hypothesis was formulated that the cause of black shoots lies in the temperature in the soil and during storage before freezing. A correlation was observed between the losses by black shoots and a temporary increase in soil temperature after a period of low temperatures, especially in lilies grown in France. The problem also occurs in lilies grown in Holland. In that case the temperatures during transport and storage are probably the cause. The physiological explanation of the problem is that the relatively low soil temperatures in fall gradually break the dormancy of the shoot. Any rise in temperature, even temperatures like 5 to 8 °C, induces the development of the new shoot.

Once this development has started it cannot be stopped and freezing these bulbs will result in black shoots.

In an experiment carried out by the export company VWS it was found that Oriental lilies that were frozen immediately upon arrival half of January showed no black shoots when the bulbs were forced in a greenhouse in August. When the bulbs were stored at 2 °C for 3 weeks before freezing a low percentage of the bulbs showed black shoots in August. Storing the bulbs at 10 to 12 °C for 3 weeks before freezing caused 100% black shoots. These results confirm the idea that a temporary rise in temperature during the cold storage before freezing is the cause of the problem. From this experiment it can be concluded that in many cases Oriental bulbs should be frozen as soon as possible after harvest. When the bulbs must be stored for some time before freezing or transported this must be done at temperatures as close to zero as possible. Whether a batch of bulbs is sensitive to black shoots can be determined by measuring the breaking index of shoot juice during the period between harvest and freezing. The breaking index is an indicator for the amount of sugar in the shoot, acting as an anti-freezing agent. When the sugar level increases during this period (multiple measurements), the lilies can be frozen safely. When a decrease in sugar level is measured dormancy is broken, shoot development has started and the risk of freezing damage is high. This method is developed by PPO.

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Producing and Using Bulbous Plants for Mixed Planters

By Dr. Terri Starman, Texas A&M University

Everyone knows that container gardens are the latest gardening craze. They have been popular for several years now but they are forever evolving. The first container gardens were produced in color bowls with colorful seed propagated annuals planted around a Dracaena ‘Spikes’ plant. Kathy Pufahl can be credited with opening our eyes to using more diverse and unusual types of plants, particularly herbaceous perennials, mixed with the annuals. She was a whiz at cramming these new and different plants into gorgeous containers. At this time I see three new trends in container gardening and the evolution of container gardens will no doubt continue. The first new trend is the increased manufacturing innovations of Upscale containers made of more weather resistant materials like those made with resins. Decorative containers are selling like “hot cakes” as people’s living spaces extend out from the homes and into their gardens. Decorative containers become part of the furnishings in garden rooms.

The second trend I see is using all of the different horticultural classifications of plants mixed in the same container. In addition to the seed annuals and herbaceous perennials come grasses, herbs, woody shrubs, vegetative annuals, tropicals, succulents, and, yes, bulbs. That is what our experiment was about a year ago and what this article is about – to take a look at using bulbs in mixed plantings. (See Experiment below).

Now that containers have become as beautiful as the plants, a third new trend is to simplify the plantings. One way to simplify a container garden is to use just three plant species. One plant is the “filler”.

Its job is to be round and robust so it can basically fill in between plants and cover the media in the container. The second plant is the “spiller”. Its job is to drape over the side of the container and soften the container’s hard edge and add an element of line and length to the mixed planting. The third plant is the “thriller”. Its job is to attract the consumer’s eye and delight them so that they will be happy and buy more container gardens in the future. A fourth plant may be needed as another “filler” to help fill in and/or add some height depending on the container size.

A bulbous plant can make a great “thriller” plant in a container garden when it has a large colorful flower like a lily, amaryllis or dahlia; when it pops out of a greenhouse in August by storing the bulbs at 10 to 12 °C for 3 weeks before freezing. Photo: VWS

100% damage by black shoots in lilies in the greenhouse in August by storing the bulbs at 10 to 12 °C for 3 weeks before freezing. Photo: VWS

No freezing damage by black shoots in lilies that were frozen immediately upon arrival (half of January).
In this container garden, beautiful Calla 'Schwarzwalder' is complemented by Begonia 'Sinbad', Eranthemum 'Ebony', Dahlia 'Gallery Art Fair', Coleus 'Merlot', Ajuga 'Black Scallop', Helichrysum 'Silver Spike', Guara 'Pink Fountain', Pelargonium 'Pink Bicolor', and Impatiens 'Infinity Pink'.

In addition to serving as thriller plants here is a list of more ways bulbs add to container gardens.

1. Seasonality. Container gardens are not just for summer anymore. Those gorgeous upscale containers need plants in them in fall and summer too.

2. Unusual flowers and foliage. Contrast makes container gardens interesting. Contrast is developed by varying the shape, size, textures, and color of flowers and foliage. There are so many various shapes of flowers in bulbous plants.

Companion plants to mix with the bulb plants in the container gardens arrived as rooted cuttings Weeks 2, 3 and 9. They were potted in 4.5" (11 and 15 cm) pots according to the final size of the plant. They were grown in the same greenhouse under the same temperature and fertilizer conditions as the bulbs. The first mixed containers were potted 29 Mar. and we continued making containers once per week until 21 May. Mixed containers were made with fully-grown flowering bulbs and companion plants. This was done initially because we didn't know what color the bulb flowers would be or their growth habit. Later with knowledge of the color and plant form of the bulb species, we made some mixed container gardens when the bulbs were emerging. In the mixed plantings, we used an average of nine plants per 14" (36 cm) container.

Please visit our web-site at http://aggie-horticulture.tamu.edu/floriculture/container-garden/index.html to learn more about producing mixed plantings and see all of the container gardens with bulbs that were made in this experiment.

Problem of black shoots in Oriental Lilies closer to a solution

By Henk Gude and Hans Kok, Applied Plant Research (PPO), Lisse, The Netherlands

Many Oriental lily bulbs are lost during storage by so-called 'black shoots', a severe form of freezing damage where the entire shoot inside the bulb is destroyed and turns black. The problem is increasing and causes great financial losses. In a meeting with Dutch lily exporters and researchers from PPO the
(Photo 5). In this container garden, contrast of flower form and color makes it exciting. Streptocarpella ‘Conord Blue’ flowers are tiny and nodding, Begonia ‘Fimbriata Yellow’ has bold flowers, Calla ‘Captain Romance’ has unusual shaped flowers, and Lilium ‘Salmon Classic’ flowers are up-facing. Other plants are Galdiolus ‘Muriel’, Hosta ‘Fragrant Bouquet’, Acalypha ‘Copper Leaf’, Scaevola ‘Whirlwind White’, and Begonia ‘Sinbad’.


(Photo 7). Pattern in the Pulmonaria ‘Raspberry Splash’ foliage adds interest to this creative container garden. Color is echoed with white striped flowers of Amaryllis ‘Baby Star’, white spots on the foliage, and the white container. This repetition of color and line of the Cyperus Isodadus create rhythm in this container garden. Other plants are Fuchsia ‘Autmnale’ and Hedera ‘Melanie’.

3. An element of life. Its fun to watch a garden grow even when the garden is in a container. Bulbous species are ideally suited to be “timed” in a container garden so the consumer sees them grow into a flowering plant. Consumers and growers as well, must realize and accept that the plants in a container garden will continue to grow, flower, and change positions slightly. Nothing lasts forever and container gardens are no exception. Some plants will need to be pruned and deadheaded to keep them fresh and in shape. At times some plants will have to be discarded and new plants planted in their place. This can be an opportunity to change spent plants out for plants of the current season. This is a “win-win” situation for the consumer who gets an updated container garden and the grower who gets to sell more plants.