MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

Fact Sheet

Fact Sheet 767

PRODUCTION OF ALLIUMS AS CUT FLOWERS

Introduction

There are about 500 species in the genus *Allium*. While a few species are found in the tropical forests of South America and one species is found in the Arctic, most are native to the northern hemisphere. The largest numbers are found in Europe, North Africa, and Asia. The genus takes its name from the Latin word "allium" for garlic.

Morphology

The leaves are basal in origin and linear, usually arising from a well-developed tunicate bulb. There are a few alliums that are rhizomatous. The leaves are sometimes keeled or cylindrical to hollow and disappear prior to flowering with some species. The length of the flower stalk (scape), is usually proportional to the circumference of the bulb within each species. The strong onion odor associated with most species is released only when the foliage is bruised.

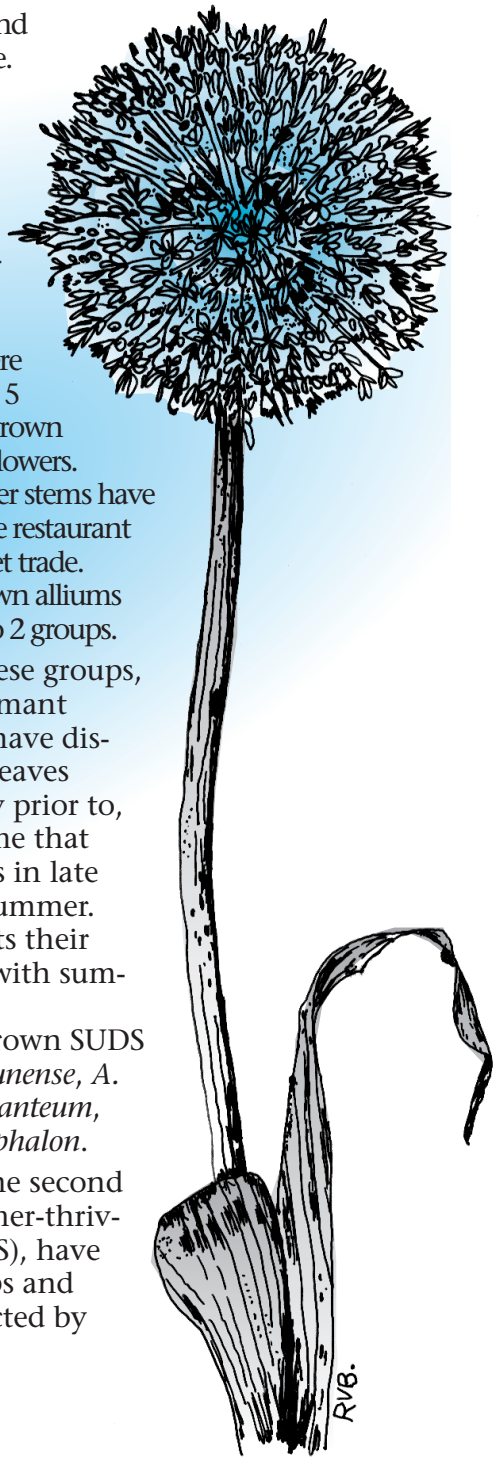
The cymose umbel can have a few to several hundred small flowers that emerge from a paper-like 1- to 3-leaved sheath at the top of the naked floral stalk. The individual flowers of the umbel are star- to bell-shaped and can be white, yellow, pink, blue, or lavender.

Classification

Almost all alliums are suitable for fresh cut flowers, and many can be used as everlasting cut flowers. The list of alliums usually grown as fresh or everlasting cut flowers is limited to those that have enough stem length to be used for cut flower arrangements, are winter hardy, and are readily available. The minimum scape length for alliums usually used as cut flowers by large commercial producers dealing with wholesalers is 24 inches. For this reason, there are essentially only 5 species of alliums grown extensively as cut flowers. Alliums with shorter stems have some market in the restaurant and farmer's market trade. Commercially grown alliums can be divided into 2 groups.

The first of these groups, the summer-dormant species (SUDS), have distinct bulbs and leaves that wither away prior to, or during the time that the plant flowers in late spring to early summer. This habit reflects their origins in areas with summer drought. Commercially grown SUDS include: *A. aflatunense*, *A. christophii*, *A. giganteum*, and *A. sphaerocephalon*.

Members of the second group, the summer-thriving species (SUTS), have less distinct bulbs and are often connected by



rhizomes. They are more prone to form clumps. Their leaves grow actively throughout the growing season. Perhaps, this is a reflection of their origin in areas with summer rainfall. The leaves should be retained after the inflorescences are harvested. These alliums are prolific seeders and can become a nuisance unless deadheaded prior to seed maturation. The only significant commercially grown species is *A. caeruleum*. *A. tuberosum* might be an addition to this group since it is fragrant and blooms in late summer.

Principal Species and Cultivars of Alliums Grown As Cut or Dried Flowers

Allium aflatunense

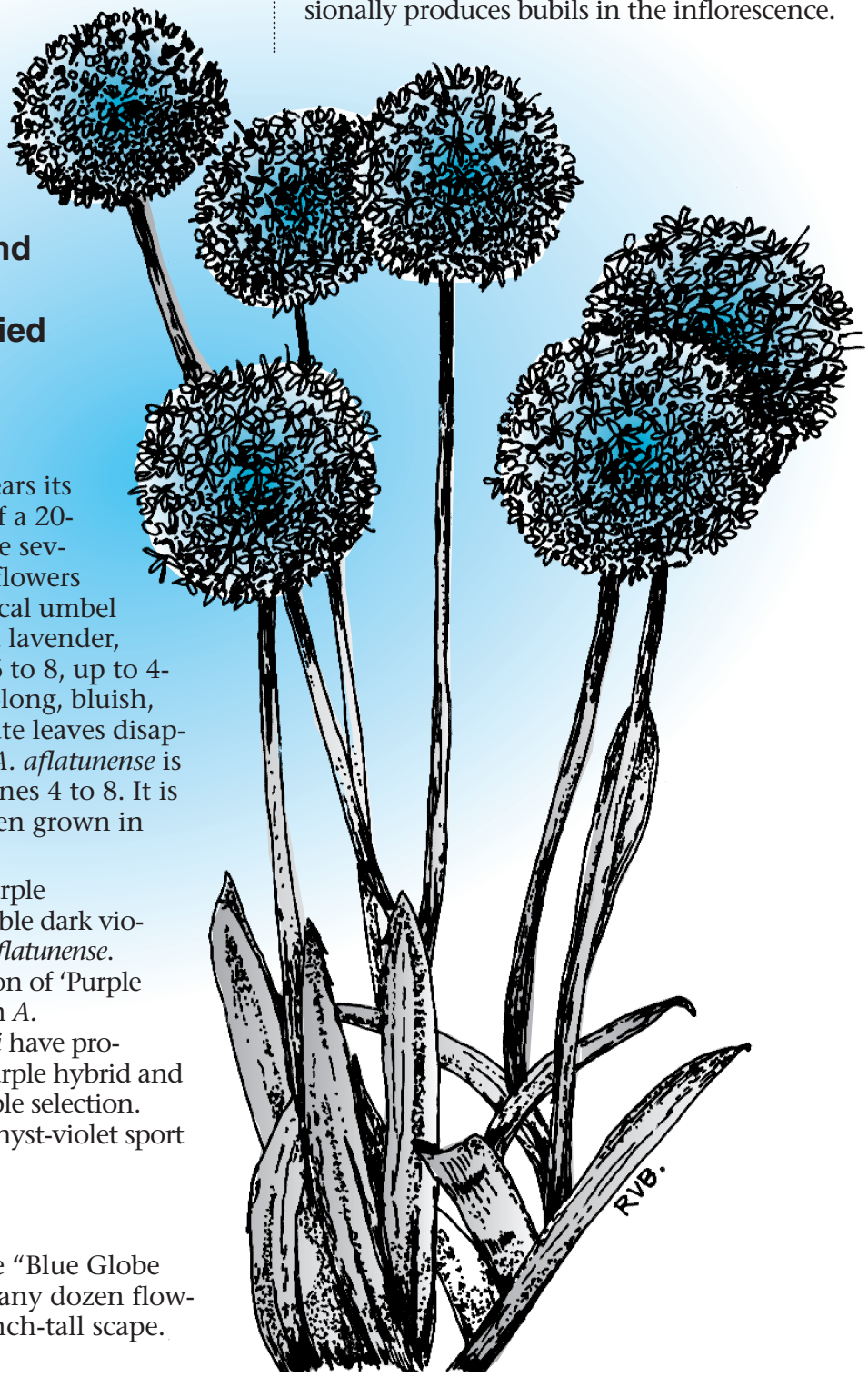
The "Persian Onion" bears its inflorescence at the end of a 20-inch-tall scape. Each of the several hundred star-shaped flowers of the 4-inch-wide, spherical umbel are ½ to ¾ inches wide and lavender, with a darker nerve. The 6 to 8, up to 4-inch-wide, 20- to 24-inch-long, bluish, smooth, linear to lanceolate leaves disappear as flowering begins. *A. aflatunense* is hardy to USDA climate zones 4 to 8. It is susceptible to root rot when grown in heavy soils.

'Mother of Pearl' and 'Purple Sensation' are slightly variable dark violet-purple selections of *A. aflatunense*. 'Purple Surprise' is a selection of 'Purple Sensation'. Crosses between *A. aflatunense* and *A. macleanii* have produced 'Gladiator', a rose-purple hybrid and 'Lucy Ball', a dark lilac-purple selection. 'Rien Poortvliet' is an amethyst-violet sport of 'Gladiator'.

Allium caeruleum

The inflorescence of the "Blue Globe Onion" is composed of many dozen flowers borne on a 16- to 18-inch-tall scape. The individual flowers of the 1- to 1½-inch-wide, tight, dense, spherical umbel are ⅜ to ½ inches wide, and are a deep cornflower blue. The 3 to 4, ⅛- to 3⁄16-inch-wide, 10- to 18-inch-long, 3- to 4-sided, grass-like leaves persist throughout the growing season.

A. caeruleum is hardy in USDA climate zones 4 to 7 and naturalizes readily. *A. caeruleum* needs hot, dry conditions to flourish. It occasionally produces bubils in the inflorescence.



Allium christophii

A. christophii, sometimes known as "Star of Persia" or "Downy Onion," has an inflorescence borne at the end of a 14- to 22-inch-tall scape. The individual (up to 100) flowers of the flattened, oval, 5- to 8-inch-wide umbel are ⅜ to ¾ of an inch wide, and a silvery purple. The 3 to 7, ¾- to 1½-inch-wide, 20-inch-long, strap-shaped, waxy leaves have a white, hairy underside and begin to dieback prior to flowering.

A. christophii is hardy in USDA climate zones 4 to 7 and naturalizes readily. The inflorescences make good dried flowers. The blooms do not ship well and are, therefore, excellent for the local market. *A. christophii* must be propagated from seed.

'Globemaster®', a cross between *A. christophii* and *A. macleanii*, has rich-purple, sterile flowers that last many weeks after being cut. The foliage remains green until after flowering. *A. christophii* exhibits excellent weather tolerance in most of the United States, and is perennial even in the heat.

Allium giganteum

The inflorescence of the "Giant Onion" is borne on a 40-inch-tall scape. The individual, over 100 florets of the 5-inch-wide spherical umbel are ½ of an inch wide and deep purple. The 6 to 9, 2-inch-wide, up to 30-inch-long, strap-shaped leaves begin to deteriorate as the plant begins to flower.

A. giganteum is hardy in USDA climate zones 4 to 8 and naturalizes readily. The bulbs split after about 2 years. The inflorescence makes an excellent dried flower.

Allium sphaerocephalon

The "Round-Headed Garlic," or "Drumstick Allium", bears its inflorescence on a 20-inch-tall scape. The individual 50 to 100 florets of the 2-inch-wide oval to rounded umbel are ¼ to ⅓ of an inch wide, and a reddish purple. The 3 to 5, ⅛-inch-wide, 24-inch-long, semi-cylindrical leaves begin to wither after flowering.

A. sphaerocephalon is hardy in USDA climate zones 4 to 8. The plant naturalizes readily. The inflorescence is excellent for drying, but must be dried rapidly to preserve color. There are no cultivars of the species.

Species & Cultivars of Allium Grown As Cut or Dried Flowers on a Limited Scale

Allium carinatum ssp. *pulchellum*

The "Keeled Garlic" bears a loose 3¾-inch-wide umbel of several petite, bell-shaped, reddish-violet flowers with protruding stamens, on a 12- to 24-inch-tall scape in July and August. It is hardy in USDA climate zones 5 to 8. The "Keeled Garlic" is excellent as a dried flower.

Allium carinatum ssp. *pulchellum* 'Album'

The "White Keeled Garlic" is similar to *A. carniatum* ssp. *pulchellum* except that it has white flowers.

Allium cernuum minor 'Alba'

The "Nodding Onion," *A. cernuum*, is a pale pink to deep rose-purple flowered species. The cultivar 'Alba' bears 30 to 40, ¼- to ⅓-inch-wide, cup-shaped, white flowers with protruding yellow or pink-toned stamens in a 1- to 2 ½-inch-wide nodding umbel on a 15-inch-tall scape. This allium is unusual because it produces several flowering stalks in succession. They are excellent cut flowers. *A. cernuum* is hardy in USDA climate zones 4 to 7.

Allium karataviense

This species is grown for its value as a dried inflorescence as well as a fresh-cut flower and potted plant. It is short, 4 to 10 inches tall, but has a comparatively large, up to 5-inch-wide, spherical umbel, composed of many dozen to over 100 pale-pink to white flowers with protruding stamens. Two broad leaves that are 1¼ to 6 inches wide, 6 to 9 inches long, grey-purple or dull-green subtend the stout scape. *A. karataviense* is hardy in USDA climate zones 4 to 8.

Allium macleanii

This species is quite similar in appearance to *A. giganteum*, and is preferred by many because it has bright green, rather than waxy-blue leaves. It bears a dense, 5- to 6-inch-wide, globular umbel of several hundred mineral-violet flowers on a 24- to 40-inch-tall scape in June to July. It is suitable for fresh

cut and dried flowers. *A. macleanii* is hardy in USDA climate zones 5 to 8.

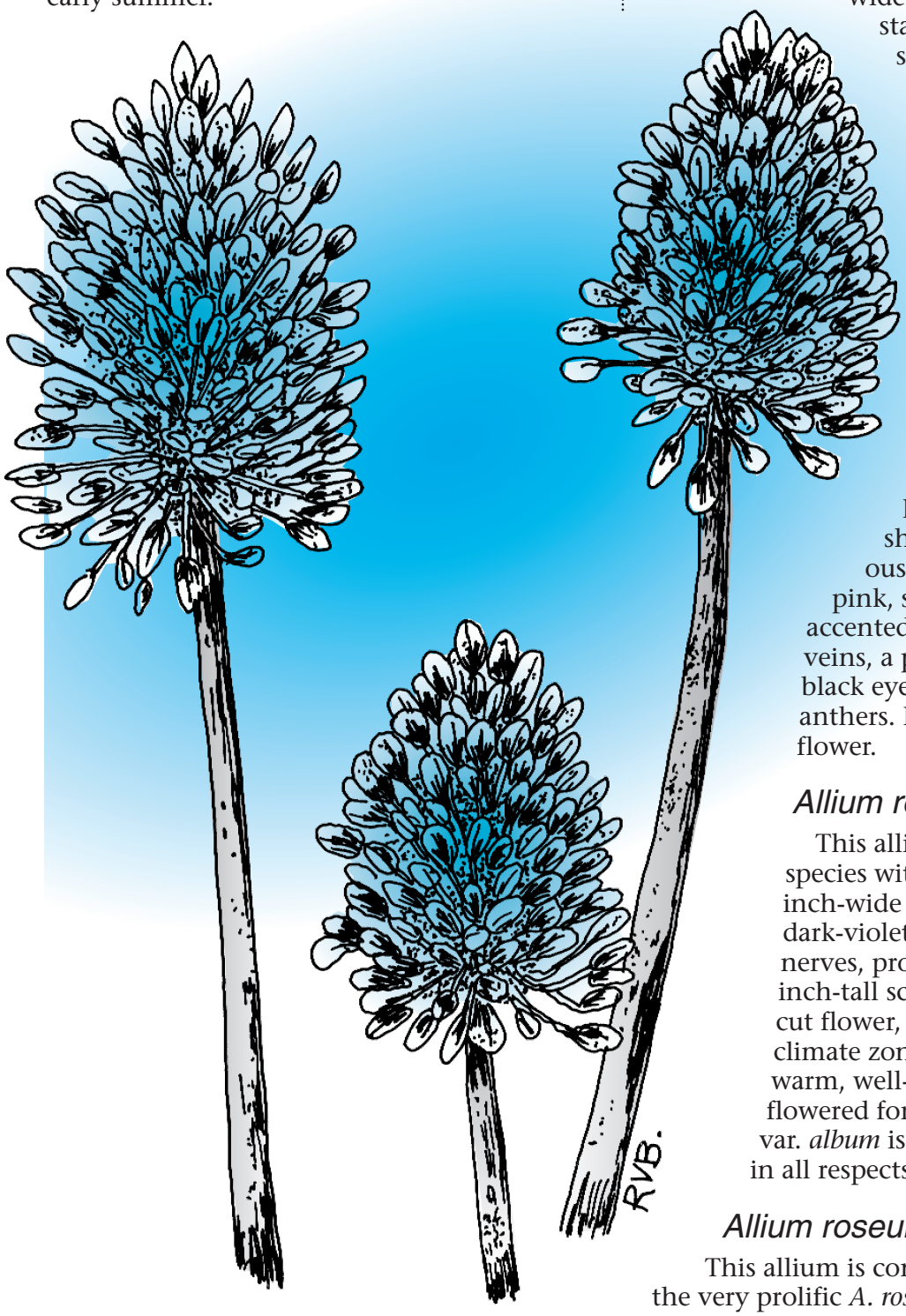
Allium 'Mars'

This cultivar is a recent and spectacular hybrid of *A. stipitatum* and *A. aflatunense*. It has a large, 6-inch-wide umbel of several hundred lavender-purple florets. It grows 36 to 48 inches tall and flowers in late spring to early summer.

A pure white cultivar of *A.* 'Mars', *A.* 'Mount Everest', has giant, 6-inch-wide snowball-like inflorescences, and is an excellent tall, white-flowered allium. 'Mars' is hardy in USDA zones 4 to 8.

Allium neapolitanum

The "Naples Garlic" produces a loose, open, 3-inch-diameter umbel of ½- to ¾-inch-wide white flowers with rosy stamens, on a 15-inch-tall scape. This allium is greatly favored in Europe as a cut flower and has a mild, sweet scent when in flower. It is hardy in USDA climate zones 7 to 9.



Allium nigrum

Sometimes marketed as *A. multibulbosum*, this allium has thick, 20- to 40-inch-tall scapes bearing flattened sphere-like or shuttlecock-shaped umbels of numerous whitish to purplish-pink, star-shaped florets accented with greenish midveins, a prominent greenish-black eye, and golden-yellow anthers. It is a long-lasting cut flower.

Allium rosenbachianum

This allium is a stout, tall species with a dense, spherical, 4-inch-wide umbel of small, starry, dark-violet flowers with darker nerves, produced on a 24- to 36-inch-tall scape. It is excellent as a cut flower, and is hardy in USDA climate zones 4 to 8. It needs a warm, well-drained site. The white-flowered form, *A. rosenbachianum* var. *album* is identical to the species in all respects except flower color.

Allium roseum var. *roseum*

This allium is considered to be a clone of the very prolific *A. roseum* var. *bulbiferum*. It

multiplies through numerous bubils and bulblets, *A. roseum* var. *roseum* flowers in June, producing a lovely pale pink or white, hemispherical, 2¾-inch-wide umbel with bell- or cup-shaped, ½-inch-diameter flowers on a 14-inch-tall scape. It is hardy in USDA climate zones 4 to 8.

Utilization

The alliums have a longer history as culinary bulbs or herbs than they do as fresh or cut flowers. Among the culinary alliums are Chinese chives, Egyptian onions, garlic, Japanese bunching onions, onion, potato onion, rakkyo. shallot, top onion, and Welsh, or spring onion. Two of these, Chinese garlic, *A. tuberosum*, as the species, and *A. schoenoprasum*, chives, as the cultivar 'Forescate', are extensively used in the ornamental border as fresh cut and dried flowers, as well as in the garden and herb bed. Most of the ornamental onions were not introduced until the 19th century. The ornamental onions are favorites in rock, heather, and formal gardens. In addition, many of them are excellent cut fresh and as everlasting flowers, and are becoming an increasingly important segment of the specialty cut flower market.

Special Considerations for Handling Bulbs

There are some guidelines that are applicable to most bulb-type cut flower operations:

- Place bulb orders with the supplier well in advance of the suppliers bulb harvest. Inform the supplier that the bulbs are for outdoor cut flower production and coordinate the date of arrival of the bulbs.
- Handle bulbs carefully, as they are never physiologically dormant. Bulbs act as biological sensors, constantly monitoring their environment and responding to it. The young shoot continues to grow and develop within the bulb. Poor handling prior to planting may show up 3 to 6 months after the improper handling occurred.
- Ventilate your newly arrived bulbs upon receiving them. The easiest way to ventilate bulbs is to spread them out in wire or slat-bottomed plastic trays.
- Inspect the bulbs for insects, diseases, and serious mechanical damage (i.e., cuts, bruises, gouges, etc.). Cut a few bulbs and examine them for the condition and state of development of floral primordia.
- Store the bulbs at the appropriate temper-

Table I - Planting Directions

Species	Bulb size	Date to plant	Depth inches	Density Bulbs/ row foot	Spacing
Allium aflatunense	4"-4.7"	Sep. to early Oct.	Tip 4" Deep	10 to 15	2" to 3"
Allium caeruleum	2.4"-2.8"	Oct. & Nov.	Tip 4" Deep	30	2"
Allium christophii	4"	Oct. to early Nov.	Tip 4" Deep	4	12"
Allium giganteum	7.8"	Oct. to early Nov.	Tip 6" Deep	2	12"
Allium sphaerocephelon	2"-2.8"	Oct. to early Nov.	Tip 4" Deep	30	2"

ature if they can not be planted immediately or if they are dormant and stored. Store all alliums, except *A. giganteum*, at 68°F. Store *A. giganteum* at 73° to 77°F.

- If bulbs have any indication of disease, dust them with an appropriate fungicide prior to planting.

Cultural Requirements

Alliums require a well-drained, even dryish site with a moderately fertile soil that has been tested and adjusted to a pH of 6 to 7. Most alliums are planted in the fall and naturalize readily. Thus, they may be undisturbed for many years.

Plant alliums on a 12-inch-wide raised ridge to promote drainage. This allows easier maintenance of the crop. Alliums can be transplanted right after they flower. Incorporate about 3 to 4 cubic yards of organic matter per 1,000 square feet of bed space before planting if economically possible. Most fall-planted alliums benefit from a light mulch.

While instructions regarding depth of planting and spacing of the various species and cultivars suitable for cut and dried flowers are listed below, a general rule of thumb is to plant the bulbs so that the base of the bulb is 3 times as deep as the bulb is wide. The bulb size listed in the table on page 5 refers to their circumference.

Environmental Factors

Hardy alliums need a cold temperature period of 12 to 22 weeks, depending upon the species, in order to flower the next year. New bulb and inflorescence initials are formed at the base of the scape during the current growing season prior to the onset of cold weather. Growth of the new bulb and differentiation of the following year's flower bud resume with the emergence of the current year's leaves and continue at the expense of the mother bulb and the food produced by the leaves until the leaves senescence prior to, or shortly after bloom. There is some documentation that long days are essential for the formation of bulbs for the next season's flowering, with a strong long day-temperature interaction. Alliums have a long dormant period, from the end of the current year's bloom until the resumption of growth in the spring.

Propagation

Most alliums naturalize easily and usually come back annually. The tunicate bulbs are propagated by division of the replacement bulb when they are dormant, by seed, or in those instances where they occur, from bulbils that develop in the umbellate inflorescence. One advantage of alliums over some traditional cut flowers, is that harvesting the flower does not interfere with continued bulb development as long as the leaves are intact.

Propagation of Alliums by Division

Detach the bulblets from the mother bulb and plant them on a 1-by-1-inch grid in a bed of sterilized loam and sand, and grow them on until they are flowering size. It will take at least 2 years for the bulblets to reach the minimum flowering size. At this time, plant them in the flower production beds. Large splits from the mother bulb will flower after only one year in the nursery bed. Bulbils, from the inflorescence, will be able to flower in 2 to 3 years.

Propagation of Alliums from Seed

Most alliums propagate quite readily from seed. Some alliums, e.g., *A. christophii*, do not readily reproduce vegetatively and must be propagated by seed. Sow the seed in a tray on top of a moist sterile mix containing some humus for moisture retention. Lightly cover the seed with more of the same mix and keep the tray at 70°F for 2 to 4 weeks. After the warm treatment, place the tray at 50° to 70°F until germination occurs. Subsequently, set the seedlings out in a nursery bed on a 2-by-2- to 3-by-3-inch grid until the bulbs reach flowering size. Seed-sown alliums will reach the minimum bulb size for flowering in 2 to 3 years.

Growing On

Fertilization

Fertilize alliums with 2 to 3 pounds of an 8-8-8 fertilizer per 100 feet of row immediately after planting. Fertilize established plants

with 2 to 3 pounds of an 8-8-8 fertilizer per 100 feet of row as soon as the shoots emerge in spring.

Watering

Most alliums prefer a well-drained, dryish soil. Water sparingly and infrequently when foliage is present. Plant the bulbs on a ridge or raised bed to guarantee the good drainage that is essential for alliums.

It is advisable to use trickle irrigation since the plants will be in the same place for many years. Trickle irrigation can deliver the water uniformly, if properly designed. Since the foliage is not wetted, pesticides are not washed off and foliar disease development is not encouraged. Trickle irrigation can be combined with plastic or organic mulches that are used to reduce weeds and to conserve soil moisture.

Use a heavy-walled "trickle hose" for alliums, one that looks more like a polyethylene pipe, rather than the typical thin-wall-row-crop tape or tubing. A heavy-wall-rowcrop tape or tubing is an alternative. The heavy-walled trickle hose can withstand the greater mechanical activity that occurs around perennial plants and can easily be moved from one site to another. In addition, the water emitters are inserted into the hose during manufacture.

Place the "trickle hose" down the row. A single hose is adequate for the 1-foot-wide raised beds recommended for alliums. Very coarse, well-drained soils will need to be watered more frequently than finer, water-retentive soils. Use a screen filter with 100 to 140 mesh to prevent clogging of the irrigation lines and a small pressure regulating device set at 8 to 10 pounds per square inch to ensure proper operating pressure for the trickle irrigation. Use pressure-compensating water emitters on hilly or sloping land. Size the water pipes to have low friction loss so that the water pressure is fairly uniform throughout the system.

Use tensiometers, devices that monitor soil moisture, to aid in deciding when to irrigate. Contact your local Maryland Cooperative Extension office for more information on trickle irrigation. Be sure to watch the weather carefully.

Insects

Aphids

Aphids are the only serious insect pest of alliums. They are soft-bodied, small insects with long slender mouthparts. Aphids damage plants by inserting a long mouthpart, called a stylet, into plant tissue, such as leaves and stems, and sucking out plant juices. Not only is their presence objectionable, but aphids, like mealybugs, scales, and whiteflies, leave a sticky honeydew deposit on plant parts. Sometimes sooty molds grow on this honeydew, leaving an ashy residue on the foliage. As aphids molt, their cast skins fall on leaves, further detracting from the aesthetic quality of the plant.

Aphid infestations may cause curling, twisting, or stunting of foliage, shoots, or other plant parts, depending on the plant and aphid species. Aphids may be vectors of virus diseases. The direct injury and presence of aphids, however, is generally more important than their role as a virus vector.

Fortunately, most alliums can tolerate moderate numbers of aphids without significant damage. In many cases, low populations of aphids are kept in check by naturally occurring predators and parasites if cover sprays of broad-spectrum insecticides are avoided. Some species of aphids can reproduce very rapidly and populations build up to damaging levels swiftly. The most common species of aphids found on alliums include green peach aphid, *Mysicae persicae*; tulip bulb aphid, *Aphis tulipae*; and potato aphid, *Macrosiphum euphorbiae*.

The most desirable way of limiting aphid problems is to avoid fostering them in the first place. The easiest way of accomplishing this is eliminating weeds, which may harbor aphids. It is also important to establish a regular regime of inspecting those cultivars of alliums that have had aphid problems in past years.

Some growers may be interested in trying biological control. For the best chance of success release the beneficial insects early in the crop cycle before infestation is obvious.

The predatory midge, *Aphidoletes aphidimyza*, is recommended for control of the green peach aphid. Release 1 to 2 cocoons

per plant, or 3 to 5 cocoons per square yard weekly or biweekly until the aphids are controlled. Two to 4 releases are usually adequate. One midge larva usually is required for each 15 to 20 aphids.

Unfortunately most insecticidal residues are harmful to beneficials, sometimes for many weeks. Insecticidal soap, horticultural oil, and azadirachtin, or Neem products are probably the most compatible with beneficials.

About 30 different insecticides are labeled for aphid control in cut flower fields, including both "conventional" and "organic" materials. A low level (0.5-1%) of insecticidal soap included in a spray mixture may enhance its performance. Good coverage is essential for contact sprays. Make the most of nonchemical methods first, and aim for good control before plants are in bud or flower, when they tend to be more susceptible to spray injury. Consult your local Cooperative Extension office for current aphid pesticide recommendations.

Disease

Alliums are remarkably free of diseases if the grower obtains clean stock, provides good drainage, a sunny location, feeds the bulbs at the appropriate time, and practices scrupulous sanitation during the growing season. Excess moisture at the wrong time is the worst enemy of alliums.

While most of the diseases found on flowering onions are more prevalent on vegetative onions, ornamental onions are susceptible to several diseases. According to Bryan, De Hertogh, and Dilles, the following diseases may be found on ornamental onions:

Botrytis

Botrytis spp., or "Fire," attacks leaves, stems, and flowers of alliums. It seldom attacks the bulbs. Botrytis normally starts in dead flowers and damaged or withered leaves. The edges of fresh flowers show water-soaked areas that enlarge rapidly. Spore production may be so rapid that entire crops can be destroyed in a few days. Rain, water splash, and a persistent water film on the plant surfaces spread the disease.

Botrytis is encouraged by cool temperatures and high relative humidity. Good hygiene, the removal of withered leaves, flowers, and bulbs is a good preventative measure. Try not to damage the foliage of those alliums that retain their leaves at the time of harvest. The spores overwinter on plant debris and in the soil.

Downy Mildew

Onion or Downy Mildew, caused by *Pernospora destructor*, makes the leaf tips shrivel. It is difficult to diagnose, as many ornamental onions have leaf-tips that whither naturally as the inflorescence matures. As the disease progresses, downy mildew appears as cotton-like growth on the foliage. It is usually most prevalent when the temperatures are high and the humidity is low.

The fungus will overwinter in the soil. The resting spores will remain viable in the soil for many seasons. Lift the bulbs and dust them with an appropriate fungicide before replanting them and spray the foliage during the growing season. Sterilize the soil if it is not possible to move the field to a new location.

Nematodes

Several nematodes may infest alliums. The most common nematode invading alliums is *Ditylenchus dipsaci*. It causes bent and yellowish leaves which later turn brown. The individual bulb scales turn brown resulting in dark rings in the bulbs that can be seen when the bulbs are cut in cross section. Infested portions of the bulb scale and leaves are often swollen. The plants may be stunted and fail to flower.

Nematodes are important vectors of virus diseases. Nematodes invade the leaves as they grow through the soil. They are carried upwards as the leaves elongate. As the leaves mature, the nematodes migrate down to the bulb. Nematodes can survive for 18 months in a moist soil and up to 5 years in a dry soil.

If nematode infestation is suspected, have the soil examined by a soil testing lab. Discard nematode-infested alliums immediately. Do not grow alliums in nematode-infested soil for at least 5 years.

Smut

Onion smut, caused by *Urocystus cepulae*, results in dark, blister-like streaks on the foliage and bulbs. It is more of a problem

with young bulbs and is more prevalent in northern latitudes than warmer climates. If onion smut is found, discard any infected bulbs, grow the alliums in a new area, and apply an appropriate fungicide.

White Rot

White rot, caused by *Sclerotium cepivorum* is evidenced by yellow foliage during the summer. It is favored by warm, moist weather. White mold begins on the foliage and stems as sunken, dark green, yellow, or gray spots or streaks. The spots enlarge and become yellowish brown with a yellow margin. As the disease progresses the roots rot and the bulb and foliage are covered with white fluffy mycelium. This is followed by the formation of small black bodies called sclerotia, in the dead tissue.

Treat infected bulbs before planting and spray the foliage the foliage with an appropriate fungicide during the growing season. Begin spraying with an appropriate fungicide when leaves are 4 to 5 inches tall, remove infected leaves and flower scapes, rotate crops, plow debris deeply when fields are tilled, and provide good air circulation by wide spacing and weeding. Lift the bulbs and treat them before replanting, as white mold is more common on those bulbs not lifted annually.

Viruses

Several virus diseases infect alliums. Symptoms range from no visible effect at all to severe discoloration, stunting, and white or yellow streaking of the foliage. Flowers are often aborted.

Onion yellow dwarf virus (OYDV) causes mosaic symptoms which manifest themselves as a yellow stripping and downward curling, flattening, and crinkling of the foliage and the stems. Tobacco rattle virus (TRV) causes an inconspicuous or slight mottling or streaking of the lower leaves and stems before the plants flower.

Viruses are often spread by aphids and other sucking insects, so their control is important. It has been reported that some viruses are carried by nematodes. If viruses are diagnosed or suspected, throw the alliums away. Weed control is important, as weeds are often alternate sites of infestation for insects.

General Insect and Disease Control

The main means of reducing the chance of insect infestation and disease infection is to start with clean bulbs. Then plant the bulbs in a clean, possibly fumigated soil and keep insect-harboring weeds to a minimum by shallow cultivation. For the latest biological and chemical control advice for insects and diseases, contact your local Cooperative Extension office.

Weeds

Weed control is one of the most important aspects of raising cut flowers. Weeds compete with the plants for water and nutrients. They often serve as hosts for insect populations that may migrate to cut flowers. The insects that move from weeds to cut flowers may bring diseases with them. Thus, the elimination of weeds is critical to cut flower production.

Weed management consists of an integrated approach involving organic and inorganic mulches, preemergent herbicides, cultivation, cover crops, and sanitation. It is important to know the life cycle of the weeds to effectively eradicate them.

Mulches inhibit the germination of some weeds by providing a barrier to germination. They also moderate soil temperature fluctuations, reduce water loss, keep soil from spattering to the flowers and foliage, and if organic, provide nutrients when they are incorporated into the soil and biodegrade. It is important that any mulch, whether organic or inorganic, allows a free exchange of atmospheric gases and percolation of water. For this reason, if inorganic mulches are used, the more porous landscape fabrics are preferable to solid plastic. Inorganic mulches are often combined with irrigation.

Cultivation should always be shallow, lest the root system be injured. Injury to the root system not only decreases the plant's ability to absorb nutrients and water, it also may act as the entry site for insects and disease. Hand weeding is a viable option for weed control in many operations if the weeds are few, scattered, and easily pulled.

Chemical control consists of preemergent and postemergent herbicides. Preemergent herbicides are applied before weeds emerge and usually give residual control for several weeks after application. Postemergent herbicides are applied after the weeds emerge and may be contact herbicides, killing only the portion of the plant that is sprayed by the herbicide. Postemergent herbicides can also be systemic herbicides, which are absorbed and move throughout the plant, killing the entire plant, roots and all, even though the whole plant is not sprayed. Systemic herbicides are very useful on weeds that have creeping roots and rhizomes. They are effective only if the weed is actively growing and translocating to the roots. Those postemergent herbicides registered for use with cut flowers are nonresidual and have little, if any, soil activity.

Start with a clean field at planting time. The only preemergent herbicide registered for use on ornamental onions is metolachor (Pennant). Pennant controls annual grasses, sedges, and a few broadleaf weeds, the primary broadleaf weed being galinsoga, (*Galinsoga ciliata* and *G. parviflora*). Cultivate lightly during the growing season to control weeds after the alliums have emerged. Spray any remaining green weed vegetation with glyphosate (Roundup) or glufosinate-ammonium (Finale) once the allium leaves have completely died back at the conclusion of the growing season.

Table II - Harvest

Species	Date of harvest	Flowering span in days	Stage of harvest
Allium aflatunense	Early to mid-May	15	Flower head 50% open
Allium caeruleum	Early June	23	Flower head 50% open
Allium christophii	Late May	19-20	Flower head 100% open
Allium giganteum	Early June	18-23	Flower head almost 100% open
Allium sphaerocephelon	Early to mid-June	17	Flower head 50% open

Table III - Storage

Species	Storage in water	Cut flower life	Dried flower
Allium aflatunense	2 weeks	2 weeks	Good
Allium caeruleum	Few days	2 weeks	Good
Allium christophii	Few days	2 weeks	Excellent
Allium giganteum	4 weeks	3 weeks	Good
Allium sphaerocephelon	4 weeks	10 days	Excellent

Harvest

The date and stage of harvest and vase-life varies with the species of allium. Table II on page 10 illustrates these differences.

Post Harvest

All cut alliums may be stored in water for varying lengths of time at 33° to 35°F with a pH of 4.0. They all respond favorably to the addition of floral preservatives to their water. All alliums will store dry for 2 to 3 days at 32° to 35°F. See Table III on page 10 for storage details.

Summary

1. Select the species and cultivars for use as fresh or dried flowers that have long enough stems for cut flower arrangements, are winter hardy, and are readily available.

2. Plant the bulbs on raised, 1-foot-wide ridges at the appropriate depth and spacing in a well-drained soil with a pH of 6 to 7.

3. Fertilize the alliums annually with 2 to 3 pounds of an 8-8-8 fertilizer per 100 foot of row as the shoots emerge in spring.

4. Water the alliums sparingly. Use trickle irrigation if possible. Use IPM methods whenever possible.

5. Control insects, diseases, and weeds with appropriate biological and chemical measures.

6. Harvest the inflorescences at the proper stage of development and handle them properly after harvest.

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