GREENHOUSE PRODUCTION OF PETUNIAS

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Petunias (*Petunia ∞ 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 and one author credits the demand for petunias for beginning the modern bedding plant industry. 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' forms 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. 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 of 3˚ to 5 inches in diameter. Cultivars have been developed in a wide range of flower colors with petals that may be frilled or have rounded edges. New cultivars were developed recently with different colored veins in the petals. Older cultivars are large plants, but the recent trend is to develop more compact cultivars. Double-flower forms have multi-petaled flowers, resembling 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 of 1˚ to 2 inches in diameter, but the flowers are more numerous and withstand adverse weather conditions better than grandifloras. This type of petunia was once 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. As a consequence, multifloras are rapidly becoming popular for 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

This 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 may offer increased disease resistance. Some authorities feel that floribundas are of questionable value because there is little distinction between floribundas and the grandifloras and multifloras.

Milliflora

These types of petunias developed from a chance genetic mutation from *Petunia ∞ hybrida* resulting in a true miniature plant. Because they flower quickly on compact plants, they provide new opportunities for using petunias unavailable with traditional types. 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

This is a new breed of petunias with more of a tropical nature than other types. They are vigorous, trailing plants that spread like a ground cover ideal for hanging baskets, planters and window boxes. They are also ever-blooming, tender perennials, tolerant of full southern sun and heat. Spreading types are not well suited for market pack production because they grow quickly rooting 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 insure 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 the 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 45EF, 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 without covering the seed. Light is not required for germination in a greenhouse. Do not cover seed as seed are so small that a covering may inhibit germination. If sowing in germination rooms, several authors recommend artificial light. The 406 plug flat is small enough for economic production while providing enough room for growth until transplanting. However, larger plug sizes may be used to meet special production goals. The most effective way to sow petunia seeds is with an automatic seeder. Because petunia seed are very small, they are available in pelleted form to accommodate handling by an automatic seeder. Sowing media pH should be 5.5 to 6.0 and with an electrical conductivity level of less than 0.75 mmhos/cm based on the 2:1 extraction method.

Temperatures for seed germination should be 75-78EF for the first three to five days, 68-75EF when cotyledons unfold and 65-70EF when true leaves appear. Use bottom heat if needed to maintain a minimum 70EF media temperature. High temperatures, greater than 90EF, will inhibit germination. Water temperatures for irrigation and mist should be at least 70EF. Petunia seed require near 100% relative humidity for rapid, uniform germination. This can be accomplished 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 two to three days after sowing and be completed in 10 days.

Seedlings must receive sufficient light after germination to prevent unwanted stretching. Maintain a minimum of 2500 footcandles after germination. This level can be raised to 5000 footcandles as seedlings mature provided 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 100-150 ppm nitrogen and applied on a constant liquid fertilization basis when cotyledons expand. Generally, minimize use of phosphorous and ammonium forms of nitrogen fertilizer to prevent stretching and soft growth. However, a high ammonium and phosphorous fertilizer such as 20-10-20 can be applied every other fertilization if seedling growth slows. 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 63E-65EF during the last few weeks 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 if needed, apply chemical growth retardants. 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 application to the entire crop. B-Nine at 2500 to 5000 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.

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GROWING-ON

Temperature

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

Photoperiod

Petunias are quantitative long-day plants, flowering under any photoperiod, but faster under long days. Long photoperiods (>13 hours) result in earlier flowering and taller, relatively unbranched plants. Short photoperiods (8-10 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 68EF, plants are compact and well branched regardless of photoperiod, but flower faster under long days. At average daily temperatures greater than 68EF 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 68EF 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 increases resulting in plants that are elongated and flower faster.

Light

Petunias are high-light plants requiring as much light as possible early in the spring to flower quickly and to 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 following transplanting.

Fertilization

Do not fertilize petunias for 7 to 10 days after transplanting allowing 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 two weeks. Recommended foliar analysis ranges for petunias can be can be found in Table 1. Fertilizer rate should be reduced by one-half in the last week or two to harden off the plants before shipping 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. Like boron, the problem is caused by high media pH or low iron concentration. If the media pH is above 6.5, apply three to five ounces of iron sulfate per 100 gallons of water as a drench. Rinse the foliage after application of iron sulfate with clear water. If the pH is below 6.2, apply iron chelate according to the manufacturers directions.

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

Growth Retardant

Plant growth retardants are usually not required if proper environmental and cultural practices are followed. As temperature rises and photoperiod lengthen late in the season, applications of B-Nine at 2500 to 5000 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 7-10 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 five to six weeks in plugs depending on cultural practices and climate, followed by four to five 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) two to three weeks longer than flats. 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 problems are related to photoperiod and temperature control. Petunias are also ozone sensitive causing bronze or silver damage to foliage.

Insects and Pests: Petunias are relatively pest free, though aphids, thrips, whiteflies and caterpillars can be problems. Slugs and snails can be problems in greenhouses with poor sanitation practices.

Diseases: Damping-off (*Pythium*, *Phytophthora*, *Rhizoctonia*) can be problems, 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.

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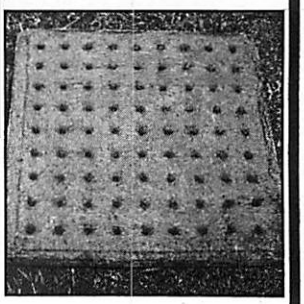

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Table 1. *Petunia* ∞ *hybrida* normal foliar analysis ranges.

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

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

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