

## Bedding Plants: Selection, Establishment and Maintenance<sup>1</sup>

---

Robert J. Black<sup>2</sup>

Bedding plants with their seemingly infinite variety of flower color and plant form fit into almost any landscape situation. They provide that necessary touch of color to an often drab landscape. Bedding plants can be grown in containers to add a splash of color to a porch, deck or patio area. They are also enjoyed as fresh and dry cut flowers and can be a very rewarding hobby.

Bedding plants can be annuals, biennials or perennials. Annuals are plants which are grown from seed, produce flowers and seed and die in one growing season. Biennials complete their life span within 2 years and perennials last for 3 years or longer. However, certain plants can be annuals, biennials or perennials depending on the locality or purpose for which they are grown.

Bedding plants are especially versatile in Florida. Many of them bloom during winter months, contributing splendidly to a colorful landscape and producing flowers for home decorations. Others grow and flower during the trying months of June, July, August and September, persistently blooming through the heat and heavy summer rains.

Culture of bedding plants in Florida is different from that in most states because Florida has three climatic regimes. During winter, nights are cool with an occasional freeze in central and south Florida and frequent freezes in north Florida. In early spring and late fall, nights are cool, whereas high night temperatures, heavy rains, and high relative humidity are typical during summer and early fall. Careful attention must be given to these climatic conditions if bedding plants are to be grown successfully in Florida. Petunias, pansies and snapdragons that grow well and flower under cool night temperatures (45-65°F) should be planted in the fall, winter and early spring. Bedding plants such as marigold, gazania, amaranthus, celosia, crossandra, impatiens, vinca and coleus that can tolerate high temperatures and humidity should be planted in late spring or early summer. Some plants such as wax begonias and salvias grow relatively well during both hot and cool seasons and can be planted year round in central and south Florida.

Florida's winter temperatures in the central and southern portions of the state are often not low enough to kill flowering plants such as geraniums and

- 
1. This document is CIR1134, one of a series of the Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date March 1, 1994. Revised September 1, 2006. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.
  2. Robert J. Black, former associate professor, Environmental Horticulture Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. U.S. Department of Agriculture, Cooperative Extension Service, University of Florida, IFAS, Florida A. & M. University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Larry Arrington, Dean

begonias. Although these plants are perennials and will grow outdoors for several years in mild climates, they should be treated as annuals and replaced with new, vigorous, disease- and insect-free plants each season. This will eliminate tall, unsightly plants and reduce the buildup of pathogens and insects.

While Florida gardeners are fortunate to have abundant sunshine and mild winters, they must contend with infertile sandy soils, plant pests and heavy rains which necessitate regular scouting and spot treatment of identified pests. The addition of bedding plants to the landscape will greatly increase maintenance. The home gardener should be aware of this and allocate more time for maintenance once the decision is made to grow bedding plants.

## Selection

It is difficult for the average home gardener to germinate seed and grow seedlings; therefore, most purchase large seedlings or young plants. Before purchasing bedding plants, the home gardener should decide how the plants will be used in the landscape. Bedding plants should serve as an accent to the landscape, not a dominant feature in the setting. Those used in front of the home should harmonize with the setting, and colors should blend with each other and with the home.

When selecting bedding plants for beds or borders, it is best to limit the choice to as few kinds as possible. Combinations of many flower colors and plant forms can distract from the overall appearance of the display. Attractive flower beds can be created by using one plant species.

Flower beds should be prepared before plants are purchased. Allowing plants to remain in their original containers for prolonged periods after purchase can have a negative effect on their performance after planting. Purchase plants when you're ready and plant them as soon as possible, preferably within twenty-four hours.

After beds are prepared and the kinds and quantity of bedding plants to be planted are determined, purchase good quality plants. Look for young, healthy, disease- and insect-free plants with dark green foliage. It is not necessary that plants are

in bloom when purchased. If plants reduced in price for sale have been subjected to water stress, are tall and spindly, or have nutrient deficiency symptoms, they are certainly not a bargain and should not be purchased. Plants that have been improperly maintained or held too long seldom recover, and if they do, they will never reach their full potential. This is true especially with celosias, marigold, pansies, salvias, snapdragons and zinnias.

Bedding plants can be purchased in compartmentalized plastic flats (cell packs) or in larger containers such as 4-inch pots. The plants grown in 4-inch pots are usually more expensive, but they are larger and therefore will produce more flowers sooner than plants grown in cell packs. As a result, beds established with plants grown in 4-inch pots are attractive sooner and for a longer period of the growing season than beds planted with plants grown in cell packs. Another advantage of planting plants grown in 4-inch pots is that because they are larger than cell pack plants, they will cover the bed sooner and help to control weeds.

Seasonal adaptation should be considered when purchasing bedding plants. Cool-season plants such as snapdragons and pansies that do well during winter are poor selections when purchased in March or April. To help select the correct bedding plant for a particular season, consult Table 1 .

Selection of bedding plants should be greatly influenced by the available light in an area. Some plants, such as marigold and ageratum, perform best in full sun. Others, such as coleus and dahlia, grow best in areas receiving several hours of morning or afternoon sun. There are no flowering plants that will perform well under heavy shade. However, plants such as crossandra and tuberous begonia grow best in areas receiving no direct sunlight. Optimum and acceptable light levels for many bedding plants are presented in Table 1.

Florida residents living within close proximity to beach front areas need to select bedding plants that are more tolerant of high winds, salt spray and irrigation water containing high levels of salt. Unfortunately, there is limited information on the tolerance of many bedding plants to these harsh growing conditions. However, some have been tested

on a beach front area in Florida and the results are presented in Table 2 (Tjia & Rose, 1987).

## Site Preparation

Bedding plant sites should be spaded or tilled at least six inches deep several weeks before planting. Florida's sandy soils have very low nutrient and water holding capacities. Incorporation of 2 to 3 inches of organic matter into planting beds will increase nutrient and water holding capacities of these soils. Organic materials such as compost or peat should be thoroughly mixed into the soil.

Garden soils, especially in recently developed areas, are frequently infertile. Flower beds should be fertilized prior to planting or at planting time and repeated on a monthly basis. Apply 6-6-6 or a similar complete fertilizer at the rate of 2 pounds (908 g) per 100 square feet (9.3m<sup>2</sup>) of bed area. Application rates for higher analysis fertilizers are presented in Table 3. Controlled release fertilizers are ideal for Florida's sandy soils. Plants usually grow much better with a continuous nutrient supply, and labor is reduced since controlled release fertilizer application frequency is less than for rapid release fertilizers. Controlled release fertilizers can be incorporated uniformly throughout the soil before planting and applied on the soil surface of established plantings.

Bedding plants can be damaged by nematodes. These microscopic worms are present in most soils in Florida and are likely to reach damaging levels where susceptible plants are grown repeatedly in the same area. Treating beds with a soil fumigant is highly desirable prior to planting. However, all fumigants are restricted use pesticides and must be applied by a professional pesticide applicator.

Other options for controlling nematodes include soil solarization and replacement of nematode-infested soil in beds (Dunn, 1992). Soil solarization is a non-chemical way to reduce soil pest populations, but it takes a lot of work and the area must be left bare 4 to 8 weeks during the summer. Clear polyethylene is used to cover moist soil that is ready to be planted. The heat generated by sunlight hitting the soil will be trapped in it and the soil temperature raise high enough to kill many nematodes in the upper few inches of the bed.

Replacement of nematode-infested soil with sterile soil or potting mix is a simple and fast method of managing nematodes, however, nematodes eventually will reinfest the "clean" soil.

Another approach to reducing nematode damage in bedding plants is to avoid planting nematode-susceptible plants. The susceptibility of some bedding plants to a common species of root-knot nematodes is presented in Table 4. This table should be used as a general guide, since it takes in account only one species of root-knot nematodes and different varieties and cultivars of bedding plants vary greatly in their susceptibility to damage by root-knot nematodes.

## Planting and Care

Bedding plants purchased in compartmentalized plastic flats usually have pot-bound root systems. If planted intact, the root system will be slow to establish in the surrounding soil and plants will suffer moisture stress. A preferred method is to loosen and untangle the root system without breaking the soil ball. Plants will usually recover rapidly and become established quickly. Tall and spindly plants should be pruned to half their original size to produce more attractive plants with more flowers. Spacing of plants in a bed should be based on the mature size of a particular plant (Table 1).

Bedding plants should be watered immediately after planting and daily until they have become established. After establishment, they should be watered on an "as needed" basis. Wilting will reduce flowering on many bedding plants and should not be allowed to happen. The frequency of irrigation will depend on soil type, exposure to sunlight, kind of bedding plant and season of the year. Some bedding plants growing in full sun during the summer may continue to require daily watering.

Water applied by an overhead sprinkler system can destroy the beauty of a flower bed by causing the flowers to rot or deteriorate rapidly. Bedding plants vary in their sensitivity to damage by overhead irrigation. Geraniums, celosias, marigolds, gerberas, verbenas, petunias, phlox, portulacas, cannas snapdragons, strawflowers and pentas are very sensitive to damage by overhead irrigation, while

begonias, pansies, coleus, caladiums, impatiens and New Guinea impatiens are tolerant to damage by overhead irrigation. Bedding plants should be watered by hand using a hose with a breaker attached or with a microirrigation system where only the soil and the root systems of the plants are wetted and flowers are not disturbed by splashing water from the irrigation system.

Weeds can be controlled either by mulching, applying preemergence herbicides and/or hand weeding. Mulches suppress weeds when the mulch material itself is weed-free and applied deeply enough to prevent weed germination or smother existing smaller weeds. The amount of mulch to apply will depend on the texture and density of the mulch. Compost and many wood and bark mulches are composed of fine particles and should not be applied any deeper than 2-3 inches (after settling). Excessive amounts of these fine-textured mulches around shallow-rooted plants can suffocate their roots causing chlorosis and poor growth. Mulches composed solely of shredded leaves, small leaves (oak leaves) or grass clippings should never exceed a 2-inch depth. These materials have flat surfaces, and tend to mat together restricting water and air to plant roots. Mulching materials should not come in contact with plant stems. The high moisture environment created by mulch increases the chances of stem rot which can result in plant death.

Pre-emergence herbicides can be very effective in managing weeds in bedding plants. In most cases, they should be applied after transplanting bedding plants to weed-free beds. Preemergence herbicides act by inhibiting the normal root development of small weeds before they emerge from the soil. In some cases, bedding plants species are tolerant of the herbicide, but more often, selectivity and safety are attained by placement. Because most weed seeds germinate within the upper half inch of soil, surface herbicide applications control them without injury to the bedding plant, which has roots normally growing well below the treated zone.

A weed management program for bedding plants based on the use of preemergence herbicides is complicated by the diversity of plants usually growing in the same bed. The herbicide may be safe

to use on one species in a bed, but can cause severe damage to other species in the same bed. The matter can become even more complicated because cultivars of the same species can respond quite differently to the same herbicide. In order to reduce the chances of damage, always check the label of a herbicide to see if it is registered for use on the plant species growing in a bed. If a species does not appear on the herbicide label, it is not legal to use the herbicide on that species even though the applicator assumes all risks and liabilities.

Hand weeding can be a very effective component of a weed management program. It should be considered when managing weeds in a few small beds or when herbicides cannot be used. Hand weeding is also a good option when herbicides are not effective in controlling all the weeds in a bed. Cultivation by hoeing and tilling is also effective in controlling small annual weeds. However, cultivation can stimulate the germination of weed seeds and reduce the effectiveness of herbicides by disrupting the contact of the herbicide with germinating weed seedlings.

Another approach to the culture of annuals in Florida is to grow them in pots. In areas where the soil is very poor or where tree roots limit growth, it is easier to plant small plants into inexpensive plastic pots filled with good soil and place the pots into flower beds. Sink pots into the soil until the top surface of the pots is at soil level. In addition to growing annuals where normally they will not grow, growing annuals in pots eliminates nematode problems, reduces water and fertilizer usage, and allows for easy replacement of plants in the flower bed.

## **Pests and Diseases**

Annuals may have insect and disease problems, and to maintain healthy and attractive plants these problems must be recognized and control measures initiated.

The best method of reducing insect and/or disease problems is to keep the plants growing vigorously and free from stress. Cultural practices that should help to reduce insect and disease problems are as follows:

1. Plant cool season bedding plants in the fall, winter and early spring and warm season bedding plants in the spring and summer months;
2. select a planting site which provides desirable growing conditions for a particular annual;
3. avoid planting in corners where light intensity and air circulation are minimal;
4. keep plants growing vigorously by following a regular fertilization and irrigation schedule;
5. avoid frequent wilting since water-stressed plants are more susceptible to infestation by thrips and red spider mites;
6. remove spent flowers from plants such as marigold, salvia, snapdragon, and geranium, which do not naturally fall from the plant;
7. prevent pathogenic fungal spores from germinating by keeping water off plants as much as possible and providing good air circulation around plants by allowing ample space between plants at planting; and
8. remove weeds from flower beds since they are frequently host to insects and/or disease organisms.

Bedding plants should be monitored frequently for insects and diseases. Infestations detected in the early stages can be controlled by spot treatment before the entire flower bed is infested. An insect infestation on a few plants can be controlled by picking insects off by hand or in the case of disease, by removing infected leaves. For severe infestations, chemical control will be needed. Contact your local County Extension Office for recommendations on selection and application of pesticides.

### Literature Cited

1. Dunn, R. A. 1992. *Nematode management in landscape ornamentals*. RF-NG013. Florida Cooperative Extension Service, University of Florida, Institute of Food and Agricultural Sciences.

- 2.
3. Tjia, B. and S. A. Rose. 1987. "Salt tolerant bedding plants". *Proc. Fl. State Hort. Soc.* 100:181-182.

### Table 1. Planting Guide

**Table 4.** Susceptibility of some annual ornamental plants to root-knot nematodes in Central Florida.\*

Table 1.

| Name                   | Exposure* |              |               | Cold Tolerance | North Florida** |              |                 | Central Florida |                 |                 | South Florida |              |                  |
|------------------------|-----------|--------------|---------------|----------------|-----------------|--------------|-----------------|-----------------|-----------------|-----------------|---------------|--------------|------------------|
|                        | Full Sun  | Sun AM or PM | No Direct Sun |                | Planting Date   | Removal Date | Planting Date   | Removal Date    | Planting Date   | Removal Date    | Planting Date | Removal Date | Spacing (Inches) |
| Ageratum               | xx        | ---          | ---           | Tender         | Mar. 1-15       | Aug.         | Mar. 1-15       | July            | Feb. 15-Mar. 15 | Feb. 1-Mar. 1   | June          | 10-12        |                  |
| Alyssum                | xx        | ---          | ---           | Tender         | Mar. 1-15       | July         | Mar. 1-15       | July            | Feb. 15-Mar. 15 | Oct. 1-15       | Mar. June     | 6            |                  |
| Amaranthus             | xx        | ---          | ---           | Tender         | Mar. 15-30      | Sept.        | Mar. 15-30      | July            | Mar. 15-30      | July-Aug.       | First Frost   | 14-18        |                  |
| Asters                 | xx        | ---          | ---           | Tender         | Mar. 1-15       | July         | Mar. 1-15       | June            | Feb. 15-28      | Oct. 15-Feb.    | June          | 12           |                  |
| Baby's Breath          | xx        | x            | ---           | Hardy          | Feb. 15-Mar. 15 | June         | Feb. 15-Mar. 15 | June            | Feb. - Mar.     | Aug.-Dec.       | Mar.-Apr.     | 12           |                  |
| Balsam                 | xx        | x            | ---           | Tender         | Mar. 15-30      | Aug.         | Mar. 1-30       | July            | Mar. 1-30       | Mar. 1-30       | June-July     | 8-12         |                  |
| Begonia (Nonstop)      | ---       | xx           | x             | Tender         | Mar. 1-15       | June         | Mar. 1-15       | May             | Feb. 15-28      | Nov.-Mar.       | May           | 12-14        |                  |
| Begonia (Tuberous)     | ---       | x            | xx            | Tender         | Mar. 1-15       | June         | Mar. 1-15       | May             | Feb. 15-28      | Oct.-Jan.       | Apr.          | 12-14        |                  |
| Begonia (Wax)          | xx        | x            | ---           | Tender         | Mar. 15-30      | Sept.-Oct.   | Mar. 15-30      | Sept.           | Feb. 15-28      | Sept.-Nov.      | Aug.          | 12-14        |                  |
| Browallia              | xx        | x            | ---           | Hardy          | Mar. 1-15       | Aug.         | Mar. 1-15       | Aug.            | Feb. 15-28      | Oct.-Feb.       | Aug.          | 12           |                  |
| Calendula              | xx        | ---          | ---           | Hardy          | Feb.-Mar.       | June         | Feb.-Mar.       | June            | Nov.-Feb.       | Jan.-Mar.       | May           | 8-10         |                  |
| Carnation (China Doll) | xx        | ---          | ---           | Hardy          | Nov.-Feb. 28    | June         | Nov.-Feb. 28    | May             | Nov.-Feb. 28    | Oct.-Jan. 15    | Apr.          | 8-10         |                  |
| Celosia                | xx        | ---          | ---           | Tender         | Mar. 15-July    | Seed Set     | Mar. 15-July    | Seed Set        | Mar.-July       | Feb.-Sept.      | Seed Set      | 14           |                  |
| Coleus                 | x         | xx           | ---           | Tender         | Apr.-Aug.       | Oct.         | Apr.-Aug.       | Oct.-Nov.       | Apr.-Aug.       | Mar.-Sept.      | First Frost   | 18-24        |                  |
| Calliopsis             | xx        | x            | ---           | Hardy          | Mar.-May        | First Frost  | Mar.-May        | First Frost     | Mar.-May        | Feb.-June       | First Frost   | 12           |                  |
| Cosmos                 | xx        | ---          | ---           | Tender         | Mar. 15         | Aug.         | Mar. 15         | July            | Feb.            | Nov.-Feb.       | June          | 12-14        |                  |
| Crossandra             | ---       | xx           | xx            | Tender         | May-July        | Oct.         | May-July        | Oct.            | Apr.-July       | Mar.-Aug.       | Nov.          | 8-12         |                  |
| Dahlia                 | ---       | x            | xx            | Tender         | Mar. 15-30      | Aug.         | Mar. 15-30      | Aug.            | Mar. 1-15       | Sept.-Dec.      | July          | 18-20        |                  |
| Dianthus               | xx        | ---          | ---           | Hardy          | Feb.            | July-Aug.    | Feb.            | July            | Feb.            | Oct.-Feb.       | June          | 10-12        |                  |
| Digitalis (Foxglove)   | xx        | x            | ---           | Hardy          | Sept.-Dec.      | July         | Sept.-Dec.      | July            | Sept.-Dec.      | not recommended |               | 12           |                  |
| Dusty Miller           | xx        | x            | ---           | Tender         | Feb.-Apr.       | Sept.        | Feb.-Apr.       | Aug.            | Feb.-Apr.       | Oct.-Mar.       | Aug.          | 12           |                  |

Table 1.

| Name                         | Exposure* |              |               | Cold Tolerance | North Florida** |                           |               | Central Florida           |               |                           | South Florida |              |                  |
|------------------------------|-----------|--------------|---------------|----------------|-----------------|---------------------------|---------------|---------------------------|---------------|---------------------------|---------------|--------------|------------------|
|                              | Full Sun  | Sun AM or PM | No Direct Sun |                | Planting Date   | Removal Date              | Planting Date | Removal Date              | Planting Date | Removal Date              | Planting Date | Removal Date | Spacing (Inches) |
| Exacum                       | xx        | xx           | ---           | Tender         | Mar.-July       | When overgrown            | Mar.-July     | When overgrown            | Feb.-Oct.     | When overgrown            | 12            |              |                  |
| Gaillardia                   | xx        | x            | ---           | Semi-Hardy     | Mar.-May        | Aug.                      | Mar.-May      | Aug.                      | Feb.-May      | Aug.                      | 12-18         |              |                  |
| Gazania                      | xx        | ---          | ----          | Hardy          | Mar.-May        | Nov.                      | Feb. 15-May   | Nov.                      | Nov.-May      | Nov.                      | 8             |              |                  |
| Geranium                     | xx        | x            | ---           | Tender         | Mar.-Apr.       | July                      | Feb.-Mar.     | July                      | Oct.-Mar.     | June                      | 16-30         |              |                  |
| Hollyhock<br>(Althaea rosea) | xx        | x            | ---           | Hardy          | Mar. 15-June    | First Frost               | Feb. 15-July  | First Frost               | Aug.-Sept.    | First Frost               | 12            |              |                  |
| Impatiens                    | ---       | xx           | x             | Tender         | Mar. 15-July    | First Frost               | Mar. 1-July   | First Frost               | Sept.-June    | First Frost               | 8-12          |              |                  |
| Kalanchoe                    | xx        | x            | ---           | Tender         | May-July        | First Frost               | May-Sept.     | First Frost               | Sept.-Dec.    | First Frost               | 12            |              |                  |
| Lobelia                      | xx        | x            | ---           | Tender         | Mar. 15-Apr.    | Aug.                      | Feb. 15-Apr.  | Aug.                      | Sept.-Feb.    | July                      | 6-8           |              |                  |
| Marquette Daisy              | xx        | ---          | ---           | Tender         | Feb. 15-Apr.    | June-July                 | Feb.-Apr.     | June-July                 | Oct.-Feb.     | June                      | 12-14         |              |                  |
| Marigold                     | xx        | ---          | ---           | Tender         | Mar. 15-May     | 3-4 months after planting | Mar.-Aug.     | 3-4 months after planting | Feb.-Dec.     | 3-4 months after planting | 8-24          |              |                  |
| Nicotiana                    | xx        | x            | ---           | Tender         | Mar. 15-July    | Aug-Sept.                 | Mar. 1-July   | Aug.-Sept.                | Feb-May       | July-Aug.                 | 16-24         |              |                  |
| Ornamental<br>Pepper         | xx        | ---          | ---           | Tender         | Mar.-July       | Oct.                      | Mar.-July     | Oct.                      | Mar.-Aug.     | Aug-Apr.-May              | 8-10          |              |                  |
| Pansy                        | xx        | ---          | ---           | Hardy          | Oct.-Feb.       | June                      | Oct.-Feb.     | June                      | Oct.-Jan.     | Apr.                      | 10-14         |              |                  |
| Pentas                       | xx        | x            | ---           | Tender         | Mar.-May        | Leaf disease              | Mar.-May      | Leaf disease              | All year      | Leaf disease              | 12-14         |              |                  |
| Petunia                      | xx        | x            | ---           | Hardy          | Oct.-Feb.       | May-June                  | Oct.-Feb.     | June                      | Sept.-Feb.    | May                       | 12-18         |              |                  |
| Phlox                        | xx        | ---          | ---           | Hardy          | Mar.-Apr.       | Aug.                      | Mar.-Apr.     | Aug.                      | Feb.-Mar.     | July                      | 8-14          |              |                  |
| Portulaca (Rose<br>moss)     | xx        | ---          | ---           | Tender         | Apr.-July       | First Frost               | Apr.-July     | First Frost               | Mar.-Aug.     | First Frost               | 10-12         |              |                  |
| Rudbeckia                    | xx        | ---          | ---           | Hardy          | Mar.-Apr.       | Aug.                      | Mar.-Apr.     | Aug.                      | Feb.-Mar.     | July                      | 15-18         |              |                  |

Table 1.

| Name                    | Exposure* |              |               | Cold Tolerance | North Florida** |                   |                 | Central Florida   |                 |                      | South Florida |              |                  |
|-------------------------|-----------|--------------|---------------|----------------|-----------------|-------------------|-----------------|-------------------|-----------------|----------------------|---------------|--------------|------------------|
|                         | Full Sun  | Sun AM or PM | No Direct Sun |                | Planting Date   | Removal Date      | Planting Date   | Removal Date      | Planting Date   | Removal Date         | Planting Date | Removal Date | Spacing (Inches) |
| Salvia                  | xx        | x            | ---           | Tender         | Mar.<br>15-Aug. | When deteriorated | Mar.<br>1-Aug.  | When deteriorated | Feb.<br>15-Dec. | When deteriorate     | 8-12          |              |                  |
| Shasta Daisy            | xx        | x            | ---           | Hardy          | Oct.-Dec.       | July              | Oct.-Dec.       | July              | not recommended | 12                   |               |              |                  |
| Snapdragon              | xx        | x            | ---           | Hardy          | Oct.-Feb.       | June              | Oct.-Feb.       | May               | Nov.-           | Apr.-May             | 10-15         |              |                  |
| Statice                 | xx        | ---          | ---           | Hardy          | Feb. 15         | June              | Dec.-Jan.       | June              | Feb.<br>Sept.-  | May                  | 8-10          |              |                  |
| Strawflower             | xx        | ---          | ---           | Tender         | Mar. 15         | Aug.              | Feb.            | July              | Nov.-           | June                 | 12-14         |              |                  |
| Streptocarpus           | ---       | xx           | x             | Tender         | Mar.-Apr.       | June              | Mar.-Apr.       | June              | Feb.-           | May                  | 10            |              |                  |
| Sweet Williams          | xx        | x            | ---           | Hardy          | Mar.-Apr.       | Aug.              | Mar.-Apr.       | Aug.              | Mar.<br>Feb.-   | May                  | 10-12         |              |                  |
| Thunbergia<br>(Catalpa) | xx        | x            | ---           | Tender         | Mar.-May        | First Frost       | Mar.-May        | First Frost       | Feb.-Apr.       | First Frost          | 8-10          |              |                  |
| Torenia                 | xx        | x            | ---           | Tender         | Mar.<br>15-June | Leaf yellowing    | Mar.<br>1-June  | Leaf yellowing    | Feb.-Oct.       | Frost Leaf Yellowing | 12-18         |              |                  |
| Verbena                 | xx        | ---          | ---           | Hardy          | Mar. 1-May      | When undesired    | Feb.<br>15-May  | When undesired    | Feb.-           | When undesired       | 12            |              |                  |
| Vinca (periwinkle)      | xx        | x            | ---           | Tender         | Mar.-July       | When undesired    | Feb.<br>15-July | When undesired    | Apr.Sept.-      | When undesired       | 12            |              |                  |
| Zinnia                  | xx        | ---          | ---           | Tender         | Mar.-June       | Leaf disease      | Mar.-June       | Leaf disease      | Feb.-           | Leaf disease         | 12-15         |              |                  |

\*Exposure: X = acceptable performance; XX = optimum performance.

\*\*North Florida - Pensacola to Jacksonville and south to Ocala; Central Florida - Leesburg south to Punta Gorda and Fort Pierce; South Florida - Stuart to Fort Myers and south to Homestead.



**Table 2.** Salt Tolerance in Bedding Plants

| <b>Good Salt Tolerance</b> |               |
|----------------------------|---------------|
| Begonia                    | Lisianthus    |
| Calendula                  | Mint          |
| Dusty Miller               | Petunia       |
| Gaillardia                 | Snapdragon    |
| Gazania                    | Statice       |
| Geranium                   | Strobilanthus |
| Gerbera                    | Vinca         |
| Kale (Ornamental)          | Zinnia        |
| <b>Poor Salt Tolerance</b> |               |
| Cleome                     | Pansy         |
| Coleus                     | Red Salvia    |
| Godetia                    | Torenia       |
| Impatiens                  | Verbena       |

**Table 3.**

| <b>Common Name</b>  | <b>Scientific Name</b>         | <b>Rating**</b> | <b>Number of Tests</b> |
|---|--------------------------------|-----------------|------------------------|
| <b>Not Infested, No Galls Found</b>                                       |                                |                 |                        |
| Marigold, African   | <i>Tagetes</i> sp.             | 0               | 2                      |
| Marigold, French  | <i>Tagetes</i> sp.             | 0               | 1                      |
| Coreopsis   | <i>Coreopsis lanceolata</i>    | 0               | 2                      |
| Argemone  | <i>Argemone</i> sp.            | 0               | 1                      |
| Rudbeckia   | <i>Rudbeckia</i> sp.           | 0               | 1                      |
| Ageratum  | <i>Ageratum</i> sp.            | 0               | 1                      |
| Evening Primrose  | <i>Oenothera lamarkiana</i>    | 0               | 1                      |
| Gaillardia  | <i>Gaillardia</i> sp.          | 0               | 2                      |
| <b>Very Lightly Infested, with One or Few Scattered Galls</b>             |                                |                 |                        |
| Michaelmas daisy  | <i>Aster tradescanti</i>       | 1               | 2                      |
| Lupine  | <i>Lupine</i> sp.              | 1               | 1                      |
| Calliopsis  | <i>Coreopsis tinctoris</i>     | 4               | 3                      |
| Four-o'clock  | <i>Mirabilis jalapa</i>        | 4               | 3                      |
| Cosmos  | <i>Cosmos bipinnatus</i>       | 4               | 3                      |
| Zinnia, small   | <i>Zinnia elegans</i>          | 5               | 3                      |
| Zinnia, giant   | <i>Zinnia elegans</i>          | 11              | 1                      |
| Sweet alyssum   | <i>Lobularia maritima</i>      | 7               | 3                      |
| Torenia, blue   | <i>Torenia fournieri</i>       | 17              | 2                      |
| Torenia, white  | <i>Torenia</i> sp.             | 17              | 1                      |
| Thunbergia  | <i>Thunbergia</i> sp.          | 22              | 1                      |
| Blue sage   | <i>Salvia farinacea</i>        | 10              | 1                      |
| Scarlet sage  | <i>Salvia splendens</i>        | 20              | 1                      |
| Arctotis  | <i>Arctotis stoechadifolia</i> | 14              | 3                      |
| Phlox, Big Drummond   | <i>Phlox drummondii</i>        | 19              | 4                      |
| <b>Very Lightly Infested, with One or Few Scattered Galls (continued)</b> |                                |                 |                        |

Table 3.

| Common Name  | Scientific Name                   | Rating** | Number of Tests |
|--|-----------------------------------|----------|-----------------|
| Phlox, Dwarf   | <i>Phlox nana compacta</i>        | 31       | 1               |
| Phlox, Starred   | <i>Phlox drummondii stellaris</i> | 26       | 1               |
| Statice  | <i>Limonium sinatum</i>           | 18       | 1               |
| Globe amaranth   | <i>Gomphrena globosa</i>          | 25       | 1               |
| Gerbera daisy  | <i>Gerbera jamesoni</i>           | 24       | 2               |
| Vinca, periwinkle  | <i>Vinca rosea</i>                | 30       | 2               |
| Stock  | <i>Matthiola</i> sp.              | 31       | 2               |
| Leptosyne  | <i>Coreopsis</i> sp.              | 29       | 1               |
| <b>Lightly Infested, with a Number of Small Galls</b>            |                                   |          |                 |
| Godetia  | <i>Gadetia</i> sp.                | 36       | 2               |
| China aster  | <i>Callistephus chinensis</i>     | 38       | 2               |
| Pentstemon   | <i>Pentstemon</i> sp.             | 38       | 1               |
| Dianthus   | <i>Dianthus</i> sp.               | 45       | 2               |
| Portulaca  | <i>Portulaca</i> sp.              | 40       | 2               |
| Verbena  | <i>Verbena</i> sp.                | 27       | 3               |
| Lantern groundcherry   | <i>Physalis francheti</i>         | 40       | 1               |
| Perennial Sweet Pea  | <i>Lathyrus latifolius</i>        | 42       | 1               |
| Liatris spicata  | <i>Liatris spicata</i>            | 44       | 1               |
| Clarkia  | <i>Clarkia</i> sp.                | 23       | 2               |
| Shasta daisy   | <i>Chrysanthemum maximum</i>      | 48       | 2               |
| Candytuft  | <i>Iberis umbellata</i>           | 46       | 2               |
| Mignonette   | <i>Reseda odorata</i>             | 50       | 1               |
| Cypress vine   | <i>Quamoclit pennata</i>          | 50       | 1               |
| Artemisia  | <i>Artemisia sacrorum viride</i>  | 50       | 1               |
| Petunia  | <i>Petunia hybrida</i>            | 52       | 3               |
| <b>Moderately Infested, with Galls More Numerous or Larger</b>   |                                   |          |                 |
| Acroclinium  | <i>Helipterum roseum</i>          | 55       | 2               |
| Linaria  | <i>Linaria</i> sp.                | 56       | 2               |
| Poppy  | <i>Papaver</i> sp.                | 56       | 1               |
| Moonflower   | <i>Calonyction</i> sp.            | 58       | 2               |
| Perennial chrysanthemum  | <i>Chrysanthemum</i> sp.          | 59       | 1               |
| Nicotiana  | <i>Nicotiana alata</i>            | 59       | 1               |
| Hunnemannia  | <i>Hunnemannia fumariaefolia</i>  | 60       | 1               |
| Annual chrysanthemum   | <i>Chrysanthemum coronarium</i>   | 65       | 1               |
| Dimorphotheca  | <i>Dimorphotheca aurantiaca</i>   | 66       | 2               |
| English Daisy  | <i>Bellis perennis</i>            | 67       | 1               |
| Scarlet Climber or Cardinal Climber                              | <i>Quamoclit sloteri</i>          | 71       | 2               |
| California poppy   | <i>Eschscholtzia californica</i>  | 71       | 2               |
| <b>Heavily Infested, with Galls More Numerous or Larger</b>      |                                   |          |                 |
| Coleus   | <i>Coleus</i> sp.                 | 71       | 2               |
| Columbine  | <i>Aquilegia</i> sp.              | 74       | 1               |
| Sunflower  | <i>Helianthus annuus</i>          | 73       | 3               |
| Chinese forget-me-not  | <i>Cynoglossum</i> sp.            | 73       | 3               |
| Heavily Infested, with Galls More Numerous or Larger (continued) |                                   |          |                 |

Table 3.

| Common Name  | Scientific Name              | Rating** | Number of Tests |
|--|------------------------------|----------|-----------------|
| Baby's breath  | <i>Gypsophila</i> sp.        | 77       | 2               |
| Gilia  | <i>Gilia</i> sp.             | 77       | 1               |
| Matricaria   | <i>Matricaria</i> sp.        | 80       | 1               |
| Nasturtium   | <i>Tropaeolum</i> sp.        | 85       | 2               |
| Snapdragon   | <i>Antirrhinum majus</i>     | 84       | 2               |
| Hollyhock  | <i>Althea rosea</i>          | 82       | 1               |
| Salpiglossis   | <i>Salpiglossis sinuata</i>  | 84       | 1               |
| Pansy  | <i>Viola tricolor</i>        | 87       | 2               |
| Centaurea  | <i>Centaurea cyanus</i>      | 90       | 3               |
| <b>Very Heavily Infested, Practically All Roots with Many Large Galls</b>  |                              |          |                 |
| Butterfly flower   | <i>Schizanthus</i> sp.       | 87       | 1               |
| Morning-glory  | <i>Ipomoea</i> sp.           | 91       | 2               |
| Larkspur   | <i>Delphinium</i> sp.        | 90       | 1               |
| Lobelia  | <i>Lobelia erinus</i>        | 94       | 3               |
| Helichrysum  | <i>Helichrysum</i> sp.       | 96       | 2               |
| Amaranthus   | <i>Amaranthus</i> sp.        | 93       | 1               |
| Calendula  | <i>Calendula officinalis</i> | 93       | 2               |
| Calendula, radio   | <i>Calendula officinalis</i> | 87       | 1               |
| Balsam (impatiens)   | <i>Impatiens balsamina</i>   | 100      | 1               |
| Blue lace flower (Didiscus)  | <i>Trachymene caerulea</i>   | 73       | 3               |
| Annual Sweet Pea   | <i>Lathyrus odoratus</i>     | 96       | 2               |
| Celosia  | <i>Celosia argentea</i>      | 99       | 2               |
| Dolichos   | <i>Dolichos</i> sp.          | 100      | 1               |
| Gourd  | <i>Cucurbita</i> sp.         | 100      | 1               |
| *Goff, C.C. 1936. <i>Relative Susceptibility of Some Annual Ornamentals to Root Knot</i> . Univ. of Florida Agr. Expt. Stn. Bull. 291.                                     |                              |          |                 |
| **Plants were rated based on average gall ratings from all tests in which that plant species was included, on a scale from 0 (no galls) to 100 (all roots heavily galled). |                              |          |                 |