12.64	8.87
2 Cream Beauty	49.39	3.60	4.27	7.93	8.13	3.96	2.73	1.48	13.56	9.67
3 Crean Son	33.15	3.60	4.20	6.95	7.87	3.57	2.93	1.48	11.89	8.20
4 Day Light	41.75	4.50	5.80	10.61	10.36	5.35	4.37	1.18	14.25	11.13
5 Double Galve	36.38	3.97	4.90	9.96	10.43	5.08	4.40	1.23	14.69	9.27
Indu Magnet										
6 HH of Sikkim	35.57	3.57	4.17	7.25	4.07	3.60	3.36	1.32	13.36	8.40
7 Missri White	39.51	4.03	4.47	8.08	7.37	4.71	3.03	1.53	13.53	9.27
8 Orange Gleen	33.89	3.77	4.27	8.80	7.66	4.53	3.10	1.39	13.00	8.00
9 Pink Favourite	35.59	4.20	4.83	9.95	9.83	4.96	3.93	1.12	14.00	10.00
10 Pink Perfection	36.23	4.23	5.03	9.83	9.86	4.90	3.83	1.22	14.11	10.07
11 Pink Supreme	36.09	4.00	4.93	9.58	9.27	4.76	3.83	1.21	13.19	8.93
12 Pride of Pong	48.40	4.27	5.17	10.88	10.06	5.62	3.20	1.33	15.75	11.60
13 Red Board	32.70	3.37	3.93	7.76	8.53	3.81	2.40	1.08	10.53	7.20
14 Rowel Pride	40.24	3.77	4.43	10.12	8.60	4.41	3.39	1.39	14.22	9.53
15 Salmon Pink	38.98	3.73	4.03	8.03	8.03	4.11	4.00	1.30	12.75	8.33
16 Sath Baba	40.45	4.00	4.67	7.38	6.27	3.87	3.47	1.29	13.26	7.80
17 Snow Gleen	30.36	3.63	4.13	6.09	7.13	3.18	2.70	1.00	12.42	7.13
18 Subarna Yellow	38.16	3.43	4.03	7.87	6.70	4.03	2.97	1.34	14.95	10.93
19 Sun Gleen	31.65	3.23	3.83	6.62	6.73	3.55	2.43	1.32	12.22	6.67
20 Sweet Dream	48.55	4.07	4.87	8.41	7.93	4.66	3.47	1.45	16.28	11.53
Mean	38.06	3.84	4.52	8.55	8.18	4.40	3.37	1.29	13.60	9.13
S. Errt	0.93	0.06	0.08	0.12	0.12	0.06	0.13	0.02	0.75	0.67
C.D. at 5%	2.66	0.17	0.24	0.39	0.36	0.18	0.38	0.06	2.14	1.91

Perfection', 'Rowel Pride', 'Subarna Yellow' and 'Sweet Dream' had the vase life more than the mean vase life (9.67, 11.13, 9.27, 9.27, 10.00, 10.07, 9.53, 10.93 and 11.53 days respectively).

#### 4.2 GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE

The genotypes exhibited significant amounts of variability for all seventeen characters studied. The range, mean, phenotypic and genotypic variance, phenotypic and genotypic coefficient of variations, heritability, genetic advance and genetic advance as per cent of mean are presented in Table-8. The phenotypic and genotypic coefficients of variation are diagrammatically represented in Fig-3 and the value of heritability and genetic advance as per cent of mean are represented in Fig. 4.

##### 4.2.1 Vegetative characters

###### 4.2.1.1 Number of leaves

The number of leaves per plant ranged from 17.78 to 36.00 with a mean of 25.25. This character showed phenotypic and genotypic variance of 26.94 and 24.64 respectively. The phenotypic and genotypic coefficients of variations were 20.55 and 19.66 per cent, with heritability value of 91.45. The genetic advance was 9.78 with 38.73 per cent of genetic advance as per cent of mean.

#### 4.2.1.2 Leaf area

The range of variation for this character was 47.35 cm<sup>2</sup> to 101.38 cm<sup>2</sup> with a mean value of 79.72 cm<sup>2</sup>. Phenotypic and genotypic variance were highest for this character (290.56 and 279.88 respectively). The phenotypic coefficient of variation was 21.38 per cent with a value of 20.99 per cent as genotypic coefficient of variation. It measured high heritability value (96.32 per cent). The genetic advance and genetic advance as per cent of mean were also higher (33.82 and 42.42 respectively).

#### 4.2.1.3 Spread of plant

The horizontal spread of the plants ranged from 20.22 cm to 49.76 cm with a mean spread of 35.43 cm. This character showed phenotypic variance of 88.89 with 84.41 as genotypic variance which were considered to be high. The phenotypic and genotypic coefficients of variation were 26.61 and 25.94 per cent respectively. The heritability value was 94.96 with genetic advance of 18.44. The genetic advance as per cent of mean was recorded to be high (52.05).

#### 4.2.1.4 Number of suckers per plant

This character exhibited a range of 2.80 to 5.33 suckers per plant with a mean of 3.73 suckers. The phenotypic and genotypic variances were low with a value of 0.50 and 0.41

respectively. The phenotypic and genotypic coefficients of variation were 18.94 and 17.15 respectively with a heritability estimate of 81.92 per cent. The character had a low expected genetic gain of 1.19 with moderate genetic advance as per cent of mean (31.96).

#### **4.2.2 Reproductive attributes**

##### **4.2.2.1 Days to first flower opening**

The genotypes differed significantly with respect to days taken to first flower opening which ranged from 71.05 to 113.78 days with a mean of 88.42 days. The phenotypic and genotypic variance were high for this character (139.81 and 132.86) followed by a value of 13.37 and 13.04 per cent as phenotypic and genotypic coefficient of variation respectively.

This character also exhibited a high heritability value of 95.02 per cent, associated with 23.15 as expected genetic advance. The genetic advance as per cent of mean measured 26.18 per cent.

##### **4.1.2.2 Number of days from appearance of bud to bloom**

The number of days to bloom from appearance of bud ranged from 11.53 to 13.97 days with 12.96 days as mean. This character exhibited lower phenotypic and genotypic variance (0.63 and 0.48 respectively). The phenotypic and genotypic coefficients of variation were 6.11 and 5.35 per cent. This

trait showed a moderate heritability estimate (76.67 per cent) associated with low genetic advance (1.25). The genetic advance as per cent of mean measured 9.64 per cent.

#### 4.2.3 Flower yield (total number of flowers) per plant

Genotypes varied significantly for the production of cut flowers per plant and it ranged from 5.73 to 17.56 with a mean number of 12.15 cut flowers per plant. The phenotypic and genotypic variance were 14.67 and 13.26 respectively. This character exhibited highest per cent phenotypic and genotypic coefficients of variation (31.52 and 29.97 respectively). It also recorded high amount of heritability (90.39 per cent). The genetic advance was recorded to be moderate (7.13) but genetic advance as per cent of mean was recorded to be the highest compared to all other characters (58.69).

#### 4.2.4 Flower characters

##### 4.2.5.1 Stalk length

The stalk length ranged from 30.36 cm to 49.39 cm with a mean length of 38.06 cm. The phenotypic and genotypic variance were moderate for this character (32.29 and 29.71 respectively). The value of phenotypic and genotypic coefficients of variation were 14.93 and 14.32 per cent respectively. The heritability value was 92.02 per cent with a genetic advance of 10.77. The genetic advance as per cent of mean was 28.30 per cent.

#### 4.2.4.2 Stalk diameter below the capitulum

This character ranged from 3.23 mm to 4.50 mm with a mean value of 3.84 mm. Phenotypic and genotypic variances were low for this character (0.12 and 0.11 respectively). The value of phenotypic and genotypic coefficients of variation were 8.88 and 8.48 per cent respectively. The heritability value was 91.37 per cent followed by a low genetic advance (0.64). But the genetic advance as per cent of mean measured 16.68 per cent.

#### 4.2.4.3 Stalk diameter at the centre of stalk

This character ranged from 3.83 mm to 5.80 mm with a mean value of 4.52 mm. Phenotypic and genotypic variances were 0.26 and 0.24 respectively. The value of phenotypic and genotypic coefficients of variation were 11.28 and 10.82 per cent. The heritability value was 91.92 per cent with a value of 0.97 as genetic advance. The genetic advance as per cent of mean measured 21.46 per cent.

#### 4.2.4.4 Flower diameter

The genotypes differed significantly with respect to flower diameter which ranged from 6.09 to 10.88 cm with a mean value of 8.55 cm. The estimate of phenotypic and genotypic variances were 1.95 and 1.90 respectively. The phenotypic and genotypic coefficients of variation were 16.37 and 16.19 per

cent respectively. This trait showed a high heritability value (97.84 per cent) with a moderately high value of genetic advance as per cent of mean (32.98 per cent). The value of genetic advance was 2.82.

#### 4.2.4.5 Number of whorls

The number of whorls per flower ranged from 4.07 to 10.43 with a mean value of 8.18. The value of phenotypic and genotypic variance were 2.55 and 2.51 respectively. This character showed moderate phenotypic and genotypic coefficient of variation (19.52 and 19.34 respectively). This character recorded the highest per cent of heritability (98.19). The genetic advance as per cent of mean was also higher (39.49 per cent). The value of genetic advance was 3.23.

#### 4.2.4.6 Length of ray floret

This character ranged from 3.18 to 5.62 cm with a mean ray floret length of 4.40 cm. The phenotypic and genotypic variances were 0.48 and 0.47 respectively. The value of phenotypic and genotypic coefficients of variation were 15.69 and 15.47 per cent respectively. It recorded a high per cent of heritability (97.48) with 1.39 as expected genetic advance. The genetic advance as per cent of mean was 31.59 per cent.

#### 4.2.4.7 Width of ray floret

The width of the ray floret ranged from 2.40 mm to 4.40 mm with a mean of 3.37 mm. The phenotypic and genotypic variances were low for this character (0.38 and 0.33 respectively), with moderate phenotypic and genotypic coefficients of variation (18.45 and 17.07 respectively). The heritability estimate was 85.97 per cent with low genetic advance of 1.10. The genetic advance as per cent of mean was 32.64 per cent.

#### 4.2.4.8 Length of involucre

The length of involucre ranged from 1.00 cm to 1.53 cm with a mean value of 1.29 cm. This character showed the lowest value for both phenotypic and genotypic variance (0.02). The phenotypic and genotypic coefficients of variation were 10.88 and 10.54 respectively with a moderately high value of heritability (94.73 per cent). This character also showed the lowest genetic advance (0.27) but the genetic advance as per cent of mean was 20.93 per cent.

#### 4.2.4.9 Field life of flower

The range of variation for this character was 10.53 to 16.28 days with a mean of 13.60 days. The value of phenotypic variation was 3.24 with 1.56 as genotypic variance. The phenotypic and genotypic coefficients of variations were

Table 8 : Genetic parameters of different characters in gerbera

Characters	Range		Mean	PV	GV	PCV%	GCV%	H %	GA	GAM
1 Number of leaves	17.78 - 36.00		25.25	26.94	24.64	20.55	19.66	91.45	9.78	38.73
2 Leaf area (cm <sup>2</sup> )	47.35 -101.38		79.72	290.56	279.88	21.38	20.99	96.32	33.82	42.42
3 Spread of plant (cm)	20.22 - 49.76		35.43	88.89	84.41	26.61	25.94	94.96	18.44	52.05
4 Number of suckers	2.80 - 5.33		3.73	0.50	0.41	18.94	17.15	81.92	1.19	31.96
5 Days to first flowering	71.05 -113.78		88.42	139.81	132.86	13.37	13.04	95.02	23.15	26.18
6 Number of days from bud to bloom	11.53 - 13.97		12.96	0.63	0.48	6.11	5.35	76.67	1.25	9.64
7 Flower yield per plant	5.73 - 17.56		12.15	14.67	13.26	31.52	29.97	90.39	7.13	58.69
8 Stalk length (cm)	30.36 - 49.39		38.06	32.29	29.71	14.93	14.32	92.02	10.77	28.30
9 Stalk diameter below capitulum (mm)	3.23 - 4.50		3.84	0.12	0.11	8.88	8.48	91.37	0.64	16.68
10 Stalk diameter at centre of stalk (cm)	3.83 - 5.80		4.52	0.26	0.24	11.28	10.82	91.92	0.97	21.46
11 Flower diameter (cm)	6.09 - 10.88		8.55	1.95	1.90	16.37	16.19	97.84	2.82	32.98
12 Number of whorls	4.07 - 10.43		8.18	2.55	2.51	19.52	19.34	98.19	3.23	39.49
13 Length of ray floret (cm)	3.18 - 5.62		4.40	0.48	0.47	15.69	15.47	97.48	1.39	31.59
14 Width of ray floret (mm)	2.40 - 4.40		3.37	0.38	0.33	18.45	17.07	85.97	1.10	32.64
15 Length of involucre (cm)	1.00 - 1.53		1.29	0.02	0.02	10.88	10.54	94.73	0.27	20.93
16 Field life of flower (days)	10.53 - 16.28		13.60	3.24	1.56	13.23	9.19	48.27	1.79	13.16
17 Vase life of flower (days)	6.67 - 11.60		9.13	3.01	1.67	19.01	14.16	55.48	1.98	21.69

**CHARACTERS :**

- 1 Number of leaves
- 2 Leaf area (cm<sup>2</sup>)
- 3 Spread of plant (cm)
- 4 Number of suckers
- 5 Days to first flowering
- 6 Number of days from bud to bloom
- 7 Flower yield per plant
- 8 Stalk length (cm)
- 9 Stalk diameter below capitulum (mm)
- 10 Stalk diameter at centre of stalk (cm)
- 11 Flower diameter (cm)
- 12 Number of whorls
- 13 Length of ray floret (cm)
- 14 Width of ray floret (mm)
- 15 Length of involucre (cm)
- 16 Field life of flower (days)
- 17 Vase life of flower (days)

LEGEND

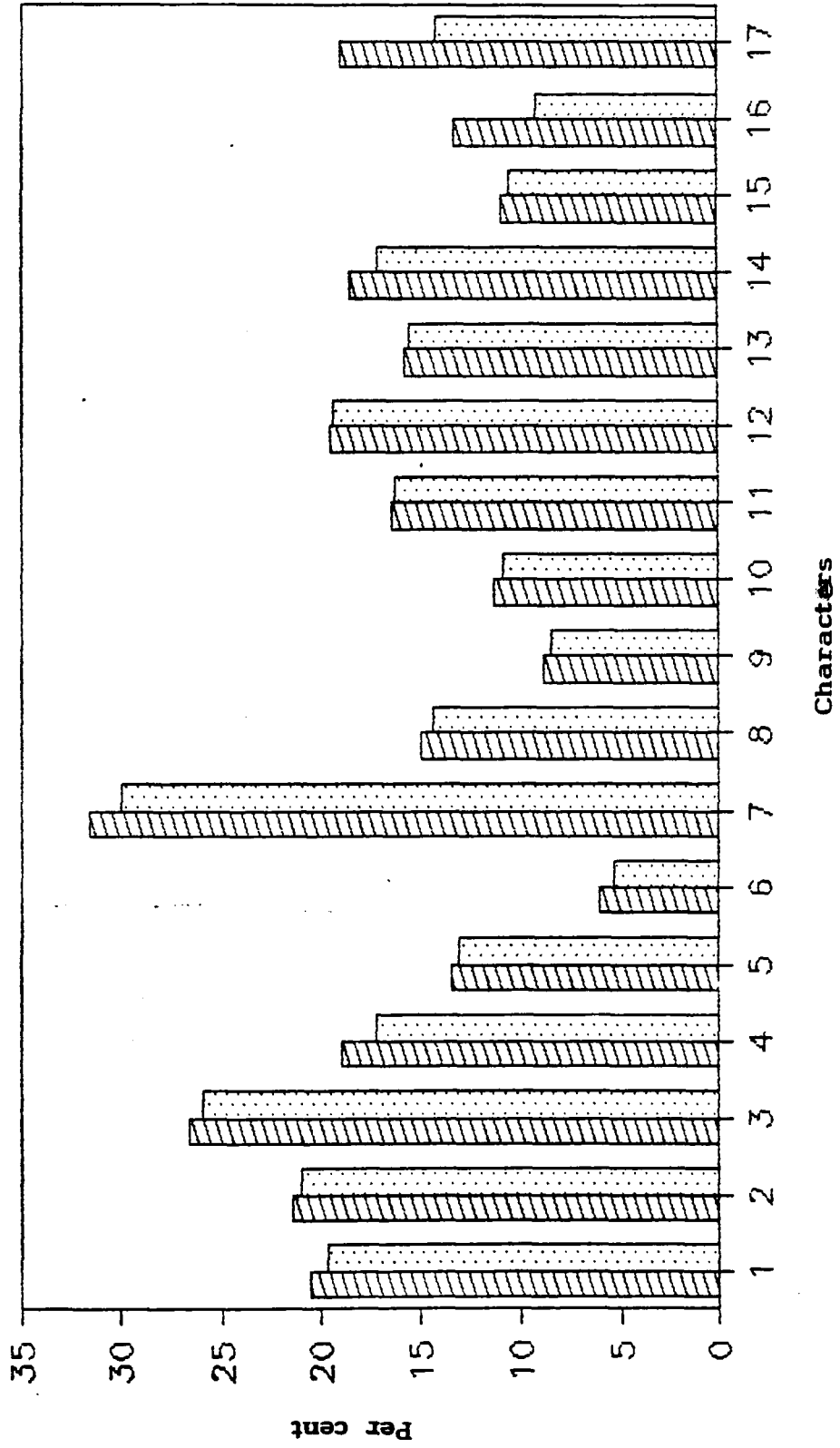


Fig. 3. Phenotypic and genotypic coefficients of variations for the characters studied in gerbera

**CHARACTERS :**

- 1 Number of leaves
- 2 Leaf area (cm<sup>2</sup>)
- 3 Spread of plant (cm)
- 4 Number of suckers
- 5 Days to first flowering
- 6 Number of days from bud to bloom
- 7 Flower yield per plant
- 8 Stalk length (cm)
- 9 Stalk diameter below capitulum (mm)
- 10 Stalk diameter at centre of stalk (cm)
- 11 Flower diameter (cm)
- 12 Number of whorls
- 13 Length of ray floret (cm)
- 14 Width of ray floret (mm)
- 15 Length of involucre (cm)
- 16 Field life of flower (days)
- 17 Vase life of flower (days)

LEGEND

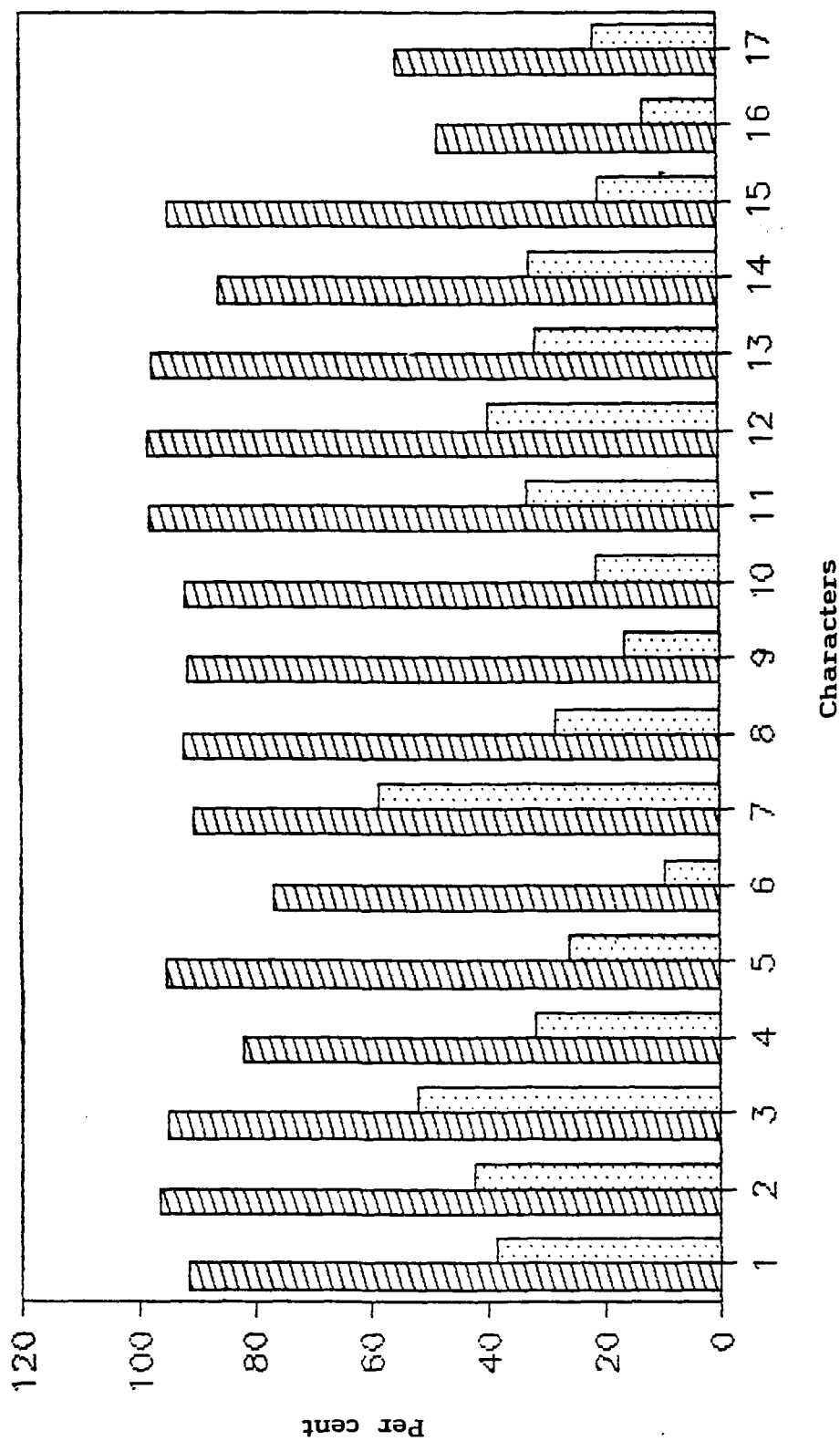


Fig. 4. Heritability and genetic advance as per cent of mean for the characters studied in gerbera

13.23 and 9.19 per cent respectively. The heritability value was the lowest for this character (48.27 per cent). The genetic advance and genetic advance as per cent of mean were 1.79 and 13.16 per cent respectively.

#### 4.2.4.10 Vase life of flower

The genotypes differed significantly with respect to the vase life, which ranged from 6.67 days to 11.60 days with a mean value of 9.13 days. The estimate of phenotypic and genotypic variances were 3.01 and 1.67 respectively. The phenotypic and genotypic coefficients of variation were 19.01 and 14.16 per cent with a marginal heritability value of 55.48 per cent. The expected genetic gain for this character measured 1.98 with 21.69 per cent genetic advance as per cent of mean.

### 4.3 PHENOTYPIC AND GENOTYPIC CORRELATIONS

The value of coefficients of correlation both at genotypic and phenotypic level for the characters studied with flower yield are presented in Table-9 and 10 respectively. For most of the characters the genotypic correlation coefficients were higher than the phenotypic correlation coefficient.

#### 4.3.1 Number of leaves

At both genotypic and phenotypic levels number of leaves showed highly significant and positive correlation with

spread of plant ( $r_g=0.793$ ;  $r_p=0.791$ ), number of suckers ( $r_g=0.979$ ;  $r_p=0.954$ ), flower yield per plant ( $r_g=0.858$ ;  $r_p=0.841$ ), stalk length ( $r_g=0.602$ ;  $r_p=0.568$ ) length of ray floret ( $r_g=0.858$ ;  $r_p=0.841$ ), stalk length ( $r_g=0.626$ ;  $r_p=0.598$ ), field life of flower ( $r_g=0.838$ ;  $r_p=0.739$ ), and vase life ( $r_g=0.847$ ;  $r_p=0.757$ ). This character showed positive non significant association with leaf area, stalk diameter below capitulum, stalk diameter at centre of stalk both at genotypic and phenotypic levels. At both genotypic and phenotypic levels number of leaves showed strong negative correlation with days to first flower opening ( $r_g=-0.713$ ;  $r_p=-0.665$ ) and number of days from bud to bloom ( $r_g=-0.660$ ;  $r_p=-0.568$ ).

#### 4.3.2 Leaf area

Leaf area had highly significant positive correlation both at genotypic and phenotypic levels with spread of plant ( $r_g=0.609$ ;  $r_p=0.593$ ). Leaf area was found to have positive significant association at genotypic level with stalk diameter below capitulum (0.468), stalk diameter at centre of stalk (0.474), flower diameter (0.484), length of ray floret (0.504), width of ray floret (0.520) and at phenotypic level with flower diameter (0.468), length of ray floret (0.499) and width of ray floret (0.480). This trait exhibited negative significant association with days to first flower opening both at genotypic and phenotypic levels ( $r_g=-0.516$ ;  $r_p=-0.491$ ). It did

show positive but non significant association with number of suckers, number of whorls, flower yield per plant, field life of flowers and vase life both at genotypic and phenotypic levels.

#### 4.3.3. Spread of plant

Spread of plant had highly significant positive correlation both at genotypic and phenotypic levels with number of suckers ( $r_g=0.746$ ;  $r_p=0.719$ ), flower yield per plant ( $r_g=0.723$ ;  $r_p=0.724$ ) and length of the ray floret ( $r_g=0.585$ ;  $r_p=0.567$ ). This character showed strong and positive significant correlation with field life ( $r_g=0.656$ ) and vase life ( $r_g=0.590$ ) at genotypic level. It also showed positive significant association with field life ( $r_p=0.551$ ) and vase life ( $r_p=0.515$ ) of flower at phenotypic level. Spread of the plant was found to have a strong and negative association with days to first flower opening both at genotypic and phenotypic levels ( $r_g=-0.693$ ;  $r_p=-0.659$ ). This character did show a positive non significant association with stalk diameter below capitulum, stalk diameter at centre of stalk, number of whorls and width of ray floret.

#### 4.3.4 Number of suckers

Number of suckers was strongly and positively associated at genotypic level and moderately associated at phenotypic level with stalk length ( $r_g=0.567$ ;  $r_p=0.504$ ). Both

at genotypic and phenotypic levels it showed a high and positive correlation with flower yield per plant ( $r_g=0.827$ ;  $r_p=0.791$ ), field life of flowers ( $r_g=0.838$ ;  $r_p=0.747$ ) and vase life ( $r_g=0.851$ ;  $r_p=0.778$ ). This trait showed highly significant and positive association with flower diameter ( $r_g=0.585$ ) and length of ray floret ( $r_g=0.610$ ) at genotypic level. At phenotypic level it showed moderate positive association with flower diameter (0.519) and length of ray floret (0.560). Number of suckers correlated positively but non significantly with stalk diameter below capitulum, stalk diameter at centre of stalk, number of whorls, and width of ray floret both at genotypic and phenotypic levels.

Both at genotypic and phenotypic levels number of suckers showed a strong negative correlation with days to first flower opening ( $r_g=-0.655$ ;  $r_p=-0.574$ ) and number of days from bud to bloom ( $r_g=-0.687$ ;  $r_p=-0.583$ ).

#### 4.3.5 Days to first flower opening

This character showed a highly significant and negative correlation with flower yield per plant ( $r_g=-0.673$ ;  $r_p=-0.632$ ), stalk diameter below capitulum ( $r_g=-0.777$ ;  $r_p=-0.713$ ) stalk diameter at centre of stalk ( $r_g=0.745$ ;  $r_p=0.703$ ), flower diameter ( $r_g=-0.614$ ;  $r_p=-0.587$ ) and length of ray floret ( $r_g=-0.649$ ;  $r_p=-0.623$ ) both at genotypic and phenotypic levels. It had a moderate and negative association with stalk length

( $r_g = -0.443$ ) at genotypic level and a weak negative association at phenotypic level ( $r_p = -0.427$ ).

#### 4.3.6 Number of days from bud to bloom

This character showed highly significant and negative correlation with flower yield per plant ( $r_g = -0.735$ ;  $r_p = -0.610$ ), flower diameter ( $r_g = -0.875$ ;  $r_p = -0.774$ ), number of whorls ( $r_g = -0.757$ ;  $r_p = -0.671$ ) and length of ray floret ( $r_g = -0.853$ ;  $r_p = -0.734$ ) both at genotypic and phenotypic levels. At genotypic level it had a strong negative correlation with field life of flower ( $-0.614$ ) and vase life ( $-0.721$ ) and at phenotypic level it had moderate negative correlation with vase life ( $-0.541$ ). It also exhibited negative non significant association with stalk length both at genotypic and phenotypic levels.

#### 4.3.7 Flower yield (total number of flowers) per plant

Total number of flowers per plant had a very high positive correlation with number of leaves ( $r_g = 0.858$ ;  $r_p = 0.841$ ), spread of plant ( $r_g = 0.723$ ;  $r_p = 0.724$ ), stalk length ( $r_g = 0.686$ ;  $r_p = 0.625$ ), flower diameter ( $r_g = 0.731$ ;  $r_p = 0.675$ ), number of whorls ( $r_g = 0.629$ ;  $r_p = 0.592$ ), length of ray floret ( $r_g = 0.749$ ;  $r_p = 0.700$ ) and field life ( $r_g = 0.817$ ;  $r_p = 0.670$ ) both at genotypic and phenotypic levels. It had a moderate positive association with stalk diameter below capitulum ( $r_g = 0.817$ ;

$r_p=0.670$ ) both at genotypic and phenotypic levels. It had a moderate positive association with stalk diameter below capitulum ( $r_g=0.532$ ;  $r_p=0.470$ ) and stalk diameter at centre of stalk ( $r_g=0.573$ ;  $r_p=0.546$ ) both at genotypic and phenotypic levels.

#### 4.3.8 Stalk length

A highly significant positive association was found between stalk length and number of leaves ( $r_g=0.602$ ) at genotypic level and at phenotypic level it had a moderate significant correlation with number of leaves ( $r_p=0.568$ ). At genotypic level this character showed positive significant correlation with stalk diameter below capitulum (0.455), stalk diameter at centre of stalk (0.448) and length of ray floret (0.465) and at phenotypic level it showed positive significant correlation with field life of flower (0.524). Both at genotypic and phenotypic level this character showed positive non significant association with flower diameter and number of whorls.

#### 4.3.9 Stalk diameter below the capitulum

This character had a highly significant positive correlation with stalk diameter at centre of stalk ( $r_g=0.958$ ;  $r_p=0.904$ ), flower diameter ( $r_g=0.766$ ;  $r_p=0.730$ ), length of ray floret ( $r_g=0.812$ ;  $r_p=0.752$ ) and width of ray floret ( $r_g=0.741$ ;  $r_p=0.671$ ) both at genotypic and phenotypic levels. At

genotypic level this trait exhibited moderate positive association with number of whorls (0.535) and field life of flower (0.556) and at phenotypic level it showed positive significant association with number of whorls (0.501) and vase life (0.527).

#### 4.3.10 Stalk diameter at the centre of stalk

This character exhibited a highly significant and positive association with flower diameter ( $r_g=0.804$ ;  $r_p=0.761$ ), number of whorls ( $r_g=0.607$ ;  $r_p=0.575$ ), length of ray floret ( $r_g=0.812$ ;  $r_p=0.760$ ), width of ray floret ( $r_g=0.740$ ;  $r_p=0.653$ ) and vase life ( $r_g=0.765$ ;  $r_p=0.566$ ) both at genotypic and phenotypic levels. With the field life of flower this character showed moderate positive association ( $r_g=0.561$ ) at genotypic level whereas it showed insignificant positive association with field life of flower at phenotypic level ( $r_p=0.411$ ).

#### 4.3.11 Flower diameter

Both at genotypic and phenotypic levels flower diameter had a highly significant and positive association with number of whorls ( $r_g=0.788$ ;  $r_p=0.774$ ), length of ray floret ( $r_g=0.979$ ;  $r_p=0.952$ ), width of ray floret ( $r_g=0.687$ ;  $r_p=0.649$ ) and vase life ( $r_g=0.777$ ;  $r_p=0.576$ ). A highly significant positive association was found between flower diameter and

field life of flower at genotypic level ( $r_g=0.584$ ), but flower diameter did not show significant correlation with field life at phenotypic level ( $r_p=0.401$ ).

#### 4.3.12 Number of whorls

This character exhibited a highly significant and positive correlation with length of ray floret ( $r_g=0.734$ ;  $r_p=0.715$ ) both at genotypic and phenotypic levels. It also had moderate positive association with width of ray floret ( $r_g=0.516$ ) and vase life ( $r_g=0.559$ ) at genotypic level. At phenotypic level it exhibited a significant association with width of ray floret (0.489) and showed positive correlation with vase life which was non significant (0.405).

#### 4.3.13 Length of ray floret

At genotypic level length of ray floret showed highly significant positive correlation with width of ray floret (0.654), field life of flower (0.658) and vase life (0.820). At phenotypic level this character exhibited strong and positive correlation with width of ray floret (0.597) and vase life (0.602) and a moderate positive association with field life of flower (0.444).

#### 4.3.14 Width of ray floret

At genotypic level it had a significant association with flower yield per plant (0.496) and vase life (0.481) and

non significant association with field life of flower (0.422). At phenotypic level it had a positive significant correlation with vase life (0.445) and positive insignificant association with flower yield per plant and field life of flower.

#### 4.3.15 Length of involucre

Length of involucre exhibited a moderate positive correlation with stalk length both at genotypic and phenotypic levels ( $r_g=0.494$ ;  $r_p=0.455$ ). This character did not show any significant association either positive or negative with any other character both at genotypic and phenotypic levels.

#### 4.3.16 Field life of flower

Field life of flower showed a strong and positive correlation with vase life ( $r_g=0.873$ ;  $r_p=0.864$ ) both at genotypic and phenotypic levels. At genotypic level field life showed high positive correlation with stalk length (0.752) and at phenotypic level it showed moderate association with stalk length (0.524).

#### 4.3.17 Vase life of flower

Both at genotypic and phenotypic levels vase life had a high and positive correlation with number of flowers ( $r_g=0.894$ ;  $r_p=0.735$ ) and stalk length ( $r_g=0.819$ ;  $r_p=0.615$ ).

Table 9 : Genotypic correlation coefficients for pairs of characters in gerbera

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Number of leaves	1.000	0.223	0.793**	0.979**	-0.713**	-0.660**	0.858**	0.602**	0.375	0.399	0.583**	0.441	0.626**	0.230	0.238	0.838**	0.847**
2 Leaf area	1.000	0.609**	0.150	-0.516*	-0.347	0.375	0.267	0.468*	0.474*	0.484*	0.484*	0.216	0.504*	0.520*	-0.013	0.334	0.179
3 Spread of plant	1.000	0.746**	-0.693**	-0.610**	0.723**	0.457*	0.392	0.372	0.372	0.553*	0.440	0.585**	0.364	0.113	0.656**	0.590**	
4 Number of suckers	1.000	-0.655**	-0.687**	0.827**	0.567**	0.353	0.376	0.585**	0.458*	0.610**	0.168	0.233	0.838**	0.851**			
5 Days to first flowering	1.000	0.417	-0.673**	-0.443*	-0.777**	-0.745**	-0.614**	-0.379	-0.649**	-0.610**	0.079	-0.775**	-0.754**				
6 Number of days from bud to bloom	1.000	-0.735**	-0.408	-0.531*	-0.611**	-0.875**	-0.757**	-0.853**	-0.490*	0.095	-0.614**	-0.721**					
7 Flower yield per plant	1.000	0.686**	0.532*	0.573**	0.731**	0.629**	0.749**	0.496*	0.260	0.817**	0.894**						
8 Stalk length	1.000	0.455*	0.448*	0.404	0.138	0.465*	0.150	0.494*	0.752**	0.819**							
9 Stalk diameter below capitulum	1.000	0.958**	0.766**	0.535*	0.812**	0.741**	-0.089	0.556*	0.745**								
10 Stalk diameter at centre of stalk	1.000	0.804**	0.607**	0.812**	0.740**	-0.149	0.561*	0.765**									
11 Flower diameter	1.000	0.788**	0.979**	0.687**	-0.068	0.584**	0.777**										
12 Number of whorls	1.000	0.734**	0.516*	-0.258	0.239	0.559*											
13 Length of ray floret	1.000	0.654**	0.057	0.658**	0.820**												
14 Width of ray floret	1.000	-0.195	0.481*														
15 Length of involucre	1.000	0.313	0.264														
16 Field life of flower	1.000	0.873**															
17 Vase life of flower	1.000																

\* - Significance at 0.05 level of probability

\*\* - Significance at 0.01 level of probability.

Table 10 : Phenotypic correlation coefficients for pairs of characters in gerbera

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Number of leaves	1.000	0.230	0.791**	0.954**	-0.665**	-0.568**	0.841**	0.568*	0.335	0.371	0.545*	0.419	0.598**	0.216	0.231	0.729**	0.757**
2 Leaf area		1.000	0.593**	0.171	-0.491*	-0.306	0.361	0.256	0.434	0.443	0.468*	0.203	0.499*	0.480*	-0.019	0.255	0.167
3 Spread of plant			1.000	0.719**	-0.659**	-0.530*	0.724**	0.429	0.356	0.344	0.526*	0.425	0.567**	0.323	0.126	0.551*	0.515*
4 Number of suckers				1.000	-0.574**	-0.583**	0.791**	0.504*	0.299	0.333	0.519*	0.405	0.560*	0.157	0.207	0.747**	0.778**
5 Days to first flowering					1.000	0.347	-0.632**	-0.427	-0.713**	-0.703**	-0.587**	-0.363	-0.623**	-0.558*	0.073	-0.511*	-0.543*
6 Number of days from bud to bloom						1.000	-0.610**	-0.305	-0.432	-0.510*	-0.774**	-0.671**	-0.734**	-0.402	0.062	-0.387	-0.541*
7 Flower yield per plant							1.000	0.625**	0.470*	0.546*	0.675**	0.592**	0.700**	0.430	0.261	0.670**	0.735**
8 Stalk length								1.000	0.406	0.413	0.369	0.130	0.442	0.138	0.455*	0.524*	0.615**
9 Stalk diameter below capitulum									1.000	0.904**	0.730**	0.501*	0.752**	0.671**	-0.075	0.376	0.527*
10 Stalk diameter at centre of stalk										1.000	0.761**	0.575**	0.760**	0.653**	-0.130	0.411	0.566**
11 Flower diameter											1.000	0.774**	0.952**	0.649**	-0.066	0.401	0.576**
12 Number of whorls												1.000	0.715**	0.489*	-0.245	0.158	0.405
13 Length of ray floret													1.000	0.597**	0.055	0.444*	0.602**
14 Width of ray floret														1.000	-0.168	0.280	0.445*
15 Length of involucre															1.000	0.215	0.194
16 Field life of flower																1.000	0.864**
17 Vase life of flower																	1.000

\* - Significance at 0.05 level of probability

\*\* - Significance at 0.01 level of probability.

#### 4.4 PATH COEFFICIENT ANALYSIS

The genotypic correlations between different characters under study were subjected to path coefficient analysis for partitioning the direct and indirect effects of these traits on flower yield per plant which was considered as the dependent variable. The direct and indirect effects of various traits are given in Table-11.

##### 4.4.1 Direct effects

The highest positive direct effect on flower yield per plant was exerted by number of whorls (0.619) followed by number of leaves (0.425), stalk length (0.366) and width of ray floret (0.342). Among the other traits with positive direct effect on flower yield per plant were field life of flower (0.261), leaf area (0.210), number of suckers (0.151), number of days from bud to bloom (0.140), length of ray floret (0.129) and length of involucre (0.063). The direct effects shown by rest of the characters were negative irrespective of their moderate to high positive correlation with flower yield. Spread of the plant had a moderate negative direct effect (-0.273) followed by diameter of the flower (-0.242), stalk diameter below capitulum (-0.222) and stalk diameter at centre of stalk (-0.140). The negative direct effects shown by vase life and days to first flowering were very low in magnitude.

#### 4.4.2 Indirect effects

Maximum indirect positive effect was exerted by flower diameter (0.488) and length of ray floret (0.454) on flower yield per plant through number of whorls while the indirect effect was medium to high from number of suckers (0.416), vase life (0.360), field life of flower (0.356), spread of plant (0.337) and stalk length through number of leaves. Number of leaves, number of suckers, spread of plant, stalk diameter at centre of stalk, stalk diameter below capitulum, width of ray floret and vase life exerted medium positive indirect effect through number of whorls. Vase life, field life of flower, number of leaves and number of suckers exerted medium to low effect through stalk length. It is seen that many characters showing high to medium indirect effect act either through number of whorls or number of leaves or stalk length.

Maximum negative indirect effect was exerted by number of days from bud to bloom (-0.468) and days to first flower opening (-0.235) via number of whorls. High to medium negative indirect effect was exerted by days to first flower opening and number of days from bud to bloom via number of leaves and number of suckers through spread of plant and length of floret via flower diameter.

Maximum total indirect effect was contributed by spread of plant (0.995) followed by diameter of flower (0.973),

Table 11 : Genotypic path analysis ( number of flowers per plant) as dependent character in gerbera

Characters	1	2	3	4	5	6	8	9	10	11	12	13	14	15	16	17	$r_{g}$ with yield/plant
1 Number of leaves	<u>0.425</u>	0.047	-0.217	0.148	0.002	-0.093	0.220	-0.083	-0.056	-0.141	0.273	0.081	0.079	0.015	0.218	-0.062	0.850**
2 Leaf area	0.095	<u>0.210</u>	-0.166	0.023	0.002	-0.049	0.098	-0.104	-0.066	-0.117	0.134	0.065	0.178	-0.001	0.087	-0.013	0.375
3 Spread of plant	0.337	0.128	<u>-0.273</u>	0.113	0.002	-0.086	0.167	-0.087	-0.052	-0.134	0.272	0.076	0.124	0.007	0.171	-0.043	0.723**
4 Number of suckers	0.416	0.032	-0.204	<u>0.151</u>	0.002	-0.096	0.208	-0.078	-0.053	-0.141	0.283	0.079	0.057	0.015	0.219	-0.062	0.827**
5 Days to first flowering	-0.303	-0.108	0.189	-0.099	<u>-0.004</u>	0.059	-0.162	0.172	0.104	0.148	-0.235	-0.084	-0.209	0.005	-0.202	0.055	-0.673**
6 Number of days from bud to bloom	-0.281	-0.073	0.167	-0.104	-0.001	<u>0.140</u>	-0.149	0.118	0.085	0.212	-0.468	-0.110	-0.168	0.006	-0.160	0.052	-0.735**
8 Stalk length	0.256	0.056	-0.125	0.086	0.002	-0.057	<u>0.366</u>	-0.101	-0.063	-0.098	0.085	0.060	0.051	0.031	0.196	-0.060	0.686**
9 Stalk diameter below capitulum	0.160	0.098	-0.107	0.053	0.003	-0.075	0.167	<u>-0.222</u>	-0.134	-0.185	0.331	0.105	0.253	-0.006	0.145	-0.054	0.532*
10 Stalk diameter at centre of stalk	0.170	0.099	-0.102	0.057	0.003	-0.086	0.164	-0.212	<u>-0.140</u>	-0.195	0.375	0.105	0.253	-0.009	0.146	-0.056	0.573**
11 Flower diameter	0.248	0.101	-0.151	0.088	0.002	-0.123	0.148	-0.170	-0.112	<u>-0.242</u>	0.488	0.127	0.235	-0.004	0.152	-0.056	0.731**
12 Number of whorls	0.188	0.045	-0.120	0.069	0.001	-0.106	0.050	-0.118	-0.085	-0.191	<u>0.619</u>	0.095	0.177	-0.016	0.062	-0.041	0.629**
13 Length of ray floret	0.266	0.106	-0.160	0.092	0.002	-0.120	0.170	-0.180	-0.114	-0.237	0.454	<u>0.129</u>	0.224	0.004	0.172	-0.060	0.749**
14 Width of ray floret	0.098	0.109	-0.099	0.025	0.002	-0.069	0.055	-0.164	-0.103	-0.166	0.319	0.085	<u>0.342</u>	-0.012	0.110	-0.035	0.496*
15 Length of involucre	0.101	-0.003	-0.031	0.035	0.000	0.013	0.181	0.020	0.021	0.016	-0.160	0.007	-0.067	<u>0.063</u>	0.082	-0.019	0.260
16 Field life of flower	0.356	0.070	-0.179	0.127	0.003	-0.086	0.275	-0.123	-0.078	-0.141	0.148	0.085	0.144	0.020	<u>0.261</u>	-0.064	0.817**
17 Vase life of flower	0.360	0.038	-0.161	0.128	0.003	-0.101	0.300	-0.165	-0.107	-0.188	0.346	0.106	0.165	0.017	0.228	<u>-0.073</u>	0.894**
Total indirect effect	0.431	0.166	0.995	0.667	-0.661	-0.874	0.319	0.754	0.712	0.973	0.010	0.619	0.155	0.196	0.557	0.969	

Diagonal values = Direct effect

Residual = 0.033.

vase life (0.969), stalk diameter below capitulum (0.754) and stalk diameter at centre of stalk (0.712). The contribution of unknown factors (residual effect) to the total variability in yield per plant at genotypic level was 0.033.

**CHAPTER - V**

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**DISCUSSION**

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## V. DISCUSSION

Any specific genetic improvement depends on the availability of source material for incorporation in the breeding programme. The source material for genetic improvement would be identified by study of amount of variability available in the genepool or germplasm. This necessitates the evaluation of the collected germplasm for various requirements in one single environment. Accordingly 20 genotypes of *Gerbera jamesonii hybrida* were evaluated and the findings of the present investigations are discussed under the following headings :

- 5.1 Performance of genotypes
- 5.2 Variability
- 5.3 Heritability and genetic advance
- 5.4 Correlations
- 5.5 Path coefficient analysis.

### 5.1 PERFORMANCE OF GENOTYPES

#### 5.1.1 Growth parameters

Evaluation of high yielding genotypes is essential since a superior genotype may exhibit its potentiality when grown under a given set of agro-climatic conditions. In the present investigation, the genotypes differed significantly with respect to different growth parameters such as number of

leaves, leaf area, plant spread and number of suckers. The varietal differences which were noticed in growth parameters of different genotypes at early stages maintained the trend throughout the growth period. At all the stages 'Pride of Pong' recorded the highest number of leaves. It also recorded highest leaf area, spread of plant and number of suckers leading to increase in the number of leaves and plant spread. In chrysanthemum, Chezhiyan *et al.* (1985) observed similar results for plant height, number of branches and plant spread. In marigold 'Cupid Orange' variety which showed highest number of branches also showed highest leaf area and plant spread (Nalawadi, 1982).

#### 5.1.2 Reproductive attributes

The genotypes showed significant differences for reproductive attributes like days to first flower opening and number of days from bud to bloom (Table-5). 'Pride of Pong', 'Pink Favourite', 'Day Light' and 'Sweet Dream' were early flowering types, which took less number of days for the first flower to open. The increased number of leaves, more spread of the plant and increased production of suckers might have lead to the early production of flowers in these varieties whereas, varieties 'Red Board', 'Cream Son' and 'HH of Sikkim' were late flowering types since the rate of leaf and sucker production was low. The classification of some chrysanthemum varieties as early flowering and late flowering types was reported by Singh

and Dadlani (1989). Varieties 'Sharadmala', 'Hemant Sagar', 'Red Gold' and 'Basanti' belonged to the former group while 'Vasantika', 'Flirt', 'Meera' and 'Shanti' were recorded as late flowering types. The number of days taken to bloom from appearance of bud was least in 'Pride of Pong' followed by 'Double Galve Indu Magnet', 'Rowel Pride', 'Pink Perfection' and 'Asha' and the highest number of days was taken by 'Snow Gleen'. The flower opening from appearance of bud was generally early in varieties with more number of suckers, more leaves, and higher leaf area. In the findings of Bhattacharjee (1981) also, the earliest flower bud opening from its appearance was observed with 'Lady Mary Herbert' and 'Primerose Queen' which had fairly higher number of suckers and higher leaf area index.

### 5.1.3 Flower yield (total number of flowers) per plant

The month wise flower yield (Table-6) indicate that the early flowering genotypes viz., 'Day Light', 'Pink Favourite', 'Pride of Pong', 'Pink Perfection' and 'Sweet Dream' flowered in December. All genotypes flowered in January, except, 'Red Board' which flowered in February and was a late flowering genotype. The flower production was stabilized from February and it was maximum in March. The decline in flower production from April and the decreased flower production in May is attributed possibly to prevailing of high temperature. The reduced flower production in June and July is due to

these genotypes which is very much desirable. The difference in the flower characters may be attributed to genetic potentiality of the genotypes. While evaluating 31 varieties of gerbera, Bhattacharjee (1981) noted genotypic differences among the varieties for different flower characters. In his studies longest flower stalk was noticed in 'Lady Mary Herbert' and 'Orange Boven' and the shortest in 'Salmon Pink' and the highest flower diameter in 'Indu Kumari' and lowest in 'Orange Boven'. Bhattacharyya *et al.* (1976) also noted varietal difference for flower diameter in Dahlia and they recorded highest flower diameter in variety 'Master piece'. The flower retention in the plant was highest in genotypes 'Sweet Dream', 'Pride of Pong' and 'Subarna Yellow'. The increased retention of flowers in the plants may be due to more number of leaves coupled with longer length of the flower stalk. Bhattacharjee (1981) noted longer retention of flowers in gerbera variety 'Debendra's Glory' which had fairly higher number of leaves and long stalk.

#### 4.1.5 Vase life

The genotypes differed significantly for vase life and the flowers in 'Pride of Pong' lasted for highest number of days followed by 'Day Light' and 'Snow Gleen' had the least vase life. The varieties which had longer stalk length and wider petals lasted for more days than those with short stalk length and narrow petals (Accati and Jona, 1989).

Based on the vase life, they may be grouped into genotypes having good, medium and poor vase life. Genotypes 'Pride of Pong', 'Sweet Dream', 'Day Light', 'Subarna Yellow', 'Pink Perfection' and 'Pink Favourite' had good vase life, genotypes 'Snow Gleen' 'Sun Gleen' 'Sath Baba' exhibited poor vase life and rest of the genotypes were having medium vase life. Similar classification was done by Nalawadi *et al.* (1980). They classified 'Firefly', 'Mins Glory', 'Kasju Glory' and 'Saborna' as varieties with good vase life, varieties 'Dr. H.C. Mukerjee', 'General Choudry', 'Sahitya' and 'Sunset' were with medium vase life and varieties 'Bhim Bhadur', 'Swadeshi', 'Niranjan' and 'Vermilon Colour' as varieties with poor vase life.

## 5.2 VARIABILITY

Genetic variability present among genotypes for a character to be improved is the most important and basic factor for successful breeding programme. In its absence the desirable response to selection cannot be expected. Therefore it is necessary for a plant breeder to assess the breeding material under consideration to findout the extent of genetic variability existing for various characters. Analysis of variance for different characters revealed that there were significant differences among the genotypes. This suggested that sufficient amount of variability existed for the characters studied and considerable improvement can be

achieved in these characters through selection. However analysis of variance by itself is not enough and conclusive to explain all the inherent genotypic divergence in the collection. High genotypic and phenotypic coefficients of variation were observed for number of flowers per plant followed by leaf area, number of leaves and number of whorls. Similar results were obtained for number of flowers per plant in chrysanthemum (Ponnuswamy, 1985). Barigidad (1991) observed similar results for leaf area and number of flowers per plant in chrysanthemum under Dharwad conditions.

High value of PCV along with GCV indicated that the environmental component was not so high. High GCV is important for plant breeders for effective utilization of the existing variability for future breeding programmes.

The characters with low PCV and GCV were; number of days from bud to bloom, stalk diameter below capitulum, length of involucre and stalk diameter at the centre of stalk. Ponnuswamy (1985) reported low coefficients of variation for earliness in chrysanthemum. Similarly, Manjunath Rao (1982) observed low to medium PCV and GCV for stalk girth and low variance for days to first flower in China aster.

Phenotypic and genotypic coefficients of variation were medium for characters like stalk length, flower diameter, number of suckers per plant and field life of flower. These

results were in accordance with the results observed by Kannan and Rammdas (1990) in gerbera under Coimbatore conditions.

Differences between PCV and GCV were narrow for all the characters studied indicating that these were not much influenced by the environment and the traits are predominantly under genetic control. Manjunath Rao (1982) reported medium differences between phenotypic coefficients of variation and genotypic coefficients variation for the character number of laterals per plant and narrow difference for all other characters in China aster.

### 5.3 HERITABILITY AND GENETIC ADVANCE

The effectiveness of selection for any character depends not only on the amount of variability present in the population, but also on the extent to which the variability is transformed from parents to offsprings. The heritability estimate offers such a measure. High heritability values for different characters are important to a plant breeder as these will enable to base his selection, reliably on the phenotypic performance. High heritability accompanied with high genetic advance is more useful than heritability values alone for predicting resultants of selection (Johnson *et al.*, 1955). The magnitude of heritable variability is the most important aspect of the genetic constitution of any breeding material, which has close bearing on the response to selection (Panse, 1957).

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The broad sense heritability estimates obtained were generally high for all the characters studied except for field life of flower and vase life. Higher heritability values were recorded for number of whorls, length of ray floret, leaf area, days to first flower opening, spread of plant, number of suckers, number of leaves and stalk length. Similar heritability estimates were reported by Kannan and Rammdas (1990) for number of leaves per plant, number of flowers per plant, number of suckers per plant and stalk length. Ponnuswamy (1985) also observed high heritability for number of flowers per plant and plant spread in chrysanthemum. In China aster, Manjunath Rao (1982) reported high heritability values for flower size, days to flower and plant spread.

In the present investigation, fairly high genetic gain was observed for leaf area, days to first flower opening, spread of plant and stalk length. Total flower yield per plant, number of whorls, number of leaves, width of ray floret, number of suckers and length of ray floret recorded high genetic advance as per cent of mean along with high heritability. This is an important consideration in breeding programme. Otherwise, a character with high heritability might give low genetic gain due to very less phenotypic variation. Number of days to first flower opening had a high genetic advance together with high heritability which indicates the additive gene effects (Panse, 1957) and selection for these

characters would be effective. Ponnuswamy *et al.* (1985) recorded high genetic advance along with high heritability for earliness to flower in chrysanthemum.

High heritability with medium genetic advance was observed for total flowers per plant, stalk length, spread of plant and number of leaves. Similar results were recorded by Bhattacharjee and Wahi (1982) in Dahlia.

High heritability value with low genetic advance were obtained for number of days from bud to bloom, stalk diameter below capitulum, stalk diameter at centre of stalk and length of involucre. Characters having low or medium heritability along with low genetic gain had predominance of non-additive gene action (Panse, 1957).

#### 5.4 CORRELATIONS

Information on correlations between important economic traits are of considerable help in the selection programme. This is because correlation ensures simultaneous improvement in one or more variables and negative correlations bring out the need to obtain a compromise between the desirable traits. Correlation between characters may be due to either pleiotrophy or genetic linkage (Harland, 1939). Knowledge of association of various characters among themselves and also with economic characters provide necessary information on indirect selection for improvement of economic characters.

Generally, genotypic correlations will be higher than phenotypic correlation. The relationship between phenotypic, genotypic and environmental correlations as discussed by Falconer (1981) emphasized that for the characters having high heritability, environmental correlations are in general expected to be lower than the genotypic correlations. Since phenotypic correlations include a part of genotypic correlations and part of environmental correlation corresponding to the heritable portion of variation in two characters. Relationship could be obtained from simple correlation coefficients which helps in determining the direction and the number of characters to be considered in improving economic characters. High correlation between two characters indicates that selection for the improvement of one character leads to the improvement in the other character depending upon the magnitude of association between them. The characters are considered to be independent when weak correlation exists between them and selection for a character may not affect the other, in such cases.

In the present study it was observed that, for most of the characters, genotypic correlation coefficients were higher than phenotypic correlation coefficients. Similar results were observed in China aster by Manjunath Rao (1982) and in chrysanthemum by Chaugule (1985). In most of the cases the phenotypic and genotypic correlations were very close or almost equal indicating less environmental influence.

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significant correlation of yield with spread of plant, stalk length and number of branches in China aster. Nalawadi (1982) observed positive correlation of flower yield with flower size, leaf area, plant spread and branches per plant. Kannan and Rammdas (1990) observed positive association between flower yield and flower retention in the plant (field life of flower). All these results support the findings of present investigation.

The strong association of flower yield with number of side shoots and plant spread indicate that with the increase in the number of suckers and spread of plant, the flower yield per plant can be increased which is very much desirable. This suggests us to go for plants with more spread and more number of suckers. Similar suggestions were made by Misra (1987) in Dahlia.

The flower diameter had positive association with stalk length, stalk diameter below the capitulum, stalk diameter at centre of the stalk and flower yield per plant. These results indicate that selection for any one of these important characters would lead to simultaneously improvement in the other character. These results are in agreement with the results obtained by Kannan and Rammdas (1990) in gerbera at Coimbatore conditions.

In gerbera vase life is another important trait. In the present investigation this trait was found to have positive

association with number of leaves, number of suckers, stalk length, stalk diameter below the capitulum, stalk diameter at centre of the stalk, length of ray floret, width of ray floret and diameter of flower. These results are in line with the results obtained by Ashwath and Parthasarathy (1994). The increased number of leaves might have helped the flowers to accumulate more of carbohydrates thereby increasing the vase life. These results suggests the need to go for flowers with long stalk, more stalk girth and more flower diameter and wider petals so as to achieve better vase life. Accati and Jona (1989) noted positive association of vase life with petal width and length of the floral stalk. This indicates that with the increase in width of petals and floral stalk length increase in the vase life can be obtained.

The length of involucre did not show much association with any character studied except with stalk length. So length of involucre has less significance in selection. Ashwath and Parthasarathy (1994) were also of the same opinion.

#### 4.5 PATH COEFFICIENT ANALYSIS

The correlation values denote only the nature and extent of association existing between pairs of characters, without revealing the cause and effect relationship. A dependent character like flower yield is controlled by several component characters which are inter related in a complex

manner and these mutual associations will influence the net association observed between a component and yield. A change in any one component is likely to disturb the whole network of cause and effect relationship. So each component has two paths of action; direct effect on flower yield and indirect effects through components which are not revealed from the mere correlation studies. Path analysis is useful in unravelling these two effects and was first suggested by Wright (1921) and subsequently elaborated by Li (1956). This is simply a standardised partial regression analysis, which is based on cause and effect relationship which serves to analyse by subdividing correlation in a causal scheme. This is being extensively utilized by plant scientists so as to get a clear picture of association of various plant characters.

In the present investigation, number of whorls had the highest positive direct effect which also had positive and significant correlation with the yield. This was followed by number of leaves, stalk length and width of ray floret. Barigidad (1991) noted medium direct effect of diameter of flower with yield.

The number of leaves and leaf area had positive indirect effect via number of whorls. The number of suckers had low direct effect on yield but their genotypic correlation was positively significant which was mainly due to its positive

indirect effects via number of leaves and number of whorls. These results are in line with the results obtained by Barigidad (1991) in chrysanthemum.

Maximum total indirect effect was contributed by spread of plant, flower diameter, stalk girth and number of suckers. Chaugule (1985) in chrysanthemum observed maximum indirect effects in case of number of branches per plant and plant height.

Spread of the plant; stalk diameter and flower diameter were also important as their total indirect effect on flower yield was high.

Of all these characters number of whorls, stalk length, width of ray floret had high direct effect and spread of the plant, stalk diameter and flower diameter had high indirect effect, thus selection considering these characters will result in substantial improvement of the crop.

#### PRACTICAL APPLICATIONS OF PRESENT INVESTIGATIONS

A study conducted to know the consumer preference for different floret colours indicated more preference for red, pink, orange colour and their shades (Appendix-IV). So, based on this genotypes like 'Pride of Pong', 'Red Board', 'Pink Supreme', 'Pink Perfection', 'Double Galve Indu Magnet', 'Sweet Dream' and 'Asha' are found to be good for transitional tract of Northern Karnataka.

On the basis of foregoing discussions the most promising genotypes for transitional tract of Karnataka are 'Pride of Pong', 'Sweet Dream', 'Cream Beauty', 'Double Galve Indu Magnet', 'Pink Perfection' 'Subarna Yellow' and 'Day Light' for different economically important characters.

#### FUTURE LINE OF WORK

In the light of the findings of present investigations the following studies are suggested;

1. Diversity among these genotypes can be studied for the further crop improvement.
2. Production of hybrids involving the elite genotypes are worthwhile.
3. Standardisation of production technology including nutrition requirements, plant density, shade requirement etc. for the genotypes suggested for cut flower production can be taken up.
4. Studies to enhance the vase life by use of different floral preservatives may be taken up.
5. Micropropagation of elite genotypes may be initiated.

**CHAPTER - VI**

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**SUMMARY**

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## VI . SUMMARY

The present studies were undertaken in 'Floriculture Unit' of Division of Horticulture, University of Agricultural Sciences, Dharwad to evaluate twenty *Gerbera jamesonii hybrida* genotypes under transitional tract of Northern Karnataka and to know the genetic variability present in the population along with association between different characters under study. The experiment was conducted in a randomised block design with three replications. The salient features of the experimental findings are summarised below.

1. Wide and significant variations for all the characters were observed among the genotypes studied.
2. 'Pride of Pong' showed superior performance for all growth parameters viz., number of leaves, leaf area, spread of plant and number of suckers per plant.
3. 'Pride of Pong' was the earliest genotype to flower and it also took the least number of days to bloom from the appearance of bud.
4. Flower yield per plant was highest in 'Pride of Pong'. However, 'Cream Beauty', 'Double Galve Indu Magnet' and 'Sweet Dream' were statistically on par with 'Pride of Pong'.
5. The longest floral stalk was recorded in 'Cream Beauty' and the shortest in 'Snow Gleen'.

6. The flower size was largest in 'Pride of Pong' and smallest in 'Snow Gleen'.
7. The highest number of whorls were recorded in 'Double Galve Indu Magnet'.
8. The length of ray floret was highest in 'Pride of Pong' where as, width of ray floret was highest in 'Double Galve Indu Magnet'.
9. The flowers were retained in the plant and vase for the highest number of days in genotype 'Pride of Pong'.
10. Phenotypic coefficient of variation and Genotypic coefficient of variation were observed to be high for flower yield per plant.
11. Phenotypic coefficient of variation and Genotypic coefficient of variation were observed to be medium for number of leaves, leaf area, spread of plant, number of suckers, days to first flower opening, stalk length, diameter of flower, number of whorls, length of ray floret, width of ray floret, field life of flower and vase life.
12. Low Phenotypic coefficient of variation and Genotypic coefficient of variation were recorded for number of days from bud to bloom, stalk diameter below the capitulum and stalk diameter at centre of the stalk.

6. The flower size was largest in 'Pride of Pong' and smallest in 'Snow Gleen'.
7. The highest number of whorls were recorded in 'Double Galve Indu Magnet'.
8. The length of ray floret was highest in 'Pride of Pong' where as, width of ray floret was highest in 'Double Galve Indu Magnet'.
9. The flowers were retained in the plant and vase for the highest number of days in genotype 'Pride of Pong'.
10. Phenotypic coefficient of variation and Genotypic coefficient of variation were observed to be high for flower yield per plant.
11. Phenotypic coefficient of variation and Genotypic coefficient of variation were observed to be medium for number of leaves, leaf area, spread of plant, number of suckers, days to first flower opening, stalk length, diameter of flower, number of whorls, length of ray floret, width of ray floret, field life of flower and vase life.
12. Low Phenotypic coefficient of variation and Genotypic coefficient of variation were recorded for number of days from bud to bloom, stalk diameter below the capitulum and stalk diameter at centre of the stalk.

**CHAPTER - VII**

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\* Original not seen.

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# APPENDICES

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**APPENDIX-I : Monthly meteorological data for the cropping season and the average of 45 years (1950-95) of the Main Research Station, UAS, Dharwad**

Months	Rainfall (mm)		Temperature (°C)				Relative humidity	
	1994-95	1950-95	Mean maximum		Mean minimum		1994-95	1950-95
			1994-95	1950-95	1994-95	1950-95		
September	52.6	107.0	27.5	28.1	19.2	19.7	86.0	81.2
October	164.2	130.1	29.0	29.6	20.1	18.7	83.0	73.7
November	0.0	34.6	28.0	28.7	16.4	15.9	85.0	65.7
December	0.0	3.3	28.0	18.8	12.4	13.6	84.0	61.6
January	5.2	0.7	27.7	29.3	13.7	13.6	83.0	60.9
February	0.0	0.0	32.6	34.2	16.7	15.3	73.0	54.2
March	0.0	6.3	35.1	35.0	19.1	18.3	68.0	55.0
April	20.6	51.0	36.8	36.3	21.3	20.4	66.0	58.9
May	56.6	91.8	33.8	35.9	21.3	21.0	68.0	65.7
June	143.4	118.86	31.4	29.3	22.1	20.7	75.0	80.0
July	184.4	160.44	27.1	26.5	21.0	20.5	87.0	86.2
August	50.5	103.60	28.4	26.6	20.7	20.2	86.0	84.4

## APPENDIX-II: Physical and chemical properties of soil from the experimental site

Particulars	Value obtained	Method adopted
<b>A. Physical properties</b>		
Clay (%)	35.20	Sankaram (1966)
Silt (%)	9.20	Sankaram (1966)
Fine sand (%)	30.44	Sankaram (1966)
Coarse sand (%)	25.16	Sankaram (1966)
<b>B. Chemical properties</b>		
Total N (kg/ha)	285.00	Modified Kjeldahl's method (Jackson, 1967)
Available P <sub>2</sub> O <sub>5</sub> (kg/ha)	11.40	Olsen's method (Muhr <i>et al.</i> , 1963)
Available K <sub>2</sub> O (kg/ha)	260.00	Flame Photometer (Muhr <i>et al.</i> , 1963)
Salts (m mhos/cm)	0.20	-----
pH	6.10	pH meter (Jackson, 1967)

APPENDIX-III : List of genotypes under study and their floret colour (RHCC.ref)  
in gerbera

Genotypes	Floret colour
1 Asha	Rose (38-)
2 Cream Beauty	Cream (1-)
3 Cream Son	White (00)
4 Day Light	Outer 3 whorls burnt orange (12), inner whorls old gold (5)
5 Double Galve Indu Magnet	Outer 4-5 whorls purple (39-), inner whorls purple (39)
6 HH of Sikkim	Outermost whorl is canary (3-), inner whorls buttercup yellow (4-)
7 Missri White	White (00)
8 Orange Gleem	Outer 3 whorls mimosa (2), inner whorls canary (3)
9 Pink Favourite	Outer 4-5 whorls flesh (22-), inner whorls rose pink (37)
10 Pink Perfection	Outer 2-3 whorls rose pink (37) and inner whorls rose (38-)
11 Pink Supreme	Rose pink (37+)
12 Pride of Pong	Cherry red (26)
13 Red Board	Crimson (32-)
14 Rowel Pride	One innermost whorl old gold (5) and other whorls buttercup yellow (4)
15 Salmon Pink	Buttercup yellow (4-)
16 Sath Baba	Carrot red (17)
17 Snow Gleem	Outer 4-5 whorls white (00) and inner whorls cream (1-)
18 Subarna Yellow	Canary (3+)
19 Sun Gleem	White (00) and one inner most whorl cream (1-)
20 Sweet Dream	Outermost whorl mandarin red (24) and inner whorls orange (18+1)

Chart used in horticulture for identifying colour hues.

Cited by the National Bureau of Standards and the Royal Horticultural Society Colour Charts.

The numericals in the brackets indicate the colour number in the chart.

(+) Plus sign indicate the colour named is darker than the illustrated colour in the charts.

(-) Minus sign indicate the colour named is lighter than the illustrated colour in the charts.

From, Graf, A.B., Exotica 3 Pictorial Cyclopedia of Exotic Plants, 1970, pp.37-38.

## APPENDIX-IV : Consumer preference for floret colour in gerbera

Genotypes	Performance (per cent of consumers)		
	I	II	III
1 Asha	8	11	10
2 Cream Beauty	-	-	1
3 Cream Son	-	-	-
4 Day Light	1	5	9
5 Double Galve Indu Magnet	6	9	11
6 HH of Sikkim	-	-	-
7 Missri White	-	1	1
8 Orange Gleen	-	-	2
9 Pink Favourite	2	5	7
10 Pink Perfection	12	13	9
11 Pink Supreme	12	15	8
12 Pride of Pong	31	14	6
13 Red Board	11	12	10
14 Rowel Pride	-	2	7
15 Salmon Pink	-	-	-
16 Sath Baba	-	-	1
17 Snow Gleen	-	-	-
18 Subarna Yellow	-	-	3
19 Sun Gleen	-	-	-
20 Sweet Dream	17	13	15
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

