HORTICULTURE

Research Yields New Lilies

Many years of research are responsible for your florist's stock of superior Easter lilies. Creation of new flower varieties is the result of vision, patience and hard work.

By HORACE LOFTIN

➤ NOTHING IN the world is easier for you to get than a big bunch of Easter lilies —if you have the money.

Your florist has them in many varieties, big and small, fragile and hardy. Gorgeously blossoming "Easter" lilies can be obtained 12 months a year.

But how these varieties are developed, how they must be nursed and pampered to grow at all, how they must be coaxed into blooming and seduced into fruiting, is a tale of patience, planning and hard work. Money will not bring a new disease-resistant or early-blooming variety into existence. Only many trials, many errors, and a few successes in the greenhouse and laboratory can do this.

The center of lily breeding research in the United States, and perhaps the world, is a small cluster of greenhouses at the U. S. Department of Agriculture's experimental station at Beltsville, Md. The guiding spirit within the bustling greenhouses is Dr. Samuel L. Emsweller, an amiable, enthusiastic botanist who has been with the Agriculture Department since 1935.

The tiny sprouting seeds and bulbs and the tall, flowering lilies that fill the greenhouses represent the varieties you will buy in the not-distant future. Many of them are still in the experimental stage. Others have been perfected; these are being raised in mass, to produce enough for distribution to commercial lily growers.

Many Species Incompatible

What is involved in the creation of new or improved varieties of lilies?

The basic step in making a new variety is to cross two different species or varieties—then step back to see what happens. And on the first step is found the first difficulty.

One of the biggest headaches of lily breeders is the high incidence of self-incompatibility within a species and cross-incompatibilities between species.

This means that a great number of varieties can only reproduce asexually, without meeting of egg and sperm, simply throwing off new shoots from parts of the bulb, or scales. But success in creating new varieties hinges on the botanist's ability to cross two different plants, each of which show characteristics desirable in a new variety.

If he cannot fertilize the egg of one of them with the sperm of the other, he is stopped cold.

Dr. Emsweller and his co-workers have attacked this problem by using a chemical growth regulator, which increases the percentage of successful fertilizations in many cases. Breaking a petal connection near the pistil of a lily and applying a weak solution of the regulator, naphthalene acetamide, to the wound, Dr. Emsweller has been able to pollinate successfully several usually uncooperative lilies.

In experiments with four Easter lily varieties, he was able to obtain fruit and seed of three of them only when he used the growth regulator. In the fourth variety, 48 untreated plants yielded nine fruits with 207 fertile seeds; while 90 treated plants gave 90 fruits with 2,414 good seeds.

Perhaps the most dramatic work in lily breeding at Beltsville is experimentation with a chemical that doubles the normal number of hereditary units of a plant, usually resulting in a plant markedly different and often superior to the parent lilies. This chemical is "colchicine," derived from the plant meadow saffron, *Colchicum autumnale*.

The inheritable characteristics of a living being are determined by genes, highly complex chemicals that control the future development of the organism. These genes are grouped in distinctive bands called chromosomes in the nucleus of a living cell. With the lilies, there are 12 different chromosomes in the cell, and there are two of each kind, making a total of 24 chromosomes in every lily cell—normally.

But when colchicine is applied to the tip of a flowering stem, or better, to a bulb scale, it often happens that the number of chromosomes becomes twice as great, producing 48 chromosomes in each cell, four of each kind of chromosome.

Actually it often happens that varying numbers like 47, 46, 45 or even 49 chromosomes result from colchicine treatment; but in general the number of chromosomes can be said to double.

What are the advantages of doubling the number of chromosomes?

Dr. Emsweller has found that tetraploid lilies (those with four sets of chromosomes;

EASTER LILIES—Research in the United States has led to freedom from foreign sources of lily bulbs. The blossoming plants are now available 12 months of the year at florists. Use of the chemical, colchicine, can double the number of hereditary units, yielding sturdier plants with larger flowers.

normal lilies are "diploid," with two sets) usually yield flowers and plants with better "substance." This means tetraploid lilies are not as easy to bruise, or hard to store or ship, as the normal diploids. The advantage of lilies of better substance to commercial nurserymen, obviously, is tremendous.

Tetraploid plants often are taller and sturdier than regular lily plants, Dr. Emsweller has found, and the flowers are often twice the size of diploids. This difference in flower size is truly spectacular, and is of immediate importance to the nurseryman.

And, Dr. Emsweller has found, tetraploid lilies often produce a higher percentage of fertile seeds than lilies with just two sets of the 12 kinds of chromosomes. Several types of tetrapolid Easter lilies have been developed at Beltsville, and are being propagated there for early distribution to commercial nurserymen.

Aim at Virus-Free Strains

Successful production of seeds is all-important in breeding new varieties, but there is an additional advantage in prompting more lilies to seed. The whole lily group, *Lilium,* has been hard hit by virus diseases that kill the plants or mar their beauty. These diseases, however, are not seed-borne in *Lilium.* So if, instead of propagating new plants from parts of infected parent bulbs, a way is found to produce desired varieties from seeds, then virus-free strains can be developed.

Once a breeder has obtained fertile lily seeds, however, his troubles are far from over. This is not so apparent with the Easter lily in which the seeds germinate within a few weeks. But with many other species, germination does not normally occur from 18 to 20 months after planting.

Even with the patience of a botanist, 20 months added to the approximately 18 it takes to raise many lilies from seedling to flowering plant can seem too long to wait. So, using a speeding-up technique, Dr. Emsweller has been able to cut the time of emergence of seedlings from 18 or 20 months to as little as four months.

To do this he places seeds in a sterilized bed of vermiculite or peat, all contained in small jars. He closes the mouth of the jars with polythene plastic sheeting, which retains moisture while allowing air to enter. The jars are then stored at a constant temperature of 65 to 67 degrees Fahrenheit. In a month or so any seedlings that have produced rootlets or tiny bulbs are removed to a temperature of 32 to 35 degrees Fahrenheit. In two or three months, the seedlings are removed again and placed in flats containing vermiculite, where they grow speedily.

Chromosomes Tell Ancestry

In the breeding of new hybrids and varieties of nearly all plants, breeders often lose track of the history of a new creation. In the case of roses, for instance, it has become impossible to determine the ancestry of any modern variety.

With lilies, happily this may not happen any more. Dr. Emsweller and his colleagues have discovered that the chromosomes of different lily species have characteristic shapes that can be identified under the microscope. A normal lily with two sets of 12 chromosomes got one of the sets from its "mother" and one from its "father." So by examining the structure of chromosomes in a lily, the parents can be ascertained, and the plant re-produced by making that cross again.

Easter lily blooms are available 12 months of the year now, largely due to a schedule of preplanting cold storage worked out by Department of Agriculture scientists. They discovered that lilies could be stored at temperatures just below freezing and still give a high flower production as long as a year after storage. Before this work, it was thought that temperatures below 35 degrees Fahrenheit would harm the lilies.

Species Number 85

The genus of lilies, *Lilium,* contains about 85 species, found naturally, with only five exceptions, in the north temperate zone of North America, Europe and Asia.

In the United States, 85% of the lilies grown are Easter lilies, *Lilium longiflorum.* Other commercially important species are the regal lily, L. *regale;* the gold-band lily, L. *auratum;* the Madonna lily, L. *candidum;* and the beautiful pink-spotted lily, L. *speciosum.*

Before the second World War, nearly all lily bulbs in the United States came from abroad. About 27,000,000 were brought here in 1940 alone. Today this picture has ended, with most lily bulbs used in this country being produced here.

Just as research has been a key to America's first place in the world of machines and engineering, so is it proving to be the way to attain the lead in creating new floral beauty.

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An estimated 15,000,000 persons in the United States—3,000,000 of them children—have some degree of *hearing loss.*

Billions of *meteoroids* plunge into the earth's atmosphere every day at speeds as high as 45 miles a second.