

take the plants off the mist as soon as they are rooted because, as rapidly as they grow, it is important to harden them off before selling them. Also, if left in the mist and heat they will grow extremely fast. This makes the new growth soft and very susceptible to disease and insect attack.

We propagate 7 different species by seed: schefflera, dwarf schefflera, green nephtysis, *Philodendron selloum*, coffee, *Dizygotheca elegantissima* (Syn.: *Aralia elegantissima*), and *Fatsia japonica* (Syn.: *Aralia seboldii*). These are planted two or three to a pot after the first true leaf forms.

Seeds of all of these germinate best at warm temperatures (about 80° F) and except for *Fatsia japonica*, temperatures around 60 to 70° to grow. *F. japonica* plants grow best at a cooler temperature (55 to 50° F).

I have in the past propagated some of the variegated nephtytis; this is done by stripping all the leaves from the vine and cutting at each node to leave an inch of stem. These are stuck in soil so that the bud is at the surface of the soil. They are kept barely moist and warm and should be rooted and starting to grow in about one month.

An important part of our program is the size of the cuttings we use. In the past I have seen plants from large cuttings that have been rooted and sold. To me this is not right; these plants are soft and, depending on where they come from on the mother plant, they will not be very well adjusted to the light intensity. We try to make our cuttings a little smaller. This allows the plant to grow to saleable size, which is at least as high or as wide as the pot. These plants will be hardier and better adjusted; they will not deteriorate on our customers shelves before they are sold. And, just maybe, they will last a little longer on Mrs. Housewife's window sill.

COMMERCIAL PROPAGATION OF LILIES

EDWARD A. McRAE

Oregon Bulb Farms,
Sandy, Oregon 97055

The past 15 years has seen a revolution in lily cultivation; this is especially true in Holland where the acreage has increased dramatically from 600 to over 3,000 acres annually. The propagation of these plants is achieved through both sexual and asexual methods and these procedures will continue to hold their place in crop production as both have their distinct advantages, depending on the market served.

SEED PROPAGATION

The main advantage of seed propagation is that the virus diseases, which plague commercial stocks, are not seed transmissible. We can use this method to continually produce healthy, vigorous and disease free stocks and propagate them annually from seed; using this method virus disease can be kept under control. The older stocks are discarded, thus health and vigor are kept at a high level, and the highest quality material possible is offered for sale. Lilies produced from seed can be strains of the true species or strains of a hybrid group.

Species. The selection of superior individuals within the species and using them as parents ensures a high standard of material not only with regard to health and vigor but also in having the special characteristics desired. The parents can be selected for vigor, disease resistance, stature, foliar characteristics and flower form, placement and substance.

The select individuals are used to produce seed and plants are naturally highly fertile within the species. A number of special clones can also be selected from the species and propagated asexually; these are tested for disease resistance, virus tolerance, propagation qualities, and adaptability. The finest of these are then tested as parents and the parental combination producing the finest and most uniform offspring are used to produce the seed. This is termed an F_1 strain within the species and the cross can be repeated at will as long as the parent clones are maintained. The species of significant importance commercially are *L. regale* (Regal lily), *L. leucanthum* var. *centifolium* 'Black Dragon Strain', *L. candidum* 'Cascade Strain', *L. auratum* var. *platyphyllum* (gold band lily), *L. speciosum* var. *rubrum* 'Supernova'.

Hybrid F_1 Strain. The procedures described previously are again followed; superior forms are selected within a hybrid group especially with regard to color, flower form, season and stature. The selections are again cloned and tested for vigor, disease resistance and finally as parents. The parents producing the greatest vigor and uniformity in the seedling population are chosen for seed production. It should be noted that reciprocal crosses are not identical in hybrid groups, one parent may be more fertile and produce larger quantities of seed, another may have superior pollen; continued vigor of seedling populations is not guaranteed if the roles of the parents is reversed. One parent, therefore, always adopts the role of the seed parent and the other the pollen parent. Hybrid F_1 strains grown commercially include 'Burgundy' and 'Citronella' in the pendant asiatic lilies, 'Copper King', 'Golden Splendor', 'Pink Perfection', and 'Hearts Desire' in the trumpets and aurelians and 'Imperial Crimson',

'Imperial Gold', 'Imperial Pink', 'Imperial Silver', and 'Jamboree' in the exotic orientals.

Seed Storage, Germination and Growth.

1. Lily seed can be stored at 0° F. and remain viable for many years.

2. There are two distinct types of seed germination in lilies which greatly influence the treatment of the seed.

Epigeal Germination This is usually termed the "above ground" germination; the tip elongates rapidly, appears above ground, along with the cotyledon, which takes on the functions of a leaf; true leaves follow and will continue to be produced throughout the growing season.

Hypogeal Germination This is termed "below ground" germination; the tip elongates but does not emerge above the ground; the food supply in the endosperm is transferred to a small bulblet. The bulblet must go through a cold period before the first true leaf appears from the center.

Seed Sowing and Growth. The epigeal seed can be sown directly in outdoor beds in early spring and the seed will usually sprout in four to six weeks if temperatures and moisture levels are favourable; the seed is covered lightly and moisture levels are maintained throughout the season. The seedlings can be lifted late in the year, packed in boxes for winter storage and planted out in rows the following spring. The larger bulbs will attain commercial size in one more year, the smaller will require two. Asiatic, trumpet, and aurelian lilies belong to the epigeal group.

The hypogeal seed is sown in June using a mixture of vermiculite and milled sphagnum moss, the medium must be moist and not saturated. The seed is thoroughly mixed with the medium which is placed in plastic sacks, a small opening is left for air exchange. The sacks are placed at an incubation temperature of 65 to 70° F. and they will germinate and form bulblets in 8 to 14 weeks depending on the variety. The sacks are removed from the incubator when the bulbs are well formed and placed at cool temperatures until spring. They are then sown in outdoor beds using the same procedures as the previous group. This group usually requires two years in the seedbed followed by one or two years in rows before commercial size is attained. The oriental lilies belong to this group.

Lily seed can also be sown under greenhouse conditions where growth will be rapid due to total control of the environment.

CLONAL PROPAGATION

Natural Propagation. The majority of lilies propagate natu-

rally through bulb division and with the formation of bulblets and bulbils. Bulb division is not important commercially and cultivars with this inherited characteristic are undesirable in most markets.

Bulblets are formed on the underground parts of the stem and these are simply collected during harvest. They are washed, treated with a suitable fungicide and planted in rows to produce future commercial crops. The smaller bulblets will require two seasons growth before reaching commercial size. It is important to collect bulblets from large plants only; this insures that vigor is maintained and that the bulblets were produced that season; this would not be guaranteed if bulblets were collected from small bulbs planted the previous year.

Bulbils. A few lilies produce bulbils in the axils of the leaves and these can be used for propagation. The bulbils are collected in late summer and planted in beds, covering lightly. The following year they are lifted and require planting in rows for a further season before reaching commercial size.

Scale Propagation. This method is used extensively in the propagation of hybrid lily clones; it induces vigor and by propagating from carefully selected mother blocks stock quality is maintained at a high level. The mother blocks are planted separately and are rigidly scrutinized throughout the season for any symptoms of disease, lack of vigor and trueness to type. The bulbs are lifted in the fall, washed carefully and scaled (large bulbs can yield from 30 to 100 scales per bulb). The scales are placed in clean plastic trays and dipped in a fungicide solution for twenty minutes. They are then packed in layers in moist vermiculite using sturdy boxes lined with plastic. The boxes are placed in an incubator at a temperature of 60 to 80° F. depending on personal preference. The scales will form bulblets in 6 to 12 weeks depending on the cultivar. The cooler temperatures tend to encourage root development which is very desirable.

Following incubation the scales are placed in cold temperatures over winter and are planted in rows outdoors the following spring. They must be covered lightly and will make considerable growth the first year. Soil is added to the rows in late fall and by the following year an excellent quantity of commercial and planting size bulbs are harvested.

Tissue Culture. Shoot tip culture has been used to produce "virus-free" stocks of lily clones very successfully. Cultures of the cultivar 'Enchantment' taken in 1968 is now producing the entire crop which is well over 1,000,000 annually. Tissue culture can also be used to rapidly increase a very promising clone in its early stages of development. It will also continue to be an invaluable tool in maintaining high quality clonal material.