

## Dwarf Gerberas — Present And Future

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The genus *Gerbera* belongs to the family Compositae, the daisy family, like other ornamental crops such as chrysanthemum, dahlia, tagetes, aster, ageratum, zinnia and cineraria. It is predominantly an Old World genus of perennial herbs with about 35 species, mainly from tropical Asia, Madagascar, tropical and southern Africa and one species from the Tropical Andes of S.A. They are sun-loving plants, inhabiting temperate and mountainous regions.

Cultivated gerbera are mainly hybrids between *G. jamesonii* from the Transvaal (S. Africa) with yellow, bright orange, flame or copper red flowers and *G. ambigua* (syn. *viridifolia*) with white or pink flowers.

Gerberas are known in horticulture mainly as garden plants and cutflowers in the warmer climates and as cutflowers under glass in cooler climates.

Over the last 12 years they have dramatically increased in popularity on the European cutflower markets and according to the latest statistics in Holland, gerbera cutflower crops occupied 260 hectares of greenhouse space in 1982 vs. only 28 hectares in 1971!

On the other hand, pot gerberas are a very recent development. My husband discovered dwarf gerberas in a German mail order catalog for amateur gardeners about 20 years ago. They were supposedly developed by Prof. Sengbusch for use in window baskets and garden planters.

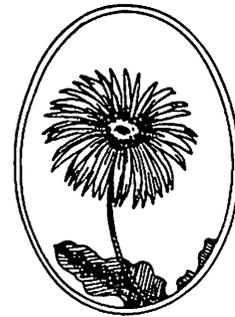
He took plants of this dwarf material to T. Sakata & Co., the famous Japanese seed firm, together with European and New Zealand gerbera varieties. From all the above stock, Sakata's breeders developed the first seed strain of modern pot gerberas. They named it 'Happipot' and released it to the Japanese market in 1977.

At the same time, plants were sent to us for evaluation, this certainly being the first importation of 'Happipot' pot gerberas in the west. Our firm started selection immediately, completely unaware of its future potential.

When I finished my studies at the Univ. of Reading in England, having worked in 7 years in the family Compositae, I decided to follow up my husband's work on dwarf gerberas. I set up an extensive breeding program in Holland, with the aim of improving the existing strain and developing new genetic lines.

Apart from the breeding work, I have been actively involved in the cultivation of pot gerberas. Careful observations are made by our firm on the growth and behavior of the crop in Holland and in other European countries, under different environmental conditions.

Since pot gerberas are a new introduction in hor-



ticulture, it is essential for growers to know how to grow them well, in order to have a successful crop with a high profit. Firstly, I would like to discuss the culture of pot gerberas, and secondly, the breeding work, and finally, their future.

### Cultural Notes

**Sowing of seed.** Dwarf gerbera seed is available, freshly harvested all year round. The seeds, sealed in moisture-proof packets, should be sown immediately after the packet has been opened. Sow without any pretreatment directly into either seedtrays or individual multipots filled with a sterilized standard seed-compost, rich in organic matter, with a pH of 6-6.5.

The seed should be barely covered with a fine, sieved layer of the same soil mixed with coarse oasis, perlite or vermiculite. Broadcast evenly about 250 seeds in a standard tray (14" x 18"). Place trays on heated benches and water thoroughly.

**Germination.** Seeds germinate in both dark and light conditions, in a humid atmosphere at a temperature of 68°-77°F and uniform soil temperature of 68°F. Under the above conditions, seeds germinate within 6-10 days. Young seedlings should not be exposed to direct sunlight and should be kept well watered.

Since the seedlings are susceptible to fungal diseases, drench after sowing with fungicide and repeat if necessary. At low natural light conditions, the growth of seedlings can be accelerated by giving additional illumination.

**Pricking out.** When seeds have been sown densely, seedlings should be transplanted into 2"-2-1/4" pots or Jiffy strips, filled with a standard transplanting mixture. This can be done within 3-4 weeks from sowing, when the first 2 true leaves are well developed. Grade seedlings according to size in order to achieve a uniform growth and to minimize losses.

**Potting.** In 5-6 weeks, a rosette should develop with about 4-5 true leaves. At this stage, pot into a 4-3/4" pot filled with a sterilized, well drained, light soil mixture. Care should be taken to place the rosette at the soil surface in order to prevent rotting.

**Growing on.** After potting and once the plants are established, the most important environmental factors determining the success of the crop are *light* and *temperature*, since both are essential in regulating flowering. In order to understand their influence on the plant, it is important to know the growing pattern of gerberas.

Gerberas show a sympodial type of growth. That is to say: the main apex gives rise to a flowering bud. At the same time, a lateral flower bud is initiated at the axil of the uppermost leaf primordium, and a lateral vegetative shoot develops in the axil of the second leaf primordium.

This kind of growth continues with the lateral vegetative shoots — the apex gives rise to a flower bud, a lateral flowering bud develops at the axil of the uppermost leaf primordium, while a lateral vegetative shoot develops in the axil of the 2nd leaf primordium, and so on . . . .

Under high light intensity, gerberas give rise to the highest number of lateral shoots and hence initiate the greatest number of flowering buds. If the light intensity is reduced, a great number of the flower buds abort. In N. European countries flower abortion is generally observed during the winter months.

Flower abortion is, in fact, enhanced if at low light intensity, the temperature is raised. Under low temperature, more lateral shoots are initiated and more shoots flower. Low temperature also causes less flower bud abortion than high temperature. Under high light intensity, low temperature enhances but initiation and the development of more lateral shoots, hence more flowers are produced compared to high temperatures.

This is explained by the fact that high light intensities and low temperatures prevent leaf formation per continuation. We would, therefore, recommend the following regimes which may vary according to your specific conditions.

After potting, place plants on benches or on the floor in a light, well-ventilated greenhouse at a temperature of 64°-70°F to establish themselves. Once the plants are established, the temperature can be lowered.

Although gerberas can tolerate temperatures down to 50°F or even lower, it is recommended that the temperature be kept between 54°-64°F. At low light conditions keep the temperature low, otherwise plants will grow tall, the leaves will become elongated and eventually a few flowers will develop on long flowering stems.

During summer, when light intensity is high and relatively high temperatures prevail, flower bud initiation can be enhanced by reducing the temperature to 54°-59°F. The above low temperature treatment can be given to plants which have been established in the final pot and should be carried out for 2-3 weeks.

Additional illumination can be given during low natural light conditions, but only if the spectrum of the lamps is close to that of natural light. "True-light" lamps were found to increase growth rate and enhance flowering.

**Flowering.** The time from sowing to flowering depends on the time of the year. In the summer months, it takes as little as 3 months for the 1st plants to flower and on average, 4 months. In the winter, however, it takes longer for them to flower, between 5-6 months.

**Watering.** The plant's water demand depends on the developmental stage of the plant. Young plants must be kept well watered and drying out should be avoided. Once plants are well established in the pot, watering has to be regulated accordingly. Plants must be kept well drained and overwatering should be avoided.

The water quality must be good; if possible use rain water or a mixture of rain water and water cleaned by osmosis. It is always advisable to use luke-warm (temperature) water.

**Feeding.** Feed plants with a well balanced fertilizer which includes microelements. Gerberas are particularly susceptible to manganese deficiency.

**Spacing.** After potting plants in the final pot, they can be placed close together. Within 3-4 weeks, depending on the time of year, plants have to be spaced in order to give them more light and achieve a good habit.

### Pests And Their Control

Gerberas are vulnerable to a number of pests and diseases. The most important pests are leaf miners, mites and white flies.

**Leaf miners.** Treat as soon as first observed with *Temik*, *Pramex*, *Tamaron* or *Curamil*, which control both the adult insect and the larvae. If crops susceptible to leaf miners are grown in the neighborhood, then treat prophylactically.

**Mites.** Symptoms: Young shoots malformed; leaves curling inwards; in mature plants, flower petals show white striations. Mites can be treated with *Pentac* or *Vendex*.

**White flies.** Care must be taken to treat white flies as soon as they are first observed, or even before they appear. Spray with different synthetic *Pyrethrum* preparations and alternate, since white fly becomes resistant to the spray.

Other pests of minor importance that can attack gerberas are aphids, red spiders, slugs and thrips.

### Pathogens And Their Control

**Phytophthora.** *Phytophthora* is the most important pathogen. It appears at the crown of the plant or sometimes at the roots, and is noticeable when the base starts to rot. It is most likely to occur in the spring or autumn during periods of temperature fluctuation and when cold water is used for watering. Treat the crop with *Fongarid* which is applied in a spray form or added to the water.

**Pythium.** *Pythium* occurs when poor hygiene is practiced in the greenhouses.

**Botrytis.** *Botrytis* is most likely to appear in the crop under high relative humidity. Insure effective ventilation in the greenhouse and remove yellow-brown leaves periodically. It is not a problem with young plants that are carefully watered. Use *Rovral* to control it.

## Breeding And The Future Of Dwarf Gerberas

In our breeding work, we are striving for 2 goals. Firstly, to narrow the variation of the present commercial variety. That is, to select forms which show desirable characters and develop these forms into new varieties.

Secondly, to increase the variation by introducing and combining new genetic material into the current genetic pool. This can be done by crossing species which have never been used in the development of the modern cultivated gerbera, or by creating new types using artificial methods such as induction of mutations by means of irradiation or chemical treatments.

Before we go any further with the potential of breeding work, I have to explain a little about the complexity of the Compositae. This family is one of the most, if not the most, advanced and specialized families of flowering plants. Its complexity lies in the structure of the flower. When a breeder starts his work, he compiles a list of characters he would like to improve. In other families, 10-20 total characters may exist, but in Compositae at least as many characters can be found in the flower alone. Let us look at some of the characters we have included in our breeding program: (a) *Plant habit*: open habit or bushy, with a single crown of multiple crowns; (b) *Plant*: size and vigor; (c) *Leaf*: shape, size, color & texture; (d) *Flowering stem*: length & strength; (e) *Periodicity of flowering*: how many flowers appear at the same time, whether they are formed all at once or at regular intervals after each other & whether the plants continue to flower over a period of time (i.e., 1 mo. to 1 yr.); (f) *Flowering pattern of the plant*: whether the flowers are developed in the center of the plant surrounded by a rosette of leaves or whether the flowers arise in between the leaves.

**FLORAL CHARACTERS.** The family is named Compositae because each head, the capitulum, consists of several small flowers. In the genus *Gerbera* and in particular in its cultivars, the number of florets per head varies from 200-1200 or more.

In the periphery of the head are the female flowers which are of 2 kinds. The outer female florets are the ligulate florets, each with a colored, petal-like projection and the inner are the disc female florets with no petal-like projection. In the disc, immediately after the female florets, are the hermaphrodite florets which are functionally male.

The main characters which give the different appearance of the flowers in gerberas are the following: (a) The size of the head; (b) The relative size of the corona, collectively the ligulate female florets, to the disc; (c) The color of the ligules, which may be self or bicolored; (d) The color of the disc, which may be different from the color of the ligules (e.g., black disc with red ligules); (e) The number of ligule rows. This varies from 1-5 in single flowers, 5-10 in semi-doubles and 10-20 or more in fully-doubles. In the latter, the whole disc is replaced by ligule-like florets; (f) The relative size of the ligules. In the semi-doubles in particular, the inner ligules become gradually reduced.

As you can see from the above mentioned characters, the breeder's task is complicated by the great number of morphological characters he has to incorporate in his breeding work. In conjunction with the morphological characters, his selection should also include physiological as well as developmental characters which are just as important, such as: (a) Vigor of the seed, which will eventually determine the percentage of germination of the seed strain; (b) Earliness of flowering; (c) Evenness of flowering; (d) Response to different light intensities & different temperature regimes; (e) Resistance to pests & diseases.

Having given you an idea of our breeding goals for the dwarf gerbera, we come to the problem of the actual breeding mechanism in Compositae. In other families, it is possible to select desirable forms and self them, so that in a few generations, one can end up having a uniform, marketable product.

In Compositae, in general (with exceptions), there is a very strong inbuilt mechanism which prevents selfing. This is achieved by genetic means as well as by the two sexes being separated in time and space. That is, the female flowers are separated from the male flowers on each head and the former mature and are receptive to pollen before the pollen of the head is shed.

Because of this, they have to be pollinated with pollen from another head and, therefore, are usually cross pollinated. Each female floret can potentially give rise to a single seed which may be genetically different from other seeds of the same head.

In the wild, insects visit several flowers and pollinate the female of the same head with many different kinds of pollen. In this way variation is achieved, which is not always desirable to the breeder who is looking for uniformity.

What a breeder then has to do is to go against nature and try to self the flower with the pollen of an older head of the same plant. The result will be a very poor, weak specimen. Inbreeding can be carried out for very few generations. Once inbred lines are established and crossed with each other, F<sub>1</sub> hybrids can be produced which are very vigorous and uniform.

We make thousands of controlled crosses and many selfings annually. Careful observations and notes are made on each individual line, starting from the seed to the mature plant. The seed of every selected line is sown separately and notes on germination time and rate, growth and development, are made.

Lines vary greatly in their performance. For example, some lines have a very low germination percentage, which varies from 0-10% on inbred lines to 50-100% in out-crossed lines. Some lines germinate within 4 days from sowing and all the seed emerges at the same time. Other lines are very erratic in their germination, which is in fact commercially undesirable. This season alone we are testing 650,000 plants from progenies of our controlled crosses, each plant separately labeled.

In our selection work we also make careful notes on the earliness and uniformity of flowering. The earliest lines start flowering within 11 weeks from sowing and each plant produces many flowers. We make selections of the earliest, most uniform lines with good horticultural potential. Such combinations are repeated for commercial seed production and the parent plants are propagated vegetatively.

The best individuals of the best lines are used for further breeding work. Many new hybrid combinations which are now flowering for the first time are quite uniform in habit and color of flower, but differ in several micro-characters such as capitulum size, ligule shape, and number of ligules.

We expect that in a few years we will be able to produce several very uniform new F<sub>1</sub> hybrid dwarf gerberas that will look like cutting-grown stock.

At the same time as the above breeding work, we are working on making new selections of different kinds of mixtures. In fact, we improve the strains continually. We have now under test production mixtures of separate shades, i.e., mixtures of yellow, pale pastels, cream, bright red, carmine red, pink and orange.

In addition, we try to separate different groups of bicolors. For example, pink with white or orange with yellow. We also make selections of special forms of flower types, such as doubles, giant flowered types, flowers with divided ligules, narrow long ligules or very broad ligules.

Dwarf gerberas are not only useful as a pot plant. In southern countries with a mild climate, they can be successfully grown as a garden plant for bedding, borders, or in planters. We are now occupied in selecting forms which are especially adapted for such purposes.

The breeding of dwarf gerberas is just at its early stages. It is the beginning of a new era in pot plants and I am sure that in the near future you will be surprised by the many different types and forms adapted to suit different climates and different tastes. I am sure that dwarf gerberas will be the pot plant as well as the garden plant of the future.

*Adapted from a talk presented at the Ohio Florist Short Course, July 1984, in Columbus, OH, & published in BPI News, July 1985.*

*A man got on an airplane & the stewardess noticed something strange in his carry-on bag. "What do you have in that bottle?" asked the stewardess.*

*"Holy Water," the man replied.*

*The stewardess picked it up, smelled it & said, "Sir, this smells like whiskey."*

*The man replied in a surprised manner, "Good heavens, another miracle."*