ALABAMA A&M AND AUBURN UNIVERSITIES

ALABAMA COOPERATIVE Extension SYSTEM

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Greenhouse Production of Petunias

Petunias *(Petunia* x *hybrida)* are among the most popular bedding plants in the world because of their versatility, variety, and flower color range. In the United states, petunias have been one of the top five selling bedding plants for over 100 years. Continuous breeding over the past three or four decades has resulted in almost every conceivable flower color, at least three horticultural types, single or double flowers, and over 400 cultivars currently available on the market.

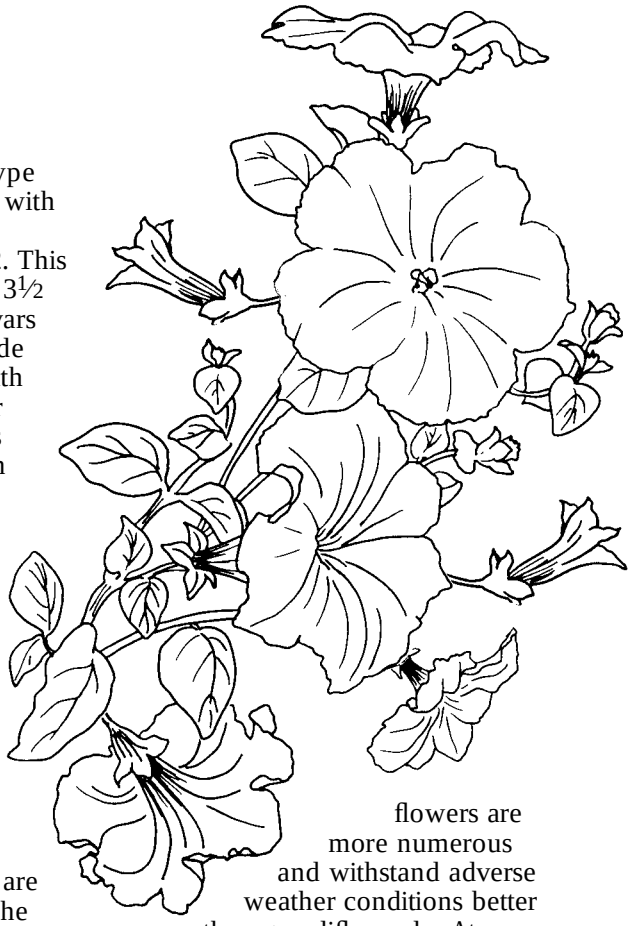
Cultivars

Petunia axillaris and *Petunia violacea*, natives of South America, are thought to be the ancestors of modern petunias. By 1850, early cultivars were found in European private gardens because of early breeding work by the French botanist Petun. In 1880, Mrs. Theodosia Shepherd developed the Superbissima type of petunia in California. These were popular because of their large 5- to 6-inch-diameter flowers. Further breeding lead to the two major horticultural types, grandiflora and multiflora. Today, grandiflora singles are the biggest sellers, followed by multiflora singles, and then the double-flower forms of each type.

Horticultural Types

Grandiflora

The grandiflora petunia type was developed in early 1950, with the first F_1 hybrid grandiflora, 'Ballerina,' introduced in 1952. This type has large showy flowers 3½ to 5 inches in diameter. Cultivars have been developed in a wide range of flower colors and with petals that may have frilled or rounded edges. New cultivars with different-colored veins in the petals have been developed recently. Older cultivars are large plants, but the recent trend is to develop more compact cultivars. Double-flower forms have multipetaled flowers that resemble carnation flowers. These are frequently used in containers because the complex flowers do not hold up well in most garden situations.



Traditionally, grandifloras are the best selling petunias, but the flowers do not hold up well under adverse garden conditions in the South. Driving rain and strong wind can tear the petals. In the southern United States, plants are hardy in areas with mild winter conditions; however, a hard frost will kill petunias. There are a number of excellent grandiflora series on the market, including Daddy, Dream, Falcon, Flash, Picotee, and Ultra.

Multiflora

The multiflora petunia type was developed in late 1940, with the first F_1 hybrid multiflora, 'Comanche,' introduced in 1953. This type has smaller flowers 1½ to 2 inches in diameter, but the flowers are more numerous and withstand adverse weather conditions better than grandifloras do. At one time, this type of petunia was not as popular with consumers as grandifloras because of the small flower size, but breeding developments have improved their acceptance. Multifloras are generally more compact plants that mature faster and are available in a wider range of colors than other petunia types are. As a consequence, multifloras are rapidly becoming popular in the southern United States. Double-flower forms of multifloras are also available. There are a number of excellent multiflora series on the market, including Carpet, Celebrity, Horizon, Merlin, Polo, and Primetime.

Floribunda

The floribunda type resulted from recent hybridization between grandifloras and multifloras. General characteristics fall in between the two in terms of plant growth habit and flower size, but floribunda may offer increased disease resistance. Some authorities think that floribundas are of questionable value because there is little distinction between them and the grandifloras and multifloras.

Milliflora

Milliflora petunias developed from a chance genetic mutation from *Petunia* x *hybrida*, resulting in a true miniature plant. Because they flower quickly on compact plants, they can be used in ways in which traditional types typically cannot be. These plants are ideal for small hanging baskets, mixed-color bowls, strawberry pots, novelty containers, window boxes, or any location where traditional petunias would be too vigorous.

Spreading Type

The spreading type is a new breed of petunia that has more of a tropical nature than other petunia types. They are vigorous, trailing plants that spread like a ground cover and are ideal for hanging baskets, planters, and window boxes. They are ever-blooming, tender perennials that are tolerant of full southern sun and heat. Spreading types are not well suited for market pack production because they grow quickly and root into adjacent cells. Current cultivars propagated from seed are 'Purple Wave' and 'Pink Wave.' The Cascadia, Supertunia, and Surfinia series are vegetatively propagated types.

Plug Culture

Growers pay a premium price for high-quality petunia seeds. Therefore, care and planning are necessary to ensure that the maximum number of transplantable seedlings will be produced from an ounce of seed. For the best results in starting petunia seed, purchase F_1 hybrid seeds fresh each season from a reputable supplier. In planning the number of seed to order for production, consider that there are 245,000 to 285,000 seeds per ounce, depending on the cultivar.

If seeds must be kept from one season to the next, store them in a dark, cool, dry environment away from insects and rodents. As a general rule, store seeds under conditions where the sum of the Fahrenheit temperature and percent relative humidity does not exceed 100. For example, where seeds are stored at 45°F, the humidity should not exceed 55 percent. Refrigerators dedicated to seed storage are often used, with the seeds sealed in containers containing a desiccant material.

Sow seed in plug flats containing a well-drained media. Do not cover the seeds—they are so small that covering them may inhibit germination. Light is not required for germination in a greenhouse; however, if seeds are sown in germination rooms, artificial light is recommended by some authorities. The 406 plug flat is small enough for economic production but large enough to accommodate growth until transplanting. However, larger plug sizes may be used to meet special production goals. The most effective way to sow petunia seeds is using an automatic seeder. Because petunia seeds are very small, they are available in pelleted form so that they can be handled by an automatic seeder. Sowing media should have a pH of 5.5 to 6.0 and an electrical conductivity level of less than 0.75 mmhos/cm based on the 2:1 extraction method.

Temperatures for seed germination should be 75° to 78°F for the first 3 to 5 days, 68° to 75°F when cotyledons unfold, and 65° to 70°F when true leaves appear. Use bottom heat if needed to maintain a minimum 70°F media temperature. High temperatures (greater than 90°F) will inhibit germination. Water temperatures for irrigation and mist should be at least 70°F. Petunia seeds require near 100 percent relative humidity for rapid, uniform germination. This can be accomplished by using timed mist, tenting the flats with clear polyethylene, or using a germination room. Keep the germination media moist but not saturated. Germination should begin 2 to 3 days after sowing and be completed in 10 days.

Seedlings must receive sufficient light after germination to prevent unwanted stretching. Maintain a minimum of 2,500 footcandles after germination. This level can be raised to 5,000 footcandles as seedlings mature as long as the temperature can be controlled.

Weekly applications of 50 to 75 ppm nitrogen from a base-forming fertilizer (15-0-15 or calcium nitrate [15.5-0-0] and potassium nitrate [13-0-44]) can be applied beginning when radicles emerge. Increase the rate to 100 to 150 ppm nitrogen and apply it on a constant liquid fertilization basis when cotyledons expand. Generally, minimize the use of phosphorous and ammonium forms of nitrogen fertilizer to prevent stretching and soft growth. However, if seedling growth slows, a high ammonium and phosphorous fertilizer such as 20-10-20 can be applied every other fertilization. Maintain media electrical conductivity during seedling growth between 1.0 and 1.5 mmhos/cm based on the 2:1 extraction method.

Water seedlings in plug flats to maintain a turgid condition, but avoid excessive moisture that can lead to root diseases and seedling stretching. Yellow lower leaves and dark, soft roots may be symptoms of root disease.

Night temperatures can be lowered to 63° to 65°F during the last few weeks that the plants are in plug flats to tone the seedlings in preparation for shipping and transplanting. Generally, petunia seedlings are ready to transplant when four to five true leaves are present and the root ball pulls from the plug intact.

To control seedling growth and prevent stretching, manage the environment, nutrition, and watering regime first, then apply chemical growth retardants if needed. The effectiveness of growth retardants depends on the environment, cultural practices, and seedling stage of growth. Therefore, test a given concentration on a few flats first before applying it to the entire crop. B-Nine at 2,500 to 5,000 ppm, Bonzi at 6 to 15 ppm, or A-Rest at 26 to 132 ppm can be applied as a spray (2 quarts per 100 square feet) to petunia seedlings. Start with the lower rates for the first application, and make additional applications only as needed.

Growing-On

Temperature

Flowering time, plant height, and lateral branching are correlated to an average daily temperature between 50° to 77°F. Higher average daily temperatures result in faster flowering, taller plants, smaller leaves, and fewer lateral branches. After transplanting, grow petunias at a 60° to 63°F night temperature and 70° to 75°F day temperature for high-quality plants. Maintain 63°F night temperatures for a week or 10 days after transplanting, then drop to 60°F if desired.

Photoperiod

Petunias are quantitative long-day plants flowering under any photoperiod but flowering faster under long days. Long photoperiods (greater than 13 hours) result in earlier flowering and taller, relatively unbranched plants. Short photoperiods (8 to 10 hours) delay flowering, retard elongation of the main stem, and promote lateral branching. This response to photoperiod, however, is influenced by temperature. At average daily temperatures less than 68°F, plants are compact and well branched regardless of the photoperiod, but they flower faster under long days. At average daily temperatures greater than 68°F with short days, plants have more branches than under long days, but flowering is delayed. The most rapid flowering occurs at average daily temperatures greater than 68°F with long photoperiods; however, the central stem is elongated, lateral branching is restricted, and leaf size is smaller. This relationship between temperature and photoperiod is apparent during spring production. In early spring, petunias are compact and slow to flower. As the season progresses, temperature and photoperiod increase, resulting in plants that are elongated and that flower faster.

Light

Petunias are high-light plants requiring as much light as possible early in the spring to flower quickly and prevent stretching. The lower the available light, the lower the temperature should be to produce high-quality plants. Reduce light intensity in late spring and summer to control high temperatures.

Growing Medium

Use a well-drained, disease-free, peat-lite medium with a pH of 5.5 to 6.0 and an initial electrical conductivity of about 0.75 mmhos/cm based on the 2:1 extraction method. Water seedlings thoroughly after transplanting them.

Fertilization

Do not fertilize petunias for 7 to 10 days after transplanting to allow the roots to reach the sides and bottom of the container. Fertilize on a constant liquid fertilization basis at 150 to 200 ppm nitrogen, using a complete fertilizer such as 20-10-20 alternated with a base-forming fertilizer such as 15-0-15 or calcium nitrate (15.5-0-0) and potassium nitrate (13-0-44). Electrical conductivity should be between 1.0 and 1.5 mmhos/cm based on the 2:1 extraction method. Growers should test media pH and soluble salts on a weekly basis and send samples of media and foliage for laboratory analysis every 2 weeks. Table 1 lists recommended foliar analysis ranges for petunias. Fertilizer rate should be reduced by one-half in the last week or two to harden off the plants before shipping them to the retail market.

Boron deficiency can be a problem in petunia and is manifested as hard, distorted, and mottled upper foliage, proliferation of lateral shoots, and terminal bud abortion. This problem can be caused by high media pH or low boron concentration. Maintain media pH at 5.5 to 6.0, and apply supplemental boron once or twice during production. As a supplement, apply Borax as a drench at 0.5 ounces per 100 gallons or Solubor at 0.25 ounces per 100 gallons.

Iron deficiency can also be a problem in petunias, causing interveinal chlorosis on upper foliage. In many circumstances, deficiency will show on certain flower colors in a mix but not on others. As with boron, this problem is caused by high media pH or low iron concentration. If the media pH is above 6.5, apply 3 to 5 ounces of iron sulfate per 100 gallons of water as a drench. Rinse the foliage with clear water after applying iron sulfate. If the pH is below 6.2, apply iron chelate according to the manufacturer's directions.

Iron and manganese toxicity have been reported in petunias when the media pH is extremely

Table 1. *Petunia* x *hybrida* Normal Foliar Analysis Ranges

Element	percentage	Element	ppm
N	3.85 to 7.60	Fe	84 to 168
P	0.47 to 0.93	Mn	44 to 177
K	3.13 to 6.65	Zn	33 to 85
Ca	1.20 to 2.81	Cu	3 to 19
Mg	0.36 to 1.37	B	18 to 43
S	0.33 to 0.80	Mo	0.19 to 0.46

Source: Plant Analysis Handbook II, MicroMacro Publishing, 1996.

low. Symptoms include tan or brown lesions on the lower foliage. Switch to a base-forming fertilizer such as 15-0-15. If the problem persists, apply a liquid lime product according to the manufacturer's directions.

Growth Retardant

Plant growth retardants are usually not required if proper environmental and cultural practices are followed. As temperature rises and photoperiod lengthens late in the season, applications of B-Nine at 2,500 to 5,000 ppm (2 quarts per 100 square feet) can be made beginning when the plants are about 2 inches in diameter. A second application can be made 7 to 10 days later. Bonzi at 15 to 50 ppm and Sumagic at 10 to 30 ppm are also effective in a single application. Do not apply growth retardants after flower buds are visible.

Scheduling

Petunias generally require 5 to 6 weeks in plugs, depending on cultural practices and climate, followed by 4 to 5 weeks in market flats for a total of 9 to 11 weeks. Four-inch pots require a week longer, and hanging baskets (three transplants per basket) require 2 to 3 weeks longer than flats do. These crop production times can vary with the large number of types and cultivars on the market. Production time also decreases as photoperiods and temperatures increase in late spring. Therefore, growers should keep detailed records of crop performance and timing to improve future scheduling efforts.

Common Problems

Physiological

Most physiological problems are related to photoperiod and temperature control. Petunias are also sensitive to ozone, which damages foliage, turning it a bronze or silver color.

Insects and Pests

Petunias are relatively pest free, although aphids, thrips, whiteflies, and caterpillars can be problems. Slugs and snails can be problems in greenhouses where sanitation practices are poor.

Diseases

Damping-off diseases *(Pythium, Phytophthora,* and *Rhizoctonia)* can be a problem, especially in the seedling stage. *Thielaviopsis* has been reported as a problem under poor cultural regimes. Grey mold *(Botrytis)* can also be a problem on open flowers under humid conditions.

Specific control measures for insect and disease problems can be found in the *Alabama Pest Management Handbook, Volumes 1 and 2* (Extension publications ANR-500A and ANR-500B). For information about obtaining these publications, contact your county Extension agent.

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